SENIOR CLASS

THESES

OF

UNIVERSITY OF MINNESOTA

NORTHWEST SCHOOL OF AGRICULTURE

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VOLUME TWELVE

Class of 1927

SENIOR THESES

1926 - 1927

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CLASS EXERCISES

Commencement Address

"Progress", Arnold Aakre, President, Class of 1927

Motto: "Forward Ever, Backward Never"

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To the members of the Senior class the event this evening is important and significant. It marks the end of three years of joyful work, of pleasant comradeship and of inspiring contact with our teachers. It marks, too, the closing of an important period in our lives--the training period, the time of fashioning our intellectual equipment and of cultivating our aptitudes so that we may be ready to assume our life's tasks.

Three years ago about ninety students from widely scattered parts of northwestern Minnesota came here to form the class of 1927. Since that time we have learned to know and to appreciate each other. We have also come to know the ideals of the school. From the very beginning we have sought to realize the opportunities that were in store for us.

When in 1925 we returned as Juniors our number was smaller but we more than made up for that by taking our part in basketball, music and other activities of the school, as well as maintaining good class records. Many have been our conquests; sweet the victories! Well-learned the lessons brought by defeat. We have gained something from all.

This year we began the closing year of the regular school course. More than at any time before we began to feel our responsibility to ourselves, to our parents and friends and to the school.

We realized, in the first place, our obligation to the great state of Minnesota and its people who established this institution. We feel, as graduates, that we are expected to give back in service to our communities and to our state interest on the investment that has been made. Our education must be used in order to be of any value. We must carry out and carry on what we have learned here. This is our plain obligation to the state and to our wonderful Red River Valley where this institution is located.

Then we feel we owe much to our parents. They have struggled to give us this educational opportunity. Tonight, in their presence, we gratefully acknowledge our debt to them. Fathers and mothers, we rejoice with you. We are glad that you are happy. We acknowledge our shortcomings but we here pledge ourselves to strive to meet your expectations--to live up to your fondest dreams.

We are truly grateful to you.

This is the Northwest School's nineteenth commencement period. The school is closing its twenty-first year. Many thousands have trod these halls. Nearly a thousand have received diplomas indicating the completion of certain courses.

Each of these groups has been dominated by a certain ideal, manifest in the mottoes adopted by the different classes. These mottoes stand as beacon lights in the pathways where our fellow alumni wander.

We, too, found a phrase that tells our aims. Our motto is "Progress". All progress is the offspring of thought and study. The greatest gift of the human race is the power of thought. As such it becomes the duty of every human being to exercise this power to his fullest capacity in order that we may continually go forward.

Every great enterprise is first a thought in some human brain. The Woolworth Building was once only a thought. Thousands of years ago an Egyptian king had a thought; early generations since have gazed on its fulfillment--The Pyramids.

After the thought the next process in progress is work. Henry Ford once said, "My advice to business men is to read a lot, think a lot and work a lot." The student can well follow this precept. On his commencement day, he realizes that he is about to begin his second step, that of work.

On every campus we find young people who earnestly come to school. They come under their own steam with some definite purpose in mind. We find others who are "sent to school." They come merely to spend their time and their parents' money there. We pride ourselves that we belong in the former class. We "came to school" with a purpose in mind.

From now on we are resolved not to stand still but go onward. The greatest blessing that can come to the members of this class is the opportunity for work. For there is much work to do. Rural life needs the invigorating influence of trained minds, of youth with its high flown idealism, its spirit of comradeship and its desire to make the open country what God intended it to be, the fairest and the best place for His Children to live.

Progress is the keynote of this modern age. We live more fully in a week now than was possible in a year a century ago. But in this very fullness of life, there is danger that we do not overlook life's essentials, that we fritter away our time and efforts with trivial things.

Pnogress is not made that way.

We aim at real progress--at true progress and are resolved to carry out our aim.

This is our last time together as an undergraduate class. It is fitting that we observe this opportunity by calling attention to the service rendered us by the school and by the faculty.

The tie between teacher and pupil is one of the most beautiful on earth. We have experienced the great joy here of having true teachers in our different classes. They have helped us. Perhaps they have also scolded us, but we deserved their importunities. They have built in us the new strength as a result of the training given.

We tremble as we leave you, for here we have relied upon your wisdom, your guidance and here we have sought assistance.

Upon this particular commencement we as a class bid farewell to our superintendent, Mr. Selvig, who has made possible the growth and development of this school during his seventeen years of service in the Red River Valley. We greatly regrēt that this is his last year with the school but wish him God-speed in his new field to which he has dedicated his influence and services.

School mates, we now leave this school in your care. You are to have the many little incidents, the quaint experiences in classroom and on campus such as we have had. We don't expect to be long remembered by each of you. Our places will be taken. But we are glad that we leave here strong-hearted, manly boys and wholesome girls who love their school and will stand up for it when we are gone. We shall be lonely many times when we think of the friendly companionships which we had here with you.

And, now a closing word to you, my classmates. We are together for the last time. Never again will this school see us met as we are met now. Let us not cease to be fellow-students together as we go out to our work. Somehow every thing in school life tends to make classmates love each other. Our minds tonight are under the spell of two great forces: Memory and hope.

We have promised ourselves a re-union and look forward to it with hope of renewing the school memories and awakening the old school spirit, but we know well that they will not be the same. Let us, then, ever remember our school with affection and gratitude and part with many pleasant memories of our fellowship.

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CLASS PROPHECY '27

Gunda Gullingsrud '27

Yesterday after I had finished my last bit of correspondence for President Coolidge, I opened my personal mail and found in it a "Northwest Monthly", a paper which I always look forward to with great interest because it tells me much news of my old school friends. This is what they are doing now.

Arnold Aakre, our class president for three years, is leading a choir in the Episcopal Church in England. The minister of this church, Rolf Anderson, is noted for his interesting and inspiring sermons.

The Marinell Beauty Shop in Angus is managed by Sophie Brieland whose work is much sought after in the Northwest. The shop is located in the second floor of the Federal State Bank in which Eldor Pederson is private secretary to the President.

Ole Breivold won the Congressional nomination for the ninth district.

Adeline Bunness is the owner of the largest poultry farm in Northern Minnesota at Gully. Harold Norseth is partly responsible for its growth.

Annie Dunbar, Kenneth Parduhn and Harwood Conner are on the stage in Chicago starring in the musical comedy "Sally of the Sawdust" in which Kenneth shows his ability to "trip the light fantastic".

Hannah Degerness and Carl Widseth are carrying on Missionary work in China. I always knew they would do something worth while.

Elsworth Dowers and Jimmy Brown are building up a fund to buy honey combs for their bees. So far they have succeeded in acquiring little honey only.

Miss Gerber is combining her art work with very efficient advertising for the Duco sign shop.

Ralph Erickson and Helen Hovland are authors of the short story "Papa Love Mamma". Four additions have been printed.

Lawrence Spears, our Annual editor who also was Pa Robinson in "Applesauce", is now professor of Physics at the Northwest School. He is also Senior Class advisor and doing much toward putting out the biggest and best annual for the least money the school has ever had.

Melvin Hole, professional detective, is trying to trace the lineage of Naomi Forder's dimpled smile.

Melvin Flaskerud is assisting Henry Ford in manufacturing Ford cars.

Selmer Harstad broke the world record for high jumping at the Olympic meet in Switzerland. He jumped five feet six inches.

Elmer Hedstrand as professional baseball player. He played an exceptionally good game at Clearbrook for Elida Erickson.

Gladys Huartson and Wesley Sheldrew are on the Orpheum Circuit as polka dancers. Douglas Clark, Valentino the second, is on the same bill.

Vivian Olson in Hollywood where she is starring in "Where's my Wondering Girl Tonight", by Russell Younggren.

Orlando Rudser has completed his course as flunky at the N.W.S.A. and now comes up every year from the U. Health Service to remove tonsils.

Myrtle Hetland and Edna Story are wearing Salvation Army uniforms talking to bystanders, they seem to fail in their attempt to draw a crowd because Nellie Strickler on the other side of the street is selling "Smiths Cough Drops" of her own discovery.

Morris Lillo as a Wall Street broker at New York.

Ann Radniecki as private secretary of Congressman Breivold.

Ralph Hamrick and Clara Ness as basketball coaches at the U. of M.

Ruby Hanson and Chester Torgerson club leaders.

Harold Nicholson, manager of the Nicholson "World Famous Curiosities Show", has added to his troupe Stanton Rudser and Donald Spong who are doing exceptional work.

Mr. LaVoi is head of the Livestock department at Edinborough. He is now using his athletic coaching ability in developing winning racers, where once it was winning Teams.

Arthur Johnson manager of Ringling Circus with Rose Kozojed as world's high kicker and Otto Saugen as world's "Big Boy".

Ruth Soltis and Alfred Danielson are operating one of the largest farms in Tabor.

Alfred Erickson is touring the world giving speeches on "Child Labor".

Glenn Smith has one of the largest Beet Plantations in the Northwest.

Ivan Suchomel is the state's champion in typing.

Arthur Stordahl, Chester Engman and Clarence Kozneck are in Paris where they are practicing acrobatic stunts.

Ruth Thorssen is a model for Montgomery-Ward in Chicago where her charming personality has made her a great success.

Bessie Swenson is a stenographer for one of the most prominent business men in St. Paul. She also finds time for home economics duties in private life.

Bennie Strickler is a professor at Carleton College.

Olaf Stenborg is football coach at Yale University.

Ishmael Rynning is studying Plant Life.

You know it makes me homesick to read all this news, how I would like to see my fellow classmates again. I am certainly glad to know that they are successful in the things they set out to do.

DOMESTIC SCIENCE AND ART

ALTERATIONS OF DRESS PATTERNS

Myrtle Hetland '27

There are many kinds of patterns. The most common are Pictorial Review, Butterick, Vogue and McCall patterns. There are many different kinds of commercial patterns for sale in the stores, ranging in price from 15¢ to $1.50.

Some of the most commonly used patterns are McCall's, Pictorial Review, and Butterick, which sell for 40¢ to 45¢, and Vogue, Fashionable Dress, and Style, which sell for 60¢ to $1.50. Other makers are Ladies Home Journal, Superior, etc. Naturally the higher priced patterns have more style, and fit the average person better than the cheaper patters. The Vogue patterns usually fit the best.

If one understands the art of altering patterns, one can change almost any pattern to suit herself in style and fit. Be very accurate in taking measurements. Always measure rather snugly around the fullest part of the bust. Be sure to take your measurement each time you buy a pattern because you may gain or lose in weight and thereby, require a different size in patterns.

When using a pattern, one must first test the size of the pattern. Check up the following measurements:

(a) Width of front

(b) Width of back

(c) Shoulder from base of neck to top of arm

(d) Length

(e) Hips

(f) Length of sleeves

(g) Width of sleeves

If these measurements do not correspond with your own, the pattern may be altered to fit.

To determine the correct length of your pattern, measure from the shoulder at the neck to the length you want the dress plus the hem allowance. Lay the tape on the pattern from shoulder at the neck down on the front and, if you are taller and need more length, slash the pattern and lengthen it the required amount. If you are short, fold the pattern over until it is as short as you require.

If you are larger in the hips than the pattern provides for, slash the back of the pattern lengthwise and separate it enough to give the required fullness. If the hips are more than seven or eight inches larger than the bust, slash the pattern in the front also, and separate it half as much in the back as in the front for additional fullness. The sleeves are slashed through halfway between elbow and shoulder and elbow and wrist for the required length, and folds are made to shorten the pattern.

In altering a pattern, one should always try to make the adjustment exactly where it is needed; that is, to put in the fullness or take it out where it will not interfere with the foundation lines of the dress design. Remember that if you are shorter in shoulder line in fitting, you must lengthen the top of the sleeves just that much so that the sleeves will fit into the armhold perfectly. In case the dress wrinkles just below the neck in the back, open and take in the shoulder seam at the neck, or lift the shoulder seam at the armhole enough to remove the wrinkles. If there is a diagonal wrinkle in front, lift the shoulder seam to remove it.

In making shoulder alterations, always open the shoulder seam and take from the front or back, as it seems necessary. It is seldom advisable to take the same amount from the front as from the back seam.

In sewing, many women cut a plain dress from a simple pattern, using in-expensive material such as muslin or prints. This they put on and fit themselves perfectly, making the length and other lines just as they want them. They then open the basted seams, cut a pattern to use in checking up new patterns, re-sew the model, and use it as a covering for a dress form. This may be padded to an exact replica of their figure, thus having a correct hem line, shoulder line, neck line, etc., as well as a perfect "dummy" to serve in fitting new dresses.

One of the delights in sewing is the perfection one can attain in fitting which, coupled with good workmanship, makes sewing a real delight and an interesting pastime rather than tedious work. Never be satisfied with careless work. Good fabrics deserve your best efforts and the satisfaction they will give you when rightly made will repay you many times over.

Practise in dressmaking as you do in music. The more your technique, the more you should watch to improve, to learn new ways, and to express the new ways in the smartest possible fashion.

"APPROPRIATENESS OF DRESS"

Gunda Gullingsrud '27
Ann Radniecki '27

Gunda Gullingsrud '27

We have chosen this subject for our thesis, because we believe after giving this demonstration we will help to clear up some of the questions which are asked daily. We shall make our demonstration brief but nevertheless we shall try to bring out the most important points: namely, harmony, color, lines, and suitability to the individual. Often a person has been judged wrongly by the inappropriateness of her dress. Since the dress is something to be worn on a human, its lines should be in line with the human figure.

The dress of the present day is designed more for comfort than for style, thus making it possible for every individual to dress comfortably and becomingly without any special effort.

The requirements for dress are:

1. Beauty in color and design
2. The effect of simplicity as opposed to gaudiness
3. Suitability to the individual
4. Suitability to the occasion.

Beauty in color and design does not mean merely a beautiful dress or a combination of flashy colors. It means harmony in color and design, as suited to the personality of the individual.

Simplicity is one of the main factors of dress. A person who follows the fashion completely should realize the importance of this truth. There is no one style that is suited to all the types of persons, but there are many variations which make it possible for each individual to pick out a style suited to her personality.

Suitability is also an important factor in the art of dress. Clothes must harmonize in color, line, and texture of factors as suited to the wearer and occasion.

By analyzing anyone's personality we mean whether or not she is an extremist or a conservative. It is recognized that a thing which is considered modest in one generation is condemned as immodest in another, but there are certain standards which are held by people of high ideals of any period. Painted faces, extremely short skirts, and extremely thin and low cut waists are among the violations of ethics in dress.

The conservative type buys and wears

clothing which is not conspicuous. She chooses the darker colors, and tailored clothes. She does not follow each style as it comes out, but chooses clothes which are good over a period of time.

If she is of the exceeding feminine type demanding ruffles and soft materials, it would be advisable for her not to wear too much white or some other very light color next to her face.

The athletic type looks well in a mannish dress. She usually has straight hair and regular features, and is of average size. She should wear simple styles because they are more becoming to her type.

The gay and lively type can wear striking designs and colors. She can also wear jewelry, and usually is able to follow the styles and fads, because as a rule, they will be becoming to her type.

The short slender type may wear just the opposite from the stout type. The bright colors are very becoming to her. She can wear both tailored and fussy clothing.

The tall slender type must never wear a dress with vertical lines, as it makes her look taller. Horizontal lines have a tendency to make the figure look shorter and not so slender. This type looks better in dresses that have color.

People who are inclined to be rather colorless and who have a quiet and retiring manner are eclipsed by large amounts of bright color. Such women should select clothing that is not conspicuous. Clothing that is most suited to her type should be either decidedly light or decidedly dark in color in order to supply some of the sparkle which her personality lacks.

We also have the short stout type. This type of a girl should never wear bright or flashy colors. All bright colors are conspicuous and appear to increase her size. Therefore they should be avoided as much as possible.

The tall stout type should also avoid the bright colors. They should not wear white waists with dark skirts, because the contrasting values seem to cut them in two.

"APPROPRIATENESS OF DRESS"

Gunda Gullingsrud '27
Ann Radniecki '27

Ann Radniecki '27

There are three properties or qualities which are known as the dimensions of color. These are just as distinct from each other as are the breadth, length, and thickness of an object. Hue, lightness or darkness, and brightness or dullness are the three qualities.

The warm colors are those colors which are between the bright yellow and the red violet on the color chart. The cool colors are between yellow green and blue violet.

Colors suited to individuals are as follows: 1. The warm type with the red orange hair may wear green, blue, orchid, navy blue, or black. She should wear these colors because they have a tendency to make her hair appear less conspicuous. 2. The cool type who has light brown hair, blue eyes, and very little color in her complexion should wear green, blue, orchid, light shades of tan or pink, navy blue, or black. 3. Lastly we have the intermediate type who is neither light nor dark, but who has some of the qualities of both the warm and the cool type. As her hair and complexion are neither light nor dark it may be called fair. She may have brown, blue, or gray eyes. Her hair is brown, suggesting neither warmth nor coolness to any striking degree. Therefore she may wear any of the colors provided the principles are carried out in the amount of color chosen, and in the occasion for which it is to be used.

Dresses suitable for the various occasions are: 1. The appropriate house dress should be made of some washable material, light in fabric and color. A dress made from a discarded evening gown would be inappropriate as a house dress. 2. The appropriate dress for business and school is the dark, tailored model of serge, flannel, or any other serviceable wool material. Gaudy, sleeveless garments made of light silk materials are in very poor taste for the office or schoolroom. 3. Dresses that can be worn for movies, church, afternoons, or informal parties are dresses made either of silk or woolen material in some dark color. The sleeves may be either long or short. Bright silk sleeveless gowns are to be avoided. 4. For sports wear either a jacket, pleated skirt, and low-heeled oxfords, knickers and boots, or tailored blouse and dress are appropriate. The light sleeveless dress and high-heeled pumps.

5. The gowns for formal or evening wear should be sleeveless, bright in color, and very extreme in style. Inappropriate dresses for this occasion are dresses such as those worn for business or sports wear.

APPROPRIATE TYPES OF HATS

Sophie Breiland '27
Nellie Strickler '27

The selection of a beautiful and becoming costume is a challenge to any woman's art ability and her sense of fitness. She must have in mind constantly that her dress should be an expression of her personality, and that all the lines, colors, and testures in the costume should be chosen to that end. In order that a costume may give the same sort of satisfaction that a picture or any other form of art may give, it must be so planned that it fulfills certain requirements. Many women consider the hat the most important article in the costume, because it serves as a background for the face and head, and if unbecoming, destroys the effect of whatever else is worn. When one is seated or in a crowd, the hat is the part of the costume most seen.

Some questions to keep in mind regarding the personality of a woman are: Is she of the athletic type, suggesting a mannish style of dress, or is she exceedingly feminine, calling to mind dainty ruffles and soft materials? Is she a dashing type so she can wear striking designs or is she quiet and retiring? A quiet type should select clothing which is not too conspicuous. Frequently, a woman buys an attractive, becoming hat. It may not look well with the other things that she has, but she does not think of that. Next, a handsome pair of shoes is purchased. They are not quite right for anything in the wardrobe, but they are "good looking". A dress is selected on the same basis, it fits well, and it is beautiful in color, but it does not look well with the hat or the shoes. Then comes an occasion when the buyer needs to wear her new hat, shoes, and dress. She looks at the things she has purchased and realizes that they cannot be work together. When she sees her mistake she has learned the first principle of good buying which is namely: Things which are to be used together must be harmonious.

Hats should be chosen before a full-length mirror where the proportion and shape can be seen with relation to the whole figure and from every point of view. A hat must be in proportion to the whole figure as well as becoming to the face and head. When worn it must seem to be a part of the head and not a separate structure put on top.

There are so many different shaped hats that it is easy for everyone to find a becoming hat. Crowns may be straight, curved, or irregular in shape. They may be stiff or soft. Brims may be straight, or they may curve from front to back or from side to side forming an irregular line. Hats may be brimless like a turban or tam.

Hats should be chosen with referance to the figure of the wearer. The tall, heavy woman's hat should be large enough to produce an effect in keeping with her general proportions. Velvet, felt, and heavy straw should be chosen instead of transparent and dainty trimmed hats which seem too light in weight for the body. A tall, thin woman should avoid tall, stiff hats, just as short women should avoid broad flat hats. A tall thin woman looks better in hats of soft texture and with no definite outline. The woman who is stout needs hats that carry the eye upward and seem to add to her height. The short, thin woman must wear hats in proportion to her size. They should never be very large, especially if of heavy material, nor should they seem heavy and solid. Airy trimming and ornament of small size should be chosen.

People may be grouped according to type of coloring and may be classified in three main groups, but within these groups there are many variations. These classifications may be designated as the cool type, the warm type, and the intermediate type.

These terms cool and warm as applied to hair and complexion are only relative and one should have a definite idea of what the terms denote as applied to the individual before going any farther.

By looking at the color chart, one can see that although all the colors between yellow and red purple are warm they are not equally warm. Red and red orange are the colors of flame and are therefore the warmest colors. Then looking at the yellow, one recognizes that while it belongs in the same group with red and red orange, it is a little cooler. Likewise, red purple is a cooler variation of red than red orange. Thinking of these hues, yellow, yellow orange, and red purple as the cooler tones of the warm hues and adding some blue, one has a color scheme that is cooler than orange, yellow orange, or red orange. When this difference is recognized one has a basis upon which to start the classification of the warm and cool types of individual.

The cool type of person is a blond or a person with light hair, light complexion, and blue eyes, or one with blue black hair, light complexion, and blue or gray eyes. This type of person should wear colors that are cool or colors such as green, blue, blue green, and blue purple or violet. Colors that are the same color as the hair are not becoming. Lighter or darker colors are much more becoming. The cool type of person who has blue black hair is able to wear brighter colors than the person with light hair.

Tha auburn type with red orange hair commonly known as "red hair" who has brown eyes and quite a bit of pigment in the skin should not wear bright colors that will tend to bring out the color of her hair but should wear colors opposite, such as green, bluish green, blue, or brownish green.

The warm type with dark brown hair, brown eyes, and quite a bit of pigment in the skin may wear bright colors as she has value contrast in her hair and eyes. She may wear colors such as yellow, yellow orange, orange, red orange, red, and often a dull, dark, red purple.

The intermediate type is just between the cool and warm type and has a quality of both. The skin is neither warm nor cool and the eyes may be blue, brown, or gray, and the hair is usually brown. This type of person can wear any color or value.

To bring out the color in the cheeks and eyes one should wear a brighter or lighter color than the eyes or cheeks which can be applied by a tie or the trimming on a hat or dress.

Therefore, in summarizing, before buying a hat one should remember the different types, colors, and materials suitable for each type.

BANDAGING

Hannah Degerness '27
Clara Gunufson '27

Hannah Degerness '27

Everyone should know something about the art of applying bandages, as he will at some time or other find this knowledge beneficial.

Bandages have three purposes: First, to hold surgical dressings and medicinal applications in place; second, to stop bleeding by pressure and, third, to serve as slings.

There are many kinds of bandages. Two of them are: the triangular bandage which is used as a sling to support the hand and arm and also to hold dressings in place; and the roller bandage (the one most commonly used) which is made by cutting or tearing cloth into strips, the width and length of the strips depending on the size of the part to be bandaged.

Various materials are used. Some of these are: Crepe paper, which is a cheap, light material readily adjusted and best suited for home uses; gauze, which is a thin, light, soft material, readily adjusted with even pressure and best suited for holding splints and dressings in place; unbleached muslin, which is heavy and firm is used to apply pressure, to give support, and to hold splints in place.

Great care must be taken to see that a bandage is not put on too tight. The bandage must be firm but not so tight that it will stop the blood circulation to any part of the body.

A bandage is either pinned, sewed or tied in place, but always so that it will not cause any discomfort to the patient. If it is pinned, a safety pin should be used, and if tied the ruf knot should be used. This knot is made by holding the ends of the bandage by the two hands, winding the end held in the right hand over that held in the left hand and bringing it through the loop.

The roller bandage can be used for any of the other purposes. They are usually made of muslin, gauze, or cheese cloth. Gauze or cheese cloth are the best because they are elastic and much better for unskilled hands to use.

Roller bandages can be bought but it is well to know how to roll them. One end of the bandage should be turned over for a length of about six inches, This lap should be folded on itself and this process repeated until a hard roll is formed. The roll is then held between the thumb and forefinger of the left hand and the bandage between the thumb and forefinger of the right hand and rolled. The bandage when completed should be in a hard roll with even edges.

The roller bandage is applied by holding the roll in the right hand, the loose end being in the left, and the outer side of the end on the place where the bandage is started.

The simplest method of application is the circular method, but that can be used only when the part is the same size throughout, as for example, the forearm above the wrist and the fingers. It is also used to hold splints and dressings in place, and is made by a series of circular turns from below upward, each turn overlapping the upper third of the one below.

The reverse is usually considered the most difficult point to learn in the application of the roller bandage, but it is not. It eliminates open spaces and unsightly loops. To make the reverse, place the thumb of the left hand on the lower edge of the bandage to hold it in place, slacken the bandage between the hand (about three inches) and turn the roller under the limb, keeping the lower edge of the bandage parallel with that ofthe turn below. Reverse again at the proper point and so on. The reverses should be made to lie in the center of the limb in one straight line.

The figure of eight bandage is found especially useful about the joints. It consists of a series of loops, each overlapping the one below by two-thirds the width of the bandage. The middle part is over the bend of the joint while the loops lie one below the other above it.

In applying roller bandages, always bandage from below upward and from within outward over the front of the limb. Bandage firmly but not too tightly or loosely and use firm even pressure. When bandaging a leg or arm, leave the tips of the fingers or toes uncovered. If theybecome blue or cold or if great pain is complained of, it is almost dertain that the bandage is too tight and has stopped the blood circulation. If so, it must be loosened immediately or the results will be dangerous. Some precautions are: Do not reverse the bandage over a sharp bone and do not use the figure eight bandage over a joint. In applying a bandage immediately after an injury, remember that swelling may follow and use care in order that the bandage may not become too tight.

BANDAGING

Clara Gunufson '27
Hannah Degerness '27

Clara Gunufson '27

The triangular bandage is perhaps the best suited for general first aid work, as it can easily be made and it is not difficult to apply. The triangular bandage is preferably made from unbleached cotton cloth. It is made from a piece of material not less than thirty-four to thirty-eight inches square and this is folded through the center into a triangle and then cut along the fold. The triangular bandage may be applied in two ways, the folded and the unfolded way.

The most important uses of the unfolded triangular bandage are: first, the arm sling, second, the hand bandage and, third, the head bandage. To apply the arm sling, place the one end of the bandage on the uninjured shoulder and allow the length of the bandage to hand down over the chest. Place the injured arm in the bandage and bring the other end of the bandage up to the injured shoulder and fasten the ends at the back of the neck by either pinning or tying them in place. This bandage affords a good rest for the arm and is very comfortable.

The foot bandage is made by spreading out the bandage and placing the foot in the center of the bandage with the toes to the point. Next bring the point of the bandage back over the instep of the foot. Then bring the other two ends forward and cross them at the front of the ankle. Then bring them back and fasten.

The hand bandage is applied in the same manner as the foot bandage. The bandage is spread out and the hand is placed in it with the palm downward and the fingers toward the point. The point is then folded back and the two ends are brought forward, crossed and tied at the back of the wrist. This bandage is very useful.

The head bandage is applied by folding a hem, which is about one and one-half inches wide across the long side of the unfolded triangular bandage. Next place the bandage so that the hem lays across the forehead directly above the eyes and the tail hangs back over the head. Then draw the tail down and fold it up and pin in place with a safety pin.

The triangular bandage, when folded, is called the cravat bandage. There are several kinds of cravat bandages. Among these are the eye bandage and the bandage for the palm of the hand.

To apply the eye bandage, place the cent r of the cravat over the injured eye and bring the ends to the back of the head and fasten in place.

The cravat bandage is put on by placing the center of the cravat in the palm of the hand and crossing the ends at the back of the hand and then tying at the back of the wrist.

The m in purpose of the cravat is to hold splints or dressings in place and to aid an injured limb.

Among the special bandages, we have the gauze bandage with compresses attached such as we find in the first aid kits. These are applied to a wound or injured spot by winding the ends in different directions and pinning them in place. Great care should be taken not to touch the inner surface of the compress. Be careful not to touch the open sore with the fingers, water, or anything except the compress.

The pressure of the bandage will stop an ordinary bleeding. A compress is made from gauze or cheese cloth. It should measure about one and one-half inches on all sides when folded. A compress should be properly disinfected and should not be contaminated by the fingers or anything in the handling of compresses. It hasbeen found that if a safe gauze can not be procured that it would be safer to leave a wound uncovered.

Next we have the tourniquets. Tourniquets are used to stop bleeding from an artery. They are used for placing around a limb to press on the artery and thus stop bleeding.

A tourniquet may be made from a towel, a bandage, a handkerchief or a cravat. It is applied by winding it around the limb twice and tying, then placing a stick between the two layers and twisting until the blood veins stand out. This proves that the blood circulation has ceased. A tourniquet should never be allowed to remain on a limb any longer than one hour, because it may stop the blood circulation and deaden the limb to which it is attached. It may, however, be loosened up and, if the bleeding recommences, the tourniquet may be replaced.

CANNING IN THE HOME

Ruth Soltis '27
Bessie Swenson '27

Ruth Soltis '27

Fruit is an important part of the human diet. It provides regulating elements that must not be overlooked in the retention of health. Fruit is not simply a luxury to be eaten for the pleasure of eating; it has real nutritive value and is an important factor in furnishing the necessary units of energy or carbohydrates.

The organic acids of fruits assist digestion by increasing the flow of saliva and the gastric juices. They help also in increasing the secretion of the pancreas, the liver, and the mucus lining of the digestive tract. The combination of sugar, pectin, acids, salts, mineral and water found in fruit aids the movement of foods through the alimentary canal and provides a stimulus for the appetite.

These statements apply not only in summer when fresh fruits are available but throughout the year. At all times the body demands certain elements for building structure and the minerals and acids must not be neglected. Generally speaking each meal should provide at least one mineral food and this is best supplied by the means of fruit. A ration carefully balanced with fruits and vegetables will provide the minerals and acids necessary for the average human system. The meats and starchy foods will take care of the tissue building substances; it is then necessary to add sugar, salt, and fats to complete the diet.

To some people fresh fruits prove difficult to digest and in such cases, it is better to serve canned or cooked fruits. Certainly in no case should fruit be eliminated altogether from the human diet except on the advice of a physician. Fruit drinks are of great value in providing the body with the needed salts and acids.

There is cellulose and starch in fruits and the canning process modifies these.

