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GROWING COMBINE GRAIN SORGHUMS[1]

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INTRODUCTION

The use of power equipment in the growing and harvesting of wheat created a demand for a short, sturdy grain sorghum which could be grown and harvested with the same machinery used in wheat production. The value of the grain sorghum crops for much of the Plains region has been appreciated for a long time by progressive farmers, but the cost of producing these crops under the old farming system greatly retarded the expansion of their acreage for commercial grain production. Now that short, sturdy, erect-growing grain sorghums of high-yielding capacity and good quality are available, keen interest in their production has been manifested over a wide area. Along with the development of these new types have come new methods and equipment to take care of the growing and harvesting of the crop under varying conditions. These new developments have helped reduce the cost of producing the crop and still maintain the quality of the grain.

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1. Contribution No. 11 from the Fort Hays Agricultural Experiment Station, Hays, Kan. (The Fort Hays station is a branch of the Kansas Agricultural Experiment Station.)

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The availability of the combine grain sorghums provides opportunities for a more balanced agriculture in the large wheat-growing areas of the Plains. Crop rotations are much more feasible with the use of the new crop. The production of cheap grain makes it possible to feed more live stock and also provides the grower with a cash grain crop which can be marketed in competition with corn.

CHARACTERISTICS OF A COMBINE GRAIN SORGHUM

Combine grain sorghums to be of most value should have the following characteristics.

Sturdiness.— Combine grain sorghums should have a short, stiff stalk which will stand up rigidly under all conditions for at least three months after ripening. Lodging is a serious fault in a combine sorghum. Heads missed by the sickle never reach the grain bin. Frequently varieties to be combined must be left in the field until long after frost and the first snowfall, before the grain is dry enough to be harvested and binned. The standing crop must be able to resist wind, rain, sleet, and snow and remain in condition to be harvested without loss.

Uniform Height.— It is very essential that combine sorghums grow to a uniform height in order that the full crop may be harvested with the least waste and the least amount of material to be threshed to get the full yield. The average height of a desirable variety of combine grain sorghum, such as Wheatland, is about 32 inches.

Erect Heads.— In addition to having a sturdy, stiff stalk, the heads of combine sorghums must be erect. The reel must be able to strike the heads and pass them on to the header platform as the sickle releases them. Recurved or "gooseneck" heads are often dropped before reaching the platform unless the crop is cut so low as to get much more of the stalk than is desirable for good threshing. Frequently the hook, left by cutting off the head just below the crook, catches on the reel and the head passes on over with the reel and is dropped behind the header. Heads somewhat open as distinguished from the distinctly compact type, such as Dwarf Yellow milo, are desirable. The open type of head dries out more quickly and threshes better than the compact type.

Exserted Heads.— The head of a combine variety should extend above the leaves so as to provide sufficient stalk to permit the heading operation without loss of part of the head and with the taking of a minimum of leaves into the cylinder.

Heads That Thresh Readily.— Since the crop is to be combined, it should be a variety which will thresh readily without cracking the grain and still stand in the field without shattering while waiting for harvest. It should thresh clean from the hull.

Capacity to Yield.— The most important function of a grain sorghum is to yield grain in large quantity. To do this it must be adapted to the locality in which it is grown, in order that it may

utilize the full length of the growing season and mature before frost. Earliness is usually gained at the expense of yield, hence the need for using varieties which will take full advantage of the growing season.

VARIETIES OF COMBINE GRAIN SORGHUMS

Because of the newness of the combine method of growing grain sorghums there are only a few varieties adapted to the purpose. Considerable work is being done now in the development of suitable varieties. New sorts, better adapted to higher elevations and to areas requiring varieties resistant to chinch-bug injury and certain plant diseases, should soon be available. A heavy-yielding combine type, sufficiently early to meet the requirements of the higher elevations in western Kansas and eastern Colorado, is urgently needed.

FIG. 1.—A matured crop of Wheatland in rows spaced 42 inches apart; yield, 69 bushels per acre.

