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### Producing Grain Sorghum : Extension Circular 1-51-2

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et al

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1956

E.C. 1-51-2

# *Producing* **GRAIN SORGHUM**



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*A Manual for Nebraska 4-H Clubs*

EXTENSION SERVICE  
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This project manual was prepared by Don K. Wiles with the assistance of personnel of the Agricultural Engineering, Agronomy, Entomology and Plant Pathology Departments of the University of Nebraska College of Agriculture. Much of the information in this circular was taken from material prepared by O. J. Webster and J. D. Furrer.

The purpose of this manual is to help you in growing grain sorghums as a 4-H project. The manual will not answer all of your problems. You should contact your club leader, county agent or both for additional information. For technical help and information in laying out contours, terraces and irrigation systems, you should contact both your county extension service and your soil conservation service.

If you plan to produce certified seed, ask your county agent for a copy of the "Nebraska Certified Seed Handbook." It will give all needed information about seed certification.

# Producing Grain Sorghum

A Manual for Nebraska 4-H Clubs

You are going to carry a 4-H grain sorghum project. During the year you will be expected to plant, care for and harvest at least one acre of an approved variety of grain sorghum. All costs of production and all income are to be recorded in your 4-H project record book. You may produce either commercial seed or certified seed.

## INTERESTING FACTS ABOUT GRAIN SORGHUMS

Grain sorghum is grown for the same reason that corn is grown -- for its grain. The kernels of grain sorghum are similar to corn and can be used in much the same way as corn.

Some animals have trouble digesting grain sorghum because of its small size and hardness. For this reason, grain sorghums should be cracked for all classes of livestock except hogs, sheep and poultry.

Sorghums are adapted to a wide variety of soils. They do best on land that is fertile, in good physical condition and well drained. Like corn, they respond well to irrigation on fertile soils.

Sorghum is a hot weather crop, and may not do well in cool seasons. In seasons of normal temperature or warmer, it can be expected to yield as much as corn.

## SELECTING THE FIELD

The better the land, the greater your chances of obtaining a good grain sorghum crop. Good land is fertile, has good physical condition (clods are easy to break), and is well drained.

The cropping system on the land will influence your final selection of a field. For example: winter wheat should not be planted on land that has just produced a crop of sorghum, unless there is plenty of available moisture for plant growth and you are willing to apply a nitrogen fertilizer to the soil at planting time.

In areas where summer fallow is practiced, a good rotation is fallow, wheat, then sorghum. In other areas, the best practice is to plant sorghum or corn following sorghum.

If you plan to produce certified seed, you must meet certain requirements. For example, the land must not have grown the same type of crop the previous year, unless the crop grown was from certified seed of the same variety and approved for certification. The field must be separated from other fields of the same crop by a strip of ground at least 5 feet in width.

NOTE: You should take soil samples from the field as soon as it is selected. Recommendations and reasons for taking soil samples are given in the part of the manual named "Soil Fertility."



Try to select a field that is fertile, mellow and well drained.

## THE NEED FOR CONSERVATION

Our soil is fast losing its fertility because of (1) the removal of plant nutrients from the soil in the form of crops and (2) the wasting of soil and plant nutrients through erosion, leaching and burning. To correct this situation, you will have to put back into the soil the nutrients that have been removed from it, and you will have to prevent needless waste of plant food and water.

The problem of putting back into the soil what has been taken from it will be discussed in the next part of this manual. Your job of preventing waste is known as conservation.

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 will have to apply good land management practices such as contour farming, strip cropping, terracing, controlling gullies, mulching, using windbreaks, using cover crops and building up and maintaining the organic matter content of the soil. Since your problem may be different from those of another club member, this manual will not attempt to recommend conservation practices for any one area. Rather, it is suggested that you discuss the problem with your county agent and your soil conservation service.

Leaching: As water runs through the soil, it takes plant food with it. This is called leaching. Leaching is a serious problem in sandy soils and in irrigated fields. The best way to prevent leaching is to keep a growing crop on the land, and in the case of irrigated fields avoid excessive irrigation. This problem should also be discussed with your county agent and your soil conservation service.