Fruit changes its composition as it becomes over ripe. With over ripening fruit begins to decay and ferment, the natural fruit sugar changing into carbon dioxide and alcohol. It is therefore advisable to use fruit just barely ripe or even a little under ripe to get the best results in canning or preserving. Wonderfully fine results have been obtained by the means of the cold pack process, not only holding fruit and vegetables intact and retaining the fresh flavor but in keeping their food value over a longer period of time.

There are several types of glass jars in common use the most common of which are the glass top, wire clamped jars, the screw top Mason jar and the vacuum seal jar. These are all good if precautions are taken that they are air tight and clean.

The directions that are recommended for using these jars are:

Sterilize or temper the jars and caps by placing them in cold or warm water and heating the water until it boils. Leave them in hot water until they are ready to use.

Select good sound fresh fruit or vegetable. Carefully reject all that is decayed or withered which will spoil the flavor of the good and perhaps ruin the whole.

Blanch or scald the fruit or vegetable by placing it in a cheese cloth bag or basket, and dip into boiling water for the time needed. Then dip in cold water and pack in jars. In case of berries and all soft fruits the blanching can be dispensed with.

In case of fruit pack the prepared fruit in jars, and after blanching fill with hot syrup, about two parts water and one part sugar. The sugar can be omitted, using hot water only and sweetening the fruit when it is used. If sugar is not available at the time of canning.

In case of vegetables, blanch, pack the prepared in jars, and fill to overflowing with hot water, adding enough salt to season. (one teaspoon to one quart).

Place the rubbers in position on the jars. See that they rest flat on the shoulders of the jars all around. Wash all powder and foreign substance from the rubbers by dipping them into hot water.

Screw caps into position until they catch but do not tighten. This method is used for Mason jars; if Ideal jars are used, place glass lid and rubbers in position. Click the top wire in position butleave the side wire up.

Place jars in cooker or boiler. Fill boiler with water until the tallest jar is covered with at least one inch of water. Place cover on boiler, and boil for time required.

Remove jars from boiler and seal immediately while hot.

After jars have cooled, turn them upside down. Examine for leaks. If leaks are found remove the cap, examine for defects, repeat the processing and seal again.

CANNING IN THE HOME

Bessie Swenson '27
Ruth Soltis '27

Bessie Swenson '27

These are two methods of canning: the cold-pack and the open kettle method. The cold pack method has proved to be a practicable means of preserving fruit, vegetables, and meats. It can be used satisfactorily in the home with the ordinary kitchen equipment and with the expenditure of little labor. The pressure cooker is very desirable in the canning of meats and such vegetables as corn, peas, or beans. The advantages of the cold pack method are:

1. Fewer spoiled jars - Jar and contents are sterilized together and no germs are introduced afterwards.

2. Better flavor - Jars are closed during sterilization, thus preventing the escape of flavoring substances.

3. More pleasing appearance - Material is not handled so much and is not cooked to pieces. The natural color is more nearly retained because of blanching and cold dipping.

Blanching really means par-boiling. Vegetables are put into boiling water for from one to five minutes to cause softening and to clean and sterilize them. By cold dip we mean to plunge. the product quickly into cold water immediately after blanching.

4. Less time, labor, and fuel is required - One handling takes the place of two, and the tedious part of the work is at the beginning, not at the end: Work and time are saved because so many jars are preserved (boiled) at the same time and with the same fuel.

The cold pack method requires firm elastic rubbers. If too soft they will blow out in the processing, but if not elastic they will break. They must be made of a compound that will stand boiling. They must be free from spongy and porous places that would admit air. They must be of proper width, size, and thickness.

Always use new rubbers of good quality; throw away the old rubbers. Much fruit spoils on account of last year's rubbers. It is false economy to risk a jar of fruit together with the sugar and labor and effort in order to save one rubber.

CANNING IN THE HOME

Bessie Swenson '27
Ruth Soltis '27

Bessie Swenson '27

By using the pressure cooker it is easier to secure the high temperature required to sterilize properly and to prevent from spoilage.

Steam pressure cookers are made to carry from one to thirty pounds of steam pressure and should be tested for higher temperature to insure safety to the operator. These canners are equipped with a steam tight sterilizer, lifting crate, thermometer, pressure guage, safety valve, and petcock.

The kettle or wash boiler provided with a rack is an inexpensive device. It is satisfactory to all who have used it, provided it has some false bottom, a rack, strip of wood, paper or wire netting.

CANNING IN THE HOME

Ruth Soltis '27
Bessie Swenson '27

Ruth Soltis '27

Apples are probably used more than any other fruit. They may be preserved fresh for a long time, but the loss from decay is so great that after a few weeks a person is forced to preserve a considerable supply. Apples have greater food value than most other fruits because of their large supply of proteins and minerals. They may be canned successfully by either cold pack or open kettle method.

The cold pack method is, however, to be preferred.

First we remove the skin, cut the apples in halves removing cores, and drop them into cold water to keep them from turning yellow. Blanch one to two minutes in boiling water and then plunge in cold water. Pack closely in hot jars. Fill to overflowing with hot syrup. Put rubbers and caps in position, not tight. Sterilize both for twenty minutes in hot water, and when done, remove one jar at a time, sealing immediately. To make the syrup suitable for plain canning, take a pound of sugar to two and a half large cups of water. This can be varied to suit the taste. If sweeter syrup is desired, more sugar may be added. This amount makes $1\frac{1}{4}$ pints of syrup. It should be boiled until it shows signs of threading. It should then be put into the jars at once, for should it boil longer it will candy in the bottom of the jars. If more syrup is needed, use more sugar and water. The syrup should always be boiling when poured into the jar.

Some of the precautions necessary in preserving and canning are:

1. Follow only one set of instructions
2. Can only clean fresh materials
3. Use perfect containers
4. Use good rubber rings
5. Boil for sufficient time to insure preservation and air tight sealing.

Preparations for canning and preservation and air tight sealing are:

1. Carefully wash all jars, covers, rubbers, canners, and other equipment
2. Test all jars and covers
3. Place jars and covers in cold water in the canner and heat to the boiling point
4. Place a second vessel of water over the fire to be heated for blanching of vegetables

5. Select fresh, firm, sound products.

6. Clean, grade, and wash products

7. Prepare in pieces of desirable and convenient size for canning.

With all the methods we have given you, fruit may be employed as a regular part ofthe daily ration throughout the year. Everyone benefits thereby in increased help and good spirits, and in the pleasure of having a wide range of good things to eat.

"EVERYBODY'S DOING IT"

Vivian M. Olson '27
Gladys Huartson '27

Vivian M. Olson '27

The topic we have chosen for our thesis is "Everybody's Doing It". Yes, everybody is purchasing cars, everybody is obeying dormitory rules (or trying to), everybody is doing this and that, and really everybody wants to have good manners.

Some folks think that the fashion of courtesy passed when the fashion of courtiers departed. Courtesy, said a very wise man many years ago, is one of the attributes of God, who sends hisrain on the just and the unjust. Courtesy is the sister of Charity, it extinguisheth hatred and kindleth love. As a matter of fact everybody wants to do the right thing in the right way.

Good manners, inspired by good principle, prompted by good fellowship, polished by good form, will fit one for good society anywhere. The old riddle asks, "What is the keynote to good manners?" The answer: "B natural". Natural manners are always the most charming, provided that one is well bred; otherwise the self revelation is unpleasant. The fashionable manners of today are simple, cordial, and free from all affectation.

Etiquette itself is based largely upon courtesy. A gentleman tips his hat to a lady because it is courteous to do so and because it shows respect for any member of the opposite and fairer sex. He doesn't do it because it is a question of right and wrong, but because etiquette demands that he show his respect in that manner.

For--"True politenessis to do and say,
The kindest things in the kindest way."

"EVERYBODY'S DOING IT"

Vivian M. Olson '27
Gladys Huartson '27

Gladys Huartson '27

Correct introductions are necessary in everyday life. The way an introduction is made depends entirely upon the age of the people introduced and whether or not they are men or women. When introducing two people care should be taken to speak the names very clearly. Gentlemen should always rise when introduced to ladies. When two ladies are introduced the younger should rise. A lady need not rise when she is being introduced to a gentleman unless it is a very aged person or someone of note. A hostess, if seated, always rises (unless a very elderly or an invalid lady) and holds out her hand to greet any stranger introduced to her. This courtesy is obligatory; also such polite phrases as: "I am very glad to meet you, Mr. Youngren"; or "This is a great pleasure, Miss Olson". The very conventional way of introducing two people is in the form of a question rather than a statement, "Miss Olson, may I present Mr. Youngren, who is one of my A. C. friends?" If two women are introduced the younger should be presented to the older woman, "Mrs. Lewis, may I present Miss Olson?"

Men are always presented to women unless the man be very distinguished, such as our President: for instance, "Miss Olson, permit me to present you to the President.

Group introductions are to be avoided if possible, but if necessary, "Miss Olson, Mr. Widseth, or Mrs. Brown, Miss Lewis" is a form that serves the purpose very satisfactorily.

The acknowledgement of an introduction should be sincere in tone and the much-used phrase, "I am very glad to meet you," may be avoided by replying, "I have looked forward to meeting you," or, "I have wanted to know you for sometime." All that is really necessary is to say, "How do you do?"

When a young lady introduces a young man to her parents she may say, "Mother, may I present my friend, Russel?" "Father, Russel." It is perfectly all right to ask that a name be given a second time if one does not clearly understand it the first time.

As to handshaking--To paraphrase Shakespeare, "To shake or not to shake," is frequently the question. It need not be if one remembers that gentlemen always shake hands when introduced. A hostess holds out her hand to greet strangers and friends. Either men or women usually shake hands if they have not seen each other for some time.

There is all the difference in the world in the character of different handshakes. Sometimes one meets a hand that actually repels, it is so lifeless and has so little warmth of greeting. Other hands are too enthusiastic, actually hurting one by their vigorous grasp. A strong, warm clasp is always the nicest kind of a handshake, and it should be accompanied by a pleasant look or smile of greetings.

If you have a shy, bashful manner of shaking hands practice until you can give a hearty handclasp and your bashfulness will be just so much less.

Emily Post in her book on Etiquette says that the first rule for behavior in society is to try to do and say those things which are agreeable to others. Sometimes we thoughtlessly fail to say the courteous things. Our conversation is an unfailing indication of ourselves.

The real secret of being a charming conversationalist is to be able to tactfully bring about the subjects in which the others are interested and forget our own interests and achievements.

Always remember that a person of real charm, avoids loud talking, speaks clearly and distinctly, doesn't criticize others, does not argue or antagonize, is thoughtful of others, and respects the ideals and ideas of all.

"EVERYBODY'S DOING IT"

Vivian M. Olson'27
Gladys Huartson '27

Vivian M. Olson '27

It has been said that much of the comfort, cheerfulness, and refinement of a family depends on attractive table service. Since good authorities differ on details and every resourceful housewife exhibits her own individuality, fundamental principles, rather than infallible rules have been given.

The behavior of an individual at the dining table, possibly more than at any other place, betrays his social training and natural refinement. Customs in table etiquette change from year to year, and also differ slightly in different localities. There is never a time, however, when tact and consideration for others can be practiced. These, after all, form the basis of all good manners.

The Napkin--Before beginning a meal the napkin is taken and spread half unfolded on the knees. It is never permissable for an adult to use the napkin as a "bib". At the close of the meal, the napkin is loosely folded, while it is still below the surface of the table, and placed beside the plate.

<u>The Knife and Fork</u>--In using the knife and fork together one should hold them firmly in the easiest position for cutting. In this position the tines of the fork are turned down, the point of the index finger is resting on the body of the fork and the handle is held firmly in the palm of the hand with the other fingers and thumb. The knife is held in the same position except that the handle is placed a little farther back in the palm of the hand.

The knife is used to cut any food not soft enough to be easily broken with the fork, and to spread butter when a butter spreader is not provided.

After having been used with the knife, the fork is transferred to the right hand, and used with the tines up to carry food to the mouth.

When not in use, the knife and fork are placed across the plate with the cutting edge of the knife to the center. The knife and fork should not be used as instruments of gesticulation; neither should they be used to mark the table cloth when one waits for food.

When food has been started to the mouth, it should be eaten at once, rather than held suspended in the air while one converses at length with a neighbor.

The Spoon--With a beverage, the spoon is used to stir and taste. It should never be left standing in a cup or glass, since this position is often responsible for accidents. Any liquid food correctly eaten with a spoon is dipped toward the side of the dish farthest away from the person eating, and sipped from the side of the spoon, not the end.

The Fingers--All breads should be taken from the bread plate with the fingers. One should never butter a whole slice of bread at one time, but divide the bread into quarters before buttering.

An erect posture should be maintained at the dining table. It is never permissable for a person to slide down in his chair, rest his arms on the table, or crown his neighbor.

Loud talking, a monopoly of the conversation, a heated argument at the table are indications of very bad manners.

It is wise to eat slowly and quietly, refraining from talking while food is in the mouth.

One must always try to avoid:

1. Noisy eating or drinking;
2. Obtrusive use of the handkerchief;
3. Talking or laughing with food in the mouth;
4. Putting fingers in the mouth;
5. Coughing or sneezing without turning the head.

"EVERYBODY'S DOING IT"

Vivian M. Olson '27
Gladys Huartson '27

Gladys Huartson'27

In concluding our thesis: Good taste or bad is revealed in everything we are, do, or have. The other people depend on us, the younger generation, for our speech, manners, and dress. These are evidences of the propriety of our taste. Rules of etiquette are nothing more than sign posts by which we are guided to the goal of good taste.

In our thesis we have illustrated two important sign posts.

If we can k ep these attributes and add finish and understanding and perfect taste in living and thinking we need not dwell on the Golden Age of the past, but believe in the Golden Age that is sure to be.

FIRST AID

Annie Dunbar '27
Ruth Thorssen '27

Annie Dunbar '27

It is safe to say that with the increased use of machinery in the daily life of all of us accidents are likely to continue to increase instead of to decrease, and it is very important that everyone should learn: first, how to prevent accidents; and second, how to treat the person after he is hurt. It is realized that prevention is many many times better than cure, and that is in the main dependent on the individual exercising common care.

In speaking of scarlet fever, for instance, it is said that better treatment is one of the factors used to lessen deaths from this disease. Better treatment is equally effective in accidents. In disease this treatment is practically always given by a doctor as it always should be. Is this the case in accidents? Certainly the services of a doctor are always demanded except for the more common injuries, but the majority occur when no doctor is on the spot. Then if you know what to do and what not to do you can save a life or make the effects of the injury much less severe. Usually for the early treatment a doctor is not available, and therefore knowledge of first aid is of great value.

For instance, one of the common afflictions, nosebleed, is sometimes very serious. Usually this does not result from a wound, but comes on spontaneously. The patient should be placed on a chair with his head tipped backward. Loosen the collar and anything tight around his neck. Then apply cold water to the back of the neck by means of a cloth wrung out of cold water.

Another very simple, but effective treatment is to put a roll of cotten between the upper lip and the teeth. If bleeding does not stop now, a teaspoon of salt or vinegar to a cup of water may be snuffed up in the nose. Pinching the bridge of the nose will also help to stop bleeding, or the nose can be packed with chipped ice or snow. Stimulants should not be given.

Another painful injury is a burn. There are three degrees of burns. They are:the first, second, and third degree burns. In the first degree burn the skin is simply reddened. The air should be excluded by applying vaseline, cold cream, or sweet oil. If none of these are obtainable lard, cream, or white of an egg may be used. Ordinary baking soda made into a thin paste with water is also very good. Old muslin or linen which is clean and sterilized can be used to cover the burn. When blisters have formed we call this a second degree burn. The treatment may be the same, but if the blistering is very extensive it will be best to show this injury to a doctor. Care should be taken not to break the blisters so as not to allow germs to enter the wound. In a third degree burn the tissues are destroyed and should have the prompt attention of a physician.

Sprains are injuries of the joints and they result from violent stretching, twisting, and partial breaking of the ligaments about a joint, and are sometimes accompanied by the breaking of a bone. Sprains of the wrist and ankle are most common. The symptoms of a sprain are severe pain immediately which is much increased by the movement of a joint. There is no deformity other than swelling. The patient should not be allowed to move the joint or step on it. Elevate the joint when possible, and apply cold in the form of snow or cracked ice in a cloth for one-half hour; then apply heat until the pain is gone.

A foreign body in the eye may sometimes be removed by holding the eye closed so that the tears will accumulate and wash it out. If this fails pull the upper lid over the lower one two or three times or with the finger close the nostril on the opposite side and have the sufferer blow his nose. The eye should not be rubbed as this will cause the irritating object to injure the delicate lining of the eyeball. If these are not effective have the patient sit down and turn the upper lid back over a cotton swab or a match placed across the middle of the lid. With the corner of a clean cloth or handkerchief wipe the object away.

Foreign bodies in the ear may result in dangerous injury to the delicate linings. Very often an insect gets into the ear. In this case let the patient lie on the unaffected side and drop a little warm water in the ear. This will drown the insect and it may be drained out by lying on that side.

Any foreign body in the throat of a child may be removed by holding him up by the feet and hitting him a smart blow between the shoulder blades, which will cause a blast of air to rush out from the lungs. We can also use our finger by getting it under the object and in this manner removing it.

Children are very apt to put foreign bodies in their noses. In this case the object may be removed with a forcep. Sometimes the object gets so far back in the nose that it is swallowed, and to determine whether this is so we can hold our finger over first one nostril then the other to see if the patient can breathe.

FIRST AID

Annie Dunbar '27
Ruth Thorssen '27

Ruth Thorssen '27

Fainting is a total loss of consciousness due to a diminished supply of blood in the brain. A fainting person falls down and appears to be asleep. The lips are pale and there may be cold sweat on the forehead. It may follow bleeding, exhaustion from heat, bad air, or an overheated room. It is common in any form of weakness, as when recovering from a severe illness. A person who has not fully recovered his strength after an illness or injury should be careful not to overdo physically.

Fainting may often be prevented by lying down or, when this is impossible, by sitting and bending over so that the head is brought between the knees. If this method should fail the patient should be stretched out at full length with the head low to facilitate the flow of blood to the brain. This position, together with cold, fresh air, and the application of cold water to the face will often restore a person who has fainted. When the patient is sufficiently conscious to swallow, give a teaspoonful of Aromatic Spirits of Ammonia in a half glass of water and keep him quiet until he has entirely recovered. A faint usually lasts only a few minutes.

When a bone is broken, the injury is called a fracture. Fractures are more frequent that dislocations but ordinarily not more serious. They usually involve the bones of the limbs, the collar bone, or ribs. There are two kinds of fractures: the simple fracture, and the compound fracture. The simple fracture is one in which the skin is not pierced, caused by blows and falls. The compound fracture is one in which the skin is pierced, caused by bad handling of a simple fracture, and from wounds. Some of the symptoms of a fracture are a pain at the point of the fracture, the person injured is unable to move the fractured limb, and deformity, with a fracture a limb will be altered in shape and shortened or bent.

As one may do great harm by moving a broken bone, for the broken ends are likely to be very sharp, it is much safer, when an injured person is unable to move a limb, and from the appearance it seems probably that a fracture has occurred, to conclude that it is a fracture without further examination, and treat it so. Send for a doctor; if he is expected to arrive promptly, nothing need be done except to put the patient in a comfortable position.

Bruises are caused by blows or falls. These are, perhaps the most common injuries. When a person falls or when he is struck by something, usually the skin is not broken, but the force of the blow injures the tissue just beneath the skin, breaking numbers of small blood vessels therein. Blood escapes from these small vessels and this causes the swelling and the ordinary black and blue spot which is due to the blood which has escaped. Bruises need no attention unless they are extensive or painful. Cold water, ice, or equal parts of cold water and alcohol applied at once will contract the blood vessels and so prevent escape of more blood and also deaden the nerves to some extent, thus relieving pain. Raising the bruised part lessens the pain, as it diminishes the blood supply to the part.

A bruise may be only the least important part of an injury, so always try to make sure there is no other injury, such as a fracture.

Cuts which are often received from broken glass or sharp instruments, should not be washed with water, because germs may come into the cut. If bleeding is very extensive tie something tight above the cut to stop the bleeding. Then apply 2% Mercharom and wash off blood around the cut and put a dressing on. Put Mercharom on every day and some clear ointment to keep the dressing from sticking to the cut.

FLOWERS FOR THE HOME

Ruby Hanson '27
Adeline Buness '27

Ruby Hanson '27

Historic art shows that a good design has an enduring quality and will outlast the mode of the hour. Design is any arrangement of lines, shapes, and colors. A good design shows an orderly arrangement of the materials used and in addition beauty is the finished product. There are two kinds of design, structural and decorative. Structural design is the design made by the size and shape of an object, whether it be the object itself or a drawing of that object on the paper. The color and texture of the object is also a part of the structural design. Decorative design is the surface enrichment of the structural design. If an object is intended for use the requirements of the structural design are: that it be suited to its purpose in addition to being beautiful; that it be simple; that it be well proportioned; that it be suited to the material of which it is made and to the process which will be followed in making it.

The designer whose work shows real quality adapts his design to the material he is using. Having decided to take a flower or leaf as the theme of his decoration he alters it to suit.

Ordinarily flower arrangements are placed on tables, and so are seen below the level of the eye; thus permitting one to look into the bouquet and see the tops of the flowers. If the bowl of flowers is raised, the stems become as noticeable as the flowers. This suggests that one should decide where the flowers are to be placed before beginning to arrange them, for any change in the height of its position will alter the appearance of the group. Tall flowers should be placed below, or on the level of the eye. If they are too high, they will carry the eye too quickly to the ceiling. If one wishes to place flowers somewhat above the level of the eye some drooping lines should be introduced into the bouquet which will carry the gaze downward toward the eye level. Flowers can be enjoyed most thoroughly when they are placed against a plain back ground. Just as a pattern in a vase detracts from the effect of the bouquet, so does a figured background. When flowers are used in a room which has figured wall paper it is well to place them on a table where they will not be seen against the

the wall, or they may be placed where they will be seen as a silhouette against a window. A plain textile may be hung on the wall behind the flowers to separate it from a figured back ground, or a tray may be placed behind the group. Whenever it is possible it is well to group a flower arrangement with something in the room, so that it becomes an essential part of the decorative scheme rather than an isolated spot. A few books may help to unite a flower group with its neighbors, or flowers may be placed near a picture, mirror, or in front of a tray so that an interesting group may be secured.

After having decided upon the colors, the position in the room, and a suitable container, one can begin to arrange the flowers. Balance is the first consideration, and the flower with the longest stem is usually placed so that its head comes in 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 and colors farther away. When a mass of flowers are placed too far toward one side of the bowl the arrangement seems to tip.

Rhythm is the next consideration. The eye should be carried easily from one part of the bouquet to every other part. Rhythm may be gained by the use of rhyming lines, shapes, or colors.

Beautiful proportion contributes 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 lengths of the stems should be in pleasant relationship. When all the stems are of the same length there is an uninteresting monotony of line across the top of the bouquet. Flowers which are naturally stiff may appear rhythmic in an arrangement if their stems are cut so that the blossoms come at beautifully spaced intervals.

FLOWERS FOR THE HOME

Adeline Buness '27
Ruby Hanson '27

Adeline Buness '27

Beautiful flower arrangements add immeasurably to the livableness of a home, and give such pleasure that one is richly rewarded for the thought that is put into them.

In considering flower arrangements as a part of the decoration of a room, one must call attention to a few things that need to be kept in mind when flowers are being arranged. The characteristics of the flowers themselves should be noted first. The line, color, and texture of the flowers must be studied in order that a suitable container may be chosen for them and in order that they may decorate the room in which they are placed.

Flowers, like pictures, may be enjoyed for their line, their mass, and their color. In order to fully enjoy the line of flowers, one should use only a single spray or a very few blossoms. Some of the flowers that 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 are massed the lines of the individual sprays are lost, and the primary interest is in the color of the plant. Some of the flowers that are attractive in a mass are peonies, chrysanthemums, asters, and larkspur. There are many flowers that have both line and color; for example, roses, nasturtiums, and poppies.

People sometimes say 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. For example, a bowl of white daisies may receive a charming accent by the addition of some blue bachelor's buttons; and yellowish-pink roses, Ophelia roses, combined with larkspur make a pleasing color and texture combination. The person who understands texture and color harmony will be able to make many of these delightful and entertaining combinations.

In selecting flowers for a room, one must first consider the color scheme of the room. The bright warm colors bring a note of gaiety into the room, while the flowers of cool colors have a subtle beauty. Yellow and yellow-orange flowers, the flowers of light, will fit into any color scheme, but the bright red-orange and bright red-purple flowers need to be handled with care. Rooms that contain considerable amounts of orange and scarlet do not successfully receive the purple and red-purple flowers. Flowers of these quarrelsome colors, bright red-orange and bright red-purple should not be used together because they destroy each other's beauty.

If a room seems cheerless or a corner seems too dark, a bouquet of yellowish colored flowers will seem to supply a glint of sunlight. On the other hand, the blue and purple flowers will appear lost in the dark corners, but will be enjoyed when they are placed in the light.

The collection of good flower vases does not necessarily mean a large expenditure of money. Simple and well proportioned shapes may be obtained without much cost. Snuf jars, ginger jars, olive and preserve bottles, and bean jars make excellent vases or containers.

The colors which are useful for vases are putty color, other soft earth colors, wood browns, soft dull blues, grayed greens, and black.

Clear glass makes a good container for most flowers. Flowers whose heads are too heavy for their stems present a more balanced appearance when they are placed in an opaque vase. Weeds, seed pods, and berries are of such a rough texture that they are out of harmony with the delicate texture of glass and should be placed in pottery or in baskets.

Short stemmed flowers should be put in low bowls, and long stemmed flowers in high vases. Tall flowers can be used successfully in low bowls if the diameter of the bowl is large enough to give the impression of balance. The size of the vase should be in harmony with the size of the bouquet.

If a flower arrangement appears small it may be enlarged and brought into scale with the line of the table by grouping candlesticks with it. Table decorations should not be so high that they prevent persons sitting on opposite sides of the table from seeing each other. Low bowls harmonize best with the shape of the table. When high bouquets are used they usually need to be brought into harmony with the line of the table by the use of transitional sizes and shapes, unless there are drooping lines in the flowers. Candlesticks may furnish the transitional line, or a low bowl of flowers may be used on either side of the high bouquet.

Flowering bulbs may be obtained so easily, and so many varieties of seed pods and berries stay beautiful throughout the winter, that one is not dependent upon hothouse flowers. Seed pods should not be painted or gilded. The use of paper or artificial wax flowers shows poor taste.

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 well placed add charm and beauty to any room. The flowers seem to vitalize one's house, and give it a spirit of friendliness.

THE ART OF CAKE MAKING

Edna Story '27

Cakes are sometimes thought of as a luxury, an accessory to a meal, rather than a food, but in my opinion home made cake is a real food. The ingredients used in cakes represent the food elements from which our meals are made, and because of its high nutritive value, cake is most desirable at a meal that lacks hearty food in the form of meat or its equivalent. Because sugar satisfies hunger almost instantly cake should be eaten at the end of the meal.

There are a few general rules which must be followed in making all cakes: (1) For a perfect cake select only the choicest materials. Be careful of the kind of flour, fat, sugar, or the grade of flavoring you use; (20 Next, be accurate in measuring to assure success. No guess work can be allowed; (3) Very careful mixing is most essential and proper baking at correct temperature.

The ingredients used in cakes are fat, sugar, eggs, liquid, leavening agent, flour, and flavoring.

In cake making as well as in the preparation of other dishes a systematic plan must be followed if good results are desired. Before the mixing is begun all utensils and ingredients should be collected. First read the recipe, place all utensils required on table, and then collect all ingredients called for.

An earthen mixing bowl is preferred in cake making, but if this is not available use an enamel bowl in preference to an aluminum one as aluminum becomes darkened and is apt to discolor the mixture. A glass mixing bowl is also excellent. Wooden spoons are preferred because they do not wear off and do not discolor the food. You will also need two measuring cups, one to measure the dry ingredients and one to use for wet materials. Glass cups are preferred. One tablespoon, one teaspoon, one case knife, are necessary for measuring, and you will use a flour sifter. Other utensils which will be used are: a dover egg beater, an egg whip, a medium sized spatula, and cake pans.

Cake pans should be prepared before the mixing is begun. Butter cakes or any of its variations require greased pans. Sponge cakes or non-butter cakes should be baked in pans that are not greased. The fat used to grease the pans should be clean and tasteless. Less is required if an oil is used rather than a soiled fat. If butter is used melt it and let it stand until the pure fat that rises to the top can be gathered. Loaf cake pans should be greased first and then have the bottom covered with a piece of oiled or light wrapping paper which can be oiled after placing into the pan. Layer cake pans should be greased and then covered with a layer of flour. Sponge cake pans need no grease of any sort, because of the nature of the cake. They may be dusted with flour but it is not necessary.

After all the ingredients and utensils are colledted, the pans greased and the oven lighted, begin to mix the cake. To make a butter cake, first cream the butter in a mixing bowl, add the sugar gradually, stirring it well so that the two combined will be creamy. The eggs are added next, following directions. Sometimes the whites and yolks are beaten separately. In that case the yolks are added, next the liquid and dry ingredients alternately a little at a time and we fold in the beaten whites last of all. The method of mixing sponge cakes is quite different. We beat the yolks until thick and lemon colored, add sugar and continue beating. Then add flour and last of all, stiffly beaten egg whites. For an angel food where no yolks are used we fold the sifted flour and sugar carefully into the beaten egg whites, add flavoring, and it is ready for the tin. After the ingredients are combined pour the mixture into the pans which have been prepared. If a two or three layer cake is to be made divide the batter evenly. Just before pouring the batter into the pans, if the pans have been oiled, sift in some flour. Shake well to remove any superfluous flour. This leaves only a thin coating which sticks to the grease and will give the cake a smooth under surface when bakes, making it much easier to frost. In filling a cake pan be sure the batter comes well up into the corners and sides of the pan. If it is unevenly distributed the cake will be higher in one place than another, but by leaving a slight depression in the center the cake will be perfectly flat on top when baked. Cake pans should be filled up two thirds full if the cake is to rise to the top of the pan. Sponge cakes and angel foods are poured into round ungreased pans.

Test the oven for the proper baking temperature first by putting a piece of unglazed paper in the oven. For a butter cake it should become a golden brown in five minutes. For a sponge cake, a creamy yellow in five minutes. We divide the time of baking into quarters:

1. Mixture begins to rise
2. It continues rising and begins to brown in spots
3. It rises in the center and browns all over
4. It settles to level and shrinks from pan finishing baking thoroughly.

