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Producing and Marketing Corn; A Manual for Nebraska 4-H Clubs : Extension Circular 1-02-2

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Producing and Marketing CORN

A Manual for Nebraska 4-H Clubs

EXTENSION SERVICE
UNIVERSITY OF NEBRASKA COLLEGE OF AGRICULTURE
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COOPERATING
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Contents

This project manual was prepared with the assistance of University of Nebraska College of Agriculture personnel in the following departments: Agricultural Economics, Agricultural Engineering, Agriculture Extension Service, Agronomy and Soils, Entomology, and Plant Pathology.

Producing and Marketing Corn In 4-H

by John D. Furrer and Don K. Wiles

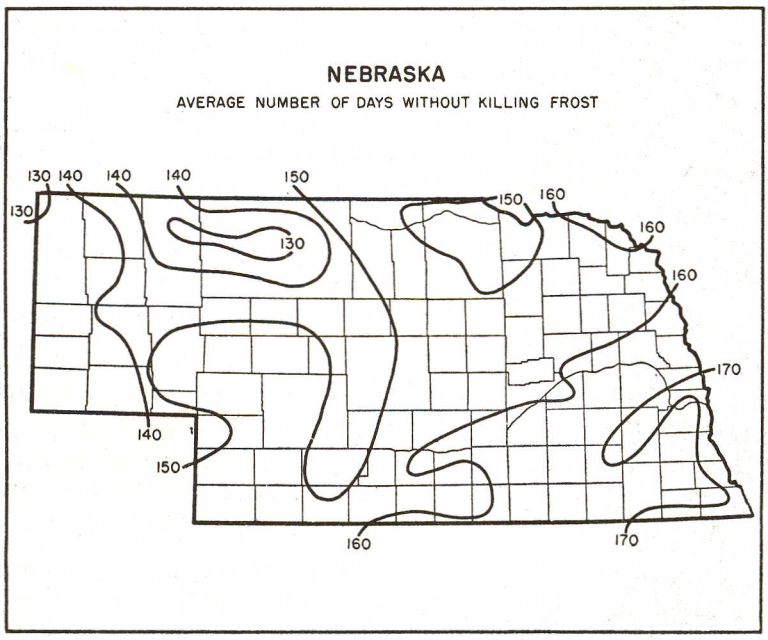
The 4-H corn project is designed for boys and girls who are interested in learning good corn production practices. Those who enroll in the project are expected to plant, care for, and harvest at least 1 acre of an adapted corn hybrid. All costs of production, all operations performed, and all income made are to be recorded in the 4-H project record book. You may produce certified hybrid seed or corn for commercial use and livestock feed.

The purpose of this manual is to help you do a better job of producing and marketing corn. If you want to raise certified seed, obtain a copy of the "Nebraska Certified Seed Handbook" from your county agent. If you plan to participate in the "Reach for Top Corn Yield Program" sponsored by the Agricultural Extension Service contact your county extension agent for information. For technical help and information in laying out contours, terraces, and irrigation systems, contact both your county extension service and your soil conservation service.

Selecting Land And Seed

The better the land and the better the seed, the greater are your chances of producing a high yield.

Land: Good land is fertile, mellow (clods break-up easily), and well drained. For top yields you will need good land. A soil test will help determine whether the application of lime or fertilizers will be profitable. Instructions on how to take a soil sample can be obtained at your county agent's office. After samples are taken, your county agent will send them to the Soil Testing Laboratory at the College of Agriculture. You will be given fertilizer recommendations that are based on the results of the soil sample test and the past cropping history of your field. Be sure to deliver your soil sample at least four weeks before time of planting.



If you are producing certified seed, select a field that meets the requirements given in the "Nebraska Certified Seed Handbook."

Seed: To obtain maximum corn yields, choose hybrids that take advantage of the growing season and mature before frost. Hybrids that mature too early will ordinarily not yield as well as later maturing hybrids. Ask your county agent about hybrids that are recommended by the Nebraska Agricultural Experiment Station. He can supply you with a list of certified seed producers, and can also give you Outstate Testing Circulars on the performance of Experiment Station and other adapted hybrids. Local seed corn dealers can also suggest hybrids that are suitable for your area.

