Senior Class
Theses of

University of Minnesota
Northwest School of Agriculture

Crookston

Volume Sixteen

Class of 1931

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CLASS EXERCISES
GREETING
March 26, 1931

Mrs. DeEtte C. Genung

Faculty, Students, and Friends of the Northwest School:

It is my pleasant duty to extend a welcome to you all! In behalf of the faculty I bring greetings. We are happy to have you here upon this day which means so much to us: this day to which the Seniors have looked for the past three years. How quickly has passed the time since they, as Freshmen, came to the Northwest School. In looking forward to this day, how far off it seemed to them then.

When Lindbergh made his famous trans-Atlantic flight, John Chinaman over in Hong Kong, named his baby son in honor of the young aviator. When asked what the child's name might be, John said, "We call him 'One Long Hop.'" Now indeed, it did seem one long hop to the Commencement day. Now that time has arrived, and in looking back, we cherish the lasting friendships made, and recall the pleasant happenings connected with our work within these walls.

This is as it should be. I'm sure that each student here during Freshman days has heard me say that we should constitute our lives so that our greatest pleasure is derived from our work.

Now, I'm not going to make a long speech - Miss Warne and I have argued that point all winter, and I won, but I can't leave you, my Seniors, with whom I have worked and played for the past three years, without a few words -

I sincerely hope that each one of you will acquire more education, if not through further schooling, then through the medium of good books and magazines or correspondence courses - through self education.

In selecting your life work, choose a vocation in which you are in harmony with your surroundings. If that is not altogether possible, then follow the advice of the famous general who commanded his soldiers: "Do the best with what you have, where you are."

Each must express the power of his personality in his own way.
That is all that we can do anyway, reproduce ourselves in our work.

Someone has said, "your work is a torn off piece of your spiritual estate. If there are sleazy threads in the warp and woof of your character, they will appear in the woven fabric. Everything that we make, we manufacture right out of our hearts."

Now as you go out into life's work, you may become discouraged at times. Things may not be as rosy as you'd planned. You may not always be able to please everyone - misunderstandings may occur, but remember that if you remain constant to your ideals, truth will prevail.

Kipling has well said:

"If you can walk with crowds and keep your virtue,
Or sit with kings, nor lose your common touch.
If neither foes, nor loving friends can hurt you,
If all men count with you, but none too much,
If you can fill each unforgiving minute
With sixty seconds of full distance run,
Yours is the earth, and everything that's in it,
And which is more, you'll be a man, my son!"

And now, those of you who are going out from us today, I hope that the earth fairly won will be yours, and that all good things in life will come to you. We have watched you develop as you have been here with us, and your welfare has been the personal concern of every member of this faculty. Should you, as you go out into the world's work, ever feel that you owe any debt of gratitude to your past instructors, pay that debt by being the person that your teachers expect you to be. We, and I know that I speak for every member of the faculty group, have tried to give you our best.

And now, once more, I bid you all a hearty welcome, a greeting tinged a bit with regret, because at this particular time, it means that we have come to the parting of the ways - so I say -

Hail - and farewell!
Mr. Chairman, Ladies and Gentlemen:

A great deal has been said about the side shows of this school life of ours. I am always reminded of a song that a crowd used to sing when I was very young. We thought it was just excruciatingly funny. It went like this:

"Cy and I we went to the circus,  
Cy got hit with a rolling pin  
Cy said he'd get even with the circus,  
So he bought two tickets and he didn't go in."

We were, of course, much too young to see that the reverse side of the mask of comedy is always tragedy, and much too inexperienced to see the tragedy of the man who paid his two tickets and didn't get what he paid for.

Woodrow Wilson is generally given credit for the famous remark that the average student is more interested in the side shows of school than he is in the show in the main tent. Mr. Avery once said that he had never found the remark or anything like it in any of his writings, but to him is generally given the credit.

Now school teachers are incurable about always starting out with definitions, and it might be a good idea to start out with a definition in this case. If the show in the main tent, as it is called, is the gaining of credits for graduation or a degree, then everything we do in school that does not contribute to that end must be a side show. This might even include a subject for which we receive no credit.

Now don't misunderstand me. This institution and every other institution of learning has only one object in being and that is scholarship. I do not mean the attainment of good grades — those are not an end in themselves; they are an inevitable by-product of
the attainment of that end, which is knowledge. We must put first things first, and the first thing in any school is scholarship, and until you have made the proper adjustments with your surroundings so that this is first in your student life and until you have learned to arrange all subsidiary aims around this central one, you have no time for side shows.

But those of you who are good students are good at the side shows too, and one of the finest things about this school is that everyone has a chance at everything. In larger institutions the important extra curricular activities are limited to a few; here, everyone has a chance.

You, who are Freshmen, came here and at once had a chance of joining a literary society. You had a Freshman pep squad; you took an active part in the song contest, and able committees from your group handled the class party and the stunt you put on on stunt night. The Juniors have done all this and more; they put on a very successful Junior-Senior banquet. The Seniors have an Annual and a class play to their credit. The advanced have done all these things and have carried on thru a fourth year. Everyone here has a chance to take in many side shows.

But right here, the simile breaks down. For we go to the side show at the circus, pay our dime and take in all we can, and here to get the most out of the side show, we must give of time and energy, and we get in proportion to what we give. Who got the most out of the song contest? Everyone got something - the harder you worked to learn your alto leads, the more you know about alto and the more time you spent struggling with the tenor, the more you know about tenor parts in general, but there is no getting around it that the ones who got the most out of the contest were the four song contest leaders and the student accompanists. Why? Because they had to put in more time in training before hand and more
energy in actual performance that night. They were exhausted and three pairs of them were discouraged, but whether or not they won is not the point. They did a fine piece of work and those that work received a training which few pupils in secondary schools ever get.

Who got the most out of the Junior-Senior banquet? Those of us who curled our hair and made ourselves beautiful and went over the last minute? I don't think so. We got a good meal and had a wonderful time. But the people who hustled around making arrangements collecting money and putting up decorations are the ones who got something worth keeping out of it. No banquet, great or small, is going to scare them now. They are ready to jump in and do things and they'll know how.

I should like to look in on your people five, ten or fifteen years hence. And I should like to see you actively engaged in what will then be the side shows for you. The main show then for you people will be either successful homemaking or the earning of a living. I hope that you girls will be housewives, and fine house­wives too. I hope you'll be successful cooks, and that your homes will be havens of peace and order, but I hope that if the call comes for help on a church supper, you'll have sense enough to leave some dust under the beds, if necessary, and go to help with the supper. Dust under the beds doesn't bother me a bit, but I do have the greatest faith in the world in church suppers. I ought to have; I was brought up on them. I think there is no finer influence in the community than these big dinners and the women who put them on.

And you men, I hope you go back to your home communities and carve out a niche for yourselves. I hope you get to be master farmers, but I hope too that you will sometimes have the sense to leave some sand on your car wheels, if necessary, in order to go down the road to help out a neighbor. When your name is mentioned during the nomination of officers for your local club, I hope
You sit still and let yourself be elected, and then never sit still again while you are in office, but do the best you can to make the organization what it ought to be.

And those of you who look forward to going to college. You happy people! I'd give almost anything to be standing in your shoes right now. You'll have the finest four years of your life, but remember this, you've paid for a whole show, and you won't get it unless you take in some of the side shows. Again I repeat, scholarship must come first. I cannot imagine anyone being contented with a grade of C. But after you have made sure of your grades, after you have made your adjustments, then take in all the side shows you can, and put everything you have into them. Those are the things that will mean the most to you when you come to remember your college life in later years.

Not that I loved scholarship less, but that I love life more. Tennyson says "It's better to wear out than to rust out" and he is right. Live your life and live it abundantly. Never fail a call for help. I maintain this: that you have only half lived if you have not gone home a number of nights dead tired from doing something for other people that you didn't have to do, and for which you received no remuneration.

The man is a failure who has put the fine effort of his manhood into nothing, but the ahaassing of money, and the securing of financial security for himself and his own. The woman is a failure who has done nothing but keep her own house in order and play bridge.

There comes a time in everyone's life when the resources that he needs most are his friends. The best way to have a friend is to be one, and the best way to be one is by giving of yourself, your time and effort in some enterprise which works for the common good of the community whether it be the establishment of a community club, or
the cleaning up of the political situation of a city or town.

I have all the faith in the world in human gratitude. In spite of the sometimes seeming ingratitude of the folks around us, I firmly believe that most people warmly appreciate our efforts. No one ever takes an active part in the side shows of life without running afoul of criticism. I remember a play I saw some years ago in which a detective asked a woman of charming character and personality if she had any enemies. She replied, "Don't insult me. Of course I have." But what the play brought out was that her enemies bore her no great ill will, and her friends were numerous and staunch. I can promise you that if you give yourselves wholeheartedly to any move in your community that promises for the best, if you do the best you can, the gratitude and friendship you receive will make the criticism seem small.

No one person can take in all the side shows. I hope you show some discrimination. I never thought that the beautiful monument that stands on our driveway as a memorial to our heroic dead was a suitable place for the breaking of the rules of this institution. I am not especially proud to drive out from town and behold infringement of school rules at the very entrance to our grounds. I do not count these as side shows worth while or otherwise. You know that at every circus there is a fat policeman who patrols the ground to keep an eye out for offenders. His presence doesn't add much to either the circus or the side shows. I know that he himself would rather be sitting in the show enjoying it with the rest of you, and we of the faculty feel the same way sometimes. My sincerest hope is that those of you who may still have a lingering liking for these less commendable uses of your spare time will work to overcome this weakness by filling in with the things of life that are worth while, and there are enough pleasurable things that are worth while so that it should not be difficult.

And therein, in the use of spare time and of spare energy
lies the great justification of the side shows. Your brilliant student, what is he to turn his energies to when lessons are done? "We've tried to give you something worth while - in debate, judging, class activities, dramatics, music. The man who rides a cultivator, what is he to think about until he gets to the end of the row and has to turn and go back? What's filling his mind? A barn dance? or community service? It depends on the training he has had. If we have given you something worth while to fill up those vacant places in your life, then we have succeeded in really educating you.

Nor is there any reason why that which has been the show in the main tent while you have been here in school should be abandoned. If you don't do anything but subscribe to a good current magazine and read it regularly, you will have done much toward furthering your own education. I hope that you will keep in touch with the latest methods of farming. I suppose that there is not one of these station men but who hopes that methods of farming will have made many changes for the better in the next fifteen years. I hope you keep abreast of the times.

And you, my seniors, who are going out from here today, what am I to say to you? After the way we've worked and worried and disagreed and laughed over things for three winters, how am I to say goodbye to you? Our relationship has been built largely on these side shows, and I know from the way you have pitched in time after time and put things over gloriously that no community in which you find yourselves is going to lack for intelligent leadership. The crowd who ran the Junior-Senior last year will face the biggest community dinner without a qualm and I know that nothing in the world can frighten the Aggie board.

We've done everything we can for you these years, but we hope that what we have taught you of living is just as great as what we have taught you of learning. Go on, go tearing into every
side show that comes up the rest of your lives. Don't rust out, form disuse – wear out form giving you energy to make life more livable for others. Be the dependable ones in every group – get under the load and work with the enthusiasm you have given to everything here in school.

"Sail on, nor fear to breast the sea,
Our hearts, our hopes are all with thee,
Our hearts, our hopes, our prayers, our tears,
Our faith, triumphant o'er our fears,
Are all with thee – Are all with thee."

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For almost everyone there is keen enjoyment in little anecdotes concerning the successes of great and noble men, or it may be of some institution, as it is with ours. Whether they tell of brave deeds, of lasting struggles, of supreme sacrifices, or of mental achievements, they are alike appealing. The interesting story of the Northwest School has always been particularly attractive to me.

Many were disappointed when Mr. Hill's free offer of three quarter sections of land, lying in a slough two miles north of Crookston, was accepted by the Board of Regents of the University of Minnesota. From the duck pond of those days, it has steadily grown into our beautiful school as we now behold it. But it has not been easy going. It was with difficulty that a foothold was established. Every new movement, whether religious, political, scientific, or agricultural is sure to be opposed, and the new project was no exception.

It is almost impossible for us to visualize the hardships endured by our Agricultural School in its first years of existence. At first there was one building, and only one. But it was a seed in good soil. To feed the students on the first floor, to teach them on the second floor, and to "sleep" them on the third floor, epitomizes the all-exclusive function of this building, which is now familiarly known to all as the Home Economics Building. New buildings were added from time to time, and extensive work was done on various projects about the Campus.
But we must go back to the Pioneers who shaped the course of our school. Mr. Hill's foresight in giving the land, Mr. Hoverstad, whose undying faith in the Red River Valley was sublime, and Mr. Robertson, Mr. Kieble, and Mr. Stephens who continued the work, and to the numerous others that helped in the growth of our school, we owe what we now possess. But let us remember that it is thru the visions of these far-sighted pioneers that our dreams now are becoming a reality.

The important part of the story is the impression the Northwest School has made in the Red River Valley. That it is great, is proved by the fact that young men and women are attracted by facilities offered within its doors. Her graduates are making good, and last, but not least, because of the assemblage here tonight whose faith in agricultural education is not dying, but rather standing at the horizon of a new day now dawning in agriculture for young men and women. Such is the importance of this vision.

Wherever we look, we find similar instances. In history, fable and song. In Virgil's "Aenead" we have the characters often governed by visions, real or imaginary. For instance, while the Trojan hero Aeneas was delaying in Carthage, instead of seeking his new Italian home, there appeared to him a vision of Mercury, ordering him to set out at once. Then Aeneas, stopping at Sicily, was visited by a vision of his dead father, who advised him to leave the feallest followers behind and to continue on to his new home. Let us note also "The Vision of Sir Launfal", a poem by James Russell Lowell, telling how a knight of King Arthur's court sought a cup seen in a vision.

However, people will say "Times have changed. The age of
miracles in past. Unfortunately so. But altho we may not have a material vision guiding us, somewhere in our minds are stored up pictures of future success. That is our vision. With it we can succeed. We have a set goal and we will reach it for it is already wained in our minds.

We have proof of this in the life of Abraham Lincoln, who, having a vision of the United States as a great republic to guide him, struggled and worked to preserve the Union. A more recent instance is that of Commander Richard E. Byrd, first to reach the North Pole by air, who probably had in his own imagination conquered the polar air regions many times before the actual event.

If the objectives of this Senior Class could be collected into a composite picture, I believe we would have something both strange and interesting. Here, perhaps, we would see a great surgeon, an engineer, a lawyer, a master farmer, a master home-maker, and many successful business men and women.

But no matter what the vision, I think success is bound to come when we have the mental picture to guide us on.

Tonight we wish to welcome the parents, teachers, and friends, who have thus far helped prepare us for our life work. I imagine that they, too, have visions - not of themselves, but of us as successful men and women. The best way to repay them for their interest in us, I believe, is to bring about the materialization of their visions.

- - - - - - - - -
Edna Anderson - Will be powdering her nose.
John Anderson - Tractor salesman in the Hawaiian Islands.
Ingvald Anderson - Professor of the East Grand Forks High School.
Kenneth Avery - Mr. Foker's successor.
George Beatty - America's most noted football player.
Rishton Bedard - Head chef of the "Blue Mill" Hamburger shop.
Rudy Berger - King of "To Pan Alley."
Roy Boman - Professor of Algebra at Northwest School.
Ann Brandli - Congresswoman from Minnesota.
Glenn Bloomquist - Successful baby rattle salesman.
Alpha Bruun - Preceptress in Senior Hall.
Hazel Comedy - Taming Mexican cowboys.
Hazel Dahløren - A "Paramount" star.
Antoinette DeMaster - Will still need to be tamed.
Clinton Donley - Debate coach at Shirley, Minnesota.
Gladys Eggen - East Polk County Club leader.
Selvin Erickson - Lieutenant Governor of Minnesota.
Vernon Erickson - Christgau's successor.
Angela Filipi - Clara Bow's double in the movies.
Jesse Filipi - Professor of English at Yale University.
Dorothy Glass - Teaching Shorthand in northern Finland.
Arthur Grove - Superintendent of Northwest School.
Selma Hedstrand - Will discover that relationship between Home Management and Housekeeping.
Arlene Hill - Taking Marion Talley's stand on Broadway.
Harry Haugen - Coaching basketball in Japan.
Arthur Hendrickson - Professor of Astronomy at Nome, Alaska.
Allen Hoff - Will have blown his way into Sousa's Band.
Silas Hviding - Will realize that two cannot live as cheaply as one.
Verner Kerlin - President of the "World's Fair" at Chicago.
Emery KenKnight - Charley Chaplin's successor.
Clifford Kroulik - Will be ready to step into the footsteps of Will Rogers.
Beatrice Leitch - Will be the fattest lady in the Barnum Bailey Circus.
Agnes Lundin - America's most noted do-nut raiser.
Mildred Malme - Will realize that lullaby's are the most difficult songs to vocalize.
Leo Maattala - Director of the "Kitchen Klan" dance orchestra at Mentor, Minnesota.
Donald McCall - Will be Daniel Webster's successor.
Martin Moen - Pastor of the Norwegian Lutheran Church, Crookston.
Carter Mortenson - Builder of monuments on school campuses.
Emma Neggaard - Will be a dancer in the Ziegfield Follies.
Helen Naplin - Teaching Home Economics and Physical Education at Northwest School.
Bjarne Nornes - Will be singing "The Dishpan Blues."
Helmer Nornes - Will be taking John McCormick's place on the opera stage.
Hazel Noyes - Door keeper of the fire escape at Sears Roebuck, Minneapolis.
Marvel Noyes - Teaching beauty culture to the Eskimos.
Harold Olson - Janitor at the power house at N.W.S.A.
Arthur Paulson - Licenced physician at Rochester, Minnesota.
Eva Parduhn - Will hitch hike from New York to California.
John Pearson - Will be the world's champion debater.
Clarence Peterson - Inventor of permanent false teeth.
Raymond Peterson - Champion onion grower of North Dakota.
Clarence Prenevoit - Will be teaching French in Mexico.
Estelle Philipp - Will be a snake charmer in "Wall Street".
Richard Radway - Will be district forest ranger of the Lake of the Woods.

Lloyd Ross - Salesman for baby chicks.
Herbert Schroeder - Will be taking dancing lessons at New York.
George Schulz - New York champion "Tap Dancer."
Agnes Sevald - Will accept Miss Bede's position at N.W.S.A.
Tumina Slette - An inventor for the "Sta-in-all-night marcelle."
Vernon Smolak - Inventor of false hair dyes.
Paul Sorensen - Tractor instructor of the University of Illinois.
Arthur Sundrud - Salesman for the Mutual Insurance Company.
Ruth Stenborg - Will still be applauding the "freshmen".
Nils Stenborg - Will be the head of the dairy department at the University of Wisconsin.

Hulda Swanson - Instructor of voice at the McPhail School of Music, Minneapolis.
Ingolf Swanson - Registrar of the N.W.S.A.
Ann Thoreson - Head nurse of the Red Cross Association.
Marion Valor - Will succeed Miss Thompson as manager of the A.C. Dining hall.

Arnold Wolden - Beauty parlor operator at Climax.
Alta Weckwerth - Will be chief cook at the Moorhead Teachers College.

Dora Woods - Will be governess for the "Gold Dust Twins."
Chester Vergens - Carrying mail by airplane between McIntosh and Drayton, North Dakota.
Class Will

Arlene Hill '31

We, the 1931 Senior Class of the N. W. S. A., being of sound mind and body, of sensible age and set convictions, and possessing a love for both fun and study, do make, publish and declare this, our last will and testament:

To the Class of 1932 we will our ability to forge ahead in contests against difficulties.

To the Class of 1933 our modest, shy and never content ways.

To the Faculty, our love and appreciation for the instructions bestowed upon us during the past three years.

We also give hearty permission to the faculty to hold us up as models to succeeding classes, realizing, as we do, the benefits to be derived from a laudable example.

Miss Warne and Mrs. Genung will to Mr. and Mrs. Dowell the trials and tribulations that fall to the lot of the Senior Class advisers.

Individual behests are as follows:

Edna Anderson wills to Milly Rybak her golden locks.

Ingvald Anderson wills his ability to sing popular songs to Harold Letnes.

John Anderson, his love for Sallie to anyone who can take it and make a getaway.

Kenneth Avery wills his letter writing ability to Arnold Strande.

And to Riley Parduhn, Arthur Burk wills his ability to get places.

George Beatty wills his Royls Royce to Andy, the bus driver.

Rishton Bedard wills his close contact with Miss Thompson to Francis Hetland.

Rudy Berger wills his curly hair to Robert Coulter.
Glenn Bloomquist wills his red sweater to Arthur Sanden.
Roy Boman his feminine personality to Vernon Mutchler.
Ann Brandli wills her ability to keep order in the library to Mr. Mlinar.
Alpha Bruun wills to Arnold Weise her happy evenings in Robertson Vestibule.
Hazel Canedy wills to Helen Sevald her ability to giggle.
Hazel Dahlgren wills part of her weight to Miss Thompson.
Tony DeMaster wills her ability to vamp Advanced boys to Esther Dalager.
Clinton Donley, his ability to write themes to Mervin Hagen.
Gladys Eggen, her natural curl to Pearl Henry.
Selvin Erickson wills his oratorical ability to Glenn Fisher.
Vernon Erickson, his smallness of stature to Edwin Widseth.
Angela Filipi her love for romantic adventures to Erdman McVeety.
Jesse Filipi wills to Edward Brandli his tiny feet.
Dorothy Glass wills her position as Aggie typist to Douglas Adkins.
Arthur Grove, his Aggie scraps to the next year's editor.
Selma Hedstrand wills to William Ford her interior decorating ability.
Arlene Hill wills her ability to break hearts to Margaret Gault.
Arthur Hendrickson wills his ability to write Senior theses to Melvin Johnson.
Harry Haugen wills his ability to wink at the girls to Ernest Beauchene.
Allan Hoff wills his brass horn to Ralph Fisher.
Silas Hviding wills his "A's" in Algebra to Walter Dorseth.
Verner Karlin wills his place in Senior Hall to Donald Toomey.
Emory KenKnight wills his ambition to John McIlraith.
Clifford Kroulik wills his love for the girls to Herbert Hanson.
Beatrice Leitch wills her ability to get up in the morning to

Bertram Johnson.

Agnes Lundin wills her Whoopee making ability to Ella Olson.
Leo Maattala wills his considerate ways to Olaf Kvalnes.
Mildred Malme wills her campus term to Wallace Abbott.
Donald McCall wills his can opener to the best salesman in the

Junior class.

Kenneth McNown's basketball ability to Peter Mandt.
Carter Mortensen wills his grin to Everett Hesby.
Martin Moen wills his football letter to Jerome Wermager.
Emma Neegard wills her willing ways to James Philipp.
Helen Naplin, her position as center on the girls' basketball
team to Jean Nisbet.

Bjarne Nornes, his nickname to Mr. Pilkey.
Helmer Nornes, wills his sideburns to Mr. Christgau.
Hazel Noyes wills her dancing ability to Irene Pearson.
Marvel Noyes wills her smile to Harriet Severson.
Harold Olson, his place in the power house to Lawrence Harstad.
Arthur Paulson wills his place in the hospital to anyone who
wants it.

Eva Parduhn, her striped jacket to Paul Engebretson.
John Pearson wills his ability to answer questions with his
book at home to whom ever Mr. Christgau suspects.

Raymond Peterson wills his flaming courage to Charlie Brandli.
Clarence Prenevost, his chess games to Christian Holte.
Estelle Philipp wills her adaptability to next year's most
lonesome freshman.
Richard Hadway his hours with Miss Sheldon to Oren Refling.

Lloyd Ross wills his success with chickens to the next one responsible for breakfast.

Herbert Schroeder wills his radio to Robertson Hall.

George Schulz, his love for dancing to Anna Loken.

Agnes Sevald, her love for sewing to Rose Naplin.

Tumina Slette wills her name to anyone who can pronounce it.

Vernon Smolak wills his chemistry formulas to Clifford Grendahl.

Paul Sorenson wills his tractor enthusiasm to Melvin Cordes.

Arthur Sundrud wills his ability to miss breakfast to Miss Sheldon.

Ruth Stenborg to Rodney her love for making candy.

Nils Stenborg to Lloyd Chapman his nonchalant walk.

Hulda Swanson wills her sunny smile to Lloyd Pugh.

Ingolf Swanson to Mr. Mlinar wills a maroon jacket, brown hat, white sweater, pair of glasses and his ability to make announcements.

Ann Thoreson, her place in the dining hall to anyone who can handle it.

Marion Valor wills her love for algebra to anyone who dislikes it.

Arnold Wolden wills his studiousness to Toots Heegard.

To Mrs. Geer, Alta Weckwerth wills her ability to carry sheep from third floor, Robertson, and turn them loose to find their way back to the fold.

Pat Woods wills her collection of sweethearts to Violet Solmonson.

Chester Yergens wills his guardian eye to William Ardell.
The foregoing beneficiaries are to have and to hold these bequests for the rest of their natural lives.

Signed and sealed before me on this the twenty-sixth day of March Nineteen Hundred Thirty One A.D.

A. A. Dowell
Executor

Witnesses:

Arthur Grove
Helmer Nornes

John Pearson
Notary Public

My commission expires after Commencement Exercises, March 26, 1931.
THE CLASS OF 1931

Helmer Nornes '31

I have been given the privilege of representing the Senior Class of 1931 and to present this key to the Senior Class of 1932.

A year ago when we, as Juniors, received this key, we knew nothing of what lay in store for us inside the door which this key was to unlock. We could only peer through the keyhole and see a portion of the interior of this great structure called the Senior Year; but we could see nothing of the splendor and beauty that lay farther on beyond our vision.

When this door was first opened unto us last fall and we took our first look inside, we thought that this was indeed a wonderful and interesting place, but now that we have made our way through its many halls and chambers, we have begun to realize that we had indeed had a very vague idea of the beauty of this structure, for here was a place far more wonderful than we had ever imagined it to be.

Now as a representative of the Senior Class of 1931, I take great pleasure in presenting this key to next year's Senior Class, and it is our sincere hope that when you unlock the door to your senior year, you may see a place full of sunshine and happiness and that, as you enter, it may disclose many new things in the field of knowledge, and we also hope that as you explore its many rooms and passages, you may find the things that will eventually lead you on to success.
RESPONSE TO SENIOR CLASS

Edwin Widseth '32

It is with great pleasure that we accept the key of knowledge handed down to us by this Senior Class that is graduating this year. They have the honor of being the largest senior class that has ever graduated from this school. They have set up a very high standard, a standard that will be worth while for other classes coming to this school to maintain. They have made many fine records during their course here that will be hard for any other class to surpass, but they will be something to try to better.

They have handed the key of knowledge down to us after the most successful year ever finished at the Northwest School. We, as Juniors, will accept the key and with the able help of our class advisers, Superintendent and Mrs. A. A. Dowell, we hope to maintain the high standard of this school, and that we may, in turn, leave something at this school that will long be remembered.
AGRICULTURE
Agronomy
COMMERCIAL FERTILIZERS IN THE RED RIVER VALLEY

Ingolf C. Swanson '31
Alvarado, Minnesota

Dedication

This term paper is dedicated to everyone interested in the use of commercial fertilizers and especially to the Agronomy Department of the Northwest School of Agriculture.

Foreword

"On the other side of Po, the use of ash is viewed so favorably by farmers that they actually prefer it to the manure furnished by their cattle." - Pliny.

The use of fertilizers dates back as far as the discovery of North America. The early settlers and Indians placed a fish in each hill of corn. This method was crude, but it proved to be the beginning of the use of artificial manure.

About the middle of the last century, nitrates of soda were discovered in large amounts in Chile and were introduced into the northern hemisphere a little later. About this time, Sir John Lawes, a noted English agricultural scientist, started to manufacture a phosphate fertilizer from bone. This material brought good results on the long cropped English soil and the introduction into the United States soon followed. This fertilizing material, along with many other forms, developed from this start into a large fertilizer manufacturing industry in our country. These materials are in common use in most states today, but chiefly east of the Mississippi River.

There are ten plant foods that are absolutely essential for plant growth. These elements are carbon, hydrogen, oxygen, nitrogen, phosphorous, potassium, calcium, magnesium, iron and sulphur. Of these ten, three are obtained from the air, and
water, oxygen, hydrogen and carbon. The other seven are obtained from the mineral grains of the soil, with the exception of nitrogen which is found in the organic matter of the soil as well as in the air.

Due to our continual method of cropping, the Red River Valley has reached the stage where it has become necessary to restore some of the plant food cropped out. There are only three elements that are lacking in the Valley, nitrogen, phosphorus, and potassium.

Our soil needs nitrogen most of all. This element can be restored in several forms, such as sodium nitrate, a form of fertilizer found in Chile in natural deposits. When mined, it is impure, but it goes through a process which renders 15 or 16% of the nitrogen available. It is very soluble and therefore gives immediate results. This type is the best commercial nitrogen fertilizer, but unfortunately this supply is limited. Ammonium sulphate is another type of nitrogen fertilizer. This material is a by-product of coal, obtained when coal is heated to make coke and gas. It contains approximately 20% nitrogen. It is soluble in water, but must be changed to a nitrate by soil bacteria before it can be utilized by the plants. It also has a tendency to cause a somewhat acid condition of the soil, if it is used continually.

Restoring nitrogen through legumes is the method that is most generally practiced. By legumes we mean alfalfa, the clovers, soybeans, peas and vetch. These plants, if inoculated, are able to obtain nitrogen from the air and, if a crop of this type is plowed under, this nitrogen is added to the soil.

Barnyard manure is still another source of nitrogen, but in this form, it appears in very small quantities, and if it has to be hauled more than one-half mile, it becomes too expensive. For
fields near the barnyard, it may be profitable, depending on the condition of the soil and whether or not the manure has bleached. Commercial nitrates are profitable on land where the return per acre is high, but for the average farmer in the Red River Valley, nitrogen should not be purchased in the form of commercial fertilizers. Legumes are cheaper and more profitable to the average farmer in the Valley.

The second plant food deficient in our soil is phosphorus. Phosphorus is found in apatite, a mineral very common in our soil, but in small amounts, and this supply lessens every year due to our continual method of cropping. It also occurs in large deposits in some places. This mineral is generally called phosphate rock. It is a limestone rich in phosphate which was formed in old lake bottoms where bones of fish collected in great quantities. There are several of these in the United States: in Tennessee, North and South Carolina, and Florida. Large deposits have recently been discovered in Idaho, Wyoming, and Montana. Phosphate rock contains both phosphorus and calcium in a rather unavailable form so that it must either be finely ground or else treated with sulphuric acid. When this is added, a chemical change takes place, which results in a new form of phosphate, more soluble than the original form found in the natural rock. This product is called super-phosphate. It is grey in color, looks somewhat like sifted wood ashes, and contains about 14 to 16 percent available phosphoric acid. Special methods of manufacture have made it possible to increase the amount of available phosphoric acid to about 45 to 47 per cent. Such phosphates are known as treble super-phosphate.

Phosphate fertilizers have given a general response in the Valley. They have been almost universally profitable where applied to alfalfa on the heavy soils of this section. They
have also shown profitable results on sugar beets and potatoes in most trials. Other common crops do not always respond but are worthy of an inexpensive test trial.

There are three forms of phosphate fertilizers used in Minnesota. However, the two most generally used are the ordinary super-phosphate and the treble super-phosphate. They both contain the same plant food, but in different amounts. The ordinary super phosphate may contain from 15 to 20% available phosphoric acid, and the treble super phosphate may contain from 45 to 47%. One is simply a more concentrated product than the other. Lime phosphate is third form used in this state. It is also known as Puhm lime phosphate. It is not recommended to this region because it is insoluble and, when we apply a fertilizer, we want a response the same year. This form contains 33% phosphate, but it is not by far as available as the other forms of phosphates, and must be applied in much larger amounts. It sells at a very low figure per ton, but the fact that much larger amounts are necessary makes it very expensive and far from profitable because of its insoluble form.

Potassium is the third element deficient in our soil. This element is generally secured from Germany and the French Province of Alsace, where the large deposits are found. The largest of these deposits is located near Stassfurt, Germany. The potash salts as they come from the mines contain considerable quantities of sodium and magnesium compounds, so that it is necessary to dissolve the raw material in water and allow it to re-crystallize, in order to secure them in a pure state. Feld spars, which is the next to the most common mineral in the soil, also contains potash.

The upland soils of the Valley are already well supplied with potash, so that for most crops, it will not be necessary.
Root crops use more potash than most other crops and are most likely to benefit by its use.

There are two common forms of potash fertilizer: namely, sulphate of potash and muriate of potash, the latter being the most common form. It contains from 50 to 60% potash. It is satisfactory for most crops, altho it cannot be used on tobacco as it injures the burning quality of the tobacco leaf. Sulphate of potash is preferred because some injury to the crop may result from heavy applications of the muriate. Hard wood ashes that have/been leached sometimes contain as high as 10% potassium.

The response to commercial fertilizers in the Valley varies so much from farm to farm and, in some instances, from field to field that one is not wise to purchase these in any considerable amount before making an inexpensive trial on his own field or farm. Results obtained on one farm may not apply to other farms in the neighborhood. Nor do the results on the Northwest Station plots, necessarily apply to any large area.

The few general statements that may be made are as follows:

1. Phosphate fertilizers are the most important in the Valley.
2. Phosphate fertilizers generally show a beneficial effect on alfalfa, clover, sugar beets and potatoes.
3. If phosphate fertilizer show a beneficial effect on alfalfa, it should be tried on the other farm crops.
4. Where phosphate fertilizers show a beneficial effect on wheat or corn, earlier maturity of these crops may be expected.
5. Nearly all our peats need phosphate.

Even tho phosphate has generally responded, when applied to alfalfa in this section, there is no certainty of its response on this or any other crop. Two or three pounds of treble superphosphate or six or seven pounds of 20% super phosphate are suffi-
cient for a trial. A trial plot two rods square equals 1/40 of an acre, on which two and one-half pounds of treble super-phosphate or six pounds of 20% super-phosphate will furnish the recommended rate of application. In making such a trial, care should be taken to locate the plot so that it may readily be found a year or two later.

Commercial fertilizers may be applied in any of the following ways: broadcast with fertilizer drill, end gate seeder, lime sower or by hand. They may also be mixed with manure. Harrow to mix it with the soil. They can be applied at any time that is convenient except when the leaves of the crop are wet. However, the earlier in the season, the more chance for response the same year. Potash fertilizers should be applied before seeding.

The rates of application of commercial fertilizers depend on the percentage of available plant food. Care should be taken not to apply too much as it may prove injurious to the germination.

The following rates are recommended for the Valley:

- 45% treble super-phosphate: 100 lbs. per acre
- 20% super-phosphate: 225 lbs. per acre
- 16% super-phosphate: 281 lbs. per acre

Treble super-phosphate costs more per sack or ton than 16% super-phosphate, but the fact that it contains as much as 31% more available plant food makes it a cheaper fertilizer, because smaller quantities are necessary to produce the same result.

When 20% super-phosphate is applied in the line of rows with sugar beets, it should be applied at the rate of 120 to 125 lbs. per acre. Treble super-phosphate is generally applied broadcast to row crops land, because of the difficulty experienced in calibrating the line of row attachments to the small amount needed. Potash fertilizers, both muriate and sulphate of potash, should be applied at the rate of 240 pounds per acre and should be broadcast.
There are many kinds of commercial fertilizers, but they are all made of one or more of the three forms of plant food and these three forms are known as nitrogen, phosphate, and potash. Some fertilizers contain only one of these, such as nitrogen only or potash only. A fertilizer that contains two forms, such as nitrogen and phosphate or phosphate and potash is known as a mixed fertilizer and when a fertilizer contains all three constituents, it is referred to as a complete fertilizer. Fertilizer mixtures are sold under a formula such as 4-8-6. This formula indicates that the mixture contains 4% nitrogen, 8% phosphoric acid and 6% potash. The order of the constituents is always the same – nitrogen, first; phosphate, second, and potash last. All fertilizers sold in Minnesota must have the analysis stamped on the sack or on a tag attached to it.

In conclusion, I wish to say that the Red River Valley will need commercial fertilizers in the future, so let us get acquainted with the use and forms of commercial plant food so that we may obtain the best possible results from our soils in the future.

Bibliography

Crops and Soils Handbook

The Soil and Its Management

Vol. 22, No. 3.

by M.F. Miller
CROP ROTATION

Allan Hoff '31
Dalton, Minnesota

Dedication

In sincere appreciation of what I have learned about soils and soil management, I hereby dedicate this thesis to Mr. R. S. Dunham, instructor and agronomist at the Northwest School of Agriculture.

Foreword

In this thesis, I have tried to point out the value of crop rotation, and how it helps to retain soil fertility and organic matter; how it aids in killing weeds, insects, and diseases; and also how labor may be used more efficiently on the farm.

The oldest experiment in the world is crop rotation; it also is the oldest experiment in the United States. Continuous cropping cannot be followed very long without injurious effects. Crop rotation overcomes many of these effects.

A crop rotation is the growing of different crops on different fields, in alternate years. For example: In a four year rotation, wheat is grown the first year and it is followed by sweet clover. Then a cultivated crop is grown, followed by flax.

Reasons for Crop Rotation

The fact which usually forces farmers to change crops is the infestation of either weeds, insects or diseases. A rotation helps to overcome and control these enemies. Almost every crop is accompanied by certain weeds that are able to grow with it but do not bother any other crop, and weeds that bother crops are different from those that bother hay. The land may become very weedy if it is cropped with small grains
continuously. Wild mustard is a serious weed in some sections where small grain is grown, but may be controlled by a cultivated crop. Wild oats also is a serious weed in places but they are controlled quite easily and readily if tilled crops are grown.

There are diseases that injure one crop and are not injurious to other crops. For example: Flax wilt is a disease that checks the growth of flax. If flax is grown on one field quite often, it is liable to become infested with disease. Flax wilt stays in the soil and it will do damage to flax the following year if flax is grown. Therefore, flax should not be grown successively on the same soil, unless resistant varieties are used. Likewise, potato scab affects only potatoes and it may become serious if potatoes are grown on the same field year after year.

Almost all of the insect enemies of crops are checked to some extent by crop rotation. The root louse, which often attacks the crop will often force rotation, and this together with other insects is controlled.

A rotation may also provide for keeping up the humus supply of the soil. Fields that are constantly grown with tilled crops will have their humus supply decreased. This is due to the fact that the small grains, if constantly grown, take away the humus without replacing any and to apply humus to the soil, the crops such as legumes and grass will have to be grown. If legumes are grown in the rotation and turned under, a great deal of organic matter is the source of humus.

A rotation distributes labor. Grain farming requires labor but not at all times of the year. In the growing of small grain crops only, the amount of labor required to do the
work is that which is needed to do the necessary work preparatory to spring work. Do the spring work and then wait for harvesting and threshing; then to do the necessary fall work. When a cultivated crop is grown, labor is required to cultivate the soil and cultivation provides for labor during the summer. Therefore, the labor that would otherwise be wasted can be applied to cultivation and other work such as harvesting.

A crop rotation distributes income. In the case where several different crops are grown, a person can be more sure that he will get some returns from his farm and labor. For example: in the four year rotation, if the wheat crop should fail, there would still be the other three crops to rely upon providing they do not fail. If none of the crops should fail they would all be crops that would have a different value and not be marketable at the same time. As they do not have the same market value nor the same flow to the market, they form a more dependable return or income.

A rotation allows for the alternation of deep and shallow rooted crops. The alternation of deep and shallow rooted crops is made possible by the growing of legumes and especially sweet clover, and for shallow rooted crops the growing of the small grains. Through the alternation of the crops, the soil is made looser and therefore the soil is deeper.

A rotation systematizes farming, making farming easier and less complex. A farm that has a rotation cycle is squared into equal area fields instead of having several small fields, thus making the work easier and more economical. However, it might take some time before the farm can successfully be laid out and planned. After having arranged the fields, the work
is simplified and a more systematic program of farming is carried on.

Cultivated Crops in Rotation

A systematic method of farming is carried on by the man who follows the crop rotation practice. However, rotation is not complete until it includes the three different kinds of crops; namely, grain, legumes, and a cultivated crop.

Grain crops are most generally plowed at the same depth year after year. As they are so plowed, a hard surface is formed at the bottom of the furrow. This hard surface prohibits the plants from getting any moisture from below the crust and so to make it possible for the plants to get more moisture, this crust must be broken. A practical means by which this crust might be broken is through the growing of a deep-rooted legume crop. Legumes do break up this surface.

Cultivated crops keep the soil loose and aerated as well as keeping the weeds down. The aeration of the soil is a fundamental principle because it hastens bacterial action. Bacteria work on the organic matter to decompose it into its elements making the steps of nitrification possible. Nitrification is the changing of this organic matter into ammonia and nitrates. The process of nitrification is the changing of the elements of organic matter into ammonia. Plants cannot use the food in this form. Therefore, they are changed into nitrous acid and then into nitric acid. The final process of nitrification is the changing of nitric acid into nitrates. This is the form in which the organic matter is used by plants. Nitrification therefore is the important fact to consider in cultivation.

The twenty years corn trial at the Northwest Experiment
Station shows that the cropping of corn on one plot does not change the acre yields much. The yield in 1930 was the largest in the history of the experiment except one in 1923. Better varieties have done a lot to keep the acre yields about the same. Also plant foods are made more available through aeration. Cultivation has been an essential in growing the corn and therefore aeration and bacterial action have been important factors which aided in keeping the corn yields about the same.

Weeds are an important source of the decrease in crops and also of the depletion of soil fertility and moisture. The weeds take an enormous amount of moisture from the soil, thus lessening the moisture content for the crops. The crops need moisture for their growth and weeds that are present take away a large percentage of moisture that is present. The important thing in regard to weeds then is to keep them cut down by means of cultivation.

Cultivation not only checks the growth of weeds, but it also checks the insects that live from year to year in the soil, and that do the damage to the crop. Cut worms, for example, are one kind of insect that can be and sometimes are injurious to the crop. Corn is the crop that is infested most by this insect. Cut worms and other crop eating insects should be cleaned out of the soil. Cultivation and crop rotation are the methods by which they can be checked.

Diseases, too, overwinter live in the soil and also on crops. If nothing is thought about the nature of diseases, serious trouble might result from the standpoint of crop production. If a certain disease should come on one crop, (alfalfa, for example) that crop should be plowed under and
another crop, not having this kind of a disease, should be grown. This type of disease spreads in the soil and it becomes very prevalent after many years of cropping of one crop on the same soil. Therefore, crop rotation finds itself to be very important in the checking of crop infesting insects and diseases, and cultivation is, as well, the mate to rotation because it does itself aid in the working against weeds, insects and diseases.

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CROP ROTATION

Leo Haattala '31
Oklee, Minnesota

Dedication

I dedicate this thesis to all that are interested in the study of Crop Rotation at the Northwest School of Agriculture.

Foreword

I have written this thesis as a reference for use in planning the Crop Rotation system for my home farm. The plans were made with the assistance of Mr. R.S. Dunham and also with suggestions from Dr. Andrew Boss. I am sure this thesis will be a great benefit to me as well as a helpful reference to anyone else interested in this subject. I wish to thank Professor R.S. Dunham, Dr. Andrew Boss, and Miss Cynthia Weinberger for their assistance in the production of this thesis.

A few years ago when this country was still young, anyone could be a farmer. It was only necessary to sow and reap, for Nature dealt lavishly with man and gave to him freely of the fertility she had been storing for countless ages. As population increased and land lost its fertility, more systematic methods of farming have been established.

The same evolution of agriculture has proceeded throughout all nations since the dawn of history and probably for centuries of the prehistoric age. Agriculture, as it exists today in North America, South America and Europe, closely resembles in its scope the agriculture practiced in the earliest periods of history.

A man gradually became dependent on the crops that he had selected to cultivate, he learned that land cropped continually with the same crop lost its producing power. There was very little
knowledge of the causes for the decrease in soil fertility so the
natural procedure was to abandon the land and to migrate to new
land of virgin fertility which then was abundant and cheap. How-
ever, there were several outstanding men who studied and understood
the cause of infertility. They also knew means by which the condi-
tions could be improved to some extent. Cato Varro in 50 B.C. made
statements that have lived true to the present day. One statement
made by Varro was:

"The practice and art of the farmer are one
thing, that of a shepherd another, and yet, the re-
lation between them is intimate, because it is much
more desirable for a farmer to feed his forage on the
land than to sell it, and a herd of cattle is the
best source of supply of that which is the most
available food to growing plants, manure, so it
follows that whoever has a farm ought to practice
both arts, that of agriculture and that of grazing."

Systematic crop ration, however, did not begin until the
Eighteenth Century. An Englishman, Jethro Tull, made many discov-
eries about soil tillage that gave a great impetus to the study
and practice of agriculture. At about this time, Lord Townshend
began the practice of rotating crops. He greatly improved the
producing power of his land in this way.

From these experiences and practices of mankind, we
realize that our methods of agriculture are not new, but we must
refresh our minds on these facts and apply them to our present
environment.

First we may begin with the advantages of a systematic
crop rotation over the common system of farming.

1. It controls weeds.
2. It controls insects.
3. It controls diseases.
4. It has a beneficial effect on the soil because
   of alternating shallow and deep-rooted crops.
5. It alternates humus-producing and humus-destroy-
ing crops.
6. It systematizes farming.
7. It diversifies labor.
It is often thought that a crop rotation system of farming increases the fertility of the soil. This is not true. A crop rotation causes greater amounts of plant food to be removed from the soil because of larger crop yields. The advantages are that the plant food elements are drawn from a more extensive soil area and a physical condition is maintained that continually makes new supplies of available plant food from the reserve material of inorganic matter throughout the soil.

Noxious weeds have great difficulty in maintaining their existence on land under a systematic rotation of grain, grass or legume and cultivated crops. If weed seeds increase during the time that grain is grown, the weed plants in succeeding years are either subdued by strong growing legume and grass crops or are uprooted when cultivated crops are grown. Many weed seeds lose their vitality during the time grass crops are grown.

Insects have great difficulty to live over winter and to reproduce from one year to the next where various classes of crops are grown. Pests, like the cinch bugs, army worms and grasshoppers, are controlled to a large extent by a rotation of crops.

A rotation of crops is also a severe check to the spread of diseases. Fungus diseases as corn smut, root rots and scab are all controlled very effectively by changing the crop.

A legume is essential in a good rotation. The deep plants aerate the soil and improve the drainage immensely, especially on soils that are alkaline. The roots penetrate deeply and remain to decay in the soil adding considerable vegetable matter.

Continuous cropping of a cultivated crop or a grain crop causes rapid decrease in the humus and vegetable matter of the
soil, while alternating the humus-destroying and the humus-producing crops tends to keep the fertility more constant.

Business and commercial principles are equally as important in farm management as are the principles governing soils management. The farmer comes in contact with problems every day that can and that are largely solved by following a systematic method of farming. The problems of buying and selling of products and supplies, the amount of roughage and feed to be grown for livestock and poultry, the amount of power machinery and equipment required each season, are all partially solved after a definite system of management is adopted.

Another very distinct advantage of a good crop rotation is that it distributes farm labor throughout the various seasons of the year. It lessens the need for labor during the planting and harvest seasons, when labor is difficult to acquire and expensive. Livestock farms, especially have a distinct advantage in this respect. The work of hauling feeds and supplies, grinding feed, spreading manure and caring for the stock will keep men and horses busy throughout the winter months. On "one crop farms" a great waste occurs, because the handling of one large crop in a short period of time forces hastily performed work by unskilled labor, which results in a great waste. For example, in harvesting potatoes, many bushels of small potatoes are always left over. In systematized farming the livestock could be fattened on these potatoes. A good farm manager cannot neglect the value of waste products.

Of course arguments as these do not appeal to men who do not desire to work steadily throughout the year, but they are logical arguments for the farmer who desires to make the most of his capital and labor investments.
Often times extensive "one crop" farmers suffer severely from fluctuating markets and from climatic conditions. Farmers who practice crop rotation, however, must market a variety of products each year, and low prices in one class of products may be counter-balanced by high prices in another class of products. The same applies to losses that occur from unforeseen and unfavorable climatic conditions. For instance, a storm could affect not the wheat crop but still might/injure the corn or the potatoes. A rotation plan is quite reliable as far as income is concerned and it is said that "It provides insurance against loss from climatic conditions."

Before a crop rotation plan may be followed, there are many items which must be considered. First, the land must be well drained, so that all land will be tillable and benefited by the rotation. Next the land must be cleared or a system of clearing should be inaugurated into the rotation plan.

In order to make a crop rotation plan systematic and capable of producing approximately the same amounts of the crops desired each year, it is necessary to divide the land into equal sized fields. The land is usually divided into several large fields for major rotations and the balance of the land is divided into smaller fields for minor rotations. The number of fields depends on the length of the rotation.

In planning the crop rotation system for my home farm, I had to take many items into consideration.

The first step to be taken was to decide the amount and kind of crops to be grown. In order to determine this, it was necessary to take an inventory of all the livestock including horses, cattle, hogs and poultry. Then by computing the feed
requirements of each type of stock and adding the totals, the total feed requirement was obtained. By dividing the requirements with the average yield per acre, the approximate number of acres of each kind of feed and pasture to be had was obtained.

For the major rotation, a plan of five fields of nearly approximate size have been laid out. The rotation includes oats, barley, green manure (sweet clover) alfalfa and flax for a cash crop. The alfalfa field will be changed every fifth year and a part of the green manure field will be pastured for cattle each season. The order of cropping is oats, sweet clover, flax, barley and alfalfa.

The balance of our 160 acre farm will comprise the minor rotations. The plan consists of five three acre fields that will provide pasture for the hogs, calves and turkeys with a field for potatoes and another for the garden.

In planning the arrangement and cropping program, Mr. R.S. Dunham and I have carefully considered the following items:

1. The topography of the land.
2. The drainage of the land.
3. The fertility of the land.
4. The cost of the fencing.
5. The accessibility to fields.
6. The present condition of each field.

The first year's program will be to fence out two of the major fields since there are no permanent crops or fences on these fields. One field will be seeded to barley and the other to oats with sweet clover. In 1932 the old alfalfa field will be plowed and the third major field will be fenced. The three fields west of the farmstead will also be combined that year and, if possible, will be fenced. In the fall of the year, the alfalfa plot north of the farmstead will be plowed. I have also planned to lay out an acre orchard just east of the farmstead.
The next year I will have the alfalfa plot east of the farmstead plowed which will make the five major fields complete. The land north of the farmstead will be divided into four fields with the fifth one on the south side of the farmstead for the minor rotations. All the fields and lanes will be permanently fenced. By the fall of 1933 the rotation system should be complete.

The planning of a crop rotation takes long hours of careful study and hard work, but these items can be distributed throughout a certain period of years with a definite program laid for each year so that the extra work will not become a burden and the expenses can be paid from the profits obtained thereon.
THE HISTORY OF NORTHERN CORN

Helmer Nornes '31
Lockhart, Minnesota

Dedication

I dedicate this thesis to Mr. R. S. Dunham in appreciation of the information which he has given me in the classroom and also for his help in securing material for my thesis.

Foreword

Many people know nothing of how we came to have such highly developed and high producing varieties of corn; so it has been my aim throughout this thesis to show how the corn varieties which we now have, have been developed here in the Northwest.

Corn is the oldest of our American cereals and has been one of the most important of food products as far back as American history records.

We read of corn in the Bible although the corn referred to here was not the corn we know, but it included wheat and barley. The true American corn is the Indian corn or maize.

Authorities hold that the Indian corn originated from a common Mexican grass called Teosinte, which grew in a wild state and was grown by the natives in many parts of both North and South America long before Columbus discovered this continent.

History tells us that when the first settlers came to America the Indians were growing corn, so evidently they were the first to raise the Indian corn or maize on the North American continent.

The earliest knowledge of corn in the northwest we get from the early explorers who visited the Indians in the Dakotas.

As far as is known the first inhabitants of the Dakotas were the three tribes of Indians now known as the Mandans, Rees, and
Grosventres, living here as early as 1738.

The Mandans were evidently the first to reach the upper Missouri. It is believed that they came from the East, probably up in the Minnesota region, but no definite record of that statement is available. Their coming dates back at least three hundred years.

The Mandans were one of the most famous of the tribes in the West. They lived in fortified villages and devoted most of their time to growing crops, especially corn. Corn played an important part in many of their sacred ceremonies, and was one of their chief articles of trade with both the white man and their red neighbors.

The Rees were another tribe of Indians who lived in Dakota. They were also known as the Panamas, Aricara or Arickarees. Like the Mandans they were extensive corn growers and traded much of their surplus to neighboring tribes. Many of their stories and traditions were about growing, cultivating, and harvesting corn. Some writers also claim that these Indians practiced seed selection and that this work was supervised by the medicine man.

The Grosventres, also known as the Minnetarees and Hidatsa, were friendly to the whites and were at peace with the other nations or tribes. They lived for a long time with the Mandans, and they adopted many of their customs and modes of living, and also became corn growers. Every traveler who visited them mentioned their well kept corn fields.

Another tribe of Indians who contributed a variety of corn to the American people were the Assiniboines. In the early part of our history, they lived in the northern portion of what is now North Dakota and Montana, but later they moved to Canada. The Assiniboine corn which we have now is the original corn grown by the Assiniboine Indians.
Some of the explorers who visited these tribes were M. DeLa Verendrye, Charles Le Raye and Lewis and Clark of the Lewis and Clark Expedition.

One of the earliest of these explorers to visit these tribes was M. De La Verendrye, a French explorer who visited them in 1738. In his records he says that the first thing the Indians did when he reached their village was to present him with Indian corn. He said the Mandans were great eaters and brought him as many as twenty dishes of corn, beans and pumpkins every day, and when he left the village, he brought with him a supply of corn flour.

The next explorer was Charles Le Raye who visited the Rees tribe who lived in what is now known as Emmons country, North Dakota. He said that these Indians raised corn, beans, melons, pumpkins, and tobacco, and carried on a considerable commerce with these products in the villages of other tribes.

In 1804 and 1805 the Lewis and Clark expedition visited these tribes and during the winter they made their headquarters at the place that is now known as Washburn, North Dakota.

It is a known act that the Lewis and Clark expedition was nearly destitute of food when they reached the Dakotas and if they had not been able to obtain corn from the Indians, they would have been compelled to abandon their explorations entirely.

Captain Lewis, in his journal, says that their blacksmiths made steel arrow heads from nearly a whole stove and they traded these to the Indians for corn, getting about seven or eight gallons of corn for each one, and in this way they obtained enough corn to continue their journey. If it had not been for corn, this great expedition would never have been as successful as it was.

From these records of exploration we find that the Indians raised corn in the Northwest and that, as corn originally was a
southern product, they were the ones who adapted it to our soil and climate in the north. One authority says, "Greece gave us art; Rome gave us government, but the Indians gave America the basis of her productive industry, corn - the red, white, blue, brown and yellow corn. Give them credit. American prosperity without corn is unthinkable."

By 1880 the development of the Dakotas as an agricultural region had become a certainty and with the building of railroads, many settlers came from the eastern states and foreign countries.

Most of the settlers who lived here believed only in raising small grains, but a few had faith in corn growing. I will mention only two of these. They were the most successful and did most in developing the corn we now have in the Red River Valley. They were Oscar H. Will and L.D. Judkins.

In 1882 Oscar Will of Bismarck, North Dakota procured seed of a mixed flint corn from the Indians and that year began the selection and improvement of a pure white flint. Mr. Will selected eight and ten-rowed ears, quite long, but with a small cob. He was very successful and developed what is now known as the Dakota White Flint. It was first distributed in 1886 and spread through the newly settled regions and the Northwest immediately.

At about the time of the first distribution of the Dakota flint, L.D. Judkins raised some and crossed it with mercer flint, a corn he had secured from the east, and from this cross produced the best known corn of Mandan origin, the Gehu yellow flint. The Dakota white flint and the Gehu yellow flint are both of true Mandan origin.

Other varieties derived from the old Mandan and Ree Indian corns are: Burleigh county mixed, Squaw corn, Fort Pick Indian corn, Beal corn, Ivory King and Ree corn. All these varie-
ties show the hardy characteristics of the Mandan and Ree Indian corn; they ripen early and, under favorable conditions, will yield as high as seventy bushels per acre.

Another popular variety which was possibly developed from the early corn raised in the Dakotas is the Northwestern Dent. It shows the characteristics of the Indian types of corn both in appearance and ability to withstand severe conditions.

Pearl flint is a white flint which was developed in 1907 by C.C. Williams of Detroit Lakes, Minnesota. This variety was also developed from a mixed Indian corn procured from the Red Lake Indians. This is one of the newest varieties of corn we have in the Northwest.

Corn has played a very important part in the development of our country. Many of the first settlers who came West and made their homes on the prairies owed their homes and the foundation of their success to this plant. When wheat and other grains failed, corn and a few pigs and cattle many times tided them over winter, and in this way, prevented these hardy pioneers from abandoning their purpose and leaving the great plains unsettled.

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THE PRODUCTION OF PURESEED FLAX

Silas Hviding '31
Hendrum, Minnesota

Dedication

To the farmers of the Red River Valley, who are interested in producing pure seed flax, I do hereby dedicate this thesis.

Foreword

The contents of this paper cover quite completely the methods used in producing and handling pure seed flax in the Red River Valley.

There has been a great demand for new varieties of flax in this section of Minnesota where the flax crop is becoming more and more important each year. A number of improved varieties have been developed in recent years. By a good variety we mean a variety that is productive enough to be of more value than other cash crops that are commonly grown in this section of the state. The variety chosen should also be resistant to such serious diseases as wilt, rust, and pasmo, which are most destructive to the flax plant.

The variety chosen should be early enough to mature before the early frosts, which occur so frequently in this section. It is also an advantage to have a variety that can be identified in the field, as is the case of the Redwing, which can be distinguished in the field when in full bloom. Redwing was developed through selection at the Minnesota Experiment station, University Farm, St. Paul. It has the advantage of early maturity, and is resistant to wilt, but is moderately susceptible to flax rust.

The Buda variety was developed at the North Dakota Experiment station at Fargo by selection from seed obtained in Hungary by Dr. H.L.
Balley. The seeds are larger than in the other standard varieties; it is not quite so resistant to flax rust as Buda, but is very resistant to wilt and pasmo.

Argentine flax includes a group of varieties imported from Argentina. The bulbs and seeds are larger, and the oil content is slightly higher than in the varieties commonly grown in the United States. It also is wilt resistant and is practically immune to flax rust. Nevertheless all Argentine strains have proved to be low yielders. This group should not be introduced into this section because it is very susceptible to pasmo, which is a comparatively new disease that is becoming a serious factor in flax growing in some parts of the Northwest. Pasmo is introduced by infected seed.

In order to establish and keep a good market for pure seed flax, it is necessary to produce seed that is known to be true to the varietal name. Certified seed is most reliable. To obtain the best market for seed flax, it must be certified. The seed must also be pure, free from admixtures, and foreign material. To retain a well developed seed market, a grower must be honest giving full weight for every bushel, and representing the quality of the seed exacting as it really is. Another very important point in keeping customers is to answer letters promptly. A pure seed grower should be prepared to give up-to-date information about the new varieties concerning yields, diseases, and, in fact, about all phases of growing and handling the crop. He should be familiar with the results of trials made by the various experiment stations and by growers.

In order to raise pure seed, a farmer must have his farm free from weeds, especially those weeds that are harmful to the
flax crop, and which cannot be separated from flax seed. In order to keep the farm free from weeds, one must have good machinery, and must so manage that the work can be done at the proper time. A well planned rotation will do this.

It is always advisable for the pure seed grower to own a thresher. This will enable him to make certain that the machine will be cleaned properly before threshing seed grain. If he does not own a machine he must use every precaution to make sure that the machine has been thoroly cleaned. The crop should be stored in a good granary with perfectly tight bins, or it will become mixed. The granary should be equipped with proper machinery for recleaning the crop. End shake mills are best for recleaning flax. The end shake mills keep the seed moving, while in the side shake mills the seed accumulates on the sieve, and it goes over without being separated.

When a grower wishes to hold his grain until the spring, and sell it for seed, he cannot be encumbered with debts and mortgages because in some cases it is necessary to extend credit to some customers who cannot pay until the fall, a whole year after the grain was produced.

When choosing a variety for pure seed production, select a variety that has been successful in your section, or a new variety which has proved to be better adapted through Experiment Station trials, and by other growers.

A grower must buy seed in sealed sacks with the certification tags attached to be sure of getting genuine pure seed flax that has been registered. Buying seed that has been run over a large mill will be an advantage.

Flax is generally sown after the seeding of wheat, barley,
and oats has been completed. Sometimes it is delayed even longer. It has been proven that the early sown flax is damaged less by heat canker, and wilt, and the bolls fill best before the warm weather arrives. But when old land is used where weeds are liable to be troublesome to the flax crop, it is best to stir the soil early in the spring, and delay seeding until most of the weed seeds have germinated; then destroy the seedlings before the crop is sown. Annual weeds cause a decrease in yield, and increase the dockage in the threshed grain. The usual rate of seeding flax is two pecks, but if weeds are troublesome, it is advisable to seed two and one-half to three pecks to an acre.

Proper preparation of the seed bed insures control of weeds, conservation of moisture, and prompt uniform germination of the seed. Sod can be plowed either in the fall or in the spring, and worked with a disk, or a roller to make a firm seed bed. There should be no air spaces and the soil should be pulverized to a depth of two or three inches, and well packed.

Every pure seed grower should have a seed plot from which he takes the seed for his next year's crop. This should be thoroughly rogued. It is easier to rogue a plot than a large field, and it can be done more thoroughly. In roguing, one should look for false flax, and wild mustard. These have seeds which are difficult to separate from the pure seed flax. In the case of perennial weeds, such as quack grass and sow thistle, the weed infected patch should be cut down.

Certification of cereals is handled by the Minnesota Crop Improvement association. The Secretary's office is at University Farm, St. Paul. The field to be certified must be inspected before harvest. The crop must be reasonably free from
weeds, and the grower must have adequate facilities for storing and handling the crop.

In the fall the applicant must submit accurate samples of thinned and recleaned seed to the state seed laboratory for purity and germination tests. If the tests are satisfactory, a certificate and tags are issued by the secretary.

The application for certification should be mailed to the secretary of the Minnesota Crop Improvement association before the first of July. The fees for certification are: For inspection of one field $2.00, and $1.00 for each additional field. Bin inspection and analysis of samples is $2.00 for each farm, and the annual membership dues, which must be paid by each applicant are $1.00. Field inspection fees and membership dues must accompany the application.

Flax is less subject to shattering, and breaking down of stems than other crops. Therefore, it can stand in the field after it is ripe without serious loss in yield or quality. This will allow the moisture content to be lower and a combine can be used. The most serious problem in harvesting with a combine is weeds. The weeds are green when it is time to harvest the crop, and the little pieces of stems of green weeds raise the moisture content, and may cause damage in storage. The ordinary grain binder is used extensively throughout this section, but in case the straw is short, it may be necessary to use a mower. Bundles should be shocked promptly because flax is easily damaged by crickets, locusts, and wet weather. It should be threshed as soon as the bundles are dry.

The threshing of flax requires care and patience, as the bolls and seed are easily blown over the sieves. The bundles
should be fed evenly and regularly into the thresher.

It is impossible to do a good job of cleaning with a separator; therefore, before pure seed is marketed, it must be recleaned. To receive the highest prices for all the seed, a grower must advertise. Pure seed should be advertised in the leading farm papers in the state and adjoining states. Exhibiting at grain shows and county fairs are very good ways of advertising.

The prices to expect for pure seed should not be so high that people will not buy, and yet should be high enough to pay for the extra labor required to produce pure seed, and also to pay the interest on the value of the crop as long as it is held.

Bibliography


THE PRODUCTION OF PURE SEED

Martin Moen '31
Dalton, Minnesota

Dedication

In sincere appreciation of what I have learned in cereal crops and pure seed production, I hereby dedicate this thesis to Mr. E. H. Clark, instructor in the Agronomy Department at the Northwest School.

Foreword

The purpose of this thesis is to bring forth the qualifications, advantages, and opportunities of pure seed production to the farmers of Northwestern Minnesota.

Pure seed production offers a splendid opportunity in practically every community. Farmers have come to realize the value of better yielding varieties of small grains. After starting with better varieties, many farmers are inspired to take better care of their farms.

Many excellent varieties of small grain for Northwestern Minnesota recently have been developed. A few of these, which have given excellent results, are Anthony and Gopher oats, velvet and glabron barley, and Marquillo and Ceres wheat.

Anthony oats is a midseason variety which has large kernels and straw of good length. It is highly resistant to stem rust but susceptible to smut. This variety was developed by the Minnesota Stations and was first distributed in 1929.
Gopher is an early maturing variety of oats, which has short, stiff straw. It is adapted to very fertile land, where lodging is a serious problem. It is an excellent yielder, and has short, plump kernels. Velvet is a smooth awned barley developed at the University Farm, St. Paul, and first distributed in 1926. It combines the desirable character of smooth awns and good yielding quality. It is quite resistant to barley stripe, which is a very serious barley disease.

Glabron barley is smooth-awned and similar to Velvet. This variety also was developed at University Farm and first distributed in 1929. It yields about the same as Velvet but has a slightly stiffer straw.

Marquillo is a rust resistant variety of wheat developed by the Minnesota Experiment Stations. It is awnless and resembles Marquis in head type, but has shorter straw. The kernels have rough appearing seed coats. It is the highest yielder of all wheats at the Northwest Station, and very resistant to stem rust. The milling and baking qualities are excellent, except that it produces a slightly yellow flour. The first distribution was made in 1929.

Ceres is an awned variety developed at the North Dakota Experiment Station. It was first distributed in 1926. It yields somewhat less than Marquillo and is somewhat resistant to stem rust. Its disadvantages are susceptibility to loose smut and leaf rust and the bearded head.

For best results in pure seed production, the farm must be well managed. The farmer should grow his crops in a well planned rotation. He must have plenty of power to do the necessary tillage work for the farm must be well tilled to control weeds. This may be done by plowing at the right depth at the right time and while the ground is not too wet. It also
requires that the fields be thoroughly worked before seeding. The control of threshing operations is important. It would be desirable for the farmer to own his own threshing machine. The grains should be threshed in a definite order to avoid inseparable mixtures.

The pure seed grower should be able to hold his grain until seeding time when the buyer is ready to purchase. This can be done by having a good granary. The bins should be located so that they are easy to reach, and should be well ventilated. There should be ample room in the granary so the different varieties may be stored without becoming mixed. Some growers prefer a special house for the ginning mill and the seed grain. All buildings in which seed is kept should be rat and mouse proof.

Foundation seed for pure seed production should be secured from a reliable source. The seed should be registered or certified. Seed from the experiment stations is preferred. Registered or certified seed is best because it is higher in purity and free from admixtures of other varieties and noxious weeds.

Seed treatment is very important in growing pure seed. The copper carbonate treatment is used for bunt or stinking smut, and for scab. Formaldehyde or cereasan are used for oats smut, and for covered and loose smut of barley and barley stripe.

For preparing the seed bed, fall plowing is best. This kills weeds and allows the land to settle, making a firm seed bed. The soil is made mellow by freezing and thawing. Early seeding is made possible. This gives the plants a better root system and allows the crop to mature before hot weather comes, thereby, escaping much rust damage. The rate of seeding
for bread wheat is five pecks to an acre; for durum wheat, six pecks; for barley, eight pecks, and for oats, ten pecks. These rates have proved to be most satisfactory in tests at the Northwest Station. Heavy fertile soils require more seed than light soils.

Purity is maintained by careful rogueing and should be done as soon as the crop heads out. If two or more persons are rogueing, they should walk about six feet apart, lengthwise of the grill rows. They should pick out all admixtures of other varieties and all objectionable weeds.

Early growers should have a seed plot for raising his own seed. Rogueing on this plot is even more important than on the main field. Rogueing should be done not only once, but as often as necessary.

Seed plots will be ruined during harvesting and threshing if proper precautions are not taken to avoid mixing. The thresher should be cleaned carefully before starting to thresh purebred grain. It is best for the grower to have his own thresher. Grain tanks and racks should be swept clean before changing from one variety to another. The grain should be threshed in a definite order to avoid inseparable admixtures. The grain should be stored in rat-mouse proof bins and where sacks can be filled easily.

The success of pure seed growing depends to a large extent upon ability to clean grain properly. The kinds of mills commonly used are the side shake and the end shake types. The side shake is mostly used for wheat, oats, and barley. The end shake is used for flax, alfalfa and other small seeds. The size and shape of seeds in the same kind of crop vary greatly from year to year. The proper screens and sieves to use for each kind of grain can be easily found by following the directions
of the manufacturers. Sieves that are marked 1/12 have openings one twelfth of an inch in diameter. The sieves which are marked 9 have openings nine sixty-fourths of an inch in diameter. Special machines are in use for removing wild oats and other weeds that are not readily separable by ordinary canning mills.

Advertising is very necessary in the seed business. The advertisements should be honest and accurate and should be inserted in well known farm papers. Another way of advertising is by showing the best types of seed at fairs and seed shows. The pure seed grower should answer all correspondence promptly whether he has anything to offer or not. Careful attention should be given to all shipments. The grain should be delivered promptly. New bags may be used or, if good used bags are available, they should be carefully cleaned. All bags should be rolled down at the top after filling and should be properly sewed before shipment. Tags should be attached outside the bag. These should show the kind of seed, varietal name, purity and germination percentages, and date taken, percentage and number of weed seeds in a pound, and growers name and address. It is well to have a tag inside the bag in order that the shipment can be readily identified, in case the outer tag should be lost in transit.

Any grower may have his purity and germination tests made by the state seed laboratory free of charge, providing the number of samples does not exceed ten in any one year. Additional samples over ten will be tested for 25¢ each. The amount of seed required for each sample is at least one-half pint. All samples should be addressed to the State Seed Laboratory, University Farm, St. Paul, Minnesota.

By growing pure seed grain, the farmer increases his yields to a great extent and increases his profits accordingly. The prices for the better quality of grain are considerably higher
than for common stock, higher not only when the grain is sold for seed, but on the ordinary grain market as well. For instance, the grain buyer usually pays a premium for bread wheat, which contains no durum admixtures. The good quality grain always grades higher than the ordinary grain sold on the market.

Pure seed production is of great value to a community because the varieties are standardized. By growing disease resistant varieties the difficulty in controlling diseases is reduced. The farm is also in cleaner condition. A farmer should consider all these advantages when planning to go into pure seed work.

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4. The Red River Valley Crops and Soils Handbook, University of Minnesota, Northwest School and Experiment Station.
5. Small Grains Varieties in Minnesota - H.K.Wilson and A.C.Arnby Bulletin 264, Agric. Experimental Station, U. of M.
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8. Control of Barley Stripe - E.C.Stakman and H.A.Rodenheiser Circular No.81 U of M Agric. Extension Division
SPRING WHEAT IN THE RED RIVER VALLEY

Vernon Smolak '31
Lancaster, Minnesota

Dedication

I hereby dedicate this thesis to my instructor, Mr. R. R. Clark, for his helpful and instructive efforts in helping me prepare it.

Preface

The economic conditions at the present time, 1931, are not the best and may not be for a few years to come. To the wheat growers in one of the greatest wheat producing sections of the world, the Red River Valley I would say, the only way to make a profit by growing wheat is to reduce the cost per bushel of production. This can be done by lowering labor costs by the use of large machinery. Another way is by raising higher yields and, in this way, reducing unit cost of production.

In my thesis on "Spring Wheat Production in the Red River Valley," I have briefly outlined and discussed the most important factors to be considered in the growing of wheat.

Spring wheat stands fifth in importance among the World's crop, being exceeded by rice, corn, cotton and hay. The annual product on is three to three and one-half billions of bushels.

The leading countries in production from 1921 to 1929 were:

United States - - - - - - - - - - - - 804,151,000 bu. annually.
Canada - - - - - - - - - - - - - - - - - 369,663,000 " "
India - - - - - - - - - - - - - - - - - 356,289,000 " "
France - - - - - - - - - - - - - - - - - 290,774,000 " "
Russia - - - - - - - - - - - - - - - - - 251,317,000 " "
Argentina - - - - - - - - - - - - - - - - - 203,388,000 " "

In the United States the five year average, 1923-27, was 809,663,000 bushels. Of this amount 549,257,000 bushels was winter wheat; 59,988,000 bushels was durum wheat (4 states), and the other, spring wheat, amounted to 200,423,000 bushels.

The leading states in 1929 in order of their production were: Kansas, North Dakota, Nebraska, Washington, Oklahoma, and Montana.
In Minnesota in 1930, the total wheat crop amounted to 21,525,000 bushels. Of this amount 15,105,000 bushels was of the class called spring wheat. Of durum wheat, there was 3,400,000 bushels and 3,020,000 bushels of winter wheat.

Northwestern Minnesota has many natural advantages for growing wheat. The land is flat, which is decidedly beneficial because it permits the use of large machinery, which lowers the cost of production by reducing the cost per bushel. By the use of large machinery, which requires skilled labor, the labor requirements in Northwestern Minnesota are kept relatively low. Wheat requires a soil with a high lime content. This is true of the soils of the Red River Valley. Wheat also does best on a heavy clay loam soil.

Northwestern Minnesota has cool weather in the spring, which is a decided benefit in the growing of wheat because it increases the amount of tilling and produces better quality of straw. At ripening time, the weather is warm, which improves the quality of grain and lessens losses from rust.

Wheat requires a moderate amount of moisture, fifteen to forty inches annually. This requirement is met in Northwestern Minnesota. Too much rainfall causes damage by lodging, and is favorable to the development of stem rust. Wheat gives high average returns for the labor and capital invested.

In wheat growing, there are disadvantages as well as advantages. Some of these are (1) one crop wheat farming increases trouble with weeds, because there is no opportunity for cultivation to control the weeds; (2) wheat is subject to hazards from drouth and rust; (3) furthermore, in favorable seasons, there is danger of over production, and (4) wheat must be sold in competition with other wheat producing countries.
In Minnesota there are three general classes of wheat: hard red spring, durum, and winter wheat. Of these, hard red spring is the most desirable for bread flour because of its high protein content. The desirable characteristics of this class has made the spring wheat area famous. The protein content of wheat gives flour tenacity which allows bread to rise to a large volume with a consequent lightness. Spring wheat flour is often mixed with winter wheat flour to raise the protein content of the latter. No varieties of winter wheat are sufficiently hardy enough to be grown successfully in the Red River Valley. Durum wheat prices are lower than those for hard red spring. There are two types of durum: amber and red. Pure amber durum commands a premium. While all durums are used for semolina manufacture, varieties differ in quality. Starchy kernels reduce the value because they reduce the quality of semolina. Variety, soil, and climate influence the color and texture. The soil and climate in the Red River Valley are generally favorable for the production of amber durum.

To command a premium on a market, durum wheat must be of clear and amber color and must not be mixed with hard red spring wheat. Such mixtures are practically inseparable and seriously interfere with the milling process. Barley in durum wheat is also objectionable. If durum wheat is of the color, texture, and purity demanded, it has a ready market at a good price.

The efforts of the European government to encourage domestic wheat production by bounties and tariffs has reduced the export demand for durum wheat of poor color and for mixed durum. The home consumption of macaroni products is increasing.

Durum varieties are more resistant to stem rust than spring varieties. Durum varieties are grown frequently as insurance against severe losses from stem rust. With the development of rust
resistant types, varieties of spring wheat yielding on a per with the better durum will be available.

The following table shows a comparison of average acre yields of recommended varieties of spring and durum wheat at the Crookston and Morris stations for the five year period 1925-29:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Morris Bu. per acre</th>
<th>Crookston Bu. per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marquis</td>
<td>19.1</td>
<td>24.1</td>
</tr>
<tr>
<td>Merquillo</td>
<td>23.3</td>
<td>31.1</td>
</tr>
<tr>
<td>Ceres</td>
<td>20.6</td>
<td>28.4</td>
</tr>
<tr>
<td>Mindum (Durum)</td>
<td>28.5</td>
<td>23.5</td>
</tr>
</tbody>
</table>

The above table shows durum (mindum) wheat to be the highest yielder at both the Morris and Crookston Stations.

There are four varieties of durum often found growing in Northwestern Minnesota. These are Pentad, Nodak, Kubanka, and Mindum. Pentad, also known as D-5 and red durum, is very resistant to stem rust and yields more than the standard varieties in seasons when rust is the limiting factor. It makes a very poor macaroni, however, and a mixture of this variety with amber durum lowers the grade and makes an undesirable market product. Pentad should be discarded from the wheat growing sections of the state.

Nodak is an amber durum variety, the result of a selection from Kubanka by R.W. Smith of the Dickinson, North Dakota Substation. It is less desirable for macaroni than Mindum and yielded less than Mindum and Kubanka in 1929. It is more resistant to stem rust than Kubanka.

Comparative yields of durum wheat varieties for the three year period 1919-21:

<table>
<thead>
<tr>
<th>Variety</th>
<th>University Farm Bu. per acre</th>
<th>Crookston</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kubanka</td>
<td></td>
<td>20.8</td>
</tr>
<tr>
<td>Pentad</td>
<td></td>
<td>21.8</td>
</tr>
<tr>
<td>Mindum</td>
<td>28.3</td>
<td>26.0</td>
</tr>
</tbody>
</table>
Kubanka is an amber durum that shows considerable resistance to stem rust, tho susceptible to some rust forms. It makes excellent macaroni. In a five year trial at the Northwest Station, it yielded 3.7 bushels to an acre less than Mindam.