As soon as the cake has baked sufficiently take it from the oven and remove it from the pan at once. Loosen the cake from the bottom of the pan and around the sides before attempting to turn it out. A knife or spatula may be used. Pans with the removable bottoms are very satisfactory. When using them, lift the cake out upon the removable bottom and run a knife under the cake until it is entirely loosened. Allow it to cool. The quickest and most convenient way to cool a cake is to turn it out on a cake cooler. If this is not available use a clean town spread on a flat surface. Do not attempt to ice a cake before it is entirely cool. If the cake sticks to the pan cover the bottom of the pan with a cold damp cloth for a few minutes.

Cakes must measure up to the certain standard so we judge our cakes according to the following score card:

I.	General appearance		20
	size	5	
	shape	5	
	crust	10	
II.	Flavor		35
	odor taste		
III.	Lightness		15
IV.	Crumb		30
	character	20	
	coarse or fine		

	tough or tender	
	moist or dry	
	elastic or not	
	Color	5
	Grain distribution of gas	5
Total		100

BARBERRY ERADICATION

Kenneth Parduhn '27
Russell Younggren '27

Kenneth Parduhn '27

INTRODUCTION

Damage Done by Black Stem Rust

The black stem rust of cereals is found wherever grain is grown in the United States, and is also found in Canada, South America, Europe, Asia, Africa, and Australia. It is especially destructive to wheat but does a great deal of damage to oats, barley, and rye. It is most serious on spring wheat. At irregular intervals, rust epidemics sweep over the country causing enormous losses. In 1904, rust caused a loss of $2,000,000 in the Dakotas and Minnesota alone. In 1916 the production of wheat in Minnesota, North and South Dakota, and Montana was 200,000,000 bushels less than the year before. Thousands of acres of wheat were never cut and much of that which was cut weighed only about fourty to fifty pounds per bushel.

The average yield of wheat in North Dakota in 1916 was 5½ bu. per acre. The ten year average was eleven bushels. In South Dakota, the average yield was seven bushels per acre as compared with a ten year average of $10\frac{1}{2}$ bushels.

It has been estimated that the loss in the United States caused by rust was 180,000,000 bu. and 100,000,000 bu. in Canada for the year 1916. It, therefore, destroyed about 280,000,000 bu. of wheat in one year in the United States and Canada. To this must be added the loss of barley and oats which in some cases was as much as 15% to 25%. Hence, you can see by these figures that black stem rust is a source of great economic loss to all growers of spring sown crops.

How to Tell Black Stem Rust

Black stem rust is often confused with other rusts of grain which are similar in appearance but act differently.

The common rusts are the black stem rust, the yellow stripe rust, orange leaf rust of wheat, crown rust of oats, the brown leaf rust of rye, and the dwarf leaf rust of barley. Each of these rusts have a red or summer stage and a black or winter stage.

The black stem rust occurs on wheat, oats, barley, and rye, and also on a number of grasses. It is the only rust which develops on the common barberry.

The Cause of Rust

Black stem rust is cased by a parasitic

fungus plant. It is a small colorless mold-like plant and can be seen only with a microscope. This plant consists of numerous thread-like tissues which grow, branch, and twist themselves into the tissues of grain and grass plants. The threads send little suckers into the cells and sap the food of the host plant. The seeds of the fungus are known as spores. These fungi are called rust because they form infections on the leaves and stems which are rusty in appearance. The infected areas have a yellowish, reddish or brownish tinge and in the black stage, the color is almost black.

There is a belief that the weather causes the rust but the rapidity with which the parasitic plant, causing the rust, grows, depends on the weather.

<u>Importance of Barberry in Spreading Rust</u>

There is no question that the barberry is the most important factor in the spread of rust in the northern Mississippi basin; in the south, it is less important. The rust in the north starts in the spring on the leaves of the barberry and then blows to the grasses and from there to the grain.

In 1918, barberry bushes were found in every county in Wisconsin. Nurserymen of Minnesota destroyed about 600,000 plants. The bushes wre also numerous in North Dakota, Montana, Wyoming, Colorado, Nebraska, Michigan, Indiana, and Ohio.

Many hedges of the bush were found growing along the side of a grain field and numerous smaller plantings were found. The bush rusts early in the spring and the spores are blown a long distance by the wind often as much as 25 miles so that by the middle of the summer, it has done considerable damage. Studies show that the red stage of the black rust does not persist over the winter commonly north of the Gulf states.

The infection spreads in the direction toward which the prevailing winds blow. The black rust spores live over the winter in the black rust pustules on the stems of cereals. These germinate in the spring, forming tiny threads on which are produced the spring spores. The spring spores that come in contact with barberry leaves grow and form the cluster cup spoil stage early in May by the time the leaves are full grown. It is from the barberry that the infection spreads to grasses and grains.

The barberry, therefore, enables the rust to start early in the spring.

The value of our grain crops is enormous and that of the barberry is nothing. Therefore, it should be eradicated.

Barberry Identification

The common barberry is a tall, erect shrub about ten to twelve feet in height. The bark is grayish in color and there are spines along the stem. These spines which form at the nodes and base of the leaves are in groups of three or more, although sometimes only one or two occurs. The leaves occur in clusters and are green or a greenish purple in color and have saw toothed edges. The flowers are yellow and the berries red and usually remain in the bush over winter. The wood of the roots and shoots is a bright yellow in color.

The Japanese Barberry, which is a harmless shrub, is low, spreading and graceful. The bark is reddish in color and the spines are smaller than those of the common plant. The flowers and berries are the same color as those of the common plant but are in small groups of two or three and not in bunches as in the common barberry.

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BARBERRY ERADICATION

Russell Younggren '27
Kenneth Parduhn '27

Russell Younggren '27

A knowledge of the life history of a plant disease is of value if we can cope with that disease. Pathologists are striving constantly to find the host plants on which diseases live, to find how the diseases live over winter, how they are spread, and how they are controlled. Such studies have proved of great value in disease control work. This is especially true with the black stem rust of wheat for in finding and removing the intermediate host plant from the Danish Peninsula scientists were able to control perfectly the black stem rust of wheat.

Life Story of The Rust Parasite:

1. These are four distinct stages of black stem rust:

(a) Early spring stage

(b) The Cluster cup stage

(c) The red or summer stage

(d) The black of winter stage

2. The different appearances of the rust through these different times is due to the formation of other spores.

A. Spring:

1. Rust starts by the growth of the winter spores on the straw and stubble of grains and grasses. These spring spores fill the air and wherever they lodge on the leaves of barberry they grow forming diseased spots on the leaves. These spots, which are called cluster cups, break the tissue on the under side of the leaves. They contain thousands of spores. These spores do not infect other barberry plants but are blown about by the wind and wherever the spores lodge on the leaves and stems of grasses they cause a typical red rust.

Generally by late May or early June the red rust gets started on the cereals and grasses.

The spores of the red rust are very small so naturally they are blown about very easily by the wind. They may fall on grain plants and it takes only about four or five hours for them to germinate when conditions are favorable. When they germinate they send out long slender threads which enter the leaves through the breathing spores and then a dense network of threads is formed on the inner side of the leaf. Anothercrop of red spores is then produced and the same process is continued. Thus new plants are continually becoming infected.

It requires only about five or six days for a single spore to complete its development and reproduce itself. These new spores continue to develop as long as the plants are green and the weather is favorable.

B. Black or Winter Stage:

The black spore stages follow the red spore stage. It is usually formed when the grain begins to ripen. The same dense network of threads which produced the red spores produces black rust or winter spores in the same way. These spores or postules may be brownish black in color early but later turn entirely black. This stage is called the "Black Rust Stage."

These black spores are not, however, blown about by the wind but stay on the stubble during the winter.

They germinate in the spring and send out thread-like tubes on which very small colorless spores, called sporidia, are produced. These sporidia are blown about by the wind and later lodge and infect the common barberry and the result is the barberry rust or spring stage of the black rust.

The four stages are therefore:

1. Spring spore stage on stubble
2. Cluster cup stage on barberry

3. Red Rust stage on cereals and grasses.

4. Black rust or winter spore stage on cereals and grasses.

How Rust Lives over Winter:

1. Overwintering of the black spores.

In the gulf states the weather is mild enough to enable the red spores to live through the winter, but in the upper Mississippi Valley only the black spores live through the winter to any extent. In the spring they germinate and infect the barberry. The rust spreads from the barberry to grains and grasses and continues to spread as long as weather conditions are favorable. Field observations show clearly that in the northern half of the Mississippi Valley the barberry gives the rust its start in the spring.

Conditions which favor Rust development:

1. Strong winds carry the spores along and therefore enable the rust to develop over a wide area. But the weather conditions must be favorable for its germination.

2. Heavy dews and fogs or quiet rains furnish the best condition for spore germination. Heavy driving rains are perhaps not as favorable for infection, because they wash many of the spores from the plants on which they have fallen.

After the rust parasite has entered the plant it will develop most rapidly when the weather is rather hot and muggy. At low temperatures the rust develops much more slowly and it may also be checked by hot, dry weather. The weather also may be favorable for infection but not for rust development after infection. When the right conditions occur at just the right time epidemics develop.

CORN FOR SILAGE

Melvin Hole '27

Succulent feed has proven to be very important for milk and beef production. Throughout the chief dairy sections of the United States, corn silage furnishes the cheapest form of succulence.

Some years ago a belief existed that silage injured the flavor of the milk. For many years the biggest milk condensing company in the country prohibited the use of silage by its patrons. The belief that the flavor of the milk was injured was probably due to the lack of experience in preparing the silage and which resulted in a poor quality of silage being produced. Those using succulent feed in earlier years probably lacked the right methods of feeding and this, together with silage of poor quality, accounted for the effect on the flavor of the milk.

Experience has now demonstrated that when good silage is fed under proper conditions, the quality of the milk is improved rather than injured. Like other feeds, silage may be abused.

The advantage of feeding corn silage over that of corn fodder is shown in the results of nine trials at various stations throughout the country in which it was found that on the average 7.4 lbs. more milk were produced from each hundred pounds of dry matter in rations containing silage than in those containing corn fodder.

The value of silage is based largely on the keeping quality and feeding value.

The keeping quality of corn silage depends on the condition of the fodder at the time it is put into the silo, the length of cutting, and the method of packing. Before harvesting corn for silage, its maturity should be considered. Silage made from immature corn is more acid than that made from mature corn. The corn should not be allowed to become thoroughly ripe and dry, however, because the stalks and foliage are rendered more difficult to digest and besides, the corn can not be packed into the silo tightly enough to prevent "fire-fanging" without using excessive amounts of water. In case the corn is frozen before it is properly matured for cutting, it should immediately be harvested to avoid the loss of the leaves by drying.

The Agricultural College of North Dakota recently completed an experiment on the composition and maturity of corn. This investigation aimed to determine the composition and yield of the whole corn plant (fodder) and its parts, ear and stover at uniform stages of growth, to compare type of varieties with respect to time of maturity, height of plant and type of kernel. They also studied the relation of maturity to chemical composition and particularly the dry matter content.

The life of a corn plant appears to be divied into two major periods. The first is from the time of planting until it tassels out and the second from the tassel stage until it is ripe. This second period consists of four stages: namely, tassel to milk, milk to dough, dought to glazed, and from glazed to ripe.

The question may arise how to tell when the plant is in a certain stage. The method followed in the experiment at the North Dakota Agricultural College and which can generally be used may be explained according to the following definitions:

Tassel - 80% of the plants having ears with silks showing.

Milk - 80% of the ears with kernels in medium milk. The milk stage is recognized by the milky consistency of the starchy part in the kernel when it is ruptured by the thumb nail.

Dough - 90% of the ears with kernels in medium dough. By this time the starchy part of the kernel has a jelly-like consistency and does not run out freely when the kernel is punctured.

Glazed - 90% of the ears with kernels fully glazed.

The glazed stage is recognized by the outer seed coat becoming somewhat shiny and the starchy part becoming firm and appearing mealy when rubbed between the fingers.

Ripe - All the ears with kernels fully glazed and 90% of the stover brown. The kernels in this stage have become quite hard.

It has been determined through experiments that the glazed stage is the proper time to harvest corn for silage.

The feeding value of silage is based on the actual amount of dry matter and nutrients it contains.

The results of the recent experiment completed at the North Dakota Agricultural College shows the actual amount of dry matter and nutrients in an acre of 1000 corn plants at various stages of its maturity.

The following figures represent the average yield per acre of 1000 plants of eighteen both late and early varieties:

	Green Matter Lbs.	Dry Matter Lbs.	Ash Lbs	Crude Protein Lbs.	Ether Extract Lbs.	Crude Fiber Lbs.	N.F.E. Lbs.
				E A R			
Tassel							
Milk	4137	833	25	103	20	157	528
Dough	5493	2093	41	226	69	248	1509
Glazed	5982	3014	48	322	121	288	2235
Ripe	5237	3046	48	319	131	261	2287
				S T O V E R			
Tassel							
Milk	17286	3124	232	251	42	875	1724
Dough	15186	3080	244	199	45	917	1675
Glazed	12252	2952	273	175	38	990	1476
Ripe	7738	2534	231	138	33	871	1261
				F O D D E R			
Tassel	18384	2478	211	289	42	685	1251
Milk	21423	3857	257	354	62	1032	2252
Dough	20679	5173	285	425	114	1165	3184
Glazed	18234	5966	321	497	159	1278	3711
Ripe	12975	5580	279	457	164	1132	3548

These results show that when the corn plants are in the glazed stage, they contain the maximum amount of feed value.

During the year 1926 an experiment was started at the Northwest School and Experiment Station. The object was to find out the amount of dry matter and nutrients of different varieties of corn. The intentions were to cut each variety when it reached the glazed stage but a killing frost on September 12 made necessary the cutting of all the varieties immediately. The result showed, however, that the varieties yielding the maximum green tonnage did not yield the maximum dry matter.

Summing up the results of these experiments quoted, the conclusion can safely be drawn that the glazed stage of the corn plant is the proper time to harvest corn for silage in order to get the maximum amount of feed value.

NATURAL AND ARTIFICIAL MANUFACTURE OF NITROGEN FERTILIZERS

Eldor Pederson '27
Ralph Hamrick '27

Ralph Hamrick '27

There was a time shortly after the middle of the last century when, following the researches of Leibig on plant feeding, scientists were greatly concerned about the final exhaustion of the nitrogen supply from the soil. They knew that continual loss of nitrogen came from cropping the land. They also knew that the supply of nitrogenous manures was limited.

This excitement among scientists was largely due to the fact that they had not learned of the power of certain bacteria to utilize the nitrogen supply of the air to help in maintaining the nitrogen supply of the soil. This discovery followed soon, however, and the great problem of nitrogen was largely solved.

The nitrogen of the soil is found principally in the organic matter. Consequently a large amount of organic matter naturally means a large amount of nitrogen. The nitrogen is locked up in the plant tissues and cannot be used by the plants until the tissues are broken down by the decomposing action of bacteria and fungi. These bacteria and fungi change the nitrogen to compoun s which supply available nitrogen for plant use. So you can see these bacteria and fungi are very necessary. The next type of bacteria I shall discuss is the nitrogen fixing bacteria on the roots of legumes.

Credit for the discovery of the nitrogen fixing power of bacteria is generally given to two German scientists, Hellriegle and Wilfarth, who, in 1856, showed that the beneficial effects of growing legumes on the soil were due to the fixation of nitrogen from the air through the medium of bacteria found in tubercles or nodules on the roots of these plants.

Of the different types of bacteria working on legumes, the most important are rod-shaped organisms that enter the rootlet through the root hairs. Once within the rootlet they find conditions favorable for growth and multiply very fast. Their presence in the legume roots causes an irritation and gall-like nodules or tubercles appear on the roots. These nodules serve as the living room for the bacteria. The bacteria live on the legume sap and gather the nitrogen largely from the soil air. When the legume has about reached its maturity the nodules become emptied and some of the bacteria pass off into the soil to be again taken up by the legumes. The more air there is in the soil the more nitrogen there is for the bacteria. So you can see it is important to keep the soil well aerated by furnishing good drainage and well worked land.

Experiments and field practices have shown that the same type of nitrogen fixing bacteria is not adapted to all legumes. For example, bacteria that produces nodules on red clover roots will not produce alfalfa nodules. The same is true of other classes of legumes. There are, however, certain widely different legumes which have the same bacteria adapted to them. The common legumes may be grouped as follows:

(1) Alfalfa, sweet clover, bur clover and yellow trefoil.

(2) Red, mammoth, alsike, and white clover.

(3) Soy beans.

(4) Cow peas, peanuts, velvet beans, Japan clover, the partridge pea, and lima beans.

(5) Garden beans.

(6) Garden peas, field peas, and vetches.

When you are going to plant a legume and the soil on which you wish to plant that legume is lacking in the nodule forming organism necessary for that legume, it must be inoculated by artificial means.

A common method of soil inoculation is to bring soil from a field that has produced a well inoculated legume of the species you wish to plant, and spread it on the field at the rate of 500 to 1000 pounds to the acre. The soil is taken from the top layer to a depth of 5 or 6 inches.

A modification of this plan is to take a small amount of inoculated soil, pulverize and sift it, then sprinkle it on the seeds (which have been previously moistened with water), mixing well till every seed is covered with dust.

Other methods of seed inoculation are those in which a pure culture of the desired bacteria is applied to the seed. These pure cultures are made by securing the bacteria from the nodules of roots and growing them on a special vegetable jelly, etc. After this they are sent to the farmer. Another pure culture method is to grow the bacteria and transfer them to sterile sand or soil, in which they are sent to the farmer. Such cultures are prepared by the United States Department of Agriculture and other colleges of agriculture.

When you are in doubt as to whether your soil is inoculated with the proper bacteria for your certain legume, it is a good policy to inoculate artificially rather than depend on natural inoculation.

Some of the common ways of putting nitrogen into the soil are equally as good if done properly. The plowing under of a legume crop is a very good means of putting nitrogen in your soil. The legume should not be plowed under until it has reached the point of maturity, as it has then gathered all the nitrogen possible. Many people hate to plow under a legume crop, but that is because they do not realize the value that the soil derives from the process. Of the green manures or legumes, sweet clover is known as one of the best for the Red River Valley.

Our ordinary farmyard manures are the most common way of helping add nitrogen to the soil. It is an old practice and in the olden times was considered next to plowing in importance. It is something that can be considered practically free to every farmer and saves the expense of buying a commercial fertilizer or plowing under a legume crop. A ton of average manure contains about ten pounds of nitrogen. So you can see that manure that is applied to your field adds greatly to the nitrogen supply.

The manufactured fertilizers are good for intensive farming, but where extensive farming is done, the natural nitrogen fertilizers are by far the most practical.

"NATURAL AND ARTIFICIAL MANUFACTURE OF NITROGEN FERTILIZERS"

Eldor Pederson '27
Ralph Hamrick '27

Eldor Pederson '27

Out of the eighty-seven chemical elements known to us, only about a dozen enter into the composition of most plants. Out of this dozen, only about three are of consequence in the fertilizer problem. The whole fertilizer problem centers around the phosphorus, potassium, and nitrogen supply.

Phosphorus and potassium are widely and generously distributed in the igneous rocks of the earth's original crust. These have come through and are found in larger or smaller quantities almost everywhere. Their story is a mineralogical one.

The case of nitrogen is quite different. Nitrogen is an inert gas which constitutes about four-fifths of the atmosphere. The two molecules that go to the make-up of this gas have such tremendous affinity for each other that only under special conditions can they be made to combine with other elements that can enter the soil and be taken up by plants. This process is necessary to plant life, because none of the plants with which we are ordinarily familiar have the power of using the free nitrogen in the air. They must get the nitrogen through their roots from compounds in the soil. Some of the higher plants, namely the legumes and the pea family, have the power of obtaining nitrogen from the air provided the nitrogen forming bacteria are on their roots.

When we trace back the nitrogen supplies in nature, such as the coal beds and nitrate beds, we can almost always trace them back to a vegetable origin. Thus we see that the nitrogen we recover from various coal distillation by-products came originally from some plant life. It is not quite so sure about the Chilean deposits of nitrate but a vegetable source seems more probable than any other.

The nitrate beds of Chile have long been the chief source of nitrogen for the world. Until 1900 practically all the nitrogen, except for small amounts of animal wastes came from Chile. Since 1902, however, the air nitrogen industries have made great progress. In about twenty years they have grown from laboratory experiments to an annual capacity of over 550,000 tons of fixed nitrogen in 1923. This would mean about two and a half millions of tons of Chilean nitrate or equivalent to the sulphate of 155 million tons of coal.

In 1902, two chemists set up a small apparatus at Niagara Falls to artificially fix atmospheric nitrogen for commercial purposes. It was based on the principle that when a powerful electric discharge or arc as it is called, takes place in the air, some of the oxygen and nitrogen become in the intense heat chemically combined. These oxides of nitrogen can then be absorbed in water to form nitric acid and when this is neutralized with lime or soda makes an excellent fertilizer. According to this theory, there is undoubtedly some nitrogen fixed in every lightning flash.

The Niagara Falls plant did not prove commercially successful so the following year experiments were made in Norway where electric power was cheaper. This plant began operating successfully in 1905 and is still in operation. This process, commonly called the arc process, consumes such enormous amounts of electric energy per pound of nitrogen fixed that it is of use only in special cases where electricity is cheap.

Newer installations are being made using more modern and efficient methods and equipment. The next method following the arc process, was the cyanamid process, The first step is the manufacture of calcium carbide by melting coke and lime together in electric ovens. The resulting calcium carbide is then crushed into a fine powder and treated with pure nitrogen made from liquid air. The nitrogen combines with the calcium carbide to form calcium cyanamid. This can be used as a fertilizer but it is somewhat difficult to apply under ordinary farm conditions. It is more practical to treat the calcium cyanamid with steam and alkali to form a soluble crystalline body which is easier to apply and would be used very extensively if it could be produced cheaply enough.

The cyanamid process reached its height during the World War and is now being rapidly superceded by still more modern and efficient processes. It was known before the war that Germany had a better method of making synthetic nitrogen but no detailed knowledge of the process could be gotten. But during the war emergency the great seventy million dollar Cyanamid plant was built at Muscle Shoals. This plant was fast becoming out of date and was never a successful plant. .

After the war the German or Haber process for direct synthesis of ammonia became more known to us. This process is likely to take the place of all the other processes. A small plant of this type was also built at Musle Shoals but this plant was so small it is more in the way of an experiment. Its requirements are small compared with the amount of coal used, and is therefore more closely affiliated with coal mining and coke ovens.

Generally stated this process consists of compressing a mixture of one part pure nitrogen and three parts pure hydrogen to a high pressure. This mixture is then passed at a dull red heat through a catalyst, to make ammonia gas. The catalyst is a granular mass of specially prepared metallic iron containing small amounts of potassium aluminate. The protection of the catalyst is one of the delicate details of the process and has required a great deal of research. It is a very complicated process at many high temperatures and a great deal of equipment is required. But these difficulties are fast being overcome and it will not be long until this process will be used exclusively.

Over 50% of the inorganic nitrogen used in the world now is made from the air, compared with only about 10% immediately before the war. The main supply then was the nitrate beds and coal distillation by-products. Thus we see that the air nitrogen industries are fast coming to be of importance to agriculture. This industry is perhaps yet only in its early stages and the time is not far off when atmospheric nitrogen will be used as a fertilizer to a greater extent than any other kind of commercial nitrogen.

PROPER TIME FOR CUTTING WHEAT,

OATS, AND BARLEY

Otto Saugen '27
OliverDalos '27

This discussion concerns the proper time to harvest our three most important grain crops: namely, wheat, oats, and barley. There has been considerable difficulty among the farmers in being able to solve this problem.

With wheat, we have the rust problem to take into consideration, while with oats and barley, we have the danger of lodging and shattering. Due to all these dangers we know of several instances where it is difficult for us to decide whether it is best to harvest our grain on the green order or give it time to ripen.

The experiment which we shall tell you about solves this problem to a fair degree. Therefore, if we but stop to consider, we can readily see that this is of great importance for us to know. The average farmer seldom realizes how much grain is lost by not harvesting in the right stage of maturity. Just for an illustration: Should wheat weigh two pounds more per bushel harvested in one stage as compared to that harvested in another stage, we would have one bushel extra for every thirty bushels we sell. If we had thirty acres of wheat, yielding fifteen bushels to the acre, we would have fifteen bushels extra, or equivalent to an extra acre of grain.

To determine the difference in yield, we weighed a sample containing 1000 kernels each of these three varieties of grain which was cut in three different stages of maturity. They were cut in the green neck stage, the yellow neck stage and the dead ripe stage. In the green neck stage, the grain had filled out, and the top kernels had turned a little ripe, but the neck of the straw just below the head was still green. In the yellow neck stage, the neck or the stem had turned yellow, but the entire plant had not turned. In the dead ripe stage, the entire plant had turned. After cutting, all plants were uniformly dried in a shed and 1000 kernels from each stage of cutting were weighed on an analytical balance. In 1922 and 1923 the same experiments were carried on. The grains were harvested at the same three stages of maturity, but instead of being hand cut and dried in a shed, they were cut by the binder and shocked and threshed in the usual manner. All varieties of oats weighed less in the green neck stage than in the ripe stage. In only two out of five varieties did the ripe oats weigh more than the yellow neck stage. An average loss of 26% occurred when cut in the green neck stage.

More variation occurred among the wheat varieties. In all varieties, the grain cut in the green neck stage weighed less than that cut in the yellow neck stage. In four out of five varieties, the grain cut in the yellow neck stage weighed less than the grain cut in the dead ripe stage.

It is possible that other factors not yet determined are influencing the results. It has also been impossible to estimate the percentage of loss by shattering that would occur under ordinary farm conditions. It is entirely possible that loss by shattering of dead ripe grain would more than equal the small percentage of increase from cutting in the dead ripe stage as compared to that cut in the yellow neck stage as was shown in the experiment by some varieties. In 1926, the results were very much different, due to the weather conditions, and to the rust which affected the wheat in particular.

The wheat which was cut in the dead ripe stage weighed 19.6% less than that which was cut in the green neck stage, while that which was cut in the yellow neck stage weighed 8.9% more than that cut in the green neck stage. The wheat which was cut in the dead ripe stage weighed 31.4% less than that cut in the yellow neck stage. This proved that in case rust should attack the grain, it is better to cut it a little before it becomes fully mature. In this case, the grain cut in the yellow neck stage weighed the most. Whenever grain rusts, it only loses in weight while ripening.

In the oats, there was very little difference to be noticed. That which was cut in the dead ripe stage weighed 2.65% more than that which was cut in the green neck stage. That which was cut in the yellow neck stage weighed 1.42% more than that which was cut in the green neck stage. That which was cut in the dead ripe stage weighed 1.27% more than that cut in the yellow neck stage.

In the barley cut, there was little difference of any importance. The barley cut in the dead ripe stage weighed 2.67% more than that cut in the green neck stage. That which was cut in the yellow neck stage weighed 2.9% (almost 3%) more than that cut in the green neck stage. That which was cut in the dead ripe stage weighed only 1/3% less than that cut in the yellow neck stage.

The main points to remember are:

1. If wheat should rust, be sure and harvest it in the green neck stage.

2. If oats and barley should show tendencies to lodge, harvest in green order. Never risk securing higher yields.

The following experiments have been tried out three times at the Northwest Experiment Station in 1922, 1923 and 1926. There is, however, considerable variation in the results from the three experiments. This was chiefly caused by the difference in weather conditions during the season.

The varieties used in this year's experiment were Marquis wheat, Gopher oats, and Minn. 184 barley. In the experiment three years ago, the same varietties were used. Several others of less importance were also used then.

For wheat, the average increased weight of grain cut when ripe as compared with that cut in the green neck stage was 2.8%. The average increased weight of grain cut in the yellow neck stage as compared with that cut in the green neck stage was 13.3%.

This year was the first time barley was included in this experiment so we have no definite result for barley.

For oats, the average increased weight of grain cut ripe as that compared with the green neck stage was 1.32%. The average increased weight of grain cut in the yellow neck stage as that compared with the green neck stage was 1.21%. The average increased weight of grain cut at maturity as that compared with the yellow neck stage was 7.13%.

We shall now tell you of the results with other varieties that were used in 1922 and 1923. For Marquis wheat, the average increased weight of grain cut ripe as compared with the green neck stage was 34.9%. In 1922 the increased weight of grain cut in the yellow neck stage as compared with that cut in the green neck stage was 17.7%. The same year the increased weight of grain cut at maturity as compared with that cut in the yellow neck stage was 9.1%. For Mindum and Durham, the average increased weight of grain cut ripe as compared with that cut green was 17.3%. The average increased weight of grain cut in the yellow neck stage as compared with that cut green was 17.8%. The average increased weight of grain cut at maturity as that compared with the yellow neck stage was 2.7%. In the Ruby and Kota wheats, the average increased weight of grain cut ripe as compared with that cut green was 18.6%. The average increased weight of grain cut in the yellow neck stage as compared with that cut in the green neck stage was 14%. The average increased weight of grain cut ripe as compared with that cut in the yellow neck stage was 4.8%.

In the oats varieties the Improved Legowa or Minn. #281 increased in weight 38.% when cut ripe as that compared with the green neck stage. The increased weight of grain cut in the yellow neck stage as compared with that cut in the green neck stage was 32.9%. The increased weight of grain cut at maturity as compared with that cut in the yellow neck stage was 7.3%. In the Victory, Scottish Chief, Swedish Select and Gopher oats, the increased weight of grain cut ripe as compared with the green neck stage was 26.7%.

The increased weight of grain cut in the yellow neck stage as compared with that cut green was 26.6%. The increased weight of grain cut at maturity as compared with that cut in the yellow neck stage was 4.1%.

With these figures, I have proved that there is a noticeable outstanding difference in the yield of grain cut in their different stages of maturity. Just by looking at a sample of grain, you will be able to notice only a very little difference. There may, however, arise difficulties in the way of being able to harvest your grain at the right stage. If this should be the case, be sure to harvest it in as nearly the proper stage as possible, which is between the yellow neck stage and the ripe stage. Never allow your grain to become over ripe because the loss by shattering will be far greater than the increased percentage of weight gained in cutting grain at the ripe stage, as compared with the yellow neck stage.

SELF-FERTILIZATION OF SEED CORN

Alfred Erickson '27

The Methods of Seed Production

After obtaining the better variety for the locality, the seed grower has the problem of keeping this variety in the same high state of production and, if possible, of improving it.

Farm crops may be placed in four groups according to their modes of reproduction.

The first group generally includes self-fertilized crops consisting of barley, wheat, oats, peas, beans, flax, and tobacco.