Wheatland.— Wheatland is the best combine grain sorghum available to date. (Fig. 1.) This variety is one of a number of straight-necked kafir-milo hybrids bred by J. B. Sieglinger at the Southern Great Plains Field Station of the United States Department of Agriculture at Woodward, Okla., and secured by the Fort Hays Agricultural Experiment Station in the spring of 1929. These selections, with some Fort Hays station hybrids, were planted that season in 5-acre blocks and in test plots to determine their value for combining. Selection No. 41-4-1 proved so outstanding that it was named Wheatland early in February of 1931, and plans were

made for its distribution. Wheatland grows to an average height of 32 inches but has a range of from 24 to 38 inches, depending upon seasonal conditions. The stalks are short, sturdy, and have strength to resist lodging to a greater degree than any other combine variety of commercial importance. The heads are elongated, cylindrical in shape, and somewhat open, varying in length from 6 to 9 inches, depending upon the season and thickness of stand. Each plant may produce from two to five tillers, or stalks, and heads of uniform height, the usual number being two per plant. The kernels resemble Yellow milo in size and color, excepting that the color is somewhat lighter and not so bright. The glumes are blackish-brown and hold the seed firmly, preventing shattering. The variety threshes readily without cracking, giving a test weight of 54 to 61 pounds per bushel.

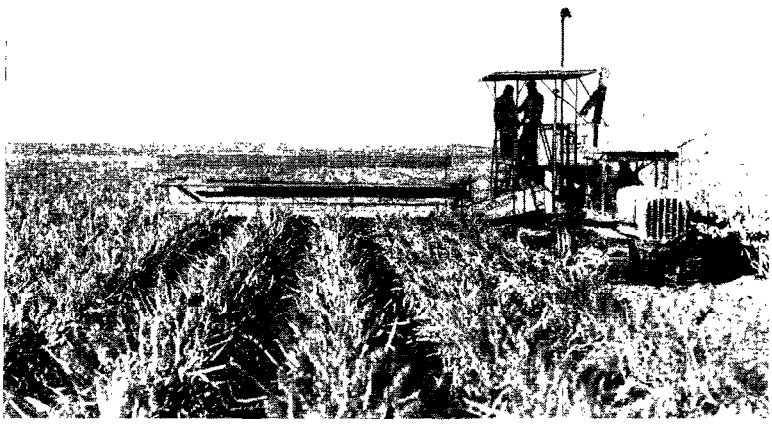

FIG. 2.—Combining Beaver. Heads are not sufficiently out of the boot in this variety.

In a normal season the variety will mature in about 105 days, but if moisture and warm weather prevail during the late fall, Wheatland will continue to grow and has been known to require 130 days to mature. It has matured in a period of 95 days. The yield is considerably increased by the longer growing period. Wheatland, in common with all sorghums, is drought evading, yet subject to considerable injury by hot, dry weather during the flowering period. Planting at a medium late date often avoids this type of injury.

Wheatland is adapted to the western half of Kansas and southward where a medium-early grain sorghum will mature. In the northwestern counties of the state the seasons may not be long enough to permit Wheatland to mature seed. In the eastern section of Kansas the use of Wheatland will be limited by chinch bugs and harvesting problems due to excessive moisture. Wheatland, like Dwarf Yellow milo, is subject to serious chinch-bug injury.

Beaver.— Beaver, a straight-neck kafir-milo hybrid, bred and distributed by the Southern Great Plains Field Station at Woodward, Okla., and used in the combine trials at the Fort Hays station, was the first variety of this kind to make its appearance in the Great Plains area. It did not yield so well as Dwarf Yellow milo, but was considered promising because of its short height, straight neck, and milo-like grain. Beaver grows to an average height of 31 inches. The heads are compact, resembling Dwarf Yellow milo, but do not grow sufficiently above the leaves to make the variety a suitable combine type. (Fig. 2.) Beaver will stand a considerable length of time after frost with only a small percentage of loss due to lodging. It matures in about 110 days. It threshes without cracking, but too much of the plant must be included in the threshing process.

LAND BEST SUITED FOR COMBINE GRAIN SORGHUMS

The combine sorghums respond to good soil and careful seed-bed preparation. The previous crop greatly influences the yield and quality of a grain sorghum. This crop grows best upon fallow land because of the reserve moisture supply and greater amount of available plant food. Barley or wheat land prepared in the fall, worked down in the spring, and kept free from weeds, is also good grain-sorghum land. Land which has grown a crop of corn or row-crop sorghum is not so desirable as wheat or barley land but considerably better than drilled sorghum land. The latter depletes the soil of nearly all its available moisture. Since the sorghum hay crop is harvested late there is little opportunity for the soil to regain much water before planting time.