Mindam, or amber durum, is unquestionably the best variety for the Minnesota farmer who wishes to grow durum wheat. It is very resistant to stem rust which is one of the reasons why it is so highly recommended. It makes the highest quality macaroni# and has high yielding ability. It has averaged 27.4 bushels to an acre, in a 17 year test, compared to Marquis, which yielded 21.7 bushels to an acre. Mindam was developed at the Minnesota Station by a selection from a mixture found in common bread wheat.

Marquis has long been the standard variety of spring wheat, but is growing less important as new varieties are being introduced. It has been used as the basis for judging the quality of new productions. The high quality of flour produced from Marquis has made it much desired by the millers. It fails to yield as much as some of the other varieties because of its susceptibility to stem rust.

The rust resistant wheats of the bread class are cerees and marquillo. Cerees is a bearded bread wheat developed by crossing Kota on Marquis and increasing an F 2 plant. On a three year average, it has yielded 3.6 bushels to an acre more than Marquis. Cerees is highly resistant to stem rust, but very susceptible to leaf rust, loose smut, and bunt. This and its bearded character are its chief disadvantages. In milling quality, Cerees is satisfactory and is about equal to Marquis.

Marquillo is a cross between Marquis and Inamillo durum. The cross was made in 1914 by the Minnesota Experiment Station. In appearance it is somewhat similar to Marquis. The chaff is
smooth and white. The straw is shorter than Marquis and of good strength. Marquillo is an awnless variety. Marquillo bakes and mills satisfactorily except that it has a tendency to produce a yellow loaf. Marquillo has proved to be high yielding. It has averaged 32.1 bushels to an acre in a three year test, compared to 14.0 bushels to an acre of Marquis. It was first distributed in 1930 to an approved list of growers.

Another class of wheat consists of the so-called rust-escaping wheats. By these are meant varieties of wheat which are able to mature early enough to ripen before serious damage is caused by stem rust.

The two best known varieties of this class are Ruby and Reward.

Ruby is a cross between Downy Rign and Red Fife. It was first distributed in Canada in 1917. Ruby is an awnless variety, but has short rudimentary awns like those found on Marquis. It matures from five to seven days earlier than Marquis. It is best adapted to potato and sugar beet land, and summer fallow. In milling and baking qualities, it ranks with Marquis. Ruby is a low yielder and shatters readily when ripe. In trials at the Crookston Station, it yielded 4.8 bushels less than Marquis.

Reward is a cross between Marquis and Prelude made in 1912 at Ottawa, Canada. It matures three to four days earlier than Marquis and has a very fine appearing kernel. In a three year trial at the Northwest Station, it has yielded practically the same as Marquis, but the bushel weight has averaged three to four pounds more. Milling qualities of this variety are good.

Stem rust, bunt or stinking smut, and loose smut are the three most damaging diseases which attack the wheat plant.

Stem rust is the most destructive cereal disease in the Red River Valley. It lives over winter as dark colored spores con-
tained in black pustules (rust spots) on old straw and stubble. It is never carried over in the wheat kernel. In the spring, the rust spores germinate and the sporidia are blown to the common barberry bush which acts as an alternate host. Orange colored spots arise on the lower surface of the leaves. These spots contain a new type of spores which can infect wheat and other grains and grasses. These result in "red rust." The stem rust usually ruptures the epidermis.

Later in the season, black spores are formed on the stem in the same spots which bear the red spores. These spores have thick walled cells enabling them to live over winter and germinate in the spring, to again attack the common barberry and renew the life cycle.

Seed treatment is useless for the control of stem rust. Growing resistant varieties such as Marquillo, Ceres, and nearly all durums is the most practical means of control. Destroying the common barberry is an effective way of controlling stem rust. This breaks the life cycle and prevents the spread of the disease, as climatic conditions prevent the red spores from living over winter in Minnesota.

Bunt or stinking smut lives over winter as spores on the outside of the wheat kernel or in smutted kernels (smut balls). The spores germinate in the soil near or on the wheat seed and the fungus grows up with the wheat plant, filling the young kernels with masses of its spores. Wheat containing smut balls or having a smutty odor sells at a discount on the market. On seed wheat the smut balls are broken in handling and, thus, the disease spreads in the thresher and in the bin.

Control of this disease consists in disinfecting the seed coat. Copper carbonate dust and 40% formaldehyde solution are disinfectants commonly used. On the copper carbonate treatment,
the dust is mixed with the seed at the rate of two or three ounces copper carbonate to each bushel. Mix thoroughly with a machine. Do not attempt to mix by shoveling or by sifting dust upon seed in a drill box. Precautions that should not be overlooked are: Avoid inhaling dust as it causes discomfort and perhaps sickness, and remember that treated wheat is poisonous or cannot be used for milling or feeding purposes. If formaldehyde is used, a solution is made up of one pint 40% formaldehyde to 40 gallons of water. Dip, sprinkle or use a commercial seed treating machine. Sow without allowing seed to dry or some injury to germination may result. This method is not as desirable as the use of copper carbonate dust.

Loose smut appears in the field just as grain is heading out. Wheat heads are entirely destroyed. Black masses of spores cling to the naked stem. These are blown away to other heads of wheat or washed to the grounds by rains. It may reduce the yield, but does not affect the quality of grain produced.

The hot water treatment is the only effective means for the control of loose smut. The most practical procedure to follow is to treat enough seed for a seed plot. This treatment is not recommended for the average farm where the facilities are not to be had, such as live steam.

The procedure to follow in using this treatment is: Place seed in loose burlap bags filled half full, and soak them in water at room temperature from five to seven hours. Then immerse in hot water at the temperature of 127 to 129 degrees F for ten minutes. Hot water above 131 degrees F, or immersed for a longer length of time than specified will injure germination severely. Water under 127 degrees F is not effective.* (See last page)

Seed treated with hot water should be sown on an isolated spot where it will not be infected by smut spores blown from fields
containing loose smut. Marquis is resistant to loose smut; Ceres and Kots are susceptible.

The place of wheat in a crop rotation system is after a cultivated crop. More plant food is available and the soil is more meadow. Land is also cleaner after a cultivated crop. Wheat following a clover crop has been found to contain a higher percentage of protein than after another grain crop. It is not a good crop for new breaking but is usually the first crop grown after summer fallow. Potato, sugar beet, and corn lands are all suitable for wheat, if a stiff strawed variety is used to prevent lodging.

As a companion crop for legume seedlings, wheat is excellent. It does not draw as much water from the soil as oats, and offers less competition to the legume crop grown with it. The narrow leaves of wheat do not shade the ground as much as the leaves of oats or barley, which is very important in a companion crop.

Wheat is not adapted to a wider range of soils. It will not grow on poor soils, but requires a good fertile clay loam soil, well drained, and practically free from weeds. A soil with an abundance of available plant food in the upper layers, good water holding capacity, and high in humus is ideal. The high lime content of the Red River Valley soils is a great advantage for wheat.

If soil is poor, nitrogen, phosphorus, or potash is most liable to be lacking. Nitrogen may be added by plowing under a legume crop. Phosphate applied at the rate of 300 pounds 16% superphosphate or a proportional amount of other phosphate to an acre may be used either with the wheat crop or with other crops in the rotation.

Selection of good seed wheat is important. It is a popular belief that wheat seed ultimately runs out and that new seed from
outside sources must be secured. The protein content may be largely influenced by the soil and climatic conditions. Also, it is influenced by the heredity. Within a variety, however, seed with high protein content is no more valuable for planting than seed of the same variety, but with a lower protein content. Planting seed from localities where protein content was high does not affect the protein content of the wheat raised.

The man who obtains seed of a recommended variety from a grower of certified seed has little need for special seed preparation except to treat for smut. A farmer producing his own seed, however, should clean the seed thoroughly with a fanning mill. It is best to purchase new seed when home grown stock has become mixed with other varieties or other grains, and inseparable weed seeds. Germination test should be made if there is any doubt regarding viability.

The seed bed should be well pulverized, firm, and moist. Undecomposed vegetable matter interferes more with wheat production than with oats or corn. Fall plowing is best because it kills annual weeds and permits working the soil to kill quack grass and sow thistle. Moreover, the soil settles and makes a firmer seed bed and winter moisture enters the soil, after which freezing and thawing mellows the soil. Fall plowing also makes early seeding possible.

A compact seed bed insures quicker and more uniform germination and the water can come up from the sub-soil easier by means of capillary action. It also prevents winds from drying out and prevents soil from blowing.

Early seeding is essential; it insures better yields of high quality grain. Crop matures before hot weather, helping plants to escape severe damages from stem rust. Early seeding enables plants to make the most use of cool early summer and affords
a greater opportunity for stooling.

The average dates of seeding for a ten year period at Crookston and Morris stations were Crookston, April 16, and Morris, April 12.

Average yields per acre of Marquis and Mindum sown at different dates, University Farm, St. Paul, 1920-22:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Date of Seeding</th>
<th>Yield Per acre</th>
<th>Decrease from Usual date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marquis</td>
<td>Usual date *</td>
<td>28.2</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>10 days late</td>
<td>17.8</td>
<td>16.6</td>
</tr>
<tr>
<td></td>
<td>20 days late</td>
<td>11.4</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>30 days late</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Mindum</td>
<td>Usual date *</td>
<td>32.6</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td>10 days late</td>
<td>22.3</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td>20 days late</td>
<td>7.4</td>
<td>30.8</td>
</tr>
<tr>
<td></td>
<td>30 days late</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

*Data from A.C. Arny - Earliest date at which seeding could be made average was April 24.

As seed represents but a small part of the spring wheat enterprise, no farmer can afford to make a mistake in the seeding rate. The normal rate is 75 to 90 pounds to an acre and has been sufficient under ideal conditions, altho the heavier rate of 190 pounds is recommended for the average farm conditions. Heavier rates may be advisable on extremely rich soil, and when wheat is sown late. Because of longer seed, durum wheat should be seeded at a heavier rate than is common for other spring wheat. The recommended rate is 105 pounds to an acre.

Yields of Hard Spring Wheat at different rates of seeding at Crookston Station 1919 and 1923.

<table>
<thead>
<tr>
<th>Rate of Seeding Per acre</th>
<th>1919 bu.</th>
<th>1923 bu.</th>
<th>Average bu.</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>9.9</td>
<td>17.4</td>
<td>13.7</td>
</tr>
<tr>
<td>60</td>
<td>13.3</td>
<td>19.6</td>
<td>16.5</td>
</tr>
<tr>
<td>75</td>
<td>13.2</td>
<td>27.0</td>
<td>20.1</td>
</tr>
<tr>
<td>90</td>
<td>13.2</td>
<td>21.9</td>
<td>17.6</td>
</tr>
<tr>
<td>120</td>
<td>13.9</td>
<td>2019</td>
<td>17.4</td>
</tr>
</tbody>
</table>
Wheat should be cut when in the hard dough stage. This prevents large losses from shattering, and there is no increased weight per bushel by allowing it to stand. With a large acreage, it is necessary to start as soon as possible to insure completion of harvest before over-ripeness causes additional loss. There are two methods of harvesting, by combine and by binder. Wheat should be cut with a binder when quite high in water content, providing the grain is well shocked. When harvesting with a combine, the water content should be reduced to about 14% to prevent losses from heating. The greatest advantage of the combine is its great labor saving. Where weeds are present, it is necessary to use a windrower in connection with the combine.

Danger of hail and delay in farm work make the use of the windrower more practical in the Red River Valley than the straight combine. In using this plan, the grain is cut at the usual binder harvest time and left in windrows to dry. As soon as drying has been completed, a combine with a pick-up attachment gathers the grain from the windrower and completes the threshing operation.*

Comparison of cost per acre of harvesting by different methods on the same farm in the Red River Valley.

<table>
<thead>
<tr>
<th>Machine Used</th>
<th>1927</th>
<th>1928</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>10 foot tractor binder &amp; stationary thresher</td>
<td>10 ft. combine &amp; windrower</td>
</tr>
<tr>
<td>Acres covered</td>
<td>303</td>
<td>419</td>
</tr>
<tr>
<td>Man labor</td>
<td>$1.30</td>
<td>$0.96</td>
</tr>
<tr>
<td>Horse work</td>
<td>0.39</td>
<td>0.21</td>
</tr>
<tr>
<td>Tractor work</td>
<td>0.35</td>
<td>0.69</td>
</tr>
<tr>
<td>Machine charge</td>
<td>0.21</td>
<td>0.96</td>
</tr>
<tr>
<td>Twine cost</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>Threshing charge</td>
<td>1.00</td>
<td>$2.25</td>
</tr>
</tbody>
</table>

*Farmers interested in using combine should obtain a copy of the Minnesota Bulletin dealing with combine harvesting in Minnesota from University Farm, St. Paul, Bulletin No. 256.
In spite of an unusually wet year and a heavier drop of grain and straw, the cost per acre was 70¢ lower when combine was used. By doing custom work for neighbors, the average was materially increased.

In observations on cost of production, it is found that yield per acre is greatest factor in determining production. Return for acre and returns for hours increase as acre yield increases.

<table>
<thead>
<tr>
<th>Cost per acre of producing spring wheat on 17 to 23 farms near Crookston 1926-28.</th>
<th>1926</th>
<th>1927</th>
<th>1928</th>
<th>5 yr. Av.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man Labor</td>
<td>7½</td>
<td>7½</td>
<td>7½</td>
<td>7½</td>
</tr>
<tr>
<td>Horse work hours</td>
<td>²</td>
<td>²</td>
<td>²</td>
<td>²</td>
</tr>
<tr>
<td>Tractor use hours</td>
<td>²</td>
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- Yield per bu. 14.5
- Cost per bu. .87
- Dec. 1 price 1.25
- Return for land 9.55
- Return for hours of man labor 1.01

Farmers wishing to know the nature of diseases of wheat should secure the Red River Valley Handbook by R.S. Dunham, T.M. McCall, and E.R. Clark, Vol. XXII No. 3, Crookston Series, or Diseases of Grain and Forage Crops in North Dakota by Wanda Weiniger, Bulletin No. 166, North Dakota Agricultural College, North Dakota.

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Animal and Dairy Husbandry
BEEF PRODUCTION

Arthur Hendrickson '31
Fosston, Minnesota

Forward

I have written this paper in order to be able to show the farmers of the Northwest the better way to market their crops through good beef cattle.

Dedication

I hereby dedicate this paper to the Northwest School for their fine work in beef improvement.

The production of beef is getting to be one of the most important industries in the Northwest. Beef cattle are not native to the western hemisphere, but like all other domestic animals, were brought over by European settlers and explorers.

The first cattle to reach here were brought over by Columbus in his second voyage in 1493, and were oxen intended for work. The early beef cattle were used more for their strength and ability to work than for the meat. In 1833, there was supposed to have been 424,000 cattle in the United States. They were the old Spanish long horn stock.

The beef animal was worked until useless, then sold or slaughtered for meat. The people had milk cows also, but used the beef animal for milk and work almost entirely. The settlers after crossing the Allegheny Mountains found the land unfit or too hard to cultivate, brush and with plenty of grass. Consequently, they started to raise cattle in numbers.

Moving a little westward there was better farming without clearing the land, and many farmers raised more grain
than they needed, so they fed it to the livestock. As a result many farmers' herds increased and cattle became more popular in this country. Many countries are great producers of beef, and the raising of beef has steadily climbed, until today, many countries are producers of beef.

The United States so far has been exporting beef, but many people think that in the future, we will import beef, and the beef producers of the United States will have to study the conditions that exist in other countries so that they will be able to plan for the future. Some of the countries that are producers of beef are: Argentina, which fattens its stock on alfalfa pastures instead of corn and other concentrated feeds; Brazil, which is a rather large country and has a rather low grade of beef, similar to the Texas long horn; Uruguay, with a poor type of cattle; Australia, which is better suited for sheep, though cattle are raised there; Canada, which offers unlimited possibilities of beef production, but it is not of importance here; Mexico, a good place for cattle and a future place when the revolutions are through and the ranches restocked. Many towns and factories have sprung up in the above countries due to the raising of beef.

Beef cattle are good on the farm because they consume large quantities of roughages, and because they can make good use of it. Nowadays, large amounts of corn stover are allowed to go to waste, also straw piles are burned or left to rot. Soil fertility is fixed up better by adding back to the land these roughages in forms of manure. Many farms have large fields that go to waste, while if the farmer had cows, this would make them a good pasture, and they could use it for maintaining themselves, and their calves; in other words, the cattle furnishes a home market for grain and hay. Many people think beef cattle need
large, warm barns, but a shed open to the south, but tight on
the other sides is just as good for loafing beef cattle, and
they assist in utilizingabor both man and horse, and are sub-
ject to very few diseases and ailments, and are unlike the dairy
cow in that respect. Much of the soil fertility is lost when
left in straw piles or in corn stover, while, if fed to beef
cattle, it forms manure which can be hauled out into the fields
to increase the soil fertility or keep it up to a certain degree.

No matter what kind of barns, feed or care you give,
you must have good animals to make a paying beef herd. Many
men in their hurry to start operations do not pay much attention
to the kind of breeding stock he has or buys, and becomes
disheartened after awhile and probably sells out. The selecting
of good stock permits either registered or unregistered cows, but
if you are just starting on a small scale, buy cheaper but better
animals at first and do not go into debt, but depend some on
building up your herd. There are three kinds of breeders: the
one who raises or breeds for markets; the one who supplies the
beef breeder with purebred bulls or cows; and the one who knows
which animals mated together will produce the best results or
correction of faults.

In choosing breeding stock, buy from the second breeder
who has purebred registered stock, most generally good stock,
and if starting on a small scale, buy a good bull and a few cows
and especially those with the characteristics of the individual
breed. Take a breed you like or which is most popular in your
community. Some of the points to consider in buying are:

1. Individuality
2. Breeding record
3. Pedigree
4. Age
5. Freedom from disease
6. Guarantee from owner
7. Cost of delivered
In mating, one thing to be careful of is that the female has obtained full growth, otherwise, it may cause the stunting of an animal's growth. After pasturization, the female may resume growth, if allowed rest for several months. One very important thing in mating is to have the calf dropped in the fall before the cold weather and before the flies. Some advantages of spring calves are:

1. Dry cows can be wintered cheaper.
2. Calves are more adapted to coldweather.
3. Cows produce more from grass than hay.
4. Time and labor is saved.
5. Calves are sold as veal without wintering.
6. Cows more likely to conceive if bred while on pasture.

Advantages of fall calving:

1. Cows are better physically.
2. Calves escape heat and flies.
3. Calves put on grass instead of in dry lot, after weaning.
4. Cows milk longer.
5. Require less pasture if cattle are sold under same age in both conditions.
6. The farmer is less busy.
7. More time for hand mating.

After the calf is born, it is always a good policy to clean the nostrils so breathing is not hindered. I suppose most beef breeders let the calf suck its dam until time of weaning. The calf that has been fed skimmilk appears to have lost the bloom and thrift that a dam-reared calf has. The fat in the dam's milk makes the calf thrifty and a better conditioned animal.

Many times unsanitary conditions of skimmilk cause digestive disorders in the calf that the sucking calf escapes. It has been shown in the feeding lot that the dam-reared calf makes better gains than the other calf, altho they tend to improve better after they get in the feedlot, but it has been shown that the gains are less economical on the latter. The dam-reared calf should be weaned after it is six to eight months of age.
Spring calves are generally weaned in November, when the herd is removed from the grass, and fall calves in the spring when the herd is put on pasture. The calf should be kept away from its mother once and for all and away from the sound of the cow. Do not let them suck after two or three days, because digestive disorders in the calf's stomach takes place due to the stale milk. The beef calf that has been weaned in the spring should be put on a good pasture like alfalfa or sweet clover, and Kentucky Blue grass if possible. The beef calf will thrive well on this pasture with plenty of clean water and a little sale. Spring calves in many states are fed this way until fall; then put in the feeding lot. The problem of dehorning is very important, and should be done before the animal is too old. The age usually selected is between four and six months and sometimes eight months, but that is rather a long time.

Much damage is caused by horned cattle, the damaging of hides and bruised carcasses, that may happen in shipping. The horned animal requires more room in the car and at the trough and feed lot, besides keeping the timid ones away from their share. The horned animals are often dangerous to tie up in a small stall. You may dehorn by using a Polled bull, like the Aberdeen Angus, or with the use of chemicals, for instance, caustic pencil, but this is very dangerous for the eyes and legs.

The most widely used is the saw and clippers, and are simply used by fastening the animal's head to the post and cutting the horns off, but there is danger of bleeding. Altho an animal may bleed a lot, it will soon stop. But if the bleeding continues, use a silk or cotton corn to ligate the artery, or by using a hot iron to sear the horn stub to stop it. Dehorning should be done in early spring and early fall to prevent moggat setting in horn, and when the weather is not cold.
Castration is generally done from four to ten weeks of age, when the flow of blood and the pain is less. Many animals, if castrated when old, bleed to death. After castration, the calf should be put in a clean box stall, and in a clean pasture. Marking is not so important, but the means of marking are by "ear notching", "ear slitting", and "ear grubbing", but the best is the ear marker, a little piece of metal inserted into the ear by pinchers, or by tattooing with indelible ink. After the beef calves have been on good pasture all summer, they are in good shape for the feeding lot, which should consist of a corral with a large shed opening to the south, with water tanks and feed racks within the shed.

The cost of equipment for beef cattle is low due to the cheap type of shed and corral. On many farms, the self-feeders are used instead of land feeding, and some advantages of them are:

1. Saving in time and labor.
2. Larger daily gains are secured.
3. Cattle are less likely to go off feed.

The cattle going off feed is a very serious problem, as cattle may lose in a short time all the gained amount. The experienced feeder never allows his feeders to become this way. The disadvantages are:

1. It is impossible to utilize large amounts of farm grown roughages.
2. Labor is required in preparing the feed.
3. Large investment in equipment is required.
4. Increase in cost of gains.

In hand feeding you may combine feeds, or you may feed roughages separate but the feeding of smaller amounts and closer together produces better results than feeding once a day.

The steers fed during the winter months may be marketed in the early spring; the steers may be fed feeds grown on the farm.
as buying of feeds eats up the profits, and some of the fertility
taken out of the soil is returned. The feeds that are very good for
the steers are alfalfa and sweet clover. Alfalfa produces better
results with ground barley and oats and corn silage if grown,
but corn in some parts of the Northwest has been found to be un-
profitable. The need of oilmeal or linseed meal is very necessary
in the fattening ration because of its laxative effect, altho with
alfalfa, little is needed.

Many feeders prefer red clover because of its fine
texture, rich in protein, and total digestible nutrients, and
palatability. One thing necessary in feeding beef cattle is the
regularity in feeding and feeding the correct amounts of each
feed. Many rations lack protein, but it may be supplied through
sweet clover, linseed oilmeal or flax seed, cottonseed meal,
gluten corn, or bran of the wheat. Many of these protein supplying
feeds are high priced, but good linseed meal or bran together with
sweet clover or alfalfa supply a large amount of protein.

Salt is one thing necessary because it stimulates the
animal's appetite, and if salt is withheld the animal becomes
restless and shows signs of malnutrition. The amount of salt
fed depends upon the character of the ration, and the kind of
salt used. Cattle on pasture consume twice as much salt as cattle
in the feed lot. One thing in feeding beef cattle or steers is to
produce them at the least possible cost, and with feeds that are
cheap but good for laying on meat. Some people think that any
kind of an animal will produce beef, but the cow may produce
meat, but not beef that the people of the world want. The steers
excelled the bulls, heifers or cows and make the best gains and
are found in large numbers throughout the year.

The beef cattle should have type and form desirable for
beef, low, deep, compact body, short neck, and wide, straight
topline, and wide loins, with deep hindquarters. They are chose according to grade, choice, good, medium or common on the market. Along in February, and if the steers are fat from continuous feeding, you may ship them, but be sure they are all evenly "fleshed", and with large layers of fat, as the fatter they are, the better price they will bring. If the beef producer can get them on the market the first of February, he will get a better price as the price commences to go down after then.

I think if the people of the Northwest would raise beef with their feeds instead of selling them for low prices, besides losing the fertility in the grain, they would be more prosperous and happy.

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THE GUERNSEY BREED
Arnold Wolden '31
Saum, Minnesota

Dedication
I dedicate this thesis to S.D. Wight, who has willingly furnished information and has instructed me in writing this thesis.

Foreword
In this thesis I have endeavored to give the history and development of the Guernsey breed of dairy cattle. I hope those who read this thesis will be benefited by its contents.

The Guernsey breed was developed on the Island of Guernsey, a small area of land lying in the English Channel between England and France. The total area of this island is approximately twenty-four square miles. The population is about 45,000 and about 10,000 cattle are kept, of which 90% are registered. It was to this little island that the original stock was brought from France more than 800 years ago, before the time of William the Conqueror.

The exact origin is unknown, but it is thought that they are a cross of the Normandy and Britany cattle of France. Of this cross the Normandy blood predominated, giving the breed a little more size and red color than that possessed by the Jersey. This crossing took place in the tenth century and since then probably no foreign blood has been introduced into the Guernsey breed.

In 1819 a law was passed which prevented the importation of other cattle into the Island except for immediate slaughter. This law, of course, tended to maintain the purity of the breed and it was also a safeguard against disease.
In general appearance the Guernsey is of fairly good size. The color is specified as being a medium shade of fawn. Frequently the body is spotted with white. The limbs and under-part of the body are generally white. In general quality, cattle of this breed show their elastic skin and moderately fine hair. The neck is light, long and nicely tapers toward the head. Its shoulders are heavy, but light in proportion to the depth of frame at the middle and udder. This gives the breed the wedge shape which is typical of a true dairy type.

Since the earliest times, Guernsey breeders have recognized the value of their cows as an economical producer of richly colored milk and butter. Therefore, in his selection, the Islander considered production alone as the important factor and as a result the type was generally ignored. In later years cattle buyers preferred the smooth, symmetrical Jersey rather than the rugged Guernsey. In order to make Guernsey cattle popular, Guernsey breeders improved the type to a considerable extent.

In this country, together with type, the Guernsey is recognized as a profitable producer. They carry remarkable dairy quality; their udders have good capacity, and the texture of their udders on a whole is not equalled in any other breed. A feature of the Guernsey not possessed by any other breed is the ability to produce richly colored milk. This feature is probably associated with skin secretions of the breed. This skin secretion is a yellow waxy substance produced on the body, and is especially noticed in the ears, on the teats, at the end of the tail, and at the base of the hoofs, and horns. Guernsey breeders give considerable attention to this secretion as indicating the color of the product.
However, some breeders deny its significance, but experimental evidence and practice seem to show that it is important.

Guernseys are especially adaptable to the production of high class market milk. Their milk is high in butterfat and its rich color makes it attractive. The average amount of fat in Guernsey milk is 5%, and a yield of 8000 pounds of milk a year should be easily averaged in a herd.

As a butter producer, the Guernsey is entitled to a special distinction. In numerous tests under official supervision, the Guernsey has obtained highest honors. The butter produced from Guernsey milk requires no artificial coloring. In the Pan-American contest, the Guernseys scored 14.97 points out of a possible 15 points in regard to the color of the butter. In regard to milk and butterfat production, the Guernsey ranks very high. The highest yield of milk of a Guernsey is 24,008 pounds, which was produced by Murne Cowan 19597. The highest production of butterfat is 1,112 pounds, which was produced by Anesthesia Fate of Hillstate.

In cheese production Guernsey milk ranks quite high, but the quality of cheese is not as high as the Jersey or Shorthorn.

The Guernseys in beef production should have a subordinate place, but it has the same objection as the other dairy breeds; that is, the percentage of high priced cuts are very low. In flavor and quality, Guernsey beef and veal will rank high.

The introduction of Guernsey cattle into America dates back to the early part of the last century. In 1818 Reuben Haines of Germantown, Pennsylvania imported a pair of Guernsey cattle from the Island of Alderney. In 1850 a few more cattle were imported. The number of Guernseys imported increased con-
considerably in a few years, and in 1877 a few Guernsey breeders organized the American Guernsey Breeders' Association. This same year there was reported to be 193 Guernseys registered, 114 of which were imported.

At the present time Guernseys rank third in numbers among the dairy breeds in the United States, there being 80,000 purebreds.

In 1901 Guernsey breeders started the Advanced Registry. To be admitted, a cow must produce a certain amount of butterfat during 365 days. The amount of butterfat a cow is required to produce varies according to age. A cow under two years must produce 230.5 pounds of butterfat; a cow from two to five years an increase of .1 pound per day, and a cow over five years must produce over 400 pounds of butterfat. In accordance with her age, the cows are divided into Classes A, B, and C. Cows over five years of age belong to Class C.

The Guernsey cow besides being a good type of dairy breed is also well adapted to dairy conditions. She has a large consuming capacity for feeds and roughages. This is absolutely essential to heavy producers as a cow must consume large quantities of feeds and roughages in order to produce large quantities of milk.

The Guernsey has also a very good temperament. This is also essential as it makes caring for the cattle easier. It also insures better treatment to the cow from the milkers.

Therefore, in concluding this thesis, I recommend the Guernsey as one of the outstanding breeds of dairy cattle.

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Types and Breeds of Farm Animals by Plumb, Pages 276-86.
HOLSTEIN - FRIESIAN HISTORY

Arthur W. Grove '31
Roosevelt, Minnesota

Dedication
To the lovers of the Holstein-Friesian cattle, I do hereby dedicate this senior thesis.

Foreword
THE FOSTER MOTHER OF THE WORLD

The cow is a most wonderful laboratory. She takes the grasses of the pasture and roughage of the field and converts them into the most perfect food for man. In that food there is a mysterious something which scientists have found nowhere else. We have sought for centuries the fabled Fountain of Youth. The nearest approach to that fountain which has yet been discovered is the udder of the cow. Without her milk, children languish, the vigor of the adult declines, and the vitality of the human race runs low. —

Frank O. Lowden

Introduction
This is indeed an age of specialization, not only in the professions and industry, but in agriculture as well. And, in no division of agriculture is this more true than in dairying. The dairy business as properly conducted today, calls for very special thought and effort. The successful breeder of dairy cattle must choose a breed best adapted to his needs and desires. He must stay with this breed, study it from all angles, and constantly select and breed toward the goal of better type and production. The man who starts out to do otherwise has no business breeding dairy cattle and will do both himself and the business an injustice.

Realizing that every breed has its good points, but naturally most concerned about the development of the Holstein-Friesian cow, I present the following pages of facts and I ask that you give them the most careful consideration when you are trying
to answer the question, "Which is the best breed?" -- The Holstein-Friesian Cow.

**Early History and Characteristics that Leave Imprints On Present Day Cattle**

The exact time and place of the origin of the Holstein-Friesian cattle is veiled in obscurity. The little that has been found about the origin of the breed of cattle leads us to believe that it is of very ancient origin.

Motley, in his history of the United Netherlands, says: "On that scrap of solid ground, rescued by human energy from the ocean, were the most fertile pastures in the world." He also goes on to state that "an ox often weighed a ton, large amounts of butter and cheese were exported annually from the Netherlands, the farmers were industrious, thriving and independent."

Historians find references of this breed of cattle as far back as 300 years before the Christian Era. A tribe of people called Friesians, who inhabited the shores of the north seas were known to have derived their chief support from their herds of cattle.

About 300 years later, it is learned that a German tribe moved northward from Hesse, and settled near the Friesians. They became known as Batavians. They were also breeders of cattle, but it is not known whether they brought their herds with them or whether they secured their cattle from the Friesians. It is, however, believed that they brought their cattle with them and that they were black, and that the Friesian cattle were white! No doubt the intermingling of these two breeds was the foundation of our present day Holstein-Friesian cow.

Historians have also unearthed other facts concerning the origin and history of the Holstein-Friesians. Caesar's writing
show us that the Friesians paid an annual tax of ox hides and ox horns to the Romans during the time of the Roman conquest of Europe (113 B.C. -- 53 A.D.).

Later writers tell us that during the 13th, 14th, 15th, and 16th centuries the production of butter and cheese in Holland and Friesland was enormous and also that large numbers of meat cattle were produced.

It is asserted that the early breeders of this breed of cattle emphasized size and production and unlike the Channel Island breeders, overlooked the importance of type. There is an understanding among farmers that the Holstein-Friesian breed lacks the uniform type that is found in the other breeds, especially the Jersey and Ayrshires. This does not hold true in our present day Holsteins as was found in the breed in its native country, and before the true Holstein-Friesian type was perfected. However, breeders do find the ever perplexing problem confronting them, "How can I get away from faulty udders and slopy rumps?" The prepotency of the breed backed by the generations of cattle that were inferior in these respects make it extremely difficult to accomplish what the breeders set forth to do -- To combine type and production.

Early Importations

Importations of this breed began with the settlement of the Dutch settlers in New York State between 1621 and 1664 and at irregular intervals after the Revolutionary War.

Mr. Chenery Makes First Permanent Importation

The first permanent importation of this breed was made by Winthrop W. Chenery of Belmont, Massachusetts, just prior to the Civil War. His last importation was made in 1861. The first animals sold by Mr. Chenery were purchased by Mr. Charles Houghton,
the first secretary and treasurer of the association of "Thoroughbred Holstein Cattle," and father of Frederick L. Houghton, the present secretary of the Holstein-Friesian Association of America.

In 1852 Mr. Chenery purchased a Holland cow from a master of a Dutch sailing vessel that had landed in Boston. This cow was selected to furnish fresh milk for the crew during the voyage. This cow proved herself as an efficient producer and caused Mr. Chenery to purchase a bull and two cows in 1857. He again purchased four more cows to add to his herd two years later. At this time a disease known as contagious pleuro-pneumonia or lung plague was prevalent in this part of the United States. Unfortunately, these cattle and all their descendants, with the exception of one young bull, contracted this disease and were destroyed by the Commonwealth of Massachusetts.

Mr. Chenery was thoroughly convinced of the superiority of these cattle to other cattle imported that again in 1891 he imported a bull and four cows. With these animals as his foundation herd, Mr. Chenery was successful in developing a small herd of cattle that influenced the breed's popularity at that time. One cow "Trexelaar," produced 76 lbs. and 5 oz. milk in one day.

History of Name

It is interesting at this point to also study the history of the name - Holstein Friesian. This name has been in use since 1885 when the "Association of Breeders of Thoroughbred Holstein Cattle" and the "American Association of Breeders of Purebred Friesian or Dutch Friesian Cattle" formed what is now known as the "Holstein-Friesian Association of America."

The common usage in conversation and frequently in writing the word Friesian is dropped and Holstein alone is used,
and at this time we do not see any probability of changing and using the entire name. So far as geographical significance is concerned, the name Holstein, applied to this breed of cattle, is incorrect. As far as known, no cattle have been exported from the country of Holstein into this country. None have been duly registered in the Herd Books. During the time of the early importations, the cattle in Holstein did not resemble the cattle found in North Holland or Friesland. The cattle of Holstein are the Angle cattle and are described as being small with fine bones, short legged, having a very fine small head and a delicately formed neck. The predominating color is red or brown, but there are many dun, black, or spotted ones.

**Few Holstein-Friesians Imported in Comparison to other Breed Importations**

In 1885 importations of Holstein-Friesians had practically ceased, and up to that time less than nine thousand head had been imported. Since 1890 only 133 animals have been imported into America.

These cattle, a native of Europe, have adapted themselves perfectly to the climate and conditions of North America. Herds of Holstein-Friesians have been developed in this country that have improved the breed to such an extent that the Holstein-Friesians of America far surpass the same breed in their native haunts.

**World Development of Holstein-Friesians**

The development of the Holstein-Friesian cow has been truly remarkable and is in itself a final proof of the fecundity and hardiness of the breed. Herds have been established in various climates. The experimental station at Nome, Alaska has developed a small herd of this breed. The Holstein-Friesians have
proven themselves practical in northern Russia near the Arctic Circle. Sunny Brazil has herds of Holstein-Friesians that are doing well under the torrid sun. In fact, Holstein-Friesians are so widely spread that they have easily become the most popular breed. They represent 60% of the dairy cattle in the United States. This is remarkable when we stop to consider that all the other dairy breeds make up the other 40%.

**Ease in Selection Due to Popularity**

Due to the popularity and to the wide distribution of the Holstein-Friesian cattle, it is easy for one to purchase a few head or a carload, within a reasonable distance from his home and usually within his own state. This gives the buyer an opportunity to give careful judgment and consideration in selecting his foundation cattle. The prices of Holstein-Friesians make it possible to secure animals just as cheaply as in other breeds and cheaper than in some.

All forms of business have what is called a "boom" at some period. This is true in the Holstein-Friesian breed of cattle as well. Fabulous prices were paid for cattle during the period of 1915 to 1920; the highest price was paid in 1919.

**Prices Paid for Holstein-Friesians**

Four figure prices are frequently paid for an individual of outstanding merit. Five thousand dollars to $10,000 have occasionally been paid, and $50,000 has caused many good animals to change owners. The highest prices paid for any animal has been $106,000. This unbelievable sum was paid for Carnation King Sylvia, by the Carnation Milk Farms of Seattle, Washington, and Occonomawac, Wisconsin. This individual was the son of May Echo Sylvia. The highest price paid for a female was established when Pabst Korndyke Kornflower was sold for $30,000.
Fortunately for the buyer, these prices do not prevail at present. Good foundation animals can now be secured for prices ranging from $200 and upward into the four figure prices.

Holstein-Friesians have proven themselves as satisfactory as the farmers' cow in herds of five to thirty cows. They also have proven themselves desirable in herds ranging in size from one hundred upward.

**The Breed as a Whole**

Undoubtedly the larger breeders of Holstein-Friesian cattle have done more towards the development of this breed than the smaller breeders. The students of Holstein-Friesian cattle have found it less difficult to improve these cattle where the mating of various blood lines could be watched. The breeder of any breed of cattle finds a difficult job to raise the production of his cows that have already reached a high level. Nine chances out of ten the student finds himself treading on dangerous ground when he begins to mate his cattle with new strains even though they are purebred Holstein-Friesian cattle. We do have the "one out of ten" to work with and it is here where some of the outstanding individuals of our breed have been developed. The large number of Holstein-Friesian cattle in this country have made it possible for the development of this breed to be as rapid as it has been. When we consider that two million Holstein-Friesians have been duly registered in the Herd Book of the Holstein-Friesian Association of America, we realize what opportunities await the breeder of these cattle.

The breed is too extensive, and the animals of outstanding prepotency too numerous to include or even mention all of those that really deserve recognition in such a work as this. I shall endeavor, however, to put down a few principal facts concerning the
important foundation families that have in my opinion contributed the most to the development of this breed in America.

**The Ormsbys**

Of all the different strains the Ormsbys are the most popular in Minnesota. In fact the Ormsbys have gained considerable recognition through development in Minnesota.

**Duchess Ormsby**

It is through Duchess Ormsby 18004 that the Ormsby strain developed. "Duchess" was the first cow to bear the Ormsby name. Sire Ormsby Hengervals De Kol, a grandson of "Old Duchess" proved to be one of the greatest sires of his day. His sons include Sir Ormsby Skylark, sire of the first 1500 lb. cow, Duchess Skylark Ormsby. His daughters, include, among other good ones, Pietertje Maid Ormsby, one of the first 35 lb. cows in the world, former world's champion in the 30 day division, with several good year records. "Pietertje Maid" is the dam of Miss Korndyke Maid Ormsby, a 1000 lb. fat producer. Minnesota has also produced such great sires as Sir Pietertje Ormsby Mercedes, sire of Sir P.O.M.37th, and is also the grandsire of King Pietertje Ormsby Piebe, who, in turn, is the sire of Miss Jewel Ormsby Piebe, who produced 556 lbs. of butter in 34 days or 82 lbs. more butter than the famous cow De Kol Plus Segis Dixie, who held the world record/a similar period, before Jewel so astoundingly broke the record.

The Ormsby strain of Holstein-Friesian cattle is found in all localities of Minnesota between the Lake of the Woods in the north and the Iowa line, and between the Dakota and Wisconsin. They have proven their worth and will undoubtedly keep on proving themselves so, for generations to come.
SIR INKA MAY, A MINNESOTA PRODUCTION

Minnesota also produced Sir Inka May, a son of May Walker Ollie Homestead, the Minnesota cow that held the United States record for butter production with 1,523 lbs. This fine record was excelled quite recently when Daisy Aggie Ormsby, 2nd, produced 1,607 lbs. of butter or 84 lbs. more than the record formerly held by May Walker Ollie Homestead.

Ormsby as a Show Ring Winner

The Ormsbys have proven themselves as show ring winners as well as producers. Sir Inka May and his sister composed the all-American produce of dam in 1926. Other famous show animals of this strain are Lady Angie Ormsby of Rock, grand champion at the Pacific International in 1921, with a record of 1,059 lbs. butter.

Alcartra Golantha Ormsby

Alcartra Golantha Ormsby, all-American aged cow in 1928, all-American two-year-old in 1925, has a record of 946 lbs. butter.

Queen Bessie Pietertje Ormsby

Queen Bessie Pietertje Ormsby is another wonderful matron. Queen Bessie began her career at the Spaulding Farms at Warren, Minnesota, where she set up a mark of 895.63 lbs. fat, 24,537.5 lbs. milk at two years and seven months of age. This was a new championship mark for her class when made. Her second record made at four years and two months was 1,095.26 lbs. fat, 26,895.3 lbs. milk. The fat record placing her sixteen pounds under the world's champion for her age. This placing is still held. When the four-year-old record was nearly completed, Queen Bessie was purchased by the Elmwood Farms at Deerfield, Illinois. At this farm she has completed two more commendable records, one at five years and eight months, 1,172.75 lbs. fat, 28,869.9 lbs. milk, the other at seven years and five months, 1,128.75 lbs. fat, 23,122.7 lbs. milk. This
gives her an average for her first four lactations of 1,073 lbs. fat, 27,118.8 lbs. milk with an average test of 3.95%. No other cow of any breed has equaled this average for her first four lactations.

Queen Bessie was sired by a line bred son of Sir Pietertje Ormsby Mercedes, the sire's dam being an 800 lbs. fat granddaughter of "Old Sir Piet."

Sir P.O.M.

Sir Pietertje Ormsby 37th is a name that will continue to live down in Holstein-Friesian history. He has recently gone into lead with respect to 1,000 lb. butter record daughters, his total now being twenty-two.

Sir Fobes

Sir Fobes Ormsby Hengervalld is a name that is at present making history. This grand old sire is now showing in seven-year-old farm and is going as strong as before. With his winning all-American honors this year, he will have won this position for five consecutive times and will have added more than thirty grand championship ribbons to his collection. Sir Fobes is the senior sire at the Elmwood Farms at Deerfield, Illinois.

Minerva Beets

Another show record never eclipsed or equaled by any cow of any breed is held by Minerva Beets, a grand old matron who won her first grand championship at the 1914 National Dairy Show, and continued this up to and including the 1919 show.

There are several animals that have received world-wide recognition for their ability to produce and reproduce fat and milk. The long time tests have been found to be a testimony of the producing ability of the cow, more so than the short time test.
**De Kol Plus Segis Dixie**

De Kol Plus Segis Dixie, a Canadian cow holds the world's record for both one and two years butter production. A strictly official record made at nine years and one month, gives her credit for producing 33,484.70 lbs. of milk, and 1,668.64 lbs. of butter in 365 days. Her milk averaged a test of 4.03% fat. Another record made at seven years and seven months credits her with 32,632.30 lbs. milk, and 1439.34 lbs. butter. This cow was the first to make two records of over 1500 lbs. She is the first and only cow with over 1700 lbs. butter (Canadian Semi-Official) and was the first cow to make two milk records over 32,000 lbs.

**Segis Pietertje Prospect**

Segis Pietertje Prospect is the world's champion for one and two years milk production. Both records being over 35,000 lbs, the larger is 37,381.40 lbs. Her two year butter production is the largest in the United States.

**Tilly Alcartra**

Tilly Alcartra is the world's champion long distance producer. In her first eight lactations, three of which were for ten months or less, she produced on semi-official test, 201,137.9 lbs. milk, 7816 lbs. butter. She was the first 30,000 lb. cow, the first 33,000 lb. cow, and the first 30,000 lb. repeater.

This mentions only the high lights of several of the most important characters in the Holstein-Friesian world, but the purpose of this thesis was to give an account of Holstein-Friesian History and for that reason, I have mentioned only characters who have given most to the history of the breed.

Over two million Holstein-Friesian cattle have been duly registered in the herd books of the association. The largest records are constantly being equalled and excelled. The average
production for the breed is annually being raised. Boys and girls are doing well with Holstein-Friesians. They have proven themselves as producers. Whether we are in Minnesota or in the sunny south, Holstein-Friesians are popular and are beautiful everywhere, so they must be good.
JERSEY CATTLE

Raymond Peterson '31
East Grand Forks, Minnesota

Dedication

In sincere appreciation, I wish to dedicate this thesis on Jersey Cattle to my parents, Mr. and Mrs. Alfred Peterson, whose many years of toil have enabled me to graduate from this school. This is also dedicated to Mr. George Wight, whose help made this thesis possible.

Introduction

THE Cow has been the friend of man for centuries. FOR the past her faithful and undying service to humanity is a thing to be thankful for. Truly the cow is the foster-Mother of our modern race.

FOR the future she can be relied upon to serve mankind in the coming ages as faithfully as before. THEREFORE, let us consider the Jersey as one of the breeds so honored.

Jersey cattle originated on the Island of Jersey, which is located in the English Channel close to France and the Island of Guernsey.

The Island of Jersey is about six miles wide and eleven miles long. Therefore, it is possible for the Royal Agricultural Society to supervise breeding operations very closely.

This Society began its systematic improvement in 1834 and continual progress has been made since. To be entered in the Island herd book, all Jerseys must be first inspected and must pass the high standards set by the Society.

All of the farms on the Island are small due to the small size of the Island itself, thus enabling the stock raisers to know their cattle thoroughly. There are about ten thousand Jersey cattle on the Island at the present time.
In 1763 the Islanders adopted laws prohibiting the importation of all cattle except for immediate slaughter and these laws were revised and strengthened in 1789. Cattle that have once left the Island cannot be brought back again. In fact, for the last twenty-five years, no live cattle of any description have been allowed to land on the Island.

The probably ancestors of the Jersey breed of cattle are the wild French cattle which roamed the mainlands centuries ago, but as there is no definite proof of this fact, their history is rather obscure.

The imported Jersey, as we know her today, is the result of centuries of breeding on the Island and the influence of the Island environment. The American Jersey is the result of American conditions, climate, feeding, and American demand for economic dairying on the original imported stock.

The first Jersey cattle were introduced to America about the year 1817, and as they attracted a good deal of favorable attention, more were soon imported. In about the year 1850 a regular system of importation was begun. At first due to natural causes, they came only to the eastern states, but after a while, they spread gradually to every part of America.

Today there are over ten million Jerseys in the United States, of which over 300,000 are registered purebreds. This shows that, altho the Jersey is not the most popular breed, they occupy a distinct place in the American dairy industry. It was estimated that probably over two million farmers have chosen Jerseys for their dairy stock and Government figures show that the Jersey is the predominant breed of dairy cattle in eighteen states. These states are: Alabama, Arkansas, Florida, Georgia, Indiana, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Tennessee, Texas, Utah, and West Virginia. In New
Zealand, fifty percent of the dairy cattle are Jerseys.

Being that they are a product of a temperate climate is no drawback to the Jersey. They are found in Northwestern Canada, where the temperature sometimes falls to forty-five degrees, F, below zero, and in southern Texas, where the mercury has been known to reach 113 above. These, of course, illustrate the two extremes, but nevertheless, they prove a breed of cattle worthy of attention. Climate holds no terror for the Jerseys. They are also found in temperate England, Semi-tropical Australia, rigorous Maine, and dripping Oregon.

Jersey cattle have been bred for over 200 years on the little Island of Jersey for high production and prepotency. They produce on the average the highest testing milk of any breed and are capable of producing over a thousand pounds of butterfat in a year. This milk, besides being rich in butterfat, contains more food solids than any other milk, ranging from five and seven-tenths to nine and six-tenths. Total digestible food solids, making it a very healthful food for young children and invalids as well as grown people.

Prepotency of any breed of animals means the ability to transmit its qualities upon its offspring. This is an important factor in animal breeding. Besides this, there are three other laws: namely, hereditity, variability, and selection. The last factor is the only one in the breeder's control, as the others are the result of natural laws, and in the Jersey, the result of two centuries of predecessors.

Jersey cattle possess these qualities in a marked degree. The small size of the Island and the long length of time the breed has existed account for this. They also have an enviable reputation for early maturity, which no other breed can equal. The females come into production at the age of two years without
injuring their producing qualities in the least, and have been known to continue high production to the ripe age of twenty years. They are very persistent also producing heavily throughout their milk year and oftentimes it is difficult to dry them off so as to give them a rest between lactation periods.

The poet Keats wrote "A thing of beauty is a joy forever," and when one looks at a Jersey, he can readily see that this is true. The soft fawns, greys, and tans are pleasing to the sense of color balance in any setting. Their clean cut limbs, small refined heads, and curved horns, together with a stately manner, also help to distinguish them from the ordinary, and mark them as a superior breed. Altho they are beautiful, their beauty is of a useful type. They have not sacrificed their dairy utility for appearance. The straight topline, well arched ribs, broad pelvis, long rump and balanced, rounded udder indicates the fact that they are capable of high production as well.

The Jersey have often been faulted on their seemingly small size and nervous temperament. This may be a serious fault and it may not. It all depends on the breeder. As they are an early maturing breed, they are only too often thrown into production at too early an age, thus sacrificing their growth and producing ability accordingly.

Having always been an intelligent and high spirited breed, it is no wonder they they will rebel when subjected to mistreatment by cruel and unhuman handlers. It is true that they will stand less abuse than other breeds, but to the intelligent livestock man, this means nothing. Rather it is an asset, as he knows that in order to receive the most from his stock, he has to treat them accordingly. Certainly Jerseys that have been handled properly have fully proved themselves by their records.
Below are listed some of the cows which have produced a thousand pounds or over of butterfat on 365 day tests. Abigail of Hillside stands out at the head of the list, having 1,197 pounds of butterfat and 23,677 pounds of milk to her credit. This is equal to 1,260 pounds of churned butter. Figures are for 1929.

1. Abigail of Hillside ---- 1197.51 lbs.
2. Darling's Jolley Lassie ---- 1141.38 lbs.
3. Groff's Constance ---- 1130.09 lbs.
5. Lad's Jota ---- 1048.07 lbs.
6. Fantick's Ruth ---- 1047.38 lbs.
7. Imperial Isabelle ---- 1045.14 lbs.
8. Madeline of Hillside ---- 1044.05 lbs.
9.Plain Mary ---- 1040.08 lbs.
10. I Vive La France ---- 1039.29 lbs.
11. Lady's Silken Glow ---- 1038.70 lbs.
12. Saint Mevas Lad's Lady ---- 1032.97 lbs.
13. II Vive La France ---- 1031.64 lbs.
14. Red Lady ---- 1028.51 lbs.
15. Imperial Xenia's Oxford Lilac ---- 1022.39 lbs.

As to the value of the Jersey to the Red River Valley, the extent is unlimited. As already stated they possess the necessary hardiness for the rigorous winters plus high efficiency and economy of production, which is needed because of the comparatively small farms and limited grazing area of the valley. They already have met with a good deal of success in the state of Minnesota, and it will not be long before they will be more often seen in the Red River Valley also.

During the present downward trend of markets, the Jersey is proving herself a real provender by her economy of production. Jersey cattle are not beefy and do not put any excess weight on their bodies, but use their feed to the highest possible efficiency. That Jersey's are great economists is a well known fact and has been proven many times. The highest average of over ten cows in Minnesota is held by the herd of Mr. W. H. Eddys and Son, Howard Lake, Minnesota. The eighteen Jersey cows in Mr. Eddy's herd averaged 538 pounds of butterfat, and 7,844 pounds of milk each in
one year of the cow testing association. The average profit above feed cost was $235.00 per cow. In addition, twelve bull and heifer calves were sold for an average of $100.00 each. Official tests made with other breeds competing have also shown that the Jersey is the most economical producer of butterfat. This means that high average production is secured at low feed cost.

Grading is the science of mating pure bred animals to scrub or low grade stock, thereby improving the offspring. A great many herds have been made to produce economically by crossing purebred Jersey stock to their original animals and grading upwards successfully by the use of tried and proven sires. Altho these grades cannot ever be registered, they may be just as good and often are better than their purebred relatives. Grading is a good practice if handled correctly and kept up, but it takes a far greater knowledge of animal breeding and better managing than the raising of purebreds. The Jersey sire here proves himself a master due to his great prepotent qualities. His ability to transmit his dairy characteristics upon low grade stock has been inherited from the centuries of straight and careful breeding upon the Island of Jersey.

A good example of what has been done in this line is the grade Jersey herd owned by Mr. and Mrs. B.F. Cooper of Hannibal, Missouri. Mr. Cooper started dairying in 1917 with three scrub heifer calves. Since they by using good judgment and careful breeding with proven Jersey sires, he has built his herd up to a point of maximum efficiency. Last year the National Dairy Show, St. Louis, exhibited this herd of 31 grades as a special exhibit.

The purpose of this paper is to refute some of the falsehoods often advanced about the Jersey Breed, and it is hoped that this aim has been accomplished. May we pay tribute to the Jerseys, a fine breed of dairy cattle.
THE PRODUCTION OF CLEAN MILK

John H. Anderson '31
Hallock, Minnesota

Dedication

I take great pleasure in dedicating this thesis to Mr. G. Wight, who has instructed me so faithfully in the past year.

Foreword

This thesis deals with the care of Milk, so as to keep it in a sweet and disease-free condition.

An attorney says, "Milk is considered as the leading food for both the animal and the human race. Without milk, children languish; the vigor of the adult declines, and the vitality of the human race runs down."

No satisfactory substitute has been found for milk and its products. The animal and plant fats that are frequently used have been found to be lacking in the nutrients that milk contains. The butterfat in milk is found only in the udder of the mammal, and contains nutrients that are important for proper nourishment.

In the early days, man tamed the wild cow so that he could use her milk. With the improvement of this cow to our present day dairy cow, civilization has improved rapidly. With the change we find that methods of handling milk differ from what were known to be satisfactory as late as the nineties.

Today we must pay a premium for Grade A or certified milk. But we are justified in demanding such milk as a guarantee of quality.

There is a wide variation in the definition of high
grade milk, but boiling them all down, we find that milk must be
safe, clean, have good flavor, have proper food value, and must
have good keeping qualities, before it can be classified as Grade
A milk.

It has been proven many times both by experiments and
by experience that milk may sometimes carry disease bacteria and
that such milk may cause an epidemic of a particular disease,
Tuberculosis, typhoid fever, septic sore throat, diphtheria, scarlet
fever, and a few other diseases of minor importance have been known
to be carried by milk.

The safety of the public milk supply has been a serious
public question. The consumers are beginning to ask the question,
"Is this milk safe?" This can only be assured by careful attention
to the health of the animals and the attendants, the purity of the
water, and the sanitary surroundings of the barn.

The milk is frequently affected with disease bacteria
before it is drawn from the cow. The work of our United States
Department of Agriculture is helping to lessen the danger of bovine
diseases such as tuberculosis, and a few other diseases carried
by bovines. It is within the reach of any wide dairyman to have a
herd of healthy cattle.

"Cleanliness is next to Godliness" is an old saying
that holds true in the dairy business. What seems clean to one
person may not appear clean to another. However, there is a common
sense judgment about cleanliness. Anyone can tell whether a cow
is reasonably clean or dirty.

In order that milk of the highest standard may be
secured, the cleanliness of the cows is essential. Loose material
clinging to the sides of the cows and to her udder and tail contains
millions of bacteria, waiting for the opportunity to dislodge and
begin a harmful career in the milk. Careful attention to the cow will lower this to the minimum. Stalls adjusted to the proper length to suit the individual animal are a great help in keeping excess filth out of the stall. Clipping the hair off the flank and udder lessen the possibility for trash to cling to that part of the cow. Brushing the cow frequently aids in the physical contentment of the cow. Brushing should be avoided immediately before milking. A good plan is to wipe the udder with a damp cloth at milking time. This removes foreign material, and the dampness has a tendency to prevent the dust remaining on the cow's udder from falling into the milk.

In high class dairies, covered milk pails are used extensively to prevent the dirt, dust, and bacteria from falling into the milk. Such milk pails remove from thirty to seventy percent of the dirt and bacteria that would otherwise fall into the milk. Various types of milk pails have been put on the market. Some of them are not practical. The best types have smooth sides with the joints and grooves soldered to prevent the accumulation of dirt. Also a pail with as small a top as possible is good. The idea is to keep as much dirt as possible from falling into the milk, because after it is once in the milk, no amount of straining can remove all of the dirt.

Milk readily absorbs odor from the air. For this reason, the air in the barn should always be kept fresh. The "cowy" smell in fresh milk usually comes from stale air in the barn. Spoiled vegetables or onions should never be in the same room where milk is cooling. Also keeping the utensil tightly covered while the milk is cooling gives the milk a smothered taste which is very objectionable.

Certain weeds and vegetables like turnips and ruta-
bagas give a disagreeable flavor to milk. Generally this can be corrected by taking the cows off pasture several hours before milking time and by feeding the turnips or rutabagas only after milking.

It should be stated here that it is impossible to keep all bacteria out of milk. Market milk always has bacteria. For example, certified milk, the highest grade milk produced is allowed to have up to 10,000 bacteria per cubic centimeter (which is about twenty drops of milk).

Since we cannot produce milk free from bacteria, we try to do the next best thing: namely, to produce milk with as few bacteria as possible.

Cleanliness in the dairy barn is important, but if the utensils with which the milk comes in contact after it leaves the cow are not clean, we lose the fight with bacteria that we started to win.

The utensils are the most important source of bacteria. Every utensil that has a clean smell, no matter how clean and well sterilized, may add millions of bacteria. Of the different utensils, the shipping can has been the most mischievous. These cans are washed and sterilized in the milk plant. But no matter how it is done, in the milk plant, by the time the cans reach the farm again, they are as a rule not fit to receive milk.

The washing of utensils on the farm is a delicate subject to discuss. There are several good methods that can be used, and in any method used, cleanliness cannot be stressed too much.

All utensils should be washed as soon as possible after they are emptied. This makes them easier to clean and bacteria cannot thrive where there is no dirt or moisture.

Live steam is without doubt the best for sterilization.
Steam is available on very few farms. The next best is hot water. With plenty of scalding water on hand, a very satisfactory job of sterilization can be had. Care should be taken that every part of the utensil is properly scalded.

Where hot water is difficult to get in sufficient amounts, the chemical sterilization of utensils may become a common practice. Not all chemical sterilizers are suitable, some having an undesirable odor and some being poisonous and impossible to be used in connection with food handling. The chlorine sterilization seems to meet these objections. There are several good preparations on the market. One of the most common is Sodium Hypochlorite, sold under different names, as B.K.Serm Hypchar, etc.

The method of applying these sterilizations is simple. A certain amount of the chemical sterilizers is put into the rinsing water. As a rule the directions come with the sterilizer so that it will not be explained in full here.

After the cans are washed and sterilized, they soon develop a stale smell unless they are exposed to air and sunshine. The sunshine dries the moisture left in the cans and also kills any bacteria that may have accumulated after the washing. The best method is to invert the cans on a rack out in the sunshine. If possible, this rack should be screened to keep this off, but if the cans are kept clean, flies will not be a serious menace.

Milk should be cooled as quickly as possible down to 50 degrees F. Cooling milk is done mainly for one reason, to hinder the bacterial growth. Bacteria are like any other vegetation; they grow rapidly in warm temperature and slowly in cold temperature. At 40 degrees there was no increase in bacteria; at 50 degrees the increase was very slight; at 60 degrees, each bacteria produced fifteen new ones; at 70 degrees each bacteria produced 700 new ones; at 80 degrees, each bacteria produced 3000 new ones. The
above results show the importance of cooling milk. The common farm method of cooling milk is to submerge cans containing milk into tanks of cold running water. In large dairies, a tubular surface cooler is the most satisfactory.

In the production of clean milk, special equipment is not necessary. It is not difficult to find dairy farms with beautiful buildings and the latest types of equipment and yet high grade milk is not produced on them. Neither is it difficult to find educated dairymen who do not produce good quality milk. Proper equipment and good education are very helpful and valuable, but back of it all, the Man is the most important factor.
Dedication

To the encouraging and inspiring work of the Senior class, I dedicate this paper.

Foreword

I have written this paper to enable the farmers of the Northwest to better be able to understand Animal "Cross Breeding."

The literature on animal breeding is not fully agreed on or clear in the defining of crossbreeding. It is frequently defined as the mating of two purebred individuals of different breeds. The farmer, however, who has for several years used a purebred Duroc Jersey boar and, in consequence, has a well graded herd of Duroc Jersey sows, on which he uses a purebred Poland China boar, thinks and speaks of it as crossbreeding; and that is what it is, for he is mixing breeds rather than grading. Then again, crossbreeding is defined as the mating of individuals of different breeds or species; this definition covers both the above mentioned types of crossing and the mating of different species.

But even this is not broad enough, because the breeder of purebreds frequently follows cross breeding for a time and then introduces new blood by mating to an animal of some breed but of a different blood line or family. This he speaks of as outcrossing. Domestic animals may be classified according to individuals, family, breed, species, and genus, and crossbreeding may be defined as the crossing of families, breeds or species.

In general, the purpose of crossbreeding is to induce variation. The results of crossbreeding, and generally the primary objections are an increase of size, vigor, and fertility. The
effects of crossbreeding, therefore, are just the opposite to those of close breeding. The general effect of close breeding is decreased in size, vigor, and fertility.

Crossbreds are produced for the following uses:

For the production of market animals only.
To make the crossbreds the basis of a new breed.
A single cross to revive its fertility.
To get new blood into a close bred family.

The Colling Brothers were advocates of close breeding but at one time they found it necessary to resort to a cross of Walloway blood to restore the fertility of their Shorthorn herd. Most breeders today are watching very closely for a decrease in fertility and they have found that they can guard against it very well from within the breed by selection and occasionally using new blood.

Many new breeders of stock have been developed by crossbreeding. The Oxford Down breed of sheep is the result of crossing Cotswolds, Hampshire Down, and Southdown, followed by nearly a century of selection.

The crossing was started about 1833 and the breed was first recognized as a breed in 1863. More recently we have the Corriedale developed in New Zealand by crossing Lincoln and Leicester rams on Merino ewes, and the Columbia, breed of sheep developed by the United States Department of Agriculture, was a cross of the Lincoln and Rambouillet. In both cases, selection and culling has been necessary.

A breed of poultry has been produced by Harry M. Lamon of the United States Department of Agriculture called the Lamona. The breed was produced by crossing the White Plymouth Rock, the Single Comb White leghorn, and the Silver Gray Dorking. This breed is more of a meat producing bird than the Mediterranean breeds and produces
white shelled eggs which are so prized on the market.

There has been crossing of breeds much more in many of the old lands than in North or South America. Many breeds of sheep are crossed for the production of market lambs. One of the most prominent of these crosses is the Border Leicester Cheviot. Half-bred rams frequently sell for prices as high as or even higher than purebreds.

Some range sheep owners come close to practicing a systematic scheme of crossing. They use the long wool rams on grade fine wool ewes, and the crossbred ewes are kept and bred to Down rams for the production of market lambs. The range men agree that a crossbred ewe flock is a more profitable one than either the fine wool or the long wool; ewes are larger and stronger; raise a larger lamb crop, and produce wool that is high in quality and quantity. The Down ram gives the lambs a blocky type which is desirable in market lambs.

The result of several crossbreeding experiments have been reported, but in most cases the numbers have been small and the experiments not closely checked. There are such wide differences within each of the various breeds that are used. Many experiments show that it is more profitable to produce crossbred hogs than purebred hogs for market purposes. This has been indicated by trials conducted at the Northwest School of Agriculture on crosses of Chester Whites and Duroc Jerseys. The crossbreds gain weight faster.

The usual advice given in the past has been that crossbreeding is satisfactory for the production of market animals, but that the crossbreds should not be maintained for breeding purposes. An old objection to crossbreeding is that the farmer practicing crossing so seldom has a regular scheme, but jumps from breed to breed. The end result will be a badly mixed group not only in regard
to body conformation, size, temperament, but many other characteristics.

Crossbreeding may be so conducted under certain limitations that it will become a source of profit while in other instances, under different conditions, it will be a source of loss. Again, it may be so conducted as to prove a stepping stone to improvement, while in yet other instances, it may go backwards. It has been the object of this thesis to investigate the question that some at least of the benefits to be derived from crossbreeding under suitable conditions may be pointed out, and likewise some of the poor things of crossbreeding, that the breeder may be enabled to avoid them.

References:

Animal Breeding by Laurence Winters
Animal Breeding by Thomas Shaw
BREEDING AND CARE OF SWINE

Carter Mortenson '31
Underwood, Minnesota

Dedication

In appreciation of what I have learned of Animal Husbandry, I hereby dedicate this thesis to my father.

Foreword

In this thesis I have tried to bring out some points in swine breeding, the value of swine, and swine sanitation; how to care for the sire, dam, and litter.

The farmers have not been taking very much interest in the breeding of swine, but their interest is increasing more and more every year. More and more farmers are realizing that the raising of hogs is one of the most important occupations in helping the farmer bring in his profits. Hogs are the quickest way to turn your feeds into a finished product, and receive the largest return.

One of the first questions which arises among farmers is, what breed shall I take? The prime importance in selecting a breed is to select a breed you like.

There are two types of hogs, the fat or lard hog, and the bacon hog. The principal breeds which belong to the fat or lard type are Chester White, Poland China, Duroc Jersey, and Berkshire, and the principal bacon type hogs are Yorkshire and Tamworth. From these breeds you are able to choose a breed you desire, and one that will suit your conditions. When you are choosing your breed, you should keep in mind the type and the breed characteristics. These are very important facts in swine breeding.
When you have selected the type and breed you desire, you have to get the sow and boar in condition for mating. This is done by feeding her a grain ration of either corn or oats and alfalfa hay. Do not let the sow get fat. You can prevent this by giving her plenty of exercise. The boar should have the same feed and care as the sow.

When the sow and boar are in good condition, the big problem of mating or reproduction has to be solved.

Every pig has an origin in the union of two germ cells, one produced by the male and one by the female. When these two germ cells unite, you have a new individual. If the sow is in vigorous condition, she produces from five to fifteen or more ova every three weeks. These ova are produced by the ovaries. When these become ripe, they drop down until finally they reach the uterus.

The male carries on a similar process by secreting his germ cells or sperms by the testes; altho the male produces many thousands of these sperms for every egg or ovum produced by the female, an average boar produces about 450,000 spermatozoas to a cubic millimeter, but only one sperm unites with the egg if in normal condition. A successful mating depends on the vigor of the sperm.

When the egg is fertilized, it attaches itself to the lining of the uterus and starts absorbing nourishment through the walls of the uterus. Each egg grows and at last divides into two parts, and these, in turn, grow and divide again, until there are four cells. This process of the cells keeps on through the whole gestation period, which is about 113 days.

The new individual will not inherit anything that did not appear in the fertilized egg; however, there may appear a
a character that cannot be seen in its first ancestry, but was present in two or more of them farther back. This, then, shows that the appearance of the individual does not show his breeding ability. This can be called hereditary differences.

We also have another variation and that is in size and vigor. This is due more to the differences in feeding and care. A well developed pig, if not properly cared for, will not resemble his sire or dam. A breeder then must not only produce pigs which will show good inheritance, but must also give them care and feed which will develop them to the best.

Along with these variations, prepotency enters in. Prepotency is the ability of an animal to transmit to the offspring his own characteristics. The sire is always more depended on, than the dam to improve your livestock, so the prepotency is sought in the sire. A prepotent sire is very desirable in improving your stock.

A prepotent animal is usually from close breeding and selecting animals of the right type. It has been shown that by such selection, the germ cells produced by the boar and sow are much alike, and that the offspring will be prepotent. A scrub will show its scrub qualities, and the prepotent animals will show their desirable characteristics.

The sire and the dam are equal in showing their characteristic on the offspring. Each germ cell from the sire and dam have characters in them to put on the offspring. Sometimes the characters of the sire are dominant, and sometimes the dam is dominant.

When breeding swine, there are many systems of breeding. There is grading up, cross breeding, and inbreeding. Upgrading is the best system of breeding when you haven't a purebred herd. Grading up is when you use a purebred boar on grade gilts. The boar should be carefully selected, and the best gilts selected from
the litter. This is a fast method of breeding up your herd.

Cross breeding is the mating of two purebred animals of different breeds, like a Berkshire boar to a Duroc Jersey sow.

Cross breeding has the effect of increasing the vigor and feeding qualities. These points are very important in producing market hogs, but from the standpoint of the farmer, he has tendency to keep some of the cross bred animals for breeding purposes. This will result in getting all varieties of color and type.

Cross breeding cannot be recommended and should not be called a method of livestock improvement. Its main purpose is to produce an animal that is more desirable for market purposes.

A breeder who has a purebred herd should not bring any unrelated strains into his herd.

Inbreeding is the mating of individuals more or less closely related. Close mating as brother or sister, half brother and sister, sire and daughter, or dam and son is called inbreeding. By inbreeding it increases the influence of an individual.

Sometimes the question of whether inbreeding is safe is asked. Experience has shown that an inbred sire has his breeding qualities increased. He becomes more prepotent in showing himself on his offspring and his breeding characters can be more surely guaranteed.

Continuous inbreeding will result in reducing the vigor and fertility. The closer they are related, the quicker the vigor and fertility is reduced. When inbreeding is practiced, a litter of hogs may contain more runts, some half male and female, while some will be thrifty and vigorous.

However, inbreeding should not be practiced by the farmer.
In selecting breeding stock, there are many principles that should be observed by the breeder. First, his individuality; second, his pedigree or breeding; and, third, his actual performance record as a breeder.

Individuality is everything that is considered in the show judging like size, conformation, feet and legs, and breed type qualities. The pedigree of an animal is only considered much when the animal has a good individuality.

A pedigree is a record of the animal's ancestry. It also contains the date of birth and gives the name of the breeder, and usually only includes the first three or four generations.

Performance is the only real test to see the breeding ability of an animal, and this is why listed sires are more reliable than an immature animal.

Many farmers want to keep their gilts for breeding purposes. This is permissible, but they should not allow them to mate before they are eight months of age.

Mating should be carried on in the latter part of November or first part of December for spring pigs. The sows will then farrow about the middle of March.

There are two methods of breeding, hand coupling or having boar in one pen and bringing sows or gilts to him. A breeding crate may be used to prevent any load on the sow. The second method is turning sire into the herd.

The care of the boar during the mating periods is very important. Together with the feeds he should be fed, the number of services also should be limited. A boar eight months of age can serve three sows a week, and a sire twelve months of age can serve twenty sows in a breeding season.

The caring of the sow during the gestation period is also essential. During this time, the sow should be kept in good
condition, but you should not let her get too fat. You can prevent this by giving her plenty of exercise.

Every farmer should be prepared to have a pen not smaller than 6 x 8 feet. The pen should have a plank floor, and should be equipped with fenders. Fenders serve as a protection for the small pigs. It is a bar projected from the wall. They are usually put on two walls. When the sow lays down, the pigs do not get smothered or laid on. The pen should be thoroughly cleaned and disinfected with hot water and lye or some other disinfectant. The floor should then be covered with a thin layer of rye or wheat straw. The sow should be put in the pen about seven or ten days before farrowing. At this time the ration should also be changed to a bulky nature, like bran, oil-meal, and a little corn. The change should be gradual.

At the time of farrowing, someone should be around to take care of the pigs. After the sow has farrowed, the pen should be cleaned and dry straw replaced.

The care of the sow and litter is also very important at this time. The sow should not be fed any feed the first day, but provided water with the chill taken out. The ration may be increased after two days. Sometimes sows eat their pigs. This shows that they are lacking in protein. This problem should be taken care of before they start eating their pigs. A good way to prevent this is to feed tankage. Sometimes the pigs have sharp teeth called needle teeth. These should be cut off. Another problem is the time of weaning. The time to wean is when the pigs are from eight to ten weeks old. The sow should be taken away from the pigs, and the pigs should be started on feed. Some good feeds are oats, bran, and skim milk.

If the farmer desires to have two litters a year, the second litter should receive the same treatment.

A farmer who intends to raise hogs with a profit must take all these factors into consideration, because swine breeding is very
important, and is one of the quickest ways of bringing the farmer a return and profit.

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SWINE SANITATION

Bjarne Nornes
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Dedication

To all those whom the following article may give some valuable information concerning the raising of swine in Minnesota, I dedicate this term paper.

Foreword

In this term paper it is my aim to set forth some of the important facts in the raising of swine under sanitary conditions. If I have succeeded in doing this and if this booklet helps anyone who is interested in raising swine, I am well satisfied with my work.

Thousands of dollars are lost annually by raising hogs under unsanitary conditions. A careful study showed that about one-third of the pigs farrowed died before they are weaned and one-third are stunted and unprofitable mostly due to unsanitary conditions. Farmers have found that they can raise from 20 to 30% more hogs under new sanitary conditions than under the old system of raising hogs. They also report that the pigs are healthier, thriftier, more uniform in size, make better and quicker gains, and require less feed.

About four million hogs are produced annually in Minnesota and with the average of five pigs saved to the litter, 800,000 sows are needed. If the average number saved could be increased to seven by sanitary conditions, 225,000 fewer sows would be needed. Sanitation in hog lots will usually prevent any kind of disease, but unsanitary conditions is almost always the causes of hog diseases.

Just before farrowing time and after the pigs have been
put on pasture are the two best times for cleaning hog houses.

When cleaning the hog houses, all the partitions should be taken out and cleaned. All the litter dirt and dust from the floors and walls should be removed with a scraper, hoe and shovel. Following this, wash all partitions, floors and walls with boiling lye water solution. The hot boiling water will kill all worms' eggs or any kind of disease, and the lye will loosen up the dirt. One pound of lye to 30 gallons of water is recommended. The water must be boiling hot or else it will not take effect.

Farmers often think it's a problem to get the water heated, when disinfecting in this manner. But this is not so difficult if it is done in the right and most convenient way. The water can be heated in large kettles as done at butchering time or many farmers have stoves installed in hog houses, or use oil stoves temporarily which prove very satisfactory. An old broom makes a good scrubbing brush. If it is impossible to disinfect in this manner, a disinfectant, such as creosol may be used.

After the hog house has been cleaned, it should be left to dry awhile before putting the hogs back in the pens.

Before putting the sow back in the clean farrowing pen, wash her sides, udder, and feet in luke warm soapy water. This will remove disease germs, and worm eggs which otherwise would be carried back into the pen. Washing the udder will prevent the small pigs from getting worm eggs when they first suckle. Clean straw for bedding should also be provided for at all times.

All hog houses should be well ventilated to prevent the accumulation of dampness on the walls and floors, which may cause rheumatism, and bronchitis and often, pneumonia.

All hog houses should be equipped with suitable feeding floors or platforms, preferably of concrete and troughs of some non-absorbent material that can be cleaned, washed, and disin-
fected frequently.

When pigs are being moved from hog house to pasture, or from one pasture to another, they should never be driven. Instead, they should be hauled to their pens and pastures. If hogs are driven to and from pasture, they may pick up worm eggs and disease germs from old hog lots and runs. Hauling them is easy if a crate on a stone boat sled is used, or a low wheeled wagon.

Pigs should always be kept on clean ground and new pastures. They should never be allowed to run in old hog lots. This is very important, especially when pigs are young. Some farmers furnish their pigs with clean pasture, but allow them to run in old filthy hog lots, which are always contaminated with disease germs. This is a very poor policy and should be avoided, if possible as many fatal hog diseases have been caused in that manner. All old hog lots and pens should be plowed and cleaned up.

Movable hog houses on hog farms are now becoming very popular and common most successful hog farms. These houses can be moved to clean ground as often as needed. Many of them have no floors, so there is little trouble in keeping them clean. All you have to do is to move them when the ground around and inside them get dirty. These houses should also be disinfected and washed quite frequently.

There are several types of movable, heated hog houses used mostly for farrowing that have proved very satisfactory and helpful in solving the sanitation problems. These houses are small, cheap and easily ventilated and heated. They are built with floors in and can very easily be cleaned. It is also easier to care for the sow during farrowing time when she is in a house by herself. Many farmers are not using their permanent farrowing houses any more. They find that they can save more pigs when farrowed in individual houses under sanitary conditions.
Farrowing fall pigs in individual houses on clean ground is highly recommended. Fall pigs should be farrowed in August or early September so when they are put in winter quarters, they will be past the age of greatest susceptibility to disease.

Continually pasturing hogs on the same pasture is also a poor policy. If, in any way possible, hogs should be put on different pastures each year. The old pastures should be plowed and seeded before they are used again. Hog pastures should be arranged so that pastures are rotated and new runs can be used each year. This sanitation problem may be simple enough, farmers will say, but who is going to carry water and feed to pigs on a pasture a long distance from the farmstead? These are problems that must be met and farmers who have given this system a trial, have found that they have been well paid for their extra work by increased profits. The water supply can either be piped where the slope of the ground will permit it, or it can be hauled out in barrels. Also where the hog lot is a long distance from the farmstead, a shallow well may be dug very cheaply. Many wells have been dug with a post auger equipped with extension. If used for a long time, it may be lined with tile.

