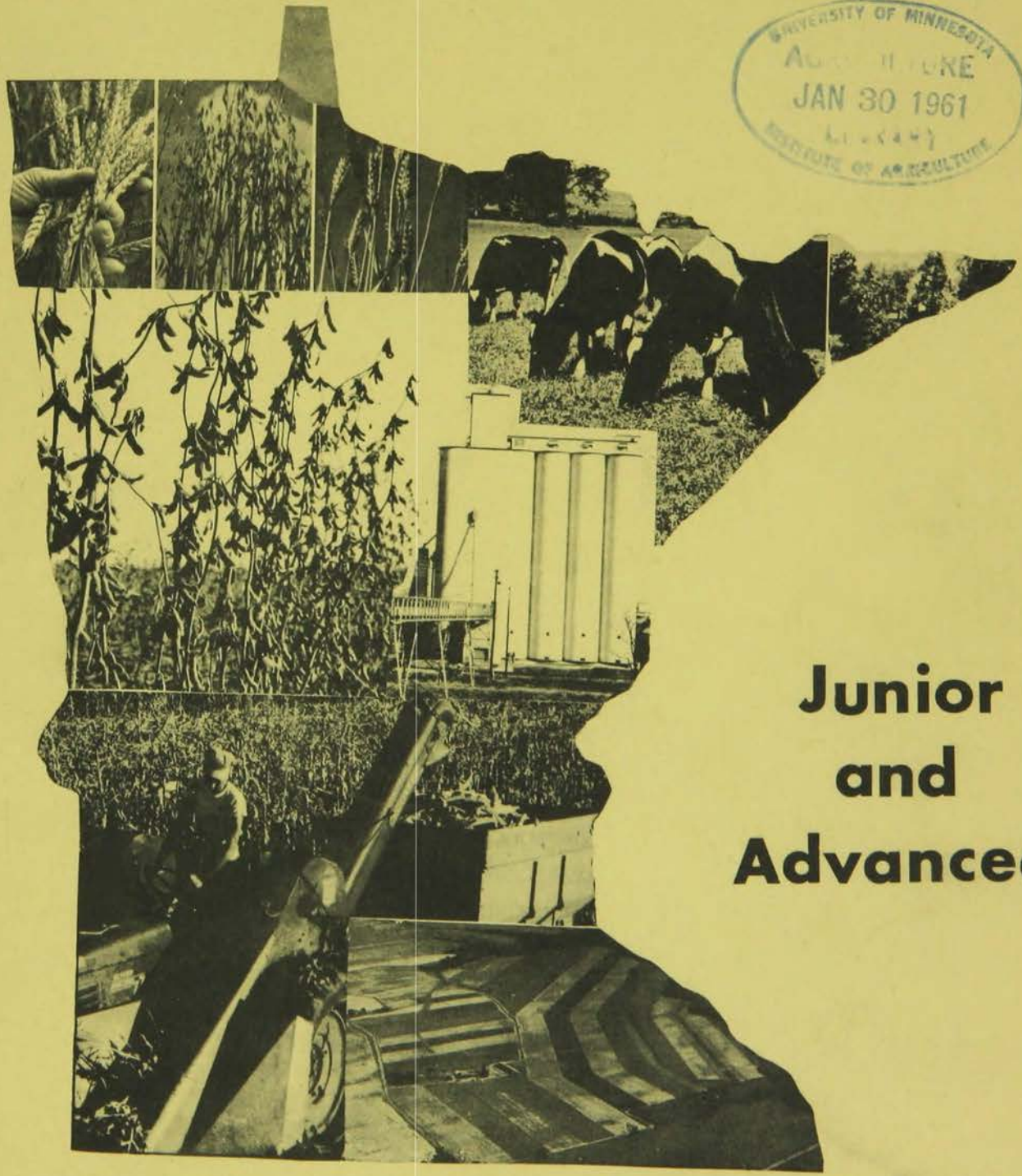
T. BULLETIN B-51 JANUARY 1961

4-H Agronomy Project

CROPS and SOILS



Junior and Advanced

UNIVERSITY OF MINNESOTA
AGRICULTURAL EXTENSION SERVICE • U. S. DEPARTMENT OF AGRICULTURE

Junior: Suggested ages - 12 through 15 years old.

