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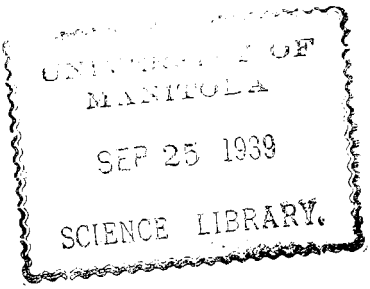

Sorghums In Colorado

J. F. BRANDON, J. J. CURTIS, AND D. W. ROBERTSON

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Contents

Sorghums In Colorado

J. F. Brandon, J. J. Curtis, and D. W. Robertson[1]

SORGHUMS ARE the chief forage crop of the eastern Colorado plains. The acreage and distribution of sorghums in Colorado are shown graphically in figure 1. Each dot represents 1,000 acres, or a major fraction thereof, based upon the average county acreages in the five Colorado Yearbooks, 1928-31 and 1933. This figure also shows approximate altitude lines at intervals of 500 feet.

The grain sorghums predominate in southeastern Colorado, while in the northeast the acreages of grain and forage sorghums are about equal. The grain sorghums grown in the northeast are planted mainly for forage. The acreage in the high-altitude counties ranges from 0 to 500 acres.

The United States Dry-Land Field Station,[2] located near Akron in Washington County, at an elevation of about 4,600 feet, is well situated to represent the average sorghum-growing conditions in Colorado. Most of the sorghum testing and improvement has been done there.

Preparing the Seedbed

Sorghums are among the most exacting of the annual field crops in their seedbed requirements. The important aims in seedbed preparation for sorghums are to store moisture, destroy weeds, and mellow and warm the soil.

A weed-free seedbed is desirable because sorghum seedlings are very small—not much, if any, larger than those of the four predominant annual weeds of this region, viz., Russian thistle (*Salsola pestifer*), rough pig weed (*Amaranthus retroflexus*), prairie sunflower (*Helianthus petiolarus*), and cocklebur (*Xanthium commune*). If weeds start in the row concurrently with the crop, they will not be held back by shading, and are very difficult to eliminate by cultivation.

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[1]Associate agronomist, Division of Dry-Land Agriculture, Bureau of Plant Industry, U. S. Department of Agriculture, and superintendent of the station; junior agronomist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture, and cerealist at the station; and agronomist at Colorado Experiment Station, respectively.

[2]The United States Dry-Land Field Station, located in northeastern Colorado, at an altitude of about 4,600 feet, is operated by the Division of Dry-Land Agriculture of the U. S. Department of Agriculture, in full cooperation with the Colorado Experiment Station. The cereal experiments at this station are under the care of a representative of the Division of Cereal Crops and Diseases of the U. S. Department of Agriculture, also in cooperation with the Colorado Experiment Station. Sorghum experiments were carried on at this station by the representative of the Division of Cereal Crops and Diseases from 1908 to 1924, by J. F. Brandon and D. W. Robertson from 1924 to 1930, and by J. J. Curtis from 1930 to the present time.