Preparing the Seedbed

A well prepared seedbed is essential in getting a good stand and giving the crop a good start. The main objectives to be accomplished in seedbed preparation are:

(1) Controlling weeds and insects. (This includes rootworms.)
(2) Getting air into the soil.
(3) Improving conditions for the decay of organic matter (old plant material).
(4) Conserving moisture.
(5) Helping warm the soil for uniform germination of the seed. (A warm soil is important because corn seed germinates poorly when the soil is cold.)

Plowing for Surface Planting: Plowing is necessary if corn is to be surface planted. Plow about 7 inches deep. Early spring plowing is usually better than fall plowing because it reduces loss of soil from wind and water erosion. Harrow the ground promptly after plowing. This conserves moisture and smoothes the seedbed.

If second-year sweetclover is to be plowed under in the spring, plow it under when it is about 6 or 8 inches tall. If the sweetclover is allowed to grow taller, it will use water that is needed by the corn. If sweetclover is plowed under too early it may not be killed and will grow in your cornfield like a weed.

Disking for Listing: Under most dryland conditions, listing corn in double disked ground will produce yields similar to those produced with the best plowing practices. Disking and listing usually costs less per acre than plowing and planting.

Planting the Seed

For high yields and efficient production of corn, attention must be given to the time, method, rate, and depth of planting.

Time: For best results, plant corn in a warm soil. The date when your soil is warm enough for planting will vary with the season and region of the state. To obtain maximum yields under irrigation, plant full-season hybrids as soon after May 1 as weather conditions will permit. Chemical treatment of your seed will help protect it in cold, wet soils and will insure a good stand. Nearly all seed corn now sold is chemically treated. If treated the seed bag will carry a seed treatment tag.

Method: Surface planting is recommended on all irrigated land and on heavier soils that receive enough natural moisture. Listing is recommended in regions of limited rainfall and on lighter soils.

Rate: A full stand of corn is necessary for high yields. Uniformity of stand is desirable, especially on fields where you are trying for 100 bushels of corn or more per acre.

Plant your corn according to the soil's fertility and moisture level. Planting too thin causes weed trouble and loss of yield. If too high a rate of planting is used on dry land,

plants may burn because of lack of moisture. On irrgated land, excessively thick stands tend to increase the number of barren stalks and cause lodging.

In order to have the correct number of stalks at harvest time, you will need to plant about 20 per cent more kernels per acre than the number of stalks you want in the fall. Be sure to keep this rule in mind when figuring your planting rates. Recommended corn plant populations for different regions of Nebraska, and the rates of planting needed to obtain these stands, are given in Table 1.

Depth: Corn should be planted just deep enough to place the seed in moist soil. Depth of planting will depend on the moisture supply and condition of the seedbed. On heavy soils, with a well prepared seedbed and good surface moisture, plant 1 to 1 1/2 inches deep. Plant deeper if the soil is sandy or if the soil is dry and loose. You should not plant deeper than 3 inches.

Operation of Equipment. Too much speed and improper adjustment of the planter are responsible for many poor and uneven stands of corn. Be sure your planter is in good working condition, well adjusted, and not driven too fast. Corn planters that are driven too fast do not drop seeds regularly and uniformly.

Choose seed plates carefully and make sure that the seed you are planting will pass through the openings. Do not assume that all seed of a given grade will plant the same. Check each lot through your machine before you begin planting.

Providing Soil Fertility

As already suggested, it is advisable to test the soil before planting. See the part of this manual titled "Selecting Land and Seed."

Amount of Nitrogen Needed: Your soil must supply about 1 1/2 pounds of nitrogen for each bushel of corn. Therefore, a 100-bushel corn crop requires 150 pounds of nitrogen per acre. If the decaying organic matter in the soil does not supply all of the needed nitrate, apply enough nitrogen fertilizer to make up the deficiency. If you are trying to produce more than 100 bushels of corn per acre, supply 2 pounds of nitrogen for each bushel expected over the 100-bushel mark.