Feed may be hauled out to pasture in big loads, enough to last for many days. This can be left in a wagon with a tight cover on or put in self feeders. This will save much time and there will not be much more work this way than feeding hogs close to the farmstead.

A sanitary automatic drinking fountain should always be provided for the hog lots. One which does not overflow and keeps an abundance of water in easy reach at all times. If a wallow hole should be necessary for watering, it should be made of concrete so that it may be cleaned and disinfected from time to time.
Hog pastures should not be watered by a common stream. Hog cholera and many other diseases are carried from infected farms to healthy herds by streams of water. Often cholera carcasses or parts thereof are carelessly thrown into a stream, thus contaminating the water and infecting hogs on other farms thru which the stream flows.

A well drained part of the farm should also be selected for pastures, A place which is dry at all times. Filthy hog wallows or stagnant pools should be drained as eggs form intestinal worms and various diseases producing germs may harbor in such places and infect the herd. Hog pastures should neither be located near a public highway. Public thoroughfare are frequently contaminated with hog diseases as a result of the driving and hauling of infected hogs or other animals from infected premises to market, and in this way, the health of herds in fields adjoining the road is endangered.

Farmers should be careful when feeding his hogs and not give them spoiled and dirty feed. A balanced ration should be fed at all times, and sudden changes from one feed to another should be avoided in order to prevent intestinal disturbances and, in this way, lower the vitality of the animal. Kitchen refuse should not be fed to hogs, as it often contains undesirable garbage which pre-disposes to intestinal derangements. In some instances, outbreaks of cholera have been traced to kitchen refuse containing pork scraps.

Feeding buckets, barrels, troughs, and feeding places should be kept scrupulously clean. Platforms made of concrete which can be cleaned and disinfected, prevent waste offeed and insure a clean feeding place, in this way, reducing the danger of internal parasites, malnutrition and other digestive disturbances. Concrete feeding floors properly drained are also recommended for hog houses.
Some kind of shade or shelter should be made available for hogs in pastures, to protect them from intense heat or hot summer days as well as to protect them from the cold in early spring and late fall. A good shade and shelter may be made by setting in regular fence posts, placing supports rails over them and then putting straw or loose hay on top. Shades should not be built too close to the ground because a higher shade allows a better circulation of air beneath.

Hogs should not be allowed to sleep or dig in old straw stacks or in houses constructed partly of straw, but should always be kept in houses that are properly ventilated and plenty of room and heat so that the hogs will not pile upon each other, which will tend to prevent diseases of the respiratory tract.

Farmers of today should be more careful when raising hogs and raise them under sanitary conditions. Most farmers of today are not careful in this respect. They keep their hogs on the dirtiest place on the farm and many of them have experienced great losses due to unsanitary conditions. Even tho prices on hogs are low at the present time, hogs, if properly raised under sanitary conditions so as to prevent diseases, and if well fed, will turn out a fair profit.

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Bibliography


Dedication
I hereby dedicate this thesis to the farmers of the Red River Valley, who are interested in the care and feeding of horses.

Foreword
In this thesis I have tried to show the most necessary things in successful Management and Care of Farm Horses.

Farm horses are not so much of importance in the Red River Valley now as they were when it was first settled.

The management of horses varies with the seasons; it requires judgment on the part of the owners to feed economically and yet keep the horse in good physical condition, so that only a minimum amount of work needs to be done during the peak periods of hard work.

During the winter season, some owners fed too heavily and others do not feed enough. Both of these extremes are to be avoided because if they are not, the animal will not keep in condition and will not do so well, as if he were kept in a good physical condition.

Many farm horses are poorly filled and conditioned for the spring work when the heaviest demands are made on them.

Fitting the horses is also another important factor; it means not only that he carries flesh enough, but also that his system is functioning properly. That means his muscles are developed and hardened and his shoulders have been toughened for heavy tasks ahead in the heavy working periods.
Men that are taking care of farm horses are sometimes called horsemen. One of the most important factors of animal husbandry is the individual man, the one that is feeding and handling the horse. He should have fondness for horses and he should also be quiet and have an even tempered disposition, regularity of habits and close observation. A horseman is looked up to when he can handle a horse properly and has the ability to keep horses in good condition so that they are ready when needed. He is recommended as a good horseman. He also should have a knack for handling horses, understand thoroughly every horse under his care, knowing how much feed is required, how much work can be accomplished in a day without overloading the horse, and having the ability to detect the warning sign of overheating and disorders of all kinds. When he is working in the fields, many of the farmers do not understand these things which are so important in taking proper care of horses.

In the management of horses, a man must know how to prepare a horse for spring work. This is one during the fitting period preceding the spring season. The horse must be so conditioned that he will be able to convert the vitality and energy which has been stored up during the winter into full power during each work day without losing much in weight. This largely depends on how the horse has been cared for during the winter months. One that has been kept inside all winter is not as ready for work as one that has been properly cared for in the open during the winter days. There is another thing that the keeper should do and that is to tone up the digestive system of the animal before the fitting period so that he will function properly when called on for maximum work. This is usually accomplished by gradually increasing the ration with the work done.
One should also begin the preparation of horses several weeks before they are actually put to heavy work and when the use of coarse non-soluble feeds in an economic practice during the winter, the horse should be gradually put on a smaller ration of finer quality of hay early in the spring and started on a light feed of grain three times daily. There is a way of feeding horses and that is by their weight. A horse that is around 1000 pounds will not require as much feed, as one that weighs sixteen and seventeen hundred pounds. One thing that one should keep in mind before he puts any horse to heavy work is to harden the horse. This means that you should start the horse out on light work which does not put much strain on the muscles. This should especially be done to young horses which have not been on the field or have not been doing any kind of hard work.

Another thing which most people overlook is the feet of the horse which is one of the most important things in order to keep the horse in good working condition. They should be watched so that they are kept in good shape on draft horses or any other kind of horse you have on the farm. The feet should be watched to see that they are in perfect condition so that they will not become sore. This will also prevent deformity of the feet which will hinder the action of the animal. A horse used on hard roads or, in some cases, those running on hard, frozen fields, should be shod. The shoes should be made to fit and the re-shoeing and resetting of the old shoes should be done regularly to prevent injury to the feet and legs.

The teeth of a horse are also important. They should at least be examined once a year by a good veterinarian,
and oftener with old horses because their teeth usually become longer and sharper than on a young horse. If the teeth are not attended to, they will cause sore tongues and cheeks, which will affect the digestion of the food and the horse will soon be run down in condition.

Grooming the horse. We do not stop to think how important grooming really is. A horse should always be groomed because this makes them feel comfortable especially after a hard day's work in the field. They should be groomed at least twice a day. It will improve the general appearance of the animal a great deal, and, what is more important, it removes the internal waste of the body which has been excreted through the pores of the skin, and also the loose scurf. If this waste matter is not removed by good grooming, the pores of the skin will be stopped and normal body activities will be hindered and the general health of the animal will be impaired. This condition is indicated by a harsh skin and a dry, rough appearance of the hair. On a horse that is well groomed, the hairs are glossy, and the skin pliable and soft. It is said by many people that a good grooming is as valuable as feed, and this is true, because it improved the action of the digestive organs and the utilization of the feed. The things that are needed to groom is a bristle or body brush, corrugated comb and mud brush. After you have bought your grooming outfit, all that is needed is the energy and willingness to use them.

If these things were taken into consideration, there would be better horsemen around in this country. Most of the farmers of the Red River Valley do not realize how important grooming is to their horses. Most of them do not think this over, but just let their horses roam around and take care of themselves. When the work calls upon the horses, if they
are not in condition, they will not have the spirit and ability to do the work. The horse will also go down in weight. If these things are not practiced in the care and management of horses, they will not pay for the feed and care required.

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Bee Culture
BEEKEEPING

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Dedication

To those who want information
and facts on beekeeping, I wish to
dedicate this paper.

Preface

This term paper has been prepared
at the earnest request of the Northwest
School. In summing up the main facts
about beekeeping, I tried to pick out
the most important things.

I wonder how many of you ever thought of other reasons
for keeping bees than the simple reason of getting honey for your
own breakfast.

There are many reasons for keeping bees. Some keep
them to make money. There is great profit in keeping bees. Money
made in this way has enabled many boys to pay their way through
college and many women to furnish their homes with better equipment.

Some people keep bees just to study Nature, while
others keep them for recreation. Beekeeping will give a new
interest to life to one who is tired, ill or nervously worn out.
For one who cannot do hard work and has to spend his time outside,
beekeeping serves the purpose of recreation. For all beekeeping
offers good financial returns. In addition, society as a whole
might profit from the three great lessons bees teach: namely,
organization, cooperation and industry.

There is not a better example of organization in
Nature than the one within the bee hive. The queen is the ruler
and the rest obey her orders. The other bees do this without
any complaints or quarrels among themselves.
In cooperation, they have to cooperate in their duties. Each kind of bees have their work to do and to do this work they have to work together, and this is cooperation.

The old quotation illustrates industry, "So doth the busy bee."

In a good hive there are about sixty thousand bees, of which is one queen, five hundred drones and the rest, workers.

The queen is easily distinguished from the rest. She is longer, having a longer and narrower abdomen than the others. She is lighter in color. Her main function in the hive is reproduction and to keep order in the hive. The other bees obey her orders and there is no quarreling in the hive. The drone is short, and stout and he is very lazy. The only function that he has in the hive is during the mating season and after this, he dies.

The worker is smaller than the queen and drone and is a very active insect. Workers gather nectar, water, pollen, feed and care for the young, clean, guard, and ventilate the hive and do the other work necessary around a hive.

The length of the life of a bee is dependent on the amount of work he does. When the nectar is abundant, the life of the worker is about six weeks.

After this brief description of the occupants of the hive, the next consideration is the history of a swarm.

If you happened to be outside and hear the hum of a swarm of bees, the first thing you would think is where they came from. They would have to come from another hive in which they happened to be a queen hatched. Two queens cannot reside in the same hive, so the old queen takes her crowd and leaves.

Other causes for swarming are unfavorable conditions, overcrowding or too many in one hive, lack of ventilation, too much heat, and abundance of drones.
Just as the old queen leaves the hive, some workers called "scouts" are sent out to find a new home. While these scouts are out finding a new home, the others gather in a cluster on a branch or bush or something similar. If the day happens to be windy, they gather low. If the day is quiet, they will gather or swarm high. When the scouts come back, they guide the rest to the home they found. It may be a hollow tree, old building, or a hive if it is put where they can find it.

If they enter a hive, the first thing they do is to clean it. All the small particles of dirt and wood are carried out and dropped outside. Things, such as small snakes, or mouse or a lizard, they will cover with sealing wax and it lays in the bottom of the hive like a mummy. They fill the irregular places with sealing wax called bee gum.

After everything is scaled and cleaned thoroughly, some workers begin drawing out comb. The comb will be built out straight if prepared sheets of wax, called foundation, are put in the frames.

When the foundation is started, the comb builders build the cells for which may be used for brooding or honey. While this all is in process, some are gathering honey and pollen. They carry the honey in their honey stomachs and pollen in sacs on their legs. Nectar and pollen are fed to the young bees in the hive and surplus nectar is stored.

The length of a trip depends a great deal on the honey flow. If the nectar is abundant, it takes about five minutes. Sometimes when the nectar is scarce, it may take two hours to return with a load.

Nectar deposited in the comb goes through a ripening process in which the nectar thickens through the evaporation of the water. It is done by ventilation which occurs by the fanning
of the young bees' wings. This also strengthens their wings so they can become able to fly.

The capping is the sealing over of the cells by the young bees. When this is finished, the honey is as we find it in the supers.

While the honey is being gathered and deposited, in the brooding places, the queen is laying eggs. It takes about three days for an egg to hatch. In the first stage of life of a bee, it is called the egg, then in order the young larva, the pupa, and the adult.

After the eggs are hatched, some of the workers take care of the larva. These bees feed them bee bread. It is a substance made from pollen. It got its name because it takes something similar to bread. Besides bringing in honey for the adult bees to eat, the bees store honey for the future. The long foresight to have a food supply for the coming winter is the bees' greatest ambition.

It requires twenty-one days from the time the egg is laid until the worker emerges as an adult. Most all bees emerging before October first die, and those emerging after this date live over winter. Bees which die in the hive in the fall and winter are thrown out by the worker bees in front of the hive.

In an ordinary hive, if there are about two thousand eggs laid, each day, there must be some that die or there would be an overcrowding in the hive in a little while.

Bees have many habits and some are very queer. It is very difficult to convince a person that has been stung that bees are not dangerous.

As a personal experience, my father had a hive swarm. The swarm was too small to do good work, so he wanted to catch the
Queen and reunite the bees all in the old hive. This swarm happened to gather on a currant bush. After they had all settled, my father took a sheet and put it on the ground and shook the bees on it. He had no veil or gloves or smoker. He worked among them with his bare hands to keep them moving so that he could find the queen.

At last he found the queen and held her between his thumb and forefinger. The bees started to gather on his arm. He rolled up his shirt sleeve and the bees were all over his arm and hung down in a funnel shape about a foot. He was not stung.

The bees sting for protection. They will not sting unless they are disturbed. You may get stung thinking you did not do any harm to the bee, but you may have disturbed her or something else has and you were the victim it came to first.

Boys often play with the bees while they are swarming or otherwise and throw sticks and stones at them. A bee seems to follow back the path of which the stick or stone came and sting or chase the youngsters away.

Another queer habit of the bees is their war on insects or animals that get into the hive. The strangers are first attacked by the guards and they are joined in the fight by the younger bees. The bees generally sting the intruder to death and if it is too large to carry out, they seal it in sealing wax and it lays as a mummy in the bottom of the hive.

The bees have very keen senses of memory, learning and association. They memory is keen because they have to remember the way back to the hive after wandering on and on after honey. They are quick at learning to do their duties about the hive. It takes only a few days for young bees to get their training so they must learn fast how to do their work well. They must associate with all types of bees in their work and they do this in harmony.
Honey

You may think that honey contains only sugar when you taste it, but it contains some salt from the nectar, at least one vitamin, odor substance, four enzyme, a little acid, some sugar and other carbohydrates. It contains food substances which we need for the human body today.

Anyone in purchasing comb honey can feel absolutely sure that it is pure because no one has ever been able to manufacture an artificial comb that looks as smooth as the comb the honey bee builds.

The amount of poor grade comb honey is decreasing on the market; however, there are increasing demands for honey of fancy quality. Chief advantages of comb honey production are: less overhead expense, less work and the cash returns per pound are greater.

Some of the disadvantages of comb honey production are: Comb honey is harder to ship than extracted; it takes longer for the bees to make because they have to build the comb every time; it granulates quicker, and is harder to handle by the retail dealers.

In extracted honey, the use of an extractor is necessary. An extractor is a machine which removes the honey from the comb. The frames of honey when they are removed from the hive are uncapped and put into this machine. It is whirled around and the honey is drawn out by centrifugal force. After the extracting frames are once drawn out, they can be used over and over again; hence, extracted honey can be produced faster and cheaper than comb honey. As a result, the beekeepers produce more extracted honey than comb and thereby lower the price for all. The market for this honey is increasing because the public is using it in a variety of ways. Over sixty percent of the honey sold to the public is extracted honey.
The chief advantages of extracted honey production to the beekeeper comes in the continued use of the extracting frames. Extracted honey sells for less money per pound than the comb honey and if it is sold at retail, there is an added cost for bottles and jars. In putting the extracted honey into containers, the honey is generally heated. Overheating causes it to lose its delicate odor.

Bees wax is made from the comb. The best quality of wax comes from the cappings. This wax is separated from the honey by heating; when heated, the wax then comes to the top and when the honey is cooled, the wax can be taken off. The chief use for bees wax is for comb foundation. In the United States there are about 500,000 pounds used for comb foundation each year. Wax is also used for candles, polishers, sealing, grafting, varnishes, electric works, salves, and cosmetics. There are about five million pounds used each year and the demand for bees wax is steadily increasing.

Honey for the market must be of good quality and be graded. One of the factors of grade is color. The color of the honey should be uniform. The white color had the best sale on the market. The containers have to be carefully selected to sell. The boxed honey in the pound boxes has to be packed carefully to keep well. Some containers may be hard to get the honey from, if it granulates.

Blending is the mixing of the different kinds of honey. This is done by heating the honey in water jacketed containers and by mixing thoroughly. In heating honey, one must be careful not to get it too hot because overheating discolors the honey and makes it taste very different.

If the honey is marketed in the sections, the sections must be scraped clean of all the sealing wax. If honey is labeled,
the label should be attractive and tell the use of honey and should be fastened securely on the honey containers.

There is a great future in beekeeping and a great opportunity for anyone who likes bees. There can be ten times as much honey produced in the future as at present without exhausting of nectar that is available. The public is demanding more and more. The market is steadily increasing all the time.

For anyone who wishes to take an occupation which is education as well as interesting, I would suggest beekeeping.
RURAL ELECTRIFICATION

Arthur Sundrud '31
Fosston, Minnesota

Dedication

I dedicate this thesis to everybody who is interested in promoting the use of electricity in rural communities.

Foreword

In this thesis I have endeavored to show the benefits of electricity on the farm. I hope that everyone who reads this paper will seriously consider the value of electricity and its use on the farm.

Everyone knows of the many uses of electricity. All of us are interested in farm electricity. On the farm we find many uses, such as light in all the buildings, power for the various household devices and for the heavier machinery about the farm. Electricity also furnishes current for various heating devices, for refrigeration, for the radio and other innumerable pieces of farm and household equipment. It also eliminates the danger of fire from the inconvenient gasoline or kerosene lamp. The only danger of fire from electricity is defective wiring or carelessness with the various heating appliances.

Many modern homes are using electricity for cooking. Cooking by this method is very much more convenient than cooking with ranges which use oil, coal or wood for fuel. The electric range eliminates the necessity of carrying fuel in and carrying ashes out. There is no kindling and keeping of fires and no black, sooty kettles to wash. Heat and time controls make the range practically automatic. It is not necessary for the housewife to be at home while her oven dinner is being prepared for
the next meal. She only has to get it ready for the oven, set the time and heat switches and the food will be cooked when the time for serving arrives. Some of the other household appliances are the electric iron, fan, vacuum cleaner, heating pads, washing machine, toaster, and the waffle iron.

A somewhat new and appreciated use for electricity is cooling. The electric refrigerator makes unnecessary the labor of putting up ice. By the use of electricity for refrigeration, any temperature which may be desired can be created and maintained. Probably the greatest use of refrigeration on the farm is the storing of perishable foods and the cooling and storing of dairy products. Refrigeration costs can be reduced where there is cold water available by pumping water around the dairy products to bring its temperature down to about the point at which it should be kept for storage. *

The most important use of electricity on the farm is power. Electric motors have a wide range of uses about the farm, such as silo filling, feed grinding, wood sawing, pumping water, running grain elevator, and many minor machines.

In the house, electric motors aid the housewife in running the sewing machine, washing machine, dishwasher, vacuum cleaner, and different kinds of kitchen aids.

In the use of electricity for feed grinding and other large power jobs about the farm, it has proved to be an economical and handy source of power. ** Most of the small equipment, such as water pumps, cream separators, and milking machines are run by small individual motors. There are other machines, and less often and in some cases only once or twice each season, that

* C.R.E.A.Bulletin, Vol.IV, No.1, Page 44.
** Successful Farming, January 1931, Page 59.
are most satisfactorily operated by individual motors, but initial cost and limited use makes the purchase of such motors prohibitive. A portable motor that can easily be moved about and attached is the solution. The most common size of the motor is five horse power; however, a small portable motor can often be used to advantage. The portable motor is very useful and the operating expense is very slight when the amount of work done is considered. Another point in favor of the electric motor is that there is much less trouble with it than with a gasoline engine, and the cost of upkeep and depreciation is less. Because of the fact that the electric motor can develop more power than its rating, it will run at a very uniform speed under varying load conditions.

There are two sources of current supply. These are the high line service and the individual farm plants. High line service is furnished by a power plant which is centrally located and which supplies the current over transmission lines to a large number of people under high voltage. This voltage is reduced at the farms by transformers which reduce the voltage to the 110 volt current which we all use. There are three types of individual plants. These are the gasoline or kerosene engine driven, the hydro-electric and the wind driven. Of these three types, the engine driven plant which uses a 32 volt battery which is charged whenever necessary is the most common and practical for use on the average farm. The hydro-electric plant is limited to those places where water power is available to operate it. It is the cheapest source of power where it can be used. The wind driven plant is not in general use; this type has the generator at the top of a tower and the battery down below. A great objection to this type of plant is that the leakage of current between the generator and the battery is very high. The high line is the cheapest source of power where large quantities
are used. The cost of electricity from the high line is smaller per unit the more current is used. The individual plant cannot be used for large power requirements because they cannot supply the amount of energy necessary.

To compare the cost of electrical energy from the different power sources shows the cost for a typical Wisconsin farmer using a battery, engine plant to be 31.6¢ per kilowatt hour. With the wind driven plant the average cost was found to be 35.2¢ per kilowatt hour. These figures allow for upkeep and depreciation. Altho the installation cost of the hydro-electric plant is high, its operating cost is low and it is a good investment where there is reliable water power. The cost of the high line service varies with the amount used and the company which supplies the current. The cost of installation is quite high, especially if the farm is any distance from the power line. In Illinois it was found that at the rate of three farmers to the mile, the mile line cost, including transformers was $1,350. On ten farms, wiring, including fixtures, cost an average of $264 per farm. This cost would be the same regardless of the source of power. The average cost per kilowatt hour on these ten farms was 7.45¢ and the average monthly cost for electricity was $10.39. An electric refrigerator on a Wisconsin farm used an average of 35 kilowatt hours per month at the low cost of $1.33 per month. An automatic air power water supply system using 27 kilowatt hours monthly at a cost of $1.05 and an electric range using 157 kilowatt hours monthly at a cost of $8.09 are also used on this farm. From these figures, it is evident

8, 7, 8. Successful Farming, January 1931.

Pages 58 and 59.
that high line service over a long period of time is cheaper than owning individual plants. The cost of electricity is so low that a family should not do without this labor saving and health promoting convenience.

Electricity can and should play an important part on every farm. There are very few places where it is more expensive than other sources of power and many instances where it is much cheaper. The cost of wiring and fixtures, and the cost of electrically operated equipment incident to the use of electric service are two factors which limit its use on the farm. However, the economic features and conveniences will bring about increased use of electricity.

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AGRICULTURE AND THE AGE OF MACHINERY

Ingvald Anderson '31
Fisher, Minnesota

Dedication

To Mr. S. A. Anderson, who has so
willingly given me his most kind assist-
ance and to anybody to whom the subject may
have any benefit, I dedicate this term
paper.

Foreword

During the time of depression, this is
written to depict the best ways of reducing
production costs of farm products.

There is much evidence to support the belief that agri-
culture is undergoing changes of very great importance. The
opening of the prairie country of the middle west about seventy-
five years ago led the way to a development of horse-drawn
machinery, which resulted in its general substitution for hand
tools on the farms, with a great lowering of production costs.
Now another development of, perhaps, like importance, is under
way through the introduction of the tractor and tractor-drawn
machinery, and to its further development.

In 1921 agriculture was one of the most depressed
industries in the country, and the outlook for the future was
very unpromising, but that situation is changing, and the
change is due to the introduction of tractors. The great
depression under which the country is going will evidently be
greatly influenced by the introduction of larger hitches and
better equipment.

Picture the undeveloped state of our cities, indus-
tries, transportation, and, above all, the entire absence of
our modern sanitary and labor saving homes, if we were still re-
required to produce our agricultural crops as we did one hundred
years ago. It takes but little imagination to picture our now
beautiful country with its marvelous, beautiful cities, as a
peasant country, ground down under long hours of toil, poorly
educated people, with simple labor-killing homes for our families
to live in, if farming was now carried on as it was in 1830.

While our population in 1950 may be six times as great
as in 1850, yet it is conceivable and probable that the decrease
in number of farm workers, which started to take place in 1910, will
continue, and by 1950, no more farm workers will be required to
supply food for a population of 150,000,000 than were required in
1850 for a population of 25,000,000. What does this mean to a
nation to have millions of its workers freed from agricultural
pursuits? It ultimately means better homes, higher standards of
living, lessened hours of labor, better health, and more happiness.

The immediate effects of the introduction of the modern
mechanical power on the farm is very significant. With tractors
and modern equipment, one man can do many times as much work in
the same time as he can with horse drawn equipment. The Iowa
State College has reported that with the two horse machinery in
common use, forty hours of man labor per acre is required to
produce a corn crop, but with the latest type of power drawn equipment
a fine crop of corn has been produced with three and eight-tenths
hours of man labor per acre.

According to figures published by the Department of
Agriculture Yearbook, the average rate for small grain binders in the
United States for a ten-hour day are: six foot binder, one man and
three horses, ten and sixty-one hundredth acres; eight foot binder,
one man, four horses, seventeen acres; 7 foot binder, 1 man, 4 horses, 15 acres. So a man can save 66% of his time by using an 8-foot binder instead of the older 6-ft, and even greater savings can be made by the use of the 10-ft. tractor binder which in a ten hour day will easily harvest thirty to forty acres a day, almost four times as much as before.

The ten foot binder which operates independently of the full wheel and also other machinery with the newly developed "power take-off" enables the farmer to run the machine at an even speed without danger of slippage of the wheels.

Many say, "The combine is limited to a few restricted sections where weather conditions are just right for its use", but we can't be too sure about that. Ten years ago practically everybody in Kansas would have said that the combine was unsuited for the conditions of Kansas, yet today there are several thousand combines in successful use in Kansas and more added to the list all the time. Combines will probably be introduced in all sections of the United States within a few years.

In the following discussion of tractors and horses as a source of farm power, the writer does not intend to imply in any way that the farmers should do away with all of the horses on the farm and substitute tractor power entirely. The comparisons are merely made to show that it may be very advisable in many instances to introduce the tractor labor in place of a large number of horses and keep the rest of the horses busy throughout the year at remunerative work. Tractor labor is cheaper than horse labor especially on the heavier farm work. Foreexample, a six horse outfit plowing, costs ten cents an hour per horse or 60¢ an hour for the horses. Six acres can be plowed in eightheours which will be 80¢ an acre
without man labor. Then, on the other hand, figure the tractor at, well, under any condition a tractor can be run for $1.00 an hour including man labor. In eight hours, twelve acres can be plowed. The cost will be $6 2/3¢ an acre. If the tractor is run to its full capacity, it can be run for much less than $1.00 an acre.

The tractor can be used for many kinds of work that a horse cannot do. For instance, belt work, which is one of the necessary jobs on the farm, either grinding feed, filling silos, threshing or any other kind of work.

The following graph shows the variation of number of horses needed at different times of the year:

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A horse must be fed whether he works or not. It is sound farm management on most farms to cut out the horse that doesn't work the whole year and let the tractor take care of the peaks. General purpose tractors are very well adapted to handle these peaks which usually occur thru the cultivating and harvesting seasons.

The horse farm is rapidly becoming a thing of the past. Combination of horse and tractor labor is proving the most efficient farm power. That farmers are accepting this fact is evident since, at the present time, there is only about one colt raised to every forty to fifty mature horses.
-5-

The following graph shows the declination of the horse and the increase in motor power in the United States.

(Graph)

These figures were furnished by the Department of Agriculture. The steady increase of motive power and the great decrease of horses in the year 1925 and 1926 shows how fast the horse is being replaced by the tractor, the better, bigger iron horse that stands more abuse and with less cost on the heavier farm jobs than bone and flesh.

The outstanding advantages of working with a tractor is of course economy, maximum production per man, work done on time for seasonable planting, all of which generally results in better crops and greater yields. Not only is the hourly accomplishment of a tractor greater than that of a horse, but the tractor unlike the horse can be worked both day and night.

Many arguments are always presented against the introduction of improved farm machinery. Mr. Dunlap of the U.S. D.A. Farm Board, in his speech during the Winter Shows argued against the introduction of tractors on farms. He stated that 28,000,000 acres of farm lands, which had formerly been used to grow feed for horses, was now being used to add to the surplus of farm products and to lower prices. These figures cannot be denied. However, it must be admitted that Mr. Dunlap did not at any time refer to the fact that lowering the cost of production of farm products would achieve the same results in relieving the present depression in the farming industry, as the raising of the price of farm products. The welfare of the American farmer is not at stake even if the prices of farm products do fall, when it is possible for him to reduce his cost of production at
the same rate. His profits remain the same and it cannot be denied that lowering prices benefits the welfare of the consuming class.

The immediate effect of improved machinery is in reducing the labor costs of the crops rather than increasing production per acre. However, it is evident that for agriculture itself to benefit from the increasing productive capacity of the farm workers, the surplus of such labor should find employment in other industries rather than that farm acreage shall be enlarged.

The farmer who adopts the advantages of motor-drawn machinery can prosper at present prices for farm products, and those who do not adopt the system will be under increasing pressure from the competition, despite anything that can be done for them. In the long run the most economical methods will prevail in all lines of industries and business, and this is as it should be because it is the way of progress and serves the general welfare.

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HAS THE TRACTOR FOUND ITS PLACE ON THE MODERN AMERICAN FARM?

Jesse J. Filipi '31
Angus, Minnesota

Dedication

In sincere appreciation of what has been done for me, I dedicate this term paper to Mr. G. D. Wight, who so willingly helped me.

Foreword

The key to profitable farming in Minnesota is "to lower costs of production" and that is mainly through the power used like horses or tractors. It is therefore necessary to know the advantages and disadvantages of both the horse and the tractor.

Profits in farming, as in any other business, are determined by the operating expense quite as much as by the gross income, and as in most other enterprises, the operating expense is the only item which can be controlled to any great extend. In attempting to reduce the expense of production in ordinary types of farming, horse labor offers a large opportunity of all operating expense and can be more favorably influenced by good farm organization and operation than can any other item.

Horses are the leading source of power in Minnesota. Reports from 538 Minnesota farms show on the basis of horse power hours, that the horses furnish about 4500 horse power hours, compared to 1500 for drawbar work done by the tractors. Taking Minnesota as a whole, the horses do a larger proportion of the total field work. Forty-five percent of the 538 farms studied had horses, while only 17 percent of the farms had tractors.

The need of horses on farms is decreasing every year.
On 230 of the farms, not using tractors, it was estimated that, in 1924, they will need 93% of the present number of horses, while 217 farmers, using tractors, estimated that they will need only 84% of the present number of horses. In averaging up the figures, it shows that about 90% of the present number of horses will be required in 1924 for the state of Minnesota.

The above figures were prepared by the Division of Farm Management and Agricultural Economics, University Farm, St. Paul, Minnesota.

The horses differ from the tractor in that it takes about four years to raise a horse to the age at which it can do satisfactory work, while it doesn't take more than a day to purchase a tractor.

University Farm figures for Minnesota show that, in 1918, there was one colt raised to every thirteen horses and, in 1925, there was one colt raised to every thirty horses; however, the farmers are raising more colts now because of the great depression. The tractors are more expensive and, when feed is as cheap as it is now, the horses can be raised very efficiently. The Minnesota State Tax Commission states that, if the farmers stop raising horses and do their work with tractors, that the price of farm products will be lowered considerably and fuel for the tractors will go the opposite direction.

We must admit that on a 320 acre farm, it would be profitable to use a tractor if grain raising was specialized to any great extent, but some people say that the farmers should sell their horses and do strictly tractor farming. This system would probably not work out entirely satisfactory, because the farmer needs at least four horses for all around work. All farmers in Minnesota have some cattle and hogs for which the horses have to be "used for hauling feed and other all around work."
Honor· ble

stated that "The tractors are responsible for the low prices in farm products." About five years ago when there was a larger amount of horses in the country, the farmer seeded a larger proportion of his farm into hay and grain for his horses, but now when they have tractors, they need very little for horse feed. If a farmer raises his own feed for the horses on the farm, he raises what he needs and home grown feed is an indirect expense, while if he buys fuel and repairs for the tractor, he has to have cash for his expenses.

It is evident that in years to come that the farmers will change their plans considerably. Now in this period of depression, the farmers tend to do more diversified farming. Even this year many farmers are already investing money into cattle and hogs. This is a very important fact to consider, because the farmer can have much evener distribution of horse labor.

The graphs below have been taken from The Horse and The Tractor Bulletin No. 231. The first graph shows distribution of horse labor on a 320 acre grain farm, and the second graph shows the distribution of horse labor on a 320 acre grain and winter fed stock farm. Both of the studies were made under the same conditions.

(Graphs)

In the first graph, the horses were used very little during winter months, and they were used to full capacity only one month during the whole year.

In the second graph, where the farmer kept stock for winter feeding and also raised some grain, the horse labor was distributed very evenly. When horse labor is distributed that evenly, it is a poor policy to purchase a tractor because there wouldn't be enough work for the tractor so the farmer could use
it to the full capacity. Where there is even distribution of horse labor, it costs much less than if it varies considerably. Neither of the farms mentioned used tractors.

The ordinary farmer in Minnesota does not have enough work on the farm to keep the tractor working to its full capacity. The average size of Minnesota farms is 200 acres. A farmer on a farm like that could operate it very satisfactorily with six horses, while if he had a tractor, he would have to have a team of horses just the same for all around work. In that case, a tractor would be very expensive because there would be very little work done with it. If the farmers in Minnesota would keep some livestock for winter feeding and raise less small grains and more legume hay, it would even up the distribution of horse labor and the labor would also be much cheaper.

There is no evidence that the horse hour costing more represented any more or better work done than that costing less as in Figure II. For the purpose of this analysis we may therefore assume that the cost per hour affords a satisfactory standard of measurements in comparing the efficiency of horse labor on the different farms.

In the discussion of the influence of good farm organization and operation on the even distribution of horse labor throughout the year, the following principal factors have been emphasized.

1. A good crop rotation; 2, the winter feeding of livestock, and 3, the careful planning of the work from day to day and from season to season.

It is generally conceded that on a modern farm in Minnesota, where there is stock and also grain farming, that the farmer could not get along very well without horses. It is very inconvenient to do work, such as making hay, or spreading manure
with a tractor. If a tractor was used for work which could as well be done by a number of horses which it was actually necessary to carry; that is, unless actually displaced horses, the horse would be standing idle while the tractor would be standing wear and tear, and the total cost of performing the farm operation would not be reduced, but rather increased.

Problems in the use of horse labor were selected for special study and publication at this time because of the wide interest in these questions on the part of farmers, especially in the corn belt section. This interest is based mainly on two factors; first, a more general appreciation by farmers that horse labor makes up a large part of all farm operations expense, and that it, above all other items of expense, is the one which can be profitable reduced by good methods of farm organization and operation, and, second, the great increase in the number of tractor manufacturers and the use of tractors during the past few years.

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Division of Farm Management and Agricultural Economics,
University Farm, St. Paul, Minnesota
HIGH COSTS OF TRACTOR OPERATION
Causes and How They Can Be Reduced

Paul Sorenson '31
Hallock, Minnesota

Dedication
I hereby dedicate this thesis to
Mr. S. A. Anderson, in sincere
appreciation of the help and know-
ledge he has given me.

Foreword
This thesis deals with the results
and analysis of the results of a
tractor project carried on by the
writer in 1930. It is hoped that
those who read it will find it inter-
esting, and also that it may in-
spire students to keep records on
their home farm enterprises.

The various items entered into the cost of tractor
operation, and the importance of each can be determined only by
keeping an accurate record of the cost items, and the work
accomplished by the tractor. The record must be kept for each
day's operation. Memory must not be relied upon or the record
will not be complete.

In my tractor project last summer, I learned many
interesting things. I have a complete record of the entire
year's work. A McCormick Deering three-plow tractor was used
for this project. The tractor worked a total of 966 hours for
disc plowing, and 201 hours for breaking.

The total cost of operating the tractor was $875,
or 90.4¢ per hour. The items of cost, according to their impor-
tance, were fuel, $328; labor $243; depreciation $160; oil, $55;
interest $48; grease $16, and repairs, $5.

Fuel for the tractor makes up 38.4% of the total
cost and there are various methods of reducing this item. A three plow tractor will use from twenty to twenty-five gallons of fuel in a ten hour day. This varies according to the load the tractor is pulling, the condition of the tractor, the kind of fuel being used, and how the carburetor is adjusted.

It is very essential that the right size load is used for the power available. If additional power is available, it would be advisable to hook several implements in tandem and "once over and it's all over." It is also very dangerous to run a tractor with a load beyond its capacity, because overloading causes the engine to run below proper speed, increasing wear and breakage, slippage, and gasoline and oil consumption.

The type of fuel used also has an important bearing upon the fuel cost item. Most tractors today will operate equally as well on kerosene and distillate, as gasoline. The Nebraska test of 1928 does not show any definite conclusions as to the economy of distillate and kerosene as compared with gasoline, altho it can be burned successfully in most of the modern tractors; distillate and kerosene will require more often changing of oil, and gasoline will have to be used for starting. More trouble can be expected in starting on cold mornings if distillate is used, and the engine must be cleaned and overhauled oftener in order to remove carbon. Distillate is a few cents cheaper in price, and it is up to the individual farmer if he wants to pay a slightly higher price, and use gasoline, and be insured of less trouble, or pay a little less for his fuel and meet the difficulties that come in using a low grade fuel. The other factors upon which fuel economy depend is the condition of the tractor, and adjustment of the carburetor. They are governed to a large extent by the efficiency of the tractor operator. The tractor should always be kept in the best
of condition, and the operator should endeavor to secure at all
times the most economical adjustment of the carburetor. It is
not unusual for the operator to vary the amount of fuel used
per day by three or four gallons by carefully checking the
carburetor adjustment.

Labor

The next item in importance to fuel is labor. Since
labor is so important, it is very desirable that a farmer has
experienced skilled labor for operating his tractor. Before a
farmer hires a man to run his tractor he should take into con-
sideration several things. Is this man mechanically minded?
Would he be able to find trouble quickly? Would he be able to
remedy it after he had found it? Or would the farmer need to
call on someone else to repair his tractor every time something
went wrong with it?

It is very desirable that the operator knows his
tractor. It is not always necessary that he has to run a tractor
of the same make before, because a man that is good in running
and looking after one tractor can as a rule run another. Tractors
are very much alike and a person soon becomes accustomed to the
tractor if he has had any experience before. It is also very
desirable that the operator understands the machine he is pull-
ing and that he can quickly adjust it.

The operator should also have an interest in the
work. He should be willing to work overtime to finish a field
providing it means only an hour or so longer for the day. As
said in discussing fuel, an interested operator can also save
several gallons of fuel a day by merely checking up on the
carburetor.

Above all, the operator should realize that a stitch
ahead of time is the best means of preventing trouble.
Depreciation and Interest

Since depreciation and interest are more or less fixed costs, they will be treated as one subject. The factors that vary one way will vary to a similar degree the other. Most tractor owners either consider these two items very little or ignore them completely, thinking that since they are fixed costs, they cannot be reduced to any great extent. However, these items do make up about 23% of the cost of tractor operation and they should not be ignored. Altho the total yearly cost of these items is practically fixed, many farmers are beginning to realize that the hourly cost can be cut down considerably by more intensive use of the tractor.

Most tractors which are used on farms are traded in for new machines. The dealer who accepts the tractors for "trade in" usually determines the value by the age and condition of the tractor and not by the number of hours it has been used.

Repairs do increase slightly with the amount of work done, but the repair cost is such a small percent of the total cost when compared to depreciation that it is of little importance. Since the farmer must pay a definite amount of depreciation and interest cost each year, regardless of the number of hours the tractor is used, it is very desirable that he use the tractor as much as possible.

Professor John H. Hopkins of Iowa State College points out in Iowa Bulletin No. 264 that the average hours cost of a tractor used less than 300 hours a year can be expected to go above one dollar an hour. On those used more than 300 hours in a year, the cost can be expected to go below one dollar an hour, and sometimes less than fifty cents an hour.
This naturally brings up the question to the tractor farmer, "How can I make more use of my tractor power?" The answer is - keep the tractor busy all seasons of the year, plowing, cultivating, planting, and harvesting. Work it at odd jobs and do as much custom work as possible.

Any three plow tractor should be able to plow, cultivate, seed, and harvest 400 acres of land each year in any district where small grain farming is carried on. This is especially true if the tractor is equipped with lights and used at night.

My home project shows that it is considerably cheaper to equip a tractor with lights and do the work of two tractors with one. This decreases the hour cost of depreciation and interest. It was found that the tractor ran better during the night. The quality of work of disc plowing was just as good during the night, and in the case of breaking, the work done in the night was the best, because the plow scoured much better during the night than in the day.

The new models of general purpose tractors on the market today are designed so that they can be used more continuously throughout the year doing all types of work on the farm. The tractor farmer especially in the section of the country where a large portion of the crops are cultivated, should think seriously of changing to this type of tractor. Use of this type of tractor will in some cases be twice that of the standard tractor and fixed cost will therefore be cut nearly in half.

Doing custom work is another method of increasing tractor use. For many years, scientists, farmers and experts classified the tractor as a hot weather beast, and as long as the sun beat down with all its strength upon the sweltering earth,
they said it could be relied upon to chug along merrily and efficiently. But when the earth swung around on its orbit, and the north winds began to sweep down upon the country, they maintained that the tractor must crawl into its hole or stand in the fence corner and hibernate like a woodchuck or a cinnamon bear.

Such an attitude is not at all surprising when we consider that only a few years ago cautious and careful people bundled up the automobile, cousin of the tractor, at the first sign of winter. Now the automobile and tractor do some of their hardest work during the winter months.

There are also many extra jobs that a tractor can do to help cut down the depreciation and interest cost. Many of the extra jobs that make a tractor pay will require but a fraction of the tractor's power. Yet, because these operations keep an investment busy and enable one to eliminate one job machinery, and horses, they make profitable tractor operation.

A few of the odd jobs a tractor can do are to grind feed, saw wood, fill silos and bail hay. Tractors can be used successfully and economically in the hay, corn, and potato fields and are beyond value in the American harvest. During the rush season of the harvest, if grain is ripening faster than it can be handled during the day, the tractor can be equipped with lights and used all night, if desired. It is easy and simple to equip a tractor with lights, and can be done by most anyone that knows anything about electricity.

**Repairs**

Each year the tractor should be given a thorough overhauling and such repairs as are necessary should be made. Only genuine parts manufactured by the company which sells the machine should be used.
Worn parts, especially those which are apt to affect others, such as transmission, bearings, etc., should be replaced during the yearly overhauling of the tractor.

Oil and Grease

These items of tractor cost can be reduced not by the saving of them, but by the systematic and consistent use. Only good oil and grease produced by a reliable company should be used in the tractor, and the oil should be of the grade recommended by the manufacturer.

Conclusion

Every farmer should know what it is costing him to keep his tractor. Accurate records are the only means of determining whether the tractor is or is not a paying investment. A careful study of the record will also show the farmer means of reducing the costs of tractor operation. It will give him the cost per hour and per acre of each of his farm operations. It will help him to determine when his tractor should be traded for a new machine and when it should be overhauled. It will impress upon him the value of keeping the tractor busy, and the value of doing custom work as a means of reducing the cost of keeping the tractor for his own work.

However, with all the above benefits received from the tractor record, none are as important as the inspiration which is given the farmer to keep cost records of his other farm enterprises.

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Foreword

Cultivation and weed eradication are two of the greatest problems confronting the farmer of today. I shall endeavor to bring before you a few of the methods used in overcoming the problems arising over these two most important factors, "cultivation and weed eradication."

There is a great difference in tractors as to size and amount of power which they develop. There are tractors that do the work of two horses, and we also have tractors that can do the work of from twenty to forty horses. It would seem impracticable to go out in the field with twenty or more horses, while the tractor can just as well be used.

There are many different types of tractors: there are the caterpillar or crawler, wheel type and the general purpose tractor.

The caterpillar tractor is used most extensively for road work and such work that cannot be done with the other types of tractors. This is due to the fact that
tractors with wheels cannot get enough traction. The large commercial crawler has a very large amount of power because the tractor is large and the tread is so long that it is almost impossible for it to slip. The small farm caterpillar is very useful for wet land or land which is rough and land that has many rocks in it. This tractor is adapted to these different jobs because it has plenty of traction surface and it is very hard to make the treads slip, as they cover a good deal of ground and have lugs that penetrate the ground to a depth of from two and one-half to four inches. The caterpillar has a remarkable amount of speed owing to the fact that it has small drive wheels running on an endless track and although this does not sound practical it proves highly so because the wheels travel much faster than the large drive wheels on the large wheel tractors.

Caterpillar tractors are used to a large extent for deep tillage operation. These tractors have an enormous power on the draw bar due to the excellent traction of the track laying treads. For this reason they are used to pull subsoilers which penetrate the soil to a depth as great as three feet, breaking up any "hard pan" which exists there. This type of cultivation aerates the soil as well as drains it. Crops can then be grown and the growth of weeds prevented.

The wheel tractor is very useful on the farm because it gives the large farmer all the power and
The small wheel tractor may be used for plowing and some of the heavier farm duties such as plowing with four-bottom plows, for use in the field where large machinery is used, and where large fields are found. It is heavy enough so that it will not slip but it is not too heavy. It has excess power so that it does not fall down in the time of need. It is just the right size to fit in between the light general purpose and the heavy wheel tractors.

There are several types of general purpose tractors, those adapted for belt work and low speeds, those adapted for heavier work and medium speeds, those adapted for light work and higher speeds. The light tractor is used mostly for cultivation and for running the lighter weed eradicating implements.

The medium speed tractor is used for light plowing, usually with two and three-bottom plows, for disk ing and harrowing and for use with the spring tooth harrow.

The heavier models of the general-purpose tractor are used for grinding feed, furnishing power for binders, and combines, and for belt power in general.

The general purpose tractor may be used for
Putting in the spring crop after the plowing, diskimg, and harrowing is done. The ground should be rolled; then the seed must be drilled into the ground with drills, the corn must be put in the ground with corn planters, and we find that the tractor can be used very successfully because more or larger drills and planters may be used, more speed is obtained and the fields are more even and the corn rows are straighter.

The tractor proves very successful for cultivation as we have tractors built high enough from the ground that they pass over the crop without harming it. Cultivation is made speedy and thorough because if the crops have been planted with the tractor, the rows are straight, therefore they will not be hard to cultivate with the tractor.

Summer fallowing is a very essential operation of this age as it reserves the moisture; it keeps the weeds down; and if it is worked occasionally during the summer, the ground is kept in good condition. The time of summer fallow is after the spring work is done until harvest. If the soil is properly fallowed, possibly once a month, it should be in fairly good condition for the crop the following year.

There are many methods of summer fallow but the one that seems to be the best is the one in which the soil is first plowed, then disked thoroughly to break up all of the lumps of soil, then fallowed by a
harrow so that all of the lumps shall be broken up.

This should be done at one time a month. The tractor proves very useful in this operation. Because harvesting requires such a large amount of power to operate the binders and combines, the tractor comes into very extensive use in this line.

Tractors can be made useful during the harvest season for cutting the grain and furnishing power for the combines.

In harvesting with the tractor and combine, the farmer is enabled to get his plowing done earlier and in this way gives him more time for other things.

The many uses of the tractor in the late fall work could hardly be given sufficient praise in this article. The tractor may be used for plowing in the fall as well as the other usual farm jobs that come up on all farms.

The connection between cultivation and weed eradication is very great because each one has quite an influence upon the other and each one depends quite a bit on the other, if the tractor is used for harvesting or cultivation it speeds the work up very much.

The uses of the tractor throughout the season for the various operations on the farm saves the farmer much valuable time. This extra time can be used to do that work which is usually left undone on most farms--
weed eradication and weed control. The wide awake tractor owner is making use of these indirect benefits of the tractor as well as the direct benefits of better tillage, thorough cultivation and efficient harvesting.
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GENERAL PURPOSE TRACTORS IN THE NORTHWEST

Selvin Erickson '31
Ross, Minnesota

Dedication

In appreciation for suggestions and services rendered while writing this thesis, I hereby dedicate this thesis to Mr. S. A. Anderson.

Foreword

Through this thesis I have tried to show why the general purpose tractors have made such rapid progress on the farms throughout the great Northwest, and reasons for its adoption.

Within a single generation, the internal combustion engine has become the most universally used and most serviceable ever substitute for animal muscles which has ever been invented. It is almost universally present in machines which fly through the aid, in vessels which float, in vessels which run beneath the water, in all kinds of vehicles of transportation in the household, the shop, on the farm, and even in mines and quarries underground; wherever one travels he finds this valuable servant of mankind doing work formerly done by the suffering muscles of human beings or dumb animals.

Because of this extensive use under all sorts of conditions, the internal combustion engine has been very highly improved and developed. So well have the engineers and manufacturers done their work that this form of power has become, all things considered, the cheapest, most flexible and most reliable form of power for most jobs requiring a limited amount of power.

Within the memory of most people now living, the internal combustion engine was more or less unreliable at least in the hands
of the average operator. This was only natural; even the inventors
and manufacturers had much to learn about this new form of power
and the use of this machine was strange and complicated and sometimes
to be regarded with awe. At first the quality of materials from
which to manufacture them was far below what could be desired, while
ignition and carburetion systems were crude, often rather complica-
ted and more or less unreliable except in the hands of a real expert.

The present internal combustion engine whether in an air-
plane, motor boat, auto or tractor is a high grade, simplified and
reliable machine which any person of ordinary intelligence can learn
to operate efficiently in a very short time if he will make an effort
and because of its almost universal employment, it behooves everyone
to be familiar with the principle of its operation.

The early tractors were not only large, but quite
expensive. They were practical, therefore, only on good sized farms
on which the cost was divided over a large number of acres, keeping
the investment in power at a reasonable figure.

With the tremendous improvement in steel and knowledge of
the methods of best treating to give great strength, the size and
weight of tractors have been reduced. The cost has also been lowered
early because of the economy in manufacture effect by quantity
production in highly efficient modern factories.

Today, therefore, tractors are not limited in applica-
tion to large farms either on account of their size or cost. A
tractor such as Farmall, John Deere, and Twin City, if properly
managed and cared for, will pay a profit on practically any farm
where four horses were formerly required to do the work. Many
farmers who had employed only two horses have found these tractors
a profitable investment since it enabled them to complete their
own farm work very quickly and then afforded an opportunity to do
considerable profitable work for the neighboring farms or in maintaining the road.

The general purpose farming is the trend of agriculture in all sections of the country. In the corn belt of the Middle west, the cotton field of the south, on the alfalfa ranches, and in the wheat fields of the north, it is the master of every farm power job. This versatile tractor will do all the work of any other type of tractor of equal capacity and in addition will plant and cultivate corn, cotton and other row crops.

The origin of the general purpose tractor took place between the years of 1915 to 1920. The first tractor that was placed on the market was the Moline tractor. This tractor had its motor mounted between the drivers, the drivers being in front. The plows and cultivator were placed on the rear end so that the rear end of the tractor rested on the plow, thereby, the tractor needed only two wheels and there were the drivers. This tractor had a self starter and was completely electrically equipped including head lights.

This developed interest among the other manufacturers and they began to experiment with different types of tractors. They have placed several models on the market which have proven satisfactory.

Farmers realize that when they wish to get a new tractor, the price they receive for their present tractor as a trade-in is affected very little by the amount of work which has been done by the tractor, but almost entirely by its age. Therefore, the total depreciation per year is practically the same whether the tractor is used three hundred hours or six hundred hours. Depreciation is one of the large items of the operation and cost of the tractor, varying from twenty to fifty percent of the total cost according to
the number of hours the tractor is used. The operating cost per hour, therefore, becomes less as the tractor is used more. This fact has had much to do with the adoption of the general purpose tractor, especially in the section where a large proportion of cultivated crops is grown. These tractors can be used throughout the year for various jobs at a reasonable cost per hour.

Timeliness is another important factor in the farming industry. Getting the farm work done at the right time means less work for the farmer, better crops, and lower cost of production. The wide-awake farmer plans his work so that he is ready to do each field operation just when it should be done. He seeds, cultivates, and harvests the crops at a time when he can utilize his labor most efficiently. Modern equipment, especially the general purpose tractor has made it much easier for the farmer to keep up to or ahead of schedule without hiring extra help at the periods of peak labor requirements.

For example, in the corn planting season, one man with a general purpose tractor and four-row planter can plant sixty acres of corn per day. In order to do the same work with horses, it would require three men, three two-row planters, and six horses. Most farmers do not have this much equipment and they must plod along at the rate of twenty acres per day, and probably be stopped several times during the planting season because of rain. Naturally this means an uneven starting of corn crops and difficulty throughout the season. Not only does the old system require more labor, but often the corn is not planted when the seed bed is in the best condition with a result of poor yields and loss of several hundred dollars to the farmer in a single season.

These tractors can be equipped with power implements. They are attached to the tractor with its leaves within the reach of
The operator. The operator can regulate the implement from the seat very easily. An average operator can do faster and better work with power lift and power take-off. For the operator it means more pleasure in farming.

The general purpose tractor is so simple to operate that a boy can operate it just as efficiently as the hired man. Boys generally like to operate tractors and by letting them do the work, they will retain their interest in farm life because of faster, easier and more interesting ways in which farm work can be done.

Farmers have found that when they use the general purpose tractor and finish their own work rapidly, they are often called upon to do work for their neighbors. The profit from this work helps to offset the cost of maintaining the tractor. Road maintenance and belt work are also custom work which can be done.

General purpose tractors have cut down the cost of production of farm crops. In the corn belt this tractor is especially adapted to do the tedious work of cultivation. This tractor with four row planter will plant forty to sixty acres a day as well handled a corn packer to harvest the crop.

A farmer with general purpose tractor can take care of his two hundred acre farm just as efficiently as when he had ten to twelve horses and two or three hired men.

Here in the Northwest the farmers are turning their attention to the general purpose tractor. This tractor can do anything on the farm, such as planting, spraying, cultivating, and harvesting the crop. Realizing this, many farmers are turning to this source of farm power.

The general purpose tractors are also proving their worth in all other sections of our country especially where row crops are grown.

There are seven million less horses and mules in the
United States in 1931 than there were in 1930. This fact indicates that the general purpose tractors are replacing many tired muscles of the dumb animals. With the perfection of the machine more and more horses will be eliminated from the farm.

We are today living in an age of mechanical power. Today it is just as essential that a farmer or farm boy should be able to operate an internal combustion engine efficiently as if it was for them to know how to hitch and drive horses twenty years ago.

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Forestry
CONSERVATION PRACTICES ADAPTABLE TO PRIVATELY OWNED
FOREST LANDS IN THE LAKE OF THE WOODS REGION
OF MINNESOTA

Richard Radway '31
Roosevelt, Minnesota

Dedication

In appreciation of the services and suggestions rendered while writing this thesis, I dedicate it to Mr. T. M. McCall.

Foreword

Throughout this thesis I have tried to give practices that are adaptable to the privately owned forest lots of Northwestern Minnesota, as I feel certain that there is a great deal of marginal land in use for agricultural work that would return a greater profit to the owner or operator if it was used for woodlots.

The virgin timber is very rapidly disappearing from the Lake of the Woods region in Minnesota. This is due to two things; the first cause was the careless logging practices of the early days; the second is fire. When the first logging companies began cutting the virgin timber, they thought the virgin timber was so plentiful they would never be able to cut it all, and hence, cut only the choice timber. In this way, they destroyed a great many of the smaller trees that in a few years would have been salable. These careless practices led to the great fire hazard and when the fires started in all the old slashing, they got out of control and this young growth of trees and the small seedlings were destroyed.

If we are to have timber, it will be necessary for the private owners to keep woodlots and, perhaps, large tracts of land merely for the growing of timber.

The privately owned forest land will serve as a protection
for the farm buildings and livestock in the winter term. It will serve as a source of fuel for the farm and also supply material for the repair of buildings and machinery that are always needed. Also by careful management and selection, it will give material for the construction of new buildings on the farm. There are always some trees that have to be culled out of the woodlot and these will make some salable timber, such as posts, poles, firewood, pulpwood, or sawlogs. There is no doubt that a woodlot that is kept clean of all old dead trees and kept growing adds a great deal of beauty to the farm, and also serves as a source of income on both good land and lands that would otherwise be idle, due to the great number of stones or the nature of the soil.

To locate land for forests is not a hard proposition because there is always some land on a farm that is unsuitable for agricultural crops, and such land may be ideal for trees. This land may be either hilly, stony, or light sandy soil, or even extend down to the low, peaty land that is not very well adapted to agricultural practices, but spruce and tamarac will grow successfully on peaty soils.

The most important crop of the farm woodlot is firewood, although there may be other salable timber also. In 1918 there were approximately 103,000,000 cords of wood used by the people of this country. The average value per cord was $4.73. The total value of this wood would amount to almost $488,000,000. A great deal more than half of this wood came from farms, so one can see that the planting of a woodlot would be a valuable asset to any farm. One of the great essentials in keeping trees growing is to keep all fires out of the woodlot and allow the humus to collect. Humus holds moisture and acts as a fertilizer for the trees.

The different types of soil one has determines very largely
the kind of trees one must select. If one has sandy soil, it would be best to select pine, such as Jack Pine, White Pine, or Norway Pine.

Jack Pine is a very hardy tree and a rapid grower, and will grow on poorer soil than any other tree, altho it is not as valuable as some of the other conifers.

White Pine and Norway Pine grow to some extent on the same type of soil as does Jack Pine, but they will grow better on a more fertile soil. White and Norway pine are more valuable as saw timber than Jack Pine.

White Pine is very valuable for saw timber. Two acres of White Pine near Keene, New Hampshire sold for $2000 on the stump. The total stand was 254 cords, which equals 170,000 board feet or an average of 85,000 feet per acre. The trees were eighty to eighty-five years old, so the growth on each acre was about one thousand feet per year and the gross returns about $12.20 per acre per year. The White Pine is a native of northern Minnesota and could be adapted just as easily in Minnesota as in New Hampshire.

For the medium low land, one could use broad leaf trees, such as birch, ash, or poplar. The birch is used to a considerable extent for cordwood, railroad ties, and is used now as an imitation for Mahogany. Ash may be used for cordwood and firewood. The poplar is used to some extent for cordwood, but its chief use is for box material. One of the railroad companies has started an experiment on poplar ties to see how long they will last and if they prove satisfactory, it will open another market for the sale of poplar.

If one has low, marshy land, the best trees to raise would be spruce or tamarac. Both of these grow well on the low
lands and there is sale for both kinds of timber. The chief use of the spruce is for pulpwood, altho a great deal of the larger trees are cut into saw logs, as it makes a valuable lumber and is easily worked with. The tamarac or larch is used for cordwood, railroad ties, piling, and to a large extent for bridge plank.

There are two methods of reforesting that are generally used, the natural reforesting and the planting of seedlings. Natural reforesting is carried on by saving a few seed trees and letting the seeds of these fall back. By this method the trees that are adaptable to certain localities and the different types of soil will be the ones that will naturally grow.

The planting of seedlings is carried on to some extent but this does not prove as successful as the first method, because they are generally planted in some barren place where they have no protection, or in some place where they are destroyed by livestock. Another menace to small seedlings is the snowshoe rabbit. This rodent strips the tender bark from them and causes them to die. In 1922 the Forestry Department of the state sent a great number of Norway Pine seedlings to northern Minnesota to be planted by the farmers on places that were unsuitable for agriculture, but at the present time there is not over 5% of the number living that were transplanted. This tends to show that natural seedlings is the best and most satisfactory method.

The value of the woodlot depends a great deal on the care given it, such as keeping fires away and not letting them burn thru the timber. This burns up the humus or leaf mold and also burns many of the small trees, causing them to die. The larger trees may also be damaged and become of little value for anything but firewood. Livestock should never be allowed to pasture on even tramp back and forth through the woodlot as this tramping will tend to dig the dirt away from the roots and skin them,
causing the trees to die. If one wants shade or protection for the livestock, it would be best to fence out a portion of the woodlot for them.

The improvement of the woodlot is very essential. This should be done by cutting out trees that are diseased or those that have been injured by insect attack. Trees that are crooked or those that have been stunted, or the ones with very large crowns should be removed. All trees that are badly fire scarred should be taken out. Slow growing trees that are crowding out fast growing ones of equal value should not be allowed to stay in the woodlot and neither should old dead trees either standing or fallen. The ones that are matured should be cut and not allowed to stand a great length of time after they reach maturity, because over-mature trees deteriorate very rapidly after they start to decline. Clinging vines should never be allowed to grow on trees. Cutting They may be killed by/ them off at the ground, but one should never try to pull them out of a tree as this is liable to cause injury to the limbs or top and cause it to decay.

In order to receive any returns from the woodlot, one must cut and sell the merchantable timber so I will give a few cutting practices that have proved satisfactory. One of the great questions in cutting timber is to protect the young growth of trees and leave them in the best condition to grow another crop.

1. Mark all trees that are to be removed.
2. Use the saw instead of the axe for cutting trees larger than four inches; this prevents waste.
3. Utilize sound, dead trees and all tops and limbs to the smallest diameter that can be marketed.
4. Cut as little young growth as possible in making room for cutting, lopping and skidding.
5. Cut stumps low.
6. Cut no sund trees that are less than ten inches at breast height, except for special uses.

7. Burning of hardwood slash or hardwood and evergreen slash is not recommended, but scatter it thin so it will rot quickly. If one wishes to burn the slash, the best time is during the winter when there is snow on the ground.

8. Fell all unmerchantable dead trees so they will rot quickly and thus help to reduce the fire hazard.

9. Cut hardwoods whenever possible after the leaves have fallen so the young growth will be protected.

10. Leave no trees lodged in the process of felling.

There are two chief ways the cutting of the merchantable timber is done: (1) By the owner of the forest land cutting it, and (2) by what is known as stumpage sale. The first method needs no explanation, but the second does. By the so-called stumpage sale, the merchantable timber is sold to a party or company and they sign a contract to do the cutting as is stated in the contract. In this way the owner does not have to do the cutting of the timber or the supervision either. The trees that are to be cut are marked and the one that buys the stumpage right, as it is generally known, does the work or hires it done. The timber is either estimated before it is cut to decide what the charges will be or the actual number of cords are taken by measurement, and the number of thousand feet of lumber that is sawed out and paid for in this method. The first method is the one that is used the most. The timber is estimated and paid for in this way.

There are two different ways of cutting, which are used the most: The strip method and the cutting of just the merchantable trees throughout the woodlot. In the first method, alternate strips of about 150 or 200 feet in width are cut. This method may not seem as destructive as the cutting of just the larger trees, but when one cuts all the timber in a strip 150 to 200 feet in width, he will undoubtedly cut a great number of small,
valuable trees that will have to be used for firewood, and if the salable timber had been cut out and the smaller trees left to grow, he would not have had to wait so long to get another crop of timber from the same land. This would also certainly increase his profits.

Thruout this thesis I have tried to give practices that are adaptable to the privately owned timber lands of northern Minnesota, for I am convinced that if we expect to continue having a large income from the sale of timber products of this state, it is up to the individual person to not only help protect the forest, but also help to get them re-established.

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THE HOME FRUIT GARDEN
Emory KenKnight '31
Cleabrook, Minnesota

Dedication
To the Freshmen of the Northwest School, this thesis is dedicated.

Foreword
I have written this thesis because I believe that the people of the Red River Valley do not fully recognize the importance of a fruit garden on their home places. I hope some reader will go home and start a fruit garden.

A plan is the start of anything, and so a plan is the beginning for the fruit grower. It may not be possible for the fruit grower to plant all of the home orchard in one year, but if a good plan is made for the orchard, then the trees may be filled in from year to year as resources permit.

The orchard should not be made so large that it will be impossible to care for it. One acre should produce enough fruit for family use and, in addition, should produce a surplus which will find a ready sale.

The location of the orchard is a very important point to consider. A place should be chosen that is favorable to the orchard and still in a convenient position in relation to the house. A rolling piece of land is best. The higher part can be used for apples and the lowest part for raspberries.

Air drainage should be considered in connection with the location. Good air drainage lessens the danger from frost and, in addition, lessens the damage from diseases.

Some quick crop should be planted in the orchard as a filler so a person will not grow tired of the business before
the first crop is produced. Strawberries and raspberries are good filler crops and can be depended on to fruit the second year. There are many dependable varieties of both strawberries and raspberries that are hardy in this region.

The strawberry will grow on any good agricultural soil that has good water-holding capacity and has an abundant available food supply. Strawberries should be planted in rows four feet apart and 18 inches apart in the row. It is best to plant in the spring. The soil should be prepared as well as it is possible to prepare it.

A mulch is necessary for the winter protection of strawberries. Clean straw or hay is best. The straw must be free from weeds. The mulch is applied after the ground is frozen. It is raked to the center of the row, when the frost goes out, and is left there to decay. The straw that is left under the plants will keep the berries clean.

Some of the better varieties are: Premier, Senator Dunlap, Minnehaha, and Mastadon.

**Spraying Outline for the Strawberry**

<table>
<thead>
<tr>
<th>Number of Spray</th>
<th>Time to Spray</th>
<th>Spray Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>When leaves are about one-half grown and before blooming.</td>
<td>4-6-50 Bordeaux Mixture.</td>
</tr>
<tr>
<td>Second</td>
<td>Just before picking.</td>
<td>2-3-50 Bordeaux Mixture.</td>
</tr>
<tr>
<td>Third</td>
<td>After fruit is picked.</td>
<td>Cut and burn all leaves on some windy day and spray with 4-6-50 Bordeaux.</td>
</tr>
</tbody>
</table>

"At the first appearance of the leaf roller, spray with 2 pounds arsenate of lead to 50 gallons of water. This spray should be repeated every week, if necessary, until the fruit is about half grown."
Raspberries give quick returns and are valuable as a filler crop for the orchard, or they may be grown with profit where planted alone. They will grow on any soil that has sufficient humus. The lowest land in the garden is best for them as they like a fairly high water table. The tip layering kinds do best in light soil, and the sucking class in moist heavy loam.

The soil should be fertilized with well rotted barnyard manure. It should be thoroughly plowed and harrowed to make a good seedbed.

The plants could be set 3 feet apart in the rows and the rows 5 or 7 feet apart. The rows should run north and south as the new growth should be shaded during the hottest part of the day. The old wood should be pruned out each year and the number of cones kept down to six or seven.

The raspberry diseases are Leaf spot, Anthracnose, Cone Blight, and RedRust. Hood says in his book "Farm Horticulture",

"While brambles are injured by numerous serious diseases, spraying is not effective in controlling many of them. The only known methods of control for the crown gall, leaf curl or mosaic are:

(1) Rogue out diseased plants as soon as they appear.

(2) Plant disease-free plants. Spraying is of no value."

Currants and gooseberries have a place in the garden and will produce abundantly. It must be remembered that too many of them should not be planted as a good bush should produce one-half bushel of fruit on a favorable year, and over production will result as there is very little sale for these fruits.

Currants and gooseberries will grow on almost any soil. They like the shade and should be planted on a northern slope or between two rows of trees.

Clean cultivation has many advantages for these crops. A cover crop may be planted in the late July or August. It is
not practical to cultivate, a mulch of straw or manure will do very nicely. Two-year-old plants are best. They should be planted four feet apart in the row and the rows 6 feet apart.

The standard varieties of gooseberries are Carrie and Como. Perfection, White Grape, and Missouri flowering currant are the best currant varieties. The last named currant is more of an ornamental shrub and may be put in the garden for an ornament as well as for its fruit.

Spraying Outline for the Currant and the Gooseberry.

Hood "Farm Horticulture"

<table>
<thead>
<tr>
<th>Number of Spray</th>
<th>Time to Spray</th>
<th>Spray Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Before buds swell in</td>
<td>Liquid lime sulphur diluted 1 gal. to 8 gal. water.</td>
</tr>
<tr>
<td></td>
<td>spring</td>
<td></td>
</tr>
<tr>
<td>Second</td>
<td>Just as leaves are</td>
<td>Bordeaux mixture 4-6-50 plus 2 lbs. arsenate of lead paste or 1 lb. of powder to 50 gal. of liquid.</td>
</tr>
<tr>
<td></td>
<td>expanding</td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td>When fruit is ( \frac{1}{4} ) grown.</td>
<td>Same as second.</td>
</tr>
<tr>
<td>Fourth</td>
<td>Near ripening season,</td>
<td>Fresh hellebore or Pyrethrum 4 oz. to 2 gal. of water at rate of 1 lb. to 5 lbs. of flour of air slacked lime.</td>
</tr>
<tr>
<td></td>
<td>if worms are troublesome on the fruit.</td>
<td></td>
</tr>
</tbody>
</table>

The grape is very hardy and gives almost certain reward for care and cultivation. It will grow on any soil, but a sandy loam is preferable. A south slope with good circulation makes the grapes ripen better. Grapes can be propagated either by cuttings or layering. The cultivation should be shallow to prevent injury to the roots.

The standard varieties of grapes are Alpha and Beta. There are many diseases of grapes, but they can be controlled by the following outline for spraying the grapes.
<table>
<thead>
<tr>
<th>Number of Spray</th>
<th>Time to Spray</th>
<th>Spray Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>When shoots are 3 to 10 in. long.</td>
<td>4-6-50 Bordeaux</td>
</tr>
<tr>
<td>Second</td>
<td>Just before blooming.</td>
<td>4-6-50 Bordeaux plus 2 lbs. arsenate of lead paste or 1 lb. powder to 50 gal. of the spray.</td>
</tr>
<tr>
<td>Third</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td>Two weeks after third. Same as third.</td>
<td></td>
</tr>
</tbody>
</table>

Early Strawberry, Flourence, and Transcendent are the best crab apples. The Whitney is also a very good as a quality crabapple that is famous for cider. The cultivation and care is the same as for the apple.

The American types of plums are generally more hardy than apples and crabapples and can be grown successfully for the commercial market. Plums will succeed on any soil but like a heavy clay loam best. The cultivation and care of the plum are essentially the same as for the apple.

There are many types and species of plums, but the home garden should have a succession of varieties. The sand cherry hybrids, crosses of the American and Japanese plums with the native sand cherry. Sapa, Opata, Zumbra, St.Anthony, and the Compass Cherrie.

The best varieties of American plums are Cheney, Terry, Assinboine, and Elliot. Nicollet is our best cherry, but has not been tested sufficiently for hardiness in Northern Minnesota as yet.

The worst insect affecting the plum is the curculio. It can be controlled by pasturing the garden while the infected plums are falling or by shaking the trees and picking up the diseased plums.
### Hood's Outline for Spraying the Plum

<table>
<thead>
<tr>
<th>Number of Spray</th>
<th>Time to Spray</th>
<th>Spray Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Before buds begin to swell in spring.</td>
<td>Liquid lime sulphur 6 gal., 50 gal. water.</td>
</tr>
<tr>
<td>Second</td>
<td>After bloom when husks are shredding.</td>
<td>Dry mix lime sulphur 9 to 10 lbs. arsenate of lead 1½ lbs. water 50 gal.</td>
</tr>
<tr>
<td>Third</td>
<td>Two or three weeks before fruit is harvested.</td>
<td>Same as second.</td>
</tr>
<tr>
<td>Fourth</td>
<td>Two or three weeks before fruit is harvested.</td>
<td>Dry mix lime sulphur 9 to 10 pounds, water 50 gallons.</td>
</tr>
</tbody>
</table>

I wish all success in growing their home gardens and hope my thesis will help someone.
Dedication

To Mr. T. M. McCall and Miss Cynthia Weinberger, I dedicate this thesis, for their very kind and cordial assistance.

Introduction

It is altogether necessary that we know something about the plant that furnishes the world with 25% of its food and which is so nutritious and probably the most wholesome of all vegetable foods.

Population is increasing with alarming rapidity, while the amount of land which can be used to supply human want is very limited. Therefore, the one solution is to produce more and better food products to the acre.

In the following thesis, there is briefly told how to grow better and more potatoes to the acre.

Soils

Although some types of soil are better adapted to potato production than others, in most cases, we are usually interested in making the best use of the soil we have. Drainage is most important in potato soils. Land that has been under pasture for a number of years is very excellent for potato growing; however, this land may be infested with grubs and worms. Sandy loams are very good for they are usually well drained, but often, they are not very fertile. Sandy loams will bring very shapely samples as the land remains mellow through the growing season. Heavy soils are, as a rule, more fertile than sandy soils, but they are not as well drained; furthermore, your crop is smaller, not in yield, but in the size of the individual tubers, and they are not as shapely.

Thorough cultivation will help a great deal in drain-
ing of heavy soils. In concluding the types of soils, I may say that a perfect potato soil should be well drained, a rather heavy sandy loam, and should contain much organic matter or humus.

**Fertilization**

Generally, fall plowing is most desirable and sub-soiling is also a well worth while practice. An excellent system for the preparation of a potato seed bed is as follows: after having grown deep rooted crops, the preceding year, such as sweet clover, disk the land well before plowing, then fall plow, then disk again the following spring after having fertilized, preferably with well rotted green manure. Working the land well is necessary because land seeded must not have too many air spaces and, in this section, it will help the drainage. In late seasons the soil should be worked especially well in order to warm up the soil. Another phase of soil preparation is soil fertilization. In fertilizing the land, we add not only plant food, but humus as well. Potatoes demand a great deal of both for a profitable yield.

If your soil is especially lacking in nitrogen or should be vegetable matter, a green manure/applied by plowing under a legume crop the preceding year. If mineral elements or plant food are in want in your soil, barnyard manure may be applied. However, both of these fertilizers may be substituted by commercial fertilizers. For example, nitrogen may be added to the soil by applying fertilizer containing ammonia, and, likewise, potash may be added by applying muriate of potash. In this section, it was proved that phosphate was perhaps the best fertilizer. It was also found at the Northwest Experiment Station that an application of this fertilizer at a rate of about 250 pounds of 20% phosphate per acre brought best results. If commercial fertilizer is to be used, its value is determined by testing in a small plot. In case barnyard manure is to be used, care should be taken not to apply too heavily as it may induce scabby potatoes. Two ways of applying commercial fertilizer
are: first, the broadcasting system, which means spreading it over the whole field; second, the line of row system, which means spreading it just where the rows are to be. There is no particular advantage in the second case. There are practically no cases in which fertilization does not bring results; that is, if the fertilizer which is added is what the soil needs. Even tho results are not obtained, the first year, the fertilizer remains in the soil for future use.

Necessity of Good Seed

Good seed is very important in potato production. Good seed is seed that is clean in respect to variety, disease, and whose tubers are strong, firm, and ready to sprout at planting time.

A seed plot is always a very desirable thing. There are two ways in which to manage a seed plot: first, the tuber unit selection method. From a lot of certified seed, select a number of the best tubers. Cut these into four parts, taking care to disinfect your knife between tubers. Keep the parts of each tuber separate from other tubers; then plant each tuber in four holes, leaving a space between each four plants or each tuber. After the plants have a fairly good start, you start your rogueing, eliminating all weak or diseased units. Save the remaining units for seed for your next plot. The other system is done likewise except that hills are selected instead of tuber units.

Treatment of the seed is not only desirable but should be compulsory to every good potato grower. It is not a paying proposition to lose half a crop through diseases which could have been prevented by seed treatment. There are several different kinds of treating substances, any one of which may be used. Perhaps the best three are hot formaldehyde, corrosive sublimate, and acidulated corrosive sublimate. Any one of these treatments on seed potatoes assures us against blackleg, scab, and rhizoctonia. The formulas and
rules of treatment for these three substances are as follows:
16 oz Formaldehyde. Soak potatoes for two to three minutes in a
solution of fifteen gallons of water and one half pint of formalin
at a temperature of 120 to 125 degrees F. Dry the soaked potatoes;
cut and plant as usual.

Corrosive sublimate: Dissolve two oz. of corrosive
sublimate (bichloride of mercury) in two gallons of hot water. When
dissolved, add cold water until you have fifteen gallons in all.
Having placed potatoes in a gunny sack, dip the sack in the sub-
stance and leave it there for one to one and one-half hours; then
allow to dry, cut, and plant.

Acidulated corrosive sublimite: This treatment is made
by adding 6 oz. of corrosive sublimite and one qt. of hydrochloric
acid to 25 gallons of water. Drop the seed in the solution and
allow to remain there five minutes before cutting and planting.

Care should be taken not to re-inflect the potatoes with
utensils that have been infected.

Enemies of the Potato

The most common kinds of diseases are scab, blackleg,
black scurf, late blight, and early blight. Altho the common scab
does not reduce the yield, it does reduce the grade and quality.
In treating for this cause, reduce your application of barnyard
manure as fertilizer. Scabs are prominent in alkali soils and in
some sections of the east, sulphur is applied to the soil in order
to restore equilibrium.

Blackleg is a disease which attacks the seed pieces.
It is enabled to penetrate through the corky layer by means of the
larva of the corn maggot fly. This insect lays its eggs on or
near the seed pieces. In order to prevent this, the seed should
be planted immediately after cutting; furthermore, the land should
be well worked, thereby preventing any air spaces in the soil through which the fly reaches the seed.

Black scurf (rhizoctonia) is a disease which attacks the growing stem and often girdling it. Sometimes it will even attack the young tuber stem. This may be checked by seed treatment and crop rotation.

Early blight is not a very dangerous disease because it may easily be remedied. This attacks the leaf and, when sprayed with bordeaux mixture, may easily be checked.

Late blight, however, is much more dangerous because it develops so rapidly and it attacks late in the fall after spraying has been abandoned. To prevent this, potatoes should be kept coated with bordeaux mixture especially in wet years.

We also have enemies in insect life. The three principal insects which damage potatoes are the flea beetle, leaf hopper, and Colorado potato beetle.