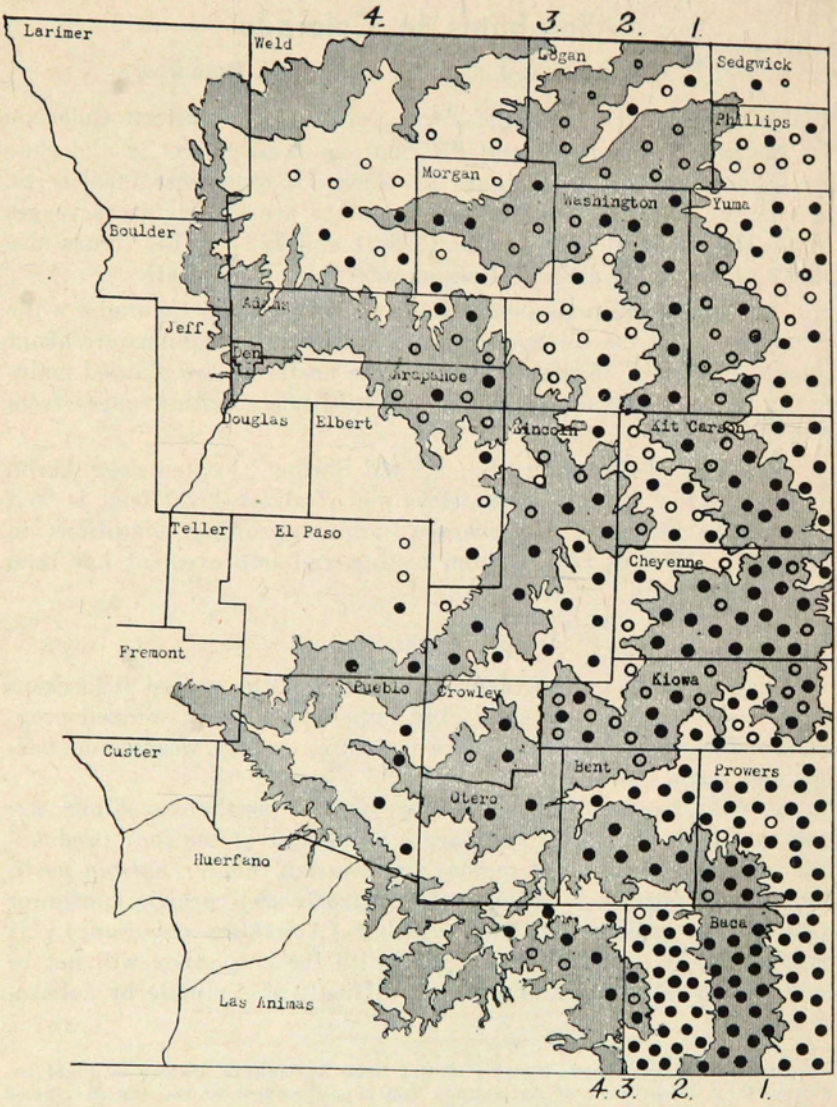

Figure 1.—Contour map of eastern Colorado, showing average distribution of sorghums for a 5-year period, 1928-31 and 1933. Legend: (1) Contour line at 4,000 feet; (2) contour line at 4,500 feet; (3) contour line at 5,000 feet; (4) contour line at 5,500 feet; (●) 1,000 acres of grain sorghum; (○) 1,000 acres of forage sorghum.

It is difficult to attain a weed-free seedbed for sorghums in the northern and the higher portions of eastern Colorado, because the best planting date for the crop almost coincides with the date of the

germination of the weed seeds, particularly those of pigweed and cocklebur. Therefore, germination of weed seeds should be encouraged in every way and the weeds destroyed by cultivation prior to planting. Sorghum seeds should be planted in a warm seedbed to encourage prompt emergence and rapid early growth.

The common method of growing sorghums in Colorado is by listing and planting in the one operation in 42- to 44-inch rows, on small grain stubble land which may or may not have been disked previously. This method places the seed in the cold, freshly exposed soil of the furrow bottoms where the temperature is likely to be too low for prompt germination, and satisfactory stands may have to depend on a period of warm, clear weather. A dashing rain immediately after lister planting not only cools the soil where the seeds have been deposited but also may wash loose soil down from the sides of the newly made furrows to bury and form a tight crust over the seed. This method of planting is not conducive to prompt emergence, good stands, or a rapid, vigorous start of the crop if a satisfactory stand is to be secured.

Early spring working of hard land stubble is very beneficial in closing a checked surface, thus preventing excessive soil moisture loss. It often happens that such early worked stubble land is moist and mellow at sorghum planting time, while similar stubble land,

Figure 2.—A good lister-worked seedbed; moisture has been conserved, soil warmed, and weeds controlled. Planting should be done in a seedbed of this type by nosing out the bottom of the furrows.

not worked, is hard and dry. The next step after the early spring working should be to list late in April or early in May, or as soon as another crop of weeds can be destroyed. This listing should leave considerable loose soil in the bottom of the furrows to prevent drying and to facilitate warming. This can be accomplished by leaving the covering disks in place.

Hard land stubble intended for row-crop planting the following year may be fall listed as the first field operation, without increasing the soil-blowing hazard or decreasing appreciably the snow-catching ability as compared with the undisturbed stubble. Fall listing or working, to be effective in bettering the seedbed preparation, must be done immediately after harvesting the small grain crop. Damming attachments, now available, may be used on the lister. Any fall growth of weeds or volunteer grain should be removed by an outward cultivation with the lister cultivator. If the basin lister has been used, it may be necessary to split the ridges and re-dam to control weed growth. Spring cultivation of fall-listed land should throw the soil inward to destroy the first crop of weeds and trap moisture in the furrows. Experiments at Akron on hard land show that fall listing of stubble land at an average date of September 1 is equal but not superior to spring listing as a soil preparation for the succeeding crop. It can be recommended only as a means of better balancing the year's work. It must be emphasized that fall working, to be effective, must be done immediately after harvest.