Application of Nitrogen Fertilizer: You can apply nitrogen as a gas, solid, or solution. Be sure to apply the nitrogen according to your soil test recommendations and the expected yields. Either side dressing after the corn is up or placing the fertilizer in the soil before planting is satisfactory.

Legumes, Manure, and Crop Residues: Legumes and manure are excellent sources of nitrogen. If possible, use legumes and manure in your crop rotation. All forms of crop-residue, as well as legumes and manure, improve the soil's organic matter, return essential plant nutrients to the soil, and conserve moisture. Also, soil high in organic matter is easier to cultivate than soil low in organic matter.

Phosphate and Potash Fertilizers: Do not apply phosphate and/or potash fertilizers to the soil unless the soil test indicates the need. If needed, place phosphate and potash in the ground before or at the time of planting. The fertilizer should be near the seed, but not in contact with it. Using an attachment on the lister or planter is a common practice.

Conserving Soil and Water

Much like the table you eat from, soil can become empty. It becomes empty by the removal of plant food in the form of crops taken from the land; and by the loss of plant food through soil erosion, leaching, and burning. To correct this situation, you will have to reduce losses from erosion and put back into the soil what has been taken.

Table 1: Recommended corn plant population for different regions of Nebraska and estimated planting rate needed to obtain these stands 1/

Region	Recommended Plant Population Per Acre	Average Distance Between Plants 1/ (Inches)	Estimated Seed Drop to Obtain Desired Stand 2/ (Inches)
Eastern Nebraska: (East of Line Thru West Boundaries of Cedar, Colfax, and Seward Counties)			
1. Non-irrigated upland	10,000	15-16	12-13
2. Bottom land, high fertility and good moisture	12,000	13-14	10-11
Eastern Half of Central Nebraska:			
1. Non-irrigated land	8,000(west)	19-20	15-16
2. Non-irrigated land	9,000(east)	17-18	13-14
Western Half of Central Nebraska:			
1. Non-irrigated land	6,000(west)	26-27	20-21
	7,000(east)	22-23	17-18
Western Nebraska (Panhandle):			
1. Non-irrigated land	5,000(north)	31-32	25-26
	6,000(south)	26-27	20-21
All Regions:			
1. Irrigated	16,000 to 18,000	9-10	7-8

1/ Figures for drilled corn in 40-inch rows

2/ Rate based on 20% loss

The problem of putting back into the soil what has been taken from it was discussed in the section "Providing Soil Fertility." Other soil and moisture losses can be combated by preventing erosion, leaching, and burning.

Every effort should be made to conserve the soil.

Erosion: Every year water washes and wind blows away millions of tons of topsoil. This soil contains large amounts of plant food. To prevent erosion you must apply good land management practices such as contour farming, strip cropping, terracing, and mulching. You may use windbreaks and cover crops; and you must build up and maintain the organic matter content in the soil. Because your problems may be different from those of another club member, this manual will not attempt to discuss recommended conservation practices for any one area. Rather, you should discuss the problem with your county agent and your soil conservationist.

Leaching: As water moves through the soil, it takes plant food with it. This is called leaching. Sandy soils leach more than heavy soils. Leaching is common on irrigated farms when too much water is applied. On non-irrigated land in Nebraska leaching is usually not serious, because our rainfall is limited. You can reduce leaching losses by maintaining adequate organic matter in the soil and by avoiding excessive irrigation.

Burning: Most of the nitrogen in the soil is held within the organic matter. As the organic material decays, nitrogen is released for plant use. Burning breaks down organic material in such a way that nitrogen is released into the air in the form of gas. Plants, other than legumes, cannot use this form of nitrogen. Organic matter also improved the condition of the soil and helps to prevent loss of soil and water due to erosion and leaching. You should return the organic matter to the soil and prevent its destruction.

Cultivating and Weed Control

Killing weeds is the principal reason for cultivation. This practice eliminates the corn plants greatest competitor for plant food and water. If you did a good job of preparing the seedbed, your job of cultivation is much easier. This is because your corn plants have a head start on the weeds.