The second group are often cross-pollinated, consisting of corn, rye, most grasses, and root crops.

The third group (cross-pollinated-obligatory) consist of red clover and sunflower.

The fourth group (vegetatively propagated) includes potatoes, sugar cane, and sweet potatoes.

Among farm crops the production of seed generally depends on a union of the male reproductive cell, contained in the pollen grain, with the female reproductive cell (the egg cell). The pollen grains of corn are produced in the tassel and each thread of silk leads to an ovary which contains the egg cell. In order to produce seed, the male reproductive cell must pass down through the silk and unite with the female cell. This process is called fertilization. If pollen and silk are borne by the same plant, the process is called self-fertilization, and if by different plants, cross-fertilization. As the egg cell and the pollen grain of self-fertilized plants are, as a rule, alike in their inherited characteristics, the progeny of a single self-fertilized plant, such as barley, wheat, or oats, have the same inheritance. There is, of course, considerable variation in all characters, owing to environmental effect but all evidence shows that these differences are not truly inherited. Occasional crosses occur in self-fertilized crops which cause inheritable variability.

<u>Seed growers' methods for self-fertilized plants</u>: The grower can, as a rule, obtain a pedigreed strain which is nearly adapted to his conditions. The only thing that he can do with this variety is to save seed in such a way that mixtures of other strains or occasional crosses are eliminated, together with obnoxious weed seeds and diseases. The strain in question can be kept in a pure condition for its characters, and if it is not entirely pure at the outset, a correct method of seed selection will tend to purify it and thus increase its value.

The work for self-fertilized crops is very simple as compared with the production of improved seed of cross-fertilized crops or the production of highly bred livestock.

The actual methods employed by the plant breeder vary, of course, with the crop used and the plant desired. One could not begin to explain even in a general way these methods for all crops. One, however, of increasing interest is the method now employed in producing new varieties of corn. As you, of course, know, the production of a kernel of corn upon a cob is the result of a grain of pollen falling upon a silk and fertilizing it. Each kernel is the result of the union of a grain of pollen and the egg cell found in the silk. In corn, the pollen is produced in the tassel while the silks are produced upon the ear. It is very evident then that in a corn field not every silk would be fertilized by pollen from the same plant. On the contrary, the pollen of several plants blown about by the wind might fall upon a single ear. As a matter of fact, this is just what occurs. Very few kernels are self-fertilized; that is, produced from the pollen of the same plant.

Since all individual plants in a corn field are not desirable, it follows that many undesirable characters are continually propagated and an ear of corn that might score 99 in a corn show, when planted, would produce plants showing the defects of the father plants. So in the new method of producing corn varieties, inbreeding is practised. Instead of crossing two varieties as in wheat, oats and barley which are self-fertilized, one variety is continually inbred until pure. This is done by placing paper sacks over both tassel and ear before any pollen is formed. When the silks appear on the ear, the sacks are momentarily removed and the pollen dusted upon those silks and the ear recovered with the sack.

The object of self-fertilizing is to exclude pollen from other plants, confining the inheritance of the selected plant to that particular individual. These selected, self-fertilized ears are harvested when ripe and each is given a number.

The next year a separate row is planted from each ear. Each row is a family of plants all from one mother ear. The plants in each of these ear rows are studied and notes taken during the growing season as to their vigor, color, height of growth, lodging, etc. At harvest time, the row is harvested and the yield of each row weighed. Before harvest, however, five of the best plants in each row are capped with bags and self-fertilized as was done the year before. The ears from these plants planted in ear rows again the following year.

After about five or six years of this method, the varieties usually become pure and distinctly exhibit their inherited characters.

The corn seed grower faces another difficulty which the small grain seed producer does not have to consider. With small grains - barley, oats and wheat - purity for all characters is the general rule. This has led the corn breeder also to attempt to obtain purity of type. Carefully controlled investigations have served to show a possible fallacy in this practice. The report of a recent study at the Minnesota Station, which contains experimental evidence together with a review of other experiments in relation to score card characters and yield, show no correlations between individual characters, such as trueness to the ideal score card ear type and subsequent yield of these ears.

Artificial self-fertilization in corn isolates homologous types which are less vigorous than normally cross-pollinated plants. All other evidence seems to show that too close a purity of type corn tends to a reduction in vigor.

The grower should, of course, produce corn of one variety which is pure, judged by easily evident characters, such as color of seed and cob-abnormalities (very large butts, badly flattened cobs, or very irregularly rowed ears), which should not be used as foundation stock.

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Aside from these, there is no need of paying much attention to type. Ability of a variety to mature under the conditions is very important and needs much attention.

VARIETY AND HISTORY OF ALFALFA

Randolph Ostlie '27
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Randolph Ostlie '27

The reason why the alfalfa has been chosen as the subject for discussion in this thesis is that it is interesting and valuable for one to know something about the history and varieties of alfalfa.

As we all know, alfalfa is one of the most important forage crops grown on the farm. It is probably one of the oldest cultivated forage crops in the world. It is known that many years before the birth of Christ, alfalfa grew spontaneously in the high dry regions of Asia and around along the coast of the Mediterranean Sea. It is mentioned in connection with such countries as Persia, Asia Minor, Afghanistan, Beluchistan, and other countries of Asia. According to Pliny, alfalfa was introduced into Greece from Media as Persia was called in those days. It is thought that happened at the time of the Persian wars which were fought at about 470 B. C. This statement is based on the authority of Greek writers of agriculture. Therefore from these facts we can see that alfalfa is among the oldest of cultivated forage crop plants, and it is the only plant cultivated solely for forage in countries of the east. That alfalfa was a cultivated crop in the daysof the Roman Empire, is a fact which can be proved because it is often referred to by Varro and Virgil who are known writers on ancient agricultural topics. Alfalfa was doubtlessly introduced into Spain in the Imperial Roman days. It is said that during the dark ages alfalfa, or lucern, as it is called in some countries, became practically extinct in Italy. It was later introduced back into Italy, from Spain where the Moors, who were great admirers of the plant, had kept it alive. The Romans highly esteemed alfalfa as a forage for their army horses and its cultivation in Italy is maintained to this day. Many people who think alfalfa is a new plant would be surprised to know that such old time agricultural authorities as Columella, Jethro Tull and Varro were familiar with the growing and raising of this plant. Varro, in his book on Roman Farm Management, says that of all legumes alfalfa is the best because when once sown it lasts ten years; it can be mowed four and even six times a year; it improves the soil and all lean cattle grow fat by feeding upon it. In the sixteenth century writers tell of the introduction of the alfalfa plant into the countries of France and Germany. It is possible that it was introduced into England as early as 1650. In England, alfalfa was neglected for many years. In 1765 a farmer in Kent had fourteen acres and it is said that he thought it good feed for the cows because it increased the milk flow. Other men, who were thought to be authorities on the subject, said that cattle were likely to become tired of alfalfa and refuse to eat it. It is known that alfalfa never became as popular in northern Europe as farther south.

The name "alfalfa" is not used in all countries. Lucern is the common name used in countries other than the United States. According to some authorities the name Lucern is derived from the word Lucerna; the name of a valley in northwestern Italy. Other men think that lucern probably comes from its local name in southern France, Laouzerdo. The word luzerne was first recorded in 1587. Also another form was given at the same time; namely, luzert. Alfalfa is a name originating in Arabia but adopted and modified by the Spaniard. The Arabian word is spelled and pronounced in various ways. Fisfisat, isfast, alfalfa, and alfasafat are some Arabian names which are probably modifications of the Persian names uspust and isfast. Medick, another name for alfalfa is derived directly from the Greek Medicai, and Latin Medica, probably because the plant was introduced from Media as Persia was called in those days. Purple Medick is ordinary alfalfa while yellow medick is sickle alfalfa, but none of these varieties are grown as far north as here.

Alfalfa early found its way to the American continents. When the Spaniards invaded Mexico, they brought with them the alfalfa plant. Also when Spain took over the lands of the Incas indians, alfalfa found its way to South America. That this is true can be proved by the fact that alfalfa can be found growing wild over large areas of land in South America. We know that alfalfa is drought resistant, and it is thought that South America is the place where the plant acquired this characteristic, or at least helped to develop it more strongly. Varro, in his book on Roman Farm Management, says that alfalfa should not be planted in soil too dry and not where it is too wet, but we know now that alfalfa will grow in many places where other crops have failed because of drought. In 1854 alfalfa was introduced into California from Chile. In California and other states that practice irrigation, alfalfa flourishes today as perhaps in no other place of the world. The plant rapidly spread throughout the western states and as we now know, it is a favorite forage almost all over the United States. It has been discovered that by careful management alfalfa can be grown successfully in more humid areas but seems to thrive best where there is less humidity in the soil. Eastward from the pacific was not the only way in which alfalfa spread eastward. As early as 1820, which was years before it reached California, alfalfa was being grown in the state of New York. Farmers in the east however, did not seem to appreciate alfalfa as much as they have come to do in later years. It is interesting to know these facts because so many people think of alfalfa as a new plant but we know that it isn't new.

VARIETY AND HISTORY OF ALFALFA

Selmer Harstad '27
Randolph Ostlie '27

Selmer Harstad '27

Although alfalfa has been grown for a few thousand years it is only within the last thirty years that varieties have been known commercially and only within the last twenty years they have been given any serious attention.

After alfalfa was introduced into various parts of the United States there developed an interest in varieties and strains for different soil and climatic conditions. One variety grew successfully in one part of the county but failed in another part, therefore, a great many distinct varieties have been developed. Some of these varieties succeed best in the cold north and northwest while others succeed only in the south or southwest where the winters are mild.

Unitl the last five or ten years very little has been done on the part of man in developing new varieties. Most varieties have been developed through natural crosses and natural selection.

There are five groups of commercial alfalfas in this country. They are the common, Turkestan, nonhardy, yellow-flowered, and variegated.

The common group has tall erect smooth plants with purple flowers. There are many different strains of this group grown throughout the south and southwestern part of the United States.

The Turkestan group includes all alfalfas that have originated in Turkestan. The plants of this group are shorter, more spreading in growth, and more hairy than the common alfalfa. All strains of Turkestan are sold as one variety.

The non-hardy group is of little importance in this part of the country because it will not stand the cold climate.

The yellow flowered group includes various forms of yellow-flowered plants. The greatest importance of this group is crossing with the common alfalfa in originating new variegated varieties.

The variegated group is the most important. It includes the alfalfas that have originated from a cross between the common and the yellow flowered alfalfas.

The varieties I will discuss are: Grimm, Cossack, Canadian variegated, Baltic, Common, and Macsel.

Grimm alfalfa was introduced into

Minnesota in 1857 by Waldelin Grimm. At first many of his plants winter-killed but he kept on seeding year after year and by taking seed from the plants that survived the severe winters, he succeeded in developing a very hardy variety. No variety has yet excelled it in hardiness, and only common alfalfa has excelled it in yield of seed and forage. Grimm looks like common alfalfa except that there is a greater variation in size and shape of plants and color of flowers. Most flowers are purple, but some are greenish, some smoky, or blackish, and a few plants have yellow flowers.

Cossack alfalfa was procured by Hansen of the United States Department of Agriculture from Russia in 1907. This variety has proved to be about equal to Grimm in both hardiness and yield of seed and forage. The plant resembles Grimm in both habit of growth and color of flowers.

The Canadian variegated is also very similar to Grimm. This variety was developed in Canada and its hardiness is mostly due to being grown so far north. It compares very well with the other variegated varieties in yield of seed and forage but various tests have shown it to be less hardy.

Very little is known about the origination of Baltic alfalfa but it resembles Grimm very much and has without doubt been developed the same way and owes its hardiness to the same causes. Comparative tests have shown very little difference in the hardiness and yield of Baltic and Grimm.

The common alfalfa was introduced to this country from different parts of Europe. This variety has more erect plants than the variegated varieties, and all the flowers are purple. It outyields the variegated varieties in both seed and forage but it is less hardy. There is a greater amount of common alfalfa seed available which makes the seed cheaper, so farther south where it will not winterkill, it is advisable to grow common alfalfa.

The Manitoba Agricultural College has recently developed a new variety from a cross between alfalfa and Black Medick. This variety is called Macsel. Not very much is known about it yet but it appears to be quite hardy. The first comparative test with other varieties is not yet complete but it seems to give a high yield of both seed and forage and the forage is of exceptionally high feeding value due to the large amount of leaves.

WEATHER FACTS AND REPORTS

Elmer Hedstrand '27
Ole Breivold '27

Elmer Hedstrand '27

We are always in contact with weather conditions and are concerned with them to a large degree. Our success, especially for those of us who produce farm products, depends largely or wholly on what kind of weather we have and at what time. We are very ignorant about weather predictions and forecasts. Many times we could save a great deal of time and money if we knew a little about how to predict weather.

After a thorough understanding of the relative values of the factors determining weather in any region has been gained it is possible to predict quite accurately the changes likely to occur. Every observer is familiar with the daily and seasonal changes of temperature; also with the fact that there are other almost equal changes that are irregular in their occurance.

There are two distinct classes of weather signs. The first is based on century-long observations by those whose occupations have led them to observe closely weather changes. The second class includes a mass of superstitions that have been observed and transmitted. The signs of the first class are known as weather proverbs. One proverb that has become quite important, especially in regions of cyclonic storms is, "Rainbow in the morning, sailor's warming; rainbow at night, sailor's delight." This holds true to some extent in our locality also. Another proverb is, "An evening gray and morning red will send the shepherd wet to bed".

Some superstitions that come under the second class become well known as signs. One that seems to be important is that if a dog or cat eats grass it is a sign of rain and miserable weather.

Some predictions obtained by observers of clouds and sky are as follows: Soft looking clouds foretell fine weather, while hard edged clouds are a sure sign of wind; small inky looking clouds foretell rain; a bright yellow sky at sunset is followed by wind and a pale yellow is followed by wet weather; a rosy sky at sunset is a sign of fine weather; a dark red sky at sunset and a red sky in the morning are both indications of wind and rain, while a gray sky in the morning is a sign of fine weather; when you see a "high dawn" look out for wind. A "high dawn" is when the first indications of daylight are seen above a bank of clouds. A "low dawn" is when the day breaks on or near the horizon, the first streaks of light being very low down.

We get some idea of weather changes by using a barometer. It works on the principle of atmospheric pressure. This pressure varies accordingly as the air is dry or full of moisture, warm or cold, etc. If the air is light, as it is when warm and free from moisture, the column of mercury falls, and if the air is heavy, it rises. A good way to get an understanding of the barometer is to study the simple mercury barometer. It consists essentially of a glass tube at least thirty-four inches long, closed at one end, filled with mercury, and placed vertically, open end down, in a dish of mercury. The tube is graduated in some linear unit, as the millimeter or tenth of an inch, the surface of the mercury in the cisterm being the zero of the scale. The mercury sinks in the tube, leaving a few inches of the upper end of the tube a vacuum: that is, with no air pressure on the mercury column. The column of mercury is held up by the pressure of the air upon the open surface of mercury in the cistern. When this pressure increases the mercury rises in the tube, and when it decreases the mercury sinks.

The other, and most commonly used type of barometer is the aneroid or non-liquid. It consists of a pile of hollow metallic discs from which the air is exhausted and to which an index is attached.

The stormograph or self-recording barometer gives a continuous record of weather conditions, tracing them by means of a pen on a chart which is wound around a rotating clock drum. These charts are divided into the days of the week and sub-divided into two-hour spaces, so that the behavior of the barometer for any preceding time is noted.

With the ordinary barometer quick changes are apt to occur which are not noted by the observer. These quick changes mean passing storms, and are all registered ahead on the stormograph. By consulting the record it is easy to see whether the change has been gradual or rapid and therefore the instrument is to be greatly preferred in all respects to those of the ordinary registering variety.

To get any good from the use of the barometer one will have to know the general indications:

I. Indications of rising barometer

1. A gradual but steady rise indicates settled fair weather.
2. A very slow rise from a low point is usually associated with high winds and dry weather.
3. A rapid rise indicates clear weather and high winds.

II. Indications of falling barometer

1. A gradual but steady fall indicates unsettled or wet weather.
2. A very slow fall from a high point is usually connected with wet and unpleasant weather without much wind.
3. A sudden fall indicates a sudden shower, or high winds, or both.

A study of the weather would not be complete without some knowledge of the thermometer.

A Hollander by the name of Drebbel invented the thermometer in 1593. It was just merely a glass tube containing air and water to indicate changes and differences in temperature. From that time until the present time, improvements have been made until now we have a very accurately scaled thermometer which contains quicksilver or sometimes colored alcohol. For very high temperatures quick silver is used because it will not boil until it reaches 674.6° fahrenheit. For very low temperatures alcohol is used for it will not freeze until 202.9° below zero is reached.

There are three types of thermometers: namely, Fahrenheit, Centigrade, and Beaumer. Of these the fahrenheit is most commonly used while the centigrade is used extensively in chemistry.

We also have two classes of thermometers which are independent of type. They are the maximum and the minimum. Their purpose is to indicate the highest or the lowest points that the alcohol or quicksilver reached during a given period that the observer was not present.

The maximum thermometer is similar to the ordinary thermometer except that the base is very fine, being just wide enough to allow the expanding liquid to press through, but too narrow for the liquid to pass back by its own weight as the temperature falls. Thus the thermometer indicates the highest temperature attained. An example of the maximum thermometer is the clinical thermometer used by physicians. The instrument must be jarred to get the column down again.

The minimum thermometer contains a short double-headed pin. The heads of the pin are slightly smaller than the bore, in order that the alcohol may pass by the pin. The tube should be placed horizontally or slightly in an incline position so that gravity cannot pull the pin down the tube, but when gravity is assisted by the surface tension of the liquid, the pin is pulled down the tube. When, with rising temperature, the liquid column begins to lengthen it passes over and by the pin but cannot push the pin against gravity up the tube. The upper end of the pin thus registers the lowest or minimum temperature attained. To set the instrument for registering a new minimum, the thermometer is held bulb upward until the pin sinks through the liquid to the end of the column.

WEATHER FACTS AND REPORTS

Elmer Hedstrand '27
Ole Breivold '27

Ole Breivold '27

My team mate has already told you about the kinds and uses of barometers and thermometers, and I shall take a little time to discuss rain guages and the measurement of rainfall. It may be interesting to know that rain guages are traced back to the 15th century. In the historical records of Korea, rain guages are mentioned during the 24th year of the reign of King Sejo, who ordered constructed a bronze instrument to measure the rainfall. It consisted of a vase resting on a stone base and was placed near the observatory of Taiko. Reports of the depth of the rainfall were sent to the King.

I shall discuss the two most important rain guages that are in use at the present time. The official Meteoralogical office rain guage consists of a copper can and removable funnel combined 18½ inches high fitted with a sharp bevelled brass collar at the top. The funnel terminates in a brass tube about 5½ inches long, which is introduced into a bottle deisgned to collect the rain. This bottle is divided to three inches in half inches so a rapid estimate can be taken if desired. To accurately determine the fall the water from the bottle is poured into a measuring glass of improved form and which is divided into hundredths of an inch. The bottom is designed as a cone, the division being sub-divided to two one-hundredths of an inch. The Electrical Tipping Rain Guages have a small bucket below the funnel which tips after having received 1-100 of an inch of rain. The amount of rainfall is measured by the number of tips which are electrically recorded any reasonable distance away.

The place for setting a rain guage is of great importance. It should be placed out in the open, a considerable distance from buildings and trees. Best results are obtained by placing it about twelve or fifteen inches above the ground, depending to a large extent upon the style of the instrument. Some arrangement should be made to protect the guage from wind. A satisfactory protection is a fence about three feet tall set at a distance of about three feet from the guage. When snow is being measured a place should be selected which shows no sign of drifting, then invert the rain guage, pressing it downward until the earth is reached. By turning it gently it will be found possible to lift up the snow in the circumference of the guage. As snow is uncertain to measure, it is well to take three or four samples and obtain an average rather than to accept any one result.

The next thing we shall discuss this morning is weather facts concerning the Red River Valley. Climate affects man in many ways; his housing, clothing, food, occupation, and manner of living are more or less determined by the climate in which he lives. The greatest part of man's food is derived directly or indirectly from the products of the soil and these are affected by climatic conditions. Climate is one of the main factors that determine what crops can be grown in a district. Soil fertility and suitability are important factors but they are of secondary importance, since fertility would avail little were the climate unfavoable.

We are fortunate in having a cool climate in the Red River Valley which enables us to raise splendid cereals such as wheat, oats, and barley. My team mate and I have made a study of weather statistics extended over a period of years. It has been our aim to pick out the different things that may be of interest concerning the weather in the Red River Valley.

By studying the weather chart over a period of ten years we find that the first and latter part of each month has the least precipitation. It may be of great interest to know just exactly which days thru the period of years show the least precipitation.

By taking the three months namely: May, June, July during a period of ten years, the 25th shows the least precipitation, seven years out of ten no rain occurred on the 25th and by studying each individual month we find that during the ten years period June 29 has a perfect record with no rain. From this study no doubt but that the 29th of June would be an ideal day for public gatherings.

The statement is often made that a wet year is followed by a dry year. By studying the state's statistics over a period of 25 years we find that this will not hold true.

The question is often asked, "Is the growing season in the Red River Valley becoming longer or shorter?" By studying the weather statistics we find that the growing season has increased six days which means a lot towards the success of a crop. We figured this out by taking a five year average from 1900-04 comparing this with a five year average from 1920-24.

It may also be of interest to know the number of clear days and the number of days with rain or snow throughout the year. By taking a ten year average from 1917 to 1925 we have 84 days with rain or snow, and 174 clear days, with the remaining days cloudy. There is a great variation in the number of days with rain or snow; for example, in 1917 we had 58 days with rain or snow compared to 116 in 1925. This shows exactly double the amount.

We may have been wondering whether the Red River Valley climate is getting colder or warmer. It is interesting to note that over a period of years very little change has taken place. We have taken a five year average from 1911 to 1915. The average temperature was 41.3. Comparing this with a five year average from 1922 to 1926 there is a difference of only 2/10%. We also find that the precipitation is decreasing. We have obtained this fact by taking a five year average from 1900 to 1904 which gives us an average precipitation of 23.42 inches. Comparing this with a five year average from 1922 to 1926 with an average precipitation of 20.23 the difference between these two averages are 3.19 in which shows that the precipitation has decreased these last years.

FARM ENGINEERING

GAS ENGINE IGNITION

Orlando Rudser '27
Ivan Suchomel '27

Ivan Suchomel '27

Many people think that electricity is very complicated but when explained it is very easily understood. I shall name, explain and demonstrate the different kinds of ignition systems. All the different kinds of ignition systems that are used come under one of these types.

First there are a few electrical terms I would like to explain to you.

The first term is amperes or amps. The number of amperes of current flowing in a circuit are the same as the number of gallons of water flowing through a pipe. That is, ampere is the unit of measure of electricity. The more amperes in a current the stronger and more deadly it is.

Voltage is the pressure of a flow of current in a given circuit. It may be likened to the pressure that forces the water through a pipe. The more pressure the current has the faster it will flow. However, this does not increase the power of the current. That is why a person can take hold of a spark plug wire with twenty thousand volts but with very little amperage and not get injured, while if he touched a wire with one hundred and ten volts but with a high amperage, he might be killed.

Ohm is the resistance to the flow of an electric current in a circuit. That is the tendency a wire has to stop the current from going through.

Circuit electricity has to have a complete path to flow through or else it is not effective. Such a path is called a closed circuit.

An open circuit is where the path has been broken at any one point.

A short circuit is where the path is broken so that the current can return to its starting point without traveling the entire course.

Electricity is generated chemically by a battery and mechanically by a generator. This dry cell has .064 ohms resistance, 25 amperes and one and one-half volts of electricity. This can be readily tested by means of a voltmeter and ammeter. If a person wants more voltage and amperage, he can wire a group of batteries in such a matter.

This storage battery has six volts and

one hundred amperes and .256 ohms resistance.

Any ignition system has to have a source of current or a coil and a set of points over which that current has to travel in order to ignite the charge. The source of a current can be either a set of batteries or a magneto. The mechanical means of generating a current is by a magneto or generator.

The Coils and Breaker Points

There are several kinds of coils. One is the common induction coil around which all the other coils are based. This coil is simply a soft iron core, with about two hundred turns of insulated wire wrapped around it. To make this coil more convenient to handle, they put it in a tin box and set it in tar with the terminals on top. This type is used on the make and break ignition system. The current flowing through magnitizes the core and increases the voltage from six to twenty volts.

A storage battery has two polls and on each poll a wire is fastened. When these wires are put together very slowly, very little spark occurs. If they are scratched or rubbed against each other very quickly, there is a strong spark produced. This is the way the breaker points on a stationary engine operate.

The make and break igniter consists of a stationary electrode and a movable electrode. The stationary electrode is insulated from the movable electrode. The only place the current can connect is at the points.

The movable electrode is operated by a cam as the exhaust valve is operated. As the spark is needed only once during two revolutions of the crank shaft, the cam is attached to a half-timed shaft. The movable electrode is operated by a rod called the tappet rod. The stationary electrode is insulated from the movable electrode with mica. One wire of the current is connected to this electrode.

When the two points are in contact, the current flows from the positive poll of the battery by a wire to the common induction coil, through the switch, to the stationary electrode, then to the movable electrode, because the two are in contact, and back to the batter by the ground.

To produce a hotter spark, one of the wires is connected to the common induction coil. This coil increases the voltage from six to twenty times which I have explained before.

A hot spark ignited the gas much easier than a small spark and therefore the hotter the spark, the better.

One of the wires are fasted to the ground and the other to the stationary electrode. When these points are put together very slowly, they produce very little spark. To make a large spark, we use the common induction coil. With this coil and a strong spring on the igniter, we are able to produce the largest spark which we can get.

GAS ENGINE IGNITION

Orlando Rudser '27
Ivan Suchomel '27

Orlando Rudser '27

The ignition system which I am going to wire up and explain uses a three point vibrating coil to increase the voltage of the current. This is necessary in order that the current will have enough strength to jump across the points of the spark plug.

This type of a coil will increase the voltage of a current from six to twenty thousand volts. However, as the amperage will not be increased, the current will not hurt a person other than giving him a shock.

This type of a coil is used on all the Ford cars and tractors. This type in a modified form is also used on all the other makes of cars, the only difference being in the method this type of coil uses in breaking the low tension or primary circuit.

The parts of a spark coil are the points, a condenser, a soft iron core, the low tension windings, the high tension windings and the safety gap.

The soft iron core and low tension windings used in this coil are the same as the core and windings of a common induction coil.

About two hundred turns of insulated wire are wrapped around a bundle of wires. When one end of the insulated wire is connected to one poll of the battery and the other end is connected to the other poll of the battery, the current passing through the insulated wire causes the iron core to become magnetized. As can be seen, the core holds its magnetism as long as there is a current flowing through the wires. It loses its magnetism as soon as the current is released, though a soft iron core is used instead of a steel core because it becomes magnetized very quickly when a current is applied and because it loses its magnetism very quickly when the current is cut off.

This principle is used to make and break the circuit. The core is located immediately below and perpendicular to the lówer vibrating point.

The points on a coil are made in two parts. The upper part is called the bridge and the lower part, the vibrating point. The only place that they touch or make a contact is at the points. When the points are held apart, no current can flow between them. When they are allowed to come together, there is a closed circuit and the electricity flows readily through them.

The points are made of platinum, in order that they can resist heat and also that they will not stick together when hot. The purpose of the points on the spark coil is to rapidly break the circuit on the low tension windings. This is accomplished in this manner: One end of the low tension wires is connected to the bottom point. A wire from the other point is connected to the source of current. Now the current comes in through the bottom wire, up through the low tension windings, up through the points and back to the battery again. This completes the low tension circuit.

As soon as the current is passed through the low tension windings, it magnetizes the core as has been shown. When this happens the magnetism of the core pulls down the lower vibrating point to the core but when this point is pulled down, there is not any current flowing through the circuit. Therefore, the iron core immediately loses its magnetism and the spring on the lower point touches the upper point again. It then closes the circuit again and a current is again passed through the low wires. Then the above process is repeated. This action goes on very rapidly.

The other important part of the coil is the high tension windings. This consists of about three thousand turns of very fine insulated wire wound around the low tension windings. There is a card board insulator between the high tension and the low tension wires so that there is not any connection between them.

When the current is broken in the low tension circuit by the vibration of the points, a current is set up or induced in the high tension wires of approximately twenty thousand volts. One of these wires from the high tension windings is run over to the spark plug and the other is run to the ground, or engine frame of the car. Therefore, the complete path of the high tension or secondary current is from the coil through one wire up to the spark plug, down through the points of the plug across to the ground and from the ground up to the high tension windings again, through the other wire.

In the Ford or three point vibrating coil, one high and one low tension wire is connected together.

In this Ford coil, the current is connected to the bottom terminal and to the upper terminal on the side. The two high tension terminals are the two on the side.

The principal parts of the ignition system, I am going to wire up and explain are the timer, the dour coils, a source of current, and the cylinder head with the spark plugs. This system is used on the Ford car and Fordson tractor exclusively.

The source of the current in this demonstration is going to be a storage battery. One pole of the battery is grounded to the car frame, as this wire is connecting the timer and cylinder head together. The other pole of the battery is connected to one low tension terminal on the coils. In this case, all the corresponding low tension terminals on the four coils are connected together to the batter. The other low tension terminal is connected to one of the timer points. These points are insulated from the body or the shell of the timer.

The brush of the timer is connected to the ground so that the only way a current can flow through the primary circuit is when the timer brush is making a contact with that point. When this is done, the coil starts to vibrate and a high tension current is induced, which in turn is transmitted to the spark plug wires, where it ignites the charge in the cylinders.

The brush is timed so that it makes a contact when the charge of gas in the motor is compressed ready to be exploded.

Some people think that a motor fires in the one, two, three, four order but this is not so, the only two possible firing orders of a four cylinder motor being one, three, four, two, or one, two, four, three. That is, the first cylinder fires, then the second cylinder, then the fourth cylinder and then the third cylinder. This is the firing order of the Ford car and Fordson tractor, and is the order in which I am going to wire up these coils.

The first wire will go from No. 1 terminal on the timer to No. 1 terminal on the coil. The high tension wire from No. 1 coil will go from No. 1 coil to No. 1 spark plug. The wire from timer terminal No. 2 will go to the low tension terminal on No. 2 coil. The high tension wire from this coil will go to No. 2 spark plug. The wire from timer terminal No. 3 will go to the low tension terminal on No.4 coil. The reason is that No. 4 cylinder is to be fired next. The high tension wire from No. 4 coil goes to No. 4 spark plug. The wire from No.4 timer terminal goes to the low tension terminal on No. 3 coil. Then the high tension wire goes over to No. 3 spark plug.