Units 1-7	See Bulletin 50
Unit 21	Fertilizer trial on crops
Unit 22	Variety comparisons
Unit 23	Weed control

Advanced: Suggested ages - 15 years and over.

Units 1-7	See Bulletin 50
Units 21-23	
Unit 41	Rate of seeding
Unit 42	Time and method of harvesting forages
Unit 43	Certified seed production

This handbook was prepared by Extension Specialists in Agronomy and Soils to aid you in giving project, record, or demonstration help. Notice that there are both helps for things to do as well as suggestions for items to make. Work done in the home may be divided into five units.

Junior and Advanced

4-H AGRONOMY PROJECT *

Crops and Soils

We are glad you have enrolled in the 4-H Agronomy project. You will have an opportunity to explore the world of crop plants and the factors involved in growing and marketing a profitable crop. You will invest valuable time and labor, as well as seed, land, and fertilizer in your project, so be sure you understand what is needed for a successful crop before you go to the field.

If you are an older member, you should answer the following questions before choosing your project:

1. What are the chances for your project to be successful?

2. How useful will the project be to you and to the agriculture of your community and state?

3. Will you also enroll in livestock projects? If so, you will want to consider crop projects that will furnish feed for the animal or animals.

4. Will crops be your only project? If so, consider the chance for profit in the project you choose.

WAYS TO GAIN PROFIT

The crops you produce for your project may be disposed of in one of three ways:

1. You may sell the product on the market for feed or food. In this case, only certain crops will prove profitable.

2. You may produce certified seed for sale. You have an excellent opportunity for a profitable project if you produce certified seed. You also have a chance to be of service to your community by helping to raise the standard of general crop production. The production of certified seed is a speciality, requiring more care and training than the production of crops which are to be sold on the market as feed or food. Certified seed projects should be carried only by older club members.

   Certified seed is produced under the inspection and certification of the Minnesota Crop Improvement Association which is the legal certifying agency in Minnesota.

   Before starting a project of certified seed production, you should first learn the fees, costs, requirements, and standards necessary. You may obtain this information from your county agricultural agent, or from the manager of the Minnestoa Crop Improvement Association, whose address is St. Paul 1, Minnesota.

3. Feed may be produced for your own livestock project. Corn, oats, and alfalfa hay especially can be used for this purpose as a supporting project for any livestock projects carried.

PROJECTS AVAILABLE

The following field crop projects are organized and available to 4-H Club members.

Corn
Soybeans
Small Grains
Forage

SIZE OF PROJECT

In the junior group at least 1 acre of the basic crop is required in addition to crop practice units as specified. In the advanced group, the requirement is for at least 5 acres of any one of the basic crops in addition to the required crop practice units.

CORN

Corn is the most important crop grown in Minnesota. It is a good crop for cash sale. It is also a good supporting project if you have a livestock project. You also have an opportunity to produce certified hybrid corn seed -- when you gain more experience.

SMALL GRAINS

Wheat is a good cash grain crop. Both Hard Red Spring and Durum types are in demand. The production of certified seed wheat also offers a profit opportunity.

Barley is a good cash grain crop if you can meet malting barley standards. It is also a good feed for livestock, therefore it is a good supporting project to consider if you have a livestock project. The production of certified barley seed also offers a profit opportunity.

Oats is a major feed grain in Minnesota. Its demand as a cash grain is not as good as for wheat or barley, but as a supporting project to livestock --it would be good. There is also an opportunity to produce certified oats seed.

Rye is not too important a crop in Minnesota but is well adapted to the lighter soil areas of the central and northern sections of the state. Rye can be used as a late fall and early spring pasture and is a good supporting project for livestock. Because rye is cross-pollinated, there is a good demand for certified seed rye to assure purity of variety.