Depth to Cultivate: Since the main purpose of cultivation is to control weeds, the growth of the weeds will determine the depth and frequency of cultivation. Prevent weed growth as much as possible by shallow cultivation. Excessively deep cultivation will injure the corn plant's roots; and severe root injury will result in lower yields. Proper cultivation will kill the weeds with minimum injury to the corn roots.

Need for Cultivation in Dry and Wet Years: The need for cultivation is no greater in dry than in wet years. It may even be less. However, heavy soils crack badly during dry years, and cultivation may be necessary to fill large cracks and stop direct loss of sub-soil moisture.

Chemical Weed Control: You can use chemicals such as 2, 4-D to control pigweed, cocklebur, sunflower, ragweed, and other broadleaf weeds in growing corn. Always follow the manufacturer's directions for spraying.

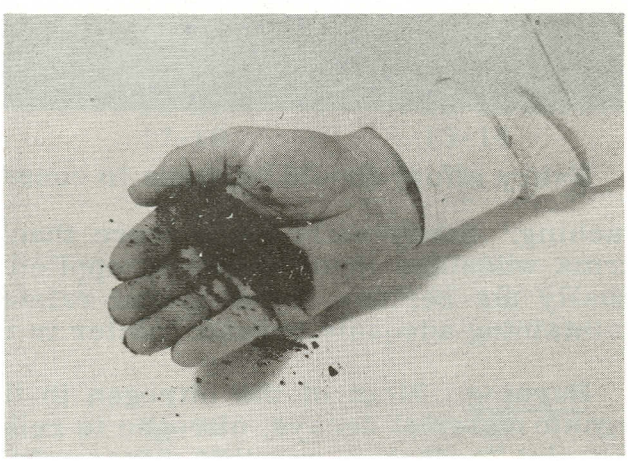
Some suggestions that may be helpful are:

(1) Direct the spray material onto the weeds and away from the corn stalks.
(2) If possible, spray your corn before it is 18 inches high. Corn less than 18 inches high is less likely to lodge or develop brittle stalks than taller corn.
(3) If airplanes or "High Clearance Sprayers" are used for late-season spraying, do not spray while the corn is shooting ears. Wait until the silks are dry.
(4) For bindweed control, substitute spraying for the first cultivation, but do not spray until the corn is 12 to 18 inches high. This permits the bindweed to develop more leaf area which in turn permits it to take in a greater amount of weed killer.
(5) Do not cultivate for 7 to 10 days after spraying.

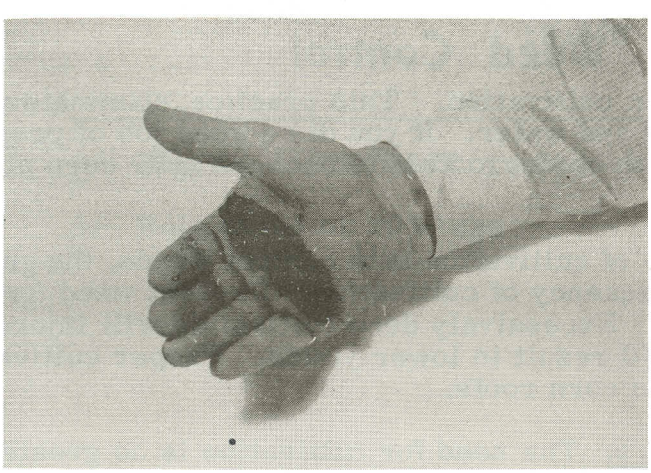
Irrigating Corn

Adequate soil moisture throughout the growing season is necessary for high yields. A 100-bushel corn crop requires about 24 inches of water per acre. To be sure of adequate moisture for early growth, apply enough water in the fall or early spring to wet heavy and medium-textured soils to a depth of 4 to 6 feet. Sandy or shallow soils will not store much water; and the normal rainfall in your area may wet the root zone of such soils. If you have sandy or shallow soils and it is dry in the spring, a light irrigation just before planting is desirable.

This soil (silt loam) has less than 1/2 as much RAM as it can hold.



This soil (silt loam) has about 1/2 the RAM that it can hold.



This soil (silt loam) has about 3/4 the RAM that it can hold.

This soil (silt loam) has 75 to 100 per cent RAM.