Preparation of the Seed Bed.— In preparing a seed bed for the combine grain sorghums the most desirable practice is to blank list in the fall, provided the land is reasonably level. (Fig. 3.) Listed ground catches snow and the freezing and thawing mellow the ground so that it works well in the spring. (Fig. 4.) Blank-listed ground warms up earlier in the spring than plowed land. As soon as the weeds have a good start the listed furrows should be filled in with the ridgebuster or weeder. (Fig. 5.) Another crop of weeds usually will appear before planting time, and these should be killed with the one-way plow or spring-tooth harrow. (Fig. 6.) If moisture is plentiful and another crop of weeds starts before planting time, it is much cheaper to kill them by another one-waying than to plant the land hoping to kill most of the weeds in the planting operation and expecting to get the survivors by cultivation after the crop comes up.

Fall plowing, spring plowing, and early spring listing are also good methods to practice in the preparation of a seed bed for the grain sorghums. Listing is much quicker and cheaper and the ground is warmed up more rapidly by this method. Throwing in when the first crop of weeds appears and subsequent cultivation to destroy weeds before planting time are necessary for best results.

FIG. 3.—Blank listing in the fall or early spring is the first step in providing a well-prepared seed bed for combine sorghums.

FIG. 4.—Fall listing catches snow. Freezing and thawing mellow the soil.

FIG. 5.—Throwing in the lister ridges and destroying the first crop of weeds with a six-row ridgebuster.

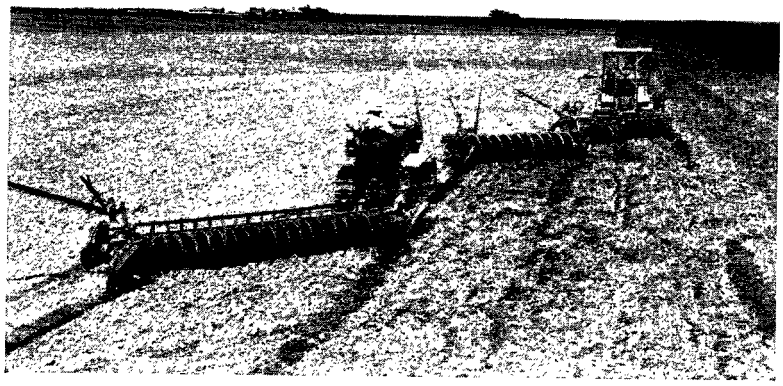

FIG. 6.—Leveling listed ground with a one-way plow after the ground has been thrown in with a ridgebuster. The second crop of weeds is also destroyed in this operation.

USE TREATED AND TESTED SEED

Treating the Seed.—The treatment of seed with copper carbonate at the rate of 3 ounces per bushel controls kernel smut and improves the stand by protecting the seed from molding.

Testing the Seed.—The quality of the seed determines the uniformity of the stand, the vigor of the crop, and the returns per acre. Such small quantities of seed are required for an acre of row crop that it certainly is a wise policy to make germination tests of the seed before planting. If replanting becomes necessary due to inferior seed, valuable time during the growing season is lost and the labor in planting is wasted. Germination may be reduced in several ways. Chief among these are (1) freezing before the seed is fully mature, (2) weathering in the field either in the shock or as standing grain, and (3) heating in the bin when stored.

PLANTING THE GRAIN SORGHUMS

Timeliness and attention to detail in carrying out the various operations incident to the planting of combine grain sorghums are most essential. There is a "best time" and a "best rate" of seeding for this crop. Several methods of planting are in use, a few of which, when carefully followed, are productive of good results.

METHODS OF PLANTING

Listing for the sorghums has been carried on for a number of years with varying degrees of success, depending upon the character of the soil and methods of preparation. A modified listing method recently has come into use and has proved highly successful. The use of the grain drill also has proved a highly satisfactory way of growing the crop. The more important methods now in use are the following:

1. The common lister-planter method, wherein the crop is listed without previous preparation of the soil, is the least desirable method, as the seed is placed in the bottom of the furrow in cold ground. The furrows are usually deep and comparatively narrow and in case of heavy rain the seeds or young plants are often covered up or washed out. Poor stands are frequently secured from this method, and to obtain a satisfactory stand extra heavy seeding is required.