When the brush rotates, it first causes No. 1 coil to vibrate, then No. 2 coil to vibrate, then No. 4 coil to vibrate, and lastly No. 3 to vibrate.

These coils in turn induce the high tension currents, which cause the various cylinders to be ignited, thereby casing the motor to run.

MOTOR OILS

Donald Spong '27
Maurice Lillo '27

At first our thesis may seem to have little relation to farming; but if you consider the oil that is now being used on the farm for cars, tractors, trucks, and gas engines, you see that it would be of great importance to the farmer to know the different grades of oil, and also the methods of testing them.

A very common method that farmers or inexperienced men use to test oil is to place a small amount of it between their fingers and feel of it. Unfortunately, this is not a reliable method of testing oil. This was shown by a little incident which happened at Fargo, North Dakota a few years ago. The J. I. Case Threshing Machine Company put on a Short Course in gasoline engineering which was attended by farmers from the surrounding communities. The instructor asked if there was anybody there that thought he could tell the different grades of oil by feeling of it, and one fellow raised his hand. The instructor gave him three samples of oil to test. One was a heavy oil, one a light oil and the other was molasses. The farmer felt of all three samples and picked out the molasses as being the best oil. You can imagine what would happen if you used molasses in your car or tractor for lubricating oil.

A good lubricating oil should do three things. It should seal compression; it should carry off heat, and it should prevent friction. In order to seal compression, the oil should maintain a film of oil between the piston, and the cylinder wall, in such a way, that when the charge explodes in the cylinder none of the gases will be permitted to escape between the cylinder wall and the piston and down into the crankcase. To carry off heat, an oil must be a good conductor of heat. It must allow the heat from the explosion to pass from the piston through the film of oil to the cylinder wall and from there into the water. In order to prevent friction, an oil must form a protective film between the bearing surfaces. This will be explained later.

The generally accepted conditions of a good lubricating oil are:

(1) The oil should have body enough to prevent the surfaces to which it is applied from

coming in contact with each other. If a moving surface comes in contact with another surfact and there is no protective film between them, friction will result as there is no surfact that is perfectly true and smooth. For example: If you rub your hands vigorously together, friction will be the result, while if you put oil or soap and water on your hands, friction will be diminshed to a great extent as they would form a protective film between the two moving surfaces.

(2) An oil should be free from all corrosive acids of mineral, animal, or vegetable origin. Any of these compounds will attack metal and leave it in a roughened condition. Thus, if the oil you used in your car contained any compounds of that nature, the bearing surfaces would be ruined.

(3) An oil should be fluid as possible consistent with body. By this, we mean that an oil should flow freely enough to distribute itself to all working parts of a motor and still have body enough to maintain a film of oil on all bearing surfaces.

(4) High flash and burning points which are ascertained by the tests which we will conduct later.

(5) An oil should be free from all substances liable to produce gumming. By this we mean any substance that will oxidize and leave a gummy-like deposit on the bearing surfaces to which it is applied.

(6) An oil must not be thinned or vaporized by heat or thickened by cold. If an oil is easily thinned by heat, as soon as the motor becomes hot, the oil, being unable to stand heal, will be thinned and thus, it will be unable to seal compression and the motor will lose power. If the oil is easily vaporized, it will pass out the breather orfices of the motor and thus be lost. If an oil is easily thickened by cold, it will not circulate freely enough to properly lubricate the motor when it is used in cold weather. Thus, bearing surfaces will be come heated and ultimately ruined.

Three important tests determine the "fire test", the "flash test" and the "vapor test."

The vapor start of an oil is the lowest temperature at which vapors will start rising from an oil when heated.

The flash test is the lowest temperature at which the vapors will flash when a flame is quickly brought to the surface.

The fire test is the temperature at which the vapors will burn continually when a flame is quickly brought to the surface.

The vapor start of an oil is important because it shows whether or not an oil contains too much light oil. An oil with a low vapor start will be easily vaporized by the heat of the motor. These vapors will then pass off through the breathing orfices of the crankcase and thus be lost.

The flash test is important because it has a direct relation to the ability that an oil has to seal compression, or prevent friction. An oil with a high flash test is important as an oil with a low flash test is apt to flash when exposed to the intense operating temperature of the motor.

The fire test is of importance because it shows the ability that an oil has to prevent friction and seal compression. If an oil has a low fire test the protective film is liable to burn because of the intense heat under which it must operate.

The cold test determines the lowest temperature at which an oil will flow. It, however, is of little importance except when motors are used in cold weather.

The emulsification test is a simple but important test which will enable anyone to determine whether or not a certain oil is a good lubricant. A bottle is filled one-third full of water and one-third full of oil. This is shaken vigorously for thirty minutes and then set aside for twenty-four hours. Good oil shows a fine line of distinction between the oil and the water. If acids are present in the oil, a curd-like mass will be produced and the water will be milky-white in color. This test is important for, if the oil you used in your car contained acids, it would emulsify with the water formed by water vapor in the air condensing on the cold parts of the motor and flowing into the crankcase. Thus, the curd-like mass produced would have no value as a lubricant.

A paraffin base oil is preferred to an asphalt base oil. This is because acids are used in the refining process of all asphalt base oils and in quite a few instances, they have not been fully neutralized due to carelessness in the refining process.

ROPE WORK

Lawrence Spears '27
Carl Widseth '27

Lawrence Spears '27

Rope is defined as a large stout cord made of strands of fiber or wire, twisted or braided together.

Rope is made of three kinds of materials such as wire, leather, and vegetable fiber. As the farmer uses very little of the first two kinds of rope, we will confine ourselves to the latter kind.

There are three kinds of vegetable fibers: manila, sisal, and henequen. Manila is the superior fiber while sisal and henequen rank very near. It is hard to say which is the best, because a good grade sisal rope is superior to a poor grade henequen and a poor grade sisal is inferior to a good grade henequen. As has been mentioned before, manila fiber is superior to all other kinds for the purpose of making rope for farm use. It is also more expensive than sisal or henequen rope, however, and therefore less of it is used.

Manila fiber comes chiefly from the Philippine Islands. It is produced by a plant which closely resembles the banana tree. The leaves are cut off and then cut into strips a quarter of an inch in thickness. The strips are then pulled under a sharp steel blade which separates the pulp from the fiber. The fiber is then baled and shipped. The best grade of manila fiber is light buff in color, lustrous, fine, flexible, uniform in size, and from six to twelve feet in length. Poorer grades of this fiber are shorter and of a yellow color. This fiber can honestly be sold as pure manila, but it can easily be detected by a close inspection.

Sisal fiber is obtained from the leaves of a plant which is a native of Central America. It produces fiber from two and one-half feet to five feet in length, slightly yellowish in color, straight, and smooth. It is less flexible and more harsh than manila fiber. Next to manila, sisal makes a stronger and more flexible rope than any other moderately priced commercial fiber.

Henequen fiber is secured from a suckering plant growing chiefly in Cuba and Yucatan. The fiber is from cream white to yellow in color and is two and one-half to five feet in length. It is also somewhat stiffer than sisal but it is often quite hard to distinguish between the two.

After the fiber has been combed it is sent to the spinning machine. A number of fibers are twisted together in a right-hand direction to make a yarn. The yarn is then twisted together in a left-hand direction to make a strand. In the case of a three-strand rope, three strands are twisted together in a righthand direction to make a rope. The amount of fiber and yarn used determine the size of the rope. The alternate right and left hand twisting causes the rope to hold its shape.

For nearly all farm uses a good grade manila rope is the cheapest in the long run. Cheaper fibers are often substituted for manila, but a careful inspection will reveal the true nature of the rope. A simple and fool-proof test is to burn a few fibers. Manila fibers will leave a black ash while sisal and henequen leaves a gray ash.

ROPE WORK

Carl Widseth '27
Lawrence Spears '27

Carl Widseth '27

If a new rope, after being uncoiled is "kinky" it may be drawn by one end over a sod covered field which will allow the extra twists to work out, while if excessively stiff it should be immersed in water or raw linseed oil and allowed to remain until the liquid is brought to a brisk boil. To keep the kinks out of a rope in use do not draw it repeatedly across itself in the same direction.

Rope lubricants and coatings may be divided into three general classes according to the way in which they protect the rope:

1. Those which form only an exterior coating protecting from external wear and unfavorable conditions, especially dampness.

2. Those which penetrate the interior and lubricate the fibers, thus reducing internal wear.

3. Those which protect both exterior and interior against wear and weather.

As a general rule <u>mineral oils</u>, which possess very good penetrating qualities and afford good protection against dampness, should not be used because experience shows that they cause rapid deterioration of the fibers and lessen the lifetime of a rope. There are several non-mineral preparations, though, that may be used to good advantage:

1. Exterior Coatings: (a) Beeswax, blacklead, and tallow; (b) Resin, blacklead, and tallow; (c) Pine tar.

2. Lubricants: (a) Tallow; (b) Lard; (c) Boiled linseed oil.

3. Exterior coatings and lubricants: (a) tallow and blacklead; (b) Tallow and graphite.

The best way to apply any of these treatments is to either immerse the rope in a hot solution or pour the solution on the rope while it is passing through a pulley. In this way it works in between the fibers and is therefore more efficient. Treating the rope with any of the above treatments will weaken the tensile strength but should lengthen the working life of a rope.

There are no specified rules which can be laid down regarding the proper way to tie knots and hitches but the following general rule should be followed:

1. The principle of a knot is that no two parts which move in the same direction, if the

rope were to slip, should lie along the side of and touching each other.

2. A knot or hitch should be so devised that the tight part of the rope must bear on the free end in such a manner as to pinch and hold it in a knot against another tight part of the rope, or in a hitch, against the object to which the rope is attached.

Knots, hitches, and splices weaken a rope because in order to tie them the fibers must be bent, which throws a strain on the outside ones, causing them to break when a load is put upon the rope. Theknots which are the strongest are the ones which require the least abrupt bending of the fibers. The following table shows the relative strength on a basis of 100, of various knots, hitches, and splices:

Straight rope	Eye splice over an Iron eye	Short splice	Timber hitch, anchor bend	Clove hitch, running bowline	Square knot, weavers knot	Over hand knot
100	90	80	65	60	50	45

When used for hoisting, as a hay carrier or in a tackle, rope is continually bending and straightening as it goes through the pulleys. This bending causes the strands to chafe one another in the center of the rope. The smaller the rope the worse the chafing. The diameter of a pulley should not be less than eight times the diameter of the rope. For economical service, rope used for work should not be run over pulleys less than thirty times its own diameter . The chafing effect is much less in a four strand rops so if small pulleys must be used this is the right kind of a rope to use.

Rope should not be coiled when damp. If a rope is wet it should be left in the sun until dry, then coiled and stored in a dry place. If coiled when damp a rope will begin to rot and will be very stiff and hard to handle.

In order to save time when work is pressing, every farmer should know how to splice a rope, to crown or whip the ends so they will not unravel, and to tie the ordinary knots and hitches. One of the best bulletins available on these things is "Hitches, Knots, and Splices"-- bulletin No. 62, published by the New York State College of Agriculture, at Cornell University, Ithaca, New York.

HORTICULTURE

BEEKEEPING IN THE RED RIVER VALLEY

Elsworth Dowers '27
James Brown '27

Elsworth Dowers '27

In the Red River Valley, bees are becoming more and more popular each year. Bees are a very profitable side line for the average farmers and some are making beekeeping a specialty. Bees, if handled properly, do not require very much labor.

In this thesis we will point out some of the most important fundamentals of beekeeping, but we can by no means go very deep into the subject.

In this new era in beekeeping, the honey producers' new year begins eight weeks before frost and not January first. The past season is history, and more than one may realize, the efforts expended during the eight weeks before frost probably govern the honey production of bees during the next twelve months more than anything that can be done for them the next spring.

By properly caring for bees in the fall, looking to young queens, adequate stores, and the measure of protection necessary for the climate, the old time bugaboo of spring dwindling and spring management which so worried our forefathers in beekeeping need no longer worry us.

Because in most localities the principal honey flows are over by August, we have chosen this time arbitrarily. If an important honey flow occurs in your locality later than August, you can simply adjust the beginning of your beekeeping new year at any date which marks the end of surplus honey storage by your bees, and thus adopt this entire system of management, no matter in what climate you reside.

Therefore, the best time to do most of your spring work is eight weeks before frost. Fall management is one of the most important operations for the honey producer, as it, in great part, determines the strength of the colony the next season and, hence, the honey flow.

Re-queen, if necessary; see that every colony has a strong vigorous queen that is capable of carrying on her work in the hive. Where the queen shows signs of failure, unite the colony with another colony that is weak but has a strong, vigorous queen, or if the colony is strong, replace the old queen with another vigorous, young queen.

The queen, as you all know, is the mother of all the bees in the colony. Therefore, you can see why she should be vigorous and healthy. She cannot do her best for her family if she is not given the best of treatment. She must have enough honey to feed her family and she must be replaced when she shows signs of failure.

Bees with a failing queen are inclined to swarm more than with young queens. No failing queen can lay enough eggs in a day before the main honey flow to serve her real purpose in the hive.

In determining whether or not the queen in a hive needs replacing, you should look for the following: First, make sure that the colony has a queen. You may do this by looking for eggs in the cells of the hive. If it is late in the summer when the queen has normally stopped laying eggs, you can determine if the hive is queened right only by looking over the combs until you find the queen herself. In case you cannot find either eggs or queen, do not make up your mind that the hive is queenless. Either close up the hive and look another day, or run all the bees through a queen excluder. If all these methods fail to find the queen, it is reasonably safe to assume that the colony is queenless. When examining bees in the fall, care should be taken to prevent robbing. If it should start, weak colonies must not be handled.

You should feed to stimulate some fall brood raising but see that it doesn't exhaust the stores.

Prepare the form of protection that you are going to use. For out-door wintering, wind protection should be afforded for the apiary. Protect the hive with packing according to the temperatures in your locality.

The bees and the packing must be kept dry. Do as much of your spring work in the fall as possible.

The next step is to determine whether or not the colony is strong enough to warrant the purchasing of a queen. If the colony does not have enough bees to crowd one hive bodyeight weeks before frost, it will usually be preferable to unite with a fairly strong queen right colony so you can winter it successfully.

If the colony is strong enough to warrant the requeening, send at once for a new queen whiah in the fall will cost from 75¢ to $1.00 each. The queens come through the mail in a little wood or wire cage, which may be used to introduce the queen into the hive. It is quite important that you follow the instructions accompanying these queens, for to turn the queen loose into the queen-less colony is almost certain to result in her destruction. While the bees realize they are with-out a mother, the strange odor and frightened actions of the new queen excite them.

If upon careful examination you determine the colony is too weak to pay to requeen it, unite the colony at once with any other of the bees in the apiary that may not have a sufficient number of bees to quite cover all the combs in one hive body but which is queen-right. This can best be done by leaving off the cover of the queen-right colony and laying a single sheet of newspaper over the top of the hive frames in the queenless colony. Remove the board and set the hive on top of the newspaper. The bees will gnaw through the paper in a day or two and unite slowly, and usually without fighting. In case the weather is still warm enough that there is danger of the bees in the top body smothering, punch a half dozen small holes in the newspaper at the time of uniting. This will allow plenty of ventilation and the bees will not go together too fast.

Now that the colonies are all united and requeened, the question comes up about the amount of stores each colony should have. Reduce the hive to winter proportions. If the bees are to be wintered outside, use two hive bodies, and if they are to be wintered in a cellar, use one hive body and store one with honey for spring use.

Remove bee excluders, reduce entrance to prevent robbing and see that all hive parts are bee tight. Any colonies that are light in stores should be fed. When feeding is necessary, use only pure sugar-water syrup made of one part water and two parts sugar. In feeding the sugar-water syrup, only feeders that feed above the cluster should be used.

If you are going to winter the bees out of doors, the hive will require at least fifty pounds of stores. If you are going to winter in a cellar, thirty pounds of stores are sufficient for an eight frame hive. There must be enough honey to successfully manage the bees from the end of the honey flow of one year to the beginning of the warm weather honey flow of the next year. A good many persons have come to improperly speak of a sufficient store of honey as enough to "winter" bees while the "springing" is even more important, because the bees must have enough food to live through the days of varying temperature in early spring. Many colonies may come through the winter in good shape but if they haven't enough food they may even then perish in great numbers.

The greatest amount of honey consumed during the winter months is largely due to insufficient protection against low temperature, wind, and moisture. Honey properly conserved in winter will be turned into thousands of baby bees the next spring, so the colony could be brought to its highest peak in numbers of bees just before the first main honey flow. Therefore, it is not only important to leave enough stores with them so th t they may live through the winter but to have an adequate supply of honey in the hive for feeding baby bees in the early cold days of the following spring.

BEEKEEPING IN THE RED RIVER VALLEY

James Brown '27
Elsworth Dowers '27

James Brown '27

My colleague has told about the importance of late summer management and the wintering of bees so I will tell about the swarming of bees and why it is a big problem to the beekeeper.

The cause of swarming may be contributed to the following reasons:

1. Hatching of young queens.
2. Lack of egg-laying room for the queen.
3. Lack of comb room.

Swarming should be controlled in order to prevent a division of the working force of the colony at a time when its unity is most needed. One cannot hope to successfully produce honey in profitable quantities unless he seriously attempts to control swarming. Some beekeepers think just the opposite of this. They think a colony of bees have not done well unless it has cost them one or more swarms. When bees swarm it is a temporary strike. There are but few bees left in the hive and this of course checks the honey flow until young workers hatch. It is necessary, if youwish to secure the maximum number of pounds of honey from each colony, to keep that colony from dividing its strength by swarming just as it starts to work.

To do this one must keep the instinct of storing surplus honey dominant and keep the natural instinct of the bee to swarm subservient. Bees are animals of instinct and do only one thing at a time well. If you create conditions within their hive leading to the domination of the storing instinct, they will bend every energy toward storing a maximum crop of honey and not give any effort toward swarming and dividing their strength. When swarming is prevented, it saves the keeper time as he will otherwise have to keep watching his apiary. No one has yet found a proven theory for the cause of swarming. However, it is quite definitely know that under all normal conditions, bees will usually swarm at a time when the brood nest is crowded with bees that are not busily engaged at work.

To control swarming, the hive should be watched to prevent the following conditions: See that the queen has plenty of comb room in which to lay her eggs. Workers hould have sufficient room in which to store their honey. The hive should have good ventilation and should not have a temperature of more than 95° F. Hives may be kept cool by placing them in the shade or by insulating them with flax board.

When bees cluster on the outside of the

hive, it is a sign that something is radically wrong. It may be an excess number of young bees in the brood chamber or it may be lack of ventilation. Look for incorrect conditions and remedy it as soon as possible.

The clipping of both wings on one side of the queen is often practised as the method to assist the beekeeper in keeping records of the age of the queen and preventing swarms abescounding. The queen may be clipped on the right side if she was introduced on an even year and on the left side in an odd year. This will not prevent swarming in any way, but is an aid in hiving swarms where they issue in spite of control measures. When clipping a queen, one should be very careful not to injure the queen and if she is handled too much, the bees will kill her when she is put back into the hive because she will have a strange smell on her body.

As I said before, clipping will not prevent a hive from swarming but will aid in hiving the bees. When a swarm issues, The queen will be found on the outside of the hive or on the ground in front of the hive. The bees, finding that the queen is not with them, will return to the exact location where they left her. A new hive should be waiting for them and the queen introduced to the new hive.

In connection with queenless hives and weak colonies comes the problem of robbing. When there is plenty of nectar available, the bees never think of robbing but when there is not very much nectar available, they start robbery. Strong colonies can take care of themselves but weak colonies cannot protect themselves. These robbers may be from your own apiary or they can be from distant hives. The worker bees of the hive being robbed will fight the robbers and if not too badly demoralized or overpowered will usually defend the hive. Queenless bees are bees near the point of starvation, or bees that have been weakened by too much smoke are the easiest victims of robbers.

Here are some things that may be done to avoid or prevent robbing:

1. Do not drop any comb containing honey or honey drippings about the yard.

2. Do not allow a colony to remain queenless.

3. Do not examine the bees when little or no nectar is available in the fields.

4. Always store honey in a room that is bee tight.

5. See that supers above the bee escape board are fitted with bee tight covers.

During the heavy honey flow, bees will not attempt to rob. They will not even take exposed honey.

Diseases of Bees

The larvae of bees are subject to two diseases commonly found in this country: namely, American Foul and European Foul brood. These diseases may be spread by robbing, the bacteria being transmitted in the honey. Neither of these diseases have any effect upon human beings who eat the honey. Full information may be had by writing the "Office of Bee Culture, U. S. Department of Agriculture, Washington, D. C. for their bulletin on American and European Foul brood.

ESTABLISHMENT AND CARE OF WINDBREAKS IN THE RED RIVER VALLEY

Rolf Anderson '27
Alfred Danielson '27

Rolf Anderson '27

People generally do not realize the value of windbreaks and woodlots on their farms and many people fail to give the woodlot credit as a farm asset because it requires many years to get returns.

Windbreaks are planted to check the force of the wind, to hold the snow away from the buildings, and to beautify the farmstead. Every farmer should have a woodlot large enough to furnish him with fuel, fence posts, poles, and a few logs for dimension lumber.

Some farmers say that they cannot afford to plant windbreaks, but we maintain that we cannot afford to be without them. Farmers can collect enough seeds to grow their own seedlings; if not, they may be bought from nurseries. Such trees when small usually cost less than ten dollars a thousand. Many farmers make mistakes by buying too large trees for the windbreak and lawn planting. This is not economy for large trees may cost from fifty to one hundred times as much per tree as two or three foot seedlings. For example, ten foot elms usually cost from seven to fourteen dollars while the two and three foot elm seedlings may be bought for $7.50 to $10.00 a thousand so you can see that in getting a windbreak started, the lot of one thousand is to be preferred.

Planting trees in large numbers if of value in another way in that you can then better afford to give them the kind of care and cultivation they need.

The idea is prevalent that it takes almost a century to grow trees, but protection can be gotten from trees when they are from five to fifteen years of age and financial returns shortly afterwards. It was true in past years many people refrained from planting large woodlots because of the high taxes, but now that the law protects the land from taxation until the tree crop is harvested, the growing of more timber on every farm is encouraged.

Trees improve the soil and are of benefit to the surrounding crops by checking the force of the wind, thus retarding the evaporation of soil moisture. Trees can better stand the severe climatic conditions than can the smaller species of plant life. Woddlots in addition to their indirect benefits bring in good financial returns.

Interesting records of Pennsylvania timber lands that have paid are of value to us. Mr. Henry Neeb from Weisport bought a farm in 1898 which comprised about 100 acres of cleared land and 109 acres of timber land. Careful records kept by the owner show that more than 250,000 board feet of white pine and hemlock lumber and 2,100 tons of mine props were removed for which he received about $8,700 at that time. Mr. Neeb protected the young trees and let them grow again and when he sold his farm in 1924, the woodlot had an average of 20 tons of mine props and 2,000 board feet of lumber per acre ready to cut with a fine standof young trees ready to take the place of the old ones.

On another instance, a widow cut the timber from a six acre woodlot, and paid off a $3,600 mortgage on her farm.

Large areas of the German forests artificially planted and carefully tended, yield a net annual revenue of four to eight dollars per acre. One forest in Switzerland yields as high as fourteen dollars per acre. Such large profits as these, in many cases higher than the revenues from our good farm lands, are not yet possible in this country, owing to the low cost of lumber, but already plantations of white pine in New England have yielded six per cent on the investment annually, and that under rather careless management.

Consider, for example, the following data collected from a windbreadk plantation near Crookston: The plantation is two rods wide and contains five rows of cottonwood trees planted four feet apart in the row. This means 1650 trees per acre. These trees will all make one post and half of them two. This means 2475 posts which have a value of eight cents apiece for treating purposes, a total yield of $198 per acre in twelve years, or $16.50 per annum, over the cost of production. This is almost as much as the gross returns from a wheat crop. Should there not be a market for that many posts, the forty cords of wood will find a ready sale at $5.00 a cord, and the profit will be practically the same.

In the growing of trees from seed, the source of seed is very important. Seed to be planted should be gotten from trees growing in the same locality or at least from trees grown under just as severe a climate as that in which the seeds are to be planted.

Trees are classified in three classes according to the time that the seed ripens, the early summer, the late summer, and the fall. The trees that ripen their seeds in the early summer are: soft maple, elm, poplars, cottonwood, and the willows. The seeds of the willow and cottonwood are gathered by cutting seed branches from the trees just before the seed is ripe and letting them ripen where they be easily collected. Maple and elm seed can be swept up from the ground. The early summer seeds should be planted as soon as they are gathered.

The trees that ripen their seeds in late summer are birch, basswood, and also the pulpy fruited trees like the chokecherry, plums, etc. The pulp should be removed from the fleshy seeds and the seeds should be kept moist until they germinate, this being accomplished by seed stratification. To stratify seeds, a little wet or moist sand is put in a box or in a pit outside, then add a layer of seed and again some moist sand is added. As many layers may be added as are wanted. The sand should then be kept moist and put in a cool cellar or still better, put outside to freeze and thaw to help crack the hard seed coat.

The trees that ripen their seed in the fall are ash, oak, the nut trees, box-elder, most of the evergreesn, hackberry, hard maple, and mountain ash. The seeds from the evergreen trees usually need artificial heat to open the cones. The seed then should be stratified in dry sand and placed in a cool shed until planted. Most of the cones can be gathered from the ground around logging camps.

Safe rules to follow in propagation by seed are: Plant the early seeds when gathered. Stratify the dry, thin-shelled seeds in dry sand and place them in the cellar. These seeds should be soaked before planting. Remove the pulp from the pulpy fruited seeds, then stratify in moist sand and set out to freeze and thaw. The nut seeds are also stratified in wet sand and set out to freeze and thaw. The evergreen seeds have to be removed from the cones, then stratified in sand and placed in a cool place. They should be soaked in warm water before planting. No seeds should be planted while the soil is dry but you should wait until after a rain so the seeds can germinate and start growing immediately.

ESTABLISHMENT AND CARE OF WINDBREAKS IN THE RED RIVER VALLEY

Alfred Danielson '27
Rolf Anderson '27

Alfred Danielson '27

Most of the people make their mistakes in forest and windbreak planting by not having their soil in the right condition. When one is planting a windbreak, the most important things to consider are the varieties best adapted to the climate of your community and the soil. The soil should be in fertile condition and free from weeds.

Trees in the windbreak row or forest should be given care in the same way as when they stood in the nursery row. When seeds or seedlings are planted in the nursery row, they should be planted quite thickly and all the weeds should be picked out of the row to allow the small seedlings to get a start. Continuous cultivation is necessary to keep the soil from drying out. When seedlings have grown to a height of fourteen inches to three feet, they can be planted in the windbreak row. Land that is to be used for windbreak planting should be kept black for at least a year before planting and after planting, the soil should be cultivated until the trees are large enough to shade the ground. Trees can be planted four feet apart in the row and four feet between each row, but the best results have been gotten from windbreaks where the rows are planted eight feet apart and the trees in the row planted two feet apart. When the seedlings are planted this way, they can be cultivated until they are three to five years of age. The trees should be examined regularly and if insects are present, the trees should be sprayed to keep the insects from destroying them.

Trees that are grown close together have an advantage over trees that are grown far apart because they can produce more foliage and therefore shade the ground better. Thickly planted trees also have another advantage in that the leaves form a mulch at the base of the trees which checks evaporation. People do not realize how much moisture is kept and made use of in the soil, just by leaves falling to the ground and forming a mulch. Experiments have been made of mulched and unmulched ground and the results were that the unmulched soil lost ten times more moisture through evaporation than the mulched soil.

Trees are classified into two groups according to the amount of foliage they produce and the amount of shade they can stand. These two groups are tolerant and intolerant trees. Tolerant trees have a lot of foliage and can stand a lot of shade while the intolerant tress have more of an open head and cannot stand as much shade. Knowing this, we can soon learn what trees can be planted in the shade and what trees must be planted in the light.

All vines and dead wood should be cleared out of the forest or windbreak because they often cause some of the small seedlings to die out and the only way we can restore the forest for future years is by giving the young trees the best possible chance of growing.

Pruning is very seldom necessary when planting forest trees but is more common when planting fruit trees. When thinning the windbreak, all the poorest trees should be cut out instead of the best ones, but most people take the best trees because they are easier to cut and handle. When trees begin to crowd, every other tree should be cut out.

Best results have been gotten from windbreaks that contain a large variety of trees because some years when the insects attack the trees, they may only attack one variety and the rest can go on growing without their growth being checked. For example, Box-elder trees are often checked in their growth and sometimes killed by an insect called the Box-elder or Railroad bug. Hence, it is important to have many varieties so the whole windbreak is not destroyed.

It is desirable to select the hardiest varieties for northern Minnesota. For the moist soils of northern Minnesota, White Willow, White Elm, Box-elder, Basswood, and Green Ash are successfully raised, and for high soils, Cottonwood, White Willow, White Elm, White Spruce, and Red Cedar are best. The varieties should be arranged in the windbreak so that the smaller trees are on the inside and the taller trees on the outside. Windbreaks should have a few rows of shrubs on the outside, then a few rows of taller trees like the Willows and on the inside, Cottonwoods are desirable because they grow very tall and fast. When the varieties are planted in this manner, the wind goes over the top instead of sifting through the trees. If the windbreak is too narrow, it is advisable to plant a hedge row about two rods north of the windbreak to catch the snow and prevent drifting.

PROPAGATION BY CUTTINGS

The best and proper way to produce cutting wood is to head back a tree or two so it will produce vigorous sprouts. The cutting is done in the fall right after the leaves have fallen. The cuttings should not be allowed to dry out, therefore, they should be healed in sand if possible right after cutting. In the spring just before they start rooting themselves, they should be planted in the windbreak row about nine and one half inches deep and one half inch sticking above the ground, containing one bud. The soil must be tamped well around the cuttings so the roots get a chance to start growing and after this is done, the rows should be mulched heavily to hold the moisture and keep the weeds from growing.

Willows, Poplars, and Cottonwoods are successfully propagated by cuttings while the other varieties of trees are more suceessfully propagated by seeds.

METHODS AND USES OF GRAFTING

Clarence Koznek '27

The scion, or part to be grafted into a tree, should be selected from a strong, healthy shoot of the last season's growth. It is best to collect these shoots during the early part of the winter and pack them away in a cool cellar in damp sawdust to prevent their drying out. If they are allowed to remain on the tree until the time of the grafting, they may be injured by severe winter weather or the buds may start to swell during the first warm days of spring. It is important that the scion wood be absolutely dormant. In preparing the scions for grafting, two or three inches of the base of the shoot is usually cut off because the buds are poorly developed, and the tips are not used because the wood is soft and pithy.