The potato flea beetle is a very small black beetle which eats tiny holes in leaves making them dry prematurely. This insect is especially prominent on early planted potatoes. Bordeaux mixture is a good repellant for this pest.

The leaf hopper is a small green flylike insect. It is injurious in both its stages and can be checked by spraying thoroly with bordeaux mixture.

Colorado potato beetle is controlled by spraying with arsenical poisons.

**Importance of Harvesting**

Early grown potatoes are usually harvested while the stems are still green. It is best, nevertheless, to dig potatoes after the stem has matured for the potato then gets a chance to harden its skin, and less injury is apt to occur. Care should be taken in harvesting that as little injury as possible is done to
the tubers, for tubers lose much weight when injured. Injury is 
often caused by not setting the knife on the digger low enough; also 
in running the apron too fast, thereby bruising them. When potatoes 
are loaded and unloaded, they should be handled with care.

Grading is a very important thing in the marketing of 
potatoes. Potatoes are graded according to variety, frost injury, 
sunburn, cracks, cuts, scabs, blight, soft rot, dry rot, or any 
other damage.

**Good Storage**

Storage is always desirable whether for your own use or 
for storing more than you need for future market. Storage will be of 
no avail if the right temperature, aeration, and humidity are not 
present. The temperature should be kept as close to freezing 
without freezing. Decay will start with too much humidity.
Dedication

I hereby dedicate this theme to my father, who has made it possible for me to attend the Northwest School.

I also include Mr. T. M. McCall, who gave me valuable assistance in the work of potato production.

The Potato is one of the most important cultivated crops in Minnesota. Minnesota ranks among the five most important potato-producing states in the Union. It is also one of the leading states for the production of pure seed. Its ideal climatic conditions, especially in the northern half, together with a variety of soils adapted to the growing of potatoes, make for successful potato growing, provided that these factors are supplemented by the right kind of growers. The potato is a cool season crop; however, it can be grown in a wide range of climate when the cooler periods are taken advantage of for the growing season.

Potatoes are an ideal crop to grow in a rotation. This crop aids in the conserving of moisture, destroying of weeds, if properly cultivated, aereates the soil, and aids in the changing of plant food from an insoluble to a soluble form. In every rotation there should be three classes of crops grown: namely, grain crops, grass crops, and cultivated crops.

Each of these crops has a different effect upon the soil. The potato crop should follow a grass or pasture
crop, such as sweet clover or alfalfa. White sweet clover has proved to be a "miracle" or "wonder working" crop in the Red River Valley in loosening up the heavy soils, and bringing up much plant food from the subsoil. Potatoes following sweet clover will withstand the floods and wet weather better than when they are preceded by a grain crop. This fact is due to the deep roots of the sweet clover which penetrate deep into the ground, thus affording drainage. Sweet clover, like all other legume crops, add nitrogen to the soil and when plowed under will sometimes furnish sufficient nitrogen and organic matter to keep up the fertility of the soil, especially when supplemented by barnyard manure or commercial forms of phosphate and sometimes potash.

The land for potatoes, if a sandy loam, which is inclined to blow, should be plowed in the spring, but heavy clay loams should be plowed in the fall, as nature can accomplish more in one winter's freezes and thaws than man can do with any amount of work. Heavy soils, plowed in the fall, can withstand the drought better than spring plowing and does not have the tendency to bake and are easier to work. Some growers skim plow their ground in the early fall and work it again in the spring. Both methods work out very satisfactorily.

The land should be plowed to a depth of seven or eight inches but, if not previously plowed at that depth, it would not be advisable to plow more than one inch below the old plowing unless there is sufficient plant food and organic matter present.

The choice of a variety adapted to the grower's soil, climate, and which meets the requirements for his particular market, is one of the first essentials of successful potato
Growing. Number 2 potatoes should not be planted as most generally they have come from diseased plants, altho when high, seed is/small tubers can be used if they have been produced from healthy plants. One should obtain his seed from a high producing strain produced in a region favorable to the growing of vigorous, healthy plants. The seed should be firm, unsprouted, of medium size, and free from disease.

The seed should be treated to prevent rhizoctonia, blackleg, scab, and other diseases which live on the tuber. They should be treated before they begin to sprout because sprouted seed, when treated, is set back from ten to fourteen days. There are many different methods of treating and some of them are with corrosive sublimate, hot formaldehyde, cold formaldehyde, and organic mercury dip. Treating the seed pieces does not always insure against diseases as the diseases will live over in the soil, but a good system of crop rotation will do much to overcome this handicap.

After the seed is treated, it should be cut in block shaped pieces rather than wedge shaped pieces, as the latter has a tendency to dry out very quickly. Great diversity of opinion exists as to the best size of seed pieces, the distance of planting and the amount of seed per acre. The large tubers when planted produce greater total yields than small cut seed, but when prices of seed and economy of labor in planting is considered, the quartered seed from four to six ounce tubers prove most profitable.

It is necessary that all potato growers have a seed plot to keep up the seed stock. Six improvement practices for improving the strain of potatoes are: namely, the tuber-indexing method, (2) tuber unit method; (3) hill selection;
mass selection; (5) field rogueing; and (6) strain testing. The seed plot should be located as far away as possible from the main field as diseases travel from plant to plant and they should not be planted on land which the previous year was planted to potatoes, as diseases will live over in the soil for a number of years.

The principal object of cultivation is to destroy weeds, but it also helps in the conserving of moisture, aerating the soil, frees plant food, and encourages the root action by loosening up the soil. It is important that the weeds are kept under control as much of the moisture is sometimes lost through weeds.

As soon as the potatoes are planted, it is a good plan to blind cultivate, using the hillers to cover up the weeds, which come up on the row. The second time the ridge upon the row will be too high to cultivate unless it is cut off; this can be done by using a large duck foot shovel. This shovel can be bolted to a plank and fastened to the cultivator beams. In this way the field can be blind cultivated as many times as desired, as long as the sprouts are not injured. It is very important that the field be worked well at this time for weeds are killed easier at this stage of growth than later.

After the potatoes have sprouted the field must be leveled off. This can be done with a drag. The harrowing may be done either lengthwise or crosswise with the rows. Care should be taken that the seed prices are not moved. The first two cultivations after the potatoes are up should be deep and close to the row, but the roots must not be injured. As the plants grow and the roots develop, the
Cultivator shovels should be widened accordingly. Cultivation should be stopped when the potatoes are in full bloom or when there is danger of injuring the roots.

It is generally known that leaves are necessary for the production of tubers; for this reason it is important that bugs, insects, and diseases do not destroy the foliage of the plant. To overcome these types of injury, it is necessary to use a potato spray. Paris Green, arsenate of lead or arsenate of calcium are used for potato beetles and other leaf-eating insects. These poisons may be used alone or in combination with Paris Green. For diseases such as early blight, late blight, the Bordeaux mixture applied with a three nozzle high pressure sprayer has proven satisfactory. The sprayer with three nozzles for each row has the advantage of applying the spray material on the stems and underneath the leaves, as well as on top of the leaves. Three or four sprayings of the Bordeaux is usually sufficient.

The time of harvesting varies with the variety of potatoes and the season. Harvesting can be started a week or ten days after the vines have dried up, or when there is no danger of the tubers peeling. Considerable care must be used when harvesting potatoes as the tubers contain considerable moisture. The skin, made up of a corky layer surrounding the tuber, prevents the water from escaping into the atmosphere and prevents organisms which cause rot and decay from entering the tuber. Damaged potatoes are not attractive to the eye and therefore do not bring a good price on the market. Tuber injury can be kept to a minimum at harvest time by regulating the depth of the digger.

Before the potatoes are sold or stored, they should
be graded. A few rotten potatoes in the bin will sometimes
spoil many bushels of sound potatoes.

Every potato grower should have some means of storing
his crop. There are three factors in storing which are neces-
sary to control within certain limits to insure good storage:
namely, temperature, aeration, and humidity. All these can
be controlled by proper construction of the storage place and
proper ventilation. The best place to store potatoes is in
root cellars or dug outs made in the side of a hill. The
natural earth walls and floor have the advantage over cement
walls. The former has the advantage of an even temperature
and it requires less aeration than the cellars which are
usually made with cement walls.

References

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Potato Culture and Fertility Practices in the Red River Valley
Northwest Station - T.M. McCall
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No.1367
The production of high quality seed stock cannot be over-estimated. The demands of the southern potato grower call for seed stock grown under northern conditions; as the potato is a cool season crop, the burden of the production falls on the northern potato grower.

The northern grower is able because of the climate and conditions favorable for potato production for seed to be able to produce seed superior both in hardiness and productivity, which is the greatest trouble the southern potato grower has to face.

The production of high quality seed has great many advantages, the most important of which are, first, the southern grower is assured of hardy seed stock; second, he is assured of northern grown seed stock, and, third, he is assured of seed stock

Verner Karlin '31
Hawley, Minnesota

Dedication

To Mr. Thomas M. McCall, whose suggestions and under whose supervision, it has been possible for me to gather facts and data concerning the production of high quality seed stock, I sincerely dedicate this thesis.

Foreword

The aim of this thesis is to set forth to the potato grower the principles to bear in mind in the production of high quality seed stock, by the use of the improved cultural practices and a complete spray program for the control of insects and diseases, besides what is required from seed selection to marketing, in order that the potato grower may continue to grow seed stock such as is required for the southern potato grower.
of superior quality when he is in need of it most.

The most important factor in potato production lies in seed selection and great care should be exercised in this respect. The varieties to grow depends upon the conditions, climate, length of season, etc. because the different varieties are adapted to different conditions.

The question is often asked, what good seed stock is. Good seed stock should first be of a productive strain; that is, a strain with a high yielding ability; second, they should be free from spindle tuber, and mosaic. These diseases can be entirely eliminated by continued selection and rogueing. Third, the quality of the stock is of extreme importance as the potato takes an important place in the human diet and a good eatable potato is of great importance; fourth, the stock should be reasonably free from external disease such as scab and Rhizoctonia, and the amount of these diseases tell a great part in the conditions and care that is taken in producing disease free stock.

The two factors which contribute most to the production of clean seed are crop rotation and seed treatment. It is necessary to control diseases such as Blackleg, Rhizoctonia, common scab, silver scurf, powdery scab, and in order to certify seed, and it is of great value to the grower also in that disease control improves the stock in both yield and quality.

The next step in potato production is in planting, and I shall start with the seed plot or the unit from which improvement takes place first.

A seed plot is a plot located from the general field, on which are planted seed from improved seed, treated, kept free from diseases, insects and undesirable characteristics, to allow one to improve his seed stock.
The seed plot should be located from the general field and should have good drainage. A lot of trouble can be eliminated if it is located so that it is easily cared for.

The type of soil is important; a rich, sandy loam is preferred; heavier soils should not be used unless no other soil is available.

Fertilization depends on conditions such as the amount of each fertility element that is available and the humus supply in the soil. The humus supply can be built up by the use of green manure crops, such as sweet clover and other various legumes. Barnyard manures are available on all farms; these supply both humus and the plant food elements. Many growers today, however, are depending quite a good deal on commercial fertilizers. When immediate results are wanted, commercial fertilizers supply plant food elements in a form that is readily available to the growing plant. During the last few years, farmers are depending more on the superphosphates, chiefly on its quick acting nature in supplying the plant food elements.

The tuber unit method of planting is recommended for the seed plot. This method consists in selecting from the seed bin before planting time a considerable number of the most perfectly shaped tubers ranging from six to eight ounces in weight. In planting, these tubers are quartered as dropped, into parts as nearly equal as possible, by splitting the bud-eye Chester twice from seed to stem end of tuber. In other words the tuber is cut through its longitudinal axis.

The four pieces of each tuber are dropped consecutively in the row at a distance of ten to twelve inches apart in the furrow. All tubers showing evidence of disease should be rejected. By allowing an additional spacing between sets of fours, the four
Plants from each tuber are definitely isolated from adjoining ones, and the grower can readily observe any variation in vigor and uniformity among the various units planted.

This method also enables the grower to detect any mixtures that may occur in the variety; all of these mixtures should be removed at once.

By marking the units that appear to be the most uniform in size, vigor, and type, when the plants are still in vigorous growth, then the first step in selection has been accomplished.

The units on small plots can be planted by hand; however, for large seed plots, planters have been perfected which will plant tuber units successfully.

When seed from the seed plot is used to plant the general field, then the regular planting machines can be used. The grower in producing the main crop needs only to treat the seed and follow good cultural practices.

The soil should be of a sandy loam character; heavy soils should be avoided as far as possible as they are unsuited for best results in growing potatoes.

The fertilization practices best for the seed plot are also best for the general field.

Desirable practices to follow in potato seed preparation includes the use of green manure, barnyard manure and commercial fertilizers, especially the superphosphates.

Plowing should be considered the most important step in seed bed preparation. On the heavier soils, the land should be plowed in the fall. Potatoes require a deep, compact and fine seed bed. The roots of the potato plant do not grow readily in subsoil, so the seed bed must be deep to provide ample feeding area for the roots. A depth of from seven to eight inches is good, but if the soil has not been previously worked to this depth, it would be
inadvisable to plow more than one-half or an inch deeper than the previous plowing.

If the soil is in a good physical condition, friable, and well supplied with humus, it is easy to prepare a fine seed bed. Disking the land before plowing is advisable in order to eliminate air spaces and allow capillary water to rise, besides aiding in killing weeds.

The disk can be used after plowing to get the seed bed ready. There is nothing better than a peg-toothed harrow for smoothing, leveling, and pulverizing the surface soil, because it combines speed and efficiency with light draft.

The distance of planting the seed pieces apart both in the row and between rows are dependent on the varieties grown and the kind of implements used. Standard distances for Early Ohio are eight to ten inches in the row, with rows three feet apart.

The principal purpose of cultivation is to destroy weeds, but other important benefits are that it conserves moisture, frees plant food elements, airs the soil and aids in making it more friable.

After planting, the weed seeds will germinate before the plants come up and a peg-toothed harrow used at this time will kill many weeds and much cultivation will be saved later on. As soon as the plants come up, a peg-toothed harrow should be used again and cultivation should be started as soon as the plants are high enough to see the row. The first cultivation should be deep and the succeeding ones shallower each succeeding time. Care should be taken to leave the land as level as possible after each cultivation to help preserve moisture.

Spray the potato crop. It is necessary and very fortunate that practically all insect and disease enemies of the potato
crop can be controlled by spraying. If a grower attempts to raise potatoes for certification, a comprehensive spraying program is required.

The materials used to combat these potato enemies are of many kinds. Paris Green and Arsenate of Lead are the most used of insect sprays, but are high in price. Many farmers have used arsenate of calcium, with good results, and have been able to cut their spraying cost in half. Calcium arsenate is a slower killing poison than Paris Green and in case insects are very numerous, it might be cheaper in the long run to use the more expensive quick acting grades as Paris Green.

The most noted spray used in combating diseases and one that is rapidly coming into use is Bordeaux mixture. The mixture mostly used is the 4-4-50 and is made up of four pounds. Quick lime, four pounds copper sulphate or blue vitriol, to fifty gallons of water to make fifty gallons of spray. For a first class spray mixture, attention must be given to the mixing of it. The best and most widely used method is to mix the materials by the stock solution method.

Clogging of the sprayer nozzles can be prevented by straining the solution through a fine mesh screen or cloth. When the Bordeaux is in the spray tank, mix the required amount of arsenate, calcium or Paris green as the conditions will warrant. Mix the poisons in a small quantity of water to form a creamy mixture, before diluting in the spray tank. The combination spray mixture will combat both insects and diseases in one blow, thereby saving time and money in the spraying operation. The amounts of poison usually added to fifty gallons of spray are Paris green, one lb., arsenate of lead and arsenate of calcium, two pounds. The Bordeaux mixture is recommended to control the leaf hopper, the various blights, hopper burn, and tip burn. Besides it has been
Proven time after time that spraying bordeaux mixture has many beneficial effects besides controlling diseases. It gives the plant a dark green color, with increased chlorophyll content, thicker leaves and sturdier stalk to plants and a longer life to the crop, in most cases from ten to two weeks longer.

The results from spraying are dependent on the kind of machine used. The best kind of liquid sprayer is one called a high pressure sprayer. For good results, a high pressure is necessary, and, if possible, three nozzles should be provided for each row; one nozzle spraying on top of plant and two throwing a spray from each side of the plant, throwing the spray slightly upward, to cover the entire plant with the spray.

The time to spray varies with the season and time of planting. The first spray for beetles should be put on as soon as the eggs start to hatch out. It is usually necessary to apply a poison spray alone first and follow up with the combined arsenical spray and bordeaux mixture when the plants are about eight inches high. This will be about the middle of June. Usually four sprayings are necessary. The main object of spraying now is to keep the plants covered with the mixture.

Rogueing should be practiced every year. Rogueing means the removal of weak and disease plants. Rogueing the seed plot should be done with care, because the seed plot is the basis for improving the crop and the main object is to help to select strong, healthy plants.

Disease control in potato production is possible only when the grower can by cultural practices, seed treatment and spraying practices, identify and remove the diseases.

**Common Diseases and Their Identification**

Spindle tuber - Spindle shaped tubers tapering off to a point at the seed end, generally the degenerating diseased
called spindle tuber. The tubers on diseased hills are generally pale in color; the eyes become more prominent, the tubers are undersized; the vine becomes erect and spindling and the yield is reduced.

Blackleg - It is a bacterial disease that readily attacks both stems and tubers. Affected plants first appear unthrifty and are below normal in size. The branches and leaves grow upward forming a more or less compact top and the leaves generally fold and curl up along the midrib. The plants gradually become yellowish green in color and in a bad case, shrivel up and die. A black, soft rot decays at the base end of the stem. On the tuber, evidence is noted by a rot, but is many times hard to detect, so care should be used in removing diseased plants from the field. A wet season is more favorable for the development of this disease than a dry one.

Mosaic - This is a disease that the only method of control is through rogueing, as the disease cannot be detected on the tubers after the plants are dug. It is distinguished by a spotting or mottling of the leaves of a pale green and yellow color. The plant may be weak and undersized in a severe attack.

Rhizocgonia - This disease is identified on the tubers by black, sooty, sclerotial bodies on the surface resembling dirt. On the plants the disease is identified by rosetting, aerial tubers and yielding of stems near the surface and below.

Scab - appears as circular, dry, corky spots on surface of tuber. Scab lowers the quality and selling price of both seed and table stock.

Late blight on the tuber is identified by rotting from the surface inward and a sudden collapse of the plant in the field.

Early blight can be identified by its brown spots on the leaves. The spots are marked with concentric line markings.
Wet or Dry Rot is identified on the tuber by a stem end rot, and darkening of the vascular bundles. It forms a dry rot in storage.

In the field, yellowing and wilting occurs and a darkening of the vascular bundles takes place.

Varietal admixtures are mixtures of other varieties and, if seen in the field, should be rogued out. The time of roguing varies, but should be done while the plants are still green just before and after blooming, or while the plants are still in bloom. At this time the diseases can be easily identified. Continue roguing until plants start to mature or as long as possible.

Field roguing or roguing the general field should be carried on with the same purpose in view as in the roguing of the seed plot. Field roguing can be very largely eliminated by careful seed plot work. The field should be gone over several times during the season and diseased plants and varietal admixtures dug out and removed from the field. In harvesting and grading, extra precautions should be taken especially with the seed plot.

The seed plot should be dug by hand and each hill should be left on the surface of the soil when dug to enable one to compare different hills. The most outstanding hills in regard to appearances of tubers, yield, and transmittible characters are saved to be used for the next year’s seed plot. Each hill should be stored in a small bag and numbered and labeled to prevent mixing. The percent clean seed, percent No.1 seed should be stated plainly.

Save disease free seed for next year’s general field planting.

The increased field is generally dug by a horse drawn elevator digger and the potatoes are picked by hand. A common practice is to haul picked potatoes direct to market. Such potatoes are graded through the track side warehouses. Many of the large potato growers grade their crop in the field with their own sorter,
rake and haul and haul them direct to market as graded stock for which a better price is obtained, except where the grower is growing certified stock, he grades and sends the stock to his customers or stores them for later delivery.

In storing the crop, a good storage cellar should be provided, and for the tubers harvested from the seed plot, a separate bin should be provided that is clean and which has previously been disinfected. The outstanding units picked out for the next year’s seed plot should be stored in a place by themselves.

The crop from the general field not marketed is usually graded and kept for sale later on, or for spring delivery.

In summary, the production practices and approved methods must be followed by seed selection for improving the seed stock, seed treatment to control tuber-borne diseases. A seed plot should be maintained to improve seed and aid in meeting the requirements of certification. The proper soil and location should be selected for the seed plot. The soil should be given the best cultural practices possible and a definite spray program is necessary for certification and control of diseases and insects. Rogueing is important to get rid of diseased plants, remove varietal admixtures, and for the certification of the crop. Proper methods of harvesting and grading are important to produce higher quality seed and store the surplus crop both from the seed plot and from the general field.

Lastly, a combination of all these operations is required if high quality seed stock such as is required by the southern potato grower is to be grown.

Minnesota, by following these improved practices, has a high leading rank in producing its share both in production and quality of stock that has led to the practice of growing stock for certification.
Minnesota ships many carloads of seed south each year, to the southern potato grower. Potato growers, by improving their practices, enable themselves to benefit by it in a higher price for their product and, at the same time, enable the southern grower to obtain better stock, besides the reputation of Minnesota as a high quality potato producing center.

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MINNESOTA POTATO DISEASES AND THEIR CONTROL

Glenn Bloomquist '31
Drayton, North Dakota

Dedication
I dedicate this thesis to my parents whose urge it was that I attend this school.

Foreword
The potato disease problem is of vast importance to potato growers of this section of the country. In gathering these few facts and writing this paper, I hope I may have brought to the minds of a few potato growers a clearer visualization of this problem.

The loss of potatoes from diseases is very large, totaling about four to six million bushels or more each year in Minnesota. Much of this loss is preventable. The interest shown by growers during the last few years indicates that there is a continually growing realization of the seriousness of potato diseases, and more intelligent efforts are being made to prevent them.

After preliminary experimental work at the University Farm, a campaign was started cooperatively by the Division of Plant Pathology to reduce losses from potato diseases and to improve the potato crop in general. This work was largely performed through the use of the seed plot method as will be discussed later. In 1919 the Legislature created the Minnesota Board for Seed Potatoes to inspect and certify. The object was to recognize the work that had been done by many growers to improve their seed stock and to give the growers of Minnesota a chance to obtain pure seed. This has emphasized the necessity for knowing and preventing the diseases.
The potato disease loss in Minnesota is great but no worse than other states; on the contrary, Minnesota is fortunate as to the different diseases that do not show up or do not do very much damage compared to other states.

Most potato diseases are caused by fungi, which are organisms that grow on or in portions of the plant. Some are caused by bacteria. There may be physical breakdowns of the tuber from frost injury and heating. Most of the diseases occur only when the weather conditions are favorable. It is a living parasite, not the weather, which causes the disease. No known potato disease will injure person or animal.

Leaf Diseases that only Affect the Leaves

Early blight is quite common throughout Minnesota. It is caused by a fungus which forms circular or irregular brown spots with concentric rings on the leaves. The spots may become quite large and unite, killing large areas of the leaves by drying them out or destroying them. The stems and tubers are not attacked; the vines may die early on account of the destruction of the leaves, this causing the tubers not to grow normal size and thus preventing the production of a normal crop.

The amount of damage varies with the season, the location, and the variety grown. Some varieties are damaged very much. As high as five to fifteen percent of the crop is not unusual.

For prevention, spray with 5-5-50, Bordeaux mixture. It is important to spray early, before the blight becomes serious and spray as often as is necessary. For information on spraying and mixing, see the discussion on spraying.

Tip burn is the drying and dying of the leaves. This starts at the tips or margin and works backward. It at times is present with early blight, but need not be confused with early
Diseases Affecting Leaves and Tubers

Late blight and rot is caused by a fungus which attacks both leaves and tubers, and is one of the most destructive potato diseases. Fortunately this disease is not very serious in Minnesota, altho it does sometimes occur in epidemic form and causes great destruction to crops not protected by thorough spraying.

Late blight occurs in the leaves as irregular spots without definite margin. In damp weather, these areas are dark and water-soaked, and are covered underneath with moldy growth. In dry weather, these dry out and appear brown. The leaves are destroyed very rapidly and even the stems are attacked. The fungus spores are washed off the leaves by rains and are carried down to the tubers by the soil water. Sometimes the disease is spread to the tubers from the tops when digging. This rot is brown and watery when the potato is dug and kept in a moist place, and the surface is sulken and lead colored, with a rather definite brown margin. It should not be confused with black leg rot or the other rots, which will be discussed later. The late blight rot develops in the field, and on the upmost side in the soil. After the tubers are dug, the rot continues, and may be affected by other rotting organisms, so that sometimes whole bins and ears can be destroyed. The fungus often lives over winter and affects the seed pieces when planted, and grows up the shoots and starts a new epidemic of the disease.

The development of the late blight depends on the weather conditions. Cool, wet weather in July or early August, followed by damp weather in August, is favorable for the development of the disease. Dry weather checks it.

Late blight can be controlled by spraying Bordeaux mixture
on the vines starting generally late in July, but is best controlled by keeping the mixture on the vines all through the growing season. Spraying is an insurance against the late blight and it will also pay for the spraying even if it is not present by an increase in yield. Never plant seed from infected fields, and postpone digging until tops have died and dried up; also keep potatoes in cool, dry, well ventilated storage.

**Virus Diseases**

Mosaic is not so very common in Minnesota, but occurs on some varieties to some extent. Diseased plants show a mottling of light green with the darker, normal green of the leaves. It is often only visible when the plants are young. The leaves are commonly crippled later in the season, and when the disease is severe, the plants often look dwarfed and unthrifty.

Mild attacks do not reduce the crop in the North, but if the seed is planted in the south, great losses occur. The disease is spread from plant to plant by insects, such as plant bee. The signs of infection are slow in appearing, and may not show up until the tubers are planted. Selection must be made from fields on which little or no disease occurs. The disease does not live over winter in soil, but is transmitted through the seed; hence, seed plots and seed selection will lessen such diseases as mosaic.

Leaf roll is similar in nature to mosaic, altho some of the symptoms are quite different. The lower leaves are usually rolled upward on the mid-rib, and are more rigid than usual. Diseased plants are smaller than normal and are yellowish in color. The tubers are very close to the stems, and the yield is reduced. The tubers generally show a net nectosis.

The rolling of the leaves should not be confused with the rolling caused by fusarium wilt, blackleg or dry stem rot. There is not a wilting of the leaves, but they remain rigid even in dry
weather; there also is no browning of the leaves on the other parts of the plant. The phloem of the affected plant is injured. Leaf roll is not very common in Minnesota fields, but has been quite abundant in the eastern states. The growers should avoid the use of seed from fields showing the disease.

Spindle tuber, so called on account of the spindle-shaped tubers produced, is commonly called by potato growers, "running out", "off shape" or "poor shape." Additional characteristics of spindle tuber are more or less spindling and upright stalks, somewhat smaller and slightly darker green leaves than on healthy plants, and the tubers, instead of being flat oblong, as in healthy plants are characteristically spindle shaped or cylindrical and with more conspicuous eyes than in the normal tubers.

The distribution of the disease is not fully known, but according to reports from large seed growing sections, it is found wherever potatoes are grown. It is believed that the disease is carried by plant lice, and through the use of diseased stock.

The best control is by the use of the seed plot and seed selection, rogueing, and plant seed free from the disease.

Blackleg is a bacterial disease which affects both the stems and the tubers. On the stem it appears an inky black discoloration, or rot near the surface of the ground, beginning usually at the point attached to the old seed piece, which practically always is rotted. The disease may extend upward to the surface in the stem, although it often stops at the above ground line. While the disease is spreading, the affected area is usually soft and slimy; later, the plant dries out. The plant becomes yellow, wilts, and usually dies. The disease may infect the tuber and set up a soft foul smelling rot. The plant is usually killed before the tubers are formed. The affected tubers are usually black on the stem and care should be taken when cutting, not to plant these infected tubers.
Black leg is one of the most important diseases in Minnesota, and, therefore, a great effort should be taken to control it. It is worse in warm, moist weather. The disease/over winter in the affected tubers, and therefore should be rogued from the field. It is spread by a bacteria which are transmitted by the corn maggot fly.

The diseased tubers which have become rotted may infect the sound tubers especially if the sound tubers have skin breaks or bruises. The tubers infected will often rot rapidly if kept in warm storage. At times in a wet fall, the disease may spread rapidly and cause a great loss from rotting. To insure freedom from black-leg, one should plant clean seed which has been effectively treated before planting; also to protect seed from this corn maggot fly, the cut seed should be planted immediately after cutting and be planted in well prepared land. When one grows his own seed, a seed bed should be had, and all diseased plants should be rogued at once. If one is uncertain of his seed, he should treat them. While cutting seed, if an infected tuber should be found, it should be thrown away and the knife disinfected with the treating solution.

Fusarium wilt is common in Minnesota soils; however, seldom is very serious damage done. The fungus lives a long time in the soil, and it also occurs naturally in some soils. It may also be planted with tubers; infected tubers show distinct ring discolorations.

Affected plants droop; the leaves roll up and become flabby; the vines become yellowish and finally die. The sap tube area of the lower stem is browned; it can be observed by cutting the stem; in bad cases, the whole stem may have a brown rot. The fungus may go down the stolons to the developing tubers, causing a discolored ring in the stem end. This stem end browning should not be confused with frost injuries or net necrosis.
Fortunately, wilt does not occur until late in the season so that the yield is not reduced very much. As vigorous plants are able to resist the action of the fungi under good growing conditions, they should be maintained. Rotation of crops, besides better growing conditions, avoid the accumulation of this and other fungi in the soil. It is also good practice to cut about half an inch off the end of the seed tuber.

External Diseases of the Potato Tuber

Rhizoctonia, known as dry stem rot, or black scurf of the potato, is the most common disease of potatoes in the potato production centers. Such common names as "rosette", "little potato", "big vine and no potatoes", and "russet scab" indicate other symptoms of the disease. The fungus attacks the stem below the ground line, causes injury to the young sprouts. Many sprouts are girdled and killed by the disease and when new ones come up, these may be attacked, and may be never able to get out of the ground, or may be weakened. The loss in yield attributed to Rhizoctonia varies from ten to twenty percent.

Dry stem rot appears as a browning or lession on the surface end in the context of the underground stem. Older plants may be attacked and girdled, and large, bushy vines bearing small aerial potatoes in the axils of the leaves and branches are frequently produced close to the underground stem, as a result of the disease potting off the stolons. Badly effected plants may show sudden wilting.

On the tubers, the disease known as black scurf is often mistaken for "dirt that won't wash off", but the black spots are compact masses of fungus adhering close to the surface. It not only affects the appearance of the tubers, but such tubers should not be planted without seed treatment. In some of the heavier soils, black scurf is abundant almost every year.
The fungus occurs naturally in Minnesota soils, and is difficult to eliminate the disease entirely. The injury is always greatest when the disease is planted with seed tuber. Disinfection of the seed with hot formaldehyde or corrosive sublimate should be practiced, and also crop rotation.

Common scab is a well known disease. The scab spots are of a corky tissue, so that the affected tuber does not ordinarily dry out or become infected by rotting organisms more easily than if scab were not present. Sometimes the areas may extend deep and, in any case, render it unsightly and less valuable for cooking. Insects may invade the scab spots, however, and add to the injury. Scab does not lower the yield of potatoes materially.

Scab is usually worse when the temperature is high and the soil is dry when tubers start their formation. The scab occurs naturally in the soil, but does not thrive in acid-reacting soils. Bone ashes, lime, or fresh manure render the soil more alkaline and, hence, increases the amount of scab. flowing under green crops tends to decrease scab.

Badly scabbed tubers are not desirable for seed because the scab injures the eyes and poor germination results. Tubers with a slight attack may be used if disinfected. It must be remembered that treating does not insure a clean crop, but lessens the liability of the injury of the disease.

Powdery scab occurs but rarely, however, produces smaller spots than common scab. The disease on young tubers first appears as small discolored pimples, or pustules that are in patches or scattered over the surface. As these pustules enlarge, they break through the surface which splits in a stellate manner and curls back, exposing a brown powdery mass of spores. These spores increase rapidly after the pustule is ruptured and leaves a shallow, crater-like less than an eighth of an inch in diameter. This is the
appearance usually observed on harvesting the potatoes, for the pustules break open easily after drying. In storage, a dry sunken rot may develop about the eyes.

Affected tubers should be sorted out and not planted. Disinfecting the seed should be practiced if the disease has been found in the lot of potatoes to be used for seed. However, the grower should, if possible, secure seed free from this disease.

Storage dry rot is caused by a _Fusarium_. Under the term "storage dry rot" are the different dry rots that commonly occur in storage cellars and houses. There are many names or kinds of them, the name depending upon the nature of the rot and of the organism causing it. In one form or another, the rot may start where ever they are stored.

The losses from rot is often very large. It may be as high as from 40 to 60 percent of the stock in the spring. There is not generally such great losses in the field, but field losses up to 30 percent are found at times.

The various storage rots can be quite largely eliminated by careful digging and handling of the potatoes and by proper disinfection of the potato vines. The storage dry rots may be caused by late blight, blackleg, and _Fusarium_ wilt. The last two spread very rapidly in badly cut and bruised stock and all these rots flourish best when there is abundant moisture and poor ventilation.

A great care should be taken to prevent the rot. All possible precautions should be taken to avoid bruising, cutting, or otherwise breaking the skin. Handling them as carefully as possible, in digging and in putting them into storage. Clean storage should be had, also should be disinfected before potatoes are stored. Also do not plant rotted seed and also treat them. The bin should be cool, dry, and well ventilated.
Methods of Prevention and Control of Seed Potato Diseases

Seed selection is one of the most important factors in producing first class seed potatoes. Such diseases that are carried over on the outside of the seed can be eliminated by seed treatment.

Some success may be obtained by careful bin selection, altho it is best to select when digging. To get the best results is to remove all diseased plants from the field. Every grower should grow a special seed plot large enough for the increased field the succeeding year. A plot of one-tenth the size of the field is large enough.

In the first place, good, vigorous seed stock of a variety best suited to local conditions is necessary. Stock that produces a large amount of weak hills will not give good results. Seed that is from a good field and has shown good results should be planted. "Use Certified Seed."

Good growing conditions are essential for the production of vigorous seed. Therefore, the most suited piece of ground on the farm should be selected for the seed plot.

Thorough deep cultivation while the plants are young, followed by shallow cultivation later in the season is necessary for the development of vigorous root system. A properly kept seed bed aids greatly in the production of good seed.

A thorough inspection should be made at blossom time and all diseased plants and varietal mixtures should be removed. Later inspection should be made for more diseased plants and the ones that come later in the season. The tubers that are under these vines should be removed so that only the vigorous stock remains at digging time.

Potato fields should be sprayed thoroly with bordeaux mixture and arsenal poisons in order to control insect pests and such diseases as early and late blight.
The seed plot should be harvested and kept separate from the rest of the field. It is best to go over the plot and pick out the most vigorous plants for the next year, dig these by hand. Then the rest of the plot can be harvested and used for the main field.

All seed stock should be handled carefully to avoid unnecessary bruising or other injury. A clean, well ventilated storage cellar, with the temperature about 34 to 40 degrees F. will keep the seed potatoes in excellent condition until planting time the next spring.

Seed plot method should be practiced on every farm where potatoes are grown to some extent. It has been shown that the increase in yield has been increased a great deal, as high as from ten to a hundred bushels an acre. It also produces potatoes more true to type and also has decreased the amount of disease a great deal.

There are various different seed treatments. Corrosive sublimate (poison) is most commonly used disinfectant for seed tubers. Ordinary formaldehyde solution kills the scab organisms, but is not as active on black scurf. It has been found to kill it, but must be kept at the right temperature.

It is safer to treat the potatoes before cutting, although the seed pieces are dried thoroughly and quickly after treating, they may be treated after cutting.

A wooden tank or fifty gallon barrels can be used to treat the seed in; no metal should be used.

Precautions - These disinfections are very poisonous to man and animal if taken internally; therefore, precautions should be taken in handling them.

Engueing the potatoes is very important, because the diseased plants should be removed to improve the seed and control
diseases. Roguing can be done best at flowering time, when mixtures of varieties can easily be removed. These plants should be carried to the end of the row. A second roguing should be made about a month later to get all of the diseased plants and this will save a lot of loss from rot in the storage.

Spraying for potato bugs, early and late blight and tip burn should be practiced. A bordeaux mixture should be used to prevent diseases and Paris green or London purple or other kinds of mixtures should be used to prevent the destruction of insects. A high pressured sprayer should be used.

The great progress in preventing diseases in Minnesota has been made by the Minnesota Pure seed growers during the past few years. Every grower should try to control the diseases and a better result will be gotten in the yield of the potatoes grown. There will also be a greater demand for Minnesota potatoes on the market and for seed in the southern states.

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Poultry Husbandry
CARE AND FEEDING OF BABY CHICKS

Roy Boman '31
Syre, Minnesota

Dedication

I take great pleasure in dedicating this thesis to Mr. A.M. Filkey, who, for the past three years, has taught me to the best of his ability.

Foreword

I have written this thesis in the hopes that it may help someone to solve a question that he has been unable to solve about "The Care and Feeding of Baby Chicks."

The care of the newly hatched chicks is without doubt the most exacting tasks of the poultryman. Babyhood is the most delicate period of the chick's life. This applies with double force when chicks are reared without the aid of a hen mother.

It is customary in chick feeding to withhold feed from them until they are 48 to 72 hours old. The usual recommendation for this practice is based upon the fact that the chick absorbs the yolk just prior to hatching, which supplies nourishment for several hours. The common belief is that additional food given before the chick has had time to assimilate this yolk will cause digestive troubles.

While the practice of withholding feed from chicks for the first 48 to 72 hours has given very satisfactory results, such a procedure seems to be based only on assumption. So far as we know no experimental evidence has been presented showing the effect of early feeding upon chicks. In the absence of such data, it was thought advisable to determine what results might be
obtained from feeding chicks as soon as hatched.

In order to throw a new light upon these problems, a series of trials were conducted at the Northwest Experiment Station (Poultry Division) under the supervision of Professor A.M. Pilkey, the object of which was to determine:

1. When newly hatched chicks should be started on feed.
2. The comparison of the all mash and all grain methods of feeding.
3. The comparison of mash plus some grain.
4. The value of hardware screen cloth compared with solid flooring with a temperature and sanitary standpoint and the amount of gains in weight made.

With these problems in mind, the experiments were outlined. Five hundred chicks were used in these trials; chicks were hatched May 15 in the same incubator. They were divided into ten pens with an equal number of chicks in each pen. Their parents were of equal age and production ability. Care was taken to insure accurate results and to make sure that no outside factors would influence the results.

The methods used were as follows:

<table>
<thead>
<tr>
<th>Lot</th>
<th>No. 1</th>
<th>No. 2</th>
<th>No. 3</th>
<th>No. 4</th>
<th>No. 5</th>
<th>No. 6</th>
<th>No. 7</th>
<th>No. 8</th>
<th>No. 9</th>
<th>No. 10</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No fasting</td>
<td>24 hr.</td>
<td>36 hr.</td>
<td>48 hr.</td>
<td>60 hr.</td>
<td>72 hr.</td>
<td>24 hr.</td>
<td>24 hr.</td>
<td>24 hr.</td>
<td>24 hr.</td>
</tr>
<tr>
<td></td>
<td>Mash and grain after seven days</td>
<td>Mash and grain after seven days</td>
<td>Mash and grain after seven days</td>
<td>Mash and grain after seven days</td>
<td>Mash and grain after seven days</td>
<td>Mash and grain after seven days</td>
<td>Only mash</td>
<td>Only grain</td>
<td>½ mash and grain</td>
<td>½ mash and grain</td>
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<tr>
<td></td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>solid floor</td>
<td>Screen floor</td>
<td>solid floor</td>
</tr>
</tbody>
</table>

All chicks were kept warm by coal burning brooder stoves in one long brooder room to insure uniform temperature. All feed was weighed and the weight of each lot of chicks was recorded weekly, also mortality losses. Lots 1 to 6 inclusive were weighed when hatched and previous to the time of feeding. The mash used
was a home mixture of equal parts of yellow corn ground, flour middlings, bran, 15% meat meal, 5% bone meal, 2% limstone grit, 2% fine charcoal, $\frac{1}{2}$ of 1% of Iodized salt, with 1% cod liver oil of all feed fed.

The results are as follows:

(1) When newly hatched chicks should be started on feed.

<table>
<thead>
<tr>
<th>Lot 1.</th>
<th>50 chicks</th>
<th>Fed at once</th>
<th>Loss in Weight by Fasting</th>
<th>Wt. in Oz. of in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 2.</td>
<td>50 chicks</td>
<td>Fed after 24 hours fasting</td>
<td>66</td>
<td>&quot; 0.0%</td>
</tr>
<tr>
<td>Lot 3.</td>
<td>50 chicks</td>
<td>Fed after 36 hours fasting</td>
<td>58</td>
<td>&quot; 12.3%</td>
</tr>
<tr>
<td>Lot 4.</td>
<td>50 chicks</td>
<td>Fed after 48 hours fasting</td>
<td>51</td>
<td>&quot; 22.3%</td>
</tr>
<tr>
<td>Lot 5.</td>
<td>50 chicks</td>
<td>Fed after 60 hours fasting</td>
<td>45</td>
<td>&quot; 31.9%</td>
</tr>
<tr>
<td>Lot 6.</td>
<td>50 chicks</td>
<td>Fed after 72 hours fasting</td>
<td>39</td>
<td>&quot; 41.1%</td>
</tr>
</tbody>
</table>

Feed Helps Yolk Absorption

The principal reason which has been advanced for not feeding chicks until they are 72 hours old is that sufficient time should elapse to permit the yolk to absorb.

Reasons for Absorption of Yolk

It is quite reasonable that the yolk should disappear faster in chicks which were fed early. In the first place, the food constituents remaining in the yolk sac are highly concentrated and not so readily available for the chick. Also, in view of the shrinkage which chicks undergo when starved, and the disappearance of body tissue, there is reason to believe that the residual yolk does not constitute a balanced nutrient for a live, active chick.

In the second place, if a chick is fed early on a balanced ration and the chick increases in size and vigor, there is reason to believe that it can readily supplement that ration with the highly concentrated and complex constituents of the residual yolk, resulting in a more rapid utilization of the yolk than is possible in the case of a starved chick.

The withholding of feed until chicks are 48 to 72 hours old has a very pronounced effect on the amount of nutrients the chick
has to draw on the yolk and body tissue. In picture No.1, it shows that there is very little difference between chicks that are fed immediately after hatching and until they are 36 hours old. After 36 hours, the chicks draw very heavily on their yolk and body tissue.

<table>
<thead>
<tr>
<th>Mortality from Pens 1 to 8 inclusively</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 1.</td>
<td>None</td>
</tr>
<tr>
<td>Lot 2.</td>
<td>2</td>
</tr>
<tr>
<td>Lot 3.</td>
<td>2</td>
</tr>
<tr>
<td>Lot 4.</td>
<td>1</td>
</tr>
<tr>
<td>Lot 5.</td>
<td>None</td>
</tr>
<tr>
<td>Lot 6.</td>
<td>1</td>
</tr>
<tr>
<td>Lot 7.</td>
<td>None</td>
</tr>
<tr>
<td>Lot 8.</td>
<td>2</td>
</tr>
</tbody>
</table>

There was but a slight mortality in any of these lots, Lots 2 and 3 having a slight increase in mortality over the other lots.

The following table gives the average gains per week and the final weight per chick of each of the trial lots.

<table>
<thead>
<tr>
<th>Chick Gains</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Final Wt.</th>
<th>F.Wt.</th>
<th>F.Wt. per chick in lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot</td>
<td>Beginning weight</td>
<td>Gain 1 wk.</td>
<td>Gain 2 wk.</td>
<td>Gain 3 wk.</td>
<td>in oz.</td>
<td>in %</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>66 oz.</td>
<td>32 oz.</td>
<td>46 oz.</td>
<td>69 oz.</td>
<td>213 oz.</td>
<td>239%</td>
<td>.1891</td>
</tr>
<tr>
<td>2</td>
<td>58 &quot;</td>
<td>43 &quot;</td>
<td>50 &quot;</td>
<td>76 &quot;</td>
<td>227 &quot;</td>
<td>265%</td>
<td>.2193</td>
</tr>
<tr>
<td>3</td>
<td>51 &quot;</td>
<td>48 &quot;</td>
<td>49 &quot;</td>
<td>80 &quot;</td>
<td>228 &quot;</td>
<td>267%</td>
<td>.2106</td>
</tr>
<tr>
<td>4</td>
<td>45 &quot;</td>
<td>46 &quot;</td>
<td>48 &quot;</td>
<td>70 &quot;</td>
<td>219 &quot;</td>
<td>245%</td>
<td>.2026</td>
</tr>
<tr>
<td>5</td>
<td>39 &quot;</td>
<td>54 &quot;</td>
<td>42 &quot;</td>
<td>57 &quot;</td>
<td>196 &quot;</td>
<td>213%</td>
<td>.1675</td>
</tr>
<tr>
<td>6</td>
<td>37 &quot;</td>
<td>50 &quot;</td>
<td>31 &quot;</td>
<td>63 &quot;</td>
<td>181 &quot;</td>
<td>185%</td>
<td>.1531</td>
</tr>
</tbody>
</table>

The results obtained suggest that the practice of withholding the feed from the chicks until they are 24 to 36 hours old is the best method to follow.

(1) The chicks that were started at 24 to 36 hours of age, which were lots 2 and 3, made the best gains and had the heaviest final weights.

(2) The comparison of the all mash and all grain methods of feeding:

<table>
<thead>
<tr>
<th>Mash</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>234.88%</td>
<td>122.33% gain made in 3 weeks.</td>
</tr>
</tbody>
</table>
From the above data we find that the chick makes the best and most economical gains from the all mash method of feeding in comparison with the all grain method.

(3) The comparison of mash plus some grain.

<table>
<thead>
<tr>
<th>Mash plus grain after 7 days</th>
<th>½ mash plus ½ grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>265.83%</td>
<td>185.03%</td>
</tr>
</tbody>
</table>

Gains made in three weeks.

From the above data we find that the chick makes the best and most economical gains from the mash plus a little grain after seven days in comparison with the one-half mash and grain method. We find that the feeding of one-half mash and grain draws too heavily on the chick's system for economical growth and gain.

(4) The value of hardware screen cloth compared with solid flooring from a temperature and sanitary standpoint and the amount of gains in weight made.

<table>
<thead>
<tr>
<th>Screen Platform</th>
<th>Solid Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss in wt. in 24 hours</td>
<td>14.36%</td>
</tr>
<tr>
<td>Gain in 3 weeks</td>
<td>153.35%</td>
</tr>
<tr>
<td>Mortality</td>
<td>8%</td>
</tr>
<tr>
<td>Av. Temperature</td>
<td>85°</td>
</tr>
<tr>
<td>Net gain in lbs. per chick</td>
<td>.0170</td>
</tr>
</tbody>
</table>

From the above data we find that the solid or board platform has every advantage over the screen platform except the sanitary part.

In conclusion I wish to say that the best practice of feeding and care of baby chicks are:

(1) To feed them when they are 24 to 36 hours old.
(2) To feed them mash plus some grain after seven days.
(3) To have a solid platform in brooder houses with an average temperature of 95°.
Dedication

I hereby dedicate this thesis to Mr. A. M. Pilkey, from whom I have received valuable knowledge of poultry.

Foreword

This thesis is written to show some of the methods in which eggs on the farm may be handled and marketed for the best profits.

The Use of Eggs

Eggs are one of nature's choicest foods. They are used for eating in almost every farm home. It has been found that they have great food value.

Eggs help take the place of meat in food nutrients. It has been found that an egg contains an abundance of vitamins.

They are an excellent food for invalids and sick people because they are exceptionally easy to digest. They are very satisfactory for small children who are undersized for their age.

The aim of every farmer should be to use all the eggs possible. If he does this, he will keep his family healthy and will help stabilize egg prices.

Importance of Quality

Every producer should appreciate the quality of eggs, whether that quality affected by conditions of marketing, or by conditions of production. He should strive for the best grade possible, because the quality affects the consumption of the egg. Hardly any food product is as dependent for demand upon its quality...
as an egg; one bad egg destroys the sale of several, while one
that is exactly right calls for more. Much has been done toward
improving the appearance and quality of eggs that are marketed,
but there are a great many improvements to be made yet.

Most of the poor quality eggs come from the average
farm where a few chickens are kept as a side line. This thesis
is written to show some of the ways that the farmer may improve
the quality of his eggs.

Gathering

Eggs should be gathered frequently, at least once a
day, and it is a good practice to gather them twice a day during
warm or very cold weather. It is especially necessary to gather
eggs in warm weather because the germ in the egg starts to develop
before the egg is laid, and if the egg is not cooled soon after
it is laid, the germ will continue to grow. Clucking hens are a
nuisance and should be penned up, because they will decrease the
quality of the egg by sitting on it for only a short while.

The nests in the poultry house should be supplied with
fresh straw at all times. This will help to keep the eggs clean.

Strong pails should be used for gathering eggs. Wire
baskets may be used if they are particularly strong. Baskets
that are not strong are apt to bend. This will break or crack
some of the eggs.

Grading

After the eggs have been gathered, they are ready for
grading. The main points to be considered are the size, shape,
color and shell condition.

The size is very important and eggs that are extra
long, small, or too large should be taken out as they will spoil
the appearance of the crate after it is packed.

Scales may be used for weighing eggs, but they are
expensive and are not necessary. The most desirable weight is the 24 oz. egg, which means 24 oz. to the dozen, or 2 oz. each.

A simple device that is very cheap and proves to be very satisfactory is a small piece of tin with a hole in it 1 5/8 inches across. If the egg goes through, it is too small. If it doesn't go through, it is all right to sell. This is not perfect, but it proves to be satisfactory and it is something that every farmer can use.

Eggs that are long, round, wide, or flatsided should be eliminated from a shipment. Slight bulges, creases or moderate roughness in the shell are not sufficient to exclude eggs from a grade.

The color is becoming a very important factor in grading eggs. Each color should be marketed separately. White eggs should be chalk white, and free from any tint of creaminess. Brown eggs are harder to sort because there are so many different shades of brown.

Certain localities and firms prefer certain colors. We find that the Chicago, New York, and Pacific Coast markets prefer a white egg, while the Boston market prefers a brown shelled egg.

Eggs with porous shells evaporate fast and will not stand holding or long shipment during warm weather.

Candling

It is necessary to candle eggs to find what the interior quality of the egg is like. To candle an egg is to look through it while it is held in front of a light. The room should be darkened so the contents of the egg can be seen plainer.

A simple candler may be made by taking a small box and putting a round hole in one end. An electric light bulb or a flashlight may be put inside.

In candling, the egg should be held with the large end
up so that the air space will normally be at the upper end. Just before the egg is placed at the lighted opening, the contents of the egg should be set whirling by a quick turn of the wrist, in order that the conditions of the interior of the egg may be easily observed. The egg must be held below the level of the eye in order to see the air space, as well as the yolk.

By candling, you may be able to find such things as rots, molds, blood rings, seeping yolks, large embryos, bloody whites, thin whites, meat spots, flat yolks, molds and other defects. These eggs are inedible and are a total loss.

Some kinds of inedible eggs cannot be detected by candling, but must be broken before the matter can be found. A few types of these are green white, musty egg, and the sour egg.

Grades

The following are the minimum requirements for each grade of eggs. The points to be considered are the shell, air cell, yolk, white, and germ.

1. U. S. Special

Shell - clean; sound.
Air cell - one-eighth inch or less in depth, localized and regular.
Yolk - dimly visible.
White - firm and clear.
Germ - not visible.

2. U. S. Extra

Shell - clean; sound.
Air cell - two-eighths inches or less in depth, localized and regular.
Yolk - may be visible.
White - firm and clear.
Germ - not visible.


Shell - clean; sound.
Air cell - three-eighths inch or less in depth; may be slightly tremulous.
Yolk - may be visible; mobile.
White - reasonably firm.
Feet - may be slightly visible.
Trade Clean; sound.
Air cell - may be over 3/8 inch in depth; may be freely mobile.
Yolk - may be plainly visible; dark; freely mobile.
White - weak and watery.
Germ - may be clearly visible, but with no blood.

U.S. Standard Dirty.
Shell - dirty; sound.
Air cell - 3/8 inch or less in depth; may be slightly tremulous.
Yolk - may be visible; mobile.
White - reasonably firm.
Yolk - may be slightly visible.

Trade Dirty.
Shell - dirty; sound.
Air cell - may be over 3/8 inch in depth; may be freely mobile.
Yolk - may be plainly visible; dark; freely mobile.
White - weak and watery.
Germ - clearly visible, but with no blood.

U.S. Check
Shell - cracked; clean or dirty.
Air cell - may be over 3/8 inch in depth; may be freely mobile.
Yolk - plainly visible; dark; freely mobile.
White - weak and watery.
Germ - may be clearly visible, but with no blood.

Cases and Cartons
If eggs are to be sold locally, they may be packed in pails, baskets, or anything else convenient. Cartons are very satisfactory. Cartons holding one dozen eggs each are the best. They make a very attractive and convenient package.

For shipping to outside places, the 30 dozen cases are the best.

Packing
When packing eggs, two cup flats should be placed back to back and put in the bottom of the case. A filler is then put in and filled with eggs. Another flat is then put on, and so on until the case is full. Two flats should be placed back to back and put on top. Care should be taken when packing that the large
end of the egg be placed upward so the air cell will be kept in its natural position.

Storing

When the eggs are packed, they should be taken to a clean cellar or room with a temperature between 40 and 60 degrees F. The room should have good ventilation and good moisture conditions and should be free from musty odors.

If the air becomes too dry, a little water may be sprinkled around the room. A window or two covered by cheese cloth should give sufficient ventilation for the room.

Marketing

There are a number of different ways to market eggs. The common method is to sell to local buyers. It is the common practice to exchange eggs for merchandise at the local store. Many producers sell direct to the consumer, such as hotels, and restaurants.

A more satisfactory method is being practiced now and that is to sell to packing plants and to cooperative associations. This plan makes better grading possible.

Home Preservation of Eggs

The problem of disposing of the eggs that were too small, mis-shaped or too large for selling causes a great deal of consideration. These eggs are kept at home. Eggs properly preserved will keep for many months.

The most convenient and popular way of preserving eggs is with the water glass solution.

When preparing waterglass, the materials needed for

80 dozen eggs are: 18 quarts water, 1½ quarts waterglass, 2

(gal.) earthen jars.

The water should be boiled and put into the jars. The water glass is then put into the water. Only eggs that are fresh,
sound, and free from cracks should be put into the solution. The contents should then be covered with wax as this will insure better keeping.

If eggs are not being packed in large quantities, you may put a few eggs into the jar each day. They may be removed for use at any time.

Eggs are low priced now and every caution must be made to produce them at the lowest price possible. This thesis may give the reader some suggestions on how to do this and how to get best results.
GRAIN RATIONS FOR EGG PRODUCTION

Clarence Peterson '31
Hawley, Minnesota

Dedication

I sincerely dedicate my thesis to Mr. A. M. Pilkey, whose untiring efforts made the material for this thesis possible.

Foreword

In this thesis, it is my aim to set forth some of the important facts concerning poultry feeding for egg production as clearly as possible. If I have succeeded in doing this, and this discussion helps anyone who is interested in the subject, I am well satisfied with my work.

One of the great problems of every poultry raiser is to find the most economical ration, giving the best possible results. Especially is this true with the egg producing breeds, and as my title suggests, I will confine my discussion to that type.

Even to the ordinary farmer, who raised his own grain, this is a great problem or should be a great problem, as every farm flock properly selected, with adequate housing, and proper care can and should be a profitable enterprise. To be profitable, I do not mean that a flock of one hundred hens will yield a profit every year that will buy a car, but that the flock will yield a fair profit per hen.

A great many projects and trials are conducted every year to determine more profitable methods of raising poultry.

Miss Cora Cooke, extension poultry specialist, has supervised poultry record projects to determine the net returns per hen. During 1930, 51 flocks with a total of 11,000 hens were
reported on. The results showed a net return per hen of $1.88, only 12¢ lower than the year before.

The 1920-31 project is well started with 79 flock owners in 35 counties keeping records under Miss Cooke's direction.

With this problem in mind, series of experiments were started by Professor A.M. Pilkey of the poultry division of the Northwest Experiment Station. These trials were started November 1, 1928 and were run for ten months of the year, leaving out the months of September and October, the months when a flock of properly culled hens lay the least eggs.

The stock used consisted of six pens, each consisting of 75 single comb White Leghorn pullets, selected so as to be as uniform as possible with regard to maturity, weight, condition, etc., the birds having been reared under identical conditions.

The four principal farm grains, corn, wheat, oats and barley, were the different grains in the rations. Each ration consisted of two of the grains listed above, they being used whole in the scratch grain and the same two grains ground in the mash. The rest of the mash was the same for all the rations consisting of 20% meat meal, 1% cod liver oil and $ of 1% iodized salt. The combination of grains used in different lots are as follows:

<table>
<thead>
<tr>
<th>Lot 1</th>
<th>wheat and barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 2</td>
<td>wheat and oats</td>
</tr>
<tr>
<td>Lot 3</td>
<td>wheat and corn</td>
</tr>
<tr>
<td>Lot 4</td>
<td>barley and corn</td>
</tr>
<tr>
<td>Lot 5</td>
<td>barley and oats</td>
</tr>
<tr>
<td>Lot 6</td>
<td>corn and oats</td>
</tr>
</tbody>
</table>

The price of the single grains for the trial from November 1928 to August 1929 were as follows:

- Corn - $1.75 per cwt.
- Wheat - $1.52 per cwt. or 95¢ per bushel.
- Barley - $1.15 per cwt. or 55¢ per bushel.
- Oats - $1.25 per cwt. or 40¢ per bushel.

The price per cwt. of the different combinations of grains and mashses are as follows:
<table>
<thead>
<tr>
<th>Lot</th>
<th>Scratch Grain</th>
<th>Mash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat and barley</td>
<td>$1.34</td>
<td>$1.91</td>
</tr>
<tr>
<td>Wheat and oats</td>
<td>$1.39</td>
<td>$1.95</td>
</tr>
<tr>
<td>Wheat and corn</td>
<td>2.21</td>
<td>2.62</td>
</tr>
<tr>
<td>Barley and corn</td>
<td>2.03</td>
<td>2.47</td>
</tr>
<tr>
<td>Barley and oats</td>
<td>1.20</td>
<td>1.80</td>
</tr>
<tr>
<td>Corn and oats</td>
<td>2.08</td>
<td>2.51</td>
</tr>
</tbody>
</table>

In the above prices, it will be noticed in the combinations comparing oats and barley, that oats is a few cents higher than barley. This fact does not mean much except, that in these trials, only oats weighing about 40 pounds to the bushel were used. And that is one thing to keep in mind concerning trials, because oats contain a large percent of fiber and, if heavy oats were not used, the poultry would get too much fiber. Especially would this be true when used in combination with barley, which also contains a large percent of fiber, and the result would be a high mortality. As it is, the mortality of the oats combination compare very favorably with any of the other combinations.

The mortality of the various lots are as follows:

<table>
<thead>
<tr>
<th>Lot</th>
<th>Percent Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat and oats</td>
<td>20</td>
</tr>
<tr>
<td>Wheat and barley</td>
<td>28</td>
</tr>
<tr>
<td>Wheat and corn</td>
<td>18.6</td>
</tr>
<tr>
<td>Barley and corn</td>
<td>17.3</td>
</tr>
<tr>
<td>Barley and oats</td>
<td>25.3</td>
</tr>
<tr>
<td>Corn and oats</td>
<td>22.6</td>
</tr>
</tbody>
</table>

As these results are for only the one year and the pens are of only 75 birds each, I will not discuss them now, for I am taking into consideration the mortality in a discussion a little later on.

In the percentage egg production of this first year's trial, the wheat and barley lot with a 63% egg production stood out above all the other lots. The other lots ranged from 55.7% to 63.2%, a variation of only .6%. However, the percentage egg production alone does not show the true economy of the feed, as the price of the feeds, mortality and several other things must be taken into
consideration, and after all, the things are discussed, an opinion of the merits of the different rations can be fairly considered.

The number of eggs produced per pound of feed is one of the things revealed in this test that must be considered. The results are as follows:

<table>
<thead>
<tr>
<th>Feed Combination</th>
<th>Eggs per pound of feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn and oats</td>
<td>2.87</td>
</tr>
<tr>
<td>Oats and barley</td>
<td>2.85</td>
</tr>
<tr>
<td>Wheat and barley</td>
<td>2.73</td>
</tr>
<tr>
<td>Wheat and oats</td>
<td>2.64</td>
</tr>
<tr>
<td>Barley and corn</td>
<td>2.50</td>
</tr>
<tr>
<td>Wheat and corn</td>
<td>2.37</td>
</tr>
</tbody>
</table>

One thing about these figures is the inefficiency of corn and oats, which, however, is the highest priced combination of them all, and it is at the bottom, 1/2 egg per pound feed less than the corn and oats combination. Another startling thing about the figures just stated is the high efficiency of the oats and barley combination, a combination many poultry raisers will usually condemn. Any, unquestionably, the reason for its high efficiency is the fact, that only heavy oats were used. And getting heavy oats need not be a serious problem, for practically all farmers raise oats and even most large poultry raisers raise oats, and a sufficient amount of heavy oats can be gotten without depriving feed from the other animals, the horses and cattle, for they can use the bulkier oats to an advantage, especially the horses. If a large part of the oats is sold as feed, the problem is still easier, for the bulkier oats can be sold practically as profitable as the heavier oats.

The most important single item in this test is the cost of feed per dozen eggs. After taking into consideration, total egg production and mortality, it can be classed as the deciding factor in determining the most profitable combination of feeds. In fact, taking into consideration only the total egg production will be
sufficient, for mortality is really considered in that, because a high or low mortality will affect the total egg production. However, I do not mean that actual price of the different combinations to be taken as a basis of what they will cost elsewhere, but only the comparison of the different combinations.

In this respect we find the oats and barley combination with the lowest cost per dozen eggs, at 10.74¢ per dozen. The barley and wheat combination is a close second with a cost of 11.20 cents per dozen eggs. The wheat and oats combination is somewhat higher with a cost of 13.14 cents per dozen eggs. In the rest of the combinations, there appears the problem confronting most of the farmers in the Northwest: namely, the price of corn. We find the corn combinations ranking as follows: The corn and oats combination with a cost of 14.31 cents per dozen; corn and barley 15.45 cents; and the corn and wheat combination with the high cost of 17.10 cents per dozen eggs.

I will now take into consideration the total egg production of each group with the cost of feed per dozen eggs. For, as I said before, it can then really be classed as the deciding factor in the efficiency of the feed. First, let us compare the oats and barley combination with the wheat and barley combination, as they were nearly the same in the cost of feed per dozen eggs. The oats and barley lot had a cost of 10.74 cents per dozen, barley combination.

In the figures of the last three combinations, we find portrayed what I mentioned before: namely, the high price of corn for poultry feed on the average farm in this part of the country.

These trials were not limited to results in profitable production for market, but also to determine the effect of the different combinations of feed on the hatching results.

The total number of eggs set, percent of infertile
eggs, percent of embryonic mortality or chicks dead in the shell, and
the percent of fertile eggs hatched, form the different parts of the
hatching results. The results showed quite distinctively that the
high producing hens to be low in hatchability. For the wheat and
barley group, which seemed to stand out over the other combinations
in profitable production, ranked below the other combinations in
 hatchability.

Some of the outstanding results of this trial are:
1. That any of the common farm grains used in this trial, in combina-
tions of two or more, will form a good ration for egg production.
2. That corn for the average farm, especially if used as a major grain,
is expensive, but unless a too high priced source of corn must be
used, it is advisable to use corn as part of the feed during the
winter months.
3. That the wheat and barley combination proved quite satisfactory.
4. That oats, if heavy, is a lot better poultry feed than most
poultry raisers give it credit for.

These trials were continued during 1929-30 and the
third trial started November 1, 1930 is under way and will be
completed August 31, 1931.

Taking these trials under observation, comparing them
with the one I have just discussed, I find that the discussion on
just the one trial will serve my purpose quite well, that is, of
bringing to light at least a few of the problems of poultry feeding.

As a feature of considerable interest, I was able, with
the aid of the Station's records of market eggs and feed, to make
diagrams of the price of the four grains used in this trial and the
selling price of eggs since November 1922, nine of the diagrams
showing the price of eggs and the other nine diagrams showing the
price of the four grains. These diagrams were drawn on the same
plan as the trial was run; that is, the ten most productive
months of the year, November to August inclusive. As a word of
explanation, however, the price of wheat until about 1928 is not
very comparable, because mostly low grade wheat was used up until
about that time.

From these diagrams it can readily be seen that the
poultry raisers are not as bad off as it is generally thought.
Let us, for example, compare the months of January for 1924 and 1931.
The price of eggs in January 1924 was 30¢ and the price of eggs in
January 1931 was about 21¢, only 9¢ lower. But then let us look at
the difference in the grains. Wheat, however, cannot very well
be compared because of the low grade wheat used in 1924. But barley
in January 1924 was 87¢ per hundred, while in January 1931, it was
but 54¢ per hundred, a difference of 33¢ per hundred. Oats in 1931
is 53¢ per hundred less and corn 15¢ less in January 1931 than in
January 1924. Still more favorable is the situation in the month
of March 1931 as compared with March 1924. With the price of the
grains about the same difference as in January of the two years,
we find the price of eggs in March 1924 drop to 20¢, while in March
1931 we find the same price of 20¢.

Certainly, considering these circumstances, the
poultry raiser of today has not much reason for complaint.

Throughout these discussions I have tried to bring
out some of the problems of feeding, and I sincerely hope I have
succeeded.
Dedication

I sincerely dedicate this term paper to Mr. A. M. Pilkey, whose untiring efforts have made this thesis possible.

Foreword

Many are interested in the fattening values of the common farm grains produced on the farm. So the purpose of this thesis is to give in accurate facts, the different values of farm grains from a fattening standpoint.

The object of this experiment was to obtain the fattening values of the common farm grains, fed singly and in combination. The grain rations used were:

1. Wheat alone.
2. Barley alone.
3. Corn alone.
5. Wheat plus corn.

The two different experiments were conducted between the following dates: Experiment No. 1 (single grains), December 17, 1930 to January 7, 1931. Experiment No. 2 (grains in combination), January 19, 1931 to February 9, 1931.

The stock used in both experiments were single comb Rhode Island Red cockerels. These 72 cockerels were divided into six lots of twelve birds each, with four birds in a pen, making three pens to each lot.

The birds were placed in the battery or fattening crates and starved for twenty-four hours. Then they were given a small amount of mash (all rations fed were in the form of a soft batter
twice daily); gradually the amount was increased until at the end of the first week, they were getting nearly all they could eat in about twenty or thirty minutes twice daily. At the end of the second, they were getting all the mash they could possibly eat in thirty minutes twice daily.

A record was made of the feed at the beginning of both trials and again at the end, to get the exact amount of feed consumed by each lot. The cockerels were weighed up at the beginning of the trial and all three lots were arranged around until all three lots were of equal or nearly equal weight. They were again weighed at the end of the first week, then at the end of the second week and then the final weight. From these records, the percentage gain or loss; pounds of feed required for one pound gain; gain per one pound of feed fed; gain or loss in feeding; cost of one pound gain; value of each grain in combination of each other; value of each grain at par, and many other things of equal importance and interest were worked out.

The rations fed are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Lot 1</th>
<th>Lot 2</th>
<th>Lot 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment No. 1</td>
<td>90 lbs. wheat</td>
<td>90 lbs. barley</td>
<td>90 lbs. corn</td>
</tr>
<tr>
<td>(Grains singly)</td>
<td>10 lbs. meat</td>
<td>10 lbs. meat</td>
<td>10 lbs. meat</td>
</tr>
<tr>
<td></td>
<td>meal</td>
<td>meal</td>
<td>meal</td>
</tr>
<tr>
<td>Experiment No. 2</td>
<td>45 lbs. wheat</td>
<td>45 lbs. wheat</td>
<td>45 lbs. barley</td>
</tr>
<tr>
<td>(Grains in combination)</td>
<td>45 lbs. barley</td>
<td>45 lbs. corn</td>
<td>45 lbs. corn</td>
</tr>
<tr>
<td></td>
<td>10 lbs. meat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>meal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All of the above grains were ground fairly fine, but not to a powder, however.

The following is the composition of the rations fed in Experiment No. 1 (Grains singly).
<table>
<thead>
<tr>
<th></th>
<th>Total fiber</th>
<th>Digestible crude protein</th>
<th>Total Digestible Nutritive</th>
<th>Nutritive Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 lbs. wheat</td>
<td>1.98</td>
<td>7.83</td>
<td>66.15</td>
<td>1:4.58</td>
</tr>
<tr>
<td>10 lbs. meat</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>1.98</td>
<td>13.25</td>
<td>73.35</td>
<td></td>
</tr>
<tr>
<td>Lot 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 lbs. barley</td>
<td>4.14</td>
<td>7.83</td>
<td>63.9</td>
<td>1:4.41</td>
</tr>
<tr>
<td>10 lbs. meat</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>4.14</td>
<td>13.25</td>
<td>71.7</td>
<td></td>
</tr>
<tr>
<td>Lot 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 lbs. corn</td>
<td>1.62</td>
<td>7.56</td>
<td>72.54</td>
<td>1:5.18</td>
</tr>
<tr>
<td>10 lbs. meat</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>1.62</td>
<td>12.98</td>
<td>80.34</td>
<td></td>
</tr>
</tbody>
</table>

Lot No. 3 best meets the requirements of a good fattening ration, because it has a wider nutritive ratio than Lots 1 and 2. It also is lower in fiber. Lot 2 has a very high percentage of fiber and a very narrow nutritive ration.

The following is the composition of the rations fed in Experiment No. 2 (Grains in combination).

<table>
<thead>
<tr>
<th></th>
<th>Total crude fiber</th>
<th>Digestible crude protein</th>
<th>Total Digestible Nutritive</th>
<th>Nutritive Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 lbs. wheat</td>
<td>.99</td>
<td>3.915</td>
<td>33.075</td>
<td></td>
</tr>
<tr>
<td>45 lbs.barley</td>
<td>2.07</td>
<td>3.915</td>
<td>31.95</td>
<td></td>
</tr>
<tr>
<td>10 lbs. meal</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>3.06</td>
<td>13.25</td>
<td>72.825</td>
<td>1:5.59</td>
</tr>
<tr>
<td>Lot 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 lbs.wheat</td>
<td>.89</td>
<td>3.915</td>
<td>33.075</td>
<td></td>
</tr>
<tr>
<td>45 lbs.corn</td>
<td>.81</td>
<td>3.78</td>
<td>36.27</td>
<td></td>
</tr>
<tr>
<td>10 lbs. meal</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>1.70</td>
<td>13.115</td>
<td>77.145</td>
<td>1:4.88</td>
</tr>
<tr>
<td>Lot 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 lbs.barley</td>
<td>2.07</td>
<td>3.915</td>
<td>31.95</td>
<td></td>
</tr>
<tr>
<td>45 lbs. corn</td>
<td>.81</td>
<td>3.78</td>
<td>36.27</td>
<td></td>
</tr>
<tr>
<td>10 lbs. meal</td>
<td></td>
<td>5.42</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>meal</td>
<td>2.88</td>
<td>13.115</td>
<td>78.02</td>
<td>1:4.79</td>
</tr>
</tbody>
</table>

It will be noticed that Lot 4 has a comparatively wide nutritive ratio. A fattening ration should have a nutritive ratio of 1:6 and should be as low as possible in protein. Lot 4, while having a wider nutritive ratio than Lots 5 and 6, has too much fiber due to its barley content.

This is the value of each grain at par:
In terms of corn ($1.33 corn produced in 3.75% 
3.75 \times 1.33 = 8.33$
$1.33 barley produced \frac{3.75}{1.33} \times \frac{1.33}{1.05} = 3.57$

It can be seen at a glance that in terms of corn, barley is over twice as good and wheat not as good as corn from a fattening standpoint, if the same amount of money is invested in each of the three different feeds.

In terms of barley (45¢ barley produced $0.78 \times 0.45 = 0.78$
45¢ wheat produced $0.45 \times 1.05 = 0.45$
45¢ corn produced $0.78 \times 1.33 = 0.58$

In terms of barley, wheat is close to it and corn is the poorest for fattening purposes, if the same amount of money is invested in each of the three different feeds.

Value of each grain in combination of each other:

<table>
<thead>
<tr>
<th>* equals gain</th>
<th>Lot 7</th>
<th>Lot 8</th>
<th>Lot 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>- equals loss</td>
<td>wheat</td>
<td>barley</td>
<td>corn</td>
</tr>
<tr>
<td>Gain or loss</td>
<td>barber</td>
<td>corn</td>
<td>wheat</td>
</tr>
<tr>
<td>Gain per lb. of feed fed</td>
<td>0.02049</td>
<td>0.1072</td>
<td>0.02447</td>
</tr>
<tr>
<td>Percent gain, first week</td>
<td>3.6188</td>
<td>3.255</td>
<td>0</td>
</tr>
<tr>
<td>Percent gain second week</td>
<td>1.3888</td>
<td>1.3888</td>
<td>0</td>
</tr>
<tr>
<td>Total percent gain</td>
<td>1.6744</td>
<td>0.6864</td>
<td>1.9553</td>
</tr>
<tr>
<td>Lbs. of feed required for lb. gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88.6</td>
<td>108</td>
<td>48.6</td>
<td></td>
</tr>
<tr>
<td>Cost of 1 pound gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73.249¢</td>
<td>86.387¢</td>
<td>48.00¢</td>
<td></td>
</tr>
<tr>
<td>Pounds of feed consumed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73.5</td>
<td>71</td>
<td>70.5</td>
<td></td>
</tr>
</tbody>
</table>

In combination of each other, Lot 9 shows up to be the best fattening lot while, Lot 7 comes second in fattening qualities and Lot 8 last. So you see that corn in combination with wheat, and corn in combination with barley made the best gains. Wheat combined with barley, and wheat combined with corn comes very close to making the same gain, but the cost of one pound gain was a great deal higher. Barley combined with wheat, and barley combined with corn made the poorest gains, and also the
highest priced gains, The gains costing nearly twice as much for Lot 8 as for Lot 9. Experiment No. 1 (Grains singly)

<table>
<thead>
<tr>
<th>* equals gain</th>
<th>Wheat Lot 1</th>
<th>Barley Lot 2</th>
<th>Corn Lot 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain or loss</td>
<td>5 lbs. - .75 *</td>
<td>3.5 *</td>
<td></td>
</tr>
<tr>
<td>Gain per lb. of feed fed</td>
<td>.0805 - .009 *</td>
<td>.042 *</td>
<td></td>
</tr>
<tr>
<td>Percent gain first week</td>
<td>1.419 - 2.085 *</td>
<td>1.511 *</td>
<td></td>
</tr>
<tr>
<td>Percent gain second week</td>
<td>7.075 - .581</td>
<td>4.320 *</td>
<td></td>
</tr>
<tr>
<td>Total percent gain</td>
<td>5.562 - .781 *</td>
<td>3.755 *</td>
<td></td>
</tr>
<tr>
<td>Pounds of feed req. for lb. gain</td>
<td>12.325 - 100</td>
<td>21.285</td>
<td></td>
</tr>
<tr>
<td>Cost of 1 lb. gain</td>
<td>12.941¢</td>
<td>45.833 *¢</td>
<td>28.309 *¢</td>
</tr>
<tr>
<td>Pounds of feed consumed</td>
<td>61.625</td>
<td>75</td>
<td>74.5</td>
</tr>
</tbody>
</table>

It will be noted that the corn lot produced the cheapest gain per pound, being about two-thirds of the cost of the pound gain in the barley lot, while the wheat lot lost money.

Experiment No. 2 (Grains in combination)

<table>
<thead>
<tr>
<th>* equals gain</th>
<th>Wheat &amp; Barley Corn Lot 4</th>
<th>Wheat &amp; Barley Corn Lot 5</th>
<th>Barley &amp; Corn Lot 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain or loss</td>
<td>½ lb. *</td>
<td>2.5 *</td>
<td>1 *</td>
</tr>
<tr>
<td>Gain per lb. of feed fed</td>
<td>.0067</td>
<td>.0542</td>
<td>.0147</td>
</tr>
<tr>
<td>Percent gain first week</td>
<td>4.444 - 2.793 -</td>
<td>2.793 *</td>
<td></td>
</tr>
<tr>
<td>Percent gain second week</td>
<td>2.777 -</td>
<td>0</td>
<td>1.117 *</td>
</tr>
<tr>
<td>Total percent gain</td>
<td>.555 *</td>
<td>2.793 *</td>
<td></td>
</tr>
<tr>
<td>Lbs. of feed req. for lb. gain</td>
<td>148</td>
<td>29.2</td>
<td>68</td>
</tr>
<tr>
<td>Cost of one pound gain</td>
<td>111.616¢</td>
<td>34.883¢</td>
<td>61.118¢</td>
</tr>
<tr>
<td>Pounds of feed consumed</td>
<td>74</td>
<td>72</td>
<td>68</td>
</tr>
</tbody>
</table>

The wheat and corn lot produced the cheapest one pound gain. This is due largely to the fact that the wheat and corn lot had a larger total gain than the other two lots. Lot 6 is next in the cheapest cost of one pound gain. The wheat and barley lot was the poorest, having the high cost of 111.616¢ for one pound of gain.