Flax is not used as a feed but rather as a cash grain in Minnesota. There is a good demand for high quality flax. Production of certified seed offers a profit opportunity.

* The material in this bulletin was developed by Extension Specialists in Agronomy and Soils.

SOYBEANS

Soybeans are the most important market crop grown in Minnesota. There is always good demand for certified seed of recommended soybean varieties.

FORAGE CROPS

For the 4-H member who has built up a sizeable livestock enterprise, forage crops are an excellent supporting project. Forage crops may be grown for hay, silage, and pasture, and with some there is a good demand for certified seed.

Certified seed production is possible with red clover, birdsfoot trefoil, sweet clover, alfalfa, bromegrass, timothy, and other grass species.

CROP PRODUCTION PRACTICE UNITS

In addition to the four basic projects --corn, soybeans, small grains, and forage crops, crop production practice units have been developed. These units should offer additional challenge to the member for growth in the Agronomy project. The units now available and suggested age for members are as follows:

Beginner: Suggested ages -- 9 through 12 years

Unit 1 Learning to know seeds and plants

Unit 2 Building a plant press

Unit 3 Collecting plants

Unit 4 Germination test

Unit 5 Soil test sampling

Unit 6 Attend a crop production field demonstration meeting

Unit 7 Clean market grain survey

Junior: Suggested ages -- 13 through 15 years

Unit 1-7

Unit 21 Fertilizer trial on crops

Unit 22 Variety comparisons

Unit 23 Weed control

Advanced: Suggested ages -- 15 years and over

Unit 1-7

Unit 21-23

Unit 41 Rate of seeding

Unit 42 Time and method of harvesting forages

Unit 43 Certified seed production

UNIT 21

FERTILIZER TRIAL ON CROPS

The use of fertilizer according to University of Minnesota recommendations based on soil testing has been one of the highest return practices for a dollar spent on the farm business. However, many farmers still do not use fertilizer on their

BROADCAST AND PLOW DOWN

BROADCAST AND DISK IN

FERTILIZER WITH THE PLANTER

SIDE-DRESSING

crops, or if they do, they may not be using the right amounts or grades.

The objectives of this unit are to determine the needs for fertilizer by use of the soil test (Unit 5) and then to study, observe, and learn the effects of fertilizer when applied according to University recommendations based on the soil test.

Selection of Plot Area

The plot should be located in a corner of the field. The soil should be uniform in color, slope, and cropping history. If possible, it should be a field not fertilized last year.

The fertilizer may be applied either broadcast or at planting time, whichever best fits the machinery available on the farm. The following are suggested fertilizer trials:

Plan A - If fertilizer is used on crops on your farm:

Check -- no fertilizer

Fertilized 1 -- Your usual rate of fertilizer

Fertilized 2 -- Applied according to University recommendations based on the soil test

Plan B - No fertilizer used on the farm over previous few years:

Check -- no fertilizer

Fertilized -- applied according to University recommendations based on the soil test

Plan C - A fertilizer system to fit the individual need or interest of the project member can be developed by soils specialists. If you are interested in an individual plan, discuss this with your county agricultural agent or club leader. You should have completed either Plan A or Plan B before considering Plan C.

Place permanent plot markings where they will not be destroyed. Record distance from permanent stakes to the plot. Follow directions for plot layout in Appendix I.

Do this:

1. Conduct a fertilizer trial on any one crop.
2. Enroll in Unit 5 "Soil Test Sampling."
3. Take yield checks.
4. Include plan of demonstration area and write up results for your agronomy project record.

Materials needed:

1. See Unit 5 "Soil Test Sampling."
2. Lath stakes for plot markers.
3. Tape measure.
4. Dairy scale to weigh harvested crop.
5. Quart jars or plastic bags for moisture samples.
6. Clean bags (burlap or paper) for yield check sample.
7. See directions for harvesting demonstration plot -- Appendix.