Burning: Most of the nitrogen that is in the soil is held within the organic matter. As the organic matter decays, the nitrogen is released for plant use. Also, organic matter helps to improve the tilth of the soil and helps to prevent loss of soil and water through erosion and leaching. Burning breaks down organic matter in such a way that nitrogen is released to the air in the form of gas. Thus, most of the nitrogen and organic matter is lost. Every effort should be made to return the organic matter to the soil and not to destroy it.

## SOIL FERTILITY

Plants must "eat" if they are to live. Your grain sorghum is no exception. Your plants use nitrogen, phosphorous, potassium, calcium, magnesium, sulphur and several trace minerals. These elements are known as plant nutrients. The absence of any of the needed plant foods will result in lower yields.

Plant Nutrients: Plant nutrients are classified as primary nutrients, secondary nutrients and trace nutrients or minerals. The words primary, secondary and trace indicate the amount required for proper plant growth. For example, nitrogen, phosphorous and potassium are primary nutrients. Sixty bushels of grain sorghum removes about 48 pounds of nitrogen (N), 25 pounds of phosphorus (P) and 13 pounds of potassium (K) from the soil. If the leaves and stalks are removed, in addition to the grain, the loss from the soil is even greater -- about 111 pounds of N, 44 pounds of P and 106 pounds of K.

The same crop requires about 5 pounds of each secondary nutrient. Calcium, magnesium and sulphur are secondary nutrients. In most cases, less than 1 pound of a trace nutrient is needed for the entire growing season of a plant. Most of Nebraska's soils contain more than enough of the secondary and trace nutrients to take care of the grain sorghum's needs.

Soil Testing: The land you have selected for your grain sorghum project may be low in one or more plant nutrients. If so, you can not expect to obtain maximum Yields. The best way to learn if the nutrients are available is to test the soil. This can be done by taking a sample of the soil to your county agent. He will mail the sample to the College of Agriculture for testing. Be sure to allow four weeks or more between the time the sample is mailed and the time the information is needed. Your county agent will tell you how to take the soil sample, and he will give you a carton for mailing the sample.



As soon as the field is selected, take a soil sample and have it tested.

Time and Method of Fertilizer Application: If you are trying fertilizer for the first time, leave a few unfertilized rows in the middle of the field. This will give you an opportunity to observe the effects of the fertilizer. At the time of harvest, make a careful estimate of the yield on the fertilized and unfertilized strips. An increase of 5 bushels of grain per acre is usually profitable.

The drill or other equipment used for applying fertilizer should be thoroughly cleaned and oiled at the end of each day's work. If this is not done, the working parts will rust and may become so caked with fertilizer that the machine will not work.

Instructions for applying fertilizer will be given with the return of the results of the soil test. Generally speaking you should:

1. Apply nitrogen at the time of the second or third cultivation. An attachment to the cultivator can be used. The nitrogen fertilizer may be broadcast between rows prior to the second cultivation. Applying anhydrous ammonia just before planting seems to give good results.
2. Place phosphate and potash in the ground before or at the time of seeding. These fertilizers should be near but not in contact with the seed. Using an attachment on the lister or planter is a common practice.

### SELECTION OF SEED

The selection of good quality seed is one of the important steps in producing high yields. Various varieties are adapted to different parts of the state and to different conditions. New and better varieties continue to replace old established ones. The latest development in the field of grain sorghum is the production of hybrid seed. Some hybrids are capable of producing 20 to 50 per cent more grain per acre than standard varieties. You should talk with your county agent before selecting your seed. He can give you information about recommended varieties and hybrids for your area and may also be able to help you locate the seed. The seed you select should be adapted to your area and should have a germination of 80 per cent or better.

The table entitled "Grain Sorghum Judging Factors" is similar to the score card used for crops judging. You may want to use it when selecting seed for your grain sorghum project.