A good grafting wax may be made by using the following ingredients: 4 parts resin, 2 parts bees wax, 1 part tallow. Melt the ingredients over a slow fire. If the resin is in lumps, it should be pulverized before it is put over the fire to facilitate melting. All particles of the resin should be completely melted before the wax is removed from the fire. Allow it to cool somewhat and pour into a tub of cold water. With the hands well greased to prevent sticking, it may then be pulled and worked like molasses candy until it assumes a smooth grain, when it may be rolled into suitable sized balls and put away on waxed or oiled paper until ready for use. It will keep indefinitely.

Very few special tools are required for successful grafting. One essential thing is that the knife be sharp and have a smooth cutting edge. A knife with a straight edge is preferable to a round pointed knife. For top working large trees a grafting chisel is almost a necessity. A local blacksmith can readily make one from an old file. A curved handle as illustrated in the cut is a convenience, enabling one to hang the tool over a limb when it is not in use. The mallet for driving the grafting chisel into the stub may be readily improvised from any convenient piece of wood. A good pruning saw should be provided. Either the ordinary narrow bladed hand-saw, commonly sold for pruning purposes, or the swivel blade pruning saw is good for this purpose. In no case would the pruning saw with teeth on both sides be recommended, as one is almost certain to injure the tree with the back of the saw when the cutting is done in close quarters. A good pair of hand pruning shears about nine or ten inches long is also a great convenience in grafting work and is pretty nearly a necessity to one who has any amount of pruning to do.

Perhaps the most useful of all grafting is the whip graft, which may be used on small branches in top working trees or for root grafting in nursery tree propagation. In making a whip graft, the stock should be cut from an inch to an inch and a half long, should be cut at the top of the stock. If the stock is small the cut may extend clear across, but when a branch 3/8 inch or more in diameter is to be worked, it is better to make the beveled cut along one side of the stock and not reaching quite to the pith. Next, a tongue should be cut beginning about one-third of the distance from the top of the bevel, and cutting downward about one-third of the length of the original bevelled cut. Avoid the cut through the pith. To secure a smooth surface on the inside of the tongue, it should be cut and not split. The scion may now be similarly prepared, beginning the first bevelled cut apposite the base of a bud and making sure that the cut is approximately the same length as in the stock. After the tongue is cut in the scion the two pieces are fitted firmly together, being careful the inner bark along one side is in contact. The scion should be cut about three to four inches long and should carry three or four buds. The two pieces are then bound with grafting cord which is made from dipping #18 cord in grafting wax. In the propagation of nursery trees, the seedlings' roots are cut into four inch lengths. Each piece of the root is then used as a stock and a scion about six inches long is whip grafted to the upper end of the root. The two are then bound together with waxed strips of cloth. Waxing is unnecessary since the grafts will not dry out when packed in damp cool material. The whip grafts are tied in bundles and packed away in a cool cellar in damp sand or sawdust. The grafts should be made during January and February and by the time they are taken out of the cellar for planting the union and the cut surfaces should be nicely covered with a heavy callous. In planting the root grafts should firmly set in an upright position with the upper bud projecting above the top of the ground. They may be set in rows four feet apart and six or eight inches apart. Root grafted trees are grown in the nursery row from one to three years before they are being sold for permanent planting.

The bridge graft is used entirely for repairing and not for propagation. Its most frequent use comes in the treatment of trees which have been girdled during the winter by mice or rabbits. It is also useful in saving trees that are severely affected with collar rot. It is simply a bridging over of the girdled space by means of scions which are inserted both top and bottom and which, when united with the stock, transport food materials downward across the girdled area and keep the tree alive. In making the bridge graft the girdled surface should first be trimmed to a clean smooth cut edge both top and bottom. The scion wood is then selected of sufficient length to reach entirely across the girdled area. The base of the scion is cut clear across with a beveled cut about an inch and a half long. After this cut is made the scion should be beveled similarly to the bottom and on the same side. The bark above and below the girdle is then slit with a knife and the edges are loosened. The beveled base of the scion is then inserted in the slit in the bark below the girdle with the beveled cut on the inner side against the wood of the tree. It is pushed firmly downward until the entire bevel is embedded in the slit bark. It should then be held firmly in place with one hand while with the other hand, grasping the scion near the top it should be bent in a bow shape until the upper bevel can be inserted into the slit of the bark and pushed into place. The now straightened scion should stand reasonably close to the trunk. Both the top and the bottom of the scion should then be tacked firmly to the tree by a small slender brad. Repeat this process until the trunk of the tree is surrounded by these scions about an inch and a half apart. The point of union at both ends of the scion should be thoroly waxed and it is usually best either to wax or to paint the bare wood of the tree to keep it from drying out. Sometimes it is impossible to attach the lower part of the scion to the base of the tree because so much of the cambium layer has been destroyed by disease. In such cases small trees may be planted close to the trunk and grafted into the main tree above the affected tissue. The small trees are cut to the proper height, the top beveled, and then slipped under the edge of the cambium layer, after which it is treated as a bridge graft. Many valuable trees have been saved in this way and the method has been found quite effective in saving collar rotted trees. In a few years these scions will increase in size until they completely cover the girdled trunk with a shell of new, actively growing wood and bark. Trees treated in this way will not suffer in the slightest degree even during first season after grafting, provided most of the scions make a successful union.

PROPAGATION OF FRUIT TREES BY GRAFTING

Morriel Mortensen '27
Arthur Stordahl '27

Morriel Mortenson '27

Before a person can do any grafting he must first have the tools to work with. So I will name a few of the essential ones.

First one must have a knife with a straight cutting edge, which is preferable to a round pointed knife. For top working large trees a grafting chisel is almost a necessity. One of these can easily be made by any local blacksmith, from an old file. A curved handle enabling one to hang it over a limb when not in use is a great convenience. The mallet for driving the chisel into the stub may be made from any piece of wood. An old pitchfork handle will do. Saw this off about a foot and a half from the end and drill a hole through it, through which you can put a string. This can be carried in much the same way as you would carry a police club. A good pruning saw or a swivel blade hand saw is good for the purpose. A pruning saw with teeth on both sides is never recommended as this is liable to injure the tree when used, as the back side of the saw might come in contact with the tree when used in tight places. A person should also have a good pair of hand pruning shears when there is any amount of grafting to be done.

Was must be used in grafting to protect the cut after it has been made and to keep the graft from drying out. A good serviceable wax can be made from the following ingredients:

Four parts Resin, two parts beeswax, one part tallow. Melt these ingredients over a slow fire. If the resin is in lumps it should be pulverized before put over the fire. All particles of resin should be completely melted before the wax is removed from the fire. Allow it to cool somewhat and pour into a tub of cold water. With the hands well greased to prevent sticking, it should then be pulled and worked somewhat like molasses candy until a smooth grain is assumed. Then it may be rolled into suitable sized balls and wrapped in waxed paper and kept indefinitely.

The scion is the part to be grafted on to the tree. The scion should be taken from a strong healthy shoot of the last season's growth. These shoots should be collected in the early winter and should be packed away in the cellar or damp sawdust to prevent their drying out. They must not be left on the tree or they may be spoiled by the weather. The scion wood must be absolutely normal to make these scions for grafting. So it is best to discard two or three inches of the base of the shoot, as this is poorly developed and the wood is soft and pithy.

Root grafting of fruit trees is almost always done with the whip graft, and is done in the winter. The stocks which are generally one or two years old, are dug up in the fall of the year. In root grafting only a piece of the root is used which is about two to four inches long. The root can be cut into several pieces and a scion of about six inches is grafted on to this. A smooth beveled cut from an inch to an inch and a half should then be cut at the top of the stock. When the stock is small this cut may extend clear across. Next a tongue should be cut beginning about one-third of the length of the original beveled cut. Do not start the cut through the pith. To secure a smooth surface the inside of the tongue should be cut, not split. The scion is now prepared the same way and the cut must be about the same length as that of the stock. The two pieces are fitted together and the inner bark along one side must be in contact. The two are then bound together with waxed cord, or waxed strips of cloth.

They are then tied in bundles and packed in damp material. They should be made in January or February and when they are taken out they should be covered with a heavy callous over the cut. In planting they should be firmly set in upright position, with the upper bud projecting above the ground.

Of the various methods of inserting a scion into the stock, the side graft is one of the best. This graft is accomplished without cutting off the s tock. In the side graft a thin bladed chisel with a bent shank is used for making the incision. The cut is made so that the scion is set into an oblique cut in the stock. The incision should be about an inch deep. The scion is cut wedge shaped as in the Cleft Graft, and is pressed into the incision until its cut surface is concealed in the stock. The wound is then tied and if it is above ground in the open it is waxed. This method of grafting may be used to good advantage upon rather small grape stocks below the surface of the ground.

THE PROPAGATION OF FRUIT TREES BY GRAFTING

Arthur Stordahl '27

The art of grafting trees and plants which has long been known to horticulturists has been used for three general purposes. The first is in the production and perpetuation of fruit tree varieties when the one desired is grafted or budded on a seedling root; the second is in top working trees of a worthless variety in order to change them to a valuable one or to grow several sorts on one tree; the third use is in treatment of trees injured by disease or girdled by rodents.

The principle involved in all grafting is to bring together the growing parts of the scion and stock in order to effect a union at the point of junction. The stock is the plant or root on which the grafting is done; the scion is the new wood that is to be grown. The growing part of all hardwood plants is located in the inner bark or the cambium layer lying between the wood and bark. Thus, in making any graft it is necessary that the cambium layer of the stock and scion touch in one or more places. It is also essential to exclude air from the union to prevent the cut surfaces of both the stock and scion from drying out and dying before a real union can take place. This is accomplished by the use of grafting wax which is applied thoroughly over all the exposed cut surfaces of both the stock and scion at the point where the graft is made. All grafting operations should be performed in the early spring just before the buds start into active growth, although the top grafting season lasts as long as the scions can be kept dormant.

The method of top grafting to be used depends on the age and size of the stalks to be grafted. Sometimes hardy trees are planted to be used as stalks for top grafting. In that case the entire top of the tree is cut back after the tree is established and only one graft is necessary to form a new top. If an old tree is to be top-worked then many grafts are necessary on the individual plant to change it over into another variety. In top grafting the stalks that are three-fouths of an inch or less in diameter are side cleft grafted, while stems three-fouths to two inches in diameter are cleft grafted. I shall explain in detail the method used in cleft grafting trees because this graft will be the one you could use most effectively in working over any of the hardy trees you have which are not producing either the quality or quantity of fruit you desire.

In cleft grafting, the stock is cut off squarely and split, and into the split a scion with a wedge shaped base is inserted. The end of the stock is usually large enough to accommodate two scions, one upon either side. In fact, it is better to use two scions, not only because they double the chances of success, but because they hasten the healing of the graft. The sides of the scion must be cut smooth and even. A single draw cut on each side with a sharp blade is much better than two or three partial cuts. The outer edge of the wedge should be a little thicker than the inner one so that the stock will bind upon it and hold it firm at the point where the union first takes place. These scions are taken in the late fall or winter or even very early in the spring before the buds swell. The stock must be cut off squarely and smoothly with a sharp fine-toothed saw. The stock is then split to the depth of an inch and a half or two inches. The scions must be thrust down in the cleft to the first bud, or even deeper and it is essential that they fit tightly. The scions are usually set a trifle obliquely, the tops projecting outwards to insure the contact or crossing of the cambium layers. The most essential points are rather to be sure that the scion fits tightly throughout its whole length and to protect the wound completely with an air-tight covering of wax. The wounds must be now covered with wax and care should be taken that it be done very securely.

The side cleft graft is used on smaller branches. This graft differs from the cleft graft as an oblique cut is made in the stock and only one scion inserted. In making the cut a downward stroke of the knife or pruning shear is made in the branch. The cut should be from one to one and one-fourth inches in length and should not extend past the center of the stem. If the stem is cut nearly off there is not enough strength left in the stock to bind or hold the branch.

POTATO INSECTS AND THEIR CONTROL

Ishmael Rynning '27
Chester Engman '27

Ishmael Rynning '27

The potato has numerous insect pests. These combined enemies of the potato plant take an annual toll of many millions of dollars from the potato crop alone. A goodly portion of this loss is due to the failure of the potato grower to sufficiently protect his crop from the ravages of these pests. Unfortunately, however, a considerable portion of the injury is caused by insect pests difficult to control, such as the flea-beetle, aphid and leaf-hopper. These enemies of the potato naturally divide themselves into different groups, according to whether they are leaf-eating or sap-sucking and according to the parts of the plant they attack.

Profitable potato growing is possible only as a provision is made for insect control. There are but three insects in most potato growing regions that are seriously and constantly harmful. They are the Colorado or striped potato beetle, the potato flea-beetle, and the leaf-hopper.

Other insects that are only occasionally injurious and usually to a limited degree are tortoise beetles, grey and black blister beetles, and the three-lined potato beetle.

The Colorado potato beetle was unknown to the potato growers of North America prior to 1855. It is supposed that the beetle crossed the Mississippi River about 1864 and reached the Atlantic seaboard some ten years later.

The adult potato beetle is about three-eighths of an inch long and yellow in color, with fine black stripes running lengthwise on each wing cover and a series of black spots on the thorax. One female may lay from 500 to 1,000 eggs. The eggs are of a bright orange yellow color, about one-thirty-second of an inch in length. They are deposited in clusters on the under side of the leaves and hatch out in about a week. The larvae grow rapidly and, when nearing full size, consume a large amount of foliage. In from nine days to two weeks they reach their full growth, leave the plants, and go into the soil for the pupal or resting stage, which lasts from ten days to two weeks. Following the pupal stage they transform to the adult stage and again appear on the potatoes. The fecundity of the beetle is high, single females being known to lay from 1,500 to 4,000 eggs during a period of two months, so the importance of controlling the first brood is evident. In Minnesota there are two generations each season.

While the potato beetle is a serious enemy of the potato plant if left unmolested, it is, in reality, one of the most easily controlled. As it is a leaf-eating insect, the manifest thing to do is to keep the foliage of the plants well covered with some form of arsenical poison. Paris Green, calcium and lead arsenate and zinc arsenite give very satisfactory results when used intelligently. The plants should be dusted or sprayed at about the time the first batch of eggs are hatching out, as they are more easily poisoned when they are a few days old. The leaves should be kept covered with poison until all the beetles are killed.

Although the flea beetle has been an important pest in the eastern states for many years, it has not been considered of much importance in Minnesota until a few years back.

The beetles are about one-twelfth of an inch in length, black, somewhat hairy, and the hind legs well developed for jumping. It is this habit of leaping away when disturbed that gives the insect its common name.

Flea beetles pass the winter in the adult stage, hidden away beneath leaves or other litter. In the spring the adults leave their hiding places and as soon as the potatoes are up begin to feed upon the leaves, usually from the under side. They eat almost through the leaf from below, leaving the upper epidermis untouched. Later this usually dries and drops out, making a hole through the leaf. This injury to the leaves is usually the first indication of an infestation, since the beetles themselves are seldom noticed.

The eggs are laid singly in the soil and the larvae, which are tiny, elongate, and worm-like in form attack the roots and finally burrow into the developing tuber, causing pimply potatoes. There is apparently but one generation a year.

The flea beetle is a much more difficult insect to control than the Colorado potato beetle owing not only to the fact that it is resistant to poison, but also to the habit of feeding on the lower surface of the leaves, making it difficult to put the poison on the foliage where it will be eaten. The most hopeful measure of control is that of thoroughly covering the foliage with Bordeaux Mixture. The Bordeaux-covered foliage seems to be distasteful to the beetle, and in that way serves as a repellent rather than a remedy.

The potato leaf hopper is one of the most destructive insect pests of the potato crop. The feeding injury, although severe, is not nearly as serious as the diseased condition called "hopper burn" which it transmits to the plants on which it feeds.

It is necessary to recognize and to fight this leaf-hopper to prevent the high percentage of loss from "hopper burn".

The adult or full-grown leaf hopper is a very small pale green insect, about one-eighth of an inch long, with large white eyes and a more or less distinct H on its body between the head and base of wings. There are six roundish white spots above this H and three white, wedge-shaped spots below it, Adults fly and hop readily when disturbed.

The eggs are tiny and transparent and are hid in the tissue of the potato leaf. The eggs can not be seen from the outside, but after they hatch the leaf tissue dies and forms small, sunken pits marking the previous location of the eggs.

The nymphs, or young leaf hoppers, pass through several stages of growth and shed their skins several times, developing wings in the adult stage.

The potato leaf hopper lives over winter in the adult stage, hidden away in brush heaps, matted weeds, and other protected places. Some time during May the leaf hoppers emerge from their winter quarters, feed for a week or so on various trees and shrubs, then suddenly migrate to potatoes and beans where mating and egg laying begin. There are two generations of the insect in the northern states.

Results have shown that Bordeaux will repel the leaf hopper, control "hopper burn", and is the best remedy.

In conclusion, I would like to have you see that even though there are many insect and disease pests of the potato, yet their control is simple if the proper practices are followed.

Spraying is absolutely necessary in potato production and a sprayer to be effective, must coat both the upper and under surfaces of the leaves. The leaf-eating insects are controlled by using stomach poisons, such as lead or calcium arsenate or paris green while Bordeaux mixture is effective against the flea beetle, leaf hopper, early and late blights. It has been found at the Northwest Experiment Station that the poison combined with the Bordeaux mixture makes an ideal combination spray and by using the combination three or four times during the season, perfect insect and disease control can be obtained.

I have discussed the insects of most importance and tried to bring out enough of their life histories to show how each is controlled most economically.

SPRAYING TO CONTROL LEAF DISEASES AND INSECTS OF POTATOES

Chester Engman '27
Ishmael Rynning '27

Chester Engman '27

It is well known that leaves are necessary for the production of tubers of the potato. The starch is made in the leaves, and we know that if the leaves are destroyed or eaten by insects, the tubers cease to develop: hence to save the leaves the grower should be equipped to spray against diseases as well as insects.

There is not time to discuss all the leaf diseases or the methods of controlling them; however we will discuss the most common diseases and the best methods of control. Diseases affecting the leaves (excepting the mosaic type of diseases) may largely be controlled by spraying with Bordeaux Mixture, and when applied properly will increase the yields profitably.

The most common diseases in Minnesota are the Early Blight and the Mosaic. The Early Blight is perhaps the worst potato leaf disease in the state. It attacks the leaves and causes them to die, and if allowed to continue will affect or stunt the growth of the tuber, and a poor yield will be the result. High temperatures with moist periods seem to be the most favorable conditions for the development of the disease. The gungus of the disease causes small brown spots to be formed on the leaves. They can be easily distinguished from ordinary spots that they have small concentric lines within. The disease lives over winter on dead potato vines. Three or four sprayings with Bordeaux Mixture will control the disease.

Late Blight is not a very common disease, but when it occurs in epidemic form it causes great damage. It can destroy entire fields of potatoes in three or four days. It appears on the average once in every five days. Cool wet weather in July and August seems to be the most favorable condition for the development of the disease, but dry weather seems to check it. This disease can be distinguished from Early Blight because it has no definite margin. In dark damp weather the leaves are dark and water soaked, and have a grey, mouldy appearance, or growth on the underside. In dry weather these spots appear brown and dried out. The reason wet and rainy weather favors the development of this disease is that the water washes the fungus off the leaves and down on the tubers.

The third disease that I will discuss is the mosaic. It is harder to detect than the blight until it has reached an advanced stage, and then it can be identified by a mottling appearance of the leaves in the form of dark green spots, and sometimes a crinkling of the leaves can be noticed. This disease is spread by sucking insects such as the plant louse and the potato leaf hopper. There is no control of this disease through spraying. The only control is by selecting seed from a plot that is free from the disease.

The Green Mountain and the Triumph varieties are very susceptible to mosaic. The loss, however, does not exceed 20% to 50%. However, when the tubers from an affected field are shipped to the southern states, they seldom produce profitable yields. This disease and other degenerate diseases of the potato are not leaf diseases in the same sense as the blights are, but are vine or constitutional diseases of the whole plant in general, and cannot be controlled by spraying, but by seed plot methods only.

Bordeaux is the fungicide most commonly used for the control of the leaf diseases of the potato. Great savings can be made in the cost of spray by home mixing, hence we shall give full directions for making the solution. Bordeaux mixture can be made by adding four pounds of copper sulphate (bluestone) to twenty-five gallons of water and four pounds of stone lime to twenty-five gallons. Then mix the two by pouring them together. Do not use a metal barrel for copper sulphate solution. Slake the lime and add it to twenty-five gallons of water. Spray at once after mixing. In using Bordeaux Mixture it is necessary for us to have sufficient lime to unite with all of the copper sulphate. Any free copper sulphate in the solution is apt to burn the foliage in the plant sprayed. Hence it is well to test out a batch of spray to see if lime is present in sufficient quantity. The test is made by taking a small quantity of Bordeaux and dropping into it a few drops of potassium femo Cyanide which is a yellow green solution. If free copper sulphate is present a red brown precipitate forms immediately. In that case more lime should be added until the solution fails to change color. If the Cyanide solution remains unchanged in the test that means you have used enough lime. Another test is the knife blade test. If a clean steel knife blade is used or placed in the solution and copper collects the blade that means that more lime should be added.

If large fields are to be sprayed make stock solutions by dissolving one pound of blue stone in each gallon of water. Add one pound of lime to each gallon of water. The stock solution will keep indefinitely if the water is not allowed to evaporate. When spraying, mix at the rate of four gallons of each mixture, and fifty gallons of water. Some growers find it more convenient to use hydrated lime instead of stone lime. Hydrated lime is equally as good as stone lime. However one and one-fourth pounds of hydrated lime should be used to every one pound of copper sulphate. The spraying should begin when the plants are about ten inches in height. There might not be any sign of disease when spraying, but the solution should be on the leaves or vines before the disease appears. The early varieties should be sprayed about three times and the late varieties about four times. If the season is dry two applications may be sufficient, but in wet seasons it may be necessary to apply six times. From the middle of July to the end of the season the leaves should be covered with the mixture.

Bordeaux Mixture and poison for

insects can be mixed together, and save time and work. If this is practiced, the spraying should begin when the plants are about six to ten inches high, or as soon as the insects appear. This should be continued about every ten days or two weeks so that all beetles are controlled, and a coat of Bordeaux is maintained on the leaves. The plants should be covered with the mixture both from above and below. If they are full grown it will take about eighty to one hundred gallons of water; otherwise forty to fifty gallons will be sufficient. The increase from spraying has been from twenty-five to fifty bushels per acre. The cost varies from three to four dollars per acre depending on equipment, methods, etc. In spraying a high pressure should be used, because the solution will form a mist and stay on the leaves. The proper pressure is about two hundred pounds and a three nozzle spray should be used.

POTATO TUBER DISEASES AND THEIR CONTROL

Neil Boehmer '27
Bennie Strickler '27

Potato tuber diseases and their control is one of the most important factors determining success or failure in the potato growing industry. There is over two million dollars lost each year in Minnesota through potato diseases and most of this loss can be prevented. But if you ask a grower why he doesn't treat his seed he will say he hasn't time. He doesn't stop to figure how much of an increase he would get if he treated his seed. This is a large subject and it would be impossible for us to go into great detail. However, to simplify the subject, we will place tuber diseases in three differemt classes: first, skin or external diseases; second, internal diseases; third, degenerate diseases.

Black scurf or Rhizoctonia is one of the most prevalent and serious diseases of the potato tuber. Two different kinds of rhizoctonia have been found in this country: one is known as Black Scurf, and the other one is known as Russet Scab.

Black Scurf consists of hard black to brown particles adhering firmly to the skin of the tuber. These particles are composed of a close weave of fungous threads and represent the winter or resting stage. They are harmless to the tuber in this stage and unless present in large quantities do not injure potatoes for table use. When introduced into the soil on seed tubers, these fungi produce an abundance of young threads which attack the young shoots, stolons, and young tubers. The fact that stems and stolons are often girdled results in low yields, and in severe cases leads to the production of aerial tubers.

In Russet Scab, another disease spread by Rhizoctonia, the fungous causes the death of the superficial layers of the skin or follows natural cracks. In most severe cases it causes deformed potatoes. When Rhizoctonia attack is associated with preceding insect injuries it has a worse effect. Rhizoctonia may attack the breathing pores and produce small pits on the tuber. The fungus also lives in the soil and may attack new crop even if clean seed is planted.

The disease scab produces rough scabby or pitted spots on the tuber which, in severe cases will cover the tuber completely. The parasite which causes this disease appears to be present in the soil and to live for three or four years. The chief agency for spread is the planting of infected seed.

Powdery Scab has recently been introduced from Europe into Canada and from there it is creeping into the United States. This disease differs from common scab in the character of the spots which are first covered and later break out into brown powdery masses. The disease is dangerous and should be carefully watched and should be promptly reported to state authorities if it appears.

Mosaic, Spindle tuber, and Curly Dwarf are known as degenerative diseases. Of the three different kinds of mosaic, mild, leaf-rolling, and rougose, mild mosaic is the worst because it spreads the fastest and is less conspicuous. Leafrolling is less common, and does not spread readily. Rougose is the most conspicuous, and it is easier to rogue out. It does not spread so fast as the other two. Mosaic diseases are very destructive in the southern growing sections and as the Red River Valley supplies much of their seed, it is necessary that we keep our seed stock clean. Mosaic diseases generally cause a dwarfing of the plants, and the leaves become matted with yellow instead of remaining solid green. Such plants should be rogued out as soon as they appear.

Spindle tuber disease is easily noticed on the plants. The leaves are always smoother and more pointed than normal leaves. Spindle tuber plants are smaller and more erect and show more leaf rolling than mosaic.

Curly Dwarf is a disease carried in the tubers, but it cannot be detected by their inspection. This is a dangerous disease and only combatable by buying clean seed. This type of disease can be determined only by inspection of growing crop. Two inspections are necessary: one at the time of blooming, and one shortly before harvest. This disease is a result of leaf roll. This disease is carried from one plant to the other in the field by insects such as plant louse.

Of the internal disease the Black-leg rot is the most serious of those attacking potatoes in the Red River Valley. It is bacterial disease and affects both tops and tubers. It derives its name from the fact that the lower portions of the diseased stems usually turn black. Potatoes in the ground decay very rapidly and become soft and slimy throughout. Fleshy decayed portions may be white or only slightly colored but turn black and slimy as the decomposition goes on. In storage blackleg is comfined to the center of the tuber which becomes hollow and black with a layer of slimy lining.

The next most serious internal disease is the Dry Rot which is caused by a particular fungus called Fusarium. The rotting is rather slow and in four to six weeks one third of the rotted portion becomes slightly wrinkled and has a characteristic bluish color. The rot makes its appearance at the stem end of the tuber. There is no watery generation of the tuber unless other organisms gain entrance so this, in fact, is a dry rot.

Hollow Heart is another internal disease of potatoes. It consists of a more or less irregular cavity in the center of the tuber. This cavity varies in size and is lined with a thin brown layer of dead cell. This is caused by too rapid growth of the tuber. It is most common in certain fast growing, large tubers. It can be readily distinguished from black heart, which has a black lining around the cavity. Hollow heart is not a decay and has no effect on the succeeding crops though affected stock is undesirable for eating.

Black Heart is caused by too high a temperature or by poor ventilation. The symptoms differ, depending on the cuase. If tubers are exposed to too high a temperature and a normal air supply there is no external symptom, but if there is too high or low a temperature with insufficient air supply there is both external and internal sumptoms. External symptoms are damp areas on the surface; internal symptoms are gray to a purplish or inky black discoloration.

Blackleg is controlled by careful selection of seed and by destroying all potatoes showing internal discoloration, and by proper seed disinfection methods.

In the control of Dry Rot there are two important rules to follow: first, plant only healthy tubers; second, rotate crops. The field from which a grower expects to take his seed crop from should be examined during the summer before the vines die to determine whether there is any wilt present. If only a small percent, the diseased hills can be rogued out. If a large percentage occurs it would be best to purchase clean seed. Treating the potatoes with formaldehyde or corrosive sublimate will not eradicate the disease, but it does help in preventing the spread. Where the disease becomes serious the grower should practice a five or eight year rotation. When crop is harvested all tubers should be picked up to prevent carrying over the disease.

Hollow Heart is more common some years. Hollow Heart depends on climatic and seasonal conditions. Practically the only control is the selection of a slower growing variety.

Black Heart is a mold which occurs in storage. Tubers will not develop black heart at a temperature below ninety-five degrees Fahrenheit, if given a good supply of air. The temperature of the storage room should be about seventy degrees Fahrenheit. Tubers should not be piled over six feet deep in bins. They should not be left long in the field after digging, nor should they be left in the hot dry soils long after the vines are dead.

There is a method of controlling these diseases. The external disease of

Rhizoctonia is hard to eradicate after the fungus becomes well established in the field. Then crop rotation should be practiced, all tubers showing the form of this disease should be soaked in a solution of four ounces of corrosive sublimate to thirty gallons of water for two hours. After using the solution one day it should be renewed. Prepare it in a wooden or earthen receptacle as it will corrode metal. Hot Formaldehyde will also control this disease.

Scab is controlled in the same way as Rhizoctonia.

Hot Formaldehyde is very effective against Rhizoctonia and scab and is preferred by many because seed can be treated much more rapidly by this method than by the corrosive sublimate method.

Two general methods can be used for heating hot formaldehyde: the live steam, and the fire trench method. The live steam method is not as successful as the fire trench. The steam destroys the formaldehyde.

For the fire trench method a trench is dug and a tank placed over it. A fire is placed in the trench and a solution of one pint formaldehyde to thirty gallons of water is put in the tank. The potatoes should be kept in the tank two minutes at a temperature of one hundred twenty degrees.

The seed affected by powdery scab should not be used in localities with cool climate since these conditions favor the development of the disease. Seed treatment will reduce the infection present on the tubers but will not prevent the infection originating from the soil whenever seasonal conditions favor it. Local experience will often enable the grower to avoid planting potatoes on soil types favorable to powdery scab.

Mosaic is controlled by tuber indexing and hill selection. Hill selections mean going over the field during the summer and picking out plants that are free from mosaic, and digging out diseased plants. Those free from disease are planted the next year on isolated piece of ground.

In tuber indexing the potatoes are selected and a piece from each is cut. The piece is numbered the same as the potato it came from. The piece is planted in a green house and when the plant is six to eight inches tall and it shows signs of mosaic it should be destroyed. The tuber producing plants that are free from mosaic should be planted in the spring on an isolated piece of ground. The potatoes are cut in four parts and planted by hand. If one plant shows infection the others will be infected too. These plants should be rogued out.