Demonstration Suggestions:

1. What's in the bag?
2. How to take a good soil sample.
3. Laying out the demonstration plot.
4. Why I use the soil test before applying fertilizer.
5. How to take a yield check.
6. Role of nitrogen, phosphorous, and potassium in plant growth.

Your Name_____ Address_____

Club Name_____ County_____

Unit 21 -- Fertilizer Trial Information Sheet

(Complete and attach to your Agronomy Project Record)

Name_____ Address_____

Fertilizer Trial: Plan A_____; Plan B_____; Plan C_____.

Soil Test: pH_____ Organic Matter_____ Phosphorous_____ Potassium_____

Soil Texture_____ Manure Applied_____

Previous Crops 19_____ 19_____ 19_____
(3 years)

FERTILIZER RECOMMENDED ( ) Nitrogen ( ) Phosphate ( ) Potash

Broadcast_____ Starter_____

What Fertilizer Was Used? Grade_____ Amount_____

PLANTING RATE

Plant Count	(Corn only) Emergence	Harvest
Plot 1		
Plot 2		
Plot 3		
Plot 4		
Plot 5		
Plot 6		

YIELD DATA:

	Fertilized Plot			Check Plot	
	weight	moisture at harvest		weight	moisture at harvest
Plot 1			Plot 4		
Plot 2			Plot 5		
Plot 3			Plot 6		
TOTAL			TOTAL		
AVER-AGE			AVER-AGE		

Yield at 15.5%(corn)_____ Yield at 15.5%(corn)_____

Yield at 14.4%(other grains and soybeans)_____ Yield at 14.0%(other grains and soybeans)_____

Yield at 15%(forage)_____ Yield at 15%(forage)_____

UNIT 22

VARIETY COMPARISONS

The selection of the proper crop variety is an important factor in successful crop production. If you use the best management practices known (fertilizer, weed control, insect and disease control, etc.), these may all be wasted if the wrong variety is used.

Good varieties are adapted to the growing conditions within a given area. With improved varieties, care has been taken to select those with high levels of disease and insect resistance, adaptation to given maturity periods, as well as other high yielding characteristics.

Experiment stations are constantly developing and testing new varieties. Each member should try out these improved varieties to see how they will perform under his management and under the environment of his farm.

Do this:

1. Compare at least three varieties or hybrids of any one crop. Corn hybrids can be selected within the zone or from zones to the north of the zone where you live.
2. Take yield checks.
3. Include plan of demonstration area and write up results you obtain from your demonstration in your agronomy project record.

Materials needed:

1. Misc. Reports 20 and 28, Minn. Agric. Expt. Station; Extension Bulletin 22 (Revised Annually).
2. Seed for three varieties or hybrids of any one crop.
3. Lath stakes for plot markers.
4. Tape measure.
5. Dairy scale to weigh harvested crop.
6. Quart jars or plastic bags for moisture sample.
7. Clean bags (burlap or paper) for yield check sample.
8. See directions for laying out and harvesting demonstration plot--Appendix.

Demonstration Suggestions:

1. Laying out the demonstration plot.
2. How to take a yield check.
3. Why I compare varieties or hybrids on my farm.

UNIT 23

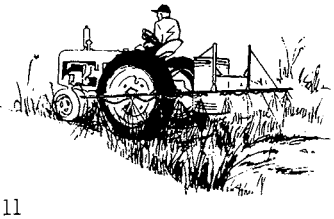
WEED CONTROL

Weeds reportedly cause reduced crop yield and increased production costs of 3.5 billion dollars each year from total United States farm income. For this reason, if no other, you should become familiar with weed pests and how they can best be controlled. Unit 3A gives information on making weed collections.

The purpose of this unit is to demonstrate methods of weed control by timely cultivation and effective use of recommended herbicides. The chemicals suggested for use are available at your local farm supplier, and equipment needed for the cultural practices suggested is generally available on the farm. Remember--the first step to good weed control is to plant seed free from weeds.