Table 2: Texture guide for RAM

Percent of RAM remaining in soil	Feel or appearance of soils: Loamy sands and sandy loams (light)	Very fine sandy loam and silt loams (medium)	Silty clay loams and clay loams (heavy)
0	Dry, loose, flows through fingers.	Powdery, sometimes slightly crusted but easily broken down into powdery condition.	Hard, baked, cracked; difficult to break down into powdery condition.
50 or less	Appears to be dry, will not form a ball with pressure.	Somewhat crumbly but will hold together from pressure.	Somewhat pliable, will ball under pressure.
50 to 75	Tends to ball under pressure but seldom will hold together when bounced in the hand.	Forms a ball, somewhat plastic, will stick slightly with pressure.	Forms a ball, will ribbon out between thumb and forefinger, has a slick feeling.
75 to 100	Forms a weak ball, breaks easily when bounced in the hand, will not slick.	Forms a ball, very pliable, slicks readily.	Easily ribbons out between thumb and forefinger, has a slick feeling.
100 percent (field capacity)	Upon squeezing no free water appears on soil, but wet outline of ball is left on hand, soil will stick to thumb when rolled between thumb and forefinger.	Same as sandy loam.	Same as sandy loam.

Testing for Moisture: To be sure of the amount of moisture in your soil, you will need to test the top 3 feet of soil for the readily available moisture. The term "Readily Available Moisture" (RAM) means the amount of moisture the soil holds for plant use in inches of water per foot of soil depth.

To determine the RAM in the soil, you should do the following:

(1) Determine the soil texture of sample. The sample should be classified as loamy sand and sandy loam (light), very fine sandy loam and silt loam (medium), or silty clay loam and clay loam (heavy).

(2) Squeeze a handful of the soil firmly. Use the squeeze pressure required for a a hard-milking cow.

(3) Observe the appearance of the soil and compare its characteristics with those given in Table 2. So that you will have a better understanding of what the various soil characteristics are like, pictures of a silt loam soil are shown in this manual. The pictures show the soil with less than 50 per cent RAM, about 50 per cent RAM, about 75 per cent RAM, and about 100 per cent RAM.

Applying the Water: For maximum yields, you should never let the RAM in the top 3 feet of soil go below 50 per cent. Check the RAM every three days.

By knowing how much RAM is in the soil and how much water your soil will hold, you can determine the amount of water needed. Generally speaking; loamy sand and sandy loam will hold 0.75 to 1.25 inches per foot of soil. Very fine sandy loam and silt loam will hold 1.50 to 2.00 inches per foot of soil. Silty clay loam and clay loam will hold about 2.00 to 2.20 inches per foot of soil.

If your test indicates that a silt loam soil contains 50 per cent RAM you will need to apply 1.00 inch of water to each foot of soil to get 100 per cent RAM, 50 per cent of 2.00 inches is equal to 1.00 inch). Since it is usually desirable to fill the top 3 feet of soil during an irrigation, you will need to apply 3 inches of water.

When irrigating, try to apply water uniformly throughout the field and avoid excessive irrigation. Too much water results in leaching. Your county agent and your soil conservationist can give you technical information and help.

Controlling Insects and Diseases

Insects: Several hundred species of insects feed on the roots, stalks, leaves, and seeds of corn. About 25 of these are especially troublesome. If the corn plant is growing vigorously, it has a good chance of escaping with little injury. This means that your corn must be:

(1) A well adapted hybrid.

(2) Planted on good land (land that is mellow, fertile, and well drained).

(3) Growing rapidly. (Good methods of handling soil, seed, and plants will encourage quick germination and rapid growth.)

(4) Growing in a crop rotation. (Rotation of crops tends to limit the number of soil-borne insects.)

A number of insecticides can be used to control insects. For advice on which to use and how to use them, ask your county agent.

Diseases: The most common diseases of corn are smut and stalk and ear rots. Selection of well-adapted hybrids, chemical seed treatment, and planting in warm soil are the best means of combating most diseases. Another important factor in reducing the hazard of diseases is a well-managed, fertile soil. This means that you should use a recommended rotation, maintain adequate amounts of organic matter in the soil, provide proper drainage, and use fertilizer when needed. In some cases plowing under diseased stalks is advisable.