## GRAIN SORGHUM JUDGING FACTORS\*

Freedom from mixture - - - - -	25
Forage sorghums - - - - -	15
Other grain sorghums - - - - -	10
Other crop seed - - - - -	5
Freedom from inert material (hulls, stems, dirt, etc.) - - - - -	5
Freedom from weed seeds - - - - -	35
Primary noxious weeds (field bindweed, hoary cress, etc.) -	25
Secondary noxious weeds (curled dock, horse nettle, etc.) -	15
Common weeds (rough pigweed, lambsquarters, etc.) - - -	5
Soundness - - - - -	25
Weathering and staining - - - - -	10
Immaturity (light-colored, shrunken kernels) - - - - -	10
Disease (smut, mold, etc.) - - - - -	10
Weevil damage - - - - -	5
Sprouted kernels - - - - -	5
Cracked kernels - - - - -	5
Uniformity (lack of uniformity of size and shape may affect stand) - - -	10

\*The point values are to be used as a guide in comparing the various faults that you may find in seed samples. Do not deduct more than the maximum point value for any major factor. For example, even though a sample contains primary and secondary noxious weed seeds and common weed seeds, do not deduct more than 35 points for weed seed content.

## PREPARING THE SEEDBED

Much of your success in raising a crop of grain sorghum will depend upon how well you prepare the seedbed and how well you plant the seed.

A well prepared seedbed is important in getting a good stand and giving the crop a good start. The main objectives in seedbed preparation are (1) weed control, (2) getting air into the soil, (3) improving conditions for the decay of organic matter, (4) conserving moisture and (5) providing a warm soil for uniform germination of the seed.

Weed control is very important because sorghum plants grow slowly during the early stages of their development. You can kill weeds easier before seeding than after the plants have emerged. A warm soil is also important because grain sorghum seed germinates poorly when the soil is cold.

Any practical method of preparing the seedbed that accomplishes these five objectives is satisfactory.

## PLANTING THE CROP

Method of Planting: Sorghum is a small-seeded crop. Surface planting with a corn planter or with a grain drill that has some spouts stopped to give the desired row spacing is recommended. Use furrow openers if more than 3 inches of the topsoil is dry.

Do not use a lister unless it makes a broad, shallow furrow. If the soil is cold, seed planted in deep furrows may rot before germinating or it may take longer than usual for the seed to begin growing. Rains falling on listed fields may wash dirt into the furrows and cover the seed so deeply that the plant can not emerge.



When planting, make sure the bed is warm and do not cover too deeply.

Date of Planting: Sorghum is a hot-weather crop. For this reason, you should not plant until the soil is warm enough to insure good seed germination and rapid emergence of the plants. As a general rule, plant sorghum about 10 days to 2 weeks later than you normally plant corn. In areas where chinch bug infestations are likely to occur, damage from these pests may be reduced by planting somewhat earlier than is otherwise recommended.

Rate of Planting: Under average field conditions only about half of the good kernels planted will produce plants. Thus, if you desire to obtain a field stand of two plants per foot of row, you would have to place four to five seeds per foot of row.

General suggestions for distance between plants in 40 or 42 inch rows are 4 to 6 inches in eastern Nebraska and 6 to 8 inches in central and western Nebraska. Thicker plantings are desirable where plenty of water is available.

Depth of Planting: Sorghum seed should generally be covered with 1 to 1 1/2 inches of soil. If the seed is planted shallower than 1 inch the surface soil may dry out before germination takes place. If planted deeper than 1 1/2 inches the seedlings may not emerge. In light soils you may plant the seed somewhat deeper than in heavy soils.

It is important that the soil be firmly packed. This slows down the drying of the soil around the seed.

Seed Treatment: All grain sorghum seeds should be treated for loose and covered kernel smut before planting. For recommended treatment see the part of this manual named "Diseases of Grain Sorghums."

## CULTIVATING AND WEED CONTROL

Killing weeds is the principal reason for cultivation. This eliminates the grain sorghums' greatest competitor for plant nutrients and water. If you prepare a good seedbed, your job of cultivation will be much easier. This is because the grain sorghum plants will have a head start over the weeds. Your job is to help the grain sorghum maintain an advantage over weeds.