This unit should be carried out in conjunction with your crop project. Be sure that you use the right chemical for the crop you are growing in your project. If you are not sure, check with your club leader or county agricultural agent before you make application to the crop.

A. Size of weed control area will depend on method of application. If you are using a farm sprayer you will most likely want large plots, such as one or two widths of the boom over the length of the project area. If you use a hand or knapsack sprayer, it is likely that you will want smaller plots. This may be an advantage as less total area and chemical will be needed. Plots should not be smaller than 1/100 acre which could be 43.5 feet by 10 feet for each plot.



Observations of weed growth can tell quite a bit about the effectiveness of the different herbicides and application methods. If the larger plots run the length of the project area, yield samples can be taken from three locations.

B. Suggested weed control demonstrations--

1. Row Crops

   a. Check--no cultivation
   b. Cultivation--two or three times
   c. Chemicals--use herbicides recommended for the crop by the University of Minnesota Agricultural Experiment Station.

   Two combinations are possible; a and b without c; or a, b, and c. This will depend somewhat on the size of project area, present status of weed control on your farm, and number of herbicides you want to demonstrate.

2. Broadcast Crops

   a. Check--no control
   b. Chemicals--use the herbicides recommended for the crop.

C. Application of Herbicides

There are three recognized groups of herbicides based on time and method of application. Wherever possible, these comparisons should be made as they apply to the crop in your project.

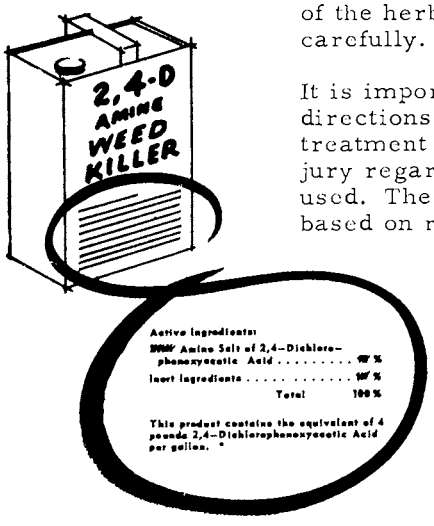
1. Pre-plant--The seedbed is prepared, but just prior to planting, the herbicide is applied. To be most effective, the herbicide should be well incorporated into the soil by discing or dragging. After the herbicide is incorporated, the crop seed is planted.

2. Pre-emergence--The crop seed is planted and before emergence the chemical is applied. With row crops this is best done with a band spray attachment fixed behind the packer wheel of the planter. With broadcast crops the field can be covered with a boom sprayer.

3. Post-emergence--The crop has emerged from the ground before herbicides are applied. Spraying is usually based on height of weed plants to be controlled.

READ THE LABEL

D. Read directions on the label of the herbicide container carefully.



It is important to follow directions as to time of treatment to avoid crop injury regardless of method used. These directions are based on research findings and are the rates and time of treatment that have given the best results over a period of years. The label is your protection; read it carefully to see if there are residue restrictions if the crop is to be fed to livestock or sold as a cash grain.

E. What Herbicides to Use:

Crop	Herbicide (number in parenthesis refers to time of application given under C)	Rate per acre
Corn	(2) CDAA (Randox)*	4 lbs/acre
	(2) Simazine	3 lbs/acre
	(2) Atrazine	3 lbs/acre
	(3) 2,4-D Amine	½ lb/acre
Soybeans	(2) CDAA (Randox)*	4 lbs/acre
	(2) Amiben	3 lbs/acre
Small grains	(3) 2,4-D or MCPA Amine	½ lb/acre
Oats, wheat, barley		
Flax	(3) MCPA or 2,4-D Amine	¼ lb/acre
	(3) TCA	5 lbs/acre
	(3) dalapon	3/4 to 1 lb/acre
Alfalfa (seeded without companion crop)	(1) EPTC (Eptam)	2 lbs
	(2) TCA	5 lbs
	(3) 2,4-D B	½ lb
	Dalapon	1 lb
	(3) 2,4-D B + dalapon	½ + 1

* Irritating to skin so avoid contact.