2. Another method is the common lister-planter nosing-out method, wherein the planting is done in the old lister furrow after the land has been blank listed in the fall or spring. By this method the blank-listed furrows have not been thrown in and the only loose soil in the bottom of the furrow is that which fell in during the lister operation. The danger in this method is that there is not much loose soil in the bottom of the furrow, and the soil in warming up dries out to a considerable extent. The seed must be planted either in this somewhat dry top soil or deeper into the hard subsoil. This method is, however, an improvement over the common lister-planter

method. Frequently the corn planter is used to plant the seed in these blank-listed rows which have been opened but not thrown in.

3. A third method involves the use of the lister-planter and the ridgebuster or weeder. The land is listed in the fall or spring and the furrows nearly filled by means of the ridgebuster or the weeder. The planting is done in the old furrows by the use of the common lister-planter or the loose-ground lister-planter. This method provides warm, mellow, moist soil in the bottom of the furrow. The furrows are not so deep and narrow as in the regularly listed furrow. The ground is warm and usually contains plenty of moisture to bring up the seed quickly and uniformly. The loose-ground lister-

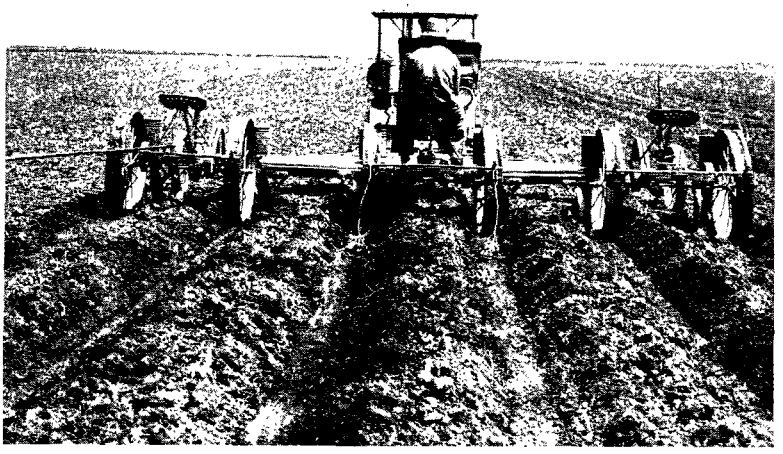

FIG. 7.—Planting with a loose-ground lister-planter. Seed planted in shallow, wide furrows is rarely covered up or washed out.

planter in this instance is run comparatively shallow thereby making a wide furrow, with the seed planted in a small ridge down the center of the furrow.

In case of heavy rainfall the seed planted in this manner is seldom covered so that, the young plant cannot emerge, and serious reduction in stand is rare. The common lister-planter sometimes clogs up in front, because in pushing out the loose soil, particularly if it is sticky, the lister share will not scour. This method, however, works well in sandy land.

4. A fourth method differs from the third in that after the land has been listed and the ridges worked down by the ridgebuster or the weeder it is planted crosswise to the old lister rows by the use of the loose-ground lister-planter. (Fig. 7.) This method provides for planting the seed in a warm, mellow, moist seed bed under the best of conditions. The furrow is shallow and wide with the seed planted under a small ridge in the bottom of the furrow. Germina-

tion is quick and complete. Less seed is required to obtain a good stand in methods (3) and (4), and the rows can be kept straight. All the sorghums on the commercial seed and feed fields at the Fort Hays branch station, with the exception of those planted with the drill, are now planted with the loose-ground lister-planter crosswise of the old lister furrows.

This type of planter can be used to good advantage (Fig. 8) on plowed land if the soil has been loosened up somewhat by means of the one-way or spring-tooth harrow to kill weeds. This tillage also helps warm the soil and hastens germination on plowed land.

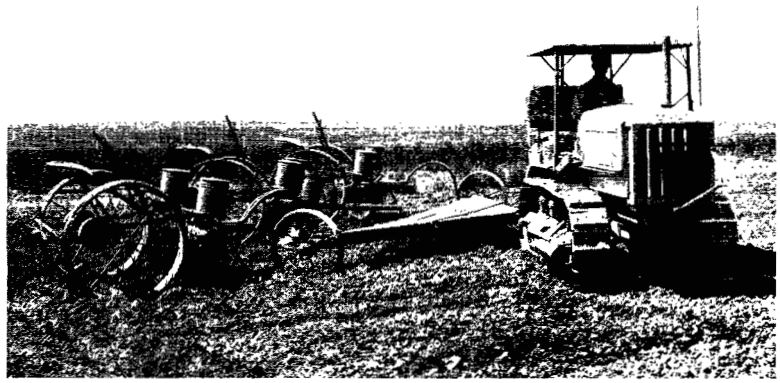

FIG. 8.—The six-row planting unit executing an about face. Flexibility of equipment facilitates short turning.