The first spring working of the hard land soils in either small-grain or row-crop stubble should be early in April, soil moisture conditions permitting. Seedbed preparation work for moisture conservation and soil warming should be started promptly, because the period of heavier rainfall begins about April 1. Spring work in preparation for planting sorghum is well repaid in increased crop yields. A warmed seedbed, nearly free from weeds and containing some stored soil moisture, is a primary requirement for successful sorghum production.

Dead thistles are often so dense on stubble fields in the spring that it is impossible to list satisfactorily until the debris has first been cut and partly incorporated with the surface soil. It is not advisable to burn this trash if it can be incorporated into the surface because our plains soils are usually deficient in humus. Neither is it advisable to turn it under with a moldboard plow. Under such circumstances, the disk may be considered as a necessary evil in seedbed preparation to cut up this material, although in general the pulverizing of the surface soil by disking is one of the worst cultural practices that can be followed in an area where soil blowing is likely to occur.

Bean land or other hard land from which the cover has been removed to be planted to sorghums should be fall listed or otherwise roughened after the crop has been removed as a protection against winter and spring soil blowing. Later preparation should be similar to that recommended for other stubble or row-crop land.

Where possible, the duckfoot cultivator should be used in place of the disk for fall or spring cultivation of stubble. Listing or working on the contour is recommended where loss of moisture by runoff is a problem.

It is never a good practice to fall list sandy soils if in so doing any soil-anchoring vegetation is destroyed. The very best winter protection from soil blowing is a surface cover of vegetative material. It is not usually safe to spring list sandy soils before May 15. These soils, however, become warm much faster than the hard lands; therefore, both listing and planting may be done in the same operation. If the dead plant material is dense enough to make a disking necessary before satisfactory listing and seeding can be accomplished, this

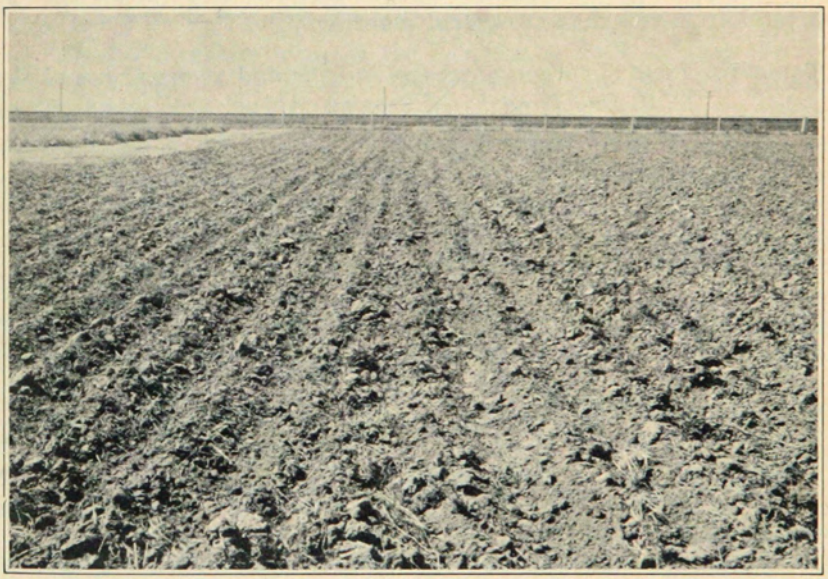

Figure 3.—A surface-worked, weed-free seedbed prior to planting.

is usually done about the middle of May, when seedlings of sunflowers and other weeds can be destroyed. Another good practice is to list the land during the first half of May, when the first crop of weeds is well emerged, and then lister-plant the sorghum later by splitting the ridges. This can be recommended only for these sandy lands.