The following is the Summary:

1. Wheat is not a very palatable poultry fattening feed. It forms a sticky or doughy mash.

2. Corn produced the cheapest and largest gain. Barley produced the next cheapest and largest gain. Wheat was the poorest,
producing a loss.

3. The wheat and corn lot produced the cheapest and largest gain of the grains in combination. The barley and corn coming next and wheat and barley being the poorest.

4. In terms of corn, barley is over twice as good for fattening as corn, and wheat is not quite as good; that is, if you buy the same money's worth of each grain.

5. In terms of barley, wheat is not as good, and corn is still lower in fattening value. This is on the basis that you use the same money's worth of each grain.

6. In the grains singly, Lot 3 (Corn) best meets the requirements of a good fattening ration, because it has a wider nutritive ratio, and is lower in fiber than the other two lots. This probably helps explain why that lot made better and cheaper gains.

7. In grains in combination, Lot 4 has a comparatively wide nutritive ratio but is higher in fiber which is not desirable in a fattening ration. Lot 5 (wheat and corn) is low in fiber, but has only a fairly wide nutritive ratio. Low fiber content in a fattening ration appears necessary by the fact that Lot 5 made the best and cheapest gain of the other two lots.

8. A good fattening ration should have a nutritive ratio of 1:6 and should be as low as possible in fiber.

9. The above points should have given you some different ideas on the fattening values of the common farm grains fed singly and in combination.
Dedication

I hereby dedicate this thesis to the ones interested in Turkey Production.

Foreword

I have sought to put before the reader my own experience in turkey raising, showing all the things necessary in successful Turkey Production.

Many people in past years had the idea that turkey raising was a hit and miss affair. In fact, it was to a large extent a hit and miss affair with emphasis on the "miss." If everything was suitable for turkey production, the raiser could make a success, but generally it was the other way. Now turkey raising is a lot more dependable under the modern confinement method. By this method turkeys can be raised very successfully year after year.

The hatching of the poults is one of the first important steps. The eggs may be set either under the turkey hen, chicken hen, or in the incubator. When a great number of early eggs are to be set, it is advisable to use an incubator. An incubator can be run very successfully by the farm. The temperature should be kept at about 101½ degrees with a standing thermometer. The eggs should be turned twice a day and the lamps filled once a day. Sometimes more moisture is needed in the incubator. This can be supplied by placing pans of water under the trays of eggs. The cost of running an incubator is small. Eight gallons of kerosene will last for one setting of eggs. On the other hand, the eggs may be set under hens and
good results have been obtained, but it is seldom that sufficient
turkey hens go setting at once to make it pay to raise the pouls in
a brooder house. Turkey eggs can be set under chicken hens,
but it is undesirable because the young poult may get lice from
the hen.

The brooder house may be any kind of a building as long
as it keeps the birds warm and dry. A very serviceable home
made brooder house can be made very cheaply and yet it will
serve the purpose almost as good as a ready made brooder house.
A shed top brooder house can be made with ship lap siding
covered with tar paper or better still a drop siding house will
be very good, but the cost will be somewhat higher. Any kind
of matched lumber will do for the floor, a cheap grade of fur
flooring is very good and heavy roofing paper on the roof will do
providing the turkeys are not hatched too early. A glass cloth
window will serve the purpose for light, and a cotton opening
near the window will serve for a ventilator. A movable
brooder coop with a movable pen may be used for the later-hatched
poult that have been hatched with a turkey hen. The coop should
be large enough to allow the hen to stand up right in it and
with plenty of room to turn around in.

The number of poult to put in a brooder house or with
the turkey hen may vary somewhat. A ten by twelve brooder house
will hold from 150 to 175 birds, while a turkey hen will take
care of twenty young poult under normal conditions. In the
brooder house the poult should be of the same age; then each
will have an equal chance of surviving. Some kind of screen
or fine wire should be used around the corners of the brooder
house so as to keep the poult from piling up in the corner
and smothering. The same is true of the brooder coop.
Many think of the feeding and care of the young poult as a complicated task, but under the confinement plan it has been simplified a great deal. The best litter for the brooder house is a coarse grade of sand. The sand absorbs the moisture to a great extent. The commercial peat is also a very good litter, but the sand will do and it is much cheaper. Do not use sand that is very fine, because fine clay-like sand will stick to the turkey's toes in great lumps when it becomes moist. The task of picking the sand from each individual poult is a very tiring job.

The feeding is not so complicated as one might think. Do not feed the turkeys supernatural feed, as it may be stated, but just common feed. The method of feeding hard boiled eggs and clabbered milk or cheese is all right, but the benefits derived from it are not worth the trouble. Commercial feed may be fed at first to some advantage; a turkey starter is good. It is best to feed the young poult's mash for the first week or so; then a scratch feed may be added before and after noon. Milk is the best to feed instead of water, if it can be had. Keep the feed before them at all hours. When the birds can get the feed whenever they want it, they will not gorge themselves as they would if they were fed but a few times a day. It is unwise to feed a commercial mixed feed to the young poult's after they start to grow unless you are raising them as a hobby and not for money making. The commercial feed is too high priced to feed to the poult's. A home mixed feed will be all right, and it will cost far less than the commercial feed. A very good home mixture can be mixed to a good advantage.

The following ration is good:

- 20% oat flour
- 20% bran
- 20% Meat middlings
- 20% coarse corn meal
- 30% meat scraps or tankage
Milk should be fed to the turkeys if it can be gotten, because it works as a beverage as well as quenching the thirst of the bird. People used to think that the little turkeys would surely die if they were handled or fed all that they wanted. Now feed is kept before them twenty-four hours a day. It is advisable to hang a lantern in the brooder house at night so those birds that go astray from the canopy can get back; also so the poultse can eat or drink at night if they desire. Birds can be found eating at any time of the night if a lantern is used.

After the weather is warm enough for the birds they should be turned out into a clean yard, free from contamination by other poultry. Turkeys can not be raised on a range the chickens have roamed on. The pen should be far enough from the chickens so that you will be absolutely sure it is a clean range. Alfalfa is the best range for turkeys, also rape pasture, or blue grass pasture will do. An alternation of the pens is necessary in order to keep the alfalfa from getting killed out by the continued use by the birds in some parts of the pen, and to keep the range in a sanitary condition all of the time. A four pen rotation with two or three weeks between each changing will work very satisfactorily.

Pen 4
Brooder House
Pen 2

Pen 3
Pen 1

The young birds should be looked after very carefully the first few days because when plenty of green food is placed before them, their eyes become larger than their crops. Many young poultse have died, because they were given too much coarse green food at once. They will eat so much the first few times that their crops become crop bound and they may die from this. They should be allowed
only a little green food each day until they have become accustomed to it.

As the poult's grow older, they will need larger feeding and drinking equipment. Don't use the little toy hoppers that have to be filled many times a day. You should use hoppers that will need filling but once a day with the dry mash. Two ten foot hoppers, one for the mash and the other for the scratch feed that hold about one to two sacksful of feed, will do for one hundred fifty turkeys. A cream can, either a five or ten gallon can, turned upside down in an old dish pan will do for a milker or waterer. If sweet milk is used, the milk should be changed once a day, because if you start feeding sweet milk, do not feed them any sour milk or buttermilk in place of it. If you start feeding buttermilk, do not feed sweet milk, because frequent changing of the milk from sweet to sour may upset the digestive system. After the birds start to mature, a scratch feed should be fed. One part wheat and two parts barley or corn will do as a scratch feed. This ration should be fed in the hoppers continually.

It is necessary to have a good roost for the birds. As soon as the birds go to roost, the danger of prowling and smothering one another is over. It is often stated that the birds will get crooked breasts if they are let on the roost too early. However, this is not always the truth. If the birds do not have the right kind of a ration or lack some minerals to build up strong bones, they may become crooked breasted. It is the nature of the birds to roost outside in the open, and it is advisable to have them roost in the open as soon as possible or as soon as they are large enough to stand the cool nights. The turkeys can stand a very hard rain, but they cannot stand hail stones. It is advisable to have
some shelter at hand for the birds during a hail storm. The sides can be taken off of the cheap brooder houses very easily. The roosts can be made projecting from the house about three or four feet from the ground on the south side. This makes an excellent roosting quarters for young turkeys. When the house is moved, the stakes at each outward end of the roosts must be held up while it is hauled to new ground. This makes it very efficient to move to fresh ground.

It is surprising how much feed the turkeys will eat both of grain and green foods, but nevertheless, a real profit can be made in raising turkeys by the confinement method.

There are a number of diseases that may effect the turkeys. Among these are blackhead and Roup which are the most prominent ones. These diseases are spread by uncleanness, sanitation is the greatest step in preventing diseases and this can be done by keeping the house, pens, and utensils clean. Some times a leg weakness is prevalent and nobody knows what causes this type of a disease. When the birds get weak-legged and become unable to walk, it is advisable to dispose of them, because they will lay around, pick up all the diseases about the yard and die in the end, either because of a disease or starving to death. The birds generally begin to get weak-legged between the second and fourth week of their life. It seems that when they once get the disease, they never get over it. The birds that get weak-legged are pronounced in the early hatchings when the birds are kept in and cannot roam out of doors. Disease is not found to a very large extent in the later hatched birds that have free access to the open air.

The figures that follow have been taken from my own past experience in turkey raising.
170 young poults were bought for $100. Of the 170 poults, 149 were raised and marketed. The cost of the feed was $134.15. 1848 pounds of turkey were sold on the market, which amounted to $474.25. The average cost of feed for each pound of turkey raised was 72¢, while the total cost per pound was 14½¢, including rent for land, depreciation on the building and the cost of the young poults. The total cost amounted to $339.96. The total profit made for the laborer was $334.29. If the turkeys are cared for by an economical method, they will bring a real profit to the owner.
Rural Life Problems
METHODS OF CLEARING LAND

John Pearson '31
Middle River, Minnesota

Dedication

In sincere appreciation of the many helps and suggestions he has given me throughout my course here at the Northwest School, I dedicate this paper to my instructor, Mr. T. M. McCall.

Foreword

I have written this thesis in the hope that it may show that the clearing of land is not altogether to be shunned, but is, in many cases, a profitable enterprise.

Land clearing is one of the greatest problems that confronts every farmer who has land that is wooded or stony. Trees and stones are ever in the way on land that is to be tilled; consequently, they must be removed.

There are many ways of clearing land. Some methods are too slow or too expensive to be practical. My thesis will be devoted to the discussion of those methods that are the most practical in northern Minnesota.

In this thesis it is not my intention to bring forth the idea that all uncleared regions should be cleared and the land devoted to tillage. There certainly are types of land on which trees should be planted rather than removed; also, there are types that would not be practical to clear due to low productivity, excessive rockiness, swampiness, or other handicaps.

However there are thousands of acres of good productive land in northern Minnesota which could certainly be cleared advantageously. I will first take up the methods of clearing such land of brush, stumps, and trees.

In the early days there were only two good ways by which...
land could be cleared of woods; one was by using a grub-hoe or an ax
assisted by considerable elbow grease; the other was by burning. These
methods are still largely used in many localities.

The use of the grub-hoe is very simple, but it is also very
difficult and slow work, if the trees and stumps are all to be removed at
one time. In sections consisting of softwood and coniferous trees, it
is often most practical to go over with a sharp ax in the late summer,
and cut down all brush and trees. When trees are cut down at this
season of the year, the stumps (especially those of softwood trees) will
not much more quickly than if cut at any other season. The brush will,
of course, start anew from the roots the following spring, and so will
certain kinds of the trees. It is therefore a very good plan to pasture
sheep or goats on land treated thus. These animals will keep the young
shoots of trees down, and in a few years, the stumps will all be rotted.

The above method is not very hard labor, but takes several
years to bring about a total clearing of the land involved.

Clearing land by fire has both advantages and disadvan-
tages. The advantages are:

1. It is a very rapid and easy method.
2. In territories of shallow swamps, the fire will consume not
   only most of the timber growth, but the moss as well.
3. It will do the same in peaty lands.
4. The resulting ashes will act as a fertilizer.

The disadvantages of clearing by fire are:

1. The fire is apt to get beyond control and then do more damage
   than good.
2. The method is not practical in swampy or peaty territories that
   have subsoil of pure sand or other non-productive soil. When
   these are all burned away in such sections, the land
   would be poorer than it was before.
3. Burning is not practical where peats or swamps are deep. When
   burning is done only in dry years.
4. Wet years.

One method of removing stumps is by the use of a stump
puller. A stump puller is a machine with a cable fastened to a spool.
In using a stump puller, one end of the cable is fastened to the stump. A horse hitched to a bar fastened to the spool is driven around in a circle so as to wind the cable on the spool and in this way pull out the stump. This is a good way of removing stumps.

The use of explosives is probably more universal than any other method of stump removal. This does not mean that explosives usually replace all other methods, or that the use of explosives alone is more economical under most conditions, for it is not the use of them alone that would be expensive.

However, the combined use of explosives, the stump puller, the grub-hoe, or both is often more economical than when any one of these methods is used alone. With this combination, large and tough stumps may first be split with a small charge of dynamite and the pieces then removed with the stump puller of the grub-hoe.

I wish at this time to give a few suggestions on the use of explosives for stump removal.

In general, a slow acting explosive is more desirable than a quick acting one. Anything quicker than 40% should not be used. One of the best explosives I have ever used is the war salvaged material - pyroTel.

All the tools required for the blasting work are the soil auger and a bar. The usual method of procedure is to start the auger at the edge of the stump, holding it at an angle and drilling a hole which leads directly underneath that part of the stump where the resistance is the greatest. This may be the middle, but it is not always so.

When the hole is drilled, the stump is ready for the charge. The dynamite cartridge is then split and the loose powder permitted to run underneath the stump through the hole drilled. One stick is kept whole to permit the fastening of the cap and fuse.
After the dynamite is placed, the charge is well tamped with loose dirt. It is highly necessary to use a long fuse to allow one to get a considerable distance from the stump before the charge goes off. Blasting stumps is a rather dangerous business at its best. The method is, however, excellent for easy removal of stumps. If the charge is placed just right, it will not only throw out the stump, but also tear loose most of the roots as well. A little practice will soon teach one how to place the charge so as to secure good results every time.

The methods that I have discussed thus far are the most practical ones for clearing land of woods. I will now take up those of clearing land of stones.

In clearing land of stones, the same rule applies as that to clearing it of woods; that is, land that it does not pay to clear for some reason or other is better left alone.

One of the most important ways of removing large stones is by the use of explosives. These may be used by a number of varying methods. The ones I will discuss are mudcapping, underdrilling, undermining, and drilling into the stone.

In mudcapping the object is to break the stone. It consists in placing the explosive on the surface of the stone and covering it with about six inches of stiff mud. For best results with this method, a quick acting explosive is necessary because it breaks the stone the most completely. Stones blasted in this way should always be entirely exposed.

The underdrilling method consists of making a hole in the ground underneath the stone with an auger or driving iron. The charge is placed in this hole much as it would be under a stump. A low grade explosive, 30 to 30%, is suitable for this purpose. Stones blasted by this method are thrown out of the ground, but are seldom broken.
For a method that will throw the stone out of the ground and at the same time break it, the undermining is best. In this method the earth is dug away on one side of the stone so the charge can be placed directly underneath. After the charge is placed, the soil is shovelled back in place and tamped. This method is, therefore, practically the same thing as putting a mudcap underneath. Because the stone is to be broken, it is well to use a quick acting explosive from 40 to 60%.

When stones are almost entirely buried, it is usually more economical to use the undermining method than to use a combination of the other two. Some additional labor is required to place the charge, but this is usually more than repaid by the saving in cost of explosive.

Still another method is drilling into the stone. Explosives are most effective when confined to a drill hole. The method is not very widely used in land clearing, however, because the cost of drilling usually amounts to more than the saving in explosives except in cases where many stones of comparatively soft texture are to be blasted.

The four methods mentioned above are the most common ones of stoning by the aid of explosives. Some farmers prefer methods that require less cash outlay. One of these consists of burying the stones. This method requires no cash outlay but is hard, tedious labor. It means simply the digging of a hole in the ground immediately adjoining and perhaps slightly underneath the edge of the stone to be buried. The excavation must be large enough to hold the rock and deep enough that it can be covered with a foot or more of earth. This method is a very good one where there are not too many stones to dispose of.

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RURAL LAWS

Harry A. Haugen '31
Plummer, Minnesota

Dedication

I hereby dedicate this thesis to Mr. R. S. Dunham in sincere appreciation of the help and knowledge he has given me.

Foreword

I have written this thesis in the hope that whoever may read it will be impressed with the value of knowing thoroughly the laws pertaining to the transfer of real estate, mortgages, liens, boundaries, and, in general, laws which a man must know in order to handle his farm successfully, and to his best advantage.

What is law? We speak of moral laws, the laws of nature, laws of political economy, laws pertaining to the different states, yet these are only a few of the varied meanings of the word "law."

The earliest source of law was custom. Long before there was anything like political organizations to enforce rules of human conduct, there were family and group customs originating in sanction of divine command, public opinion, or family authority. Today, customs play a small part in the laws of any progressing country; laws have been made as necessity demands them to protect personal liberty and property.

Law, in the true legal sense, is a rule of human conduct, that will be enforced by the state, through its tribunals or officers.

In this thesis, I shall try to tell you about a few of the things a farmer should know, and must know, in order to handle
his property, both real estate, and personal, to his best advantage, and his neighbor's peace of mind. First I shall tell you something about the title to real estate.

In years gone by, by a "livery of sieisin", as it was called, or by actually putting the purchaser in possession of the property, land could be transferred, but not now. In addition to being written, the instrument must have a seal; also, the transferee must give some consideration, no matter how small in return for the transfer.

In order to understand the laws pertaining to real estate, more fully, we must first become acquainted with the terms used, and their meaning.

A deed is a contract between two parties for whatever is stated in the deed. The various deeds are catalogued as "warranty deeds," "special warranty deeds" and "quit claim deeds." In the first the grantor guarantees a perfectly clear title. In the second, he guarantees a clear title with some exception. A quit claim deed is signed by the wife, children, or anyone else having an interest in the property to show that they no longer have any interest in the property whatsoever.

The deeds, whether catalogued as warranty or quit claim are also catalogued as indentures, and deeds poll. An indenture is derived from the fact that the two parts of a deed were executed on a parchment and torn apart on an identical or irregular line. Deeds poll are those executed by the grantor only.

The different parts of a deed are: the premises, the recital, and the words of conveyance.

In every well drawn deed, there is a suggestion of these words:

In the premises: "Know all men by these presents that I", 
or, "to all to whom these presents shall come, Greeting."

Know that I." If an indenture it would read like this: "This indenture, made this 8th day of March, etc."

The recitals or introductory matter follow the premises and are preceded by the word "Whereas". The making of the recitals should be done with great care, because the parties are not permitted to deny the truth of the recitals. Neither of the parties can deny that some consideration passed hands.

The words of conveyance include the description of the property granted, the words that indicate what estate is created, the covenants for title, the release of the wife's dower or husband's curtesy, the release of statutory exemptions, the witnessing clause, signature, and seal, and the acknowledgment.

The description of the land must be absolutely 100% perfect. It is often compared and recomputed with known correct statements and surveyors plats. This is necessary because, if the descriptions are incorrect in any way, the whole conveyance fails. No other part of the instrument is so vitally important as the description. If the land is laid out in blocks and lots, very little argument can arise as to the size of the land received, and its boundaries. If the premises are described by metes and boundaries, and if any conflict should arise between distants and monuments, the monuments always govern. Thus if a man owned land that lay alongside of a river, even tho it was a navigated river, he would own one-half of the river. The same applies to roads or highways.

Real estate is classified as freehold and less than freehold.

A freehold estate is an estate of uncertain duration. Under this would come the estate of inheritance; this, divided into two parts: simple, and fu tail. A simple estate has
a perfectly clear title, and has been given by deed or will. The heir has complete ownership, and has the right to sell, or do as he pleases with the estate. A fee tail estate has been handed down from generation to generation, and cannot be sold, but must remain in the family.

A less than freehold estate is an estate that is used from year to year, or for several years.

**Abstract of Title**

If a man contemplated buying a piece of land, he should get a good abstract lawyer to look up the past history of that particular property. The lawyer would go to the Register of Deeds office and get a copy of the title to that land. This copy is called an "abstract of title." An abstract of title shows everything in the line of delinquent taxes, mortgages, and any other cloud, if any, that has been recorded in the Register of Deeds office.

Whenever buying a piece of land or any piece of property, a person should have the grantor's wife, and any children that are of age, or anyone else that may have an interest in the property, sign quit claim deeds; in order to get a perfectly clear title. Then he must record them in the Register of Deeds office in order to show that he has bought the estate, and has a title to it. If he did not do this, someone else might come forward and show a title to that property; the grantor would have a hard time proving that he had a title to the property.

**Wills**

All gifts must be absolute. Wills stating that one person is to receive property, to be his until death, and then automatically become someone elses, are void and extremely annoying.

The widow gets all of the household effects, and has interest in estate as a whole until death or remarriage. In case
of remarriage, the estate will be divided equally among the children.

Here is a will in its simplest form:

"I, Edward H. Hendrille, of Crookston, in the State of Minnesota, do make, publish, and declare this as and for my last will and testament; that is to say, — I give, devise, and bequeath all my property, real and personal of every kind and nature to my wife, Mary G. Hendrille, to be hers absolutely and forever and I do hereby nominate and appoint the said Mary G. Hendrille to be executrix of this will.

In witness whereof I have hereunto set my hand and seal this eighth day of January in the year Nineteen Hundred and Thirty-One.

(Signed) Edward H. Hendrille.

Signed, sealed, published, and declared by the testator as and for his last will and testament in our presence, who, at his request and in his presence and in the presence of each other, have each of us hereunto subscribed our names as witnesses:

F.R. Snyder
J.K. O'Brien

Among all the ways of getting land without the consent of the owner, a foreclosure of mortgage is one of the leading ones. If a man borrows money from some bank or money lender, that bank or money lender, in order to be sure that he is to get his money back, has the borrower sign a deed on his land or property as security. If the borrower fails to pay the money, he has borrowed, at the time specified in the deed, the lender may, through legal proceedings, acquire the property.

Another way of acquiring land or property without the consent of the owner is by a "lien." If a man works for a farmer
for a certain length of time, and the farmer refuses to pay his wages, the laborer may file a lien against the farmer's crops or whatever else his income may be. The lien must be paid out of the proceeds from sales of the property the lien is against.

Adverse possession is also a way by which property may be acquired without consent of the owner. If a man builds a fence across a part of another man's farm, and pays taxes on it for fifteen years, the land automatically becomes his.

Still another way of acquiring property without the consent of the owner is by "delinquent taxes." If a man is unable or quits paying taxes on his property, the state will sell the land for the amount of the back taxes; or to the highest bidder at public auction. If the delinquent taxpayer is able to pay the amount of back taxes within twelve months of the sale, he can get his property back again, with a perfectly clear title.

Sometimes land is acquired through the "easement" of the owner. If a land owner permits people to drive across his land, and he makes no effort to stop them, that road becomes a public road.

Condemnation of land by the government is another way of making land away from the owner without his consent. Whenever the government builds a railway, highway, or are setting the land aside for any other public use, they give the owner a certain price for his land, and make him get out. The owner has no choice in the matter.

When renting or leasing land, so as to avoid difficulties later on, the following points must be included in the deed:

Terms, including expenses, receipts, and crops, and how they are to be divided.

The length of the lease and the day it expires.
How the farm should be managed.

Compensation for unexhausted improvements. If the tenant plants alfalfa, builds a fence, or adds some other permanent improvement to the farm, he is entitled to some return for it, depending upon the time it will last.

Whether or not the landlord will do any supervision.

The names of the parties involved, and the witness.

Description of land and property.

Provision that either party may terminate lease by giving notice on a certain date, usually the first of August, and making a cash payment as forfeiture, usually one or two dollars per acre.

If the lease expires in the spring, it should be made clear that the new tenant may get on the land in order to plow.

A tenant, when moving off a place, should leave an equal money value, as compared to what he found on the farm.

A lease should include everything that will cover any situation that may arise.

If a man is to be a successful farmer, he will have to become thoroughly familiar with the laws mentioned in this paper, or buy a book on law, and study it carefully, so that when the occasion may arise, he will know exactly what to do, and how to go about it.
Dedication

I hereby dedicate this thesis to R. S. Dunham who so willingly helped me to gather material for this subject.

Foreword

I am writing this thesis for the purpose of giving the people a better understanding of the different kinds of leases.

The reason I am taking this subject as my thesis is that it is one of the problems that are confronting the farmers of the Northwest today. In nearly every community there can be found farms that are almost ruined because there has been no effort put into keeping the weeds under control and the productivity of the soil up. This is largely due to tenant farming.

In studying the different types of leases, we find that certain leases will not encourage the tenant to put any effort in keeping the farm in good condition and, therefore, we cannot put all the blame on the tenant alone. Some leases do away with this problem to some extent, because they are drawn up so that it is a benefit to both the landlord and tenant to try and keep up the productivity of the farm.

The first I am taking up is the number of years that leases are usually made. I have some statistics that show the different leases and the one that is most commonly used in different parts of the state.

Length of leases is shown in the following table, which is taken from various sections of Minnesota. These reports are
taken from 545 different farms.

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<td>1. One year</td>
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<td>2. Two, three and four year</td>
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<td>3. Five years</td>
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This shows that about two-thirds of the farms in the Northwest and Southwest are rented under a one year lease.

The fact that the tenant does not have the farm lease for more than one year will not encourage him to put extra expense and labor on the farm because he will probably have to leave the farm before he will get any returns for the extra expense and labor he has put in. If a provision for such matters were included in the lease, so that when the tenant leaves, he is paid a certain amount for the improvements he has made and has not received any returns for, such as seeding of alfalfa or applying commercial fertilizer.

This is a clause that is suggested by William L. Cavert for alfalfa:

The tenant may seed up to _____ acres of hardy alfalfa at his own expense. In case the tenant should not secure a lease for the following year, he will be entitled to the following payments per acre for good stands of hardy alfalfa left on the place: for alfalfa fields that are coming one year at the completion of contract $_____; for alfalfa fields that are two years old $_____; for alfalfa fields that are three years old $_____; for alfalfa fields that are found years old $_____. The tenant should not be entitled to payment for any stands of alfalfa under this clause if the fields are pastured or cut after September fifth of the previous year. Any payments under this clause to be due and payable at the expiring of this lease. (insert date).

There are five common types of leases. The first is the one-third crop share lease where the landlord furnishes nothing but the land. The tenant furnishes all equipment and pays all expenses and the crop is divided one-third to the landlord and two-thirds to the tenant.
This lease is of advantage to the landlord because all the management is left chiefly to the tenant. The disadvantage of this lease is that it does not encourage the tenant to make any improvements and keep the soil up in production.

The second type of lease is the one-half crop share lease, in which the landlord furnishes seed and pays one-half of the threshing expenses. The tenant furnishes labor, equipment and pays one-half of threshing expenses. The crop is divided equally between the landlord and tenant.

Under this lease the landlord helps in the management of the farm and it helps the tenant who feels that he cannot take all the responsibility on himself. The landlord will take more interest in keeping up the productivity of his farm and will help in making improvements.

The third type of lease is the cash rent lease, where the tenant pays a certain amount per acre per year for the farm. This is the most suitable lease for the tenant who has capital enough and is capable of taking all the responsibility in managing the farm alone. This is also a good lease for the landlord who does not have the time to spend on the farm.

There is one disadvantage with this type of lease, in case of short terms, and that is the tendency of the tenant to not take the interest in the farm and keeping it up in condition because he can readily move off and find a farm more suitable.

The fourth kind of lease is the crop and stock share lease. In this lease the tenant supplies machinery and all labor. The crop sales are divided equally. Beef cows, sheep and steers are owned in common and sales proceeds divided equally. For dairy farms the landlord furnishes all cows and one-half
interest in the bull. The tenant furnishes all the labor and the receipts are divided equally.

This is a good lease from the standpoint of keeping the productivity of the farm up and keeping the weeds under control, because the manure will be put back into the soil as fertilizer and it will encourage the use of legumes as a means of getting hay for the stock. It also encourages the landlord to help in keeping the farm in condition.

The last type is the one-third stock and crop share lease. The landlord furnishes land, improvements, machinery and equipment, all milk cows, all horses and two-thirds of hogs, sheep, and young cattle. The tenant pays one-third interest in the young cattle, hogs and sheep and furnishes all labor. All farm expenses are paid one-third by tenant and two-thirds by the landlord. The receipts are divided one-third to the tenant and two-thirds to the landlord.

This is a very good lease for the man who wants to start in business of his own, but does not have enough capital to equip himself with machinery and stock. This also has the advantage of keeping the farm improved in that it encourages the raising of legumes for the purpose of hay and the manure will be returned to the soil as fertilizer.

The most common leases in the northwestern part of Minnesota are the crop-share leases. The average length of the leases are from one to three years. In many cases the landlord is opposed to long term leases because he is financially responsible and can be held more strictly to the contract, while the tenant carries little or no responsibility. The fact that there are so many short term leases is one of the worst evils of tenant
farming because the tenant probably will not stay on a farm more than one term and therefore cannot afford to put any effort in improving the farm because the returns will not be realized the first years.

The reason that there are so many crop-share leases is probably due to the fact that this section of Minnesota has been devoted chiefly to small grain production.

Bibliography

Material for this thesis was taken from bulletins from the University of Minnesota and the Crops and Soils Handbook by R.S. Dunham and E.R. Clark.
BENEFITS OF RURAL SCOUTING

Arthur Burk '31
Brooks, Minnesota

Dedication

To my brother scouts of the "Northwest Eagle Fraternity," whose scouting spirit has inspired me to write this thesis for the interest of all boys who are scouts or wish to become scouts, I hereby dedicate this thesis.

Foreword

In writing this book, it has been my purpose to try to set before the reader a clearer understanding of the "Boy Scouts of America" and the purpose, aim and value of scouting to every scout.

The Boy Scouts of America was formed in 1909 by W.D. Boyce and a group of other outstanding men who were interested in the scouting movement. The "good turn" of a British Boy Scout to W.D. Boyce brought scouting to the United States (1909) and to millions of American boys.

Since its organization, the Boy Scout movement has steadily developed until it is today, the World's greatest organization. Scouting is a world wide organization. Scouts and scout troops are found in almost every country in the world. Scouting knows no race, creed nor class. Scouts are found alike in Catholic parish, Jewish synagogue, Lutheran church, or Methodist congregation. It is available to farm and city alike and it serves the rich as it serves the poor. Scouting, I will say, is neither a military nor anti-military organization.

The Boy Scouts of America is chartered directly by Congress and the President of the United States is its honorary president.
Theodore Roosevelt said:

"The Boy Scouts of America is distinctively an asset to our country for the development of efficiency, virtuility, and good citizenship."

Five other presidents have endorsed scouting and their endorsements prove that they are intensely interested in the progress of scouting.

Scouting offers many big adventures to outstanding scouts. Mr. Martin Johnson's active interest in scouting induced him to give three scouts of the United States a trip to Africa where they had the height of adventure hunting big game and photographing wild life in its native haunts.

Twenty-two Lone Scouts and Boy Scouts of Minnesota were given trips to the Minnesota State Fair last fall with all expenses paid. But the boys are not in the scouting game just to win prizes and trips. The big adventure of a scout comes from being a real scout in everyday life.

"Because youth, loyalty and ambition mean more to exploration than science and training, I am going to take a Boy Scout with me to the Antarctic," said Commander Byrd of the United States Navy. This is what great men think of our beloved organization. Many of you have no doubt read of the adventures of this scout told by himself in a book he wrote of his greatest adventure.

A scout receives many benefits from his scout training. Does scouting have a mental influence on its members? This question might be answered by the following figures:

Nearly half of the men in colleges today have been and are scouts. The following scouts are in:

- Harvard 49%
- Northwestern University 42%
- Washington and Jefferson 64%
- Michigan 44%
- U.S. Naval Academy 50%
- Lafayette 50%
- U.S. Military Academy 48%
The Boy Scouts of America was formed for the purpose of promoting and cultivating courage, honor, cooperation, friendliness, loyalty, helpfulness, cheerfulness, and self-reliance, so that in the near future he may be an efficient leader in the various paths of our civilization.

Scouting furnishes training through a program of activity chuckful of fun and action. Through activities, such as first aid, signalling, swimming, life saving, tracking, hiking, woodcraft, camcraft, seamanship, and through instruction in safety first, patriotism, merit badge tests - the scout is built up physically, mentally, morally, and spiritually.

Scouting has an advantage in that its activities are largely in connection with the great out-of-doors. Who loves the wide, clean out-of-doors like the scout? His training is such that in the course of his scout training he is able to communicate with another scout a mile away, by signals, tie a knot that will hold, climb a tree or swim a stream which would seem impossible to many people. He can pick a good campsite from every standpoint, or lay a trail over any kind of country which can be followed only by a brother scout.

Many tricks of the outdoors or woodsman mean much to the scout. It is easy for him to measure the height of a tree or hill without the use of a tape measure or ruler. The scout observes the things in nature. The woods and fields are full of interesting life which requires close observation to be noticed. The scout noiselessly stalks birds and wild animals and gets interesting photographs of wild life. He thus sees much without being noticed. The forests, game and birds are the scout's friends and he strives to protect and preserve all manner of wild life.
He knows many stars by name and can find his way by them at night. His knowledge of woodcraft enables him to tell directions while he is in the woods without the aid of a compass, how to make shelters and how to find and prepare food in the wilderness, if necessary.

Campcraft is one of the most interesting activities in connection with scouting. Camping takes the scout to the woods, lakes and streams and to many historic places of interest. In camp the scout must rely upon his own self to make his shelter, choose his campsite, make his fire, cook his meals either with or without dishes and to perform the other duties of camp life. A scout can make a good fire even in wet weather without using more than two matches. If his supply of matches is exhausted, he only grins and proceeds to kindle a fire by rubbing sticks together. The camp-cooked meal is always the best meal a fellow ever tasted even though he helped cook it himself.

The scout hikes, and camping trips are always full of fun and aren't without their share of jokes. Someone is always getting into a tight place or saying something that keeps the bunch in a jolly mood. Scout hikes and camping trips, though they may be limited to a short space of time, bring the scout into close contact with nature in the great out-of-doors. It is surprising how little the average person knows about the birds, wild animals, plants and trees which are about him all the time.

Scout training differs from many forms of training in that the scout does not receive his training by merely reading about it. It is a system of learning by doing. Scouting is just like basketball in that you can not become a good player by
merely watching the game from the side lines. You have got to get in there and play the game. Of course the scout program does not change a nobody into a good scout over night by pinning a Tenderfoot badge upon your coat and telling you to fly. It requires perseverance and interest to be a good scout and you can be sure the scouting will give activities and associations which won't let your interest lag. The scout trail is full of inspiration and joy.

The word of honor of a scout is as true as steel and as good as gold. If he were to violate his honor by telling a lie or by not doing exactly a given task, he may be directed to hand over his scout badge. By his clean cut means of living, the scout in time wins the confidence and respect of everybody.

He is clean in thought, speech and body. He does not drink intoxicating liquors because he knows they are poisonous to the body. He values good health too much to have it destroyed by the use of tobacco.

A good scout is considerate of other people's rights and is respectable and courteous to all people, especially to older people, the crippled, weak, helpless and needy folks.

Danger does not stop a scout when someone's life is in danger. He is courageous and cool-headed in times of panic and his training as a scout enables him to meet emergencies without flinching. Of course the scout does not throw himself into a burning building or into a river just to show he is brave. No! That is not the attitude of a scout. He thinks before he leaps but, if it is necessary, he will risk his life to save the life of another.

The Scout takes as his motto, "Be Prepared." Every scout knows that if he is to be of value to himself or anyone else, he
must first prepare himself. When a tornado struck Omaha or Southern Illinois — when floods swept Pueblo — when an earthquake and fire hit California, and when powder magazine exploded in New Jersey — the scouts showed their preparedness and readiness to serve. Fifteen hundred lives have been credited to be saved by Boy Scouts during the twenty years of its existence. The motto, "Be Prepared", can well be applied to everything else in life.

The Boy Scouts of America have a real aim in view. That aim is to build up its members physically, mentally, morally and spiritually, and give you activities and experiences which, through fun, will develop good habits and character that will make your whole life a fuller, happier and more useful one.

Upon joining the Boy Scouts of America, the prospective member takes the following oath:

On my honor I will do my best —

1. To do my duty to God and my Country, and to obey the Scout Law.
2. Help other people at all times.
3. To keep myself physically strong, mentally awake, and morally straight.

The twelve points of the Scout Law are briefly: A scout is trustworthy, loyal, helpful, friendly, courteous, kind, obedient, cheerful, thrifty, brave, clean, and reverent.

All this may seem very serious and dignified to the boy who had just joined, And so it is, for he has taken the first really important step of making a man of himself. And yet all this development will come through the doorway of fun.

The scout gains many valuable and interesting experiences while doing his "daily good turn" which is a part of every scout. By "daily good turn" of a scout, it is meant that the scout does
something each day to help someone else.

As has already been mentioned, scouting is available to farm and city boys alike. The Boy Scout program was formerly available only to boys whereas it was possible to have a troop of twenty or more members.

Mr. Boyce, who was very interested in boys and the prospect of giving farm boys a chance to participate in scouting, formed the Lone Scouts of America in 1915. The L.S.A. was an organization for, of and by boys whose purpose was cooperation and friendliness and whose purpose is Self Respect. The Lone program had many benefits and advantages over the Boy Scout program. The points about the L.S.A. are too long to be discussed here at this time.

In 1924 the Boy Scouts of America merged with the Lone Scouts of America to form a single but stronger unit. The change was regretted by most active Lone scouts at that time, but old timers who have been with the scouting movement for five, ten and even twenty years cannot look into the present Lone scout program without truthfully saying that rural scouting is better today than ever before.

Since the merger of the L.S.A. with the B.S.A. we, the Lone Scouts, have enjoyed every benefit and privilege that the Boy Scouts have. In fact, there is no distinction between the two. A Lone Scout is a Boy Scout of America. We, the Lone Scouts, have the same privileges, enjoy the same worldwide brotherhood of the organization, wear the same uniform and the same insignia as the Boy Scouts. The Lone Scout can win merit badges, attend the regular summer scout camps, rallies or any other scout gathering, compete in contests and enjoy all of the other benefits of the
The highest rank in Scouting is the Eagle Scout rank. The scout's first step is to become a tenderfoot. Each rank has requirements which must be passed before the next rank can be won. The ranks consist of: Tenderfoot, Second class, First class, Star, Life and Eagle Scout ranks. Each step becomes increasingly more difficult, but always more interesting as the scout progresses up the ladder to Eagle Scout rank. To become an Eagle Scout, the scout must have won at least twenty-one merit badges including twelve required merit badges.

There are over ninety available subjects in which you can win a merit badge, including such as Agriculture, Angling, Aviation, Camping, Civics, Conservation, Electricity, Forestry, Life Saving, Music, and Journalism. The education received from passing the tests of the Eagle Scout rank is so great that it is considered the equivalent to a college education. It has the advantage of helping a fellow find out what line he would like to take up as his life work.

The Lone Scout enjoys two other phases of scouting outside the regular Boy Scout program. These are Boosting and Contributing. Contributing is the writing phase of scouting. There are four medals which can be won by a scout for his achievements of writing stories, poems and articles and having them published in newspapers or magazines to score the required number of contributing points. The Lone Scout Quillio Award is awarded for 1300 contributing points. The fact that only about sixty of these awards have been made during the last sixteen years should not disappoint scouts from striving for this honor, but should rather encourage him to become one of these.
We need council chiefs, district leaders and local scout leaders but what we need more than anything is boosters. A scout participates as an individual scout and because he gets a lot of joy out of scouting, he unselfishly passes the word about scouting on to other boys and gets the cooperation of a group of boys into a scout troop. Scouts, give the Boy Scouts of America your honest boosting, for it needs every bit of your support.

Having discussed briefly the aim, meaning and benefits of the Boy Scouts of America, it would not be complete without an actual demonstration of some of the activities. The activities are, of course, too numerous to demonstrate all of them so I have only chosen a few. They are knot tying, first aid, signalling, fire by friction, and the American flag.

(Demonstration)

In closing I wish to say to all scouts: Be up and coming and take advantage of what scouting offers you. Don't sit back and watch the other fellow; do the work and have the fun. Break out of the old shell; make the Eagle Scout and Supreme Scout ranks your goal and, with it, a strong and noble character, a strong body and a sound mind.
SANITARY WAYS OF SEWAGE DISPOSAL

George H. Schulz '31
Fergus Falls, Minnesota

Dedication

In grateful acknowledgment for my education, I sincerely dedicate this thesis to my father and mother for their great help and encouragement.

Septic Tanks

With the increasing popularity of modern plumbing fixtures, in the farm home, the method of disposing of the waste water or sewage becomes an exceedingly pertinent one.

There are two ways by which sewage can be disposed of on the average farm; first, the cesspool. This method is merely running all waste into a hole dug in the ground in which the solid matter will settled to the bottom until the hole is filled. A new one is then dug and the process is repeated over again. It is obvious to anyone that such a system is undesirable. With this system the soil becomes contaminated, thereby, infecting the water supply, which may be the direct cause of such diseases as typhoid fever, tuberculosis, dysentery, diarrhea, cholera, infantum, and hookworm.

The second method of disposing of sewage is by the use of the septic tank. This is the only sanitary and safe way of taking care of household waste.

A septic tank is simply a water tight concrete tank built under the ground. The sewage is piped into the tank at one end. It is held in the tank for a short time to allow the septic action to take place. The overflow pipe is in the other end. This overflow water or effluent is clean and odorless.
It may be piped to an open ditch without fear of becoming a nuisance.

A septic tank is a device whose primary purpose is to aid in the inoffensive disposition of human and other wastes. As the name implies, this disposition is accomplished by means of septic action, which consists of the breaking down of various organic substances into simpler compounds or even into the elements themselves. This process is commonly known as putrefaction or rotting. All organic substances are subject to this rotting action which takes place more or less rapidly depending upon conditions.

Perhaps the easiest way to understand this process of septic action is to think of its opposite. We are all familiar with the methods employed in preserving food stuffs, such as meats, milk, fruits and vegetables. They should be kept in cool, well ventilated places. Sometimes preservatives of one kind or another are used, or possibly the food is heated by boiling or otherwise. The purpose of all this is to retard or entirely prevent bacterial growth and consequent spoilage. Again, strong disinfectants or deodorants are used to kill bacteria after they have made a start. Chloride of lime and "sani-flush" are substances commonly used for this purpose. If the owner of a septic tank will remember that anything which will retard bacterial growth is bad for a septic tank, and keep such things out of the tank, he will be more apt to get good results.

There are kinds of bacteria not all of which are harmful in the sense that they cause spoilage. The two types most important in septic action are known as aerobic and anaerobic. The former works and thrives in the presence of air, while the latter does best in the absence of air. The former works in the scum and on the surface of the tank liquid, while the latter is
at home in the bottom of the tank. Both types are useful in a
septic tank, but the ones that live and multiply in the bottom
of the tank are the most important.

Organic substances are almost entirely compounds of car-on and oxygen, hydrogen or nitrogen, or perhaps all of them.
These elements in themselves are practically odorless and taste-
less, but when combined in certain ways and proportions, are very
offensive. For instance, hydrogen, nitrogen, and oxygen, all
plain gasses, when combined in a certain proportion, form nitric
acid. Again, hydrogen, sulphur, and oxygen, all of the unoffensive
alone, produce the well known rotten egg smell. Hydrogen and
oxygen in the proportion of two to one form water.

The action that goes on in theseptic tank is about as
follows: a particle of organic matter enters the tank and ordinar-
ily sinks to the bottom. As soon as the bacteria begin to act
upon it, a certain amount of gas is produced, which causes the
particle to break up into smaller particles or perhaps the whole
mass rises to the surface of the liquid in the tank. In due time
the gas is liberated from the particles, which again sinks to the
bottom. This process continues until the whole mass is broken
up into the elements or into stable compounds as water. The
gasses find their way out through the vent or are combined to form
various substances. The final residue, consisting very largely
of carbon, settles to the bottom of the tank and forms what is called
sludge. This sludge is very little heavier than the water in the
tank and should not be disturbed by the entering sewage.

Part of the entering sewage is lighter than water, either
due to the nature of the substance or to the gasses contained in
it and floats on the surface. This material forms a scum over
the surface of the liquid and is the home and breeding grounds
for those bacteria that need air for their life processes. Unless
this scum becomes thick enough to cause trouble, it should not be disturbed. Under certain conditions this scum becomes very thick and leathery and may occupy all the space above the liquid in the tank to the exclusion of the necessary air. In such a case, it should be removed or broken up and pushed down into the liquid. In general, the scum may be ignored in all domestic septic tanks.

Septic tanks do not always do what is expected of them and the failure may be and generally is due to some fault of construction or operation. One of the most important reasons for failure is a too diluted condition of the entering sewage. Water is universally used as a medium for conveying the sewage to the tank. It should be remembered, however, that water, in itself, is not offensive, nor does it need septic treatment. Wherever it is possible, the rains from the lavatory, the bath tub, the kitchen sink, and the laundry tubs should lead around the septic tank and not through it. When a tank is working properly, the liquid leaving the tank will be almost clear and practically odorless, and may be disposed of very easily. If, however, all the house water is run through the tank, it keeps the contents thoroughly stirred up and the effluent will carry considerable solid matter with it. In order to reduce this stirring up action to a minimum, the inlet should be under the surface of the liquid and baffled in such a way that currents in the tank are prevented.

There are two styles of septic tanks. They are the single and double chamber. The bacterial action is the same in either, but in the double chamber, the waste is retained a little longer, and therefore, a more thorough action is derived. The septic method is the most satisfactory method of the disposal of household and other waste, where a municipal sewage is not accessible.

There are also two general methods for the disposal of
the tank effluent, sub-surface irrigation and dilution. The first method consists of emptying the effluent into tile lines which are buried in convenient places. In general, these tile lines should be as near two feet under the surface as conditions will permit. The tile, preferably clay drain tile, should be laid with open joints and, if in parallel lines, not closer than twelve feet apart.

Common practice calls for about one foot of tile for every gallon of tank capacity where the tile is laid in sandy or gravelly soil. If the soil is heavy loam or clay, not less than two or more feet of tile should be provided per gallon of tank capacity. Wherever tile disposition is practiced, it is advisable to use some sort of automatic siphon for periodically dosing the tile lines. Ideal conditions are such that the dose is spread over as large an area as possible and then this area be permitted to rest as long as possible in order to absorb or assimilate the dose.

The second method of disposition of the effluent is, if the conditions are such that the effluent may be emptied into a running stream or ditch at some distance from the house or other buildings. In this case the siphon may be omitted and all of the house water put through the tank. The sewage will, under ordinary conditions, be diluted to a state of inoffensiveness.

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Soils
THE SOILS OF MINNESOTA

George Beatty '31
Euclid, Minnesota

Dedication

This senior thesis is dedicated to all who are interested in the study of soils at the Northwest School of Agriculture.

Foreword

The greatest of Minnesota's natural resources is her soil. It is one indestructible storehouse of the food supply for the present and future generations.

Minnesota is a state of varied natural resources. Within the boundaries of the state are the oldest formations in the world, the ancient granites, and the youngest formations, the glacial deposits.

The fertility of the soil is not a matter of chance, but a product or result of activities that have long been going on. The best method of approach to an understanding of the soil is through a study of the way by which the soils were formed.

The soil as a unit is made up of various mineral that have been crushed or otherwise broken down into the smaller particles. These particles mixed with organic matter form the soil as we know it. Soil has been defined as that in which plants grow. It has been defined by Professor Daniel E. Willard as rock dust, organic matter and moisture well mixed. One of the most important things about the soil is the subsoil. Subsoil is the layer or portion of the loose mantle covering the earth that lies immediately below the productive portion of the soil. On one hand it is of the same nature as the overlying soil except for changes
that have been brought about by weathering, and on the other, it is like the underlying rock or formation from which it has been formed. Subsoil differs from soil in that it lacks humus or organic matter, it is less oxidized and is more compact. Subsoil differs from soil in color and may often be distinguished by this means.

Minnesota soils are naturally rich because they are made up of a mixture of many kinds of broken rock with age-long accumulation of decayed organic matter. The character of the rock determines the chemical elements that the soil may contain. About every kind of known rock has entered into the formation of Minnesota's soils. The surface formation of nearly all of Minnesota is a glacial one, a mixture of fine and coarser rock materials transported, broken and pulverized by glacial ice.

The greater part of all the glaciated land surface of Minnesota is what is known as till plain, or ground moraines, and is fairly uniform over wide areas. Next in extent and importance are the belts and ridges of terminal moraines. These like the till plains are a direct deposit from the melting ice of the great glaciers. The soils of the terminal moraines are generally somewhat more porous than those of the till plains and the moraines are more or less stony.

Drift materials which were assorted and deposited by ponded glacial waters, known as lacustrine or lake deposits, make up another important class of glacial soils. The largest and most important area of this class of soils is that of the Red River Valley or the bottom of the glacial lake Agassiz. The soils of this class vary from the heaviest clay formations to the light sandy and gravelly types of soil found near and on the shores. The lacustrine soils are among the most productive in the world.
In the southeastern corner of the state embracing Houston and the eastern part of Winona counties, the glaciers never came. This area is a part of the driftless area of the upper Mississippi Valley. The bed rock is a limestone formation and a residual clay subsoil has been formed from the weathering of this rock. A wind blown silt loam covers the higher land, the gentler slopes and even the cliff slopes where it is not washed away. Limestone rock may be seen along the edges of bluffs and the steeper valley sides.

West of this driftless area is a district covering several counties which, like the driftless area, is well drained and has no lakes. It was, however, covered over with a mantle of till during the earlier glacial invasions. This drift deposit has been covered to a depth of fifteen to twenty feet with wind blown loess. The deposit made by the ice has been eroded or washed away to a great extent and it is not sufficient to entirely fill the old valley's. The present surface is that of an old well drained landscape, having the valley's partly filled with drift. This section of Minnesota ranks high in livestock and diversified farming.

A vast region in northwestern and northern Minnesota is embraced in a region that was covered by the waters of the glacial lake Agassiz. The five counties of Red Lake, Pennington, Marshall, Kittson and Roseau are entirely included in this area and portions of the following twelve were included within the boundaries of the lake. The counties are Traverse, Clearwater, Beltrami, Koochiching, Stevens, Grant, Ottertail, Wilkin, Clay, Norman, Polk and St. Louis.

There were four types or classes of soils formed from the lake deposits. These soil deposits occupy a somewhat irregular area in the old lake bed. The four classes or types are, first,
lacustrine or lake clay soils; second, sandy soils formed from washed sediments; third, soils formed from lake washed till, and, fourth, swamp land including deep peat and muck.

The largest portion of the Red River Valley in Minnesota is a belt extending east from the river sixteen or eighteen miles. In this part of the lake, the finer sediments were deposited. The soil in this district is a heavy clay or clay loam. This belt of finer sediments merges into a sandy belt on the east or shore side of the lake bed.

The lake washed sand region of the Red River Valley extends from northern Wilkin county northward to the international boundary bordering the east side of the clay belt. In northern Polk county, the shore of Lake Agassiz bears abruptly to the east; the belt of lake-washed sand, however, continues northward. In central Polk, western Red Lake, western Pennington and central Marshall counties, sandy and gravelly beach ridges are numerous and between these ridges the soil is clayey in large part.

A considerable area of lake-washed clayey till occurs in five of the afore-mentioned counties. The soils that have been derived from this till are generally loams varying from a heavy clay loam to a light sandy and gravelly mixture, and all generally with a clay subsoil.

Clayey lake-washed till and swamp make up the greater part of the ancient lake bottom eastward from Red Lake, Marshall, Pennington and Roseau counties.

The southern shore line of the great lake was south of lower Red Lake. The most extended point of the lake to the east was ten miles west of Tower south of Vermillion Lake in St. Louis County. From this point the shore extends northeast to the international
boundary line.

In closing I only wish to say that I have found the study of this subject very interesting.

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Biography

This thesis has been written from material selected from lectures in class notes taken from several agricultural bulletins concerning this subject from the textbook that is used by the Senior Class on the subject and from Professor D. E. Willard's famous book, "The Story of the North Star State."
MAJOR SOIL DIVISIONS OF THE UNITED STATES

Herbert W. Schroeder '31
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Dedication

I sincerely dedicate this term paper to Mr. R. S. Dunham, who has greatly assisted me in preparing and securing material in regard to this subject, and who has been my faithful teacher, and through his teaching, I have learned much.

Over fifteen hundred kinds of soils, regardless of textural differences have to date been identified. This list is so large and there are so many different kinds of soils found that even the soil specialists have difficulty in remembering them. As time goes on, several hundred more kinds of soils will undoubtedly be added to the sum.

First Attempts to Classify Soils

The early soil investigator had nothing to go by to classify the soils, because it was a science and was related to soils. Geologists thought that soils were related on the basis of rocks from which they came. Limestones or sandstones, for example, were supposed to yield soils of the same character. No geologist in the United States is known to have made an attempt to establish this idea, as a fact through the study of the soil itself, further than to make some general texture comparisons of the soils, but it furnished the basis for soil students.

The two major groups in geologic classification of soils are the residual and transported. The residual group was then sub-divided in accordance with the rocks paying attention to the collection formed in limestones, sandstones, etc.

The transported soils group was sub-divided in accordance
with the forces which had transferred the deposits, glacial, solian, etc. This system was not only used in this country, but was also extensively used abroad. It furnished the chief basis for the well known official studies and soil map of the Bureau of Soils, published as Bulletin 98 in 1913, and the earlier work of G.M. Coffey in 1911.

**Disadvantages**

The disadvantages of the geologic classification are:

First, the basic features of normal soils were determined by their parent material. Basic features of soils are not determined by parent material. Such classifications did not tell anything of the soil itself. Second, it was found that soils derived from unlike parent material were in many cases fundamentally alike. It was found to be wholly impossible to harmonize fundamental soil characteristics with geologic characteristics or any other basis than the complete independence of the one from the other group of characteristics. It is evident that definitions and groups based upon geologic classification that trace back to parent material reveal nothing of importance about the fundamental nature of the soils and are therefore of no value in making geographic studies. They merely classify the properties of the soil.

Third, this system of classification of soils was too complicated as it had too many classes.

This discovery explains differences and similarities between soils not explained by geologic classification of soils. Probably the most significant thing that modern soil science has found out is that soils pass through cycles of development resembling those of animals, that there are young, mature and old soils. This does not mean that every soil will in the course of time pass through the complete cycle from infancy to old age,
but that when conditions are favorable, for the completion of the cycle that exists in the case of any soil, such a soil in the course of time becomes mature and then old. It furnishes the key to both the striking differences between certain soils which it would appear should be alike, and closer resemblance between other soils, which should be dissimilar.

Mature soils have normally developed profiles. ("The series of layers in any given soil is designated as its profile.") They are characterized by those features which all soils of a given environment acquire when undisturbed by erosion or deposition through an extended period of time. They occupy relatively level surfaces, such as smooth uplands and terraces, and are formed under good drainage conditions.

Young soils have incompletely developed profiles and show the characteristics of their parent material to a greater or less degree. Young soils have the same relation to an old soil that a calf has to a cow. They occupy flood plains where new sediments are deposited and hilly lands, where the surface is being continuously removed by erosion and the underlying undeveloped formation is brought to the surface.

Old soils have passed maturity. They have the same relation to a young soil as a cow does to a heifer. They have lost some of the essential characteristics of normal soils and have acquired abnormal features. Most of them occupy old flat land surfaces which have not been disturbed for long periods of time.

Soils with the same properties are put in the same class, whereas, in the geologic classification, soils with the same general properties, but in different locations, and with different parent material were placed in different classes.
Second, differences between soil classifications are differences of the soil itself and not of climate, crops, parent material or age, which were used in geologic classifications of soils.

Third, the present classification is very much simplified compared to the geologic method.

The most striking and unique scheme of classification based upon the soils chemical features is that proposed by Marbut. He restricted his groups to normal members and separates the soils of the United States into two major divisions or groups, which he qualifies as lime-accumulating and non-lime-accumulating.

The Pedalferic group is the non-lime-accumulating group and is developed in a low average precipitation consisting of grasses or shrubs.

This method of grouping soils not only meets the requirements for geographic inquiry, but it also includes several features of particular merit. It is limited to mature soils. The age group under normal geographic conditions of a region, when reviewed in a general way, having adjusted themselves to normal soil conditions of a given area. This plan of division separates the soils into two groups of very unlike character.

Pedalfers - The pedalfers occupy the entire eastern half of the country as well as numerous areas scattered through the west. The western mountains include much rough, stony land on which soil development has taken place only locally.

Climate is the most potent in determining mature soils basic characteristics. One of the principles of modern soil science is the doctrine that "climatic forces are the predominating soil forming agencies of the world." They control the moisture and temperate conditions which the complex changes in both mineral and organic matter takes place.

The pedalfers are humid soils. The minimum average annual
rainfall under which they occur is about twenty-five to thirty inches the amount necessary to produce their features varying slightly with such factors as latitude and parent material. Under given climatic conditions, the soils derived from coarser parent materials absorb moisture more rapidly and, hence, experience the effects of more humid conditions than soils evolved from finer material.

**Temperature** - The average monthly temperature under which the pedalfers of the United States have developed range from less than 0° F to more than 65° F in January and from less than 65° F to more than 80° F in July. The difference in temperature bring about the development of unlike groups within the pedalfers.

**Natural Vegetation** - Vegetation is of major importance upon the fundamental features of soils. Determined in a broad way by climate, it plays an important part both as a living organism and as a dead organic substance.

The parent material from which the pedalfers have evolved is of all the great rock groups: namely, sedimentary, igneous and metamorphic rocks. On the study of soils, parent material may be mainly neglected.

The surroundings under which the pedalfers have evolved has been such that it maintained the soil and parent material in a moist condition to great depths. This is the result of the abundant precipitation of at least twenty-five to thirty inches annually. It is also due, however, to the character of the natural vegetation and forest formation. Materials upon which pedalfers depend are to a great degree carried out of soil and lost in drainage water by heavy rainfalls.

The pedalfers are made up of five great sub-groups, to which the names, podsols, grey brown ertho, red and yellow erths, ferruginous lateritics and prairyerths have been applied.
The pedocals are western soils. Unlike the pedalferic group, they are not developed in both divisions of the country. The principal unbroken body which lies east of the Rocky Mountains is considerably smaller than the pedalfers. West of the Great Plains the area is to a great extent interrupted by extensive areas of rough stony land and local developments of pedalfers.

The pedocals are semi-arid and arid soils. The maximum precipitation under which they evolved is about twenty-five inches annually.

The average monthly temperature range is about the same as that of the pedalfers. The July limits are approximately 65°F and 90°F and the January 6°F and 55°F. As in the case of the pedalfers the difference in temperature has brought about the formation of unlike groups within the major division.

The natural vegetation of the pedocals is most briefly described as non-forest. The plant found is usually grasses, but there are also brush and shrubs. The prevailing vegetation in the principal body east of the Rocky Mountains are grassland communities.

The parent formation of the pedocals includes a wide range of materials. They are mostly glacial deposits, alluvial fan and plain materials, marl and chalk, loess, sands and clays. There are also residual accumulations derived from sandstones, shales, limestones, and crystalline rocks. The relationship of the parent materials to the mature pedocals as a group is of minor importance.

Low rainfall under which the pedocals develop is such that soil material is maintained in a continuous moist condition to only limited depths. In fact, this is the most striking
differance or influence affecting the evolution of the major soils divisions. When the moisture column is unbroken to the water table, materials extracted by solution are subject to complete removal in the drainage waters. The less soluble materials are deposited at higher levels and the depth of penetration is naturally greater in soils of coarser textures.

The pedocals are divided into four great sub-groups: namely, the blackerths, the chestnuterths, the brownerths, and the grayatherths.

In comparing the area of distribution of the major soil divisions with the land under cultivation, it is apparent that the pedalfers comprise the principal agricultural soils of the United States. Their area of distribution includes the largest proportion of land in harvested crops within the country. Outside the northern and southern margins of the major eastern body, there are few extensive tracts viewed in a large way, which do not include crop lands.

Such relationships as have been noted in the survey brings out the fact that the United States possesses two major soils divisions of markedly unlike character. One of these divisions as a whole, is naturally relatively poor and of low fertility, while the other is comparatively rich and of high fertility. The poorer division, the pedalferic, is the leading agricultural soil, and one of great diversity in spite of its natural poorness, whereas the rich division, the pedocalic, is the principal pastoral soil with only agricultural adjustments of near character.

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GEOLOGICAL FORMATION OF NORTHEASTERN MINNESOTA

Vernon Erickson '31
Badger, Minnesota

Dedication

I wish to dedicate this thesis to all people interested in the soil formation of Northwestern Minnesota and especially to Mr. R. S. Dunham of the Agronomy Department at the Northwest School of Agriculture.

Foreword

It is my aim in writing this thesis to set forth some of the facts concerning the soil formation of Northwestern Minnesota. If I have accomplished this, I am well satisfied.

It should be of interest to everyone to have a knowledge of the way the soil was formed and more especially to the farmer who is directly dependent upon the soil for his living. Yet I wonder how many know how the soil was formed.

Many years ago huge glaciers crossed northwestern Minnesota as well as other parts of this state. These glaciers were the result of many years of ice accumulation in the far north. The glaciers crowning Minnesota had three sources known as the Keewatin, Patrician, and Labradorian centers of ice accumulation. The Keewatin center of ice accumulation was west of the Hudson Bay; the Patrician, south, and the Labradorian, east.

It has been found through a study of the glacial deposits in Minnesota and in neighboring states that the deposits which form so extensive a mantle are the result of more than one invasion of ice from the Canadian Highlands.

In the first invasion of ice known as the Kewatin drift, the greater part of Minnesota was covered except the southeastern and southwestern corners. This drift came from Manitoba as shown by the plentiful supply of lime carried by it into this part of
The movement of ice in the closing stage of the glacial advances was from the north and northeast. Those from the northeast were from the Labradorian center. There were two glaciers from this center, the Labradorian and Wisconsin drifts. Both of these drifts covered the greater part of the state, including all of northwestern Minnesota. The drifts from the Patrician center also covered all of northwestern Minnesota.

We know the path the glaciers have taken by the striae on rock out crops. One of these places is the rock out crop at Long Point near the Lake of the Woods. Distinct grooves are cut in the rock showing the course of the glacier.

The glacial advances did not all happen at the same time, but were so separated as to permit the invasion of one period to have large valley's cut in them before the next invasion occurred. The latter advances failed to cover some of the earlier deposits so they are exposed to view and the degree of erosion may be compared to that of the newer deposits. It has been found that the older deposits are so cut up by drainage lines that little undrained territory remains while the younger drift deposits have large lakes and undrained basins in them. It is because they were not covered by the last drift that the counties in southeastern and southwestern corners of the state have few lakes and little undrained territory, while northwestern Minnesota, which was covered by the last drift, has numerous lakes and a comparatively larger amount of swampy land.

In northwestern Minnesota, there are large areas of undrained land which are composed largely of peat and known as peat swamps. They are of little value agriculturally, because of the undecayed organic matter. They may become very productive, when
drained, if not of too great a depth. The reason Minnesota has so much peat swamp is that it was covered by the last glacial stage and therefore has a comparatively new formation of the soil, so the drainage system has not been able to work its way toward the drainage of these swamps.

In the front of the glaciers, large quantities of soil sediment were pushed and as the glaciers melted away, they formed the topography of the country. These deposits are called terminal moraines. Moraines were also formed by the action of the water within the glacier. The moraines are rolling stretches of land and may be found in a territory south of Red Lake, in southeastern Mahnomen and Becker counties, and also in central Ottertail County. Most of the moranic country is south and southeast of Crookston. There is a stretch of waterlaid moraine south and a little toward the east of Thief River Falls. This extends thirty-five miles and is about eight miles wide. The water laid moraine is the result of the deposits of lakes at ice borders and is usually smooth clay ridges. While the land laid moraine ranges from stony and sandy soil to heavy clay and few stones, all classes of morainic land are fair to good farm land.

As the glaciers melted away, they left two great lakes, Lake Duluth and Lake Agassiz. It is Lake Agassiz in which we are most interested as it occupied the Red River Basin. This lake extended as far as Lake Traverse and continued northward past the international boundary line. The action of the lake accounts for the different types of soil in northwestern Minnesota. The action of the water carried the finer sediment, such as clay and silt, into the deeper part of the lake and the coarser particles were washed up against the shore forming beaches. The most prominent feature about Lake Agassiz is the beaches or ridges of
sand and gravel washed up along the shore. They are from five to ten and sometimes fifteen or twenty feet high. They form wonderful lines for highways; therefore, much of the pioneer travel and settlement was along these ridges or beaches of Lake Agassiz.

By the cutting away of the outlet, the lake was lowered from time to time. In the first stages of Lake Agassiz, it drained toward the south, but as the glaciers, which blocked the north, melted away, it began draining toward the north. By the cutting away of the outlet, the lake was lowered from time to time. As a result of the gradual lowering of water, the lake was at some time subject to wave action. The deep part of Lake Agassiz along the Red River received nearly all of the fine sediment which was washed out from the till at higher levels. This forms the bulk of the black clay and clay loam of the Red River Basin. At its eastern boundary is a transition to sand. This is succeeded by stony sandy deposits which seem to be glacial material worked over by the lake.

Through a study of the soil in Northwestern Minnesota, it may be seen that it has passed through various stages of development until the present time, and is still gradually changing, but only in a small way. It may seem that it all happened in a short time, but it required a very long time to pass through all these changes.
THE GEOLOGICAL FORMATION OF MINNESOTA

Harold W. Olson '31
Beltrami, Minnesota

Dedication

In sincere appreciation of what has been done for me in making it possible to write this theme, I dedicate this thesis to Mr. R. S. Dunham of the Northwest School.

Preface

I presume you have all heard about the great ice sheet that came down from the north and covered the greater portion of Minnesota. This great ice sheet formed the landscape of Minnesota.

I wonder how many of us really know what is meant by the words, Landscape Geology. We speak of the land surface as the landscape. Has it ever occurred to you that this landscape came to be the way you see it today through a long series of processes? The land surface is not the same today as it was yesterday, and tomorrow it will be different from what it is today. The land surface is changing all the time. These changes are going on very slowly to be sure, but they nevertheless go on. They have been going on during the countless ages of the past and will continue as long as the earth stands.

The Landscape of Minnesota

The landscape of Minnesota is the expression of all that has gone on since the primitive crust of the earth first appeared above the waters of the Primeval ocean. The wind and the rain, frost and sunshine began their task of leveling down the landscape as soon as it appeared above the sea.

Natural Process of Weathering

The portion of the land surface above sea level is being
One of the most active of the natural processes by which land surfaces are worn away is that of running water. Wind piles up fragments of earth into hills, called dunes. Ice in the form of great glaciers has piled up masses of clay, sand, gravel and boulders into hills called moraines.

We can plainly see that the hills, hollows, plains and lakes are not distributed in any certain system or order. It is very hard to understand how it has been formed because the changing of the landscape has been going on for so many years.

**Glaciers**

Minnesota has been overrun with glaciers at four different times. The ice sheets have changed the landscape of Minnesota by forming hills and valleys, and by making lakes and level plains. It was through the action of these ice sheets that Lake Agassiz, or what is now called the Red River Valley, was formed.

**Hills of Minnesota**

There are seven types of hills in Minnesota. They may be divided into the following classes: hills of erosion, or those that have been formed by running water; hills of glacial deposit, or masses of earth material piled together by moving ice; hills of glacial erosion, or those that have been carved out of the landscape by the digging and scooping agency of moving ice; hills of windblown sand; loess hills, or masses of fine grained material borne by the wind and deposited as dirt; hills of uplift, or higher parts of the crust of the earth pushed up by forces within the earth.

1. Hills of Erosion - The side of a valley is a hill.

If valleys are close together, they are parted or separated by hills. When it rains on the land, water runs down the hillsides and down the valleys, that is, low valleys and hills. This is how hills of erosion are made.
(2) Hills of Glacial Deposit - Throughout a large district in central and southern Minnesota occur hills of variable size and of very distinctive character. They differ entirely in appearance from the hills of Southern Minnesota. There is no general uniformity in their height. They are often not separated by valleys, but rather by hollows without outlets. They are sometimes stony in character, the stones being of great variety and nearly all rounded in form. They are mounds or piles of earth carried or "drifted" by glaciers from Canada, and thrown down wherever the end of the glacier happened to be at different times.

The "drift" landscape is often very rough and irregular. The hills vary in size from little knolls a few feet in height to massive hills 150 feet or more in height. They are made up of clay, sand, gravel cobbles, and boulders.

(3) Hills of Glacial Erosion - These hills are different from those that were just described in that these hills are made of rock fixed in position and generally of one kind. These hills are generally composed of hard rock, because otherwise they would not have withstood the weaving, breaking and crushing power of the great ice sheet. Hills of this character occur in the vicinity of Carlton in Carlton County near the city of Duluth, in the neighborhood of Vermillion in St. Louis County, and also in the county about Rainy Lake.

(4) Hills of Wind Blown Sand - The wind is sometimes an active agent in shaping the landscape forms. Sand and dust borne by the wind and drifted into piles form dunes. There are two general types of dunes, those that are of fine dusty sand, and those that are of coarser materials. Minnesota dunes are mostly of the dusty variety. The dust holds moisture; hence, such dunes are productive.

(5) Loess Hills - These hills are thought to have been formed from dust carried by the winds which settled in grass and woods until
a thick coating was formed. This type of hill is well developed south of Red Wing and Cannon Falls.

(6) Hills of Uplift - Volcanic hills and hills formed by the upward thrust of the crust of the earth are found in the northeastern part of Minnesota. The hard rocks of which these hills are formed are known as igneous rocks.

(7) Volcanic Hills - These hills are formed by a violent explosion or upheaval from within the earth. These hills are the highest of any in the northeastern part of Minnesota. In Cook County, some hills rise to 2200 feet above sealevel, or 1600 feet above Lake Agassiz.

Turning again to the surface formation of Minnesota, we find that there are a great number of different kinds of soil. The Lake laid soil along the Red River basin is a clayey type and the largest part of it is of high fertility. The land laid soil is divided into two classes, the sandy type in southeastern part of White Earth county and part of Hubbard county, and the clayey type is in eastern Polk county, and western Mahnomen county. The lake washed soil is a clayey type found in parts of Pennington, Red Lake and Roseau counties. There is a considerable amount of swamp land north of Red Lake in Red Lake county and part of Beltrami county. There are some parts of the state that are quite sandy and not such a productive type of soil. There is also a great number of gravel ridges around which is usually found a small part of stony land.

Looking again at the landscape of Minnesota, we find that this state has several rivers and yet a great part of the land is a swamp or rather unproductive land. Upon studying the matter closer, we find that the rivers are very small and, therefore, dirty, and sluggish. We find that the same thing is true with the lakes. We find that the rivers have no certain system or order. A river may flow in one direction for several miles and then it may turn directly...
around and flow back almost in its same path. We see a river takes its origin in some higher plain and flow away into some swamp or marsh land somewhere.

The Old Landscape Becomes New

When the glaciers moved from Canada during the glacial period they put a new face on Minnesota. On the new facethere are many lakes of all sizes and all depths, lakes many miles in area down to frog ponds and sloughs. On the old landscape there were many streams and all of them had regular valleys of erosion, while on the new surface there are some streams with valleys, some valleys without streams, and in some places neither streams nor valleys, only lakes and sloughs. Since the glaciers melted, for thousands of years the streams have been working at valley making again, but it will be many thousands of years yet before the valleys are "old" again - before all the lakes will be gone, their basins cut across by valleys and ravines, and the hills rounded by erosion, and deep valleys carved in this young glacial landscape.

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THE ORGANIZATION OF THE GOVERNMENT OF MINNESOTA

Arthur Paulson '31
Detroit Lakes, Minnesota

Dedication

In appreciation of the interest taken and the assistance rendered, I dedicate this thesis to Mr. E. R. Clark.

Foreword

My purpose in writing this thesis is to set forth in a brief, simple form the skeleton structure of our state government.

The government of Minnesota, like that of other states, is vested in three departments - the legislative, the executive, and the judicial. Among these three departments and their lower organization are distributed all the powers of government which the state derives from the state and national constitutions. All three departments are necessary to the existence and continuance of the government.

The legislative power is vested in a legislature consisting of a senate and a house of representatives. The house of representatives is made up of 137 members who are elected for terms of two years. The senate consists of 67 members elected for four years. There are 67 legislative districts in the state divided roughly according to population. There is one senator and one or more representatives from each district. Members of both houses are nominated and elected on a non-partisan ticket. They are elected at the regular state election held the first Tuesday after the first Monday in November. Should a vacancy occur in either house, a special election is called in that district by the governor.

The legislature meets in regular session on Tuesday after
the first Monday in January in every odd numbered year. The constitution provides that no session shall exceed ninety legislative days. An important part of the legislative work is done by committees in both houses. All bills pertaining to such subjects as judiciary, finance, education, public lands, etc. are referred to the appropriate committees.

The executive department includes the governor, the secretary of state, the state auditor, the state treasurer, the attorney general, and the railroad and warehouse commission. It also includes a number of boards and commissions appointed by the governor with the consent of the senate. The elective officers are nominated by parties at the state primary elections in June and are elected at the regular elections in November. All hold office for two years excepting the auditor and the railroad and warehouse commission whose terms are four years.

The governor is the chief executive officer. It is his duty to see that the laws are enforced. He appoints the various officers of the state who are not elected and members of several boards and commissions. He can call the legislature in special session and can sign or veto bills passed by the legislature. As he is usually the leader of the majority party, he exerts a great influence on the legislature politically.

In case the governor for any cause or disability is removed from office, the lieutenant governor takes his place. The lieutenant governor is also the presiding officer of the senate.

The most important duty of the secretary of state is the preservation of state records. All public records, reports, laws, and resolutions are enrolled in his office. He has charge of all elections. He issues articles of incorporation and license for motor vehicles. He is also the keeper of the great seal of Minnesota.
The auditor is one of the most important executive officers. He has charge of all state lands, forest and mineral resources. He issues warrants on the treasurer for all money authorized by law to be paid by the treasurer. He keeps an account of all the taxes collected in the state.

The treasurer receives and has charge of all money belonging to the state and pays it out on orders issued by the auditor. He must deposit the money as directed by the executive council.

The attorney general is the law officer of the state. He acts as legal adviser to the other officials and represents the state in all suits in which the state is involved. He must prosecute criminal cases in district court if he is requested to do so by the county attorneys. He also gives opinions on the constitutionality of laws passed by the legislature.

The railroad and warehouse commission consists of three members who are elected for a term of four years, two being elected one year and one two years later. The work of this commission embraces the supervision of railroad rates, telephone companies, and other public utilities. They license grain elevators and public warehouses, and have charge of the state grain inspection.

The judicial power of the state is vested in the supreme court, in the district courts, in probate and justice courts, and in police and municipal courts.

The supreme court consists of seven judges chosen by the electors of the state to serve six years. Two terms are held each year at the state capitol. This court passes on the constitutionality of laws enacted by the legislature. Its jurisdiction extends over the entire state and is both original and appellate.
Its original jurisdiction is very limited. Its work is confined chiefly to cases appealed from the lower courts.

The state is divided into nineteen judicial districts. Each district elects one or more judges for a term of six years. In case of vacancies, the governor appoints judges to fill the unexpired terms. These judges have original jurisdiction in civil actions within their districts when the sum in question exceeds one hundred dollars and in criminal action when the maximum punishment exceeds three months imprisonment, or a fine of one hundred dollars. Two terms are usually held in each county each year.

The justice court is the humblest court in the land. It is presided over by a justice of the peace. There are two justices for each township or village and two or more for each city. In the townships and villages, they are elected at the regular town meeting and serve for two years. They have jurisdiction in all civil cases in which the amount in dispute does not exceed one hundred dollars, except when real estate is involved. They have jurisdiction in criminal cases if the punishment does not exceed a fine of one hundred dollars or three months imprisonment. Their jurisdiction extends over the entire county in which they are located.

There is a probate court in every county. The judge is elected for four years and vacancies are filled by the governor. This court probates wills, administers real estate, appoints guardians for minors and examines people suspected of being insane and commits them to an asylum.

For the purpose of local government, the state is divided into counties, townships, and school districts. Certain communities with large populations are organized as cities and villages.

Minnesota is divided into 87 counties. A county is or-
organized by the legislature on petition by the voters in that dis-
trict. The county affairs are handled by a board of commissioners,
an auditor, treasurer, register of deeds, a sheriff, county attorney,
judge of probate, surveyor, coroner, clerk of court, and a superin-
tendent of schools.

The county board consists of five members from as many
districts. Each district is represented by a commissioner who
must be a resident and voter in that district. They are elected for
four years and vacancies are filled by appointment by the chairmen
of the town boards of the district in which the vacancies exist.
Their duty is to manage the county business, levy the county taxes,
build roads, care for the poor, and appropriate money for all
county expenditures.