5. The drilling of combine sorghums for grain production in 14-inch rows by means of the deep-furrow drill, or the common drill, is the method used most recently in Kansas and is one which bears much promise. (Figs. 9 and 10.) The land should be prepared, as indicated in the preceding discussion, before planting the crop. It is especially necessary to kill two or three weed crops before planting with the grain drill, as there is very little opportunity for cultivation after the crop is up. It is much more desirable to delay planting until about June 10 and give the land another good cultivation before planting than to plant the crop earlier without the extra cultivation. Delayed planting allows more time for the soil to become warm, and killing the weeds before planting conserves all the available moisture for profitable crop production. Where the ordinary grain drill is used every other hole is stopped up so as to provide a 14-inch drill row in the case of the 7-inch drill, or a 16-inch row where the 8-inch drill is used. The 12-inch furrow drills are also fairly satisfactory, although experiments indicate that rows with spacing less than 14 inches usually will not yield so well as the 14-inch spacing.

A spacing of 21 inches is not wide enough for good cultivation but is wide enough to allow weed growth between the rows with consequent reduction in yield. This method is in the experimental stage.

DATE OF PLANTING

The results of the date-of-seeding tests conducted at the Fort Hays station prove conclusively that grain sorghums planted on or after June 1 yield more grain than those planted on or before May 15. Keeping the land clean and free from weeds until planting time, and seeding sufficiently late to avoid some of the hot winds and drought during the flowering period, account largely for the increase in yield. Varieties seeded between June 1 and 15 not only produce heavier yields than those seeded earlier, but grow faster and require less total time to mature. A delay of 15 days in planting time from May 15 to June 1 has resulted in only six days' delay in maturity in the fall. Some varieties respond better to delayed planting than others.

The Fort Hays Agricultural Experiment Station has for a number of years been carrying on date-of-seeding experiments with a group of sorghums suitable for combine methods of harvesting. These experiments on the date of seeding the various varieties are very conclusive in showing that the time of planting does have a great influence on yield. In fact the results indicate clearly that sorghums over much of the western part of Kansas often are planted too early. It would be far better to delay planting for 10 or 15 days and spend this time in killing weeds and allowing the soil to become warm. The results of the date-of-seeding experiments are given in Table I. These results include only three- and four-year averages, but show rather definitely that Wheatland makes favorable response to delayed planting. Beaver and Custer also yield more when not planted until the later date.

TABLE I.—COMPARATIVE YIELDS FROM DIFFERENT DATES OF PLANTING DWARF GRAIN SORGHUMS SUITED TO THE COMBINE METHOD OF HARVESTING.

Hays, Kan., 1929 to 1932.

DATE OF PLANTING.	Yield in bushels per acre.					
	3-yr. av., 1930-'32.			4-yr. av., 1929-'32.		
	May 15.	June 1.	June 15.	May 15.	June 1.	June 15.
Variety.						
Wheatland	35.2	42.1	55.6	.....	.....	.....
Double Dwarf milo	34.3	44.1	47.4	31.7	44.9	46.4
Beaver	29.9	37.7	45.7	31.1	38.6	45.3
Sooner	41.4	41.9	41.4	44.2	47.8	42.4
Custer	31.9	35.3	37.5	32.6	35.6	37.0

FIG. 9.—Drilling Wheatland with a 14-inch deep-furrow drill.

FIG. 10.—A matured crop of Wheatland drilled with a 14-inch deep-furrow drill.

RATE OF PLANTING

The usual tendency in planting sorghums for grain production is to sow too much seed. This may be accounted for to some extent by a desire to overcome an inferior seed-bed condition or the effect of too early planting of poor seed in cold ground. The grain sorghums when planted in 40- to 42-inch rows by means of the lister-planter or the loose-ground lister-planter should be sown at the rate of from 3 to 5 pounds per acre, depending upon the character of the seed bed. Three pounds of seed per acre are sufficient where a warm, moist, mellow seed bed has been secured and when seed of good quality is used.