The commercial grower who wishes to eradicate spindle tuber and black leg should practice bin selection. Potatoes of the right size should be selected and the stem end of the tuber cut off. If it shows brown spots and streaks it should be thrown away. He should select enough potatoes to plant the amount of acreage he wants. All long run out tubers should be discarded.

The certified seed grower should have a seed plot and before digging he should pick out the high yielding and most vigorous tubers of good type, planting these tubers in seed plot next year. When planting the potatoes in seed plot the high yielding should be kept separate for study. During summer all plants that show symptoms of spindle tuber should be weeded out.

In tuber unit method, the potatoes

are cut in four parts and are planted close together; a space is left and the next four parts are planted. The improved tuber unit method is tuber indexing, which has already been explained.

Curly Dwarf is controlled by tuber indexing and pure seed plot. Experiments show that tuber indexing is the only way to eradicate degenerate diseases. There are many other kinds of tuber disease but the most important have been given.

SELECTION OF SEED POTATOES

Arnold Aakre '27
Olaf Stenborg '27

Arnold Aakre '27

During the past there has been a constantly increasing demand for good seed potatoes. This demand on the part of the grower has been largely due to the evidence shown of the superiority of certified seed over uncertified seed potatoes. The idea a few years ago that the source of seed was of little importance has fewer supporters today than ever.

Before discussing the value of good seed I shall define the term. The first requirement in good seed potatoes is that they be as free as possible from seed borne diseases, or at least those which cannot be destroyed by treatment. The stock must be true to name and to type of the variety. It should possess good vigor and high productive capacity.

Every farmer who grows a considerable amount of potatoes should set aside a plot of ground large enough to grow sufficient seed for his own use. The soil in which he grows his potatoes should not have had potatoes for at least five years. By careful selection, control of diseases, and good cultural practices, and by growing varieties best suited to local conditions, an increase in yield of from twenty-five to fifty percent, and great improvement in quality may be expected. The grower should select the seed potatoes for next year's seed plot at digging time, from good yielding hills producing uniform type of tubers. This may be done by digging the hills by hand before the entire seed plot is dug. The seed plot tubers so selected should be put away in barrels or crates and stored in a cool, well ventilated place so that the potatoes will be in the best possible condition in the spring.

In a seed plot demonstration carried on in Clay county, from seven plots, the average yield from common seed was ninety-five bushels per acre. The yield from selected seed was 133.1 bushels and the average increase per acre on the seed plot was 38.1 bushels. The seed potatoes used on the seed plot were carefully selected as to type, and the stem ends cut off to eliminate the possibility of planting wilt-infected potatoes. In 1919 the United States Department of Agriculture in cooperation with the Wisconsin Agricultural Experiment Station began a study of different lots of certified seed potatoes, for the purpose of determining the best strains of seed stock of five of the leading varieties. These studies were continued over a period of five years and resulted in showing that there were some outstanding strains which produced much heavier yields than others of the same variety. The difference in some cases amounted to over one hundred bushels per acre. These data were so outstanding as to at once arrest the attention of those interested in seed improvement. Other experiments of certified and uncertified potatoes showed increases of 41 bushels in Pennsylvania, 72 bushels in South Dakota, and up as high as a gain of 219 bushels in Montana. The value and importance of good seed can be approximately estimated from the data which have been submitted.

In Minnesota every grower having his potatoes inspected is required to grow a seed plot each year. Bliss Triumphs and Green Mountains should be planted at least ten rods from any other potatoes. Two field and one grading inspection are made. Only the standard varieties will be considered for certification. These are: Early Ohio, Irish Cobbler, Bliss Triumph, Rural New Yorker, Green Mountain, Russet Burbank, and Burbank potatoes. Potatoes will not be eligible for certification if the field contains more than 3% weak plants.

If the seed stock has 5% mosaic, 5% leaf-roll, 2% spindle tuber disease and late blight, this totally disqualifies the seed stock. Under second inspection the percentage is one percent less except for spindle tuber disease.

Every grower applying for seed certification must send in 100 tubers of the variety to be grown to state inspector. The state inspector tuber indexes the lot and sends back the tubers free from disease, in case the lot is reasonably free from disease. If more than the percent of tolerance of any of the degenerate diseases appears in the trial lot, the grower is advised to get new seed and is spared the cost of field inspection. The fifty or more sound tubers that the grower gets back from the test should be planted in an isolated seed plot and kept separate until of sufficient quantity to plant the general field.

THE SELECTION OF SEED POTATOES

Olaf Stenborg '27
Arnold Aakre '27

Olaf Stenborg '27

Good judgment should be used in the selection of land for a potato seed plot.

The potato seed plot should be located where common scab and black scurf disease do not persist in the soil. Low wet land favors the development of blacklet and late blight rot, hence the seed plot should be located on well drained land.

The seed plot should be isolated several hundred feet from other potatoes, for degenerate or virus disease may be carried by sucking insects such as the plant louse and leaf hopper, to the seed plot if it is alongside the main field. The serious mosaic diseases attach a variety of plants hence the potatoes should be isolated if disease freeness is to be maintained.

Sanitary precautions should be taken to prevent the spread of disease in cutting and handling the seed for the seed plot.

The cutting knife may be responsible for the spread of some of the virus diseases such as spindle tuber. It has been proven by experiments that if spindle tubers are cut alternately with sound stock the sound stock, when planted, produces 40% spindle tuber. Therefore in selecting the seed for plots careful selection and attention during cutting may help to reduce trouble from late blight, blackleg, wilt, leafroll, and spindle tuber. However, wilt and the degeneration diseases should be eliminated largely during the preceding season, by selection of seed from a field seen to be comparatively free from these diseases. Many of the degenerate diseases such as spindle tuber can be eliminated by bin selection, saving only the tubers that are true to type. Tubers showing decay, vascular discoloration, and deep bruises are more or less a menace to the following crop and therefore are not fit for seed purposes. Although these defects may not lead to a serious disease of the potato tuber, they will at least lead to seed-piece decay or weaken the vitality of the plants.

Small tubers such as may be planted whole, may be as good for seed as the larger tubers. However, when the source of stock is not known the use of small seed tubers should be avoided, as they may have come from mosaic or leafroll hills or from plants which have died prematurely of other diseases, hence in the bin we cannot tell the kind of cull from which the tubers come.

It is impossible to detect degeneration diseases in tubers during storage. Tubers should be greened in order to find out if they have become diseased from parent vines. The sprout vigor will not indicate the presence of all degeneration diseases. The most satisfactory method of testing seed potatoes for internal degenerate diseases is the tuber index method. This test corresponds to the individual ear test of corn. In testing a tuber a single eye seed piece is removed and the tuber and the eye numbered the same. The seed pieces are grown in flats, greenhouses, hotbeds, or cold frames, and all tubers that correspond to the seed pieces that grow strong healthy plants are used for the seed plot. If the sample tested is large enough, it is an index of the percentage of disease that will appear in the main crop or stocks. The most healthy stocks can be chosen for planting.

The seed stock may be cut in a mass and planted by hand or machine. Hand planting with the seed pieces placed with eyes up will give best results, because they will give earlier appearing plants, which means more complete roguing at the beginning of the season before transmitting insects have become common.

As against mass planting there are certain advantages in planting the seed of each tuber in a group of consecutive hills.

In planting by tuber units, it is best to select tubers weighing six or eight ounces and to cut each into four pieces. A potato planter has been perfected and is recommended for the planting of tuber units. It will plant the potatoes in groups leaving an empty hill between each unit. This method of planting makes it easier to detect tuber disease. In some cases only one to two of the hills in a unit is affected. Still the whole unit should be rogued out, because usually all parts of the tuber, if any, are diseased. The grouping of most diseased hills in tuber units reduces the amount of exposure to infection occurring through proximity before roguing in grouped units is easier. Opening between units reduces the spreading of disease also the limit of each unit can be seen and the unit can more easily be removed.

One of the greatest advantages of the tuber unit is that it makes it easier to detect degeneration diseases and so increases both accuracy and speed in roguing out such diseases.

In the hill method the most vigorous hills are marked during the growing season and the tubers used for seed are selected from these plants at harvest time. Individual hills may also be indexed in the same way as simple tubers, and all poor culls can be discarded.

By starting with a few tubers free from all degenerate and virus diseases most anyone could grow a pure seed plot.

In conclusion, at present many things are involved with seed plot work, about some at least we are largely in the dark; and success is often a gamble like the rest of the potato game, with climate and season playing a large part. Time and experience will disclose by whom, where, and how, work with seed plots is profitable. Meanwhile, we hope that some improvement will be made and that some useless practices will be avoided.

SUGAR BEETS FOR THE RED RIVER VALLEY

Ralph Erickson '27
Harwood Conner '27

Ralph Erickson '27

A German chemist in 1747 was the first to discover that sugar beets contained sugar worth extracting. For many years no important results followed until experiments were renewed by Napoleon, who ordered ten factories to be built in France. The industry has grown to all parts of Europe. In 1924 - 25 Europe produced nearly 8,000,000 tons of beet sugar. That year the United States produced over 1,000,000 tons of beet sugar. Taking the sugar production of the world for 1924 - 25 over 9,000,000 of the 25,000,000 tons came from sugar beets, showing the importance of the sugar beet industry. The sugar beet is of primary importance in the temperate zone where sugar cane does not thrive. A wide strip of territory extending across the whole north end of the United States has proved to be good for sugar beets.

The first sugar beet industry in the United States was established in California in 1869. The first sugar beet had a red coloring which led to the breeding of a beet from the lightest colored mangels. The present day sugar beet has the color of white colored turnip and has a sugar content varying from 12% to 20%. As a crop for the Red River Valley the sugar beet is very valuable because a cultivated crop is needed. The sugar beet is very desirable in the crop rotation because of its deep rooted habits and in that it does not pull hard on the surface soil fertility. The potatoes, small grains, alfalfa, and sweet clover, are profitable to use with the sugar beets in the rotation system. Beets open up the soil to a great depth and add humus to the soil. Sugar beets, when given clean cultivation, prepare the land for the succeeding crops by destroying weeds and making plant food available. Sugar beets cut down the cost of producing grains in that the land does not have to be plowed for the grain crop. All sugar beets grown commercially for sugar making purposes are grown under contracts. The contracts are issued by the sugar company and signed by some official or agent of the company, and also by the grower. The points covered in the contracts include acreage to be planted, the price to be paid for the beets, the cost of labor and seed, methods of handling the crop, the time of harvest and the regulation of delivery. The contracts are necessary because a definite acreage is required in order to operate a mill successfully. Almost any fertile soil capable of producing good yields of other crops will, if properly handled, produce good sugar beets. However clay loam soil types are best. Providing the climatic conditions are preferable. Hard pan subsoil should be avoided especially if the hard pan is so near the surface that it will interfere with the proper growth and development of the roots. Very porous or gravelly subsoil which permits rapid leaching will not give the best results with sugar beets because the moisture passes down rapidly and not enough is retained in the soil. Therefore in selecting soil for sugar beets careful attention should be given both to the surface soil and the subsoil. There are two important points to be kept in mind when plowing for sugar beets: namely, the time and the depth of plowing. The time for plowing beet land is in the fall. The advantages are that under proper conditions the soil will be in ideal physical condition in thespring because weathering has pulverized the soil lumps which permits the roots to reach the elements necessary for plant growth. Deep plowing will give the best results providing it is done in the fall.

Fall plowing can be done to the depth of seven or eight inches. If plowing must be left until spring it is advisable to plow not more than one or two inches deeper than the ground was previously plowed since too much raw soil on the surface does not make a good seed bed. If, however, the plowing is done with a disc plow the ground can be stirred to a greater depth even in the spring without injury to the seed bed. This is due to the fact that the disc plow has a tendency to mix the top and bottom soil without bringing the raw soil to the surface as is done with the mold board plow. The importance of not only maintaining, but improving the fertility of the soil is now being recognized. If vegetable matter is needed, such plants as rape and rye can be planted. If organic matter is needed, plant alfalfa or sweet clover and plow under. Vegetable matter is so essential that it cannot be too strongly emphasized. We do also use commercial fertilizers, but must be used with care. Otherwise loss instead of gain will be the result. Acid phosphate with 16 to 20% available phosphoric acid applied at the rate of 125 pounds per acre has proved profitable for sugar beets on most soils in the Red River Valley. The seed should be planted in rows 22 inches apart but the depth varies in planting for $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches good stands are seldom obtained from deeper planting. The amount of seed planted per acre varies from 12 to 15 pounds. The time best for planting is during the first weeks in May. The planting should not be all done at once, but rather at intervals of one week or ten days. This enables the beet worker to get one part of the field blocked and thinned before the next part of the field is ready. All of the operation of beet culture should be done timely without delay if maximum returns are to be expected. Sugar beets, because of their ability to withstand adverse conditions, and because of the returns that can be expected in soil and financial improvements, should become a permanent crop in the Red River Valley.

SUGAR BEETS FOR THE RED RIVER VALLEY

Harwood Connor '27
Ralph Erickson '27

Harwood Connor '27

Sugar beets should be given their first cultivation just as soon as the rows can be followed. This should be done before the spacing and thinning is done, and again as soon as the beets straighten up after thinning. No fixed rule can be laid down as to the number of cultivations a field should receive, since this must be governed by soil and weather conditions and by the presence of weeds. In general, there should be a cultivation after each rain, and in case of drought the cultivations should be frequent, in order to retain the moisture below.

It should be kept in mind that cultivation serves three important purposes: namely, opening the soil to admit air, enabling it to absorb and retain moisture, and to destroy weeds. Experiance has shown that air is just as essential to the activities of root growth and development as moisture. The ground should be cultivated so as to form a granular mulch. Weeds rob the soil of both moisture and fertility and therefore should not be allowed to exist either in or between the rows.

Blocking or spacing should be done just as soon as there are large enough to be handled, which is usually when they have four leaves. Beets are generally seeded in a solid row, although hill planting is receiving considerable attention. In any case the beets must be spaced and thinned, since they must stand one in a place at suitable distance apart in order to produce satisfactory results. Spacing is nearly always done with a hoe of convenient size, which is operated at right angles to the row, leaving the remaining in small tufts at suitable distances fromeach other in the row. The beets removed with the hoe should be cut off at such a depth that they won't grow again. It is always best to leave the larger and stronger plants to make the crop, and these are seldom found at regular and desired intervals in the row. Hence, judgement should be used in spacing beets. After spacing has ɒeen done the beets should stand in tufts or bunches at intervals of eight to twelve inches in the row.

Thinning is one of the tedious jobs in the growing of sugar beets. The thinning must be done very carefully so as to leave a single beet and no doubles in one place. The success of the crop depends a great deal upon the thinning.

Thinning should be done a few days after spacing. The reason for thinning becomes apparent when one remembers that there is in the soil at a given time a certain amount of available plant food and moisture, and the earlier the useless plants are removed the more food and moisture will be left for the beets that are to make the crop. The same holds good in regards to weeds, which should all be carefully removed. As in spacing, the largest and strongest beets should be left. After the beets are thinned they wilt for a time, leaving the bent over stems exposed to the sun. For this reason the earth should be drawn up around the plants when thinning, in order to protect them as far as possible.

Diseases: There are many diseases of sugar beets. Some of the diseases are well known and easily controlled; others, while known, are handled with difficulty; and still others are obscure as to their causes. The losses produced by diseases may be brought about by a destruction of the plant itself or by some injury which reduces the size or quality of the beet root.

Among the diseases which attack the belt during the early growth is the so-called damping-off. There are several forms of this disease, due, apparently to different organisms. This disease is very common in early spring. Sometimes the tops turn black; then again the roots turn black and soften. The only time the plant will recover is when the outer skin is only affected. The disease will not occur unless one of the damping-off organisms is present.

There is also one called nematodes. This is a worm-like organism, sometimes called an eelworm, which attaches itself to the root and when present in large enough number retards the growth. This pest lives in the soil from year to year and as yet there is no remedy that is very effective.

Root-rot is a very destructive mid-summer disease, caused by a fungi. This disease generally destroys the plant before harvesting. The most effective way to combat this disease is by crop rotation.

Leaf-spot is caused the same way as root-rot.

The most important insect that affects the leaves are webworms and the beet army worm. Their principle work is to destroy the leaves. They also have a retarding affect upon the growth of the beet. Usually these insects start in one corner of the field and work until the whole field is covered. These may be controlled by the use of lead arsenate, Paris green, or other arsenicals. In Leafhopper, cutworms, and false chinch bug are insects that affect the rest of the beet. The leafhopper and cutworm can be checked by the use of poison bait while the chinch bug can be killed by using contact sprays.

Harvesting sugar beets by hand consists of three distinct operations. They are: lifting, pulling, and topping. As a rule the side lifter is used as this has a lighter draft but the main thing is that all beets be loosened and that as few of them as possible be broken. After the beets are loosened they are thrown into piles. The number of rows used to make a pile is a matter of convenience. When the beets are pulled more or less dirt clings to them. As much as possible should be removed by shaking. Before topping the beets the ground where the beets are to be put after topping should be smooth. Topping is done with one stroke of a heavy knife. There are several types of harvester which lifts and tops the beets at one operation. Some of these will be on the market in the near future. This greatly reduces the cost of harvesting.

The main by-products are the beet top and pult, and waste lime. If properly handled, beet tops form a valuable asset for the beet grower, and as stock food they should be valued at their real worth. Many farmers sell them at a cash price ranging from $2.50 to $5.00 per acre. In the case the grower is the loser for two reasons: namely, in the first place the top is of great feed value, and , in the second place, if he allows the tops to leave his farm he loses their manurial value. The tops can be utilized by letting the stock run in the fields.

Beet pulp is also excellent for stock. This by-product is the refuse that remains after the beet roots have been sliced and the sugar extracted. Pulp may be fed either green or dry.

Profits from sugar beets depend a great deal on the way they are grown, and handled, but there is no doubt if they are grown and handled right there is money in them.

In conclusion we want to make clear that the most important things to keep in mind in the growing of sugar beets is type of soil, preparation of seed bed, cultivation, and last but not least, the control of diseases and insects.

THE VALUE OF BIRDS AND THEIR PROTECTION

Glenn Smith '27
Arthur Johnson '27

Glenn Smith '27

Some people may think that the subject of birds is not very closely related to the subject of agriculture. However, we will try to show that birds are absolutely essential for carrying on crop production; for without them our crops would be ravaged annually by pests.

The economic value of birds to man lies in the service they render in preventing the undue increase of insects, indevouring small rodents, in destroying the seeds of harmful plants, and in acting as scavengers.

Leading entomologists estimate that insects cause an annual loss of at least two hundred million dollars to the agricultural interests of the United States. This, of course, does not include the damage done to ornamental shrubbery, shade and forest trees. Insects are the natural enemies of vegetation, and birds are the natural enemies of insects.

Birds digest their food so rapidly that it is difficult to estimate from the contents of a bird's stomach at a given time how much it eats during the day. The stomach of a yellowbilled cuckoo, shot at six o'clock in the morning contained the partially digested remains of forty-three tent caterpillars, but how many it would have eaten before night no one can say. The stomachs of four chickadees contained one thousand and twenty-eight eggs of the cankerworm. The stomachs offour other birds of the same species contained about six hundred eggs and one hundred and five female moths of the cankerworm. Many additional cases could be cited, showing the intimate relation of birds to insect life, and emphasizing the necessity of protecting and encouraging these feathered friends of the farmer.

In the United States are found more than eight hundred distinct kinds of birds, sixty-nine families, of which twenty families are classed as waterfowl, seven as shore birds, four as upland game birds, five as birds of prey, and thirty-three as land birds. In general the smaller land birds are of greatest interest to the farmer and orchardist. Of the larger birds, however, the upland game birds, the hawks, and the owls, deserve some mention.

Hawks and owls, though not closely related, may be considered together on account of the similarity of their feeding habits. Feeding chiefly upon living animals smaller than themselves, naturally they sometimes prey upon some of the domesticated kinds, particularly poultry. This has given them a bad reputation with farmers. Scientific investigation of their habits shows that only a few species of hawks and only one owl feed chiefly, or even largely, upon birds and therefore to any great extent upon poultry. The birds of prey regarded as chiefly injurious include the sharp-shinned, Cooper, and duck hawks, the gos-hawk, and the great horned owl. The bird hawks fly swiftly over trees and bushes, and make sudden darts upon their prey, and from this behavior and their color, three of the species are often known as blue darters. The chiefly beneficial hawks differ in flight from the darting hawks, either soaring at a considerable height or hovering over places where they are seeking prey. The great horned owl, which like most of its relatives, feeds at night, gets only poultry that is improperly exposed, and when prevented from doing this, its habits are largely beneficial. The remaining species of hawks and owls, more than fifty in all; have useful habits. They feed on a great variety of rodents and have a tremendous effect in controlling the numbers of these pests.

The crow is a bird that is often condemned by the farmer. However, upon studying its food habits, the crow's merits and shortcomings appear about equally divided. About twenty-eight percent of the yearly food of the adult crow consists of animal matter. Over two-thirds of this, or about a fifth of the whole diet of the crow, is composed of insects, and these include many of the most destructive pests with which the farmer has to deal. Where crows are very numerous it may become necessary to get rid of some of them, but they should never be exterminated entirely.

The upland game birds include the prairie chicken, (grouse) partridge, quail, upland plover, and pheasant. Besides their value as game birds, these birds are of great value to the farmer in helping to control insects and weeds.

The small birds may be classified according to their food habits, and their value as songsters.

Some insectivorous birds are: Woodpeckers, flickers, mosquito hawks, flycatchers, cuckoos, meadow larks, kingbirds, and swallows.

Some of the birds that are valued as songsters as well as being insectivorous are: mockingbirds, catbirds, thrashers, wrens, orioles, and robins.

The swallows are among the most insectivorous of birds. Their food consists of the smaller insects captured in mid-air or picked from the tops of tall grass or weeds.

The kingbird is also largely insectivorous. It is a true flycatcher and takes on the wing a large part of its food. It is a valuable bird to have around the poultry yard because of its hostility to hawks and crows.

Mockingbirds, catbirds, and thrashers are distinguished by unusual ability as songsters. Economically considered, all are rather too fond of cultivated fruits, but as a rule they do more good than harm.

Closely related to the mockers and thrashers are the wrens, of which we have eleven species. In food habits these little birds are entirely beneficial. They may be said to live upon animal food alone, for an examination of eighty-eight stomachs showed that ninety-eight percent of the contents was made up of insects or their allies, and only two percent was vegetable food. Half of the animal food consisted of grasshoppers and beetles; the remainder of caterpillars, bugs, spiders, and plant lice.

The Baltimore oriole is noted for its beautiful plumage, sweetness of song, and beneficial food habits. Caterpillars constitute the largest item of the food of the oriole. In two hundred four stomachs they formed thirty-four percent of the food. The other insects consist of beetles, bugs, ants, grasshoppers, and some spiders.

The robin is an omnivorous feeder and its food habits have sometimes caused apprehension to the fruit grower, for it is fond of cherries and other small fruits. Examinations of 1,236 stomachs show that forty-two percent of itsfood is animal matter, principally insects, while the remainder is made up largely of small fruits or berries.

To understand the economic value of birds, not only must the feeding habits of species and families be known, but also the collective effect of birds upon pests and crops. Most of their damage results from local over-abundance either of one species or of a number of species of similar feeding habits, and it is inflicted chiefly upon fruit and grain crops.

If birds by their united effort are able to accomplish great harm, they are for the same reason able to do great good in the destruction of insect pests. Unusual outbreaks of pests upon which birds can feed are always attended by gatherings of the bird clans. However, important as this may be, their every-day services in consuming insects of all kinds, thus holding down the whole tide of insect life, are of greater importance. No one who has observed the ceaseless activity of birds in feeding their young can doubt that the destruction of insects in this way is enormous. The house wren brings food to its young about once every two minutes all day long. Not many birds equal this record, but the average rate probably is one feeding to every five to eight minutes.

Insect life is the greatest menace to agriculture today. Man has, by bringing new land into cultivation, increased the food supply of insects, and by wanton destruction and deforestation has decreased the population of natural insect enemies. The problem then before us is one of restoring that equilibrium or balance in nature whereby our noxious pests are kept in check by natural means. Much of this can be accomplished through conservation and encouraged propagation of bird life.

THE VALUE OF BIRDS AND THEIR PROTECTION

Arthur Johnson'27
Glenn Smith '27

Arthur Johnson '27

The fundamental reason for the need of protection of our native birds is the rapid settlement and population of our country. A hundred years ago the population was thinly scattered in the East. To the Westward was an immense unbroken wilderness with such resources as appeared inexhaustible. During the first half of that century no one ever thought that the game birds and animals would ever be exhausted.

The past fifty years have brought about an enormous change of opinion. The prairie chicken, the wild ducks, wild turkeys, wild geese, and ruffled grouse are all being protected. This has been largely due to individual work of hunters and sportsmen. Now the people have greatly increased in number, and the question of protection of wild life has become a difficult problem. If fashion says that feathers from a certain specie of birds shall be worn, immediately that kind of bird is doomed to almost complete destruction. Then as soon as that specie of birds is nearly all killed off and style names the plumes of another kind of bird to be worn, that bird, too, is diminished as the previous specie.

The highways with the autos, the trolleys into the country, and other means of travel interweaving the country, all serve as destroyers of birds and bird life by taking people into the country where they rob birds' nests of their eggs and young. Examples of this are egg collectors who gather eggs by the thousands, and small boys who rob the nests of eggs or young, whichever they find.

Other destroyers of bird life are: foxes, wolves, dogs, cats, skunks, weasels, hawks, and other birds of prey. In order to increase our wild bird life, the enemies of the birds must first be educated, killed, or driven away. Birds' nests in trees may be protected from animals by tacking a strip of tin, about one foot wide, around the tree trunk, below the branches. This keeps the animals from climbing up to the nests.

The first national movement in favor of protection of the non-game birds of the United States was started in 1886 by Dr. George Grinnel, editor of the "Forest and Stream". An association called "The Audubon Society" was formed. The head office was located at New York, with local secretaries and members scattered throughout the country. The purpose of the society was "to protect American birds, not used for food, from destruction for commercial purposes". This was soon put into force because of the demands to supply the American and European milliners.

You can see that people thought about protection of wild birds quite a few years ago, although it has not developed very much until recent years.

Several years ago it became evident to advocates of bird protection that state and local laws alone were not sufficient. Tho these were steadily being improved and an awakened public conscience was bringing about better enforcement, it was evident that by the time the laws had improved enough to afford real protection no game birds would be left to be protected.

The only hope was that of Federal legislation; and after several years of agitation a national law for protecting migratory game and insectivorous birds was passed by Congress, in 1913. Under its provisions the Department of Agriculture is given full authority to determine what shall be closed seasons, and to prepare regulations for their observance. The committee in the department, at the request of bird lovers, has withdrawn a number of birds from the list of game birds and has given them protection throughout the year. They are: sandpiper, curlew, avocet, godwit, and some of the plovers. Since it was evident that protection in addition to that provided by state laws must be given especially to s shore birds, it was decided that the best way to afford part of this needed extra protection was to prohibit all spring shooting. Within a few years a great revolution has taken place in public sentiment regarding spring shooting. Even ignoring the barbarity of shooting a mated bird, the conviction has become general that a given bird population will furnish the best sport and the greatest amount of that sport if shooting occurs only during fall migration, when the birds are in prime condition. Indeed this belief has become so general that in all speeches and discussions before the committee and Congress in regard to a national migratory game bird law, it was taken for granted that one of the Federal regulations would be the absolute abolition of all spring shooting. So complete had been the understanding that the framers of the regulations felt as much bound to include in them the prohibition of spring shooting as though it had been specially mentioned in the act of Congress.

Realizing that migratory birds must have ptotection when on their northern and southern flights, the United States and the Dominion of Canada have cooperated in the protection of them by establishing bird refuges and in protecting them by laws.

During the past ten years National bird reservations have been established by Executive order for the purpose of affording protection to important breeding colonies, to furnish refuges for migratory birds, or for winter protection. Most of the reservations are on small tracts of rocky, hilly, or swampy land that would otherwise be used for nothing.

The birds on these reservations are protected by a special act of Congress, by state laws, and in some cases by a special provision of state game laws.

The national bird reservations are divided into six districts: (1) The Gulf district, including ten reservations in Florida, four in Louisiana, and one in Porto Rico; (2) The Lake district, including two reservations in Michigan, two in North Dakota, and one in Wisconsin; (3) The Mountain district, including twelve reservations in the Rocky Mountain states, South Dakota, and Nebraska; (4) the Pacific district, including three reservations in California, four in Oregon, and eight in Washington; (5) the Alaska district, including eight reservations; and (6) the Hawaiian district, including one reservation.

State game refuges are established by petition of the land owners. The petition is sent to the State Game and Fish Commissioner who sets a date for a hearing in the district that is to be set off. In case there are no serious objections, the area defended in the petition is set off as a State Game refuge.

There are not enough birds on the farms, especially on the cultivated parts. Protection alone will help a good deal to bring birds to the farms. Eforts should be made to attract them, not only around the buildings, but in the fields as well. Shelter and nesting places must be protected and not destroyed. Clearing brush away from the woods and fences destroys nesting places of many birds and naturally drives them away from the fields.

If there are not trees and shrubs around the home and fences, birds will not stay there, but will go where there are trees and shrubs. If you plant a lot of trees and shrubbery around the buildings and fences, the birds will soon find that there is a place where they are more protected from the wind and that furnishes good mesting places as well.

Some birds do not like to build their nests in trees or on buildings, but if bird houses of the peoper size and shape are located on poles extending eight or ten feet above the ground, are located where the birds will not be disturbed, the birds will build in them. Birds that do build in trees will be more encouraged if a framework with a roof on is provided for them.

The bird population may be greatly increased by feed. Birds, like people, require food both summer and winter. Summer food is generally provided by wild fruit, insects, worms, etc. Winter and spring feeding is more necessary because the snow covers up all of the weed seeds and other feeds that the birds live on. This may be substituted by feeding on shelves in feeding houses, or on trays made especially for that purpose. Birds will eat almost anything that they can get into their mouths.

Water is a very essential attraction for birds. If there is no natural or unmolested water source close at hand, shallow bird baths and fountains should be supplied. Even in winter water should be supplied, but it should be warmed in order to keep it from freezing as quickly.