The auditor is the county bookkeeper. He attends the
sessions of the county board and keeps a record of the proceedings.
He countersigns all records for payment of money approved by the
board. He keeps an account of all receipts and expenditures of
the county and prepares an annual statement of the county finances.
He computes the taxes for each person in the county. He also
prepares the ballots for county elections.

The treasurer receives the taxes and pays out money
upon warrants issued by the board of commissioners.

All deeds, mortgages, and other important documents are
required by law to be registered in the office of the register of
deeds. He registers the description of the pedigrees of purebred
livestock and may be authorized to issue abstracts of titles to
real estate.

The sheriff is the executive officer of the county. It
is his duty to preserve the peace and keeps the county prisoners.
He also serves legal papers such as notices of mortgage foreclosures
and judgments.
The county attorney is the legal officer and adviser. He appears in court in all cases in which the county is a party and in criminal cases, he represents the state as prosecutor.

The principal duty of the coroner is to hold an inquest upon the body of any person who has met a violent death.

The surveyor makes the surveys and supervises the construction of county roads, bridges, and any other construction work which the county undertakes. ??

The county superintendent has general charge of the rural public schools.

The next unit of government is the township. The political unit called the town or township is built upon the congressional township which is an area of land six miles square.

The town officers consist of three supervisors, a clerk, treasurer, assessor, two justices of the peace, and two constables. These officers are elected at the town meeting held each year the second Tuesday in March.

The supervisors serve three years and all the other members for two years. Vacancies are filled by the board itself. The supervisors act as the board of health and equalization, and as judges of elections. They levy the taxes for town roads, and allow bills against the town.

The clerk keeps the town records, such as records of town meetings and elections and a list of births and deaths. He countersigns all orders on the treasurer. The treasurer keeps the town funds and pays out the money on orders signed by the clerk. The assessor fixes the value of all personal property in the town each year and on real estate every two years.

The smallest unit of government is the school district.
There are two important types of school districts in Minnesota. They are the rural or common and the independent. The common school district is organized by the county board on petition by the freeholders in the district. The school meeting is held on the third Tuesday in July. At this meeting the officers are elected, money is appropriated for the coming term and salaries for the officers for the past year are fixed.

The board consists of a chairman, clerk, and treasurer. These officers have general charge of the business of the school such as employing a teacher and providing supplies for the school. They serve for three years and vacancies are filled by appointment by the board.

The independent district differs from the common district in that it has six members on its board. They serve for three years, two being elected each year. This board in addition to performing the duties of the common school board, levies the taxes and appropriates money for the maintenance of the school.

Our government is constructed so as to maintain a balance between the state and federal governments, and between the state government and the lower organizations. Under this system more benefits are secured for a greater number of people with less interference and oppression than is the case in which the government is more centralized as in France.

In our government the power and responsibility rests primarily with the people. Therefore, it is the duty of the individual to take an active interest in the government and exercise his power intelligently.
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FINE ARTS
THE BEGINNINGS OF THE HISTORY OF THE DRAMA

Donald McCall '31
Crookston, Minnesota

Dedication

To those students interested in the theatre and its history, and especially to the newly formed drama class of 1931, I dedicate this, my Senior Thesis.

To some people the history of the Drama, or the story of the theatre, is a very dry, dull and uninteresting subject. To me it is decidedly not. To anyone who is at all interested in modern drama, as plays and movies, the history of the drama should be interesting, and as most people are not familiar with this evolution, that is the reason I have chosen this for my thesis.

I shall deal with the beginnings of the different theatres.

Though it seems strange, all drama had its beginning in religion. According to some people it has gotten much too far away from its original theme, but nevertheless the fact remains that all drama started in religious worship.

The Theatre of India

Long before the Greeks paid tribute to Dionysus, the Hindus paid tribute to Rama and other deified kings, at big festivals twice a year. At six or seven hundred A.D. the Hindus were surprisingly far advanced in their dramatic methods of worship. They would present long dramas at lengthy revels in honor of their gods. One of these ancient plays has survived to the present day. It is called "Shakuntala" and people often give it for diversion nowadays in spite of the fact it is more
than fourteen hundred years old.

One thing distinctive of the Indian theatre was the theoretic classification of everything imaginable:

"Beginning with such broad categories as exotic, comical, pathetic, tragic, heroic, awful, hateful and miraculous with subdivisions ad infinitum. Exhausting this they assembled grouped and classified the roles of the actor. The result was 48 types of hero, 384 female types, and many varieties of villain, confidant, et cetera."

As the Indian theatre developed, they wrote better plays, and later Shakespeare was a favorite.

The Javanese Theatre

The Javanese Theatre from what we know today was composed mainly of puppets. The Javans worshiped their ancestors, and the puppet proved a good conveyor of their emotions. Slowly as the years crept by, the people themselves acted on their stage as puppets. After the people supplanted the puppets, it wasn't long before they ceased acting as puppets and became human people, and though their actions were all standard or canned, they developed a distinctive drama, a drama all their own.

The Chinese Theatre

In China the age of the theatre rivals that of old India. The oldest specimens of dramatic Chinese literature go back to the sixth century A.D. It is interesting to note that their first actors were called "Students of the Pear Garden."

Chinese acting was confined mostly to operas, and lasted unbelievable lengths of time. Performances began in the late afternoon and continued past midnight. A six or seven-hour performance was not at all uncommon.

The show was continuous. If a scene needed changing, the stage hand came out and changed it, or if a chair was out of place,
he placed it, and no one thought anything of it.

Another distinctive feature of the Chinese stage was the fact that there were no mob scenes. If the play called for two armies fighting, each captain had a banner or banners representing the number of men in his respective army. One banner meant 1000 soldiers; two banners meant 2000 soldiers, and so on. Hence, much was left to the imagination of the audience.

Because of the progress of westernization now taking place in China, it is losing many of its traditional characteristics, but they are trying to keep as much as they can.

The Japanese Theatre

Unlike most oriental countries, we can trace the beginning of the Dramatic Art to Japan, for the Japanese are naturally good actors. Around the year 1375 the king was impressed by the dancing of a certain priest. He was, in fact, so taken up with the dance that he invited the dancer to come to his palace and become one of his household. As this was an honor for the priest, he accepted, and after a time added other things to his dance. Finally it became a crude drama, and developed what was called the "No-Dance" or "No-Play." The "No" in this case means the same today as drama. Because of the fact that the king liked these "No-Plays" and since they were pleasingly different, other people copied this and formed traveling companies. The "No-Plays" were short ones, several being presented in one evening.

Japan also had "doll plays", the wooden actors being operated by people always in plain sight. Today we would think that this would detract from the performance, but to them, it seems, it did not.

From the rise of the "Kabuki", a longer and more interesting drama, both the "no-Play" and the "doll play" prac-
tically died out. This play, called the "Kabuki" was somewhat lengthy, having begun at daybreak and lasting at sunset. Travelers coming to see this would come the evening before in order to be there on time. The women would sit up all night before one of these plays either preparing their hair or, having prepared it, afraid to lie down for fear of spoiling it.

Through westernization the Japanese theatre has suffered the loss of its old traditions, and today it is almost as much like our theatre as the Japanese can make it.

So much for the Oriental theatres.

We now turn to the Greek theatre, the seed from which our modern drama has sprung.

The origin of the Greek drama was the ceremonial worship of Dionysus or Bacchus, God of wine and fertility.

The Greeks were in the habit of holding numerous festivals in honor of this deity, the observance being known as the "ditheraemb." These "ditheraems" were called "Tragodias" or "goat songs" from which our modern word "tragedy" has come.

The people assembled in one of the open amphitheatres corresponding to the modern football stadium, and watched a chorus of men down in front weave along in a snake dance, chanting and dipping their hands in a pot of wine and throwing it upon themselves. In the background was a raised platform of pillars which served as a dressing room, and also to shut off the natural background. Later the leader of this chorus mounted this platform chanting with his chorus. Still later he chanted and they answered, thus developing dialogue. The time was now ripe for some one to develop this. Thespis stepped in and made the first dramatic step. Being leader, he dressed himself as Dionysus, and had the chorus act as the God's followers. Soon
another man mounted the stage, and the two actors performed.
Later the chorus dwindled in popularity, and finally altogether
vanished, leaving the actors on the stage.

These big festivals were held twice a year under the
management of the state. Everyone was compelled by law to come.
Even prisoners were released for the occasion.

As the plays proved more interesting, the state gave
prizes for the best, and thus stimulated the writing of many
good ones.

These plays were costly and required a wealthy backer
called a "choregus."

The auditorium or place where the worship was held was
built on a hillside in horseshoe shape. Seats were first made
of planks, but later of stone. In the center of this horseshoe
was the place called the orchestra. In the center of the orche-
stra was the "thymele" or altar. Back of the orchestra was the
stage building, a wide shallow structure of two stories, on
the stately pillars rested. At either end were wings projecting toward
the audience called "proscenia." Obviously we get our "proscenium
arch" from this.

The gods or heroes portrayed by the Greeks really looked
quite funny. They wore big masks with a projection at the top
like the common fool's cap. They had thick wooden soles on their
shoes, making them about six inches taller.

Their audiences were usually about 17,000 people and the
actors, to make themselves heard, had big mouths cut in their
masks and sometimes had a megaphone built in. All in all they
looked quite grotesque and ludicrous.

Since the Greek civilization gave way to the Romans, the
Romans to the Goths, and so on up, this is really the first
beginning of our modern drama.

"The torch of the theatrical art passed from Greek hands to Roman, and it was in Roman hands that the flame was all but extinguished. The Romans by nature were not a dramatic people; what they wanted was spectacle."

When the Romans came into power they changed the Greek setting somewhat, putting all of the action on the stage and seating the nobles in the orchestra.

They did not build many theatres, but those built were immense, holding from eleven to forty thousand persons. Many temporary theatres were built by nobles of great wealth. One that was built for a gala occasion, and then burned held eighty thousand spectators, and cost four million dollars.

Another equally remarkable one was built in the first century B.C. by a wealthy man for his father's funeral. Two auditoriums were constructed with their backs to each other.

"Plays were then performed for each audience, and at the conclusion of the plays, the auditorium, audiences and all, were swung about, forming a huge closed stadium, in the center of which athletic spectacles were given."

Both of the buildings in these instances must have cost a half dozen fortunes, but the main reason men built them was to show off wealth, and they certainly must have succeeded.

Actors were considered by the Romans as of no account. They were usually slaves, and when a noble became an actor, he immediately lost all civil rights which he possessed.

It was now that religion and drama clashed. It was now the beginning of the Christian era and the church relentlessly attacked these revels. However, the people continued to attend these plays and what the church could not accomplish, the barbarians could and did.
While the Goths and, later, the Lombards ruled Rome, the theatres were emptied and plays prohibited by law. Then the thread of dramatic interest was carried doggedly on by traveling jugglers, clowns, tight rope walkers and singers.

This has been a resume of the ancient beginnings of the drama, the story of the theatre, up to the mediaeval theatricals referred to as minstrelsy.

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THE DEVELOPMENT OF THE AMERICAN THEATRE

Antoinette DeMaster '31
Beaulieu, Minnesota

Dedication

This thesis is dedicated to anyone who is interested in dramatics, and in the growth and improvement of the American Theatre.

Foreword

The theatre provides the best kind of amusement for the American people, and the money that the country spends for the theatre is certainly well spent.

It would be obviously untrue to say that no theatricals existed in the American colonies before 1700, for the slightest understanding of human nature tells us that the dramatic impulse asserts itself however crudely and timidly wherever society exists.

But there is no record of any professional companies of players before 1700, and the only amateur production of a stage play is that of "Gustavus Vasa", a tragedy written by Benjamin Colman and acted by the students of Harvard College in 1690.

The first license to perform plays professionally was granted in New York to Richard Hunter during the period 1699-1701. The next record was to Anthony Aston in 1703.

In 1716 at Williamsburg, Virginia, the first American playhouse was built. From 1735 on it was used for amateur performances by William and Mary College until, in 1745, it was converted into a town hall and its theatrical life ceased.

New York got its first play house in 1732. It was merely a large room with a raised platform at one end. The players came from England.
Charleston, South Carolina had plays as early as 1732. The players are thought to be the same ones who played in Williamsburg and New York. Philadelphia, then America's largest city, had plays in 1749 despite the strong opposition of the Quakers; but in 1750 a law was passed forbidding all play acting in the Colony.

The first half of the century we have little record of the theatre, but from 1750 on the story is clearer and more complex.

In 1750 the first light opera, John Gay's "The Beggar's Opera" was given in New York by English players headed by John Murray and Thomas Kean. In 1752 there arrived from England the first well trained dramatic company, which had been organized by two London actor managers, Lewis and William Hallam. After their Philadelphia season, the company moved to Jamaica where Lewis died, and upon his death, the company disbanded.

David Douglass, besides acting as head of a group of first players, was America's great theatre builder. He built among others, the first permanent (brick) playhouse in Philadelphia. Douglass first called his actors "The Company from London" but when anti-British feeling became strong, he changed the name to "The American Company." His foremost actor was Lewis Hallam, Jr.

At the outbreak of the Revolution, Congress recommended the prohibition of play-acting and many states acted accordingly, thus the Revolutionary Period would be practically devoid of theatricals had it not been for the British soldiers, for wherever they were quartered, dramatic performances were given.

Following the War, the theatre came back with greater force than before because a national spirit inspired art, and so it was the American actors and playwrights came into existence. Massachusetts still kept the law prohibiting play-acting
in existence, but in Boston, the people built a theatre under the name of the "New Exhibition Room." Playhouses were now becoming more numerous and there were several in some of the larger cities.

By 1800, although the American actor had not come into his own, or the American playwright had scarcely made himself heard, the theatre was a firmly grounded institution and was ready for a great era of progress, which began in the nineteenth century.

We have seen that the theatre is now firmly established in the eastern cities before 1800. The first decade of the nineteenth century brought many theatres in the East and also brought them farther into the interior of the country. There were as yet no railroads in the country, but the theatre troupe is never long in overcoming these difficulties.

The middle western cities began having theatres in 1819, and from that time on, they continued becoming more numerous. Towns which were situated on rivers attracted theatricals sooner than their land bound sisters. And about 1830 a new type of theatre came into being - the show boat. All through the century they flourished and are not extinct even now.

Meanwhile new playhouses were appearing in the East and many of these were very famous. The Park Theatre in New York until it was destroyed in 1848 was the most famous in America and every famous actor in America and in it was presented the first Italian opera in America. ?

In 1830 another New York theatre had its beginning. It was for many years the most fashionable pleasure center in New York and in 1866 it housed the record breaking spectacle "The Black Crook" which ran for a hundred nights consecutively, a record at that time.
The year 1841 contributes two events of unusual interest -
the opening of the Boston Museum and the opening of the Barnum Museum. The Boston Museum was merely a camouflage. It later housed plays. The Barnum Museum contained great rarities and treasures.

Now let us glance at some of the actors from 1800 to 1850. They are a very imposing list and I shall only give the names of these great performers. They are: Joseph Jefferson (1774-1832); Thomas Abthorpe Cooper (1776-1849); John Howard Payne (1792-1852); George Frederick Cooke (1756-1812); James William Wallack (1795-1834); Edwin Forrest (1806-1872); Edmund Kean (1807-1833); Charles Mathews, Sr. (1775-1835); Junius Brutus Booth (1796-1852); James H. Hackett (1800-1871); William Charles Macready (1793-1873); George Halland (1791-1870); Louisa Lane (1820-1897); Charles Kean (1811-1868); Charles Kemble (1775-1854); Tyrone Power (1798-1841); Charlotte Cushman (1816-1876); Edward Loomis Davenport (1816-1877); Charles Mathews, Jr. (1804-1878); and Anna Cora Mowatt (1819-1870).

Until about 1825, Philadelphia had been the best theatrical city in America. But some time during the next five years, New York theatres took the lead. Although these theatres were thought by their patrons to be luxurious, they would seem to us now rather shoddy. They were generally dirty and ill-smelling, and infested with rats. The pit and gallery were a rowdy atmosphere and, therefore, seldom occupied by women. There was a part set aside for negroes and the prices ranged from 25¢ to a dollar for tickets. By 1850 our theatres were still largely dependent on foreign plays and players, but it was involving rapidly into a national institution.

The year 1849 is almost as important in American history as 1492, and in the history of the theatre it is a date written in
In that year the eyes of the world were turned to the far west and inside a few months San Francisco became the liveliest and most picturesque of American towns and had an atmosphere that could not but give rise to a theatre. It became the houses of the greatest foreign and American actors, but although after the gold rush, the country settled down, San Francisco never ceased to be a theatrical city.

Now let us return to the east and list some of the famous producers and managers in New York. As my space is limited, I shall only name these people. They are James W. Wallock, Albert M. Palmer, Augustin Dally, Stelle MacKay, who cannot be properly catalogued, as he was an actor, manager, producer, playwright, teacher and inventor, Daniel Frohman, Charles Frohman, David Belasco, and Sam Lee and Jacob Shubert.

As I have named the actors in the first half of the nineteenth century, it is only proper that I should do so for the last half. The principal actors from 1850-1900 are John Brougham (1810-1880); Dion Boucicault (1822-1890); Lester Wallack (1829-1873); Laura Keene (1826-1873); E.A. Sothern (1827-1881); Joseph Jefferson III (1829-1905); Edwin Booth (1833-1865); Lawrence Barrett (1838-1891); John McCullough (1833-1885); Adah Isaac Menken (1835-1885); Mrs. G.H. Gilbert (1823-1904); Fanny Davenport (1850-1898); Mme. Janauschek (1830-1904); Adelaide Neilson (1843-1880); Mary Anderson (1858- ); Rose Coghill (1850- ); John Drew (1853-1927); Helena Modjeska (1845-1909); Charles Fechter (1824-1879); Robert B. Mantell (1854 - ); Clara Morris (1846-1925); Ada Rehan (1861-1916); Minnie Maddern (1865- ); E.H. Sothern (1853- ); Julia Marlowe (1870 - ); Maude Adams (1872 - ). Many more actors have played on the American stage during this period, but lack of space forbids that any more be mentioned.
And now let us look briefly at the American dramatists from 1850-1900. A few unimportant plays were written around 1850, but it was not until 1870 that there were visible signs of drama which reflected native atmosphere and psychology. In that year Bronson Howard won his place as "Dean of American Drama" with his play "Saratoga." Contemporary with Howard was James A. Herne, famous for "Hearts of Oak," "Shores Acres" and "Griffith Davenport." Another is Stelle MacKaye who has already been mentioned.

The following generation brought forth many playwrights, most of whom are still represented on our stage. They are David Belasco, Augustus Thomas, William Gillette, and Clyde Fitch, most clever of them all.

Most of these plays were not great in a literary sense, but they pictured with a fair degree of faithfulness the fundamental characteristics of the American heart and mind.

It is now necessary to conclude this survey of a period crowded with important theatrical events. Little attention has been paid to secondary or minor drama, such as opera, vaudeville, circus, and burlesque. Also little has been said about the matter of theatrical architecture, machinery, and scenic equipment. However, two things need be emphasized. The first is that during the nineties the permanent stock company practically disappeared and the star system with its indefinite run took its place. The second is that by the end of the century the American theatre was practically independent of foreign actors and producers.

Finally it must be mentioned that in 1895-96 Lumiere in France and Edison in America made the first moving pictures. What this meant to the theatre in the twentieth century, I will now take up very briefly.
In the first part of the century the star system prevailed throughout the country. The moving picture was still a harmless novelty and the commercialized legitimate theatre had things pretty much its own way. Its chief rival was the vaudeville which in 1906 under Tony Paston gave it a little system.

In 1909 an attempt was made in New York to build a national theatre. This lasted two seasons and then it stopped wasting several million dollars.

About the time that the new theatre was founded, a number of lesser experiments were made with the repertory idea. These were very successful and their development continued. Also in the years 1911 and 12, the Little Theatre movement began. Between 1911 and the present day, hundreds of little theatres have arisen in America. Many have struggled and died, but it is surprising to see how many have prospered.

About the same time that the Little Theatre made its first appearance in America, the American Universities awakened and began to organize their dramatic activities along creative and artistic lines. The Wisconsin Players were the first to come into being in 1911. In 1912 was founded the most famous of all University theatres, the 47 Workshop of Harvard. The founder was George Pierce Baker. Other college players were the Dakota Players, the Carolina Playmakers, and the Carnegie Institution of Technology. To mention all the college players would be a long account and, therefore, we must merely mention the pioneers.

If the strictly professional Little Theatre cannot compete with the commercial theatre, at least it has proved that the strictly professional repertory theatre can do so. This has been proved by many repertory theatres that are now running.

Now let us mention the actors of the twentieth century.
The list I am giving is incomplete, of course, but it is long enough to remind the reader how rich our stage is in capable performers. George Arliss, Holbrook Blinn, Walter Hampden, Fritz Leiber, John Barrymore, Alla Nazimova, Elsie Ferguson, Grace George, Richard Bennett, Leo Ditrichstein, Emmet Corrigan, Norman Trevor, E. Wynn Mathison, H. B. Warner, Marjorie Rambeau, Lynn Harding, O. P. Heggie, Guy Bates Post, Bertha Kalich, Helen Westley, Nance O'Neil, Ina Claire, Frank Craven, Eva le Gallienne, Joseph Schillkrout, Jacob Ben-Ami, Alfred Lunt, Lenore Ulric, Peggy Wood, Rollo Peters, Jane Cowl, Basil Sidney, Katherine Cornell, Margalo Gilmore, Ruth Chatterton, Jeanne Eagels, Helen Menken, Emily Stevens, Pauline Lord, Margaret Wycheler, Helen Gahagan, Billie Burke, Geoffrey Kerr, Louis Wolheim, Olga Petrova, Otto Kruger, Florence and Mary Nash, Glenn Hunter, Gregory Kelly, Walter Huston, Helen Hayes, Fay Bainter, J. C. And Elliot Nugent, Wallace Eddinger, Mary Boland, Walker Whiteside, Lester Lonergan, Laura Hope Crews, Francis Starr, Clare Eams, Lynn Fontanne, Judith Anderson, Pauline Frederick, Earnest Glendinning, Louise Clouser Hale, Violet Heming, Crystal Herne, Leslie Howard, Henry Hall, Whitford Kane, Madge Kennedy, Doris Kenyon, Francine Larrimore, Winnifred Leniham, Helen MacKellar, Bruce McRae, Florence Reed, James Rennie, Charles Gilpin, Paul Robeson, Laurette Taylor, Blanche Yurka. Added to this list are such brilliant dancers, clowns and musical comedy stars as Isadora Duncan, Ruth St. Denis, Ted Shawn, Margaret Severn, and Ruth Page, Frank Tinney, James Barton, Fred Stone, Ed. Wynn, Al Jolson, Eddie Cantor, Leon Errol, Will Rogers, and Marx Brothers, Fannie Brice, the Duncan Sisters, Elsie Janis, Fred and Adele Astaire, Kay and Johnny Dooley, Marilyn Miller, George Jessel, Florence Moore, Mary Eaton, and Helen Ford.

We have already pointed out that from 1700-1850 our stage was given over to English drama. And during the next fifty years only a handful of native dramatists arose, but now although the
the playwrights, who have secured a hearing during the last quarter century, cannot stand comparison with the great English dramatists, they can be put forward without embarrassment as representatives of our literature.

The American critic is almost as startling as the American playwright or stage designer. Whereas a few years ago, we had a few people who wrote leisurely, a manner of personalities in the theatre, we now have a small army of intense, scholarly, exasperatingly keen young men, who write bewilderingly intelligent books on the theatre. History is their plaything; the world, their orange.

At the beginning of the account of the twentieth century, the motion picture was mentioned; Now I shall take it up.

Only thirty years old, the motion picture is today not only of the greatest commercial enterprises of the world; it is also the most popular form of theatrical amusement. From the business point of view, the motion picture has proved a stupendous success. Another advantage of the movies is that comic pantomime can be recorded most effectively on the screen.

When an American producer sets to work on a feature film today, he cannot ignore the market value of the forthcoming product. In 1912 a feature picture cost the film at most fifteen or twenty thousand dollars. Today it costs One hundred thousand dollars. It cost ten thousand dollars to make "The Cabinet of Dr. Caligari", but over two million dollars to make the "King of Kings."

Today there are not more than five hundred playhouses in America devoted to legitimate drama. Very few first rate companies go on tour. The smaller cities and towns depend on motion picture and vaudeville. It is estimated that there are approximately four hundred tent shows on the road, playing a
average of forty weeks a year.

The trouper, however, does not die. He has always been a part of the theatre — sometimes all of it. He is seldom remembered; he does not care to be. It is he who knows the theatre best for he creates it wherever he goes. When our great playhouses tumble, and our theories fade, the trouper will still be with us, a living theatre.

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FISH AND GAME
Forest Fires

For want of a nail a shoe was lost,
For want of a shoe a horse was lost,
For want of a horse a man was lost,
And all for the want of a horse shoe nail.

For want of a forest the streams went dry,
For want of a stream the fish all die,
For want of the fish the fishermen sigh,
All caused by a fire when the brush was dry.

John E. Gribble.

Foreword

In order to call the attention of the public to the rapidly decreasing numbers of Wild Life, and also to the diminishing areas of forest, I have prepared this senior thesis.

It is my hope that these humble efforts shall inspire the readers to help conserve our various states of nature for the future generations.

Dedication

It is only fitting for me to dedicate this senior thesis to "America's Slaughtered Wild Life," that have made such a noble stand for life, in which they have battled for their lives, as have only few human beings.

Chapter I
Ownership of Fish and Game

1. Ownership by the State.

The ownership of wild animals, so far as they are capable of ownership, is invested in the state as the representative and for the benefit of all its people in common. All the citizens of the state have property in the wild life within the state's border. This interest is limited to them only. Thus, legally, Minnesota might refuse to issue hunting or fishing licenses to citizens from other states. In one case she does; a trapping license is not issued to a non-resident of the state.
In the national constitution, Congress has been given the power to regulate commerce with the Indian tribes. Neither the constitution of a state nor any act of legislature can withdraw them from the control of Congress.

Mr. Justice Miller, in United States of Kagama, said as to the subject:

"The power of the National Government over these remnants of a race once powerful, now weak and diminished in numbers, is necessary for the protection, as well as to the safety of those among whom they dwell. It must exist in the government, because it never has existed anywhere else, because the theatre of its excise is within the geographical limits of the United States, because it has never been denied, and because it alone can enforce its laws on all the tribes."

All Indians born within the United States have been declared to be United States citizens, but they are not citizens of the state wherein the reservation is located. Thus Indians on the Red Lake Reservation are citizens of the United States, but not citizens of Minnesota, neither are they subject to the laws of Minnesota so long as they remain on the reservation. They may hunt and fish on the reservation at any time.

Once, however, an Indian leaves the reservation, he becomes subject to ordinary laws of the state just as another person, even tho his absence is only temporary. If he is caught fishing or hunting while off the reservation, he may be punished with the same penalties that would be applied to an ordinary citizen.

"An Indian from a reservation in the Red Lake District left the reservation, and proceeded into an adjoining county to hunt deer. He was successful and bagged a nice buck, but he was arrested and punished for the violation of game laws of the state."

3. Ownership by Private Individuals

Although all wild game is owned by the state, yet an
individual may acquire qualified property in wild life, dependent
upon what ever condition the state lays down.

The state recognizes two means by which the individual
may acquire property in wild animals.

(1) By catching and taming. For instance, a deer is caught and
held in captivity; as long as the deer is held by the person, it is
legally called his property. This however does not permit him to
kill the deer out of season or break any state game law pertaining
to it, or if the deer should escape to the woods, it again becomes
the property of the state. Any citizen being entitled to hunt or
kill it, providing no game laws are broken in so doing.

(2) By killing. Any bird or animal that is killed legally
during the open season becomes the property of the person who
inflicts the mortal wound.

"A man in pursuit of a deer succeeded in mortally
wounding a nice buck. The buck being only wounded ran
and, in trying to escape the first hunter, the second
hunter killed the buck. A dispute arose over the
ownership of the dead deer. In court it was ruled
that the first man to inflict the mortal wound (in this
case - the first hunter) was the rightful owner, so the
deer was given to the first hunter."

It is understood by everyone that pursuit or starting
of a wild fowl or quadruped is not possession. Possession is
obtained only when the animal is killed or wounded, or otherwise
deprived of its liberty and, until such a time, it is to be
considered at large and may be hunted; however lacking in good
sportsmanship it may be, come between pursuer and pursued and by
killing the animal to obtain possession.

In common law, the exclusive right of the owner of
the land to take wild game on his land is known "property natione
soli." It is right, however qualified by state ownership in wild
life, and therefore may be regulated or prohibited as the state
pleases. In Minnesota, nevertheless, the statutes uphold such exclusive rights.

"No person shall at any time enter upon any land not his own with the intent to take or kill any wild animals, after being notified by the owner or occupant thereof not to do so. Such notice may be given orally or by posting written or printed notices to that effect in English languages in conspicuous places on land so prohibited."

A property owner in the state may, if he so desires, close his land to hunting by other parties. However he acquires no right to take wild life himself except in accordance to the state laws during the open season. This right rests entirely upon the ownership of the property.

Ownership is comparatively easy to determine when property in question is dry land, but the determining of ownership of land covered with water is quite different. In Minnesota, as in most states, the ownership of such land is determined by whether the water covering it is navigable. The term used covers navigation in any sort of a boat or use for any public purpose. Mr. Justice Mitchell in the opinion of the Supreme court in Lamprey State:

"Many, if not the most of the meandered lakes of this state are not adapted to and probably never will be used, and as the population increases, will be used by the people for sailing, rowing, swimming, fishing, fowling, and skating. To hand over all these lakes to private ownership under the old test of navigability would be a great wrong upon the public for all the time - however, as that may be, we are satisfied that, so long as these lakes are capable of use for boating even for pleasure, they are navigable within the reason and spirit of the common law rule. When the waters of any of them have so far dried up as to be no longer capable of any beneficial use by the public, they are no longer public waters, and the former beds, under the principle already announced, would become the private ownership of riparian owners."

Justice Mitchell also suggested that the terms navigable and non-navigable waters be dropped and the term public and private waters be appropriated in their stead as being the real distinction.
The beds of navigable streams and lakes belong to the state because the water above them is being navigable in public. Non-navigable or private waters carry with them private ownership of their beds. In a case of owners on both sides of the stream, or lake that is non-navigable, the boundaries of each reach to the center of the stream or lake.

A person owning the bed of a stream may not take, or hinder fish from such waters, as they go up or down streams except in such a manner as is prescribed by law in accordance to the open season.

Chapter II

The Organization of Game and Fish Departments

The first laws prohibiting the killing of certain game, such as, deer, elk, and caribou, out of season, were put into force about 1866. The enforcement of these laws rested with the town, board and officers.

In 1874 the legislature by statute provided for the appointment of three commissioners of fisheries, of whom were to serve without pay. They were employed to receive from the United States Commissioners fish fry and to plant them in the lakes and streams of the state; they were also instructed to make recommendations from time to time on the subject of fish culture as it applied in Minnesota.

As the time slipped by and the population became denser, newer areas were opened up. This method of enforcement of game laws became more and more unsatisfactory. In the year 1887 the legislature provided for the appointment of a chief game warden, with his deputies, by the Governor. However, this act had been poorly drawn up, being vague and indefinite in its provisions.
a period of four years, the department was reorganized. Under the act of 1891 the governor was authorized to appoint five persons to serve for a term of six years without salary, who were to constitute the Board of Game and Fish Commissioners. This Board was given power to appoint a Game Warden and deputies who were also to have charge of the fish hatcheries. Thus game and fish conservation were brought together as one unit and the foundations of the present department were laid.

Slight changes took place in this organization up to 1925, at which time the governor recommended to the legislature that there be established eleven departments in the state administration, among them a Department of Conservation, which was to be placed under the supervision of a Commissioner of Conservation appointed by the Governor. The department under the Commissioner was to be organized in three divisions (1) Forestry, (2) Drainage and (3) Game and Fish, each department being headed by a Director appointed by the Commissioner.

Although the proposed plan of the governor was not followed in all its details, yet it was adhered to. The organization finally placed the three Directors on an equal basis, all appointed directly by the governor instead of united under the Commissioner of Conservation.

The Commissioner of Fish and Game is charged with the execution of the laws of the state, relating to wild life and he also has the power as is his duty, (1) to preserve and cultivate varieties of wild animals that are of value to the public, and to destroy unprotected and predatory animals, deemed by him to threaten the life of well meaning game; (2) to receive and distribute specimens of eggs of game for breeding and stocking
purposes; (3) to publish material and statistics and information germane to the purpose of this act (An example of this is the magazine Fur, Fins and Feathers); (4) to acquire land, establish and maintain fish hatcheries, and to manage the ones already established; (5) to set aside and reserve any water or land for the purpose of a reserve or refuge; (6) to make rules and regulations regarding to the breeding and raising of fish and game for propagation purposes; (7) and to reforest large and small game hunting grounds subject to approval by the governor and to set aside not to exceed one third of reserve as a state game reserve; (8) also to govern the conduct of persons on that public hunting grounds and game refuges.

In connection with the Fish and Game Department, the Commissioner holds the power of recommending to the governor that the open season for any type of wild animals be temporarily abolished. This however does not permit him to open a closed season on any form of wild animals that have been protected.

Chapter III

The Licensing System – The Taking and Disposal of Game and Fish

Like most other states, Minnesota uses a licensing system, which has proved to be the best method of supervising the taking of game and fish. The requirements, as quoted by the Minnesota Statutes:

"No person shall hunt, pursue, or kill any wild fowl, quadruped or animal, for which a closed season is provided, or to take with traps or other devices any fur bearing animals, except as here provided, without first having procured a license to do so, and then only during the respective period of year when it shall be lawful."

A license may be procured from the County Auditor, at
the set prices according to the kind purchased.

The resident and non-resident hunters of the state are required to produce a license at the age of sixteen years, and for a fishing license, at the age of twenty-one years. The fee of $1.00 is charged a resident of the state for a small game license, and to a non-resident a fee of twenty-five dollars. The big game license fee for a resident is $2.00, and for a non-resident, $50.00. The term of big game applies to deer, moose, elk, caribou, and bear.

The resident and non-resident angling license may be purchased from the Auditor at a cost of 50¢ per head, or $1.00 for the entire family of the resident. The non-resident license is $3.00. Only a resident trapping license is issued by this state, the cost of which is $1.00.

A special license is required for commercial fishing, that is, fishing where nets are used. Such a license may be obtained only by special application the commissioner, stating the location, and the kind of fish that are to be taken, number and size of nets, etc, the price of such a license being $35.00 for each pound net.

Game and fish taken in violation of the law are liable to confiscation, and the violator is subject to a fine or jail sentence or both. The confiscated game is given to the needy people, hospitals, and orphanages in the state.

All moneys received from fees and licenses go to a special fund known as the Game and Fish Fund; this fund is for the establishing and maintaining fish hatcheries, for the purchasing of lands that are to be set aside for game reserves, for the propagation of game and fish; and also for the ordinary running expenses of the department. During the past two years all of the cost of running the entire department has been met from licenses and fees.
Chapter IV

Game Refuges and the Propagation of Fish and Game

Lands that have been found to be unfit for agricultural purposes have been set aside as State Game Refuges. Not only have these reserves been set aside as a breeding place of migratory birds, but for all wild life whether included in the list of those protected by law or not. Fur bearing animals, fish and all kinds of flowers, trees, or plant life may not be taken, destroyed, or injured in any way on these game refuges.

When ever all the owners, lessees, or persons in possession of any land located outside the limits of city, or village, file a petition with the State Game Commissioner, accompanied by a map showing clearly the land proposed to be set aside, the Commissioner may set aside such land as a State Game Refuge. The owners must then post notices, furnished by the commissioner, on the land stating that it has been set aside as a reserve.

Propagation of Fish and Game

There are two kinds of hatcheries that are in operation in the state. The first is Public Hatcheries. These are operated by the state and are under the direction of the Superintendent of Fish propagation. These are becoming more and more important; in the year of 1928 there were 430,000,000 fish fry planted in the various streams and lakes of this state.

The second is Private Owned hatcheries. Any person
deserving to run a private commercial hatchery may do so if a license is obtained from the commissioner. Fish raised and sold by hatcheries of this sort must be tagged as are those of the state.

Besides the State Game reserves, there is yet another method of breeding grounds for wild animals and fowl. This is the Private Owned Game farms. Any person wishing to have a game farm must first obtain a license from the commissioner. Upon receipt of the license, the applicant becomes the owner of the animals found on that land, provided he pays for the beavers and muskrats found thereon. All pelts that are sold from such farms are plainly tagged. Each owner of one of these farms is required to make an annual report to the commissioner in regard to the increase or decrease in number of animals in that establishment.

Chapter V

Conclusion

There are a number of movements under way that will help conserve our wild life for the future generations. At present the Minnesota Game Protective League is working on a number of plans. The Izaak Walton League of America is also busy upon this subject.

The Minnesota Game Protective League has proposed that the establishment of Wednesday as a weekly "rest day" during the small game hunting season, holding that this would provide a much needed interruption in the annual autumnal bombardment. Also the opening of the duck season at noon instead of daybreak, all of which would mean a better sporting chance for the birds. They have also proposed that the custom of baiting, feeding grounds to attract
waterfowl be prohibited by law. This would deprive exclusive
gunner's clubs of some of their "sure thing" shooting, which
has proved to be nothing but a misfortune for ducks and other fowl.

It is also advocated by a number of well known sports-
men that a decrease in bag limits would help in the conservation
of our wild life.

It is quite evident that our waterfowl are fast on the
road to extinction. Shall we stand idle and allow our wild fowl and
other animals to take that long trail of extinction as have the
Antelope, the Buffalo, and the Dodo? No let us preserve our
wild life for the coming generations. In order to do this, we must
obey all of our state game laws, and conserve and preserve our
hunting and sportsman's paradise here at home!

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The material for this senior thesis has been obtained
from Mason's "Minnesota Statutes for 1927-29", also from such
magazines as "Outdoor Life", "Field and Stream", and "Trails of the
Northwoods."

My able instructor and supervisor, Mr. Robert H.
Connery, has contributed much time and effort to these few pages.

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EVOLUTION OF COSTUMES

Dora Woods '31
Radville, Saskatchewan
Canada

Dedication

In appreciation of the help I received in the writing of this paper, I hereby do dedicate this term paper to Miss Elsie Mae Kingston.

Foreword

Hoping that it may be of interest to everyone who reads it, I hereby submit this term paper.

Costumes from the beginning have received a full share of the world's interest and attention. Dress in the twentieth century is taken so much as a matter of course, that we seldom think over its beginning in the past.

The Egyptians were the first to leave their records of costume in a form so durable that they could not be easily destroyed. Our sources of information concerning this period are quite as realistic as a modern fashion plate; they are none other than the pictures of the Egyptian life painted upon the walls of tombs and temples. Today these drawings are quite as distinct and, in many cases, as bright in coloring, as when left by the hand of the artist. Here we see the laborer, the merchant, the king, the rich, the poor, each clad in garments of his own class.

The ancient records show that the lower classes of Egypt wore no clothes at all, while the upper classes wore very little. But gradually clothing became general, and loin cloth became the dress of the peasants, and as short skirt or apron was that of the higher class. The materials were coarse and made of flax which was cultivated abundantly in Egypt.
During these early periods (255 B.C.-1530 B.C.) there was a sameness in the costumes of the women of all classes, and though there was a great variety in the early costume of men, yet the tendencies of the development of the costumes of the two sexes were quite similar. This characteristic dress, consisted of a long straight tunic, reaching from the bust to the ankles.

From the earliest times the men of higher class wore a short simple skirt which became the foundation for all later developments. This skirt became a longer and wider, sometimes reaching to the ankles. As coarser materials were given up and more transparent materials used, it was necessary to wear a second skirt under the first. At first these two skirts were similar, but as time went on the under skirt became longer and wider, and the outer one looped in puffs over it, giving the suggestion of drapery. Gradually these two skirts changed again, the under one became a strip of sash folder about the hips and tied in front. The manner of adjusting the sash varied. It was sometimes reached down over the back of the leg, and sometimes gathered short in front, and sometimes wrapped twice.

The women wore a long straight tunic reaching from bust to the ankles. Another style was the short tunic with a jewelled belt connected by straps with a jewelled collar. Also innumerable rows of beads were worn about the neck, forming a great mass of colors.

In 1545 B.C. there were many changes in dress due to the new relations with Western Asia. Coarser materials gave way to finer ones; cotton and linen were used extensively; the value of dyes became known and a new fashion of dress.
This fashion was the covering of the upper part of the body and adopting the short skirt and the arm passed into a sleeve on the left arm. This gradually involved into a robe with sleeves. This has been known as the robe of the priests. The women's dress resembled that of the men, having a sleeve for the left arm leaving the right arm free.

Later the wearing of a long mantle became fashionable. This was draped sometimes under one arm and over the other; sometimes over both shoulders and fastened in front. Later this became short and was often edged with fringe.

The costume of the royalty was an apron hung from a girdle in front very richly ornamented with colored feathers, lions heads and other devices.

The Egyptian ladies were much like our lady "flappers" of today. They liked bright colors, were very fond of jewelry, and from them we derive the jewelry of today such as beads, rings, anklets, etc. We also may think it strange that the Egyptian ladies also used all types of cosmetics just as our modern flappers. She used lip stick, eye brow pencil, rouge, at all time, and often perfumes and oils.

Combs, hairpins, mirrors, and fans were necessities of the Egyptian ladies, and she also kept her hair curled at all times. Gradually we find that the articles of cosmetics, as well as garments of Egypt influenced other nations. The influence of Egypt is recognized again and again even today in our costumes of modern design.

Then we also had Asia Minor costumes, which played a very important part in the history as it was the channel through which civilization and culture of Asia was transmitted to Greece and Europe.
The characteristic type of dress throughout the region was distincting that of the Orient, whose contribution to the world of dress has been that of pantaloons and sleeves. Invariably these figures of Asia Minor wore the vest with sleeves reaching to wrist and pantaloons descending to the ankles. The vest and pantaloons were always of the same, and the vest was closed either in front or back by clasps or studs; over the vest was worn a sleeveless tunic of another material. The pantaloons were sometimes close fitting, others falling in great folds and caught in the shoes or sandals.

Next came the Phrygians; their dress consisted of two tunics, the under tunic was longer and terminated near the knees. Sleeves were wrist length. Second tunic had no sleeves and reached to the hips. Women wore long straight tunic close fitting with sleeves also reaching to the wrist. The tunic was made of fine texture and very much embroidery work. Over this dress they wore a rich mantle.

The Persians wore the same garments for both men and women. They also wore long and enormous wigs of curled hair, or long braids falling on their shoulder. A fine cloth bound about the head was a common custom, this known as the turban of Modern Asia.

The Medes were characterized by their display of luxury. They wore long tunics descending to their feet, and these were of brilliant colors and richly embroidered.

The Syrians wore narrow close fitting plain clothes, in which dark blue threads, alternated with red, frequently adorned with rich embroidery.

Gradually through the extensive commercial relations existing between these countries bordering on the Red Sea, and
the Mediterranean Sea, much dress was purely local in character. If the type of dress appealed to another people, it was adopted and became part of the national costume.

Next in costumes comes the Greek, perhaps one of the most important in history, as from the Greeks we get most of our fashions today. It can be truthfully said that "There is nothing new under the Sun" as all our modern styles can be traced back in resemblance of those back in Ancient Greek styles.

The type of garments that the Greek women wore were of two styles, one which was very simple, a sleeveless garment of soft wool, held by a brooch on either shoulder, and a girdle. The skirt fell in thick folds giving the appearance of plaits. The other type had the effect of being two garments, quite low neck. The waist gave a bloused effect, dropping over the sleeves and down the side giving an uneven hem line. She also wore a girdle around her waist and could blouse the skirt and make it the desired length.

In all types of Greek costumes they are described as being long draped and skirts with the plaited effect. Does not this remind you somewhat of the present day gowns? I think then it can be truthfully said, it is to the Greeks that we are indebted for our styles of today.

Like all dwellers in the lands of sunshine, the Greek women favored gay colors, and their garments were dyed or enriched with borders of gay colors. The materials were simple and soft and very beautiful effects were attained by using the simplest methods.

The footwear of the Greek women was as simple as her costume and as entirely adequate to the purpose for which it was intended, consisting of heelless sandals, held by a more or less elaborate network of straps. The coquette, however, it is said, knew something of the flattering effect of high heeled sandals, although
they were severely disapproved of.

As might be expected in such an age, the importance of the head dress became of great importance. The Greek beauty was no stranger to the curling iron. Some wore their hair in curls; others gathered it into a pug at the back of the head.

Hats were somewhat worn also. Veils were worn more for a head covering though.

The use of cosmetics was common to the Greek lady, also creams and oils for the skin.

The jewelers at the service of the Greek ladies included some of the most highly skilled goldsmiths the world has ever known. So fine, so beautiful and so accurate in design that the eyes of today require a glass to appreciate the full beauty of it. Necklaces, bracelets, earrings and rings were thus exquisitely wrought in gold and sometimes set with pearls or some other jewel.

So it is said about the Greek woman's costume that it was simple and beautiful in its long graceful folds and soft materials. It was admirably suited to the expression of the Greek women's beauty.

It is equally plain to see then the important part that the Greek's costumes have played in planning of our costumes of today.

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NATIONAL COSTUME IN SWEDEN

Beatrice Josephine Leitch '31
Underwood, Minnesota

Dedication

To Elsie Mae Kingston, who has so generously given of her time to help me with this thesis.

Foreword

To direct the attention of the public to the characteristics of the Swedish Costume which portray a beauty of design and workmanship from which we might draw a lesson in the designing of present American costumes.

The national costumes in Europe are different in each country, each having its own particular dress. We never think of the Netherlands without calling to mind the wooden shoes which are worn.

In Ireland you would think of the "Land of the Emerald Green" where all the linen is produced. The women of Ireland wear plaited linen skirts. Both men's and women's costumes are made of linen. The plaid skirts are worn by the Scotch. In the time of the Anglo-Saxon plaids were the only material used for their costumes.

You could always tell that a person was from Denmark by the elaborate metal belt and bright bonnets that were always worn. The Norwegians were known for their wonderful embroidery.

There is no country that has the same characteristics of dress as the Swedes. The Swedes do more agricultural work than the Norwegians. In the southern part are well tilled fields which are used for farming. In the central part there are hills and dales
wherein are mines of copper and iron which probably has been famous for some hundreds of years. In the cities and towns, manufacturing articles from matches to steam engines are the chief work of the people.

The farther north of Sweden a person goes, the winter days become colder and are much shorter, while in the summer the sun shines an entire month without once dipping below the horizon. At this time the people live out of doors day and night. The chief sports in the summer season are rowing, sailing, swimming, singing, and dancing, Olympic games, while ski running is enjoyed in the winter.

The characteristic dress of the Rattvik peasant women consists of a lofty pointed conical bonnet, a corseted skirt, which was sometimes flowered, and a horizontally striped and rainbow-colored strip, which when sewed on the front of the skirt, recalls the gaily striped aprons.

A Swedish woman is usually fair complexioned, with light colored hair. The people are very strong and energetic, and are able to do most any kind of work that is set before them.

The Rattvik men wear long blue coats, inner waist coat that is littered with brass buttons, yellow knee breeches that reach only to the inner coat, and a felt hat.

It is only the older generation that prefer wearing their ancestral clothes, because the younger generations wear similar fashions of today.

When the Swedish people go to church, they dress in very gay colors, trimmed with embroidery. The men are the leaders. They go ahead and hold the flaring torches and lead the people to Gustavus Vasa's monument where they go to hear sermons.

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POINTS IN JUDGING A COSTUME

Agnes Lundin '31
Stephen, Minnesota

Dedication

To all women who are interested in the Art and Appropriateness of dress, I hereby dedicate my thesis.

Preface

To direct the attention of the women to the importance of dress. To show the appropriate time, place and dress to wear at certain occasions, a lesson we, none, can afford to pass by.

The purpose of this thesis is to give you a brief summary of some of the most important points in the judging of a costume.

These three points might be grouped under three main headings, as follows:

1. Suitability to person.
2. Suitability to occasion.
3. Harmony of accessories.

In speaking of the suitability to the person, these questions seem to form themselves uppermost in our minds. Is the color you have chosen becoming to your person? For instance, if you are a blonde, you would not wear too much brown or if you were a brunette, you would not wear too many dull colors. Then, is it the most appropriate color for the occasion you are to wear the garment? If you were invited out to a dinner party, you would not wear a loud, bright red or yellow or green dress, but some sheer flimsy pastel colored dress, or some very soft-toned color. The next question must be definitely settled if you are to appear well dressed, and that is, are they suitable to your type of personality? If we were to see a dignified matron dressed in a bright colorful costume suitable for a school girl, we would
know at once that she was inappropriately dressed.

The Camelion who changes its color from season to season has progressed to an inevitable position. It is not our privilege however as human beings to change our personal coloring. Therefore, we must choose colors for our clothing which will be suited to the color of our hair, eyes and complexion.

Color in dress is a means of providing a frame of setting for the personality of the wearer. The face should be the outstanding feature in the plan. Color should always charm and delight the observer and should fit in harmoniously with the wearer and her surroundings.

Unlike the Camelion who changes its colors, we have the advantage of changing our apparent size. By the knowledge and clever use of lines, we can produce a costume which will seem to either add ten pounds or twenty pounds in size or subtract it as we desire.

The short, stout girl, if she is clever and really desires to attain the slender willowy figure of the fashion plate, should select dresses with long, vertical lines, few frills and no large figured materials.

The tall slender person who feels her clothes hang loosely on her as they would on a pole may get much satisfaction from a dress with horizontal lines, frills, ruffles, and decorations which lead the eye across the figure and thus give apparent width.

From an assortment of dresses suited to the individual, yet varying in material, style and color must be chosen a dress suitable for special occasions.

"Dresses for breakfast, and dinner and balls,
Dresses to sit in and stand in and walk in,
Dresses to dance in, and flirt in, and talk in,
Dresses in which to do nothing at all.
Dresses for winter, spring, summer and fall,
All of them different in color and shape,
Silk, muslin, and lace, Velveteen satin and crepe,
Brocade and broadcloth and other material
Quite as expensive and much more ethereal."

The person who is best dressed is always the one who is appropriately dressed.

A costume is more than just a dress or a coat. It is the assemblage of all garments as accessories worn with and including the dress. These then must have a oneness and be in complete harmony with one another.

A costume is not only judged on the points I have mentioned before, but also on the workmanship put in the garment. It is surprising how few people realize the economy of making their own garments at home.

In our sewing classes under the supervision of Miss Elsie Mae Kingston, we are taught this economy of making our own garments.

If one were to go into any down town store, one would see many beautiful and charming costumes, but this workmanship does not compare with home workmanship. In making our own garments, here at school, we found that some of the girls saved from $3.00 to $5.00 on their dresses which proves that making one's own garments is a very profitable business because it not only saves one a money on the material and time, but it also enables one to have the garment made the style one chooses to make it.

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Dedication

I dedicate this, my senior thesis on Accessories and Dress, to the future Home Economics classes who are interested in this subject.

Foreword

This thesis was written with the purpose of helping the future Home Economics classes choose the correct and appropriate accessories for dress.

I am certain we all like to appear in public and be looked upon as being well dressed. It is not always the person that makes the clothes, but the way the clothes and accessories are being worn by the person that make them noticeable.

Today I shall try to show you and also help you pick out the correct accessories to select for your costume.

Accessories do not only mean your beads, rings, but also your shoes, stockings, hats, scarfs, handkerchiefs, purse, gloves and all other things which help make up your costume.

There are different types of dresses or costumes to be worn for different occasions. There are five different types of dresses which are the daytime dress, evening dress, special costume, house servants dress, the wardrobe ensemble.

Under the daytime dress we have different types of dress which are the formal, 'after five' dress. These dresses are worn to the bridge and tea parties and receptions. For the woman who dresses on an income, she would have this dress made of a black flat crepe with a black Soliel felt or straw hat, black suede or
kid pumps with or without buckle, hose of a very dark brown which would give the appearance of black chiffon, black or white suede gloves; for a high light either wear gardenias or pearls, but never both; a black antelope handbag; a black broadcloth coat or a seal fur coat. For a more extravagant person, the costume may be made of velvet, chiffon, georgette, or crepe de chene. A coat of silk velvet, broadcloth or fur, such as Persian lamb, mink or sable. The dress may be sleeveless with a little jacket. With this dress you do not want to wear too many elaborate accessories, such as diamonds and pearls as this is very apt to detract the beauty of the dress. The hose should be of harmonizing color and of sheer chiffon, the shoes of velvet or satin with little or no trimming. The hat may be of velvet or some silk material. An ensemble trimmed in fur of fox, beaver, or lynx may be worn. The hat should match the suit or blouse. A simple silk dress is very appropriate. This may be chosen out of the latter group. Under a fur coat a bright colored silk dress is worn.

The informal for town is quite a bit like the formal except the materials are more durable, and the accessories more of the tailored idea. They may be "masculine" but not "mannish." In this dress, good line must be considered. The hats have the brims either worn down or upturned. Shoes are foot-supporting with leather heels, and usually have a low heel. Gloves are of plain but practical material, and the purse of a wearing quality.

For colder season, one may choose an ensemble, a travel coat of wool or tailored fur coat to be worn with skirt and blouse or with a woolen dress. For warmer weather, a dull silk of sufficient weight to carry the desired design, or a light weight jacket suit. The informal for country and campus afford freedom for activity; they have the appearance of serviceability and are jaunty, but neat. This dress has about the same characteristics
as the informal for town so I need not describe it further. Then there is the sport dress for golf, tennis, etc. which has its styling in rightness for the service, weather, comfort, freedom and for its activity. For golf you may wear a three-piece jersey or knitted suit with heavy brogue oxfords, woolen or lisle hose, hat of tweed or felt. No other accessories should be worn except a sport ring or wrist watch. I cannot take each sport separately as there are too many and the clothes for each sport a lot alike. The dress for tennis may be a comfortable and cool dress of silk or wool. Short hose can be worn and flat-heeled shoes. The cape or coat to be worn between sets or after the game may be as bizarre as the wearer dictates.

Under the heading of evening dress, we have the formal for the ball and opera. Informal for theatre, dance and Sunday supper. Informal for intimate tea time and hostess.

The formal dress for the more mature woman have trailing skirts, gorgeous wraps. The costume is made of velvet, satin and lame. This dress should have subtle lines, sophisticated colorings, glittering jewels, and an assemblage of details that will carry out the spirit behind the raiment. Distinction rather than youth should be the aim of older women. For the younger woman, gayety should be expressed. The costume should be of material that is sheer and fine and also sparkling and picturesque. All is carried with gracefulness of youth. Just picture this gown at a ball - A white satin gown with black gauze fan, black satin slippers with rhinestone buckles, onyx and diamond, long earrings, long black or white suede mosquetr al gloves. Wouldn't you just love to appear at a ball in such a costume? You certainly would not feel out of place. When these clothes are worn, the person should express youth and dignity. The informal for dance and Sunday supper has its own characteristics which are expressed for the "after six" occasion.
There are two types of informal evening dresses. First, the tailored type for Sunday evening suppers, theatres, and dancing in public places. These dresses are not extreme in length or design. They include long, transparent sleeves, little jackets and scarfs. The fabric may be of lace crepe, net chiffon, georgette, or velvet. A hat may be worn which is of net, tulle, or velvet. They are usually medium sized and sometimes drawn tightly over the head so they show the shape of the head. Bows often make the trimming.

Then there is the second type which is informal tea gowns for hostess, Sunday night, studio gowns and pajamas for home. This dress calls for loose, flowing lines in skirts or trousers worn with coats with variety in length. Ornamental sleeves, decorations of fur, lace or embroidery. The more soft dresses are for hours spent with friends around the fire or in the lighted gardens.

We next have the special costumes for travel and stage.

For an airplane tour a woman needs a leather coat, trousers, helmet, skirt and sports oxfords. She also needs some clothes for social occasions. She needs these extra for her social gatherings as she is rather prominent. She has an extra five piece ensemble, crepe silk dress, lace evening dress, and for accessories, 3 pairs of shoes, two hats, two pairs gloves, five pairs hose, seven handkerchiefs, two scarfs, silk shawl for evening wear, suede purse and her toiletries. This outfit weighed twelve pounds.

For the stage or similar costume may be worn a dress of dark brown crepe, brown shoes, hose of a lighter hue, sleeves long and close-fitting. No jewelry was worn except a necklace of Chinese amber and dull gold. The hat was medium sized in unity with idea, design and color. This lady gave a lecture on dress so she would naturally have to be dressed accordingly. A person who is to appear on the platform and stage should take into consideration about her
dress the appropriateness, color, background, design, pattern, fabric, details of dress, and lighting.

The house servants uniform is also very important as the maids, waitress, cook, etc. should be just as neat and clean as everything else.

The maid should be dressed in only practical clothes. They may be of color or material selected according to the person's own taste and idea. The waitress should have a dress of washable fabric, either white or in color. Aprons should have the straps over the shoulder. The cook should wear a white starched Hoover apron and the caps should cover the hair entirely to be sanitary.

The wardrobe ensemble should be selected according to the season: winter and summer. The business and professional women have their business or sports dresses to wear besides their dresses for social occasions.

The clothes should not be selected in a hurry as you are generally dissatisfied and found you did not get what you wanted. Trimmings, accessories, handkerchiefs, shoes, stockings, etc. are very hard to select and take both time and thought.

Trimming is not put on a dress to change it or make you look conspicuous but is used to brighten the dress for pleasing effect and for freer expression.

Accessories are a part of the entire costume including cuffs, collar, hose, shoes and beads and, therefore, needs great care in their selection so as not to overdo it or wear the wrong thing at the wrong time.

Stockings should be chosen in harmony with the rest of the costume. The hose should repeat some color note in the costume of one stylishly dressed.

Since accessories are the small details which make up the
completeness of a costume, one's best judgment should be used in selecting them. There should be a real purpose for wearing hair ornaments, earrings, gloves, purse, etc. The effect of the whole costume may be spoiled upon poor selection of one detail. A costume is viewed as a unit made up of subordinate parts and may these subordinate parts be such as will blend into one harmonious whole, instead of calling attention to themselves.

"The Etiquette of Dress"

Dresses for breakfasts, and dinners and balls
Dresses to sit in, and stand in, and walk in,
Dresses to dance in, and flirt in, and talk in,
Dresses in which to do nothing at all;
Dresses for winter, spring, summer and fall,
All of them different in color and shape.
Silk, muslin, and lace, velvet, satin and crepe,
Brocade and broadcloth, and other material,
Quite as expensive and much more ethereal.
EVOLUTION OF AMERICAN DRESS

Arlene Hill '31
Brooks, Minnesota

Dedication

I dedicate this term paper to Elsie Mae Kingston, my teacher in clothing and design.

Foreword

I chose this topic because very few people ever stop to think of the origin of dress. This will give you a brief outline of the evolution of dress from the beginning of the Seventeenth Century to the end of the Eighteenth Century.

This paper is written with the idea of giving people a better knowledge of the history of their dress.

The people in English Colonies in Virginia, Maryland, the Barbadoes and the Carolinas during the reigns of James I, Charles I and James II and William and Mary, were dressed with very much style.

The men of adventure in the days of Captain John Smith wore the prevailing dress of an English gentleman. The attire and make up generally consisted of a brocaded doublet, a lace trimmed ruff and a pointed beard. The men generally wore padding or stuffing in their breeches.

After King James died, a new type of dress was adopted. The boy's clothes were ruffles and stays which were starched. Collar and cuff sets were worn with all their suits.

A woman of this same time wore a long soft skirt with a low cut bodice finished with square tabs about the waist, full
sleeves a little below the elbow, with soft ruffles of rich lace, a wide collar of the same lace being worn over the shoulders but these allowed the throat and neck to show. Soft breast knots of ribbon were also much worn. The hair was usually curled over the brow falling to the shoulders in rather tight ringlets and arranged in a knot at the back.

Most all of the coats, stockings, undergarments, handkerchiefs, gloves and caps were made from yarn. These were made by the women during the winter time.

The children in the southern colonies were dressed very much like their parents. The boy's clothes were patterned from their father's and older brother's and the small girl's clothes were designed from the standard dress of the mother.

The English colonies in Massachusetts, Connecticut, New Hampshire, Maine, and Rhode Island were using almost the same type of dress as was used in the southern colonies. People in the north had to follow rules of their leader and he always told them how many articles they should have in their wardrobe. Some of the laws that were enforced in the New England Colonies were that no person, man, woman or child would be allowed to wear a garment with no sleeves or even part sleeves. All garments must have sleeves that reached to the wrist and sometimes were made to fit down over the hand. A very important law in this section regarded lace. At one time the people were forced to wear a large lace collar. In a very few years this law was changed and the law provided that only a very narrow low edging could be used on any garment.

In about 1680 long straight coats without a collar but a small neckband were introduced. These were not worn very much and the fad lasted only a short time.
The children were dressed much as their parents, this rule also being enforced in the south. The babies' clothes were masterpieces of embroidery. The small articles of clothing were almost practically the same as were worn by the English in the south.

During this same period of time, there were English and Dutch settling in New York, Long Island, the Jerseys, Delaware and Pennsylvania. These people were particular and their type of dress was somewhat different than that of the southern and northern colonies.

The Dutch women during working hours wore a short woolen petticoat with a loose jacket of red cotton or blue Holland, a white kerchief folded around the shoulders, and a close white cap. Sometimes the women wore coarse white aprons.

The babies were dressed with ribbons and frills. They wore small lace caps and were wrapped in elaborate blankets. The color blue was used for boys and white for girls.

The children were gaily dressed and had many unnecessary articles of clothing.

The men wore velvet coats, hats with shiny buttons, and their attire was the same throughout the colonies. The dress was elaborate and they didn't wear a certain type for a very long period of time.

In the English settlements in the Middle Colonies, the women were dressed in bright colored silks, brocades and laces. Much money was spent on clothes and the women were very particular about their dress.

The men in the English settlements wore bright colored silks set with brilliants. They wore high-heeled shoes with shining
buckles and they also wore ribbons of the color that there was around their knees.

The children were dressed with much style and great care was taken so that they should have an entirely clean change of clothes at least three times a day. This method was followed until the children were at least eighteen years of age.

I have tried to tell you in as few words as possible about the clothing worn by the Dutch and English in the three divisions of colonies during the seventeenth century.

In the first half of the eighteenth century which was most prosperous and comfortable period of colonial life in America, fashion was a conspicuous element.

During the Reign of Queen Anne, two important changes took place in style - the headress was greatly changed. The styles said that the hair dress should be low and coiled neatly about the head. This was a distinct change from the high hair dress that had been used for many years previous.

The next transformation was the hoop invented by a man named Selby in 1711 and destined in one form or other to hold its way over feminine taste for many years. The women wore gay colored hoods lined with silk.

Black and white beaver hats for ladies were advertised in 1719 faced with colored silks and trimmed with gold or silver lace.

In 1720 women wore muffs that were made narrow and long; their crossed hands filled one exactly; afterward they became wider. In various forms, muffs continued in fashion through the century.

A mask of black velvet was often worn in winter with a silver mouthpiece to keep it on.
During the Reign of George II a change was made. The use of powder was introduced. The hoops were made larger, and the dresses were worn without a train. Headdresses at this time were made with three lace ruffles tucked to stand up in front. French curls that were made in 1745 were described as looking like eggs strung in order on a wire tied around the head.

In 1760 gowns began to be worn with a close fitting bodice ending in a long point in the back, the skirt sewn on with a multiplicity of fine gathers, still opening over a petticoat, the latter often beautifully quilted. Aprons were worn too according to the dictates of fancy. Sleeves were still trimmed with ruffles of lace but often edged with narrow cuffs turned back, the lace falling from underneath. The hoop skirt which had been used so long went out of style after the Revolution.

Caps of a great variety of shapes were worn on all occasions by the women of this period. In 1795 a very decided change in woman's dress is noted. Soft clinging materials out styled the stiff brocades and rustling silks. Gowns were made with narrow skirts and short bodices with long, tight fitting sleeves. The shoulders were generally uncovered, but muslin or muslin handkerchiefs were sometimes worn in the house, while for outdoor wear, long scarfs were put around the shoulders and fell to the feet in front. Hair was worn in loose curls, generally caught up with a comb or a knot of ribbon. Caps for elderly people were made in a variety of style.

The clothes of children in the Eighteenth Century were marvelously made and quaintly resembled the garments of their parents.

Dresses of 1750 were made with great skill of fine white cambric with low necks and short sleeves fastened up with
buttons and loops of narrow tape on the shoulders. Sps which babies wore both day and night were also exquisite needlework.

Men wore cocked hats, and wigs, coats with large cuffs, big skirts lined and stiffened with buckram. The coat of a beau had three or four large pleats. The boys often wore wigs and their clothing in general was similar to that of the men.

The dress of a gentleman in 1735 is described as a coat made of colored velvet or fine cloth laced with gold or silver breeches to match, waistcoat of rich flowered silk of large pattern on a white ground.

All costumes during the next reign were very simple.

The Spanish in Florida and California

The first settlement was founded by the Spaniards at St. Augustine in Florida. By nature the settlers were cruel, superstitious and shortsighted in policy, but their costumes as represented by contemporary painters were strikingly picturesque.

"A gay and gallant company

Those voyagers of old."

Women were dressed in bodices and short gowns of handmade woolen stiffs or of French goods of finer texture.

Men wore long vests drawn over skirts; leggings of buckskin or coarse woolen cloth, woolen clog shoes or moccasins. In the winter they wore long capes with attached hoods and blue handkerchiefs tied over their heads turban like.

This gives you a brief outline of the evolution of dress in the Eighteenth Century.

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Bibliography

Historic Dress

By McClellan
I shall continue telling you about the different costumes of the Nineteenth Century. I have divided them into different periods, and shall give you an outline of each period.

1776-1810

Rich fabrics such as silks and velvets were very popular. Other favorites were mulls, lawns and batistes. Much decoration was used on them in the form of embroidery, fringe, and spangles. Crowns of hats imitated the tall ones worn by the soldiers; fur reappeared as trimming, as well as broad collars and cuffs. The bodice was short; the sleeves became a trifle fuller, and longer, reaching, in some instances, to the wrists.

1810-1830

Most of the ladies of this period belonged to the Royalist party. They adopted white gowns with eighteen crosswise tucks in the skirt in honor of Louis XVIII, and white plumes on their chip hats or in their high powdered hair. By 1822, the waist line was down at its normal position, extremely small, and its presence emphasized by a broad, straight belt. The sleeves were set into lowered armseye.

About 1820 there appeared the leg o' mutton sleeve, with its fullness at the top held out from the arms by means of boning or padding; with long sleeves were worn kid gloves of bright hue, the short sleeves for evening being accompanied by white gloves with many buttons to secure a trim fit at the wrists.
1830-1850

The long drooping shoulders were a marked feature of the gown, particularly during the years of the Romantic period when Louis Philippi was on the throne. In order to accent the fashionable droop and width of the shoulder, scarfs and other small capes were adopted. The low, straight cut neckline of the evening dress came into use.

To preserve balance in the appearance of the figure, the skirts became very wide at the bottom and the hem several inches from the ground.

Ruffles, pleating, flounces, puffings, tucks, were all very popular as this period drew to a close. The skirt received all the decoration; at this time, they used all the decoration that would add to its breadth. Light weight cottons and silks were adopted by the women.

The hair was tortured into bunches of curls and ringlets at the temples; then brushed smoothly up the back of the head and twisted into loops and knots that were held in place by combs or pins.

The last eight years of Louis Philippi's reign saw a more attractive arrangement, the hair parted in the center and fastened in simple knots at the back of the head, and looped braids or soft curls were caught at each temple.

1850-1870

This period falls under the first Napoleonic emperor. The dress was straight, scant and simple. They wore close fitting bodices with its long sleeves that spread into a bell shape below the elbow, long shoulder and neckline that encircled the thread closely.

The skirts were ground length, so little of the feet were visible; however, there appeared either a high boot of black kid
or patent leather laced at the instep and with high heels, or slippers with bows or buckles.

Handkerchiefs trimmed with lace and hand embroidery were considered necessary to complete the costume.

Necklaces, bracelets, rings, and watches were also very popular at this time.

The costumes were rather rude in color, and of a great variety of texture. Plaids, checks, and stripes were more popular than any floral design.

1870-1885

Close fitting gowns were worn during this period. Skirts touched the floor swinging off at the sides in long trains. Sleeves were long and close fitting, except for evening wear. Evening gowns were sleeveless and long kid gloves became popular again.

One of the most fashionable wraps were the long mantles of velvet, trimmed in winter with an abundance of fur. Finally the long train gowns disappeared with the advent of the cloth costume for street wear. Close fitting jackets were worn with plaid skirts. In 1881 the Jersey material was introduced from England. It clung very closely to the figure and was worn with a kilted skirt of ground length.

For a few years the bustle was in evidence. Jewellery was also very popular.

1885-1900

At the beginning of this period, huge balloon sleeves with its stiffening and lining became very popular. The skirts were smooth and glove fitting about the hips.

Later the waist line was thrown into relief by a highly colored sash that tied in a bow at the back. As an evening gown, its square or round cut neck line was softened with lace sleeves.
taking the form of short, full puffs.

By 1888 the tailored suit became very popular. The coat part fit snugly at the waist; the sleeves were sort of full at the top. The blouse was of colored silk or cloth that accompanied the suit. The hats worn in 1890 were very small. Now that I have described the ladies dress of the Nineteenth Century I shall now tell you about the men's dress.

They wore full bottomed wigs until the middle of the century. By 1780 high waisted, double breasted, cut away coats were worn; gradually, their cuffs became smaller and tighter.

Their waist coat or vest until the 50's reached almost to the knee. They wore three-corner-hats. Their shoes were broad, square toes becoming more nearly normal. They also wore close fitting boots. Their shirts were made mostly of linen with ruffles of lawn or lace at the wrist.

Some accessories were a cane, watches, box lace handkerchiefs.

From this outline I have given to you, I am sure you will appreciate the changes in dress.
Dedication

I hereby dedicate this term paper to all persons who may be interested in the subject, "The Grooming of a Well Dressed Woman."

Foreword

May this term paper give some help to any woman who reads it in advising and bringing to her mind the few points that are so necessary if she is to be a well groomed person.

Before we go on to discuss the grooming of a well dressed woman, we should first distinguish between the pretty and the beautiful woman. The pretty woman is one whose looks are entirely superficial; she goes frequently around the corner to use her vanity case (in modern days, she does not even take the trouble to go around the corner). The beautiful woman cultivates health, which is the fountain head of sweet disposition, and spontaneity. She has the natural beauty of sparkling eyes, clear skin, and glistening hair.

All women wish to be beautiful and to possess that elusive, yet most potent something which we call charm. But what is charm, and whence is it? Charm is the grace which compels a desired response from others, and because it is a from-within quality, every woman may possess it, and every woman by cultivating charm may become beautiful.

We must remember that charm is not dependent upon clothes, that is, is a quality from within; but it can be expressed in clothes, just as all inner life is expressed through the outward self.
Women have passed the stage of inefficiency in dress as they have progressed in many other things, and are choosing their clothes with a definite idea of use and beauty. Girls and women are dressing more sanely because of their wider outlook of life and deeper understanding of their responsibility, a sense that they have an important role to play in life. They are now thinking of clothes in terms of individuality, of physical comfort, and of health. Physical comfort demands body freedom. Because a Queen Anne, once upon a time, had a thirteen inch waist line, a style was created, and from that time until forty years ago, women prided themselves on their small waist measurements. They wore shoes two sizes too small for their feet, because small feet were supposed to indicate refinement. These women were consciously or subconsciously suffering for years, and, as a result, at forty years of age, they had wrinkles around their eyes. They learned too late, if ever at all, that discomfort is never beautiful. Girls of today will not be wrinkled at forty, because their clothes are worn with ease and permit the full deep breathing that is essential to health.

Standing, sitting and walking are the three graces to which every woman should give attention in order to have a good appearance. Always stand on the front or the ball of the foot and keep the knees straight. Carry yourself so that a string extended downward from your chest would reach the floor without touching any other part of the body. Make yourself feel tall. Imagine that you are a pine tree on a hilltop.

Rules for correct posture in walking are as generally known as they are neglected. We all admire the erect posture and swinging gait of a moccasined Indian. The contrast between the walk of
the foreign peasant and that of the fashionably attired American woman is very noticeable. The foreigner carries a large bundle on her head, and on her feet are shoes that are big enough to give freedom to every bend of the instep. She swings from the hips as she walks, and she makes a truly graceful stride. Observe the American woman. Because she is inclined to be somewhat stout, she has drawn herself down in front until the strain on her clothing is intense. She has on high heeled shoes and is hobbling along rather painfully. Had the American women but known how to imitate her humbler sister’s free movement and carriage, how much more beautiful she might have become, and how much happier would be her spirit. Is your walk in keep with your personality? Grace is skill in movement, and that skill is only attained by daily attention to your walking stride.

When you sit down, turn with one knee slightly toward the chair upon which you are to sit, letting one knee take the weight of the body as you are seated. When seated, keep one foot slightly in advance of the other, and note that you have a long, graceful line from the crown of your head to the point of the toe. In rising, let the foot which is farthest back take the weight. You will find that this permits you to rise without bending so far forward that you appear ungraceful.

Beauty depends on health. A healthy woman has charm regardless of her age or features. She has an appearance of poise and good health which comes with a healthy, well groomed body under proper control.

No matter how elegant the material is in a woman’s dress, nor how costly her jewels, if she is not clean, she is not a well dressed or well groomed woman.

Occasionally we come in contact with a woman who has
good taste in dress, and her appearance would be pleasing except for the fact that it is not pleasant to be near her. A person of refinement would not think of going among other people after a hard day's work without a bath and putting on fresh, clean clothes. Bath tubs are a delight and are easier to use than the substitutes but we can keep clean by using soap and water, if only a sponge bath is possible. Baths should be indulged in at least twice a week for ordinary cleanliness. A warm tub bath from ninety to ninety-eight degrees F with soap is cleansing and refreshing. A warm bath followed by a cold sponge or shower closes the pores and stimulates circulation. Hot baths over ninety-eight degrees F are apt to affect the heart. They should be taken as a remedy to relieve congestion or colds. Certainly if the public were more careful of personal cleanliness, public gatherings would not be quite so obnoxious. We owe it to society to keep scrupulously clean.

Proper cleansing of the skin is often a cure for pimples or blackheads which result from these pores being clogged with oil and dirt. Perfect digestion and elimination must be obtained through proper food, exercise and fresh air and bath day and night. Selection of good soap is important; strong alkaline soaps irritate the skin. After soap has been used on the face, the skin should be rinsed preferably with cold water to close the pores. If one will cleanse the face with cold cream after having thoroly washed it with water, you will notice that more oil and dirt from the face is deposited on the cloth with which the cold cream has been wiped off. This is proof enough that soap and water does not do all. A face cream adapted to the skin should be applied once a day in winter. If the skin has an oily tendency, a greaseless cream should be used. A good lotion for an oily skin is boric acid and glycerine in equal parts, with a few drops of camphor. A
healthy skin usually means a healthy body. Certainly women with clean healthy faces have a charm all their own.

A film of cream should always be used to protect the pores of the skin when face powder is applied. Use face powders blended especially for the individual complexion, one for daylight and one for artificial light. The texture and quality of the skin determine the choice of heavy or light powder. Rouge should be selected by an expert and applied skillfully. Liquid powder may be applied to face, neck, and arms for evening or stage appearance. Depilatories for the removal of superfluous hair are many. There are a number of wax preparations which are quite satisfying because they gradually kill the roots of the hair. The wax is put on the flesh hot. When it is cool, it is removed, taking with it the hairs.

Tissues for removing creams are sanitary and convenient. Powder or any other face lotion which is put on carelessly, however, is as unattractive as the shiny face.

When lying down for the afternoon rest, which every woman should have, pads of absorbent cotton, wet with ice cold water and witch hazel and placed over the eyes will give a soothing restfulness and a brilliancy to the eyes.

In showing your ears, be sure to look at your profile in a mirror. Some people look well from the front view with their ears showing, but are decidedly homely if viewed in profile.

The woman with the too-round face should not allow her ears to show, for it will add breadth and the continuation of a wide line of the skin's color. A dark hat worn rather close over the ears and near to her cheeks will break that line and give a narrower expression to the face. The golden haired girl will find that a black, close fitting hat or a black ribbon worn around the
head rather than across the forehead will make her face appear more slender.

If a woman has high cheek bones in a narrow face, she should not show her ears. A piquant touch may be given, however, by long earrings hanging from small and attractive ears.

The dentist is the one who should give advice about the teeth. Certainly no one ought to neglect this greatest aid to laughter, for you know that if you can laugh at trouble, it will quickly run away. It's not easy to laugh, however, if you feel conscious that such a trouble chases will transform you into a less attractive person. If your teeth are pretty, laugh all you can, and, as you have heard, the world laughs with you.

To guard against decay and infection, the teeth should be brushed daily and the gongue should be cleaned each time the teeth are cleaned. Common salt is a good dentifrice and helps to toughen the gums if they are inclined to bleed. Dental floss should be used to clean food particles from the teeth. Toothpicks used at the table, on the street, or in the parlor are considered crude and vulgar.