Any high-altitude plains soil is already in nearly ideal physical condition in its lower depths for good crop production. If weeds are prevented from robbing the soil of moisture, if the surface has been kept open and receptive, if the necessary cultivations have been along contour lines and in blocked furrows to prevent rainfall runoff, if the land has been handled so as to prevent blowing, if the surface has been properly warmed—a good sorghum seedbed will have been created.

Irrigated land to be planted to sorghum should be clean cultivated prior to planting. Spring plowing with later cultivations is recommended.

Planting the Sorghum Crop

Sorghum intended for hay, silage, or grain on the non-irrigated lands usually is planted in rows and cultivated. Grain sorghums should be planted in rows, regardless of soil type. Experiments at Akron show that the yield of forage sorghums is about 25 percent greater from row than from drill planting.

TABLE 1.—*Yield of forage sorghums in wide and narrow rows at the U. S. Dry Land Field Station, Akron, Colo., during 9 of the 12 years 1925-36.*

Method of seeding	Yield in pounds per acre (9-year average)
	Pounds
In rows, 42 inches apart	4,387
Drilled, rows 8 inches apart	3,222

Besides the greater uncertainty of the drilled crop and the lower average yields shown above, it is difficult to secure a sufficiently weed-free soil for successful drill seeding of the sorghums on the hard land. The drilled crop in the above-mentioned experiment, seeded at the same time as the rows, about June 2, was often very weedy. Drill seeding of the forage sorghums is not recommended for either hard or sandy lands except for reasons other than high acre yields.

Forage sorghums planted in rows have some tendency to become coarse on sandy soils; hence, the crop is sometimes sowed or drilled. This latter method of planting leaves a closely spaced, well-anchored stubble that is an excellent winter protection against soil blowing. The closer spacing of the plants tends to reduce the height and coarseness of the stalks. The row method of planting, however, is usually preferred, even on sandy soils, because of the greater certainty of production. The coarseness of the stalks can be decreased to some extent by increasing the rate of planting.

Row planting is done on the early fall- or spring-prepared seedbed, with the lister or the corn planter equipped with furrow openers running in the bottoms of the previously opened furrows. The lister planter is perhaps to be preferred in this region, since it is more usable for other types of row-crop planting and can be made to throw the loose weed-seed bearing soil out of the furrow. Care must be used in finishing the lister cultivations prior to seeding to have the ridges flattened so that that implement can be used for planting.

In using the lister for planting, the covering disks are removed and the subsoiler lowered only to the depth it is desired to plant. In using a lister, be sure that no loose surface soil rides over the lister moldboards to drop into the row below. This portion of the soil contains weed seeds and must be kept out of the furrow and the row. Covering is done by the small trailing wheels pressing the soil over the seed. The wheel covering is advisedly augmented by a short length of reasonably heavy chain dragged behind. This chain effects better coverage and by granulating the surface aids in preventing drying of the soil over the seed.

It is a mistaken idea, on the hard lands at least, that the unturned soil of the ridges must be stirred by splitting. In Kansas Bulletin 265, "Sorghum Production in Kansas," data are presented showing about a 15-percent increase in grain yield where the old furrows are nosed out at planting time over preparation where the ridges are split before planting time. Experiments at Akron with corn also indicate that it is better to lister-plant row crops on the plains hard lands, in the bottoms of the original furrows, leaving the ridges intact until worked down in cultivating the crop. The loss in corn yield at Akron from splitting the ridges during the six years 1932-37 has been 25 percent.

Forage sorghums should be planted in cultivated rows, if seed production is the chief objective. Requirements for keeping the seed pure are the same as for other open-pollinated crops. The field should be isolated at least 40 rods from the nearest sorghum field.

Some forage usually can be produced by thickly seeded grain and dual-purpose sorghums, but thin seeding and some accumulated soil moisture are necessary to insure grain production. The seeding precautions, other than the seeding rate, are the same for grain sorghums as for the row-planted forage sorghums. Surface drilling in rows 30 to 36 inches apart is recommended for irrigated conditions.

Experiments at Akron (table 2) show that Sudan grass, if seeded at the normal sorghum seeding date, will yield slightly better when planted in regulation-width rows and cultivated.