F. Do this:

1. Select part of your project area for the weed control unit.
2. Measure off each plot and mark with a lath stake. Replicate if you intend to take yields.
3. Calibrate sprayer by following directions given in Extension Folder 191. Calibrate hand sprayers by covering plot area with water only to see how many trips over the plot are needed to empty the sprayer.
4. Observe your plot weekly. Indicate type of weeds present and kind of control. Indicate crop injury or kill.
5. Use a rainfall gauge and record the amount of rainfall on a calendar for each day it rained.
6. Include plan and write up your demonstration results for the agronomy project record. Each year the North Central Weed Control Conference sponsors an essay contest "How we control weeds on our farm." The state winner award is $25 and the regional winner award is a $300 scholarship to the agricultural college of winner's choice. The essay is to be 1,000 words or less. (Entrance in the essay contest is optional to the project)
7. Enroll in Unit 3 "Plant Collections" and collect only those weeds found in your project area. (This is optional, not a requirement for completion in this unit.)

Demonstration suggestions

1. Weed control methods
2. Calibrating the farm sprayer
3. How herbicides kill weeds

Your Name _____ Address _____

Club Name _____ County _____

UNIT 23 -- WEED CONTROL DEMONSTRATION

(Attach this information sheet to the agronomy project record.)

WEED CONTROL RESULTS IN

CROP _____

Write in the name of herbicides used and check appropriate boxes to indicate control and injury.

Herbicide used	Rate of application	DEGREE OF WEED CONTROL						SYMPTOMS OF CROP INJURY				REMARKS
		Grasses			Broad Leaved							
		good	fair	poor	good	fair	poor	none	slight	moderate	severe	

UNIT 41

RATE OF SEEDING

The rate of planting used with any given crop will have an effect on the total plant population on a given area of soil. Many farmers plant large amounts of seed, but fail to benefit from this practice because of high planting speed, low fertility, natural causes, lack of weed control, etc. In this unit you will observe the effect of different planting rates on yield, vigor of the crop, quality of the crop, and costs and returns.

Rates of Planting

Corn-- 1) 10,000 vs 14,000 vs 18,000 on light textured soils
2) 12,000 vs 16,000 vs 20,000
3) 14,000 vs 18,000 vs 22,000
4) narrow rows vs wide rows

a. 20" vs 40"
or
b. 30" vs 40"
c. 20" vs 30" vs 40"

Soybeans-- 1) narrow vs wide rows
2) broadcast vs wide rows
3) broadcast vs narrow vs wide rows

Small grains-- recommended seeding rate vs double vs three times

Alfalfa-- 1) recommended vs half vs double
or 2) add grasses at recommended vs

Red Cover half vs double with alfalfa or red clover constant rate.

How to seed different rates

If possible the corn planter or grain drill should be used for planting in this unit. However, your project area may be too small to make this possible. If this is the case, hand planting may be more satisfactory. Use the corn Planting Guide in the Appendix to determine planter setting for corn.

Row widths

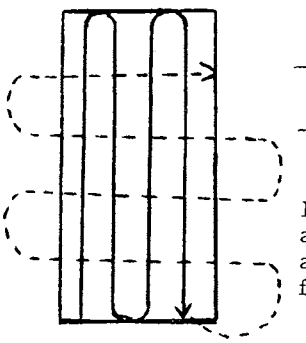
If the corn planter is set at 40 inches, the 20-inch versus 40-inch comparison can be made by doubling back over the 40-inch rows. In a complete round trip four 20-inch rows can be planted.

If you use the 30-inch combination, this can be done by having seed in only one box and then shortening the row marker to give 30-inch row width. It will take two round trips across the field to get four 30-inch rows.

The grain drill should be used to plant the broadcast crop in the broadcast vs. row width comparisons.

Broadcast seedings

With small grains, calibrate the drill to seed the recommended rate for the crop. To double the rate, cross the area perpendicular to the single rate. For the triple rate, travel in the same direction as the single rate.