The response to protection and friendly care of birds is shown by a report from near Pontiac, Michigan. A tract of 150 acres has been protected for several years for the benefit of wild birds and other wild life. Dogs and other destroyers of bird life have been kept out. Over fifty bird houses have been erected. Regular feeding places are maintained during about eight months of the year. In 1920 a bird census that was taken of sixty acres of this tract, shows that the birds have not been slow to recognize the advantages of this area as a nesting and feeding place.

To maintain a game supply, and at the same time provide fair sport for the increasing number of hunters is a very large problem that is facing us at the present. Altho recognition of the value of wild life, and the importance of conserving beneficial species of birds and mamals is becoming more general in the past few years, and the demand for the protection of game is more insistent; much remains to be done to get local aid and interest from people everywhere. Without this cooperation the conservation of wild life is extremely difficult if not impossible.

LIVESTOCK

DAIRY BARNS--LOCATION, VENTILATION, and INTERIOR ARRANGEMENT

Clarence Krogstad '27
Melvin Flaskerud '27

Clarence Krogstad '27

In selecting a place for the building of a new dairy barn we should consider its relation to other buildings already on the land. If no other buildings are present, the contour of the land as affecting drainage of the barn and lots surrounding the barn should receive first consideration. Other factors to consider in selecting a building site are: water supply, outlets to pasture and barn lots, and outlets to fields and roads.

The location of the dairy barn should permit of convenient communication with other buildings, and should be arranged to reduce steps to the minimum and still not be close enough to other buildings to be a hazard in case of fire. Buildings to be remodelled should be changed to meet the requirements mentioned above in so far as possible.

Good drainage is of great importance in the location of the dairy barn, because

Sufficient slope away from the barn will not only aid in taking waste water away, but will also keep the lots around the barn in which the cows are kept, in better condition, and this in turn will mean cleaner cows.

Where possible to do so, and still meet other requirements, it is best to run the barn north and south in order to get a more equal distribution of sunlight on both sides of the barn. Generally this position of the barn will reduce the surface exposed to the prevailing winds.

Before building one should make a careful study of barn plans and visit farmers who have good barns. Altho it is not always possible, because of lack of funds to build as well as is desired, one will be well repaid for the time spent in inspecting well-built barns. A careful study of barns and barn plans will help to decide on the proper location. Many of the desirable conveniences and good features in arrangements that give a great deal of satisfaction after the barn is completed do not cost much in dollars, but must be planned for before the building is begun so that installing can be done with a minimum expenditure of time and money.

A well-planned and well-built barn saves labor and makes work more pleasant. It also is a factor in home beautification. A nice house and a poorly built barn will spoil the entire appearance of the farmstead. A well-planned farmstead necessitates a definite plan in arranging the buildings. The formal or square system is very desirable. This is a square arrangement of the buildings. If one building is built to face north and south all other buildings should follow the same plan. A very poor arrangement is to have some buildings facing north and south and others standing corner-wise, or northwest and southeast. This poor arrangement indicates that the owner has been very careless and is very evident that no plan of building location has been followed.

After barn walls have been built all rubbish and refuse within the enclosure should be removed and the floor area graded to the required level, allowing, of course, for the thickness of the concrete floor. The soil where the concrete is to be laid should be thoroughly compacted. If the location is such as to make it possible for water to get under the floor at any time this possibility should be reduced by using a fill of clean gravel, cinders, or crushed stone, providing suitable drainage for this fill.

Forms for defining floor slabs, alleyways, or other areas to be concreted should be of smooth lumber, rigidly braced in line and carefully set to proper grade. The manger curb is usually placed first. It should be not less than four inches thick and is usually made six inches high on the stall side. Uprights supporting stanchions are of several types. Some are attached to anchors which are in the curb and others are embedded in the concrete. The latter type must be in line and carefully plumbed before placing the concrete. One manufacturer has devised a clamp to bolt over the curb and support the stanchions.

Feed and litter alleys are usually placed after the curb; then the stall platform and the manger are placed.

The length of the stall platform, that is, the distance from the manger curb to the gutter, will depend upon the breed of cattle kept. For Jerseys or Guernseys the average length is about four feet eight inches; for Holsteins about five feet are necessary. The platform should be pitched about one inch from the curb toward the gutter.

The manger should be around two feet seven inches across and from eighteen to thirty inches high, with a curved bottom.

The gutter should be sixteen inches wide and eight inches deep from the stall and six inches deep at the driveway or alley. The reason for having the driveway lower than the stall platform is that the cows are kept cleaner, so that they can get out of their stalls more easily and they show up much better when the driveway is lower.

Calves should be fed as individuals, and for this reason provisions should be made for tying the calves during the time they are fed their milk and grain. A very cheap pen can be made out of wood which includes both stanchions and mangers. Individual pens for young calves do not pay unless the individuals are very valuable. One calf up to six months of age requires thirty square feet of floor space. The steel pens are preferred because they are much easier to keep clean. It is almost impossible to keep wooden pens free from lice.

The cow should be taken from her stall four or five days prior to calving and put into a box stall until ready to return to her stall.

This box stall should be in a place where there is not too much confusion, but where the cow can be easily seen by the barn men. Stalls ten by twelve feet equipped with a feed manger and hay rack are suitable. A steel pen with mangers attached are very desirable. A wood frame pen is satisfactory if preferred to the steel equipment.

Place the bull pen in one corner of the barn. Because the material used in building the steel pens is very expensive the pen is placed in a corner so that only two sides have to be purchased. Build the pen about twelve feet square, using steel to withstand the strength of the bull. Place the manger in one corner of the pen. Build a run or yard adjoining the barn so that the bull can get fresh air and exercise. This run should be about twelve by twenty feet. It must be built strong enough so that the bull cannot break it down.

DAIRY BARNS--LOCATION, VENTILATION, and INTERIOR ARRANGEMENT

Melvin Flaskerud '27
Clarence Krogstad '27

Melvin Flaskerud '27

To be satisfactory a barn should be convenient, sanitary, comfortable, well ventilated, and well lighted. With proper planning the ideals may be realized at a reasonable cost.

The inside arrangement of the dairy barn should reduce to a minimum the steps and labor necessary in feeding, milking, and cleaning.

The barn should be so constructed, and the material used in the construction of the floor and walls of such a nature that it can be easily cleaned. Corners, ledges, and places where dust or cobwebs can gather should be avoided. If a barn or milk room can be easily cleaned it will be kept cleaner than a room that is hard to clean. Sanitation is secured by good windows, clean mangers, deep gutters, and adjustable stanchions. Concrete floors add to the comfort of the animals. Alleys of the right width make chores easier. A concrete floor is easy to keep clean and is not slippery if finished with a wooden float. It is cold for cows to lie on, however, unless kept well bedded with straw or similar material. A wooden overlay made of cresoted planks gives the cows necessary insulation and when laid tight to the concrete in sanitary cork brick or cresoted wooden blocks are excellent but expensive. A plank floor with space beneath, will accumulate filth and become unsanitary.

A dairy barn should be sufficiently well built to keep the animals warm and comforable during the winter from the heat generated of their own bodies. Consideration should also be given to making the barn comfortable during the summer. For cows alone, eight feet is sufficient height from the litter alley floor to the under side of the ceiling joists. The general purpose barn containing horses also, requires eight feet six inches. Light ceiling on the under side of the joists makes a cleaner and warmer job, but many good barns are without it and merely have matched flooring on the upper side of the joists. Painting such joists and the bridging between them is difficult and cobwebs must be swept down frequently.

The usual requirement of window area for a dairy barn is four square feet of glass for each cown. This is desirable in order that the barn may be provided with sunlight for disinfectant purposes. A well lighted barn appears more clean and comfortable than a dark, dingy shelter. Recent developements in this knowledge of nutrition indicate that sunlight may have a beneficial influence on metabolism. It may prove to be desirable to make provision for getting more sunlight on milk cows. This can be done by turning them out in the sunshine or by arranging the windows so that they can be raised to allow direct sunlight to enter. Sunlight is considered essential to the health of the dairy cows, and it also helps to destroy disease germs which may be found in dark and dirty stables. The height of the windows should always be greater than their width, as more floor area is exposed to the sun this way than with low, wide windows. In the northern states objection is sometimes made to the use of too much glass on account of the loss of heat through the windows, which tends to lower the temperature of the barn. This difficulty may be remedied by using storm sash in the winter or by using double glazed sash; either of these is better than small windows.

Unless adequate storage space for feed and bedding is provided elsewhere, provision should be made in the new barn.

A well-built barn is generally the most economical in the long run. It is far better to build by degrees than to go in debt too heavily on barn equipment or to build too cheaply. Good accommodations for cattle, meeting all the needs mentioned above, can be had at a very reasonable price--at such a price that a dairyman cannot afford to be without them.

Ventilation in a barn is the process and practice of keeping a barn supplied with fresh air. It is a continuous process and is accomplished by diluting the air in the barn with fresh air in such quantities to maintain the desired degree of purity. The foul air escapes from the barn as the fresh air enters.

To maintain health, fresh air is essential. Ventilation in barns is just as necessary as inhomes, schools, factories, and other buildings in which human beings live or work in more or less close quarters.

The need for ventilation of cow stables is a consequence of the increased demand for clean, wholesome milk at low cost of production which has made it necessary that each cow shall produce as much milk as possible. Lightly constructed barns are apt to be damp unless ventilation is provided, and the stabling of animals in dark, poorly ventilated, damp barns affects their health and helps to spread tuberculosis among the stock wherever the germs are present. Clean, wholesome milk can be had only from healthy cows.

A good ventilation system, if properly installed and operated, will (1) supply without draft the fresh air necessary to the health and comfort of cows; (2) make possible control of barn temperature; (3) preserve the building and feed stuffs from mold that may spoil due to excessive moisture; (4) provide a measure of disease prevention and control.

The King system of ventilation provides for a number of small intakes and one or more large outlets. Fresh air enters above the sills, rises between the studding, and enters the stable at the ceiling. The outlet flues start near the floors, passing upward inside the barn, through the mow to the ventilator on the roof. The total area of the intake is generally two-thirds that of the outlets, depending upon climatic conditions. There is no accurate data with respect to the actual velocity of air in flues of different heights. Using King's recommendation as to the amount of ventilation required and assuming a flue velocity of 250 feet per minute, which is approximately that which may be obtained in a 30 foot flue under average conditions.

Outlets are usually arranged in pairs when the cows are to face inward, the outlets are placed on the outside wall on each side of the barn and often enter the same ventilator at the ridge. The flue should be air-tight and as straight as possible, with no abrupt turns. A barn sixty to eighty feet long usually should have two ventilators; in longer barns the exact number of outlets depends on the number and arrangement of the stock in the barn.

Several different arrangements of outlet flues are used. Some pass directly out through the roof at the plate, others, if the roof is of the gambrel type, continue along the lower set of rafters and pass out at the break; the most common practice is to continue the flues to the ridge of the roof.

The intakes should be smaller in size than the outlets and of greater number. They are generally placed ten or twelve feet apart and distributed to insure a good circulation of air in all parts of the stable. In the King system intakes start above the sill, rise between the studding, and discharge into the stable at the ceiling. In the colder sections it should be less, but air will enter the stable as fast as the outlets remove it, and if the intake area is too small the velocity of the incoming air will be so great as to cause drafts.

THE MORTGAGE LIFTERS

Douglas Clark '27
Loren Parkin '27

Douglas Clark '27

No branch of livestock farming gives better results than the raising of swine when conducted with a reasonable amount of intelligence. The hog is one of the most important animals to raise on the farm, either for meat or for profit, and no farm is complete unless some hogs are kept to aid in the modern method of farming. The farmers of the Northwest are awakening to the merits of the hog, and are rapidly increasing their bank account, by the output of pork. The hog requires less labor, less equipment, less capital, and makes greater gain per cwt. of <u>concentrates</u> than any other farm animal, and reproduces itself faster and in greater numbers, thereby returning money more quickly than any other farm animal.

The total production of hogs on farms in Minnesota in 1920 was 2,381,000 while in 1926 the production was 3,456,999, this being a total increase in five years of 31 per cent. This shows how the hog raising industry is coming to the front.

South St. Paul ranks third in receipts for hogs, second in hog slaughter, and first in the United States for shipment. This shows that we have one of the world's greatest packing plants right at home.

There are two economic problems in hog production that confront the hog grower. He should be able to forecast when to increase or decrease the total production of hogs, and at what time during the year to have hogs ready for market. Livestock men have come to realize that a study of past prices furnishes in part a basis for forecasting future price trends. There is a certain degree of regularity which characterizes the upward and downward price movements. The time intervening between the peak point and the lowest point in receipts is about two or three years for each production period. Likewise, the intervals between the lowest point and point in receipts vary from two to three years, for each production period. The natural tendency is to decrease production following a season or two of profitable prices. This fluctuation may be termed the long-time price tendency and is valuable in foretelling the future.

The other question that confronts the hog producer is the proper time in the year to place hogs on the market. There is the short-time or month to month price changes, that should be studied. A study of the average monthly receipts and the monthly price changes on four of the principal markets indicate that receipts can be divided into two periods. Referring to this chart you will note that receipts are highest in December and January when the heaviest run of spring pigs reached the market. A second heavy run will be noted in May and June when the smaller fall pig crop reaches the market. Note also that the prices decrease as receipts increase. An understanding of the yearly fluctuations in receipts and prices and the seasonal trends in the hog market is at least a beginning of a better knowledge of successful pork production.

From 20 to 25 per cent of the yearly hog crop is now fall born. Fall pigs can be successfully raised in the Red River Valley with very little if any extra equipment. Tests at University Farm have shown that fall pigs gained 1.39 pounds daily while spring pigs made a daily gain of 1.4 pounds. The gain by the fall pigs was made at a lower cost. Fall raised pigs have the advantage of reaching the top market in April.

In the matter of swine production there are a few factors to be kept in mind. These I shall bring to your attention by referring to the following chart.

Hog raising has probably made more clear money for the farmer than any other enterprise. For this reason you would expect to find the hog the best housed animal on the farm. But this is not true.

Some farmers have the idea that anything is good enough for a hog, but this animal to be the most profitable must receive good care and protection.

One factor in success with hogs is shelter. Young pigs must be kept warm as they chill easily and recover slowly if at all. To prevent taking cold they must be kept, dry, warm and away from drafts. The best hog house provides plenty of fresh air and is constructed so that sunlight is well distributed over the entire floor.

Several kinds of hog houses are used but among these there are two or three which are best adapted. One of which I will describe. This section of this type of house is illustrated by the following chart. This is called the half monitor type of house. Such a house should be 28 feet wide. This width will be sufficient for two rows of pens each 10 feet deep and an alley way of eight feet.

A row of windows on the south wall provides sunlight for the south row of pens. Light for the north pens is furnished from window in the short wall made by the jog in the roof. It is well to note that the width of the sunbeam depends on the position of the window. This chart illustrates a sunbeam on March 21. When the window is vertical the sunbeam will be the width shown by the two dark lines. The window placed at an angle of 30 degrees will add one-half more to the width of the sunbeam as illustrated by this red line and the dark line. This type of hog house distributes sunlight over the floors of both rows of pens at the time of the year when it is too cold for the spring pig crop to get out of doors.

THE MORTGAGE LIFTERS

Loren Parkin '27
Douglas Clark '27

Loren Parkin '27

The type of hog grown is always a compromise between what the consumer wants and what the producer can most economically furnish. I shall limit my discussion to the lard type of hog. This type is the most common in the Northwest, although there are farmers who are interested in the bacon type.

There was a time when the only type of lard hog was the very compact, wide, low-set animal that matured early and fattened most easily. This type does not make the most rapid or economical gain and cannot be profitably carried beyond a certain rather low limit of weight. Sows of this type are not prolific.

Occasionally one will find hog producers who still adhere to this type. This type produces the maximum amount of lard and the minimum of lean meat, producing pork cuts that carry too much fat and therefore do not meet the consumer's preference. As this type does not make economical gain, it does not find favor with the hog raiser who has made a study of the cost of pork production.

The hog feeder looks for points that will indicate a profitable utilization of feed. He wants a hog with a large rugged frame, a strong back and limbs, a broad, deep chest, a vigorous constitution, and enough depth to indicate strong feeding capacity, and an active rustling disposition.

Only purebred or high grade stock should be selected. It does not pay to feed high priced grain to scrub hogs. Purebred hogs are more highly specialized machines in converting farm feeds into pork than scrub hogs.

One should choose the breed he likes best; if he intends to grow purebred breeding stock, he should choose the breed that is most popular in his community. Otherwise he may have trouble in obtaining new blood as well as disposing of surplus stock.

The hogs would not be the mortgage lifters if no consideration was given to the cost of production. The greatest part of the production cost is the feed.

There is no one method in feeding that can be considered as the only method to follow. In general it can be said that the same good judgment required in the selection of the right type of stock must be practiced in feeding and management. Good selection will be rendered ineffective if the feeding is such that the animal will not thrive and yield a good increase. The real problem in swine feeding is to supply sufficient nutritive material for building and repairing the body and furnishing sufficient energy to lay on fat. The most satisfactory ration must necessarily be made up of feeds which are wholesome, relished by the hog, and at the same time, which are reasonable in cost.

Feeding for economical pork production may be divided into three periods; namely, the feed and care of the brood sow, the care of the pigs before weaning, and the ration for the growing pigs from weaning to marketing.

In this demonstration, I shall speak principally on the feeding after weaning. However, mention should be made that strong pigs can be expected only when the brood sow has been properly fed and to encourage the pig to eat as soon as possible.

Pigs that are eating liberally of a good growing ration before weaning will continue to thrive when separated from the sows.

The weaned pig should be provided with skimmilk and such nitrogenous feeds as middlings and tankage to supplement the ground barley or corn. A mineral mixture must also be provided for bone development. Equal parts of steamed bone meal and salt will supply the mineral needs for pigs.

Before weaning, the pigs with sows should have been placed on a clean pasture. During the entire summer season the pasture crop should be an important factor in hog feeding. Experimental work has demonstrated that the use of forage crop is an economical way of producing pork.

Hogs relish green forage and it is difficult to understand why more farmers do not take advantage of feeding off green crops in this way. Pastures furnish the growing pig a succulent food, which enables him to assimilate better the grain which is fed in addition; green crops also assure the growing pig a sufficient quantity of protein, and aids in mineral assimilation, thereby enabling the pig to thrive properly.

If we expect to grow hogs and prepare them for market exclusively by the use of grain, it will not be found very profitable as a rule. Experimental data secured from a feeding trial at the Northwest Station will illustrate the economy of pasture for growing pigs. The results of the feeding trial show that the lot of pigs fed in a dry lot received the same kind of grain ration that was fed to a lot having the run of a rape pasture. The pigs were fed for a period of seventy days. During this time the dry lot fed pigs required six hundred twenty pounds of grain to make one hundred pounds increase growth, while the pasture fed pigs produced one hundred pounds of gain with four hundred thirty-eight pounds of grain. In this trial the pasture made a saving in grain of thirty-two and six-tenths percent. Also the cost of gain was made at two dollars per hundred weight cheaper on pasture.

Furthermore, this same trial shows that pasture produced a more rapid gain. Starting July 1 with an initial weight of sixty-three pounds per pig for each lot; the pasture fed pigs on September 8 average one hundred fifty-nine pounds in weight, while the dry lot pigs averaged only one hundred sixteen pounds. A difference of twenty-eight and one-tenth percent in the rate of gain.

In the demonstration, my colleague and I have endeavored briefly to present a few of the problems connected with the successful management of the mortgage lifters. Such factors in the management will add interest as well as profit to this phase of livestock production, and when properly applied will make the hog an ideal lifter of the farm mortgage.

Much has been said about the Red River Valley's pre-eminence in music. The glad songs of the birds, the soft rustling of the wind through the trees, the crooning melodies that arise from everywhere,--these are all beautiful but the music that counts the most in giving wings to the mortgage, that will bring joy to all as it is accompanied by the welcome jingling of silver, is that of the farmer who calls the porkers to their repast.

This is how he does it.

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This Valley chorus that will make its mark.

POULTRY

MARKETING POULTRY PRODUCTS

Stanton Rudser '27
Harold Nicholson '27

Stanton Rudser '27

There is comparatively little specialization in this country in raising market poultry. The great bulk of market poultry, however, is a by-product incidental to the production of eggs. On general farms poultry is kept to supply both eggs and meat. While chickens are reared in considerable numbers in the east, the greater supply of poultry, in the future, will come from the north central states, namely: Minnesota, Iowa, Wisconsin, and Illinois.

The purpose of fattening poultry for market is twofold: first, to obtain gain in weight, and second to improve quality. Poultry may be fattened from ten to twenty days. There are four different ways to fatten poultry. They are range, pen, crate, and noodling. The range method is used to start chicks. Pen and crate for finishing and noodling, which is an expensive practice, is used only on geese.

When poultry is marketed

dressed, the killing must be carefully and properly done, so as to safeguard its keeping qualities. Scalded picked poultry does not bring as high a return because scalded picked keeping qualities are inferior to those of dry picked. The head should be left on as an evidence that the bird was in good health when slaughtered.

The producer may market his poultry alive or dressed. The common practice is to market the poultry alive as the producer has not the proper facilities for killing.

The poultry may be marketed direct to the consumer through a poultry dealer or a local buyer who may be an agent for a packer. Both alive and dressed is marketed direct to consumer. The amount sold by this method is comparatively small.

The common method of marketing poultry where producer is within easy shipping distance of the consuming market is to ship alive in crates. Yet a great bulk of the poultry goes to the packer who dresses it for the market. As some markets demand live poultry there is a shortage of live poultry from near-by farms and it is necessary to obtain shipments in car lots from the packers or shippers in the west.

The coop used for shipping live poultry should be made of light and strong material. The bottom should be tight and on the sides and top the slats should be close enough to prevent the poultry from sticking their heads through and being injured. Provide well ventilated coops as this lowers the loss from suffication. Never over-crowd the coops as this causes over-heating of the chickens and the result is a great loss. The standard sized coops used is three feet by two feet and twelve inches high. The height depends upon kind and size of fouls to be shipped.

In cooping poultry for shipment, the birds should be graded so that each lot is as uniform in color, size, grade, and class as possible. A uniform lot is much more attractive and ordinarily sells more readily. Under no circumstances include culls, weaklings, and cripples with stock of better quality, for they are likely to lower the net returns.

Shipments should be made so that they will arrive on market early enough in the day so that they will be weighed the same day. Live poultry should never arrive late Saturday afternoon, for these birds are held over until the next Monday before being weighed. It is best to have shipments on the road as short a time as possible and the smallest shrinkage will result.

The market grades and quotations for poultry are not uniform in different markets. Poultry quotations represent the three main classes, that is live, fresh dressed, and frozen. The latter is poultry that has been held in cold storage in order to carry it for a considerable time.

Various grades are quoted in each of these classes, based upon conditions, quality, age, and sex. A few other factors may be recognized in quoting dressed poultry, chief among which are scalded or dry picked, ice or dry packed, and milk or corn fed. Three grades of each of the various classes of dressed poultry are commonly made. The best grade includes those birds which are in good condition of flesh and cleanness, and are well dressed. The second are thin fleshed and poorly dressed.

Third, the culls which are inferior to both grades.

The following market grades of poultry are in common use and the Minnesota standard is similar to it:

Broilers--broilers are immature chickens which as a rule weigh from two and a half to three and a half pounds each.

Fryers--fryers are immature chickens which, as a rule, weigh from two and a half to three and a half pounds each.

Roosters--roosters are young chickens which weigh four pounds or over.

Stags--sometimes young males which have matured to some extent are termed as stags.

Springs or springers is a term commonly used to designate all young stock hatched during the preceding spring and early summer.

Capons--Capons are unsexed male chickens when marketed at an age of seven or ten months, weight from five to ten pounds each.

Fowls--Fowls are matured stock which are usually the cheapest of all grades.

In practically all classes of poultry the grades are based upon the weight of the birds, either per dozen or per bird.

Usually producers do not have enough dressed poultry to market to make it necessary tó do very much in the way of grading. However, an effort should be made to secure as great uniformity as possible in appearance and size.

In commercial packing plants, grading is an important process. After being chilled the birds are sorted according to size and kind and are graded on the basis of their weight, freedom from blemishes, torn skin, pin feathers, and deformities. Grading should be done in a chilled room, preferably by daylight, as this permits a more careful examination and grading according to color.

Most producers pack their poultry in barrels for the reason that ice can be more readily used in barrels than in other types of packages. In barrel packing the dressed carcasses are packed by placing first a layer of ice and then a layer of poultry, covering this with a layer of ice and continuing to alternate in this manner until the barrel is filled. The barrel should be covered over the top with a piece of burlap tacked to the sides.

Under commercial conditions in larger packing houses the barrel pack is used largely for culls and for scald-picked: In other words, for the poultry of less desirable grade. The more desirable poultry is packed in wooden boxes with twelve birds to a box. A few packers of milk fed chickens use pasteboard cartoons, packing two broilers and one or two roasters to a carton. All box packed and much of the barrel packed poultry in up-to-date packing establishments is dry packed; that is, packed without ice. All boxes and barrels should be stenciled to show kind of poultry which the package contains, and the tare and net weights.

If market is near by shipments may be made by express but in long distant shipments it is safer to use a refrigerator car. When the poultry is not moved into an immediate channel of consumption it should be held in cold storage in frozen condition at a temperature of ten to fifteen degrees Fahrenheit. Frozen poultry that has been thawed out will not keep so well after refreezing.

If you market poultry remember to:

Study your shipping facilities and determine when shipments will arrive on market.

Do not feed before shipping unless birds will not arrive on the market until the following day.

Do not overcrowd the birds in the coops.

Fattening the birds before they are marketed will usually pay. Dress the poultry in such a manner as to meet the demands of your market.

Chill the birds immediately and thoroughly after killing and picking. Never draw poultry unless your particular trade demands it.

Do not ship dressed poultry without packing in plenty of ice. Find out what days are best on your market.

Grade your poultry so that it is uniform in size, color, and grade, and pack accordingly.

MARKETING POULTRY PRODUCTS

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More than five million farms in the United States produce eggs. On most of these farms eggs is a side line and the surplus available for market is small, but the total surplus of these farms is sufficient to supply the needs of an urban population of more than 54,000,000 people.

The greater supply of eggs is in eastern north central, and western north central states, although large numbers of of eggs are produced in the east and along the Pacific Coast where the climatic conditions are especially favorable. In 1919 Iowa led with an annual production of 120,000,000 dozen.

Egg marketing methods may be divided into three groups. Direct, indirect, and intermediate. Direct marketing is the sale of eggs by the producer to the consumer. Indirect marketing is the sale of eggs by the producer to various agencies which in turn sell to packers or concentrators. Intermediate marketing is a method by which the producer sells to dealers in the consuming market, the eggs passing through the hands of more dealers before they reach the consumer.

Grading of eggs is merely a process of sorting them according to quality and of packing each quality in separate containers. The grading of eggs by the producer is simple and should never be neglected. It consists of the throwing out of all eggs which are unsuitable for food, and also of sorting out those which by reason of their small or large size, or dirty or cracked condition are unsuitable for market but which, when wholesome, should be retained for home consumption or for sale to local retail dealers. If every farmer practiced this simple method of grading much of the trouble and loss involved in the handling of eggs commercially would be eliminated and the general quality of market eggs would be improved.

The packages most generally used for packing eggs are the carton, the egg case, and the fillers and flats. The carton is a pasteboard package with a capacity of one dozen eggs. This style is very seldom used except when the producer is selling direct to the consumer.

The producer who ships his eggs generally uses the standard thirty dozen case which is used by packers. This type of case is made of very light wood. The sides, top, and bottom are of three-sixteenth inch material while the partition and ends are seven-sixteenths inch. It is important that the center board be in the true center of the case so that the two compartments will be of equal and proper size and the eggs and packing will have neither too little nor too much room.

The ordinary filler is made of strawboard and contains thirty-six square cells arranged in a square with six on a side.

Five fillers, each holding three dozen eggs, are used in each side of the case, or ten fillers in all. Fillers of this style are commonly called honeycomb fillers though the real honeycomb is made up of six-sided cells. Special fillers must be used when duck eggs are shipped. In these fillers there are only twenty-five fillers instead of thirty-six on account of the large size of the eggs.

To determine the quality of eggs as shown by the condition of the air cell, yolk, white, and germ, it is necessary to candle them. Candling consists of holding the egg before a strong light, usually artificial, in such a way that the rays of light penetrate the egg to a considerable extent, thus enabling the conditions of the contents to be noted. Most producers do not candle eggs, although, buyers and dealers find it advantageous to do so. Candling should be practiced most generally by producers. Where it is done daily it is a short process on the average farm and will eliminate any eggs which are badly deteriorated and which should never find their way into the market egg basket.

Home-made egg candlers may be easily and cheaply made by using any light that is strong enough for this purpose. An electric light is best, but a good kerosene lamp, gas, or sunlight may be used. One of the simplest and most satisfactory home-made devices consists of a length of stovepipe with an electric light or kerosene lamp set inside. A round hole one and one-fourth inches in diameter should be cut directly on a level with the light. In candling eggs, they are held in a slanting position with the large end against the hole through which the light passes. The eggs are grasped by the small end and while held between the thumb and tips of the fingers it is given two or three quick turns on its long axis. This moves the contents of the egg, and throws the yolk nearer the shell, allowing its conditions to be more carefully observed.

To understand the conditions or factors that may affect the quality of eggs, their structure and composition should be reviewed. The yolk is suspended in the white at approximately the center of the egg and is surrounded by the vitilline membrane. On the surface of the yolk and always on its upper side appears the germ or germinal spot. In some cases there may be more than one. In an infertile egg this germ is small and irregular in shape; in a fresh fertile egg it is round and larger.

The white consists of albuminous material which fills the space between the yolk and the shell. It varies in density, being thickest in the portion near the yolk and thinnest in the portion next to the shell membrane.

The shell is composed largely of lime, is porous in structure and allows the evaporation of water from the egg contents, the penetration of odors, and flavors, and under unfavorable environments, the entrance of bacteria.

About ninety-nine percent of the eggs used in America are produced here. Egg products are consumed mainly by wholesale bakers and by confectioners, or these the frozen products serve largely as an ingredient of cakes and dried eggs find their outlet chiefly in the backing of pies, sweet specialties, and confections. Considerable dried albumin and some dried yolk and mixed eggs are also used in art. Some liquid yolk and mixed eggs, as well as some dried egg or yolk are consumed in tanning. Egg yolk oil is used in glove leather and in book binding. Dried albumin is used for finishing glazed lether, in chrome tanning of skins, and as a mechanical fixing agent in textile dying, particularly in pringing delicate tints for which blood albumin is not suitable.

I hope that we have convinced you that marketing of poultry products is one of the outstanding industries in the United States.