Teeth should be cleaned and examined by a dentist annually. Like a garment, "a stitch in time saves nine" and in the matter of feelings, it would prevent much pain, save money, and possibly save more teeth. Oftentimes it is a decaying tooth which causes the unpleasant breath which is most embarrassing. If one still has a bad breath, after teeth are cared for, the cause may be from poor digestion, diseased tonsils, or some other cause. The cause should be eliminated, but in the meantime a mouth wash which is pleasant to use will help the matter some.

The neck and chin need constant care to retain a pleasing symmetry. The neck must be bathed and fed with nourish-
ing cold cream daily, for it is only a starved neck that early shows signs of wrinkles. The hollow places at each side of the base of the throat can be filled out by a liberal use of cocoa butter.

Brown spots which so often come on the neck under the ears and other parts of the body, may indicate liver trouble, which can be prevented by eating oranges.

Hair gets soiled just as clothes do. Women working in a steaming kitchen, and doing their own sweeping certainly collect much dirt in their hair. Some people have trouble with their hair getting "stringy" very soon. A shampoo is refreshing and is good for the hair. In washing the hair, a soap free from alkali should be used, and the hair rinsed at least twice. In the first rinse some vinegar may be added, perhaps two tablespoons or else lemon juice which is very effective. This cuts the soap and helps to rinse all of it out. This also gives gloss to the hair. If soap is left in the hair, it is apt to look dull and lifeless and also get oily sooner.

The hair should never be dried by artificial heat, but out of doors if possible. If a curl is desired, the naturally curly or permanent waved hair should be allowed to dry without rubbing. When it is completely dry, it should be combed with a very coarse comb.

Combs and brushes used on the hair should be kept immaculately clean.

In order for the hair to have fresh air, it should be spread over the pillow when you are sleeping, or worn hanging down part of the day.

Now that we have learned some of the ways of keeping the hair in a healthy condition, let us see what beauty miracles we can work further with the crowning glory.
In hair dressing, as in all other arts, simplicity is the most necessary element. Hair, whether bobbed or long, should be cared for daily. If bobbed hair is worn, the most becoming and convenient bob should be chosen and then the hair should be and should look as tho it had been combed. Some shaggy bobs look as if the wearer chose that style so she never would have the bother of redressing it again. Hair should be combed in the most becoming manner. When you have chosen and decided upon the coiffure which suits your features, the size of your head, the length of your neck, and width of your shoulders, and size and height of your figure, do not change it.

There is no part of the body, with the exception of the face, that is so expressive of a woman's character as her hands. If women realized this, they would most certainly make more use of what might be a real beauty factor. We are not all blessed with beautiful hands, nor can we all keep out of the garden, the canning or the dish water. Certainly the hands that get into all these things need some attention. If we dress up for an afternoon party and our hands are rough and almost ruin the silk dress we have on, it means we haven't managed right and that somewhere in the twenty-four hours, some time should have been given to the care of the hands. Rough, red chapped hands are not beautiful nor do they feel comfortable. Chapped hands are caused by excessive evaporation of moisture from the skin, due to high winds, to the use of strong soap, or other irritations which break the outer skin. The hands should be kept clean. Wash them thoroly with pure soap, scrub with a brush that is not too hard, use lemon juice to remove the stains, rinse thoroly with warm and cold water, wipe with care each finger and knuckle separately, and then rub on a good lotion. A good skin lotion can be made from an ounce of glycerine with a
half-teaspoon of benzoin diluted in rosewater. Lemon juice not only removes stains but it bleaches the skin as well.

We may consider ourselves more civilized than the Chinaman who measures his social prestige by the length of his fingernails, but there is no truer way of judging one's fastidiousness than by hand and finger nails.

Hands may not be beautiful, but if the nails show proper care, they bespeak a refined sense of beauty. Nails should not be clipped. It is better to shape them with an emery board. Two or three minutes shaping each day will keep them the desired length. The nails should be shaped to correspond to the shape of the fingers. Very pointed nails are like all affected things—displeasing. To clean underneath the nail, an orange stick wrapped with a little cotton should be used. This may be dipped in a bleach, such as diluted peroxide, and used not only under the tip of the nail, but on its entire length. This will remove discolorations. A sharp instrument will scratch the nail, making it rough and ready to hold dirt.

The flat end of the orange wood stick should be used to push back the cuticle at the base of the nail. This will prevent the half moon from becoming eclipsed. The fingers should be wet during the process, and care should be used to prevent breaking the tender skin. If there are rough edges, they can be trimmed with any sharply pointed curved scissors.

Nail powder can be rubbed on the nail with a buffer. Some manicurists use a preparation of pumice, but this is very hard on the cuticle. The polish is finer. Briskly buffing the nails will make them tinge with circulating blood; this will give a pink coat, showing the presence of the desired vitality which causes the nail to grow.

Extremely shiny nails are in poor taste. A dull polish
is the correct finish under all circumstances.

Keep on your dressing table a small covered jar in which you have placed a piece of absorbent cotton saturated with olive oil. Just before you get into bed, after your nails have been thoroly cleansed, dip the fingers up and down in the cotton. The oil will prevent brittleness which causes broken unsightly nails.

A beautiful young lady with grace of figure, held out her hand to me, and I saw how the stubby finger ends spoiled the most expressive of all her attractions. She had the terrible habit of biting her finger nails. She should have been broken of the habit in infancy or as soon as biting began. Bitter aloes put on the ends of the fingers will sometimes aid in the cure, but certainly a grown woman should have sufficient mental control to make it possible for her to refrain from such a desecration of her beauty.

"'Tis not a lip or eye, we beauty call, But the joint force and full result of all."
- Alexander Pope

Bibliography

Individuality and Clothes by Margaret Story
Chapter IV

Paper written by "The Home Demonstration Office" at University Farm, St. Paul, Minnesota.
The Home
EVOLUTION OF THE HOME

Ann Thoreson '31
Littlefork, Minnesota

Dedication

To all who are interested in the history of our homes from the beginning civilization to this present day and age, I wish to dedicate my thesis.

Foreword

May you enjoy the rapid development of the modern home to that of the future home, as we have enjoyed the development of the past home to the present home.

Let us first consider what is meant by "the evolution of the home." Conversations nowadays are based upon evolution in many different plans, such as plants and animals. By evolution we mean a progressive change, a complex arrangement or organism of the home as developed from crude or simple evolution of civilization of which that from slavery is a good example. By this simple explanation we come to the conclusion that the modern house of today derived from a crude or simpler form.

We have many forms of dwelling, but they simply mean a definite thing to us and we know very little of their origination. Going back hundreds of years we can find something about the early human inhabitation, how the family originated and how the language originated. Music has a very interesting beginning as well. We know absolutely nothing about the earliest human dwelling, but we know of types of early human dwellings and in the study of these types, we can easily see by following up, the evolution of the modern house.

Since both the modern house and the earliest dwelling were meant to serve the needs of human beings, they need not
differ, yet in a stronger sense, there is a decided difference. We know that shelter from the cold and the heat is just as necessary now as it was in the early ages, so in that instance, we are alike, but in the forms of shelter, there is a great difference. Through the study of the early human inhabitations, it has been decided that man found his first shelter under the spreading branches of a tree. This was most satisfactory in a warm climate and one free from wild beasts.

The inter-twining and overlapping of the branches are supposed to have suggested the thatched roof, for which shingles are now substituted. Trees are stationary so some means of movable shelter had to be made for those nomadic tribes whose inhabitation depends upon the water supply and the pasture. It was discovered that a small amount of wood would serve nicely as a frame work or support, when using skins for a covering. This made a very desirable dwelling and it was very easily transported, thus the tent was used a great deal, especially by the Indian tribes.

Nature has provided another form of dwelling which is the cave in the rock; very often wild animals lived in these caves and it was sometimes necessary to drive them out before man could use the cave. In the West, the "dug-out" is a modern resemblance of the cave in the rock. Neither the "dug-out" nor the "sod hut" are as desirable as the log cabin which has served as a dwelling place for so many pioneers. The log cabin seems to be the most universal form of early dwelling, and it is very desirable. Types of the early log cabin are found in the primitive and modern races in Russia and in all parts of the United States.

There are other forms of human habitation which are of interest, especially in the Americas. Let us first consider the pueblos. It refers by name to a town, market place, or village,
and is used in different parts of Mexico. In the pueblos, there are many groups of rooms and these rooms can be entered only by the use of a ladder which permits you to climb up to the top where the doors or openings are located. Often you pull the ladders up after entering; thus these dwellings were considered very safe. The pueblos were constructed of stone, these being carefully laid and the cracks or crevices filled with mud or clay. Some of these pueblos were circular and others were rectangular in shape. They contained from two to six stories and had seventy to eighty rooms in each story. Many of these rooms were more like cells because of their smallness in size. Some of these stories had trap doors, thus communication was made possible, while other doors were placed in the side of the wall admitting sunshine and air.

The cliff dwellings resemble the pueblos in some respects. The houses were built of rock or cliff and were often reached with great difficulty, their shape and size depending largely upon the size and shape of the rock used. Their walls were made of stone cemented with clay and they showed much skill in construction.

While these show much skill in architectural points, they would seem very unsatisfactory to the modern man of today. The stone walls and floor, unsanitary conditions and the absence of light and heat would be entirely out of place for a home for this day and age.

Besides the ones just mentioned, let us consider a group of four other houses. The Swiss, Grecian, Roman and Japanese. The lake dwellings of Switzerland are older than the pyramids of Egypt. They were built in the still water of the lakes far enough from the shore to be left quietly alone; after life became safer, they returned to the land.

Among the Greeks, the energies of the people seem to have
been given to the making of temples rather than private dwellings. The Greek temples were made inside of large walled spaces or cities, they were one story in height and had stone floors. The Greeks show the separation of the men from the women by the special courts which they had. A woman of wealth is not supposed to leave this court more than once a year.

The wealthy Roman homes with their various courts occupied one block. The outside was rented for shops or to the poor people. The walls in the rich man's house were made of wood finished with plaster, the floors being made of stone.

The Japanese house is built of wood and has a tile roof. It has no cellar; its walls are made of sliding shutters so it was possible to make doors more easily. The size of the rooms is decided by the number of mats. These mats are made of straw three by six feet in size. There is no need for a bedroom in a Japanese house because any room can be transformed into a bedroom by the putting of thick comforters upon the mats.

The Swiss houses are made almost entirely of wood; the lower story is used for masonry and the basement is sometimes used for stores and for domestic animals. The timbers of the lower story project and form the gable windows.

It may be well to consider how social conditions and traditions have influenced American architecture. In such a new country there was more freedom of action; the people are more organized in their manner of conducting affairs; there was also less wealth and fewer class distinctions. When the resources were undeveloped and the people had little wealth, the houses and the life of the American people was very simple. The American architecture shows a strong individuality; it is original, varied and irregular. The Americans are a comfort loving people. For many
years the American homes were not associated with the treasures of the old world. The newer and better architecture is found by using the elements of proportion, symmetry and beauty as found in the world structures, and using them in the construction of buildings which are suited to the needs of the Americans. We all know the castles of Rome would not be suitable for the free and easy American people, nor would the American people consent to having the first floor of their home for the shops and stores, as was done in the olden times.

The American homes are perhaps the most interesting to us, so let us take a few moments in which to consider them.

The log cabin was perhaps the earliest home of the colonists, but its construction soon changed from log walls to clap boards and this was the beginning of half timber work. The "old colonial" was an immediate follower.

Two very distinctive types of colonial houses are found in the very earliest houses; they were both made known on the English modes.

The Puritans also known as the "New England" houses were built on the large estates of the Virginian people. The early Puritans showed their business life in their houses; the houses were very comfortable, having three stories, all of which had plain exteriors and interiors.

In the sunny south, the climate was very lovely and the soil good for production. The Virginian homes were different because of this. The houses had to be large to accommodate the family, guests and slaves.

The Spanish idea is expressed in the homes of Florida; they are made of light colored stone, and are very beautiful to see.

It is necessary for an architect to know a great deal
about the architecture of other people and of different forms in
order to develop a true style. To build a small bungalow and
furnish it with large furniture suitable to a mission house
would be considered poor art. We want the furnishings to harmonize
with the style and size of our house; we also seek convenience in
our houses.

A few of the best known styles of houses in America are
the modern colonial and the Dutch colonial houses; these are not
true types, however, and the reason for that is that the archi-
tectural features have derived from the true colonial style. In
California, the name mission is applied to the style of bungalow
used there. The English style is derived from the many English
styles of design. Perhaps you are wondering where we get the
name bungalow. This is a house designed with irregular lines.
The farm house gets its name from the place where it is located.
The suburban house also gets its name from the place where it is
located; it is a house designed for the suburban. A country house
is usually built on a large country estate. A city residence may
designate any house built on a city lot. The term apartment
house means a multiple house with much smaller rooms. It is
usually inexpensively furnished and is very poorly arranged from
the standpoint of health conditions. The duplex house is designed
for two families, one living on the first floor and the other on the
second floor, both under the same roof, separated by a wall. We
think of houses having two families in them as a poor place for
children. They have no freedom and often children are an annoy-
ance to other families of the same house.

We have watched the different steps of changes in the
homes, starting with the beginning of civilization up until this
day and age, and we fully realize the wonderful improvements that
have taken place. We sincerely hope there will be a steady im-

progemenent and that some day there will be an architecture developed in America which will far surpass any we have seen, read, or heard about.
CURTAINING THE HOME

Tumina Slette '31
Twin Valley, Minnesota

Foreword

I hope this term paper will give some help to whoever reads it concerning their window problems and how to solve them.

Dedication

In appreciation of what I have learned from the Home Economics Department, I wish to dedicate my term paper to Miss Elsie Mae Kingston of the Northwest School of Agriculture.

Like all other arts, the art of window curtaining or draping consists chiefly of putting the right thing in the right place. I do not think that there is any other item of home decoration that offers such wide scope for the exercise of good taste within the limits of moderate cost as does the window problem.

The main point to be kept in mind is how to unite in the best way usefulness and artistic effect. This can be accomplished by following the guide of simplicity, harmony, and refinement.

To be useful, curtains must not conceal an attractive view, prevent adequate ventilation, or shut out too much daylight. They should soften and diffuse the light entering the room and break the severe lines of the wooden casing around the window.

Windows are the eyes of the home; they bring light to the people within the walls. If there is beautiful scenery outside, the windows should be treated to enhance that beauty
and relate it to the home as one of the most enjoyable features. Everyone loves the beautiful out-of-doors, so why exclude it?

It has been agreed that the main purpose of window decorations are to secure privacy, to soften light, to soften severe lines of walls and windows, and to lend decorative beauty and charm. One of the first steps in planning curtains is to consider the number of windows in the room and their shape, size, location, and exposure. The more pleasing these features are, the simpler it is to plan curtains which are attractive; usually the windows must be accepted and curtained as they are.

Windows are of two general types: casement, and the double hung sash. There is little choice between the two, if they are both well made. The casement windows are made to open out, while the double hung sash windows lends itself to detached placing.

There are definite laws which aid in deciding how the curtains should be hung, what materials, colors, and patterns should be used in the various rooms and with different types of furnishing.

The window curtains form with the walls, floor, and ceiling the background for the furniture and occupants of the room. The lines of the curtain are determined by the way in which it is hung. They are formed by the direction and length of drapery as well as by the bands, trimmings, features, pattern and each fold of the material.

These lines guide the eyes and direct the interest. Vertical lines are formal and dignified and stress height. Horizontal lines are formed by the valance, tiebacks, trimming bands, and double sash curtains.

The longer the horizontal lines, the greater will be
the widening effect given to the window and to the room. Therefore to increase height of a short window, use long drapes, and to reduce height slightly, use both vertical and horizontal lines.

The laws of proportion needs to be constantly applied whenever spacing of lines, masses, or colors is being considered. Occasionally a window is so awkwardly proportioned that it is difficult to make a curtain look well on it.

Thus if a window is too broad and low, the side draperies may be made of a striped fabric and spread over the window to reduce the expanse of glass. The valance can be placed above the casing and just barely reach the glass or the valance may be omitted or reduced to a mere ruffle.

If the windows are too tall and narrow, the proportions can be modified by mounting the rods out on the wall instead of on the casing and the side draperies may be pulled over until they just reach the glass.

The laws of balance must be applied to each grouping of furniture and wall decorations as well. In order to distribute interest and restore balance to the room, very simple curtains blending with the wall should be used with furniture pleasing in color and shape.

On the wall opposite the windows an attractive grouping of furniture with well placed colorful pictures will aid in the distribution of interest. Forgetting the practical and viewing curtaining from the artistic side alone, it is evident that color is the most important single factor in the success of draperies. Color can correct even the handicap of poor light, weak proportions, and bad lines.

The five principal colors are red, yellow, green, blue, and purple. Bulky furniture and dark woodwork require a heavy color, such as dark red, green, or a blue to balance them.
Red, yellow, and orange are classed as advancing colors, and they must be used judiciously in small rooms or the effect is overpowering. Since these colors are associated with fire and sun, when used in winter draperies for a dark and cheerless room, they counteract the effect of darkness.

The grayed blues, greens, and violets are associated with the distant sky and hills and give the feeling of space. Curtains of the nature of green are perhaps the coolest and most satisfactory in reducing the brilliance of a sunny room.

In selecting the color or colors, to be used in the draperies, consider the walls, floor, woodwork, and all the furnishings of the room. When the draperies are figured, a more harmonious effect is gained by selecting a fabric which the background is the same color as the walls, only slightly darker, and in which the principal color in the design repeats the color of the rug or upholstery. White window curtains should be used only where the woodwork or the walls are white.

In a room requiring warmth, pale orange or cream walls blending into soft, warm brown linen draperies and lustrous orange gauze glass curtains would be cheerful and pleasing. If the rug and much of the furniture is in plain colors, the draperies may be cretonne or printed linen having a dominant color that carries out the plan of the background. Too much plain color makes a room bare and uninviting.

The color scheme of the draperies should be planned with the whole house in mind. The dominant colors in adjacent rooms should harmonize. To go from a rose and blue living room through a green hall into a yellow and blue, purple, or orange dining room is disturbing to a sensitive individual.

If colored glass curtains are chosen, they should be part
of the whole wall plan. This applies to using plain draperies on a figured wall paper, and figured curtains on plain walls.

Texture and pattern modify color and must be considered in close relation to it. By texture is meant the effect of the weave and fiber upon the appearance of the fabric. The spirit and the character of the room determine to a large extent the texture that should be used. Lustrous orange satin draperies would be out of keeping in a rough plastered room with a huge stone fireplace, beamed ceiling, and small casement windows.

With dainty, painted furniture, organdy, swiss, or voile curtains preserve the spirit of the room, whereas with heavy overstuffed furniture, they are quite lost. In this case, heavy linen, tapestry, or even velours are necessary. Silk, damask, rayon, and novelty cotton are suitable with fine mahogany.

The recognized curtains for windows are generally classified as glass curtains, side draperies, valance, draw curtains, and shades. Glass curtains are made of thin translucent fabrics of any of the fibers. They may be placed over all or part of the windows. This type of curtain generally extends to the sill. They diffuse the light entering the room, modify its color, are a protection to the side draperies, lend an air of privacy, and if one type is used throughout the house, give a uniform effect from the exterior.

Materials commonly used for glass curtains are net, marquisette, scrim, voile, theatrical gauze, and silk gauze. When laundered, net curtains should be dried on stretchers so that there will be no danger of shrinkage.

Side draperies are heavier than glass curtains and are arranged to form a frame at the sides of the window. They subdue the light in the room, act as shades if arranged to draw, give a finished appearance to the window, aid in modifying ugly propor-
tions, and serve to unify the color scheme.

Fine, firm, flexible material hangs and looks best for draperies. At the present time, cretonnes and printed linens are very popular.

Valances are that part of the window drapery which is placed across the top of the window. They may be used with or without side draperies and are made plaited, shirred, draped, and fitted. Their principal purpose is decoration. They give a finish to the window treatment by carrying the eye across the top. Valances may be used with drapes or without, and when used with drapes, they are made of the same color. The ordinary width of the valance is one-sixth the length of the curtain, making an average of eight, twelve, or fifteen inches.

Draw curtains are adjusted on rings and pulleys and can be drawn together with a cord. For example, like the dining hall curtains, and the curtains in Robertson Hall.

Typical draw curtains are made of casement cloth, mohair, pongee, linen, silk and cotton combinations, and even unbleached muslin plain or dyed, Japanese crepe, china silk, gingham and cretonne.

Shades serve to exclude glare in the daytime and maintain privacy at night. They are usually placed under the glass curtain. The ordinary type of Holland cloth, plain or patterned. Shades should be chosen from the standpoint of durability, color, fastness to light, ease of action, and opaqueness. If the draperies are arranged to draw, shades may be omitted.

Curtains for different rooms are as follows. The living room, dining room, bedroom, and kitchen require materials and methods of curtaining that conform to the use of the room and express the individuality of the occupants.
The living room is the place where the family and friends gather. It must be restful, comfortable and cheerful. This depends largely upon the kind of curtains and accessories are in the room.

Plain colored overdraperies of poplin, monk's cloth, mohair, crash, or denim, with bands, braid, or hems of contrasting color will blend with almost any type of furniture. For the living room that seems awkward and cold, cretonnes and patterned fabrics are advisable.

If the dining room connects with the living room, a more harmonious effect can be gained in the small room by using draperies like those in the living room. It is permissible, however, to use more extreme patterns, coloring, and methods of curtaining in the dining room.

Gayety and happiness should be expressed in color and design. Materials appropriate for the breakfast nook are spotted, checked, or striped gingham, English prints, cretonne, or muslin banded with color.

For inexpensive curtains in the bedrooms, daintily colored dotted swiss is attractive, and unbleached muslin bound, banded, or appliqued with color is always good. For the boys bedroom, avoid ruffles, pastel colors, or half tones. He needs strong color and simple lines.

The daughter's room can be made to express the opposite spirit. She may enjoy ruffles and dainty colors or she may be a hearty out of doors girl who enjoys the same things as her brother.

At small paned windows in the kitchen, if the view is pleasant, curtains may be omitted. At the average kitchen windows, a softer effect is gained by using side curtains of
gingham, muslin or some other durable, easily laundered material. A very common treatment is to place a curtain only on the lower sash.

In concluding, I wish to say that any person, interested in curtains, will always notice them from the exterior of the house, as well as the interior, "So, Beware of Passers-by."

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CUSHIONS FOR THE HOME

Helen Naplin '31
Wylie, Minnesota

Dedication

I dedicate this thesis to the Home Economics Department and any person who is interested in making Cushions for the Home.

Foreword

May this term paper give some help to whoever reads it about Cushions and Their Use.

Preface

This thesis has been prepared to give the important facts in selecting cushions to match the surroundings of the room.

It is only recently that we have begun to realize the importance of having all the little things that go towards the furnishing of our homes harmonize.

Among the accessories that do much to make or mar an attractive room are cushions. A few years ago, if we happened to be the owner of a few elaborately embroidered cushions, they would all go in the best room of the house whether they clashed with the other accessories in the room or not.

You should have a variety in the cushions that are to be used in the same room; at the same time, they should belong together. This can be achieved by using the same material, but making the cushions different in style. For example, a piece of fabric of which a cross stitch cushion is made might form the corded band on a plain colored cushion.
You should first decide how many cushions are to be needed; then work out a color scheme to match the surroundings of the room. While bright colors are often introduced by means of the cushions, it is advisable to make the greater number in quieter tones like tan in place or orange, and grey; green in place of moss green. There should be one bright green or orange cushion in the group, and if more color is needed, it can be used in pipings or trimmings on one of the darker colors.

In selecting a patterned material by the yard for a pillow, enough must be purchased to place the design in the center of the pillow. This does not apply to an all over pattern but one with strips of varying widths, or tapestry design.

If the cover of the sofa is plain, there is opportunity for introducing a variety of colors on the pillows, such as a rainbow set of covers in red, blue, green, orange, and violet, but if the cover of the sofa has figures, it is better to have the pillows of a neutral tone and plan in color and design. The richer, more elegant the sofa cover, the less conspicuous may be the pillow.

Some of the most decorative pillows are made from the cheapest of materials. Short remnants of cretonne may be picked up for almost nothing in the spring, and fall, and put away for pillows for the summer.

It is safe to remember in selecting pillows for the home that an artistic pillow is a useful pillow. An elaborately embroidered pillow top, which does not stand the wear has been replaced by a plain, serviceable one. Pillows on sofas and day beds that daily receive hard wear and tear may be among the most attractive and efficient.

The beauty of a pillow top may come from its color or colors that have been correctly chosen for the room, or it may come from a combination of color and design.
Remember that artistic pillows display harmony, not endless hours of work.

In a room where velvet and tapestry and other rich materials are used, you would not want voiles and gingham pillows but rather pillows of damask, taffetas, velvets and silk poplin material. In rooms with cotton draperies and furnishings, cushions of silk and velvet seem out of place. You would want cotton materials such as gingham, cretonne, voile, and also linen and sateen.

Simple shapes are in much better taste than odd, novel shapes. Round, rectangular, cylindrical and square are perhaps most common, altho pillows made in shapes of cats and dogs, which add cheer to a child's room can be used.

There is a great variety in sizes of cushions, and the place where the pillow is to be used would determine the size of the pillow. For the bedroom, you would want a smaller pillow than for the porch or living room. Sizes of down cushions are 18 to 26 inches square, while 22 inches is the best for ordinary use, altho cushions range from ten to 26 inches square.

Cushions for the living room should be made to stand service and wear but also should be attractive and should add something to the room. You can all picture a living room without any cushions, a bare couch and stiff, hard looking chairs. As soon as a few suitable attractive cushions are added, the room has a more easy and comfortable feeling. Your living room cushions should match the surroundings of your room. Each cushion should have its place in the making up of a perfect color scheme.

Living room cushions in order to give service should be of some strong material as velvet, linen, satin, damask, cretonne, and other materials. The covers should be able to be removed and washed so they can be kept clean and fresh.

You always think of bedroom pillows as soft and fluffy.
Cushions in dark colors are not used in bedrooms, but rather voiles and other soft materials. Your bedroom is a place where you can show your individual likes and skill in choosing the accessories in the room.

Dainty cushions can be made from scraps of silk combined with other materials. These cost very little. Your bedroom should look cool and dainty; therefore, it is a good plan to cover windows with voiles and pillows with something dainty, such as white or figured swiss with frilled rubbles. This looks cool and sweet.

The third place where cushions are used is on the porch; as a piazza is the summer sitting room, the making of artistic and suitable pillows is of great importance. You should not take pillows worn out and ragged from the living room and put them on the porch, for they would probably be as out of place as a worn out party dress in an office. Cushions made from woven grass from Madagascar in two contrasting colors are very good for porch cushions. Strong materials should be used; some art art ticking, which can be gotten in tan shades for applique, and stencilling. One of the most common in use is oilcloth, which is very popular and looks very attractive, but cracks and peels if it is crushed. This material can be washed if it becomes dusty. Other common materials are linen and Indian Head.

Years ago pillows were common in use on the floor, but are gradually going out of style, because they cannot be kept clean and are considered poor taste.

Fillings for cushions are down, feathers, moss, silk floss, hair and cotton. When considering the filling, it is well to understand where the cushion is to be placed; for a stiff back cushion, hair and moss is better than just felt or down. A divan of usual length may have three stiff pillows at the back which should
nearly match the cover of the divan. Smaller soft pillows should be filled in. Usually seven pillows is the average amount for a divan. Soft pillows that are filled with down should have an interlining to keep the down from working its way out.

The cushions we make need not be expensive nor display endless hours of work, for attractive cushions can be made cheaply by proper choosing in color, material, and design.

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Floors

Gladys Eggen '31
Fertile, Minnesota

Dedication

I dedicate this thesis to Miss Retta Bede for the good instruction received from her, and to all students of the Northwest School.

Foreword

May this term paper give some help to whoever reads it, about their floor problems and solve them.

Preface

This term paper has been prepared at the earnest request of the Northwest School. In giving the different facts about floors, I have tried to pick out the most important things about them. Floors are important problems that confront every housewife.

Floors are often a perplexing problem, especially in these days when everything connected with the building, furnishing and upkeep of a house is high in value. Fifty years ago much attention was not given to the floors themselves beyond having them level, fairly tight and of sound lumber, for they were usually covered entirely with a carpet or carpet matting in the living rooms, and left bare and unfinished or, at most, painted in the kitchen and pantries. The floor is the foundation and in all cases part of the background of the room and its furnishings.

Floors are made to be walked on but they cannot be considered satisfactory if they are not easy to clean or do not wear well. There are many qualities that a truly ideal floor should possess. First of all they must be noiseless, as the clatter of footsteps on marble or wood is annoying to listen to.
Sometimes hardness in floors is fatiguing to both nerves and muscles. A floor should be firm enough to bear without yielding the strain that it receives. Extra support is sometimes needed underneath a floor, especially an old one over which there is constant passing and where there are kept heavy objects, such as sofas or cabinets.

A floor should also be level. Uneven floors are uncomfortable to walk on and bring harder wear on some parts of the floor covering. It must be smooth surfaced and free from cracks and seams. It must not only be easy to clean, but to keep clean. The ideal floor must be economical in respect to upkeep. In the matter of cost, there are two things to consider, the first, cost, and then the upkeep.

In this country wood has been by far the most popular material for floors in private houses. Wood for flooring is classified as: hardwood, and softwood. These are just trade names as some of the so-called softwoods are harder than some of those classes as hardwoods. Of the hardwoods, maple, beech, oak and birch are most used. These have several characteristics which distinguish them from other hardwoods, used for flooring. They are free from slivers or splinters and they have an unusually tight grain so they take a beautiful and lustrous polish.

Maple is the lightest of the four in color. It should not be stained because it is so exceedingly close grained. Its natural color when waxed or varnished is beautiful and cheerful, a rich golden hue. Maple is usually used in the kitchen where it is usually scrubbed, and becomes almost white. Most ballroom floors are of maple and make a beautiful setting for party clothes. This flooring wood is tough, hard, heavy, strong, and durable. Its strength can be equalled to hickory. Maple is the ideal flooring
for residential use. It resists pressure and the friction of passing feet. It usually outwears stone. Years of use will find your maple floors as smoothly beautiful as the day they were laid. Maple, with its color advantages, comfort and durability, sets a standard in what is most modern in residential flooring.

Beech and birch should be used if you want a richer natural color. These woods have a more pronounced graining so they will retain a fine stain and finish. Because of their fine physical characteristics and color, they have become great favorites with the home builder. They make beautiful, artistic and durable floors and they are highly recommended as alternates for maple when a darker finish is desired. Birch is used less for flooring than for wood trim. It takes stain better than any other wood and is desirable when any special variety of color is sought. Beech is a more open-grained wood than maple and, like birch, takes stain very well.

Oak is a very desirable flooring. The qualities that make oak desirable are its distinctive beauty of grain and its extreme hardness. The method known as quarter sawing serves to further bring out the grain beauty, giving a flecked and mottled effect not equalled by any other wood. Another characteristic that must be considered in its finishing is its openness or coarseness of grain.

Softwoods include the various kinds of conifers. The most durable for floors are the long leaf pine and Douglas fir or red spruce.

4 Whatever kind of wood is chosen, certain general points should be considered. The way the flooring is sawed has much to do with the beauty of grain and the durability of surface. Quarter sawing is best. The boards are less likely to shrink and
swell and the surface is more durable than in plain sawed lumber. All sawing should be properly dried so it will not be seriously affected by heat and moisture after it is laid. Thickness and width of flooring vary. A good size to use is 7/8 inch by 2½ inch wide.

The finishing and the care of wooden floors are important problems that confront every housewife. Leaving wooden floors both unfinished and uncovered is not satisfactory, except occasionally in the kitchen or bathroom.

New wood floors may be finished in a variety of ways, depending on the kind of wood used and the individual preference. All wood finishes do not agree upon the same method of treating floors, but they all agree that it is economy to use the best materials. Before any finish is applied, the floors should be made smooth by sandpapering and then swept and dusted with a soft cloth. This work is done very easily if the sandpaper is fastened on the bottom of a polishing brush. After the floor has been scraped and sandpapered, it is found very satisfactory to apply Old English Paste Wood Filler. When this filler has been allowed to dry, apply a thin coat of Old English Wax. Too much wax should not be applied because it does not produce a beautiful and natural finish. Old English Wax brings out the natural beauty of the grain without changing the color of the floor. If staining is preferred, apply a good penetrating stain before using the filler. Stains are used on floors to bring out the grain of the wood, or to make them harmonize in color with other woodwork or with the furnishings.

Floors may be stained, oiled, painted, varnished, shellacked and waxed, but the most satisfactory finish for hardwood, considered by many, is waxing. It preserves the natural color of the wood, brings out the beauty of the grain, and is easily revived and
renewed. Given the proper care, waxed floors improve with age, even under hard usage. Don't wash your floors - water ruins them. Soap, plain water, or the use of a damp cloth is harmful to floors. It warps the wood, raises the grain, opens the seams, and makes floors gray looking. Cleaning or polishing preparations that will successfully clean and polish a waxed floor without removing the wax or injuring the surface is Old English Wax Brightener. This contains no oils and no other injurious ingredients. This is the ideal furniture polish because it not only imparts a beautiful lustre, but protects the finish as well.

Floor coverings when well chosen and properly laid are one of the most attractive and useful features of the furnishings of the home. It is poor economy and taste to put a delicately colored rug or carpet with a soft pile, that is easily crushed, in a room where there is constant passing and things are likely to be spilled on it. Linoleum is especially economical in a kitchen and it protects the floors from hard wear. Linoleum may be classed both as a flooring, and floor covering. Where a patterned linoleum is used, inlaid linoleum which means that the colors of the design go right through to the backing, is a better investment than the printed where the design is only painted on the surface. However, if an inexpensive floor is desired, the printed linoleum is quite practical. Its life may be lengthened by protecting it with varnish or compounds prepared for this purpose. For the best results, linoleum should be cemented to the floor.

Floors play a very important part in the general scheme of our home. If they are finished beautifully, the whole interior of our home will convey an impression of beauty, richness and refinement, and if they are dull, and unattractive, our homes will be cheerless and uninviting.
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FLOWERS AND VASES FOR THE HOME

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Dedication

Beautiful flowers add immeasurably to to the livableness of the home, and they give such pleasure that one is richly rewarded for the thought which is put into them.

Foreword

We wish to dedicate this thesis to everybody and anybody interested in beautiful flowers and flower arrangement for the home.

"Flowers in the Home"
Angela Filipi

Almost all of us are fond of flowers and like to have them in our homes and gardens. Flowers, when carefully selected, arranged, and placed, add a distinct charm to every occasion.

In floral arrangement, simplicity is the keynote and therefore in arranging flowers, we should try to have simple lines and designs and yet have them pleasing and attractive to the eye. Each flower has individuality and it should be brought out in the floral arrangement.

Flowers, like pictures, may be enjoyed for their line, their mass, or their color. Flowers and berries which have much beauty in their lines, should be so arranged as to emphasize this quality. In order to fully enjoy line, a single spray or a very few blossoms should be used. Some of the flowers which are particularly beautiful in line are jonquils,
lilies, and irises. Seed pods, pussy willows, and berries may also have lines of remarkable beauty. When flowers or berries are massed, the lines of the individual sprays are lost, and the primary interest is in the color of the plant.

In bouquets arranged in a mass, one is not so aware of the line, and such bouquets bring sparkle and richness into a room. Some of the flowers which are attractive are peonies, lilacs, chrysanthemums, asters, and larkspur. There are many flowers which have both beautiful line and color. Some of these are roses, nasturtiums, and poppies. Therefore, when only a few of these are used in a container, they are enjoyed for their line; when these flowers are massed, they produce fine color. Even when one is working for the effect of color in a mass, it is desirable to have flowers arranged rather loosely so that they may not appear crowded.

It is often said that a bouquet should never contain more than one kind of flower, or more than one color. Such arrangements have perfect harmony, yet very interesting effects may be secured by combining suitable colors and textures. The person who understands texture and color harmony will be able to make these delightful and entertaining combinations.

A careful consideration of the color scheme of the room should be taken when selecting flowers for a room. Flowers of a bright warm color bring a note of gaiety into the room, while the flowers of a cool color have a subtle beauty. Yellow and yellow-orange flowers - the colors of light - will fit into any color scheme, but bright red orange and bright red purple need be handled with care. Flowers of quarrelsome colors, like bright red-orange and bright red-purple should not be used together as they destroy each other's beauty. If a room seems cheerless, or a corner seems too dark, a bouquet
of yellowish flowers will seem to supply a glint of sunshine. On the other hand, the blue and the purple flowers will appear lost in the dark corners, and will be enjoyed most when they are placed in the light.

After having decided upon the colors, the position in the room, and a suitable container, one can begin to arrange the flowers. The first thing to be considered is balance. The flower with the longest stem is usually placed so that its head comes above the center of the bowl. Then the largest or the most conspicuous flowers should be placed around the center and balanced by less striking shapes or colors farther away. If a large mass is placed too far toward one side, the arrangement seems to tip.

Flowers may be arranged formally or informally. The formal arrangement is now rarely used, for the graceful lines and forms of flowers seem to take naturally to the less obvious balance of the occult or informal arrangement.

Rhythm is the next consideration. The eye should be easily carried from one part of the bouquet to another part. Rhythm may be gained through the use of rhyming lines, sizes, or colors.

Beautiful proportions contribute as much to the enjoyment of a flower arrangement as any other factor. First, one should be mindful of the size of the bouquet so that it may be consistent in scale with the objects around it, and, second, the spaces between the flowers and the variations in the length of stems should be in pleasant relationship. Flowers, which are naturally stiff, may appear rhythmic in an arrangement if their stems are cut so that the blossoms come at beautiful spaced intervals.

If house plants are given plenty of sunshine and
are carefully taken care of, they make beautiful decorations and add sunlight and gaiety during the dreary winter, when fresh flowers from the garden are not available.

Some people think that any kind of a plant will grow in the house. This is not true. There are many kinds that will not live in our houses at all. They do not like the dry air, the scanty supply of sunshine, the gas from our stoves, and ranges, and our overheated rooms. Only a few indeed are able to adapt themselves to our way of living. Some of these are the Wandering Jew, Begonia, Geranium, Lily, Daffodil, Sweet Alyssum, Umbrella Plant, Pot marigold, German Ivy, Christmas Cactus, and Boston Fern. There are others also but the ones I have named are probably the best known. Most plants will not bloom well without sunshine, so if you have no sunny window to place them in, you should select plants that have handsome foliage and be content with their beautiful leaves. Neglect is the cause of many failures, and if you are not ready to give your plants as much loving care as they require, you had better not begin at all.

When selecting pots for your plants, select those that have good drainage. That is, there must be some way for the excess water to run out after the soil has taken up all that it can. If the drainage is good, it does not make much difference whether the pot is made of clay or wood.

In flower arrangement, as in all decoration, simplicity, as well as sincerity, should be the aim. A few flowers well arranged, and a few simple bouquets or a couple of house plants well placed add beauty and charm to any room, and they will seem to vitalize one's house, and to give it a spirit of friendliness.
"Vases in the Home"

Selma Hedstrand

Vases now play one of the most important parts as accessories in our homes. They may be used either to add interest to a room or to detract from the room. That is the reason we wish to know something about them so they can be used to an advantage.

People judge us by our homes. When beauty is expressed in our surroundings, it becomes a part of our lives and personalities. We should train ourselves to appreciate beauty by adding simple vases; for instance, those that have lovely lines and beautiful proportions.

Since the appearance of the things which we acquire causes us to enjoy them, we must learn to judge them in order that we may choose wisely.

In the preceding thesis, that you have heard given, the importance of rhythm, harmony, and emphasis in the building of homes and choosing of curtains and customs has been stressed. These principles also apply to vases.

By structural design in vases, we mean the size and shape. A vase should be simple, well-proportioned, and be made of suitable material. One which has bad structural design is not suited to its purpose of holding flowers.

No matter what our problem may be, whether it is the decoration of a vase, a costume or curtaining a room, the design should fulfill the following requirements. The decoration should be used in moderation; the decoration should be placed at structural points; the placing of the decoration should enhance the appearance of the object; there should be plenty of background; the decoration should be suitable to the
material. A good effect in the structural design in a vase may be spoiled by the addition of the decoration, which may be too elaborate.

Some vases may be beautiful in their structural and decorative design and yet may have too much decoration or be too emphatic to be used as a flower container, but it may be used as a note of emphasis in a room.

In order to have flower containers that are of good taste, one does not need to spend a large amount of money. One can obtain, without much cost, simple and well proportioned vases of good color by making them from olive bottles, pickle and jam jars.

The color of vases is usually of soft earth colors such as wood browns, soft dull blues, grayed greens, black, and clear glass.

Weeds, seed pods, berries and any other flowers of coarse texture do not look well in a delicate glass container but are very attractive when placed in pottery or in baskets of rough texture.

We do not like to see vases of real bright colors because they detract our attention from the flowers.

Mother Nature is our greatest teacher in flower arrangements and by following her way of arranging flowers, we cannot go wrong. We should place flowers in their containers according to their growth with the short stemmed flowers in low bowls and long stemmed flowers in high vases.

After we have placed the flowers so that they make an attractive bouquet, we have as our next problem the placing of the bouquet. Ordinarily, flowers are placed below the level
of the eye. If we place a bouquet of tall flowers high, they carry our eye to the ceiling. If they are placed above the level of the eye, some of the flowers in the bouquet should droop downward so they will carry the eye downward toward the level of the eye.

It is not only too attractive vases that detract from the flowers, but also a figured background, as it becomes difficult to distinguish the bouquet from the background. But often we find that the walls of some room in which we wish to place a bouquet are papered with a fancy figured paper. This, however, should not prevent us from using flowers in this room.

By placing the bouquet in front of a window, or if we place a tray behind the bouquet, it brings out the flowers. Any other plain article may be used.

We should learn to group articles in the room with groups of flowers because it makes the bouquet look as if it were planted there and not just there because there was no other place for them. It makes the bouquet much more attractive if it is grouped with such articles as pictures, mirrors, books, trays, and writing material.

In selecting your vases, be sure to bear in mind that there are two kinds; those to be used as flower containers and those that are used alone to add some point of interest to the color scheme.

In selecting your bouquet for your dining room table, do not use one that is too large. This prevents the people from seeing across the table so that they cannot converse from one end of the table to the other. Low bowls of flowers harmonize best with the shape of the table.
Artificial, wax, and paper flowers have no place in the bouquets of today. For winter bouquets, there are several varieties of seed pods and berries that stay beautiful throughout the winter. If these are used, they should not be gilted or painted as it shows only poor taste.

A few flowers well arranged, placed in the correct type of vase, with the correct background will add much charm, beauty, and a spirit of friendliness in any one's house.

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PICTURES IN THE HOME

Alpha Bruun '31
Climax, Minnesota

Dedication

I hereby dedicate this term paper to the thousands of people who are keenly interested in the beautification of their homes.

Foreword

In the presentation of this term paper, I have pointed out the purpose, methods, and results of the beautifying and making the home more attractive with the use of certain pictures.

Usually there are too many pictures in the home and too few that are worth while. We tend to fill our walls with silly pictures. We seem to be afraid of a bare space, and, rather than have it, tack up a cover torn from a magazine showing embracing lovers, or maybe a calendar of crude colors and unnatural figures.

Some years ago it was impossible to get copies of the good pictures at reasonable prices. Most of the pictures on the walls were of brilliant colors and poor drawing. There were many bright flowers and fruit pieces, unnatural landscapes and sentimental scenes. These were large in size, placed in ornate frames, usually bright gilt, and hung on the walls so that they tilted far out like an unnatural growth. At this time the walls were covered with papers of strong colors, reds, greens, and browns, with large, startling patterns standing out in spots. The carpets, the lace curtains, the soft pillows on the couch were all noisy in pattern and color, and the pictures had to be noisy also in order to attract their share of attention.
We have now learned that loud designs and brilliant colors are not pleasant to live with. We have repapered our walls in soft tones with no spotty designs. The rugs do not call attention to themselves. Windows have been recurtained in a simple way. Sofa pillows are of plain material harmonizing with the davenport and the other furnishings. But pictures do not wear out and in many homes they have not been changed. The same old pictures with their gaudy frames, bright colors and uninteresting subjects are still in use. They easily spoil the whole effect of a room which may be otherwise attractively furnished.

"A room hung with pictures is a room hung with thought." Sir Joshua Reynolds

The appreciation of good pictures is not natural to many of us; however, such an appreciation may be cultivated in the same way as we may cultivate a taste for good music and good literature. We should not choose pictures for our homes simply because other people have them. As one lady said, "Oh, yes we must have pictures. Everybody has them, and besides they help to cover up all the wall paper." Another woman was asked concerning a picture above her mantle, "Of whom is that picture?" She replied by saying, "Oh, I don’t know who it is. We have had it for twenty years and it has always hung in that place." What meaning did such a picture have for the family? If pictures have no meaning to us, why frame and hang them in our homes?

A woman writer tells of finding a little home in Western Canada. It was poorly built, unattractive and poorly furnished, but there was one good picture in that home that made one forget all the missing things. It was a good, but inexpensive copy of a famous painting, a landscape scene. The mother told the visitor of the picture in this way. "Of course you have noticed
our one good picture and perhaps you have wondered how we came by it. We have had that picture nearly two years. It has made a great change in our home. None of us would part with it. We consider it our choicest possession." This woman had become sick and discouraged, tired of life; then a niece from the city came to visit them, finding more beauty in everything, the flowers, the birds, etc. After the young lady returned to the city, she sent them this picture. The Woman concluded by saying, "We are still very poor; life is still hard sometimes, but somehow now we find a great deal of happiness in our home and we have learned to appreciate the beauty of the world outside."

That is the story of the influence of a good picture in one home. Another is the story of the Angelus. This picture is the picture of a peasant man and woman, bowing in prayer at their work in the field, while the angelus rings out. This picture "The Angelus" was given to a hard working woman who saw few of the beautiful things in life. At first she was very angry and resented the gift saying to her husband, "Those people are like us; they are making fun of us," but when the country minister, calling one day, chanced to see the picture and told her the story, a change came over the woman. She began to look at life in a different way; she was kinder in her home; she saw beauty in nature. All this is beautifully told in a reading called "The Angelus" written by Eleanor H. Porter.

Too many pictures in a room are undesirable. It is like crowding a room with excess furniture. It is better to have a few good pictures and have them all mean something to us. All pictures should be of some or such a nature as to contribute to
the restfulness of a room. Perhaps everyone of us have had the ex-
perience of sitting in a room confronted by a picture that actually
worried us. Pictures that show cruelty, grief or suffering are not
good object pictures for children and are out of place in the home.

Today it is possible to obtain copies or reproductions of the works of the best artists at such a small cost that any
home can afford them.

Styles in pictures change as well as clothing. Not
so many years ago enlarged family portraits occupied a prominent
place in our parlor or living room; today we realize that they are
out of place in these rooms. Perhaps every family has one or more
of these pictures and the question arises, "Where shall we put them?"
The bedroom, if any place. The living room is a place where we
receive and entertain our friends and we cannot expect them to
cherish our relatives or friends as we do. Neither should we expect
them to enjoy looking at enlarged pictures of people they do not
know, and whom, as far as they know, may be dead or alive.

We can all remember when pictures of still life,
highly colored, such as fruits, birds, fish, and vegetables,
adorned the walls of our dining rooms. When we stop to think
about them, can we think of anything more unpleasant and unnatural
than three highly colored ducks hanging head downward on our dining
room walls? Simple pictures in water colors, such as landscape
scenes are appropriate. Very few pictures are needed in a dining
room.

Sometimes an entire home is furnished with pic-
tures painted by one member of the family. These paintings are
very often poorly painted and are not attractive to our friends.
In that case they should be used in the bedrooms or halls not in
a conspicuous place as in the living rooms. If these pictures
are worthy and many times they are, they should be placed in the living room with other pictures.

If one is fond of nature, he may find pleasure in Corot who has painted many beautiful country scenes, such as "Spring" and "Dance of the Nymphs." Millet has painted peasant life most wonderfully. Some of his best known pictures are "The Angelus", "The Sowers" and "The Gleaners." One of the most beautiful pictures of child life is the "Age of Innocence" by Reynolds. These are just a few of many of the beautiful and inspiring pictures one may choose. The "Song of the Lark" is another picture that is very much worth while.

One of the best ways to cultivate a taste for good pictures is to first study one good picture - look at the coloring. Usually bright colors in pictures are not good. Study the pictures to see if they are true to life. If you like a picture, analyze it; learn why you like it. Learn something about the picture, and the artist who painted it, then learn the picture's story. Many times we learn to love a picture if we know its meaning.

Choosing the picture itself is only the first step, altho it is the most important step in the process of getting a result that will give lasting satisfaction. The next consideration is the frame. Here again harmony is the keynote. The picture frame should be very inconspicuous, and subordinated to the picture. The frame should be the connecting link between the wall and the picture. It should be in simple straight lines and in proportion to the size of the picture. The frame should be flat, so that it fits right against the wall. If it has depth, it stands as a thing apart from the wall.

The gilt frame for years was the popular one. It was shiny, ornate and wide. The color was so bright it killed the
colors in the picture. The dull bronze frame has been found to relate itself much more easily to the wall and tones of the picture.

We have now the polychrome frame which is wood moulding slightly tinted in colors which repeat the colors in the picture, and also of the wall on which it is placed. This frame is very good if used for that purpose, but there is great danger of its being used for its color without thought as to whether they blend with picture and wall.

In general, the frame should be as dark as the middle tone of the picture; in that way too great contrasts are avoided.

Most pictures are framed without mats. Occasionally a mat is used, but never black or white. The mat should match the middle tone of the picture and the frame.

The wall upon which the picture is to hang has much to do with its effectiveness. Wall paper with a very large, conspicuous pattern is never a suitable background for pictures. The pattern continually pulls the eye away. The ideal wall, so far as pictures are concerned, is one with a plain paper in a very soft tan, green, or gray, or painted in one of these colors. One can also get paper with a sort of brocaded pattern in "self-color" that makes a good background for pictures.

The arrangement of the pictures on the wall also presents a problem. Most people have a tendency to hang pictures far too high. A picture should be hung so that its center comes at about the eye level of a person of average height. It should be suspended from the picture moulding by two wires, each attached to its separate picture hook, and kept absolutely parallel with the sides of the frame. These wires should be kept as inconspicuous as possible. Silk cord of the color of the wall may be substituted for them.
The pictures one wishes to hang in a room are seldom of the same size and their arrangement often presents quite a problem. The general rule is that the bottom edges of the frames should be on a line. Small pictures may sometimes be hung above larger ones, but never larger ones above smaller. Sometimes several small pictures may be grouped together so as to form a unit to the eye. Here, again, we return to the guiding principle of harmony. Think of the whole wall as a unit, and get a harmonious relation between the pictures on that wall. Then, do the same with the room as a whole.

Whatever is on the wall is a part of the wall and must seem to belong there in order to be truly decorative and not just a bit of unconnected ornamentation. The picture itself, the colors in which it is printed, and the frame should relate to the wall and not stand out as separate things.

The size and shape of the picture must also be considered in connection with the wall space. If the wall space is long and narrow, use a long, narrow picture. If the width of the space is of larger dimension, select a picture of similar proportion for that space. It is difficult to fit a round or oval picture to any space.

A picture, especially one of considerable size, must be hung in relation to the furniture under it. A large picture with no furniture near it will appear quite spotty. A table, chair, desk or cabinet should be placed against the wall under it. The picture should be hung low enough so that it seems a part of the group. If the space is too great between pictures and desk, it may be necessary to place something on top of the desk to bring the two together.

An inviting, comfortable living room is usually one important explanation for a happy home. In such a room there is
personality and individuality, and where ever there are good pictures hung attractively, there one feels this atmosphere of individuality and good taste.

A landscape is appropriate for one of the larger wall space of the living room. Its prevailing color should echo a color found in the draperies, or rug, or upholstery. Or some other subject, such as a good reproduction of a portrait of some famous beauty in the charming costume of her day, or a picturesque cavalier, painted by one of the masters, may occupy the place of honor in the living room. Or a sea view, with a ship in full sail, or one of the quaint interior scenes which Dutch Masters loved to paint. A finely woven tapestry may also be hung in a living room and give distinction to the other furnishings.

It is well to have one picture in the living room which adds a striking note of color, as a vivid and pleasing contrast to the general tone of the furnishings.

The pictures of this room, where the family gathers and strangers are entertained should be general in interest. They should not clash with each other in color, or be too unrelated in subject. For example, the sporting prints so often used appropriately in dining rooms, halls, and libraries would be out of keeping in a room where a Madonna occupies a prominent place.

In the dining room, gayety of color, combined with formality of arrangement helps to enliven the table talk, and lends grace to the meal. Flower pieces and garden scenes may be hung on the walls, or hunting prints, or quaint views, such as scenes from Old English coaching days. A large and more formal dining room becomes a room of great distinction with a well framed portrait or two on its walls. Either good portraits of one's own family or ancestors, painted by a recognized artist, or color reproduction of famous personages, copies of the work of Rembrandt, Sargent, or some other master are suitable
in such a room.

The book lovers of the family, whose special room is the library, usually enjoy those pictures which are suggestive of literary scenes, or characters, or historical scenes. Etchings are also appropriate in the library.

Most intimate of all is the bedroom, and there one's own pictures may be hung - framed photographs of friends. A boy or girl delights to have pictures about him in his own room, which illustrate his own hobby - dogs, or ships, or flowers, or illustrations from beloved story books, or revered heroes. Of these there are a vast variety in the picture shops from which to choose.

The kitchen - where cheering, colorful scenes are often valuable - both for decorative purposes and as a counter-irritant. A picture of a sunny, winding road over country hills or a glimpse of some fragrant, old fashioned garden may take part in imaginary conversations from the frame above the kitchen table.

Artists are specialists in color, and a picture, being the work of an artist, is the finest example of the harmonious mingling of colors. For this reason, pictures are a fitting adornment for the "home beautiful."

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Dedication

I dedicate this thesis to the
House Planning Classes at the Northwest
School.

Foreword

The purpose of writing this thesis is,
to help the future generation in remodeling
their homes.

No one, so far as I know, is ever completely satisfied
with her home. Always there is a missing closet, or a stairway
that is too steep, or a fireplace that doesn't draw, or any one
of a dozen other defects. But comparatively few of us ever get
to the place where we really do something about it.

And the main reason, I believe, is that we always think
it will be too much bother, or will cost more than it is worth.
So that is why I say, "Plan it." Plans cost you little or nothing
- pencils and paper are cheap - and it really is a lot of fun to
put down in black and white just what you want to do to the house.

In stationery stores, paper can be purchased which is
ruled off in quarter-inch squares and a pad of such paper forms
the basis of all home made houseplanning. First of all, measure
your rooms and draw them out on paper, letting one square repre-
sent one square foot. Be sure to leave half a square (six inches)
for the walls - walls have thickness, you know! Then, when the
plan of your house as it is, is done, you can plan one which will
show your house as you would like it to be.

Another reason why this plan is such a good thing is that
with it, you can approach your architect or contractor with some-
thing tangible. Instead of talking vaguely about a new porch, you can show him where it should be and what size you want it. Then, if there are objections to your proposal, he, in turn, can explain them intelligently and perhaps make a new sketch which will, in its turn, show you exactly what he means.

Of course, the exact reasons for remodeling a house will vary in every case, but there are three broad headings under which they fall and which determine largely the type of change and the money which will willingly be spent.

First of all comes that more or less ordinary situation of a family which has become too large for the house. Perhaps the children are growing up and need separate bedrooms. Perhaps another living room or a library is desirable. Maybe some older person is coming to live with the family and a bedroom on the first floor would suit him best.

Something like this, but differing, is the family which has lived for a long time in one house and is unwilling to leave it; yet with the passing of years, it has gone out of style, both in its exterior decorations and its interior plans. Modern plannings calls for smaller kitchens than old styles and sometimes part of the kitchen can be walled off and converted into an additional room.

The third reason for remodeling is different. Suppose a family wants to own a home. It finds that all the new houses in a certain location are too expensive or that they are not suitable to the needs of the particular family. But there is an old house in the neighborhood which can be bought cheaply and which perhaps could be made into a livable and pretty dwelling.

The person buying an old house which he has never lived in must check up on a number of points, as all of them are vital in deciding whether or not to remodel one's own house, took they
may well be given with some detail.

First of all, it is just as well to call the elements to one's aid. It may sound like over suspicion to suggest it, but the best time to inspect a house is just after a heavy rain and preferably when the sun is still obscured. Then, at least, the worst is known. Leaking basements and leaking roofs, tree shadowed windows and all the other ills that houses are heir to are most apparent. A flashlight is essential to the expedition for use in many obscure placed.

The first thing to do is to look at the foundations carefully, not so much in respect to its beauty but as to its firmness. Much can be done to add beauty, but a defective foundation, one that is too small or one that has settled and cracked, brings to mind the tale of the man who "builted his house upon the sand."

After looking at the foundation, carefully, inspect the walls. See if the house gives evidence of adequate painting during the course of its existence. Look at the wood of the house just above the corner of the foundation. Note the sills around the windows and the threshold of the door. Reasonable wear is all right, but any signs of decay are serious.

When you have examined the outside of the house, start at the basement. In an old house, it is too much to expect a finished floor, but the floor should be dry, or, if there are any puddles of water, trace them to their source. If the rain water has seeped in from the wall, a mason should be consulted as to the possibilities of sealing up the cracks. Another point is the basement walls. Are they tight and thick enough to bear the weight of the house? If additions to the house may be planned, which will increase its weight, the
strength of the basement walls and foundations must be taken into consideration again.

No matter how good a house looks in every other way, it is of no account if it cannot be adequately heated. Examine the furnace if there is one and, when possible, ask a former tenant whether the house is warm. Very often all that is necessary in an old house is the installation of a modern furnace, but of course the cost must be considered.

No one likes to crawl around in a dusty attic, but it will repay the person who does it. Here show the leaks through which the rain will seep. Sagging rafters, inadequate flashing along the valleys; that is, the tin which should be put along the dips in the roof before the shingles are put on, and the condition of the roof as a whole are all in view here. Before you leave, be sure and look at the gutters and downspouts. Modern ones are of heavy copper, zinc, or tin which is well painted, but old ones will probably have to be replaced.

With this complete view and such notes as seem necessary on hand, sensible consideration of costs can be made with the aid of an expert. And here let me stress the necessity of hiring an architect, if any, but the slightest changes are to be made. Tearing out partitions effects a radical change in the distribution of weight and without technical advice, a house may be ruined. The architect can also suggest the proper materials to use in reconstruction. He will steer you clear of any complications with labor unions; he will supervise the carrying out of his specifications, and best of all, he will adapt the house in such a way that it will be beautiful.

In buying a brick or stone house, the same points are to be watched. In addition, cracks in the wall should be
noted. Many of the old houses in the middle west are made of the beautiful native limestone.

Another method of securing an old house is to watch carefully until someone buys a lot and old house with the intention of wrecking it and then building a new house. Very often such a building can be purchased for as little as a hundred dollars and moved to a lot in the desired location for a reasonable cost. Often the house can be placed on its own foundation for a small enough sum that extensive remodeling can be done and the total cost still kept low.

In all these cases, the necessity for thorough and dispassionate consideration of the cost and the possibilities of remodeling are self-evident. With such planning, the cost can be figured closely and the owner is assured that the remodeled house will be exactly what he wants.

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BREAD BAKING

Ruth Stenborg '31
Clearbrook, Minnesota

Bread is the name given to the staple food product prepared by the baking of flour.

Bread baking, or, at any rate, the preparation of cakes from flour or parched grains by means of heat, is one of the most ancient of human arts. At Wangen and Robenhausen have been found the calcined remains of cakes made from coarsely ground grain. The cakes were made of different kinds of grain, barley and one-grained wheat being among the ingredients. This bread was made, not from fine meal, but from grain crushed between some hard surfaces. Perhaps the earliest form of bread, if that word may be used, was prepared from acorns and beech nuts. To this day, a sort of cake made from crushed acorns is bitter and unfit to eat till it has been thoroly soaked in boiling water. The saturated flour is squeezed into a kind of cake and dried in the sun.

The lake dwellers probably baked their bread by laying the dough on a flat or convex-shaped stone, which was heated, while the cake was covered with hot ashes. Stones have been found among prehistoric remains which were apparently used for this purpose.

They say that leavened bread was introduced by a slave. She was out in the yard making bread. Somehow orother she forgot to bake all the bread so that a small portion was left. When the next baking day came, she discovered this old unbaked bread dough. She was about to throw it away when her
master came out. Fearful of his anger, she quickly dumped this old dough into the newly mixed dough. When the bread was baked, it was very nice and light. In many parts of Europe, bread is still made from leaven, which, properly speaking, consists of a portion of dough held over from the previous baking. The lump of old dough, placed aside in a uniform temperature for some eight hours, swells and acquires an alcoholic odor. It is then worked up with flour and water to a firm paste double its original volume. Six hours later, by the addition of more flour and water, its amount is again doubled, though its consistency is made rather softer. Finally, by another addition of flour and water, the amount is again doubled. This mass is divided into two parts; one is baked, yielding rather dark sour bread, while the other is mixed with more flour and water. This portion is in turn halved, part is baked, and part again mixed with more flour, this last batch yielding the best and whitest bread. In North Germany, leaven is generally used for making rye bread, and loaves baked from a mixture of wheat and rye flour.

There are several different kinds of flour. Wheat is superior for making most kinds of flour and similar products because of the two proteins in it which form gluten when the flour is made into a dough.

Here I have a piece of gluten. I have obtained this by washing out all the starch from the flour, leaving this elastic substance. I made a small piece of dough and put it into a cheese cloth. I put this under the faucet and let cold water run over it; this washed all the starch away. Here I have the same size of gluten baked. It is only a crust with a hollow center. Gluten is the substance in the flour that makes the dough rise.

The bread baking value of the different types of wheat flour depends on the quantity and quality of the gluten
that can be developed in them. Flours are called "strong" if they have a comparatively large quantity and good quality of gluten, and weak, if their gluten is low in quantity or poor in baking quality.

The nature and amount of gluten in flour depends both on the kind of wheat from which it is made and on the milling. Hard wheat contains more gluten than soft wheat. Good wheat flour should be white with a faintly creamy tinge.

Rye ranks next to wheat as a bread grain because it contains similar proteins. In fact, rye flour is practically the only other kind that can be used successfully alone in yeast breads, and even it gives better results if mixed with wheat flour. Products from corn, oats, buckwheat, barley, rice, potatoes, peanuts, soy beans, and many other materials may be substituted for part of the wheat flour in yeast breads, and some of them can be used as the chief ingredient of excellent quick breads where there is less need for gluten. Usually, however, even in quick breads, a mixture of wheat flour with the other materials makes a lighter product.

The essential ingredients in bread are flour, liquid, salt, and leavening. French bread illustrates than an appetizing product can be made from these materials with water as the liquid. In this country, however, it is customary to use sugar, shortening, and oftentimes, milk.

The recipe I am going to use this morning will make one loaf of bread. It calls for 1 cup of liquid, \( \frac{1}{2} \) tablespoon fat, 2 teaspoons sugar, \( 1 \frac{1}{2} \) teaspoons salt, \( \frac{1}{2} \) cake compressed yeast dissolved in \( \frac{1}{4} \) cup lukewarm water, 3 cups sifted flour (about).

When milk is used as the liquid, the bread is improved in food value and does not grow stale so rapidly as when
water is used. Evaporated or powdered milk may be used when fresh milk is difficult to obtain. Bread made with potato water does not dry out so fast as that in which water is used as the only liquid. I am using water this morning so I will measure out one cup of lukewarm water. Always use level measurements when baking as you cannot obtain the same results if you are careless in your measurements. Be sure the water is not too hot because hot water will kill the yeast. If the water is too cold, it will retard the growth of the yeast and you will not obtain very good results.

A small quantity of sugar added to the dough makes it rise more quickly and helps to give a golden brown color to the crust. Sugar is a good for the yeast and aids in the rising process. Some persons think that the flavor also is better when sugar is used. The recipe calls for two teaspoons sugar. I have measured the sugar into the cup with the yeast. The recipe calls for one and one-half teaspoons of salt. This has been measured into this bowl. Salt is added for flavor. The yeast grows faster in bread dough when only a small quantity is used, but there should be enough of it to bring out the wheat flavor.

I will add about half the flour to this mixture of water and salt. This has to be beaten hard to develop the gluten. The yeast may be bought in dry or compressed cakes or grown at home in the form of a starter or liquid yeast. The dry cakes keep better than the other forms, but since the yeast cells are not growing actively, a longer time is required to make bread with dry yeast. I am using compressed yeast as it is the quickest. I have already put it to soak in one-fourth cup of lukewarm water. This mixture is now ready for the yeast.
The recipe calls for one-half tablespoon fat. I have melted that and it is to be added next. Shortening in bread makes it more tender and adds to its fuel value. Butter is sometimes used, chiefly for its flavor, but lard or any other good cooking fat is satisfactory. Part of the remaining flour is now added. I can't add it all at once because it may be too much.

When the flour and liquid are thoroughly mixed and the dough no longer sticks to the sides of the mixing bowl, it is ready to be kneaded. The bread should be worked quickly with the palms of the hands until it is smooth and elastic. Dough made from hard wheat flour requires more kneading than that made from soft wheat flour.

The dough is then formed into a ball and put in a greased bowl to rise. Turn the dough over once or twice in the bowl so that the whole surface of the dough is thinly greased; this will keep the top from getting hard and cracking. Fat should be used sparingly, however, so that no streaks of it will show later in the bread. Put a clean cloth and a tight plate or cover on the bowl. This will help to control the temperature, to keep out the dust, and prevent drying. I am putting the bowl in a basin of warm water so that it will rise quickly.

When the dough has risen to about double its original bulk, it should be tested with the finger to determine whether it is ready to punch down for a second rising.

I have another dough here that is ready to be molded into a loaf. The loaf is molded by flattening it on the board into an oblong piece and then folding and sealing the edges together with the palms of the hands. This is repeated several times, each time I fold it a different way. The last time the sides are brought together, sealed and placed sealed edges down,
in a greased pan for the last rising. Grease the top surface slightly to keep the top from hardening.

Set the pan in a basin of warm water and cover with a clean cloth. When the loaf is about double in bulk, the surface should be lightly pressed with the finger to test whether it is ready to be baked.

The oven should be fairly hot at first, about 400 degrees to 415 degrees F, depending on the size of the loaf. Unless the oven bakes very evenly, the loaves should be turned after they have been in about twenty minutes. The temperature of the oven may then be lowered a little. The baking requires from 45 minutes to one hour depending on the size of the loaf and the temperature of the oven. When the loaves shrink from the sides of the pans and give a hollow sound when tapped, the bread is done. The time of baking can be divided into four divisions. During the first quarter, it rises; second, speckles; third, browns evenly; fourth, finishes baking. Brushing the loaves with milk or butter just before they are taken from the oven oftentimes improves the color of the crust and makes them glossy and more tender but less crisp. As soon as the loaves are taken out of the oven, they should be turned out of the pans and placed on a rack to cool. They should not be covered when warm.

The points that are most important in yeast breads, in addition to food value, are lightness, good flavor and color, texture, and keeping qualities.

I have a loaf here that is already baked which I will judge. There are four points to consider in judging bread. They are: external appearance, crust, crumb and flavor. This is the score card used by all 4-H club members. External appearance counts 15. There are three factors to be considered under appearance; they are color, size and shape.
A standard loaf should be dome shaped, evenly rounded on top, no bulges, have smooth unbroken crust, and uniform golden brown color. A broken crust may be due to cooling too fast. A standard loaf of bread weighs from one to one and one-half pounds. This loaf is of standard weight. It has a very uniform color and its crust is very smooth, altho it is broken in one or two places. I will take off about three points because of its broken crust.

The crust is judged by its depth and texture. The crust should be of even thickness, from one-eighth to one-fourth inch. Crusts that are too thick may be due to lack of moisture in the oven or too long or too slow a baking. The crust should be crisp and tender. Tough crust is due to slow baking or too little shortening. This crust is of an even thickness and is very crisp and tender. I will give this point its full credit.

The crumb is judged by its color, grain, lightness, moisture and thoroughness of baking.

The crumb should be creamy white with a satiny luster. A yellow or grayish color may be due to very dark flour or to over-fermentation, old or stale yeast, too cool an oven, or too low temperature while rising.

The grain should be even and fine. Coarse and uneven cells may be due to over-fermentation. The cell walls should be thin and the bread should feel elastic and springy.

A loaf should be elastic; that is, when pressed firmly between the fingers, it should spring back quickly to the original shape.

To determine moisture and thoroughness of baking, roll a little of the bread between the thumb and finger. If the mass is sticky, it has not been baked enough. If it crumbles readily, it is too dry. It was overbaked or too much flour used.
As a whole, the crumb is quite good altho it seems kind of dry. I will take off two points for its dryness.

Flavor includes taste and odor. Bread should not taste of any ingredients, as yeast, fat, or salt, but should have a sweet, wholesome flavor much like that obtained from chewing wheat. This flavor is sometimes described as nut-like.

In writing this thesis I have tried to bring out the important points in the making of bread. I have tried to show you what the different ingredients you use contribute towards the making of good bread.

I thank you.
FOODS AND FOOD HABITS

Agnes Sevald '31
Winger, Minnesota

Dedication

This thesis on Foods and Food Habits is dedicated to the women of America who are interested in the feeding of their families as a help to physical and mental health.

Foreword

In the last few years there has been much study concerning Foods and Food Habits. In this thesis I have set forth a few points to consider in the planning of the family menu in relation to the family health and income.

Through all ages man has had to have food, clothing and shelter. Of these, food has always been a vital part. Clothing and shelter vary with the place in which we live, less being needed in the warmer countries.

With civilization has come the use of a great variety of foods. People now are beginning to realize the significance of correct foods and food habits.

Three large classes of foods are: fats, carbohydrates, and protein. Some of the fats are cream, butter, fat meats, vegetables, and animal oils. These foods give fuel and energy. The carbohydrates are composed of sugars and starches found in cereals, fruits and vegetables. These also are energy and fuel producing foods. Protein foods are body builders. Some examples of these are milk, cheese, lean meats, fish and some vegetables. Ash, which is composed of minerals, is very essential in the diet as it builds strong teeth, bones, tissues and muscles.
Nutritional disturbances have been found to occur in spite of the fact that the diet is well balanced in fats, carbohydrates, and proteins. It is not enough that the diet contains these but it must also contain certain essential factors of unknown chemical nature called vitamins. They cannot be seen, felt or tasted, but are known by their results. Rickets, scurvy, beri-beri, and injury to bones and teeth are disorders suffered if the essential vitamins are forgotten. Some good sources for vitamins are milk, butter, egg yolks, green vegetables, citrus fruits, tomatoes and whole grains.

We find that our diets must be suited to the individual and his individual needs. I am most interested in the diets of young people and I am going to talk about their diets beginning with babyhood. I will begin with the food requirements of the five months old child. If the child does not get the proper foods from the very start, he will not develop physically and mentally as he should. The foundation for success and happiness is a strong healthy body. Thus the future success and happiness of the child is largely in the hands of the mother or the person in whose charge he is.

There are certain age periods in a child's life and each has definite needs which cannot be overlooked. The following foods should be included in the diet of the child between the ages of five and nine months: milk, orange juice and boiled cereal.

Many women do not know how much food the baby will eat. He should have all the solids he will take. Sometimes they need urging, but usually they will eat enough. The quantity of milk should not be less than one pint and a half and not over one quart. Cod liver oil should be given whenever advised by the doctors. Sun
baths should be a daily part of every child's life.

The "Toddler age" or the years between babyhood and school years are very important in the forming of the proper health habits. There will be very little trouble in establishing good health habits if the right rules are followed. The correct foods should be placed before the child at regular intervals. The child should always be left alone to eat. The active child gets hungry and will eat its food if left alone. The food should be carefully prepared and given the child at regular intervals and at the same hour each day. The pre-school child should have the following foods: cooked cereal, whole milk, graham and rye breads, cooked and raw fruits and vegetables. Stewed fruits are very good. Orange and tomato juice is very essential. Children should not have very rich, highly seasoned or fried foods. The pre-school child should have an hour's nap after dinner every day.

The school child must have good health and proper foods in order to withstand the stress and strain of school life. The thing most important in feeding the school child is to have hot, well balanced nourishing meals served at regular hours. The school child's meals should include breakfast, dinner, supper, and an after-school lunch. The healthy naturally active school child is hungry after returning from school and should have a light, wholesome lunch such as a glass of milk and graham crackers or milk with wholewheat bread and butter. The diet of the school child should always include the following foods: boiled cereals, much leafy green vegetables, fruit, whole grain breads, and at least a quart of milk a day. No coffee should be given the child.

Malnutrition according to the doctor is the most frequent and serious of all the diseases of childhood. It is said that one child out of every three suffers from this disease. The chief
causes of malnutrition are faulty health habits as:

1. Late hours from attending movies or motoring to excess.

2. Faulty food habits. The use of tea and coffee, too much sweets, irregular, unbalanced meals.

3. Emotional strain - nagging parents, jealousy of other children, too much or too little home control.

4. Physical defects such as adenoids, diseased tonsils, eye strain, or defective hearing.

The best way to correct malnutrition is to find the cause and remove it. We must be very careful in the planning of the meals for the undernourished as they need more milk, eggs, fruit and green vegetables. Milk and egg custards are very good desserts and can be varied by adding raisins, dates, or nuts.

During the adolescent period or the early high school age, physical health is very important. If boys and girls are not in good physical condition, they cannot be expected to do good mental work. Many boys and girls at this age will eat many sweets in between meals and have no appetite for the wholesome food they need to furnish energy and the body building materials which are so essential. Special effort should be made to see that they get what they need and not let them eat too much of the sweets. The fact is often overlooked that girls at this age develop very rapidly and need food to supply that growth. Boys generally grow faster and exercise more than girls and thus need more and heavier foods.

Much food is needed to furnish energy for the work, play and sports that youth indulges in. At this age we should be acquainted with and like a very large variety of foods. The food should be suited to the individual. For example, a man doing office work does not need as much heavy food as the man doing hard physical labor.

Plenty of rest is very important, and we should have at least eight hours of sleep altho nine hours are better.

I am not going to tell about foods for the grown person
for in many cases we find it necessary for them to have special diets. If a person has developed the right food habits, it is usually found that he has good health during middle age and later life. As a rule, older people should eat much less as they are not growing and do not indulge in heavy work. Heavy foods should be avoided. Their diet should have many leafy vegetables, plenty of fruits and light desserts.

I have touched on only a few of the high spots in this discussion of foods and food habits, but it will give you a rough outline to follow in the planning of the child's or your own. Health depends on many factors; the most important is foods which build up our bodies and keep them properly nourished.

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Manners
EVERYDAY MANNERS

Hulda Swanson '31
Kennedy, Minnesota

Dedication

I dedicate this writing to Miss Retta Bede who has so kindly and willingly given me much assistance and aid.

Foreword

This thesis is written to point out to the public the necessity and high value of Good Manners.

Manners, commonly known as politeness, may be defined as doing the kindest thing in the kindest way. Altho manners do not change the character of anyone, yet they add much charm to any personality. They are essential for success in social life, and add greatly to our business success as well. Manners may be classified under the following divisions: home, school, public, and business.

The home really is the foundation of all politeness because it is there that little children learn their behavior. Manners good or bad become the habits of girls or boys. Therefore, there is a necessity of training little children good habits while young. In this way people unconsciously become the possessors of charming manners.

One of the hardest types of manners to teach children and the ones by which we are judged most frequently are those pertaining to eating, as the little rhyme goes:

"The Goops they lick their fingers, And the Goops they lick their knives They spill their broth on the tablecloth Oh! they lead disgusting lives. The Goops they talk while eating, And loud and fast they chew; And that is why I'm glad that I Am not a Goop - are you? "

Don't ever be a Goop! Altho eating is not an especially graceful process, yet it should be made as inconspicuous as possible. There are a few definite rules which make it more or less noticeable if followed by everyone. Promptness is one of the very first essentials to consider. Second, after being seated, wait until everyone is ready before starting to eat. The hostess gives the signal to begin eating by taking up her fork first.

Use only the space provided for you to avoid pushing or crowding others because this often results in upsetting or spilling the food and is at all times rather embarrassing.

Use the silver for the purpose for which it was intended only and in the order which it is laid, also being careful in the way you handle it. Since none of us are cannibals, no great haste need be shown at the table.

Playing with the silver, chewing and talking loudly, stretching across the table, upsetting food, are all bad practices which should be avoided at the table as they show improper conduct and poor culture, at the table.

Because the social part of the meal is so important, good conversation should be emphasized. Pleasant subjects only should be brought up at the table. Always eat as though you were at a King's table and you will find table manners a simple thing. Besides table manners, there are certain manners which apply to the home in general.

You can all start the day right with a cheery good morning and continuing throughout the day in a pleasant mood and by being considerate and helpful, you can make life a pleasure to other people as well as yourself. Both boys and girls should be thoughtful of those older than they are. Be helpful toward your Mother, and cautious toward younger brothers or sisters. Always do your work
cheerfully. By all means, have respect for other people's property and do not harm or destroy something over which someone has labored hard.

If you are entertaining a guest in your home, try to make him feel welcome and at ease by doing your best to give him an enjoyable time. See that he has met all members of the family. Altho introductions are perhaps a difficulty, yet they are simple. A few specific rules should be followed. If you are introducing a friend to your Mother, you may say, "Mother, this is Mary Howe." Always present young people to older persons and less distinguished people to the more distinguished. A man is always presented to a woman. You do not need to offer your hand, altho it may seem more courteous. Never say, "Glad to Meet you" but rather "How do you do." Never allow any feeling of awkwardness to keep you from doing what you know is correct.