In planting the combine types with the deep-furrow drill or the common grain drill in 14-inch rows, 5 pounds of seed per acre are sufficient to produce a satisfactory stand if a good seed bed has been prepared. It is a difficult matter to make most grain drills sow such a small amount of seed without the use of special equipment. Grain drill manufacturers now supply reducers for this purpose, which are satisfactory if used as recommended. If one is not certain as to the amount of seed being planted, the planting machinery should be calibrated.

At the Fort Hays Agricultural Experiment Station in 1932 blocks of combine grain sorghums were planted for harvesting with the combine. The plantings were made on fall-listed row-crop sorghum ground on June 15. In this group Wheatland was planted three different ways. One block was planted in 42-inch rows with the loose-ground lister-planter; another block was sown in 14-inch rows with the deep-furrow drill; and another block drilled in 14-inch rows with a common grain drill of the press-wheel type. The season was very favorable, resulting in high yields. The 42-inch-row block

TABLE II.—THE COMPARATIVE YIELDS, GRAIN LOSSES, AND MOISTURE CONTENT OF THE COMBINE GRAIN SORGHUMS PRODUCED IN FIELD EXPERIMENTS, 1932.

Combined November 8, 1932, Hays, Kan.

VARIETY.	Bushels per acre.			Per cent of total yield in lodged and dropped heads.	Per cent of moisture in threshed grain.
	Total yield.	Amount actually combined.	Loss in lodged and dropped heads.		
Wheatland:					
14-inch furrow drill	72 7	71.5	1 2	1.7	14 8
14-inch common drill	69 7	67.2	2 5	3 6	13 9
42-inch rows	69.2	67.3	1 9	2 7	14.1
Wheatland backcross: 42-inch rows.	56.0	51.7	4.3	7 7	14 1
Beaver	54 1	50 9	3.2	5 9	15.3
Custer	48 8	44.9	3 9	8.0	15.6
Day	47.7	44.1	3.6	7.5	14.2
Two-foot	43.6	38.5	5 1	11.7	14.0

produced 69.2 bushels per acre; the 14-inch-furrow-drill block, 72.7 bushels; and the 14-inch-common-drill block, 69.7 bushels per acre. The rate of seeding was 3 pounds per acre for the 42-inch rows and 5 pounds for the 14-inch drills. Table II gives the results from this experiment.

CULTIVATING THE CROP

The chief reason for cultivating a sorghum crop is to kill weeds. If two or three weed crops are killed by proper tillage methods before planting, the need for cultivation after the crop has been planted is reduced greatly. Excessive rainfall during the growing season often makes extra cultivation necessary despite the best tillage

FIG. 11.—The first weeding should be given as soon as the rows are well defined.

methods, as it is sometimes impossible to get into the field to cultivate when the work should be done.

Just as soon as the crop is up so that the rows are well defined the first operation with the weeder should be carried out. (Fig. II.) This consists of throwing the soil away from the plant to the ridge between the rows. By the time the plants are 6 to 12 inches high the ridges should be thrown in, covering any small weeds that may be present. (Fig. 12.) The time that these operations are done determines very largely whether or not the weeds will be kept under control. If the weeds become so large that the second cultivation will not cover them, they will thrive throughout the season, depriving the sorghum of much needed moisture and plant food.

Shovel cultivators occasionally are needed to destroy weeds between the rows. The shovels should be run at shallow depths to avoid cutting off the side roots of the sorghum plant.

Combine sorghums seeded with a furrow wheat drill can be harrowed if weeds are present when the crop is small. However, if the seed bed has been well prepared and planting has been delayed until after June 1, there should be little need for harrowing this crop.

HARVESTING GRAIN SORGHUMS

Combining. — Combine grain sorghums, as the name implies, can be harvested with the combine grain harvester. (Fig. 13.) Combining should be delayed until the excess moisture in the head and stalk has disappeared. It sometimes is possible to combine a grain sorghum crop before frost. Usually, however, it requires a severe frost to reduce the moisture content of the sorghum sufficiently to