Harvesting and Storing

A crop is not made until it is harvested and properly stored. This is as true of your corn crop as of any other crop. In fact, the average normal corn loss is about 15 per cent of the crop. If the corn is badly infested with corn borers or the stalks are blown over, the losses are greater.

Most of the normal losses are due to improper harvesting and storing methods. Your losses can be kept to a minimum by selecting the correct harvesting methods, properly adjusting and operating the harvesting machines, harvesting as early as possible, and using good storage practices and equipment.

Harvesting: When your crop reaches maturity it contains about 34 per cent moisture. If harvested before the kernel moisture content lowers to 20 per cent or less, your harvest losses will not be serious. (See Table 3.)

Table 3: Expected corn crop losses in the field in relation to maturity and kernel moisture content.

Days after maturity	Kernel moisture %	Expected crop loss (% of total yield)
0	34	1
10	26	2
20	20	4
27	17.5	7
34	16	10
41	15	13
49	15	15

There are three kinds of corn harvesters on the market: the picker, picker-sheller, and picker-combine. For maximum efficiency of operation, harvest while the corn has a moisture content of 20 per cent or higher. Before harvesting, be sure that all adjustments are properly made; and be sure that the row spacing of the harvester is the same as the width of the planted rows. Recommended adjustments are given in the operator's manual that is provided by the manufacturer.

CAUTION: ALWAYS STOP THE CORN HARVESTER WHEN CLEANING THE SNAPPING OR HUSKING ROLLS OR WHEN MAKING ANY ADJUSTMENTS. The corn harvester is one of the most dangerous farm machines. It can cause the loss of hands, arms, and even lives. Such accidents are needless.

Table 4: Determination of field losses of shelled and ear corn

Shelled Corn Losses		DISTANCE TO COUNT SHELLED CORN BETWEEN ROWS: for 36-inch row spacing	for 38-inch row spacing	for 40-inch row spacing	for 42-inch row spacing
		49 inches	46 inches	44 inches	42 inches
(1) Count kernels between two rows for the distance that corresponds to your row spacing.....					
(2) Divide the number of kernels counted by 20 and enter on line a. This indicates the bushels of shelled corn lost per acre.....	a				
(3) Repeat this procedure in at least three other places in the field and enter the results on lines b, c, and d.....	b				
	c				
	d				
(4) Compute the average of entries on lines a, b, c, and d. This indicates the average number of bushels of SHELLED CORN LOST per acre.....					

Ear Corn Losses		DISTANCE TO PICK UP EARS BETWEEN ROWS: for 36-inch row spacing	for 38-inch row spacing	for 40-inch row spacing	for 42-inch row spacing
		195 feet	185 feet	175 feet	165 feet
(1) Pick up ears between two rows for the distance that corresponds to your row spacing.....					
(2) Weigh the ears and enter on line a. This indicates the bushels of ear corn lost per acre.....	a				
(3) Repeat this procedure in at least three other places in the field and enter the results on lines b, c, and d.....	b				
	c				
	d				
(4) Compute the average of entries on lines a, b, c, and d. This indicates the average number of bushels of EAR CORN LOST per acre.....					

Total Field Losses

Add the average shelled corn loss and average ear corn loss. This indicates the TOTAL FIELD LOSS in bushels per acre.....

To help with the estimating of the shelled corn lost, you can make a wood frame according to your row spacing. This frame would be used as an area marker.

Estimating field losses: Table 4 will help you figure field losses. Before you start to use the table, be sure that you know the row spacing of your corn. If your corn rows are 40 inches apart, count the number of kernels between two rows for a distance of 44 inches (Step 1). The next step (Step 2) is to divide the number of kernels you counted by 20. If you found 80 kernels, your answer would be 4, which indicates the number of bushels of shelled corn lost per acre. Repeat these steps in several places in the field, and then average the results. The average will give you a more accurate estimate.

Your next step is to figure the ear losses. For corn rows spaced 40 inches apart, measure off 175 feet of row (Step 1). Weigh the ears of corn that you pick up (Step 2). The pounds of ear corn picked up is considered equal to the bushels of ear corn left on each acre. To obtain accurate loss figures, it is important to average ear corn losses from several places in the field.