TABLE 2.—*Mature forage yields of Sudan grass in three widths of row spacings at the U. S. Dry Land Field Station, Akron, Colo., during 11 of the 13 years 1925-37.*

Method of seeding	Yield per acre (11-year average)
	Pounds
In rows, 42 inches apart	2,467
In rows, 20 inches apart	2,336
In rows, 8 inches apart (sowed)	2,425

There is the same weed difficulty with this sowed crop that there is with the forage sorghums when the seeding is made early, between June 1 and 6, at the elevation of the Akron Station. Later drill seeding of Sudan grass is sometimes advisable.

Depth to Plant

The proper depth for planting depends on the type of soil and the amount of moisture present. One-half inch of moist soil covering over sorghum seed would be ideal if one were assured of cloudy, damp weather until emergence was realized. However, on the plains the surface soil is especially likely to dry, and we must plant at the maximum depth that will permit certain emergence. This is about 1 to 2 inches. Obviously, the seed should be deposited in moist soil regardless of the depth necessary to reach it. It is not conducive to good stands to have to plant much deeper than these recommended depths, and this rarely will be necessary if the seedbed has been well prepared. The lister subsoiler or the planter shoe marks should be closed and the surface packed.

Date to Plant

The sorghums are warm-weather plants and need a warm soil for germination and vigorous early growth. Since they require the entire growing season to mature in most sections of Colorado, it is very important to prepare the seedbed properly and to plant as soon as warm soil and weather are assured.

The earliest recommended planting dates for sorghums in Colorado are from about May 20, in the lower altitudes of the southeast, to about May 25 in the same regions of the northeast. From these earliest dates at the lower altitudes, the planting should be delayed about 5 days for each increase of 500 feet in elevation, up until about June 8, when it should be safe to plant in any soil preparation anywhere on the Eastern Slope below 6,000 feet in elevation. Early maturing grain sorghums may be planted up to June 20 in most of

southeastern Colorado. Sorghums do not do well at altitudes in excess of 6,000 feet elevation on the Eastern Slope; hence, they are not recommended for this area. Listing and planting in the same operation should not be attempted until about 5 days later than the earliest recommended planting date. With the same soil preparation, planting is possible about 5 days earlier on sandy than on hard lands.

The earlier the planting is done, the better must be the seedbed preparation. Where soil moisture is generally deficient, it may be preferable to delay planting as long as possible before seeding one of the early varieties.

Sudan grass is earlier than any of the other sorghums and so may be seeded later. The later the planting is delayed up to the date that will permit the crop to reach the desired stage of maturity, the better the yield, provided the seedbed has been prepared early and moisture has been conserved. For seed production, Sudan grass should not be planted later than from about June 10 to 20 in the northeast in order to reach maturity, the earlier date applying to the higher altitudes. In the southeast, these dates may be from 10 to 15 days later. When Sudan grass is intended for pasture, early grazing is desired, so the seeding date should be the same as that recommended for other sorghums. When hay is desired and the crop is drilled, the seeding date may be delayed about 20 days. This will give additional time for freeing the land of weeds and for storing moisture for the benefit of the crop.

Rate of Planting

Special sorghum plates are desirable and necessary for the grain and dual-purpose sorts. Since the seed may vary in size and type, depending on the variety, and in comparative plumpness from year to year, it is advisable to have at least three sets of plates with holes 11/64, 12/64, and 18/64 of an inch in diameter. These holes should be reamed out on the under side to facilitate the passage of the seed. Select the plate that will pass two or three seeds through a hole at a time without clogging. It will then usually be possible to regulate the speed of the plate to the desired planting rate. Corn plates are unsatisfactory, even for forage sorghums, because they tend to plant too many seeds.

Row-planted sorghums in eastern Colorado require 1 to 10 pounds of seed per acre depending upon the type, the size, and the viability of the seed; the condition of the seedbed; and the stand desired. This information is useful only in determining the approximate amount of seed necessary for the proposed acreage. Before actual planting, it is desirable to check the seeding rate by dropping

Figure 4.—This field of Highland Kafir is entirely too thin, yet it yielded 8 bushels per acre in 1938. Average spacing was a plant every 60 inches in 42-inch rows.

the seeds on the surface of the ground, where they can be counted. Seed having a laboratory germination of 90 percent or higher, planted at the recommended dates and treated, will produce about half as many plants as there are viable seeds. Thus, twice as many viable seeds should be planted in a given distance as plants desired. Seed germinating less than about 80 percent should not be planted in Colorado with the expectation of satisfactory stands. Stands from untreated seed may be very uncertain.