Depth to Cultivate: Since the main purpose of cultivation is to control weeds, the depth and frequency of cultivation should be determined by the weeds' growth. Their growth should be prevented as far as possible by shallow cultivation. Deep cultivation will injure the roots of the grain sorghum plant; severe injury to the roots will result in lower yields. Proper cultivation should kill the weeds with minimum injury to the grain sorghum's roots. A rotary hoe is an excellent machine for weeding sorghum while the plants are 2 or 3 inches tall.



Every effort should be made to keep weeds under control.

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 the large cracks and stop direct loss of moisture from the subsoil.

Chemical Weed Control: The use of 2, 4-D to control broadleaf weeds such as pigweed, cocklebur, sunflower and ragweed in growing sorghum should only supplement mechanical cultivation. The use of 2, 4-D on grain sorghums may cause some damage.



In years when timely cultivation is impossible because of wet fields, you may have to use chemicals for weed control. If you have to spray, apply treatment when the plants are 4 to 12 inches tall. Never spray during the flowering stage, because this lowers the plants' ability to produce seed. Spraying when plants are less than 4 inches high is likely to harm root development. For proper rates of application follow the manufacturer's instructions.

## IRRIGATION

Grain sorghums can be grown successfully under irrigation. Many farmers apply enough irrigation water in the fall or early spring to wet the soil to a depth of 4 to 6 feet. Sorghums that are given good subsoil moisture in this way will usually produce a satisfactory crop without summer irrigation.

If you do decide to irrigate during the spring and summer, proper irrigation will give best results. For proper irrigation, check your soil periodically (at least once a week) and start irrigating when the soil has half its readily available moisture remaining. See Extension Circular 55-700, "Field Moisture Test For Determining When to Irrigate," for a practical method of estimating the amount of moisture in the soil. (Your county agent has a supply of the circular.) By following suggestions in it you can determine the amount of water needed to refill the soil to its moisture holding capacity.

Do not apply more water than is needed to fill up the root zone. Too much water will result in the leaching of plant nutrients and loss of these elements to the plants.

For help and information in setting up an irrigation system, visit your county extension service and your local soil conservation service. They will be glad to help you in every possible way.

## INSECTS OF GRAIN SORGHUMS

Insects may threaten your grain sorghum crop; and in such cases you should consult your county agent for recommended insecticides and methods of application. Some of the more common insects of grain sorghum in Nebraska are chinch bugs, corn earworms, fall earworms, corn leaf aphids, cutworms, false wireworms and wireworms. Remember, the best control measure is to prevent infestation--this can be done by applying good management practices.

Chinch Bugs: Chinch bugs are especially destructive to grain sorghums. The bugs migrate into the sorghum fields from fields of wheat, barley and similar small grains. They attack the stalks of sorghums, sucking sap and killing plants. Young bugs are red; adults are black and white. Chinch bugs have a distinctive "stink bug" odor when crushed. Planting grain sorghums at a distance from small grains will help avoid infestations.

Corn Earworms and Fall Armyworms: These two insects usually attack the heads of sorghums and feed on the developing kernels. A heavy population will destroy large numbers of individual kernels, thus reducing yields.

Eggs are laid on the plants by a miller. The eggs soon hatch into small caterpillars that are covered with stiff hairs. Full grown worms of corn earworms and fall armyworms are similar in color and size. They may be pink, yellowish or dark brown and are about 1 1/2 inches long.

Corn Leaf Aphid: Aphids suck the sap from leaves and soft kernels. They infest the whorl and later the developing heads of sorghums. The aphid is a small, bluish green plant louse. Usually natural enemies, especially lady beetles and lace wings, keep aphid numbers low.

Cutworms: Cutworms sometimes damage sorghums. They feed on small plants during the night and on cloudy days. If small plants are wilting, carefully examine the top inch of soil for the presence of cutworms. They are usually dirty colored, smooth bodied and stay in the soil during the day.

False Wireworms and Wireworms: Wireworms chew into seeds after they are planted, on roots as they grow, and into the stalk that is under the soil surface. Both insects are smooth, hard shelled, yellow or orange worms about 1 inch long.