Your total corn losses can be determined by adding together the average shelled corn losses and ear corn losses.

Storing: Unless mechanical drying is provided, ear corn with a kernel moisture content greater than 20 per cent can not be safely stored in cribs. Stored ear corn that is free of chaff, husks, and shelled corn will dry faster and store better than dirty corn.

Shelled corn with a kernel moisture content greater than 13 per cent can not be safely stored for long periods unless it is dried. The storage space required by shelled corn is about half that required by ear corn. Also, shelled corn is easier to handle and requires less labor.

Corn can be dried mechanically before it is stored, or it can be dried while in storage, Mechanical drying can be practical for small crops as well as for large crops. For help and information on proper drying, talk with your county agent and your electric power supplier.

Before you harvest the corn crop, you should clean all storage bins and cribs. Your storage place should be constructed and maintained so that the grain will be free of rodent, bird, and insect infestations. Your county agent has a large variety of plans for proper storage buildings for shelled or ear corn.

Marketing and Utilization of Corn

Class: Corn is divided into three market classes as follows: Yellow Corn, White Corn, and Mixed Corn. To be classified as Yellow Corn, at least 95 per cent of the kernels must be yellow. White Corn must not have more than 2 per cent of its kernels of another color. Mixed Corn is corn that can not be classified as either Yellow Corn or White Corn.

Grades: Corn is graded according to a standard that has been set up by the U. S. Department of Agriculture. The grade requirements for Yellow Corn, White Corn, and Mixed Corn are given in Table 5.

Use of Corn: Most of the corn that is grown in the United States is fed to animals which, in turn, are used as food for humans. It has been estimated that 85 per cent of the corn crop is used in this way. The remaining 15 per cent is used by (1) the "dry" millers and breakfast-food manufacturers, (2) the livestock feed manufacturers, (3) the distilling industry, and (4) the corn refining industry. Stalks, leaves, cobs, and tassels are now used to a small extent by some industries; and may be used even more in the future.

Table 5: Grade requirements for yellow corn, white corn, and mixed corn

Grade Number	Minimum test weight per bushel (pounds)	Maximum limits of			
		Moisture (per cent)	Cracked corn and foreign material (per cent)	Damaged kernels	
				Total (per cent)	Heat damaged (per cent)
1	54	14.0	2	3	.1
2	53	15.5	3	5	.2
3	51	17.5	4	7	.5
4	48	20.0	5	10	1.0
5	44	23.0	7	15	3.0

Sample grade --Sample grade shall include corn of the class Yellow Corn, or White Corn, or Mixed Corn which does not come within the requirements of any of the grades from number 1 to number 5; or which contains stones and/or cinders; or which is musty, or sour, or heating, or hot; or which has any commercially objectionable foreign odor; or which is otherwise of distinctly low quality.

Cutting Costs and Maintaining Income

The economic success of your project is measured in terms of net income. Your net profit is the amount of money you have after all costs, including labor, have been paid. If you are to make the maximum net income, you will have to analyze all costs carefully and eliminate those that are unnecessary. You will, of course, have to spend money in order to make money. Your important decisions are those that determine which expenditures are justified in terms of income. Such decisions should be based on careful analysis of costs, an estimate of likely returns, and an understanding of the risks involved in the enterprise.

One way of maintaining and possibly increasing your income is to strive for high yields. With increased yields you will often get more corn per dollar spent. It is important that you select high-yielding varieties that are adapted to your locality. It is also important that you determine the system of crop rotation that will produce the best yield and that you manage your crop well. Another possibility is to produce a product that will sell for a higher-than-ordinary price. If you can produce a high quality product at about the same cost as one of lower quality, your net returns will increase.

You can find ways of holding costs down. For example, the per acre cost is less for listing corn in disked ground than for planting corn in plowed ground. During years of falling prices, you may be ahead to buy good used machinery rather than new machinery. Making your machinery and equipment run longer is another possibility. You will need to study your own situation. A careful study may reveal different ways of cutting costs.