Numerous experiments in the Great Plains show that sorghum seed which has a laboratory germination of 90 percent or better will not germinate more than from 55 to 60 percent under average field conditions, and that seed with a germination of about 70 percent will give a field germination of only about 2 to 7 percent.[3] This low field germination compared with that in the laboratory indicates the sensitiveness of the sorghums to cold soil and the great susceptibility of this type of seed to destruction by soil organisms.

Experiments with sorghums that tiller or sucker freely, seeded in rows in other sections of the Great Plains, indicate that the total yield per acre is affected very little by different spacings of the plants in the row up to 10 inches, and even up to 20 inches for milo. The coarseness may be increased and hence the quality of the forage lowered by thin stands.

The plant spacing in the row will depend on the use for which the crop is intended. If emphasis is on grain production, the plant spacing should be relatively wide, 3 to 12 inches. This will require from 2 to 3 pounds of seed per acre. If a fine-stemmed forage is de-

[3]Kans. Bul. 265, "Sorghum Production in Kansas."

Figure 5.—A few places in this field of Highland Kafir have an ideal stand. Here are shown six plants and eleven heads in 36 inches of row.

sired, spacing should be 1 to 3 inches. This will require from 6 to 10 pounds of seed per acre.

Considerable care should be exercised in seeding the grain sorghums on the different types of dry land soils.

The following spacings are desirable: (1) On row crop land, plant from 4 to 12 inches; (2) on small grain stubble, plant from 8 to 12 inches; and (3) on summer fallow, plant from 3 to 5 inches. These spacings can be closely approximated by treating highly viable seed and by seeding in good season on a well-prepared seedbed.

Drill-sown sorghums on the non-irrigated soils of eastern Colorado will require from 30 to 40 pounds per acre, depending on the size and viability of the seed and on the condition of the seedbed.[3] This type of seeding, however, is not generally recommended for the non-irrigated lands of Colorado. The minimum desired ground cover in the case of the sowed crop is that which will give adequate early shading to discourage weeds emerging later. For the small-seeded varieties free from hulls, the rates indicated for wheat will be about right when setting the drill for sorghums.

Sudan grass drilled for hay or pasture on the non-irrigated lands will require from 20 to 30 pounds of seed per acre. There are almost twice as many seeds in a pound of Sudan grass as in the sorghums. The seeding rate should be from about 40 to 50 pounds per acre on

Figure 6.—Selections of Sudan grass at the Colorado Experiment Station.

irrigated lands to prevent excessively coarse growth. The flax rates are about right for setting the drill for seeding Sudan grass.

Sudan grass seeded in rows in well-prepared soil for seed production will require from about 1 to 2 pounds of seed per acre to give a stand of from 3 to 4 inches between plants. If planted early in 20- to 22-inch rows for pasture, about 6 to 8 pounds of seed per acre will be required, because the soil then may be too cool for high germination. Some growers prefer narrow rows for pasture. In using the lister or the corn planter equipped with a furrow-opener, the seeds are placed in comparatively weed-free soil in the bottoms of shallow furrows, and the weeds often do not come up between the rows until a hard, beating rain compacts the soil. Often the Sudan grass plants are well emerged and growing before any considerable number of weeds appear. A vigorous harrowing after the plants have attained some size levels the soil and destroys many of the weeds. Some farmers plant Sudan grass in 42- to 44-inch rows for pasture and cultivate to control weeds. A thick stand in the rows is desirable for this purpose, which will require from 4 to 6 pounds per acre.

Treating the Seed

Seed of sorghums should be treated before planting in Colorado. This is important in successful production, as all efforts toward good seedbed preparation may be nullified by failure to secure a satisfactory stand and to prevent covered kernel smut (*Sphacelotheca sor-*

ghi.) This disease is prevalent in Colorado; and all varieties except Feterita, Hegari, and milo are very susceptible. At the Hays, Kans., Station, it has been found that dust treatments, particularly with Improved Ceresan or copper carbonate, improved field stands appreciably.[4] The frost-free period there is much longer than in eastern Colorado; hence, the soil is likely to be warmer at planting time. This treatment is not adequate to insure stands when planting is too early, but it may protect seed during periods unfavorable for germination.

This treatment consists of coating the seed with the dust by the same method employed in treating wheat. Formaldehyde treatment prevents kernel smut but does not protect the seed in the soil.