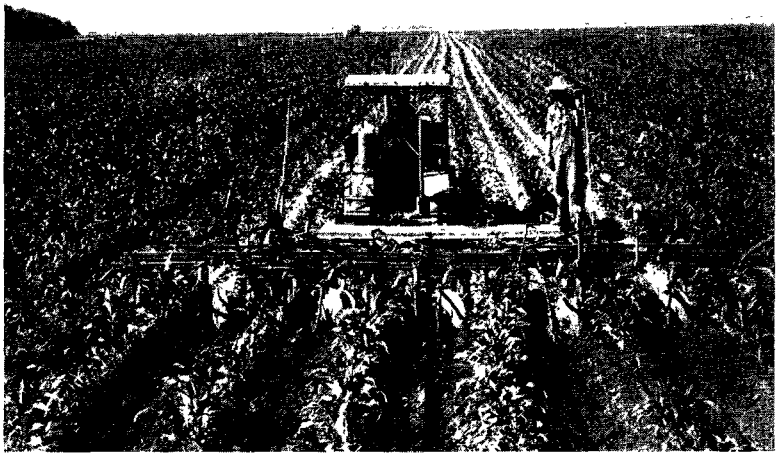

FIG. 12.—The second weeding should be given before the sorghum is a foot high.

permit safe storage of the combined grain. Experiments at the Fort Hays station show that sorghum grain having a moisture content slightly over 13.5 per cent will keep in bins throughout the winter months, but there is danger of heating with the coming of summer temperatures.

Sorghum grain with a slight excess of moisture will heat and mold more quickly than will wheat with a similar moisture content. In storing grain sorghums it is essential that the crop be threshed clean and that it be free from pieces of stalks, as the stalk carries more moisture than an equal volume of threshed grain.

The combine will thresh grain sorghums satisfactorily if the standing crop is ready to be harvested. A short trial will determine whether or not the grain is dry enough to combine. The machine will operate satisfactorily considerably before the sorghum grain is low enough in moisture content to keep well in bins. Herein lies

the danger in the use of the combine. The admonition, "Don't combine too soon," applies more in the combining of sorghums than in the combining of wheat.

The adjustment of the combine for threshing wheat carries too many concaves and the cylinder runs too fast to thresh grain sorghums without cracking. Half the concaves and several of the teeth in the remaining concaves should be removed and the cylinder speed reduced, as recommended by most combine manufacturers in instructions which accompany the machines.

Heading and Threshing.— Combine grain sorghums can be harvested with the header and the heads dumped in small narrow

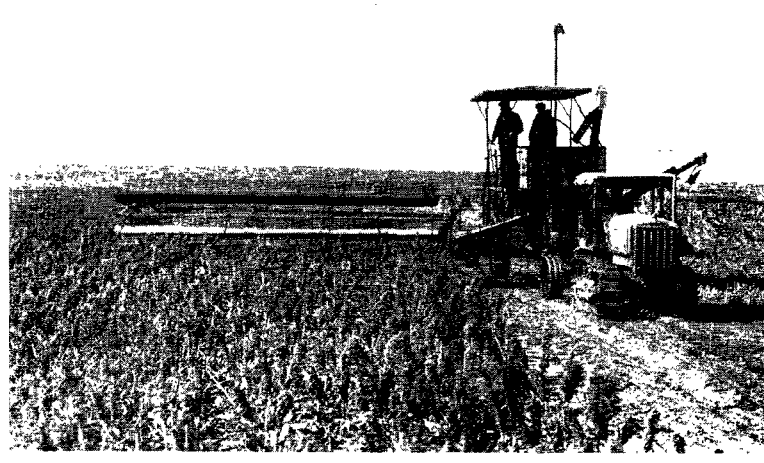

FIG. 13.—Combining drilled Wheatland. This variety combines very satisfactorily.

ricks to dry. The ricks can be threshed when dry. Heading can be done just as soon as the crop is ripe.

The Fort Hays station uses what has been termed the windrow header-dump-box method of harvesting all seed stock of Wheatland. By this method the headed grain is elevated into a box attached to the windrower. This box has a tilting bottom and as soon as it is full of heads the operator pulls a lever and the bottom of the box tilts downward, the end gate automatically opens outwardly, and the load of heads drops on the ground making a narrow, long pile. As soon as the heads are thoroughly dry they are threshed. A prolonged period of rainfall may cause the heads nearest the ground to mold to some extent, and in that event damaged grain will result.

The dump-box method has been in use for three years and has given splendid satisfaction during that time. (Fig. 14.) Comparative costs are always interesting. The average cost per acre of the windrow header-dump-box method of harvesting Wheatland was $3.30, heading with the dump-box costing 68 cents and threshing,

$2.62 per acre. The average cost of harvesting the same crop with the combine was $2.61 per acre. The cost of combining sorghums is practically the same as that of wheat where the yields are high.