Sorghum planted in sod ground or following a legume is most likely to be damaged. More wireworm damage can be expected in southwest Nebraska than in other regions. Damage can be reduced by proper seed treatment practices.

## DISEASES OF GRAIN SORGHUMS

Your grain sorghum crop may be attacked by a disease such as rot, smut, weak neck or leaf spotting. The best control measure is to prevent infestation.

Charcoal Rot: This disease causes premature ripening of the seed. You will notice lodging of the stalk as the plant approaches maturity. The break usually occurs just above the crown. When the stalk is split at the ground level, you will find that the inside has a shredded appearance. (The center or pith has disappeared and the rest of the inside of the stalk is separated into individual strands.) This shredded interior of the stalk appears to be dusted with fine charcoal. The shredded condition may extend up in the stalk to a height of 10 to 12 inches and out into the roots at least 12 inches.

Control: A crop rotation, using small grains in the rotation, is the best known way to prevent charcoal rot. Harvesting the sorghum before it is dead ripe may help prevent loss of heads due to lodging.

Loose and Covered Kernel Smut: Loose and covered smut are very similar in appearance. The inside of most or all of the kernels is filled with a dark brown to black mass of spores. In the case of loose smut, the plants are usually somewhat stunted. With covered smut, stunting of the affected plant is not so noticeable.

Control: All sorghum seed should be treated for control of loose and covered kernel smut. Chemicals such as Ceresan M, Panogen, Agrox, Arasan, Spergon, Orthocide, Capitan and Setrete can be used. Seed should be treated before planting according to the manufacturer's instructions. When used at higher than recommended rates some compounds will cause serious injury to the seed. **REMEMBER**, most materials used for treating seed are poisonous to man and animals. Handle the chemicals with care.

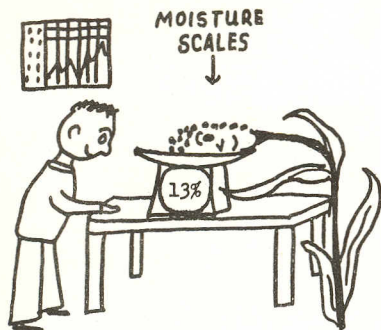
Weak Neck: This disease may cause a discoloration and disintegration of all or part of the peduncle. The peduncle is the part of the plant between the head and the first node or joint. In severe cases the heads will break over. Grain from affected plants is light in weight and of poor quality.

Control: Late-planted sorghums are usually not as severely affected as early plantings. Considerable resistance has been reported in some varieties of sorghums.

Nonparasitic Leaf Spotting: Dark colored spots often occur on the leaves of sorghums. The spots may be entirely colored, or their centers may have dead tissues with dark margins. There is no known control measure.

## HARVESTING AND STORING

Harvesting the Crop: Practically all grain sorghum is now harvested with combines. Your crop should be left standing in the field until the grain is thoroughly dry, unless artificial drying facilities are available. During good drying weather, the crop is generally ready for combining 10 to 14 days after a killing frost. A few varieties have a dry stem that makes it possible to combine before frost.



Grain sorghum can not be safely stored if it has more than 13% moisture content.

The combine reel should be equipped with wide slats set so that they just clear the sickle bar. The cylinder speed should be reduced to one-half to two-thirds the speed normally used for threshing small grain. The operator's manual, provided by the manufacturer, gives recommendations for correct speed and other necessary combine adjustments.

Storing Grain Sorghum: Heating and spoilage of sorghum grain in storage are common troubles. Such problems are generally due to too much moisture in the grain at harvest time. Heating and spoilage can be avoided by using artificial drying facilities where the grain has more than 13% moisture, or by storing only grain with 13% or less moisture content. When mechanical dryers are properly used, the grain can be placed in storage with a moisture content as high as 20%. Plans for artificial drying facilities and proper storage bins may be obtained through your county extension service.

Before harvesting, all storage bins should be cleaned and treated for insects that might damage the grain. The storage place should be constructed so that the seed will be free of infestation by rats, mice and birds. Every effort should be made to keep the stored grain free of pests and insects.