Cultivating

Cultivation should eliminate weeds and keep the soil surface receptive to rainfall. It should be as shallow as possible to accomplish the desired results. Deep cultivation destroys many roots and is often more damaging than beneficial.

When the crop has been planted in lister furrows, probably the most suitable cultivating implement is the lister cultivator, sometimes called a "curler". This is a combined disk and shovel implement. The first cultivation is to free the sides and the top of the ridges of weeds and is usually necessary by the time the rows become well defined. The disks of the implement are set to throw the soil away from the row. If a good job of cultivating has been done, the ridges will be left decidedly sharpened.

Sometimes the first cultivation can be delayed until the sorghum plants are of some size, especially if considerable effort has been spent on seedbed preparation. Then the spike-tooth, or spring-tooth, harrow may be used, or the lister cultivator with the disks set to throw the dirt toward the row and the shovels set to tear the crown of the ridge, with the fenders in place to prevent covering the plants. Just as much earth is allowed to roll under the fenders and about the plants as they can withstand, meanwhile covering the small weeds in the row.

Harrows are often used after the first outward cultivation, if weeds are not troublesome along the sides of the ridges and in the row. This flattens the tops of the ridges and makes it easier for teams or tractors to operate in the later leveling cultivations. This operation may be necessary regardless of weeds, if tractors are to be used. The wheels require a flat-topped ridge for traction. A final

[4] Jour. Amer. Soc. Agron., vol. 28, no. 12, Dec. 1936.

leveling cultivation often is desirable, even if weeds do not force it, in order to have the field in suitable condition for harvest.

Surface-planted sorghums are cultivated the same as other surface-planted row crops. When the planter equipped with furrow openers has been used, it is possible to roll, not throw, considerable dirt down about the plants in an early cultivation without covering them.

Harvesting

If the crop is to be bound and shocked, row-planted grain sorghums are ready to harvest when the seeds are fully colored. If the crop is hand-headed, the grain should be well hardened. If the crop is harvested with a combine, the grain must be hard and dry. Grain is not likely to keep in storage if it contains more than 14 percent moisture.[5]

In Colorado the grain crop is usually bound and shocked to save the forage, or stover, for livestock. The heads are best removed from the bound grain, after it has dried in the shock, by means of the "cheese" knife attached to the side of the barge.[5]

With hand-fed threshers, the bundles may be inserted, withdrawn, and turned, and reinserted until the grain has been removed and the remaining stover thrown to one side for feed. With self-fed threshers, the whole bundle may be run through if the stalks are dry and not too coarse.

Often the heads are removed from the standing stalks in the field, placed in small piles, and later ricked for final drying. There is also a special knife for this purpose.[5] Some use the header for the straight-shanked grain sorghums and follow the same procedure in drying the grain. A carrying basket attached to the header might well drop the heads in small piles for greater ease in handling. Winter pasturing of row-crop forage encourages soil blowing and should be discouraged.

In Colorado the heads may be placed directly into ricks, if the field heading is not done until after a hard freeze. They can usually be placed in ricks after a week of drying, if the header has been used. It is not advisable to leave the grain in the field any longer than is necessary to drive out the excess moisture, because of the danger of rabbit and bird damage. Ricked heads should be watched during the early drying period and turned, if necessary, to prevent spoilage.

[5]U. S. D. A. F. B. 1764, "Growing and Feeding Grain Sorghums," by J. H. Martin, J. S. Cole, and A. T. Semple.

The ordinary varieties of grain sorghum will not stand in the field until the grain is dry enough to keep in the bin. Where one expects to combine the crop the special combine-type varieties should be planted.

The row-planted forage sorghums are usually harvested with the row binder and cured in shocks in the field. Sorghums should be harvested for forage when the seed is in the soft dough stage, according to the Kansas Agricultural Experiment Station,[3] where studies of this problem were made. Tests there showed that the sugar content increases up to the soft dough stage, then remains constant for a time. The fibre content, on the other hand, increased rapidly after that stage of development. Sorghums harvested much earlier than the soft dough stage resulted in a feed too laxative and washy; harvested much later, they resulted in a feed too fibrous and harsh, causing much waste in feeding.

Figure 7.—A field of shocked forage sorghum.