With forage legumes the forage seed box gears should be calibrated for the half rate. One round trip across the field will give the recommended seeding rate. Two round trips will give the double seeding rate.

If grasses are to be used in mixture with the forage legumes, seed the grasses alone over the whole area at the recommended rate before the legume is seeded. If grasses are to be seeded at varied rates, seed the legume alone over the area at the recommended rate. Follow the same procedure with grasses as with alfalfa to get desired rate.

Do this:

1. Select part of your project area for the rate of seeding unit. Compare at least two rates of seeding.
2. Measure off each plot and mark with lath stakes. Replicate the treatments.
3. Take yield checks. See Appendix.
4. Be sure other factors such as fertility, weed control, and variety are not limiting factors.
5. Include plan and write up results of demonstration in the agronomy project record.

Demonstration Suggestions:

1. Influence of plant population on yield.
2. Calibrating the corn planter or grain drill.

UNIT 42

TIME AND METHOD OF HARVESTING FORAGES

Much research has been done to determine the best time to harvest forage crops for hay, pasture, and silage. However, many livestock farmers are not aware of the potential feeding value in their forage crops because they have failed to harvest the crop at the most nutritious stage.

This unit should be carried along with a livestock project. The suggested methods in each of the major forage uses should point out essential steps needed for efficient and economical livestock feeding.

There are two phases to a good forage program. First is the production of high quality hay, silage, or pasture; second is the most economical utilization of the nutrients in the forage through livestock feeding. Since these practices are part of a long time farming program you will want to work closely with your parents on them. The following sub-units or practices will help you learn more about good forages.

The crop practice units in the agronomy project will be of help to you in getting this unit underway.

A. Harvesting forage for hay

The first crop of forage grasses and legumes has proved to be the highest in nutrition if it is harvested at early growth stages. Too often harvest is delayed to get larger total yields of dry matter per acre, but this often results in less feed value produced per acre. One problem in early harvest is moisture during June.

Cut forage crops early
for high quality

The second and third crops can usually be harvested without weather damage and are believed to be higher in feeding value.

Suggestions in this section may help you see the need for early hay harvest on your farm.

Do this:

1. Harvest part of your hay crop on two different dates and keep records on yield of dry matter, protein, TDN, and fiber content. The harvest periods are as follows:

	Plan A	Plan B
First crop	June 1-10	June 20-30
Second crop	July 15-20	August 1-10
Third crop	by August 30	

2. Store hay from the two cutting plans separately so it can be sampled and fed separately.

Sampling hay

3. Carefully select samples for protein and fiber analysis from the different cuttings. Calculate digestible protein and TDN yield per acre.

4. Compute a balanced ration for your livestock using this hay based on results of analysis.

Materials needed:

1. Agronomy Fact Sheet No. 8, Cut Early For Quality Hay.
2. Calculation of dry matter, digestibile protein, and TDN yield--See Appendix.
3. Field of forage for harvesting.
4. Plastic bags for hay samples.
5. 3-foot x 3-foot quadrat.

B. Harvesting grasses and legumes for silage

One way to beat the weather is to harvest all or part of the first crop as silage. Because of the high moisture in the plants in early growth stages, follow suggestions in Extension Folder 181, Grass Silage in respect to wilting or use of preservatives.

Do this:

1. Harvest and store a crop of legumes or legume grass mixture as hay crop silage. Calculate forage yield per acre.

2. Carefully sample the material at time of storage for chemical analysis. Calculate digestible protein and TDN yield per acre.

3. Compute a balanced ration for your livestock using this hay crop silage as part of the forage fed.

C. Harvesting oats for silage or hay

Oats have a longtime reputation as a low return crop on Minnesota farms when harvested as grain. One way to step up their value is to harvest as oats or hay, since the whole plant is used in feeding. Follow the suggestions in Agronomy Fact Sheet No. 3, Oat Silage, as to time to harvest.

Do this:

Follow the same procedure given under hay crop silage, section B.