SUMMARY

The combine grain sorghums are the answer of the plant breeder and agronomist for a grain-sorghum crop which can be grown and harvested with wheat machinery.

The availability of combine types of grain sorghums provides opportunity for a better-balanced agriculture in the wheat-growing areas and furnishes the grower with another cash crop.

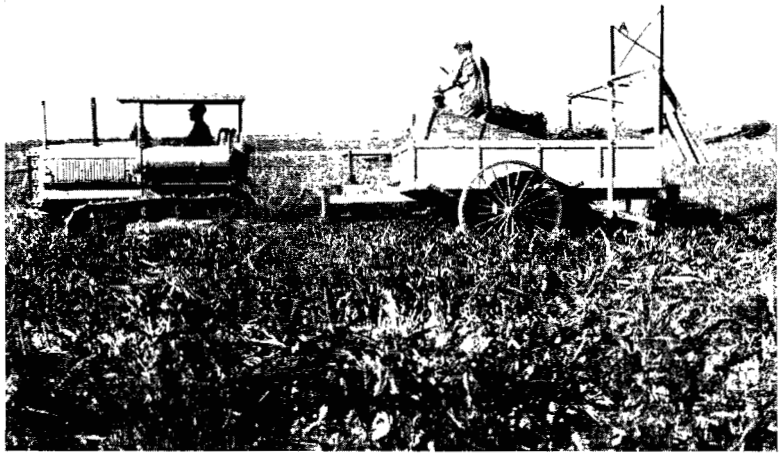

FIG. 14.—Harvesting Wheatland by the windrow header-dump-box method of harvesting. A 20-foot header will harvest 50 acres a day.

Combine grain sorghums should be short, sturdy types with erect heads, having the ability to stand upright after maturity without lodging, until harvested. The average height of the plants should be less than 3 feet. Combine grain sorghums should have capacity to yield heavily and possess grain which threshes readily without cracking.

Wheatland is the best combine grain sorghum available. It has a growing season slightly in excess of 100 days, stands 32 inches high, grows erect, does not lodge, yields well, and threshes easily without cracking. It is, however, susceptible to chinch-bug injury. Wheatland will mature in all sections of Kansas excepting the northwestern counties.

Combine sorghums yield best when planted in properly prepared, good soil. Fallow or well-prepared barley-, wheat-, or corn-land is best suited for the production of this crop.

Blank listing in the fall, throwing in when the first weeds appear in the spring, and additional tillage for weeds with the one-way or

spring-tooth harrow once or twice before planting constitute the best method of preparing land for grain sorghums.

Treating the seed with copper carbonate at the rate of 3 ounces per bushel before planting prevents kernel smut and improves the stand. Germination tests should be made of seed before planting.

Planting with the lister or the loose-ground lister-planter in well-prepared warm soil insures rapid germination and quick growth. The deep-furrow drill or common drill arranged to sow in 14-inch rows can also be used with good success.

Combine sorghums should be listed at the rate of 3 to 5 pounds per acre when planted in a good seed bed in 42-inch rows, or 5 to 7 pounds when drilled with the deep-furrow drill.

Grain sorghums yield best when planted during the first week in June at Hays or in areas having similar climatic conditions.

The cultivation of grain sorghums planted in 42-inch rows is largely accomplished by completely destroying the weeds while preparing the seed bed. Throwing out to the ridge when the rows become well defined, and throwing the ridge to the plants when they are about a foot high, should constitute the main weed-killing operations after the row crop comes up. If the weeds still persist the shovel cultivator should be used, avoiding deep cultivation.

Grain sorghums planted with the grain drill cannot be harrowed except during a short period after emergence. If weed killing has been well done in preparing the seed bed before planting, harrowing will not be necessary.

Combine grain sorghums should not be harvested until the grain is sufficiently dry to keep in a grain bin. To be stored safely, grain sorghums should not contain more than 13.5 per cent moisture, as the grain will heat and mold if a larger percentage of moisture remains.

To thresh combine grain sorghums successfully the speed of the cylinder should be reduced to the revolutions recommended by the manufacturers of the thresher, and sufficient concaves and teeth should be removed to make the cylinder take the heads and stalks without cracking the grain.

The common grain header or the windrow dump-box-header can be used to harvest combine grain sorghums. If this is used the grain can be cut as soon as it is ripe, ricked or bunched, and threshed as soon as it is dry.