If you are a guest at any home, be courteous, friendly and even helpful to your hostess. Never suggest or do things against her will. When attending a party, take part in the entertainments provided whether you enjoy them or not, but do not try to draw too much attention by being gaudy, loud, or rude. Possibly the party could be a success without your assistance.

The type of clothes you wear should suit the occasion, but shouldn't be too elaborate. Certainly you don't care to glitter like a jewelry counter.

The next classification to consider are school manners. Some of the same essentials apply to the school as well as the home. Come to your classes on time, starting early enough so that you won't need to rush through the halls, pushing and shoving everyone else about. Don't disturb other class members, but rather be quiet and attentive. Don't whisper or giggle while someone is speaking. It is not necessary to turn around to see who enters the door or to watch
other people in class. In going from one room to another, keep to your right and do as little crowding as possible. A traffic officer should not be a necessity in school to keep order among students. Respect for other people's property is as necessary in school as any other place. Never meddle with or use other's belongings without permission. In all games or contests, you should be a modest winner, or a cheerful loser. Do not boast of your success, or sulk because you lost.

Manners in public are perhaps more frequently violated than any other. While you are on a bus or street car, occupy as little space as possible, being careful not to crowd or push other people. While entering or going out, don't stop and block the pass way. Loud talking, gum chewing, and giggling show poor culture, and should be avoided. Gum should be "parked outside" and chewed in privacy only. Great care should be shown in doing these little courtesies.

If you are in a public eating place or store, where other people must wait on you, do not treat them rudely because they are doing their best to serve you. When attending any place of amusement, you should be quiet and orderly. What is more disturbing than having somebody close by laughing, giggling, chewing gum or explaining the performance?

Last, but not least, the manners to consider are those dealing with business. This type is so very important because they largely determine your success or failure in business. The underlying principles are the same as for any other manners, but maybe more formal. A business gathering is neither a funeral nor a party. An attitude of dignity and respect are by all means the very best.

A cheery greeting is very essential to start the day. Your general behavior and appearance should reflect credit to the
firm for which you work. Clothing should be neat, simple, and appropriate to the occasion.

Always be cautious and attentive to your employer. The more interest you show in the work, the larger your reward. If corrected for mistakes, take every correction cheerfully and make a willing attempt to do better.

The use of the telephone is important too. Make telephone conversations short, complete, to the point, yet polite. Do not forget a simple "please" or "thank you" because they should be used. Try to cooperate with your workers, and see their point of view and you'll be an agreeable co-worker.

Since lessons aren't over when you receive your diploma, you must continue to learn from others throughout your life. Try to make the best of each opportunity and do your best for those with whom you deal, for that's the road to success.

Since manners are so simple, yet important, we all should cultivate them from youth onward. They at last become natural and will have an influence over our character, tending to make it more perfect.

The references used for this theme have been "Everyday Manners" by Ethel Taylor and Emily Post's book on "Etiquette."
Lace Making
Dedication

I hereby dedicate this paper to those who may be interested in knowing more about lace.

Preface

The reason I chose this topic is that very few people know much about lace, and I thought that those who read this thesis would benefit by it.

Lace is an open work fabric of fine threads of linen, silk, cotton, etc. made with a needle, bobbin, or machinery, and is usually figured.

Lace, like music, belongs to modern times. We know that lace dating back beyond 1800 is hand made. The year 1495 seems to be the earliest record of lace. Italy is considered the real mother of the lace industry. Exquisite laces were produced in Venice early in the sixteenth century, much of the output being produced in convents, although women everywhere found it an interesting task. Catherine de Medici, a Venetian lady of power, is credited with having introduced lace making into France about 1585. Egyptian and Assyrian translation of records apply the term "lade" to network or embroidery. Early mummy wrappings discovered in Egyptian, Greecian and Roman tombs were drawn work or
cutwork. Coptic textiles of the third and fifth centuries show threads drawn out and replaced by colored threads. Later gold and silver threads were used to decorate Testaments of the Clergy and gowns of the Middle Ages.

We think of most of this form of lace as braid. From the sixteenth to the last half of the eighteenth century, hand made laces were very prevalent. Machine made lace then became known and this for the vogue of laces, then dainty and frail, has never died.

Lace was not depicted in pictures until the middle of the sixteenth century. In the National Portrait Gallery hangs a picture of Queen Mary Tudor with linen cuffs embroidered. The picture next has a little lace edging around the ruff and in the portrait of Elizabeth, lace and ruff have grown rampant.

All lace was extinguished by the French Revolution and by the classical fashions in dress under the empire period. There are now schools in Venice, France, and Belgium. Modern hand made laces are very expensive because of the high cost of labor.

The earliest laces produced in France, as shown in Clovet's portraits, were insignificant. They were edgings of little beauty. The drawn work was handsome. In that or "laces" and "cutwork", the workers of the period excelled. Before the Retecella laces of Italy were imported, the laces and cutwork were practically all that was known or used. These laces were commonly made in squares, as being easy to handle and a single pattern filled each square. These squares were joined together by an ornamental pattern of stitches, and made very beautiful bed covers and ornaments of all kinds of household effects.

"As the Venetians advanced in the art and produced more beautiful lace, the French court demanded it and were eager
to squander such fabulous sums on it that the government thought it time to interfere." #In 1629 an edict was issued on the "Regulation as to Superfluity in Costume" and in 1660 we find another edict, both of these limiting the amount of lace to be worn. It seems that they had little effect.

"Colbert, the Astute minister of Louis XIV, became alarmed at the immense sums of money which went out of the country to purchase the laces of Venice. He conceived the idea of bringing to France, skilled work women so that French lace should rival that of Italy and Flanders, reporting to the King that there will always be found fools enough to purchase the manufactures of France, though France should be prohibited from purchasing those of other countries." *

So he sought advice from the French Ambassador at Venice who recommended sending some women from Venice where "All the poor families and all the convents made a living out of this lace making," to teach the girls of France. Colbert succeeded. He bribed the best workers of Venetian schools and induced them to settle at Aleucon. He chose this town because it had long been a center for the manufacture of Point Coupe! which was practically the only lace other than the drawn work and darned net made in France in the earliest days.

"Point de France became so fashionable that the wearing of it was compulsory. All those who were either attached to the royal household or received at Versailles, could only appear, the ladies in trimmings and head dresses, the gentlemen in ruffles and cravats of the royal manufacture." **

# Clifford, S.L.Lace, Its Origin and History
** Goldenburg, S.L.Lace, Its Origin and History.
The name "point de France" is given to all lace made from its commencement by Colbert's direction until about 1678, when the lace workers, perhaps forgetting the traditions of the Venetian school, developed a style of their own and the work became more distinctly French, being more delicate, finer in substance, the patterns clearer and more defined. The importation also of the fine flax thread from Flanders brought the more exquisite pillow lace of Brussels to the notice of the French lace workers. The next lace in order of merit was "Point de Alencon."

At about the same time that the manufacture of "point de France" was begun in Alencon, there was established at Argentan a similar bureau, which was the origin of lace by that name. The manufacture of lace at Argentan became practically extinct by 1701 but was revived by Mathieu Guryard.

The Guipure made at LePuy, an old variety of lace in France, and it has of late years been called cluny lace. It is a coarse lace and is particularly effective when made in black. The old patterns were fine and graceful, both in scroll and in floral forms, and there is a certain rich elegance to the black lace which makes it seem strange that it has not been more popular. While this was a needle lace, the modern cluny is a bobbin lace, geometric in character and following the antique pattern rather closely. The best bobbin laces were made in Valenciennes.

Lille lace ranks high as a handmade lace. The mesh is clear and large. The patterns are simple. The white lace of Chantilly much resembles Lille.

Black silk lace of very fine quality was begun to be produced about the middle of the eighteenth century. The manufacture of real old black Chantilly ceased with the Revolution and was revived only with the empire. The manufacture of the blonde laces was also commenced. They were called blonde because they...
were made in the natural color silk floss imported from China. Afterwards when the art of bleaching was discovered, it was made in a peculiar silvery color.

"Naturally all these earlier laces were made entirely by hand and all the laces up to the present time that are entitled to qualify as 'real' are hand made. The making of laces, exclusively by hand, came to an end in the latter part of the eighteenth century."

Our mammoth machine-made lace industry had its inception about 1820. The industry has now reached a high state of perfection, artists and skilled workers being required all along the line, and so perfectly are the handmade laces reproduced that it is often difficult for anyone except a careful student of laces to tell the real from the imitation or machine-made. Many of our laces developed from the old laces of France.

Dividing all laces into three groups with sub-divisions, we find the following:

I. Fabric Laces -
a. Drawn work.
b. Darned work.
c. Cut work.
d. Retecella
e. Punts in Aria

III. Bobbin or pillow lace -
a. Torchon - plaited or woven thread
b. Maltese and Cluny - Twisted
c. Battenberg - made with tape
d. Val - bobbin lace a brides
e. Duchesse and Brussel
1. Bobbin lace a Ruseau

I. Fabric laces - Stitches are rope stitch, in and out stitch, and over and over stitch.

Using previously existing materials. Lace worked out of linen originated in Italy; it was also made in Spain, France, England, and the Greek Islands. It was popular during the fifteenth and sixteenth centuries - not used for decoration of dresses, but
more for church, and household purposes. The pattern is geometric.

A. Drawn work - punts Tirato (Illus. Page 17 Sharp). This made of loose linen threads drawn apart and sewed together. The design in Venice is angular, such as horses, dogs, birds, and mythical animals. The design in Spain consists of heavy scrolls, which is Moorish taste. The design in Greek Islands is influenced by Byzantine classical patterns.

B. Darned Netting - Filet (French work for net) Page 21 Sharp.

Net into which pattern has been darned. The ground is made with knots or sometimes threads twisted. The thread is then worked on netting with an in and out stitch like weaving. The design consists of lambs, pelicans, dragons and imaginary beasts. It is used in church work for sacred emblems. It was popular in Italy in the sixteenth century. It consists of a square mesh starting with a single thread and increasing a stitch on each side until the required size is obtained. Uses - bedcovers, valances, and window curtains. Use fine thread for personal adornment, and coarse thread for furniture, draperies, etc. Formerly colored silk thread and gold thread were used. These are still popular in Russian filet. Machine made darned netting is softer and flimsier than the hand made.

C Cut work (Page 25, Sharp, English - 163)

It is made by cutting square or rectangular spaces out of linen and filling them in with needle stitches or transverse threads. The design is geometrical - plain space is embroidered parallel to either the warp or woof, with no padding. Cut work was the favorite accomplishment of ladies of Queen Elizabeth's time. Sheets kept for special family occasions, such as births, christenings, weddings, funerals, etc. and some cut work on them. Starch and constant wear has been too much for "lawn cut work." in The British Museum, pattern books date back to 1527-1722.
D. Reticella or Greek Lace (1480-1620) Page 29 - Sharp, 122 - Clifford.

Was worked on a linen foundation, but the linen has disappeared. The hemstitched edge is all that is discernible. Clifford says that this is the earliest needlepoint lace. It is a development of cut work and drawn work.

E. "Punts in Aris" (Marking something out of nothing Page 32 - Sharp)

The threads are laid down on a parchment pattern and are worked over.

II. Needle Point Lace -

Lace is made with a needle. The stitches are entirely without foundation of material, but are a series of loops. Italian drawn work and cut work blazed the trail for Venetian point lace. This discovery that foundation material was no longer necessary led to a new type of lace - "needle point." While working with filet, the loop stitch was introduced which is the foundation of needlepoint. The sumptuary laws of the fourteenth and early fifteenth centuries prohibiting the use of gold and silver threads were partly responsible for needlepoint and bobbin laces being made of flax. Solid parts are seen to be made of looped buttonhole stitches. Needlepoint was started in Venice in the fifteenth century. This new industry supplied the women of Europe a livelihood gained in an easy, artistic and delightful way.

A. Gros point à Venise Venetian point (Sharp - pages 37-39, Clifford Page 66)

Was of a carved effect. Some of the other characteristics are: stuffed and padded ornaments made with needlework stitches, large patterns in the form of flowers, sprays and foliage, bold design and delicate workmanship. Venetian point in France, owing to the long curls of young King Louis the 14th, caused the falling collars to go out of style. Ponderous wigs were worn to imitate
the King's natural locks; therefore, cambric neckties with falling ends of richest Venetian point lace were used. Men wore lace on their cuffs, frills on their breeches one half yard wide, rosettes on their shoes, and taps of their boots. Women wore lace on their sleeves, aprons, etc. Lace was also used for household articles, such as dinner table covers, pillow cases, coverlets, church altar cloths and cardinal's albs.

**B. Point plat or Venetian Point** (Clifford Page 142–&)
The designs were made without being raised. Connecting stitches were lengthened and worked over with buttonhole stitch. This is made on parchment and is basted onto the cloth. The design is made with cord and then filled in and the underneath cloth cut away, releasing the parchment and lace separately.

**C. Corcelline point**
Lace makers became so familiar with the task that they wove dreams into work light and airy. The connecting bars were enriched with picots. The design consisted of tiny flowers, leaf forms, fishermaids, corals, etc. This originated according to a story when a Venetian lacemaker received some coral as a parting gift from a sailor lover. She too wove her dreams into her work. The results seem to be a tangle work of nature in charming detail.

**D. Rose Point** (Venetian flat point, Cardinal lace, Pope's point, point d'Espagne) Sharp Page 45.
This is a lighter form than Venetian point. The design is smaller and the connecting bars are more frequent. Rose point reflects elegant fondness for fine detail. Flowers, wreaths, and picots, are placed on top of one another. Now much is made in Belgium as well as in Italy.

**E. Point a Reseau – Grounded point lace** (Sharp, Page 55)
Was produced the latter part of the eighteenth century. The mesh itself was developed in France. The French court demanded Vene-
tian lace - then all at once Italian lace was prohibited. The profits of Venetian lace fell off so they hoped to continue their sale by imitating the manufacturers of Alencon. Therefore, they adopted "reseau" ground. The mesh produced was outlined with "cordonnet." The arrangement of decoration is poor so it falls in the Rococco style. Shallow scallops form part of the design.

III. Bobbin or pillow Lace.

The honor of the origin of bobbin laces goes to Flanders, but Italy and Belgium both claim merit of its invention. Popular opinion is that it spread from Italy through France to Belgium by means of traveling peddlers.

Bobbin lace is made by twisting or plaiting threads wound on bobbins. It often resembles woven cambric or cloth in texture. The weaving is done with hands and bobbins, not looms. Bone bobbins are mostly used. The bobbin was used as a love token. An inscription on read, "Love me or leave me alone forever." Until brass pins were used in lace making, they used bone to hold the threads in place on the pattern. Sometimes the pattern was priced in bone instead of on a pillow; hence, the name, bone lace or bobbin lace. Parchment pillow lace was treasured and handed down from mother to daughter.

A. Bobbin lace made with plaited or woven threads.

Torchon is flat woven and of the simplest style "beggars' lace." It was produced in Saxony. It was the most widely known. It is coarse, soft, loose, and strong. Use - trimmings for muslin undergarments, and is a favorite finish for scrim curtains. The machine made is low in price. It has years of popularity and dull seasons. Lace made by men is finer, firmer, and superior to that made by women.

B. Bobbin lace made with twisted threads. Maltese & Cluny (Sharp Page 89)
Maltese - Knotted and twisted threads to imitate the grain of wheat, rice, and millet. It is geometric and heavy. The design is of an ancient type, and has a wavy character. White linen thread or black and white silk are used. This lace dates back to the sixteenth century. A woman interested in lace making brought about the change from Maltese lace in 1830 by importing Genoa lace makers to the Island of Maltese.

Cluny - patterns for making it filled lace pattern books of the sixteenth century. Originally a needle lace, but is now a bobbin lace. It is made with white linen or cotton on black silk. Use - Window curtain trimmings, dresser scarfs, edges, etc. It was made at Puy, France; given its name from the Museum of Antiques in the Hotel Cluny in Paris where much of it was displayed. Cluny lace is now being made more with cotton than linen, because it is more within the means of the cottage workers.

C. Bobbin lace made with tape (Battenburg, pillow guipure) Sharp 68-69.

The early Genoese tape laces were made on cushions. The tape followed the design perfectly without overlapping and without joining or cutting. It is made of narrow tape or braid formed with patterns held together with braids not covered with buttonhole stitch. Renaissance in style. Mezzo punts (Sharp Page 73) is a mixture of needle and pillow lace.

D. Bobbin lace a Brides

True Val mesh is diamond shaped. Mechlin mesh is hexagonal. (Sharl Page 106) The design and mesh are made at the same time and out of the same thread. This is one of the best known laces. Carnation is the favorite design. It has a close even texture toile, no cordonet. The eighteenth century lace is superior in beauty, and fineness over the present lace. It was made in underground rooms. The thread was spun from the finest flax. Machine
vals are made in England, Italy, France and Germany.

**E. Bobbin - lace a Reseau - Duchesse.**

Units joined together with bars. When pinned with mesh to make a netground between designs, it is called Brussels. It is pure white, with a graceful flowing pattern, with a large leafage, flower, or scroll design. Use - scarfs, vests, collars, bridal veils of exquisite Duchesse are handed down from generation to generation in families fortunate enough to possess heirlooms.

**Brussels pillow lace** (Sharp Page 127-130)

Reseau follows outline pattern. Hexagonal mesh - two sides are made of four threads, four sides are made of two threads. No cordonnet but open work around the design. It is spun in dark, damp cellars.

**Point plat applique** (Sharp Page 137)

Brussels pillow lace appliqued on after 1810, invention of machine made net had been perfected, and lace workers appliqued pillow made patterns on this inexpensive material.

Silk net of great fineness was called Tulle. It was invented during the seventeenth or eighteenth century. Embroidered tulle is known as point d' esprit (small oval or square dots). This is made in Brittany, Denmark, Genoa.

The evolution from these fifteen styles has produced a vast number of laces:

**Group IV. Knotted, macrome, tatting, hairpin lace.**

Knotted fringe was really the beginning of the future pillow lace, "Macrome" is an Arabic word meaning ornamental trimming or fringe. Knotted lace is made by interlacing threads on pillows not by plaiting as is now done. This grew out of Byzantine knotted fringe, produced in Genoa in the sixteenth century. Uses - church and household purposes.
Group V. Knitted lace.

Group VI. Crochet lace.

Group VII. Machine lace.

Plowen - applied to all laces issuing from that section and including imitations of nearly all point laces, which are embroidered on a wool ground, this being afterward dissolved in acid and the cotton or silk design left uninjured. Lace made exclusively by hand ended the last half of the eighteenth century. The first machine was invented in 1820 by an English man whose name was John Heathcotes. Lace chests were popular but of short existence. Hand made lace in America began with the landing of the Pilgrims. Machine made lace is not made with the looped stitches like needlepoint lace nor is it plaited like bobbin lace. The toile or pattern is ribbed like a stocking and cotton and rayon are after used instead of linen. Cotton does not hold firmness and color when washed; it becomes loose and wooly in appearance.

For the benefit of the visitors to Venice, there still exists the "Burano lace schools" under the patronage of Queen of Italy in Palazzo, Municipals, an island of Burano near Venice. It was started to help the poor. The only one who remembered these old laces was an old lady seventy years of ago, who consequently could not teach, but others who watched her until they learned the various styles, and have thus handed them down to the present day.

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Hygiene
LET US KEEP CLEAN

Dorothy Glass '31
Mentor, Minnesota

Foreword

May this term paper give some help to whoever reads it about their laundry problems, and solve it for them.

Dedication

I hereby dedicate this term paper to Miss Retta Bede, from whom I have received valuable information for this paper.

The way we wash our clothes has changed widely since the time when they were washed "so early Monday morning." In these modern days, launder day is no different from any other day of the week, and is sometimes easier than other days.

Well designed and easily handled washing machines have taken the place of the low set laundry tub, and the ribbed board where the women rubbed their clothes and their fingers too. There are also many well equipped laundries that take your clothes from your home and return them clean and freshly ironed. But after considering this we find that about 29% of the women stick to the old fashioned washing method instead of using power machines.

In choosing a washing machine, choose one that can be relied upon to wash all types of clothing satisfactorily, from the finest silks to the sturdiest cottons both white and colored. It has been proved that silks and fine fabrics, as well as cottons and linens, can be successfully washed by machine methods, whether done by a commercial laundry or by equipment of
home size. Besides knowing the types of machines, each purchaser should investigate a machine for the following points: easy rolling casters, adjustable legs, noise and vibration when the machine is in operation, ease of oiling, and caring for machine, water outlet, large and easy drain, hinged lid and a service department nearby at which to purchase repairs. There are five types of washing machines on the market with which every purchaser should be familiar. The purpose of all washing machines is to force the soap suds through the clothes, thus washing the dirt out.

The Dolly type of machine has metal or wood projections usually in the cover of the machine. The projects revolve first one way and then the opposite way and keep the clothes moving through the water.

The Gyrator type has projections similar to those in the Dolly type of machine only they are placed at the bottom of the tub.

The Oscillating type machine has a round tub suspended into a cabinet and as the tub moves back and forth, the water is forced through the clothes that are in the tub.

The Cylinder type washer has a perforated cylinder which holds the clothes. The cylinder is suspended into a tub of water and the clothes are carried through the water by the action of the cylinder, which revolves when in motion.

The last type of washing machines is the Vacuum type, sometimes called the suction type because it has one to three cups which are suspended into the tub like inverted funnels. These cups move up and down sucking the water through the clothes and forcing the dirt out.

Most machines have a water line and water poured in above that line may affect the mechanism of the machine and will cut down
the efficiency of the washer. Do not overload the machine with clothes as it is especially hard on the motor, and the clothes will not be clean. When through with the washing, clean every part of your machine thoroughly, drain and dry. Care of a machine will make it last much longer.

The wringer is included as a part of the washing machine. It is made of firm rubber balls, having enclosed gears and ball-bearings. A good wringer is adjusted to swing in any direction.

In considering the types of irons used, a great many varieties are found. An electric iron is best if electricity is available, but a gasoline or charcoal iron will do. An electric iron for general use should not weigh over six pounds. Although considering the many types of irons, many women will still use the old fashioned sad iron, while in more modern laundries in a modern home, a "mangle" is used. The mangle is much easier to use and when skill has been obtained, an ironing may be done in about an hour, while otherwise it would take about five or six hours with the old fashioned sad iron.

The high lights in modern laundering are the following:

1. The laundering of silks in an electric washer is just as safe and satisfactory, if proper methods are followed.
2. Lukewarm water should be used for both washing and rinsing of silks.
3. Very soiled cottons and linens should be given a "break" of luke-warm water and cleanser before the soap wash.
4. Rinsing of all the clothes is done in the machine.
5. Boiling of clothes is unnecessary except for sterilization purposes.
6. A good power laundry is as careful of your finest washable silks as you are.

We all know there are impurities in water and by the term "impurities", we mean substances out of place, as pure water is
composed of oxide of hydrogen or H₂O. For instance if water has salt dissolved in it, the water is impure although we do not think of salt as being impure in itself. Mineral impurities usually make the water hard and therefore troublesome for laundry work. Water for laundry work must be clear, and soft, and clear from any discoloration due to decaying vegetable matter, clayey soil, and so on. Muddy water can be filtered through sand to make it clear and clean. If this method is used, dissolve a little hot water and add to this one gallon of hot water with a scant tablespoon each of 'alum' and 'borax' allowing the water to settle. The alum and borax will settle to the bottom and carry the mud with it, thus cleaning the water. The mud must then be pared off from the sediment. When water is made hard by carbonate of lime, add any alkali to soften.

Kerosene is excellent in washing dish towels. To use this, make a strong suds, using a tablespoon of kerosene to one gallon of water. Lastly soap towels well and boil them.

There are three or more kinds of bluing now on the market. Three kinds are: namely, Prussian, Ultramarine and Indigo. The Prussian blue gives a little better color as it is soluble and very easily used. The Ultramarine blue is of an iron compound, but does not compose of alkali. It is often sold as "ball bluing" and is insoluble in water. The water breaks it up into fine particles and constant stirring of the water is necessary if you want your clothes to be evenly blued. The ball bluing should be tied up in a cloth and then set in the water to slowly dissolve. Indigo blue is easily to use but does not give such a good color. Women use bluing only to help bleach their clothes.

Some of the clothes in everyday washing have to be starched, to make them stiffer and to give them a better appearance.
It also helps them to stay clean longer.

The steps in laundering are many. First is the sorting of the clothes. All the table linen is sorted together and also the other groups of clothes. In using a washing machine the first water must be boiling and soap suds added to get a nice cleansing water. The water is put into the machine and then the first group of clothes. The linens are put in and washed for about five to eight minutes. Wring out the clothes in lukewarm water and put in the next batch of clothing in the machine to wash. When all the clothes are washed, run them through a cool rinse water which has a bit of bluing in it. The clothes should be run through this rinse water as they are washed in the machine, the white clothes first and on down to the darkest colors. The clothes such as prints in house dresses, dresser scarfs, napkins, table linen and the collars and cuffs of shirts are starched. Starch the light colored clothes first and the dark ones last.

In hanging your clothes on the line, you want some of your clothes, such as tablecloths and sheets, bleached. To do this, hang them in the sun. Pastel colors should be hung in the shade so the sun does not fade them.

When your clothes are dry, take them in; sprinkle them and roll up in a ball. A clothes basket is very handy to put them in. It is best to sprinkle the clothes at night and then iron them the next day. This way they iron very smoothly and easily.

In washing woolen blankets, care should be taken, as a wool fiber consists of many small scales overlapping one another, and if hot water is used to wash, the blanket will shrink and will be rough and coarse. Wash woolen blankets in lukewarm water for about five minutes and then plunge them into lukewarm water and hang
on the line without wringing the water out. Care should be taken
to hang them straight or the edges will be crooked. Pick out a
sunny day with a light breeze when washing woolen blankets, as they
will dry much more soft and fluffy.

Stains of every kind are hard to get off clothes and care
should be taken when doing so, as not to take the cloth along with
the stain. Stains should be removed before washing the garment, if
possible. For grease spots, use benzine, naptha, gasoline or
kerosene. But, as these are inflammable and explosive, work out of
doors with them. Bluing spots may be frequently soaked in strong
ammonia water. For grass stains, use alcohol or ammonia. Fresh
stains as coffee, tea, or fruit may be removed by hot water. Fresh
paint is taken off by the use of turpentine. Ink spots are taken
off by lemon juice with salt; sprinkle with lemon juice and spread
in the sun to dry. If the stains are fresh, they may be removed
by cold or tepid water, skimmed milk and sour milk.

Many women want to bleach their sheets and linens that
may have acquired a dingy yellow color. To do this, use the fumes
of burning sulphur, chloride of lime and Javelle water.

I hope that in these few pages I have given you some of
the High Lights in Modern Laundering that may be useful.

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HEALTH HABITS AND PERSONAL HYGIENE

Mildred Ualme '31
Nielsville, Minnesota

Dedication

I dedicate this term paper to all students of the Northwest School.

Foreword

In this term paper I shall strive to take up some of the things that determine health and some of the things we must do to keep healthy.

Health is the most important factor in our lives. In order to be healthy we must know the essential points at which our health can be kept.

Sleep is very valuable to the growing child. Most of us have found that the average child, after he passes the baby stage at least, makes an attempt to get out of taking a nap during the day or going to bed at his regular time at night.

Rest is also very important to the growing child.

Our knowledge of children tells us that they are not concerned with doing things that make them healthy. Hunger brings on the desire to eat and every child prefers sweets if he can get them.

So we all know the guardian or the parent of the growing child has very much responsibility.

You must have seen the child mother, a little girl of perhaps not more than twelve or thirteen, who takes care of her little brothers and sisters while both parents are at work. It has made my heart ache to see these children as I have in the city streets.

We must never forget that ever minute of rest is a
growing minute, a time of building up and not tearing down. Fatigue often affects the appetite and may interfere with proper digestion. The rested stomach is usually hungry for good food and is ready to receive and take care of it.

For all growing children, including boys and girls of high school age, sleep should be regular. The retiring time should never vary. When the habit of sleeping regularly is once formed, no time is wasted in going to sleep. Trouble starts when exceptions are made and children are allowed to stay up beyond regular bed time.

The conditions should be right for rest and sleep. If possible, a child should sleep in a bed by himself and also in a room apart from the adult members of the family. The bed should be comfortable and clean.

I have not said anything about the boy and girl of high school age. Regularity of rest and sleep should still be kept during these ages.

It startles us when we realize that the tuberculosis rate has not decreased among boys and girls of high school ages. We must do all we can to build up strength and energy in young children in order that they may have and keep maximum physical vigor to carry them safely through the period of adolescence to sturdy manhood and womanhood.

Muscular exercise not only builds muscle, but also encourages blood circulation and thereby aids the internal organs. The point of view in relationship to exercise has been changed, therefore, from the idea that would demand an exceptional performance, such as the ability to run one hundred yards in ten seconds or to leap six feet in the air,
to the idea that exercise must be taken for the promotion of good health and a sense of vitality. Physicians are inclined to suggest to the average man that he exercise enough to keep himself in good condition, but not to the point of fatigue or distress.

The amount of exercise that each person takes should be adjusted to his occupation and to his individual needs. Swimming, walking, golf, horseback, riding, fishing and gardening are forms of exercise which, if taken in moderation, are suitable to persons of any age. Competitive sports are dangerous to persons of advanced age because they are likely in the midst of such activities to put more stress on their tissues than the tissues can stand. Extraordinary effort or activities after thirty years of age frequently do more damage than good.

The physiologists have found that a healthful man or woman with well developed muscles who works hard can sustain an average output of about one-tenth horsepower for eight hours. Everybody knows that a Ford car or any other automobile can develop at least 20 horsepower without wrecking the machinery. The human being may easily wreck his machinery if he overworks tissues when they need rest. If a muscle is taken from the body and stimulated with electricity once every second, its contractions become slower and slower and weaker and weaker, until finally it is unable to contract at all. This is due to fatigue. Those who have run long races know that at the end of the race the legs do not seem to be weak but simply will not move as fast as one wants them to move.

Cleanliness is essential to health.
A serious point has arisen in relation to the fact that underwear has been largely discarded by women. Almost half the body is bare, except for the single outer garment which is seldom washed and which serves as a direct covering of the skin. Here the same garment is constantly in contact with the skin, collecting germs and serving to infect the skin with bacteria. A recent study made in the University of Nebraska indicates the way in which germs accumulate on garments which are worn frequently without washing. The germs on outer garments were counted day after day when the garment was worn steadily without changing. From an average count of 400,000 germs per square inch after one use, the number increased to nearly 10,000,000 germs per square inch after a skirt was worn six times. When the skirt was carefully laundered, the number of germs was reduced to 1000 per square inch or less and when the garment was dried in the sunlight and open air, the germs were eliminated almost entirely from its surface. Here is an indication of the relationship of garments worn day after day without washing or steam cleaning and the development of germs on the surface of the skin, followed by pimples and other infections.

From the point of view of health, clothing should be of a lightness that can be borne by the wearer without being pinched by the cold and without feeling the need of artificial heat when the weather is mild.

The care of the hair is another important health habit. Brushing the hair causes a good circulation of blood in the scalp, thus providing the growing cells of the hair with an abundance of food and oxygen, and promptly carrying away their
wastes. The hair should be washed occasionally with good soap to remove dust and oil.

We must all keep our nails in the best condition. Always remember to file or trim your nails and also to keep them clean underneath the nail.

We all admire people who have pretty teeth. Many of us wish we had pretty teeth. I am sure we all could have pretty teeth if we cared for them in the proper way. A clean mouth and good teeth in a good condition for thorough mastication are of the greatest importance in maintaining general health and in assisting the body to resist disease. The teeth should be brushed twice a day. You should use a good or well known grade of tooth paste.

If you follow all these suggestions, I am sure you will be a healthy person and you will enjoy life to the utmost.

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Foot Health
OUR FEET

Ann Brandli '31
Warroad, Minnesota

Preface

I prepared this term paper with the intention of helping anyone in need of the knowledge of foot ailments, with the causes, results, and cures, if any.

Foreword

I hope this paper will benefit each one who reads it, and also that it will solve his or her difficulties. There is a great deal of instruction on caring for our feet included, which should especially interest every school boy and girl.

Dedication

In appreciation of the material and help I received for my term paper, I dedicate this to Miss Elsie Mae Kingston, and to all of her gymnasium students.

This question, "How many people in this country actually suffer from some sort of foot trouble" has been answered by high authorities that there are ninety per cent, yet very few of these cases are extremely serious.

Foot health is very important to the human body. Many people suffer from ailments traced to foot troubles. The comfort you take in life and the condition of your general health depends largely upon the attention you give your feet. The foot is not merely the end of the leg; it is an important organ designed by Nature for holding the weight of the body and for propelling the body in walking, lifting it along, exercising meanwhile an elastic quality which protects the body from jar as a shock absorber and to give ease. Conditions of the feet may be indicators of disturbances of the general health, and if thoroly investigated,
may reveal important facts. For this reason, the feet cannot be separated from the rest of the body and treated as a foreign member, but must be considered as a vital part of the human body.

It would be almost impossible to over-emphasize the value of proper posture and the position of the feet. If the organs of the body are to function properly and the muscles of the feet, lower limbs, hips and trunk are to perform their duties without pain and discomfort, the body must be carried erect, with shoulders even and the back straight.

Take particular notice of a large number of people as they pass on the street. Note the difference in the steps. Some are flat-footed, walk briskly, but a goodly number are awkward, clumsy steppers, plodding along. What a remarkable difference it makes whether an individual has good feet or poor! Walking is accomplished by the feet moving straight ahead in the same line in which the body moves, thereby distributing the body weight evenly from heel to toe.

"STAND STRAIGHT! WALK STRAIGHT! THAT IS GOOD POSTURE." Posture effects every organ of the body, especially does it effect the organs of the feet. Incorrect posture is, as a rule, caused from the pressure of uncomfortable and unscientifically constructed shoes. In standing, the feet should point straight to the front and be from two to four inches apart.

In childhood, you may have been taught to walk with your toes pointing out. This is entirely wrong in the light of present day knowledge. It results in a stilted, ungainly and more tiring walk. Unless this is corrected in childhood, the muscles become set to this method of walking and a permanent and injurious habit is formed.

With the exception of a few, all people are born with normal feet. Nature intended that we should walk without an inch,
or two inch block under our heels. This is the reason why Indians had little or no trouble with their feet. They work the natural shaped moccasin. All primitive people have perfect feet due to going barefooted or wearing the soft soled shoes. Do you swing along easily and gracefully - toes straight ahead - or do you turn your toes out and walk on the inside of your feet to avoid discomfort? In other words, are you a "clumper?" Walk softly - without pounding your heels. The stealthy tread of the Indian is the ideal method of walking.

The heel should touch the ground first, then should follow the outer part of the foot and as the whole weight of the body follows the tread, there is a natural roll to the inner part of the sole. It might help you to learn how to walk properly, if you walk frequently before a large mirror, following the directions given here.

Try to put a little extra weight on the outside and equal weight on both feet. Frequently remind yourself of this correct position in standing. You can do it by drawing in all your toes in the shoe as though you were about to secure a grip on something within the shoe. Even when you sit, point your toes straight forward. It is the most comfortable way to sit, and easily the most charming from a standpoint of appearance. Your feet are marvelously built; if well treated, they will render marvelous service. And you will be richly repaid if you study how to use them and care for them.

Your body rests upon your feet just as a high building rests upon its foundation. If a stone slips out of place in the foundation, a crack may appear in the topmost ceiling. If your feet become weakened or flattened, you are likely to feel the effects clear to the top of your head.

The problem of foot health is becoming more serious
due to modern fashions as they are not designed for health. Few people pay any attention to their feet until they have severe pain and discomfort. They do not realize that foot trouble can have serious and unpleasant consequences. Have you ever noticed the person who has foot trouble? More than likely he or she is frowning.

A beauty specialist told a lady that the wrinkles in her face were caused from her feet.

When you have a blister on your heel, take a look in the mirror and see the results. In any event, she not only has a pained expression on her face, but she looks uncomfortable and ill at ease. We cannot have any of these things if we are to look our best. A pretty face must be free from frowns; it must have a happy expression. And in general a person who is pretty or attractive must have poise; she must look perfectly at ease under all circumstances. Yes, healthy, comfortable feet are very important, not only for beauty, but for living, working, and enjoying life in general.

Not only the feet have effects upon beauty, but they also effect the organs of the body. In order to have these organs in perfect condition, the suggestions mentioned above should be daily practiced.

The human foot is composed of twenty-six small bones connected by four times as many ligaments, and operated by many muscles and nerves. There are four arches in the foot: the long arch at the inside of the foot from heel to the great toe; the front arch extending across the ball of the foot; the third arch at the outside of the foot from the heel to the base of the small toe; and the fourth arch across the middle of the foot under the instep. With this four arches in each foot, the body is balanced upon what is called the tri-pod weight bearing points, or a three-point sus-
pension: namely, the base of the heel, the base of the great toe, and the base of the little toe.

The multiplicity of bones and joints is in part responsible for the ease with which the foot is deformed. But, if the foot was one solid bone, it would readily fracture when placed down suddenly, such as stepping from a curb. Nature evidently foresaw the coming of civilization and planned the human foot both as a means of locomotion and a shock absorber for the more delicate organs of the body.

The composition of the human foot is as follows:

1. Bones, to give rigidity.
2. Ligaments, to hold in shape.
4. Muscles, to provide motive power.
5. Nerves, to direct.

Each one of these integral parts has its own individual function to perform, and only when each one is able to perform properly is the foot going to be comfortable and healthy. Like the great bridge, one small girder might not seem so important. You might think it could be torn out and thrown away. Yet by doing so, you very likely would weaken the entire structure, and eventually cause its ruin.

Nature has made the foot so strong and durable that it will withstand a surprisingly large amount of abuse. But there is a limit to the abuse and strain that any piece of machinery or structure can stand.

The twenty-six bones in the foot are divided into two sections, the toes and arches. Fourteen of these, however, are in the toes, and are relatively unimportant in making the foot the marvelous structure it is. They are the most active part of the foot, and consequently their restriction in shoes improperly constructed or poorly fitted causes much suffering and impedes the proper functioning of the other twelve bones.
The twelve bones which form the arches are worthy of closest study. Five long bones are under the ball of your foot, and the other seven form the leg. Ligaments are, in effect, bandages which hold the bones forming the arch in their natural arched position. They are somewhat elastic and under normal conditions of use and exercise, they hold their tone. They may lose their effectiveness, however, from two very different causes. One, when an unnatural strain is placed upon them constantly. The other when their function is usurped by extreme "protective" footwear or from lack of use.

Nature has a habit of giving up a job on which she is given too much assistance. The normal foot in a correct she needs no mechanical "arch supports" either inbuilt or applied. If the ligaments have actually lost their tone and the arches are down, then Nature's job must be done for her mechanically.

We have seen that the foot is one of the most complicated parts of the body. Without the hard pavements man has constructed, and the needs he has developed for protection, feet would develop naturally. Man's progress, not Nature, is at fault, if feet are not normal.

The most common foot ailment is that known as "fallen arch", "Flatfoot" or "weak foot." It consists of a flattening of the long arch that extends from the heel to the great toe. One of the first symptoms to be noticed is a pain under the arch and up the back of the leg. Other symptoms are easy fatigue, sudden turning of the ankles, swelling of the ankles, severe back aches, nervous breakdowns, irritability, ill-temper, eye-aches, and particularly in children, lack of development.

There are dozens of different causes for weak and fallen arches. Pounding the feet on hard floors and sidewalks and toeing
out may cause this condition, but usually it is wrong shoes. Either shoes that were not made right, or shoes that were misfit-ted, or shoes which were originally of correct design and properly fitted, but were worn after they had lost their shape. Standing on the feet for long hours every day without being able to walk and exercise the arches tends to strain them. People become over-weight and thus place an added burden on their feet which sometimes is too great for the arches to bear. Many other things, even undernourishment, can cause the trouble. But whatever the cause, the result is always at least discomfort somewhere in the body, possibly a painful, plodding walk, and sometimes actual illness.

There is a change also in the print made by the flat foot. The normal foot print is narrow in the middle and wide at the heel and at the toes. The flat foot leaves an impression that it is almost the same width through its entire length.

The natural flat foot is one in which the arches have been down since infancy. All children are born with very nearly flat feet, and remain in that condition until the time that they attempt to stand or walk. Then, through muscular action, the arches gradually assume a normal position. In instances where the child is not physically fit, or where the child stands or walks too soon or too far before the muscles are strong enough to carry the weight, the arches never develop, and the bones assume a flat condition known as natural or congenital flat foot. The cure for fallen arches is plenty of foot exercise and the wearing of arch support shoes. These are not always satisfactory as they protect the foot so much that it does not get the necessary amount of exercise.

Another extremely painful condition of the foot which is little understood is the flattening of the anterior arch, which extends across the ball of the foot from the base of the great toe to the base of the little toe. At this point, the experts
say, ninety per cent of the foot troubles of women are to be found. The first warning of any unnatural condition of the anterior arch is pain in the three outer toes and directly under the ball of the foot. What is the cause? It is not rheumatism or gout or neuritis, as is often thought, altho occasionally these ailments may be the cause of pains in the feet. That burning, stinging, agonizing pain under the ball of the foot is more probably due to a concave sole.

This sole which rounds down under the ball of the foot and binds up at the sides is the one which causes the trouble. Such a sole permits the short front arch to drop. Then apparently the nerves of the foot are held in a vise like grip between the bones of the foot. This causes intense pain. One of the signs of anterior arch trouble is a painful callus in the middle of the ball of the foot. Such a callus is abnormal and indicates undue irritation in this particular spot because the arch has dropped. Relief may be obtained by placing a padding under the ball of the foot, or by putting a band of rubber webbing or adhesive plaster around the foot.

When the arch that extends across the ball of the foot becomes depressed, it causes extreme soreness under the surface which is often described as stone bruise. Actually, in children's feet, the cause is usually lack of width through the ball of the shoe. Callouses and soreness are the symptoms. A deep-seated tenderness on the inside of the heel is often caused by strains to the muscles attached to the heel bone or disturbances in the nerves. Proper cushioning of the heel inside the shoe and soft cushion heels prevent and correct the condition. Care should be taken to see that the weight of the body is properly distributed through wearing correctly made shoes. Sometimes the toes are white, cold and painful, or occasionally only one toe may be
affected, while the others are warm and pink. This is due to construction of the small arteries leading to the toes by shoes worn too tight. Through the same cause, the skin may become inflamed and the feet be hot and swollen. The only positive relief that can be obtained is through wearing properly constructed shoes, which are wide enough and loose enough to allow free blood circulation. Weak ankles are an indication of weak arches and should be treated in the same way.

When the toe nails curve under on the sides and grow into the soft tissues of the nail grooves, it is usually caused by wearing short shoes. To avoid ingrown toe nails, cut a small "V" in the middle of the toe nail. The trouble may be as slight as a corn, callous, or ingrown nail, or it may be as severe as a large joint, weak ankle or flat foot. These often prove disastrous when the wrong treatment is advised. Corn remedies, adhesive plasters and razors have often resulted in infection necessitating amputations and loss of life.

Through misuse of the foot, lack of exercise of the leg, muscles, or the wearing of badly designed or ill-fitting shoes, the arches may begin to sag and the bones may slip out of place. Then distress is bound to follow. Abuse, disuse, and misuse of the foot is a crime, and discomfort is the penalty. If your arch is becomingly strained, it affects your whole nervous system. If the bones in the forepart of your feet are pinched, then you are robbed of your energy. The feet are weakened and perspire freely. The distress is not limited to the feet, but often extends to remote parts of the body. Stubborn cases of headaches, backaches, continued fatigue, poor circulation, indigestion, unruly nerves, spinal disorder, and pain often mistaken for kidney trouble, neuritis, or rheumatism, may have their
origin in the feet. Keep your feet well and walking becomes a pleasure.

Consider your delicate foot structure. It is truly amazing how much abuse your feet can stand without being seriously injured. If your feet are giving you some trouble, or if you have reason to believe that your feet are partly responsible for other bodily ailments, perhaps you need only change shoes, or take proper care of your feet to overcome the difficulty.

To stand, to walk, to run, while bearing the weight of the body, and in addition, whatever load may be carried in the arms or on the back, is a truly amazing scope of operation for a single weight-bearing structure. The most ingenious form of transportation or conveyance created by man is decidedly crude in comparison. The foot will carry a hundred times its own weight. People expect their feet to bear this burden day after day, year after year, morning, afternoon, and evening, and at the same time withstand obvious abuse.

The human foot can stand a great deal, but it should not be expected to stand everything. My last impression I wish to make and leave with you is, "Be Kind To Your Feet."

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Dedication

I wish to dedicate this term paper to anyone interested in their foot troubles and cause, and especially to the Northwest School of Agriculture.

Foreword

May this term paper give some help to whoever reads it about their foot troubles and shoes, and solve many questions.

You give regular attention to the tires of your car. Do you give equal amount of attention to the tires of the human body, your feet?

The majority of foot troubles come from incorrect shoes. The inner edge of the sole of your shoe should be straight. The hinge of the foot is across the ball and this part of the shoe should be free to move easily and naturally. Shoes should allow the foot to function normally and the toes should lie straight and slightly separated. The shoes should be long enough and wide enough, roomy over the toes, and fitting snugly around the heel and over the instep.

The shoes that fit your neighbor, well, may not fit you at all. Don't blame or depend on the salesman. His business is to sell shoes - not treat feet. Thousands of people ruin their feet because shoes are cheap. They try to make themselves believe that shoes will break in and become comfortable. Learn to select shoes that fit. Take plenty of
time buying shoes. Have your feet measured by standardized methods; try on both shoes of a pair. Stand with your weight entirely on one foot and then on the other. When walking, the weight is carried alternately on each foot. When carrying the body's weight, the feet are longer and more spread out than when they are relaxed. Shoes may seem to be very comfortable when you stand with your weight on both feet, but when you throw all your weight on one foot, the shoes may be quite uncomfortable. Do not overlook the fact that feet are larger when carrying the body weight than when relaxed.

Examine your shoes often. You can readily see whether or not you are walking correctly. The shoes should be worn evenly across the heel and along the ball of the foot. If the wear is on one side, the chances are that you are developing foot trouble.

Men's shoes usually follow the natural shape of the foot more closely than women's shoes. In spite of that, however, when men were examined for service in the World War, by far the most important of all defects found were in the feet. Since then most men have insisted upon having sensible shoes.

How can you tell whether your shoes are the right shape or not? First, by considering what the shape of your foot should be. Stand with your feet bare, your heels together, nor bring the toes together. Do they come together the whole length? If not, they have been turned from their true direction by badly designed shoes. When you are wearing shoes of proper design you can bring your feet together and have the inner edges in contact clear to the end of the toes.

There are certain makes of shoes which meet this require-

ment. Most do not.
Shoes should not be too flexible nor too thin soled. If we could walk on soft, spring earth, as the Indians walked, as the Indians walked, shod in soft-soled moccasins, we would have no arch trouble. But walking on hard pavements, as most of us do, we must cushion our feet against the shock of each step. That is why a fairly heavy sole is usually preferable to a thin sole.

If your feet are to function freely and in a normal manner, they must have room; but there is as much danger in a shoe that is too loose as in one that is too tight. Stockings are almost as important as shoes. See to it, therefore, that your shoes and your stockings are not too small, pointed, or too large. See that your stockings give your toes unrestricted freedom.

High heels have long been a fruitful source of argument. Some women say they must wear high heels to be comfortable. Yet high heels are undoubtedly responsible for many sore feet, aching backs, and touchy tempers.

If Nature had planned that our heels were to be lifted from half an inch to three inches off the ground, she would have built our feet that way in the first place, but she intended that we should walk with our heels touching the ground at every step.

Consider what would happen to a post a foot square and six feet high, if it were raised two and one-half inches from the ground on one side. Unless prevented, it would obey the law of gravity, and fall.

When our bodies are lifted in this unnatural way with blocks under our heels, we have to use muscular effort to hold ourselves upright. In doing that, we turn the spine unnaturally
and throw the abdominal organs out of posture.

There may be some persons who can wear high heels all their lives without injury or discomfort. Others can go for many years apparently unharmed. But usually there comes a time, during or after middle life when both feet and body rebel against unnatural treatment, and develop troubles of many kinds.

Three tests that show whether your shoes will cause trouble some day are: Do they rinkle next to the arch? Is the heel wearing on the inside corner? Is the tread creeping back from the ball or the arch?

Shoes fitted too short, too narrow, or the wrong shape, even though they are correctly designed, invariably end in major or minor foot troubles. With this in mind, you will in the future refuse to wear a shoe that you know is either incorrectly made or misfitted.

There are several types of measuring sticks and methods of measuring feet. The length of the shoe required is ascertained by placing your foot in the stick, which contains a standard scale that indicates the shoe length required. The width is ascertained by placing the foot into the stick crosswise. A standard scale then indicates the width.

No matter how accurately these scales are worked out, and what type of measuring device is used, they merely indicate the probably size and cannot be accurately depended upon. The reason for this are manifold. First of all, there is great variation in the stretch or expansion forward of different types of feet when the weight of the body is placed on them. Some feet are fleshy and require greater width than indicated on that account. There may be a corn, a bunion or other blemishes which
must be taken into consideration. The toe may be proportionately long or short. The anterior arch may slant back more than the average foot.

Only the knowledge of an experienced shoe fitter, his practiced eye and strained fingers can be depended on to get you a perfect fit. Forget the size you wear. Leave it to the shoe man.

Watch the trained shoe fitter. He knows that fitting does not mean just putting on a shoe that will go on the foot. He studies your foot for arch weaknesses, or possible blemishes like bunions, and corns. He ascertains your probable size with a measuring stick. He never depends on the size of the shoe you've been wearing. The old shoe may have been misfitted. It may be a different type last than now wanted, or it may be different in any number of ways from the new shoe which the foot is going to wear.

Having mentally sized up your foot, he knows fairly accurately the type of last you need. His first consideration when the shoe is on the foot is the set of your foot from toes to ball. He will see to it that the great toe joint sits accurately at the joint in your shoes where the sole flattens out. Then he will get the position and feel of your little toe joint. He is making sure, first of all, you see, of the two most important forward points of your foot's main contacts with the shoe. Then his fingers travel across the toes of your foot. He is making sure the toes are not cramped or squeezed. Then he ascertains the set of the shoe against the arch of your foot. Then his interest travels to the set of the heel in the shoe. If he is fitting an Oxford, pump or
or strap pattern, he makes sure your heel will not slip in the shoe. He wants your heel hugged neatly — neither too tight nor too loose. Now he checks for toe freedom. Where the front of the toe strikes in the shoe is unimportant, so long as there is plenty of room so the toes cannot touch the front of the shoe. There must be plenty of room here. More than is necessary can do no harm if the shoe is otherwise fitted.

If the clerk is satisfied, he will ask you to place your weight on the foot. In this position he again checks the different points. Sometimes, not often, he finds in this position a condition that may necessitate another size or last. He then asks you to walk several steps. The shoes should not cramp you. If they do, tell the clerk. After all, a perfectly fitted shoe is a matter of cooperation between an informed customer and an expert shoe fitter.

In selecting shoes it is well to choose something standard in style and color. It is important that the heel and arch fit well so that the foot doesn't slide in the shoe. A medium or low heel is the best type for general wear. The insides of the shoes should be quite straight. A pointed shoe crowds the toe and cripples the muscles. Often the pointed toe causes bunions and a fallen arch. With bunions and fallen arches the women can never feel their best.

The width of the shoes is expressed in letters and the length in numbers. Stack widths range from triple A (AAA) the narrowest, to double E (EE) the widest. Whole sizes increase in length by one-third of an inch. The American size system runs from 0 to 13½ in the first series and continues from 10 in the second series. In the first series, size 0 is 4
inches long and size 13½ is 8½ inches long. In the second series, size one is 8 2/3 inches long and size 12 is 12½ inches long.

Cheap shoes are not always an economy, nor are high priced shoes necessarily the wisest investment. Frequently a good share of the high cost goes for fancy workmanship and for novelty. Continued satisfaction with shoes can be had by sticking to the make.

Here are other things you should consider together with fit. They are the heel set, insoles, vamp, toe cap, welt, outsole, shank, toe lift, and counters.

The proper care of shoes coupled with the intelligent selection means a reduction of from one-fourth to one-half in shoe bills and at the same time keeps the feet neatly and serviceably shod. It is not necessary to discard shoes as soon as they begin to show signs of wear. After a seam has ripped or the outsole has worn through, shoes can often be repaired and worn for a long time.

Shoe trees help to keep shoes their original shape. If they cannot be had, the use of paperpads or stiffings are fairly satisfactory.

An economical plan is to have two pairs of shoes for alternate daily wear, thus permitting each pair to dry out between times. Perspiration is very hard on leather. Uppers constantly wet with perspiration may soon crack and rip, especially if not protected by occasional oiling.

Mud, water, or excessive dryness ruin leather. Oil and grease preserve it. Therefore, the life of boots and shoes may be extended by keeping them clean, pliable and water resis-
tant. Those for farm or other outdoor use need greasing. Those for street wear need polishing only, tho the soles may be oiled or greased. Frequent polishing, especially with flexible wax polish, keeps the leather soft and pliable and gives it a finish that helps to turn water and prevents the collection of dust and dirt. A light, even oiling with castor oil on a cheese cloth pad once or twice a month helps to keep patent leather uppers from cracking. Shoes thus cared for wear much longer than those that are neglected.

Good care includes prompt repair. It is never true economy to wear down at the heel. Such shoes neither protect the feet nor properly support the body. What might be saved in leather may be paid to foot specialists and doctors. The minute a seam begins to rip, the uppers crack thru, a heel twists out of shape or runs down, or a hole wears through the outsole, the shoe needs mending. If the necessary bit of repairing is put off, the shoe may be so badly worn that it is no longer worth mending. This is particularly true if the welt is worn away or the insole worn through.

Heels should always be kept squared up. When they begin to run down on one side, both the shoe and the body are put under a strain. The shoes are soon permanently twisted and their normal position and shape, and the feet, ankles, and legs may be twisted also. Unless the leather or rubber lift on wooden heels is promptly replaced when it wears away, the covering of the wooden part is cut thru and may have to be replaced.

Ripped seams in the upper can frequently be stitched at home. The necessary equipment for repairing shoes includes a last holder, three or four iron lasts of different sizes, a
shoemaker's hammer, a pair of pincers, one or two leather knives, a leather rasp or file, awls, nails for soles and heels, flax shoe thread, bristles and wax.

With this necessary equipment, anybody can repair their shoes and increase the shoes' life again as long. In concluding I wish to say that incorrect shoes are the cause of much of your trouble.

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Diseases
THE PREVENTION OF TUBERCULOSIS

Eva Parduhn '31
Cedar Bend, Minnesota

Foreword

As this thesis is put into file, may it serve as a help to anyone who may read it for their own special benefit. May all who read this take heed to what I have tried to make clear.

There are over one million people in the United States constantly sick with tuberculosis, many of whom are careless or ignorant. To save yourself from tuberculosis, one should live, work, play, sleep, and rest in the sunshine and open air whenever possible.

If you have a cold which lasts longer than an ordinary cold should, if you are losing weight and feel more tired than usual, if you have a slight fever, and if you spit blood or have sharp pains in your chest, you should see a doctor at once. Any one of these symptoms may mean that the tuberculosis germs are attacking you. Losing weight and loss of appetite are both serious features of this disease. One should always try to eat nourishing foods and use plenty of milk, which is pasteurized or from cows which have been tested for tuberculosis. These germs may be easily carried by milk; therefore, it would pay one to be sure that the milk which one is using is certified and free from all disease germs.

To prevent tuberculosis one should avoid overwork, late hours, and all excesses which weaken the body. These will all weaken the body and the tuberculosis germs will have a better
advantage when the body can't fight against the disease.

Well fed persons resist tuberculosis, but the underfed will yield readily. Actual want is by no means the commonest cause of poor nourishment. Children as well as adults should always eat regular meals, and have a variety of food, and foods which are body builders. For example, the rich business man, who hastily consumes a scanty breakfast of toast and coffee, and who works hard all day in an office with only a hasty lunch at noon, cannot consider himself well fed even though he has a full meal in the evening.

Candies and cookies given to children between meals and frequently causing lack of appetite at the table are not good substitutes for proper food. The lack of knowledge of food values is very common, and especially in the cities where products which are often made to tempt the eye are often taken instead of the wholesome foods such as soups, roasts, and stews from the home kitchen. Fatty foods substances, such as butter, cream, fat meats, and olive oil are especially valuable for building up resistance against tuberculosis. Plenty of good green, leafy vegetables should be eaten often.

If a person has had the measles and whooping cough, this may cause tuberculosis to set in, if one has not had the proper care at this time and afterwards.

At an early age, nearly all people have become slightly infected with living tubercle bacilli. The body should be kept well nourished and avoid heat fatigue, work and sleep in well ventilated rooms, in freely flowing air. Everyone should spend as much time as possible outdoors, have plenty of rest, practice deep breathing and proper carriage. One should always be careful to avoid other diseases as far as it is possible. It is also good to be always temperate in all things, not work too much or
play too much, or such things which are harmful to the body.

Tuberculosis often begins in early childhood; it differs from the so-called children's diseases in that it is a lasting disease. In almost all cases, it develops very slowly so as to appear to be asleep until the early adult years are reached, but by the proper care, tuberculosis in childhood may be prevented from becoming serious. We often hear that tuberculosis is inherited but this is untrue. It is not inherited; it is caused only by a germ called the tubercle bacillus. People who have tuberculosis of the lungs and especially those in the more advanced stages, cough and spit out tubercle bacilli, and if children constantly come in contact with these people, they are of course more than likely to breathe in or swallow some of the germs. If children live in the home where one has tuberculosis, it is very dangerous because they are almost constantly exposed to tubercle bacilli.

There are now two tests used by doctors that are of great help; one is the x-ray examination or picture, where diseased lungs and glands are discovered, and the other is the "tubercular test." This is a very simple and harmless and practically painless skin test which shows whether or not there are tubercle bacilli in the body.

Tuberculosis can be prevented. With tuberculosis of the lungs, one should be shielded from large doses of tubercle bacilli. Anyone in the family who has tuberculosis should be taken to the sanitarium. Kissing is very bad and should be forbidden. All dishes and eating utensils should always be scalded; it would be a very good plan for the patient to always have his individual dishes which can be washed and scalded separately. All sputum should be destroyed and this may be done by burning. All patients should sleep alone. Healthful habits should be
cultivated; good food, fresh air and sunshine are very essential.

The lungs should never be cramped by too tight or too heavy clothing or by stooped shoulders.

Tuberculosis begins in different ways, usually the beginning is gradual. The patient will develop a slight cough, which, often but not always, will not yield to treatment. Any cough which lasts longer than three weeks should be regarded as suspicious.

It is necessary that everything possible be done to build up the child's general health. Defects, such as bad teeth and tonsils, must be corrected. Health habits are to be cultivated. Good food, sunshine, and fresh air in abundance are essential.

I hope that I have made it clear to you the important steps in the prevention of tuberculosis. If people would be more careful of their health, there would be much less tuberculosis today, and we all know that tuberculosis can be prevented. It is up to each individual to help in the prevention of this wide spreading disease.

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TUBERCULOSIS AND ITS CURE

Dedication

I dedicate this term paper to all those whom are working so hard on The Fight against Tuberculosis.

Foreword

In this paper I have tried to bring out some of the most important points in the Cure of Tuberculosis and I hope it may give information to those who read it.

Tuberculosis is a disease which, as a rule, develops slowly. It is a disease caused by the growth in the lungs or, less commonly in other parts of the body of a minute microscopic germ called the tubercle bacillus. This germ has no definite incubation period. It usually enters the body in early childhood but in the majority of cases, the germ lies inactive and causes the person no trouble. It is only when the resisting power of the body has been weakened by overwork, poor living conditions, or some sickness that the germs multiply and become active.

A man with the early stages of tuberculosis seldom feels very sick, does not appear sick to his friends and is able to go about his work. Under favorable conditions such a man may get well without knowing he has had tuberculosis, but if he does not take good care of himself he will gradually grow weaker and weaker until it comes to the advanced stage.

Tuberculosis is not inherited as so many have been thinking. It is caused only by a germ called the tubercle bacillus. These are mostly transmitted from persons who have the disease especially those in the more advanced stages. They
Cough out and spit out the tubercle bacillus, sometimes in large quantities and children coming in contact with such persons are, of course, likely to breathe in or swallow some of the germs. Dried dust containing the germ of a careless spitter may be directly inhaled or may also be picked up by the fingers.

"The advanced states of tuberculosis can be recognized by almost anyone, but early diagnosis requires skill. A cough is not always present. Sometimes a slight afternoon fever is the only positive symptom and for months a patient may think that he has some other sickness. A lost of weight and strength, a rapid heartbeat, indigestion or loss of appetite and sometimes a slight pain in the chest and hoarseness are some of the most common symptoms of early tuberculosis.

"The symptoms of the advanced stage are chills, bloody sputum, night sweats, excessive loss of weight, flushed cheeks and an inability to work."

One should know first of all that tuberculosis is curable, but it is a very serious disease no matter how slight the symptoms may be. It is often difficult to convince patients of its seriousness as they often feel quite well, but when tuberculosis is suspected, that person should at once put himself into the hands of a good doctor. It is of the utmost importance that you find out at the earliest possible moment whether or not you really have the disease.

"The Importance of early diagnosis is for two reasons. In the first place, proper treatment at this time will usually result in a cure, and in the second place, the early cases are often dangerous carriers of infection to others. A very slight cough may be bringing up thousands of tubercle bacilli daily. A
dry cough or sneeze may spread hundreds of germs."

You should know that there is no drug known however rare or expensive it may be which has any specific curative action on this disease and all remedies advertised as cures for the tuberculosis should be avoided. The usual cough medicines are harmful. Radium x-rays or electricity in any of its forms have no special value as cures for tuberculosis of the lungs. No serum yet has been discovered that will cure and there is no plaster or poultice which has any effect on the disease.

"You should never consult a doctor who advertises his medicines and treatments as cures as he is only interested in your money."

In tuberculosis the patient has special need to rely upon the honesty of his physician. For the poor in cities there are numerous dispensaries where they can be examined free of charge by the best of medical talent. Whenever possible, the sanitarium treatment is the best, but be not discouraged if this cannot be had. Tuberculosis can be cured at home, if the patient has the will power and moral courage to follow strictly his physician's directions.

It is necessary for the patient to have a correct mental attitude. He must have an intelligent understanding of the serious nature of his disease and the principle of treatment. There are no sacrifices too great to pay for the cure desired.

There was a time when change of climate was almost always recommended for tuberculosis and people believed that certain climates would cure it. They thought that dry air or mountain air, warm or cold air was best and sometimes they said that the climate of Florida or of California would cure tuberculosis. Medical opinion has changed
Now all authorities recognize that proper treatment is more important than climate. Living in a favorable atmosphere is highly desirable and will assist in regaining health, but climate must not be secured at the expense of other factors of equal importance. You should consider when searching for a favorable climate that you should not forfeit suitable rest, food, and peace of mind. Homesickness and worry is often too great a price to pay for a favorable atmosphere.

"There is no locality in the United States that has a favorable climate all the year around and most localities have a favorable climate for a considerable portion of the year. Modestly cool air is best."

Recovery depends upon yourself. Rest, fresh air and nourishing foods are the three most necessary things for recovery.

"With so many public tuberculosis hospitals now in existence, it is usually possible for a patient to obtain several months of sanitarium treatment. This is very desirable, in that you may obtain the careful teaching and training of doctors and nurses in how to conduct and regulate your life for the best result. When you then come home and continue your treatment you will know how you must live to obtain a complete recovery. You should bring the home treatment as near the sanitarium as possible for the best result." It is important that a doctor should see you at least twice a week to obtain his advice, and his directions should be strictly followed.

It is essential that the patient get the greatest amount of fresh air and sunshine possible. This may be had in different ways. There may be sleeping porches, tent houses, or a well ventilated room in the house. Fresh air has a tonic effect
upon the body as well as supplying the necessary oxygen.

The best room is one which faces south in order to get all the sunshine possible. Direct sunshine kills the tubercle bacillus in a very few hours; therefore, all rooms, bedding, clothing, and everything which the patient uses should be exposed to the sun as much as possible. Sunshine has a good moral effect and promotes cheerfulness. In certain cases, direct sunshine on the body is valuable but this treatment should not be tried without the advice of the doctor.

While the patient should remain in the open air as much as possible, he must be comfortable. He must have enough protection on the body to keep warm but do not use more than will keep you comfortably warm because it may cause overhating and perspiration, and this is apt to lead to chills and a cold. There should be as much protection under the patient as over him. It is often advisable to put a woolen blanket next to the mattress. Ear muffs, night caps and sweaters add comfort in the severest winter. In summer he must be protected from the heat of the midday sun and against cold showers. The patient's diet must be under the careful supervision of the physician at all times.

"Only plain foods such as steaks, chops, roasts, fowl, fish, eggs, milk, potatoes, green vegetables, whole grains, and a moderate amount of fruit should be taken. No alcohol or tobacco should be used. Too much food is just as harmful as too little. Only such amounts as the body can digest and assimilate should be taken. Excessive quantities of food produce digestive disturbances, harmful to the patient. Regularity of meals is essential and they should be at least five hours apart."

If you understand the nature of the disease, you will
realize that every bit of strength you have must go to building up the wall around these germs. The poisons of the germs prevent the proper digestion of food and when there is only enough nourishment in the body to fight the disease, there is none at all to spend in amusement or work. Every little thing you do, even a short walk or too much talking makes the breathing a little more rapid and makes the heart beat a great deal faster. This is why exercise, if taken at all, should be under supervision, as exercise may increase the amount of poisons and do harm. Advanced cases often require months or even years of complete rest in bed.

Everything possible should be done to build up the strength of the patient so as to help him in the fight against the progress of the disease. Absolute rest is kept up until the temperature, pulse and signs in the chest show that the progress of the disease has been checked. Complete rest means that he does not get up to walk at all. Even walking around in the room may mean that the patient loses in the daytime all the improvement that he made during the night. Complete rest may mean different things for different patients. Some may go to the bathroom and to the dining room without harm; others should not even do this. If you keep getting out of bed and persist in sitting up, you may never start your treatment fairly.

After the progress of the disease is checked, the wall which the patient has built around the germs is strong enough to hold them while he is still at rest, and the body is able to take care of the poison which is formed. The next step is to give the patient just enough exercise that is necessary for the body to build a little firmer wall and more able to take care of the poison. The amount of exercise that a patient should take can be determined only by a doctor after the most careful observations
and study of the case. Exercise should increase slowly, waiting long enough for the wall around the germ and for the body to become adjusted and hardened to the increasing amount of exercise.

Some rules to be observed by tuberculosis patients are:

1. "Place yourself under the care of a physician skilled in the treatment of tuberculosis.

2. "Keep your bedroom windows open constantly and stay in bed both day and night until your temperature remains normal at all hours.

3. "Take no medicine except that prescribed by your doctor.

4. "Drink no whiskey, beer or other liquors.

5. "Eat regularly and try to gain in weight. Plain food is better than dainties. Milk and eggs are good. Vegetables, meat, bread and butter must not be omitted.

6. "Take no exercise except that which is ordered by your doctor. Avoid getting tired.

7. "Keep your feet warm and dry.

8. "If you are offered admission to a hospital, accept it at once.

9. "Hold a handkerchief or a paper napkin before your mouth when you cough or sneeze.

10. "The patient should be careful in all his habits."

Those with tuberculosis should remember that if the right start is made in the first part of their treatment, the last part will be very much easier.

Long before a patient can be declared an arrested case, he will have lost all symptoms and feel entirely well. This is a dangerous period. A patient feeling well may over exert himself bringing on a relapse.

It is a time when a person should strictly follow his doctor's advice, and live carefully and wisely until he has accomplished a permanent arrest and a full working efficiency. Also remember after obtaining a cure, it will be necessary to live a careful and rational existence for the rest of your life.
The house should be thoroughly cleaned after a tuberculosis patient has been there. If these germs are not destroyed, they will live for many months and remember the lowest winter temperature will not have any effect on them. The most dangerous places is in the dark rooms and halls where the sun cannot enter. As strong daylight or sunshine kills them in a few days. Dust is a means by which these germs are carried through the air. Therefore rooms should not be dry swept nor should dry dusting be allowed.

Antiseptics are of little or no value in cleaning, but soap and water are the best agents to combat infection. A boiling temperature also kills the grass and therefore the articles like bedding, clothing, handkerchiefs, napkins and towels should be boiled.

"It should be remembered that tuberculosis is almost always a house or indoor infection and that it is rarely or never caught outdoors where the sunlight, which is our best disinfectant, quickly kills the germs."

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Public Health Radio Broadcast
Rules to be Observed by Patients
What you Should Know about Tuberculosis
Getting Well

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WEATHER AND CLIMATE

C. L. M. Armstrong '31
Ames, Iowa

Dedication:

This work is dedicated to my parents, who have so loyally helped and urged my attendance at this school.

Preface

The weather plays an important part in the farming of the country. In knowing these facts and writing this paper, I hope to have brought to the minds of the farmers of this section a clearer view of this vast problem.

Climate affects and in many ways the buildings, plantings, crops, and manner of living. The area of Iowa is influenced by the climate in which we live.

Some of man's best works either directly or indirectly from the products of the soil. These are also affected by the climate and weather.

WEATHER

The principal factors that influence the growing of certain crops in different parts of the country are temperature, rainfall, soil, sunlight, and distance from storms. For the most important will have an effect on the climate, on the activity of the earth, on the vegetation and other elements.

Any new plant or tree is such, made stronger, which are the result of the effects of their higher steps of development and man's action. It is to reach their highest step of development and man's action.

The effects of the climate are in wind and temperature. In such number of this field to which the climate is subjected.
WEATHER AND CLIMATE

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Dedication

This book is dedicated to my parents who have so loyally helped and urged my attendance at this school.

Foreword

The weather problem is of vast importance to the farmers of this section of the country. In gathering these facts and writing this paper, I hope I have brought to the minds of the farmers of this section a clearer view of this vast problem.

Climate affects man in many ways; his housing, clothing, food and manner of living are more or less influenced by the climate in which he dwells.

Much of man's food comes either directly or indirectly from the products of the soil, and these are also affected by the climatic conditions.

The principal factors that influence the growing of certain crops in different parts of the country are topography, character of soil, climate, and distance from market. But the most important and unalterable of these is the climate, as the fertility of the soil is largely dependent on the climate, which operates indirectly through vegetation and otherwise.

Now some plants grow best in warm, humid climates, while others prefer warm, dry climate. But generally most of the important crops grow best and reach their highest stage of development, and are produced most profitably in regions where the climate is moderate, especially as to rainfall and temperature. In such regions we find the world's most important crops as wheat, barley, oats, potatoes, and most vegetables and fruits. Almost all the natural vegetation
of the earth's surface depends on the suitability of the land and also on the climate, especially on the amount and seasonal distribution of rainfall.

Climate means the average of the weather conditions for a considerable period of time. The climatic conditions of a place are best determined by at least twenty years of observation. While temperature means the condition of the atmosphere with reference to its pressure, temperature, moisture, the presence of clouds, and the direction and velocity of the wind at any given time.

Change in the atmosphere can be referred to as a great steam engine. The power of the steam engine as everyone knows is furnished by the heat and energy of the fuel, and is drawn off in the form of steam. The steam is then transformed into work by the mechanical parts of the engine.

The tropics in nature are like the boiler of the engine. It is this part of the globe that furnishes the force to the winds, but it also evaporates the water from the tropical seas. This water then rises to the colder air above where it condenses and goes with the wind for many miles where it is dropped in different parts of the globe as rain and snow. The cold of the upper atmosphere, the elevated plateaus, and the polar regions serve as the condensers of this evaporated water. Last of all, the winds, which might be termed the flywheel, as it is largely through them that the unending changes in the weather are brought about.

The sun also keeps rising in the sky and as the rays become more vertical, we have the familiar change from cold to the warm seasons.

The earth, of course, is known to turn on her axis and so occurs night and day, or even the opposite as day and night. This is commonly called the defective force of the earth's rotation, or in every day language, it is anybody that is moving without friction.
on the surface of the rotating earth, which continually changes its geographic direction, or the earth rotates under it, working to the right in the Northern Hemisphere, and to the left in the Southern Hemisphere. This change of direction depends upon the latitude.

The winds starting at the equator are moving toward the pole in the northern Hemisphere and become southwest winds, while those starting at the poles and moving toward the equator become northeast and east winds. On this exchange of air between the poles and the equator are great whirls set up in the atmosphere known to the observers as cyclones and anticyclones, or on the weather maps as lows and highs.

Cyclones or lows are winds which blow in a whirl toward the center, which is of lower pressure than on the outside. The term cyclone is sometimes misused as some people do when they call a whirl that is small of diameter a cyclone when it is a tornado. A cyclone is sometimes as large as 500 to 1000 miles in diameter and in some parts of the globe occur daily. This term cyclone has been used for about a half century, and means that the whirl is turning counter clockwise. The characteristics of a cyclone are south winds, warm moist air, and cloudiness which is followed by rain or snow.

The anticyclone has northerly winds, cold dry air, clear skies, and is usually followed by a calm clear day.

The north storm means any disturbance of the average conditions and unless specifically named may be any of the following: rain, snow, wind, hail or a thunder storm. They can also be called hot wind storms, or cold wind storms, or dust storms, snow storms, or blizzards.

The hurricane or typhoon is a large storm often several hundred miles in diameter, which in the center is very calm. The clouds break away, and the rain stops falling, while the center of a
thunder storm is the place of the most rain, wind and lightning.

The tornado is much smaller in size and is usually about two miles or less in diameter, with very violent winds. In the typical tornado, the wind circulates around a center and continues to move up which forms a funnel shaped cloud, which has a great amount of suction to draw up very large and heavy articles.

The word which wind is used for many kinds of winds, as on the one extreme a hurricane and on the other, the common dust whirl of the streets; any revolving mass of air is termed a whirl wind.

Predicting the time of a storm on some future day must be done by an expert observer. But a farmer can tell when it is going to storm, first, by the formation of the clouds; second, by the direction of the wind and the temperature and pressure of the air. A storm is sometimes preceded by a hot dry day, or by a cold, damp day so this helps the farmer a little. Now in the case of fog, when the fog is heavy in the morning and it starts to go up, it will usually rain or storm in the evening, but the opposite is true if the fog comes down. By being observant of these changes, a farmer can tell pretty closely to the time of the rain or storms and be prepared.

"Wind" What is meant by wind? Well, a wind is a moving mass of air that travels at the speed of twenty-five to forty miles an hour, while moving air traveling slower than this is termed a breeze, or any that is traveling faster than forty miles an hour is term a storm.

The barometer is an instrument that looks somewhat like a thermometer, only the thermometer measures the temperature of the air, while a barometer measures the weight of pressure in the air or the humidity. Both of these instruments help a great deal in finding out the changes in weather.
The weather charts are made by the observers who study the weather at all times, and put down in table form all that is going on as the time a storm starts and stops, the temperature for that time, the direction of the wind, the depth of rainfall or snow fall, and the kind of a day it was. This is kept separately for each month.

The temperature means the condition of the day according to its heat, or coldness. This is recorded in terms as Maximum and Minimum. The maximum means the highest degree on the thermometer, while the minimum means the lowest degree on the thermometer.

Now the maximum of a day cannot be lower than the minimum of the day before, or the minimum of the same day, while the minimum can never be higher than the maximum. The mean is considered the average of both the maximum and the minimum degrees.

The measuring of rainfall and snowfall is called Precipitation. Rainfall is measured by a metal cylinder that is put out in the open space, where no building or trees will hinder the rainfall. Then after a rain, they take a stick that has numbers stamped on it, and put this down in the cylinder for about two seconds, after which the numbers are read to find out the depth, or they can pour the water into a measuring tube and count the number of tubes of water caught.

The measuring of snowfall is a little different, altho it is caught in the same kind of a cylinder, but if the wind is blowing, the snow will have to be emptied out and snow taken from a place in the open where the snow lays in normal snowfall depth. This is done by tipping the cylinder upside down and cutting a cylinder of snow the full depth. Then a measuring tube of water is poured into the snow. This melts the snow. When this is
done, a measuring tube of water is taken out of the cylinder, after which the water that is left is poured into measuring tubes and the tubes are counted to find the amount of snowfall.

Weather Records have been kept at the Northwest School for thirty years. These records have been kept since 1910. The equipment has been of standard weather bureau equipment, and the records have been accepted as official records, and since 1915 the station has become a corn and wheat region station, sending in reports by telegram during the crop season.

The averages are as follows: The snow and rainfall was about 21 inches. The snowfall alone was about three inches. The summer temperature was about 58 degrees, while the winter temperature was about 19 degrees. The number of frost free days was about 126 days, while the prevailing wind was south.

The seasons extremes were in January 1912, and January 1916, when the coldest days were 39 degrees below zero. The hottest day was July 28 in 1917 with a temperature of 108 degrees above zero. The winters of 1916 and 1917 were the coldest, while the summer of 1922 was the warmest. The longest frost free period was 171 days in 1915, while the driest summer was in 1920 and the wettest summer was in 1905.

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