D. Harvesting corn for silage

There are several ways to utilize the feeding value contained in corn through livestock feeding. One is whole plant silage, the second is ear corn silage, the third is shelled corn silage. Agronomy Fact Sheet #9, Corn Silage, discusses these three methods. Use whatever harvest and storage method best fits into your livestock and equipment program.

Do this:

Follow the same procedure given under hay crop silage, section B.

E. Rotational Grazing

Rotational grazing has given higher per acre production of animal products and requires fewer acres in pasture. This system works with all classes of livestock, but perhaps can be most easily demonstrated with dairy cows.

Do this:

1. Select 5 acres of crop land pasture.

2. Use an electric fence to divide the field into areas that can be grazed in 3 days.

3. Record: a) days cows graze rotation area

   b) milk production

   c) value of milk production

   d) pounds of grain, hay, and silage fed while on rotation area

   e) value of supplemental feeds

4. Calculate total returns per acre.

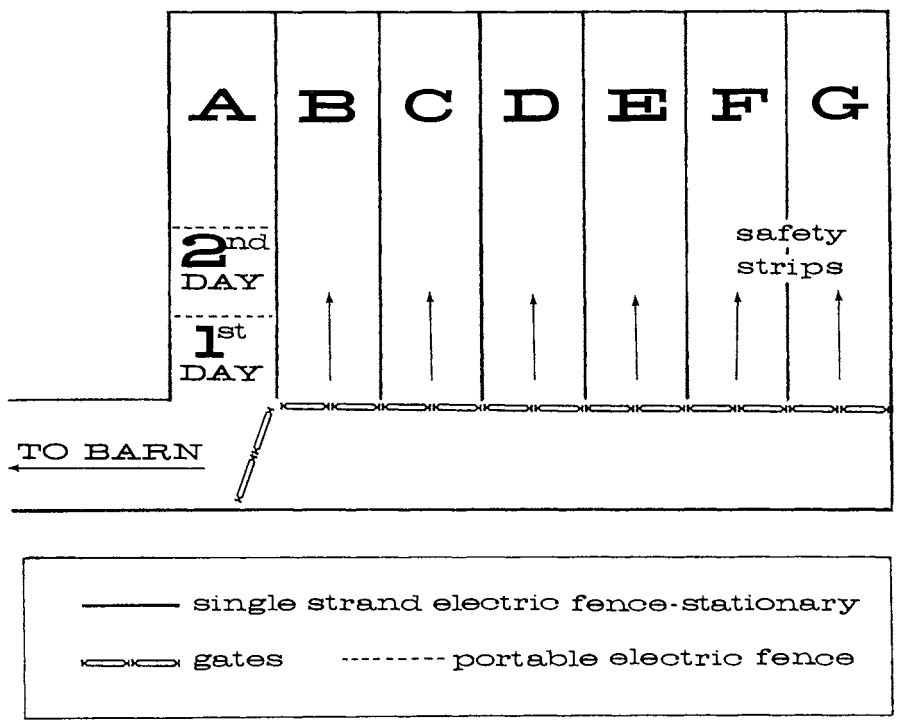
5. Diagram pasture area, fencing, and approximate acreage for each grazing period.

Demonstration suggestions

1. Value of early harvested hay in livestock feeding.

2. Silages in livestock feeding.

3. Sampling forages for chemical analysis.



UNIT 43

CERTIFIED SEED PRODUCTION

The production of certified seed offers a good opportunity for an older agronomy project member to increase profit opportunities from growing crops. He can also serve the community by raising the standard of general crop production.

The production of certified seed is a specialty, requiring more care and skill than regular production of crops sold for feed or food. It is also important to determine the market potential for certified seed crops you may grow.

All the basic crops in the agronomy project are eligible for certification under the regulations of the Minnesota Crop Improvement Association. For additional information on crops and varieties, and standards for certification, contact the MCIA at St. Paul 1, Minnesota, or discuss your interest with the county agricultural agent.