Sorghums shrink in curing, and improperly set shocks will twist and sometimes fall, or at least expose the entire top to the weather. Wide spacing at the base aids aeration and gives the shock a firm base on which to settle and shrink. Fine-stemmed crops of row-planted forage sorghum may be harvested with grain headers and cured in windrows or in small piles.

Forage sorghums intended for the silo should be left until the grain is mature. They then make excellent silage of high feeding value. It is very important to avoid ensiling immature or green sorghum alone, but some such immature kind may be mixed with corn or with other mature sorghum. Lacking these, immature sorghum should be harvested and cured for hay. Many of the troubles with sorghum silage have been traced to the use of an immature crop.

Drilled Sudan grass may be mowed with a mower or harvested with a grain binder. Where a side-delivery rake is available, the former method is to be preferred. There is danger of molding when the binder is used to tie the green crop in bundles.

Harvesting methods are treated more fully in U. S. D. A. Farmers' Bulletin 1764, "Growing and Feeding Grain Sorghums."

Storing

Forage sorghums may be stored in stacks or large ricks, or in the barn, if proper precautions are observed. Stacking or storing should not be attempted until midwinter, after the forage has thoroughly cured in the shock. It should be allowed to dry after a rain or snow. Care must be observed in stacking to keep the middle well packed and above the level maintained around the outside. After the stack or rick has been finished, it should be covered with some finer material, such as straw or Sudan grass hay, and weighted down until it has become well anchored by weathering.

An ideal way to store fully matured forage sorghum is in the trench or other types of silos. Preferably the silage should be made in the fall when the plant contains considerable natural moisture to further the fermentation process that results in silage. The field-cured crop may be placed in the silo in the spring, if the proper amount of water is added. Further information on making sorghum silage may be had by applying to the Colorado Agricultural Experiment Station at Fort Collins, Colo.

Sorghum grain cannot be safely stored in a bin until the moisture content is down to, or below, 14 percent. That is why a successful combine type must have a short, stiff stalk well enough anchored to the soil to stand in the field until the grain is dry or have a very open, loose head that will dry the grain very rapidly. In Colorado these combine types standing in the field usually will be dry enough for threshing by November. Headed or shocked grain sorghum in this state should be ready to bin by late November or December.

The Hays, Kans., Station has made a study of different types of aerated bins for storing grain sorghums with high moisture content. Problems with early fall storage of the grain sorghums should be taken up with them.

Uses

Grain sorghums are established on the market as a feed. For most types of animal fattening, the grain has from about 90 to 95

percent the value of no. 1 corn.* For some other types of feeding, it is equal to and even superior to corn. In the grain sorghum regions, the grain is depended upon for animal feeding, much as corn is in the Corn Belt. Where the grain sorghums are adapted, one should have no hestitancy in growing them.

Forage sorghums are used mainly as roughage for livestock maintenance and for milk production. For the latter purpose, they should be balanced by the addition of grain, protein, and minerals. Recent feeding experiments at the Colorado Experiment Station at Fort Collins indicate that sorghum forage may also have an important place in animal-fattening rations. The cereals, including corn and sorghums, and the stover and straw of these crops are all classified among feeds as carbohydrate. This part of the fattening ration is cheaply produced on the plains.

Forage sorghum can usually be fed safely when cut green as a midsummer or early fall forage, if thoroughly field cured. It is very dangerous if not properly cured and dry. If it is necessary to cut early fall forage from the sorghum field, observe carefully the curing and drying precautions.

The forage from the thin stands of sorghum, where the stalks are coarse, is better utilized as silage. If fed dry, its utilization, hence its feeding value, is enhanced by chopping or grinding.

Forage sorghum seed usually is not of enough value as a grain feed to warrant growing the crop for that purpose alone. Forage sorghums are not generally heavy seed producers. Amber sorghum grown on spring-plowed small-grain stubble at the Akron Station averaged only 560 pounds of seed per acre over the 6-year period from 1930 to 1935. This is equivalent to 11.2 bushels per acre. The seed of the free-shelling sorghums, such as Kansas Orange, is generally much inferior in feeding value to kafir and milo and to the white-seeded, dual-purpose sorghums. The Amber types of sorghum seed probably have even less feeding value than the free-shelling types, because of the high percentage of glumes.

It is not safe to pasture any of the sorghums, except possibly Sudan grass. Prussic acid, a deadly and quick-acting poison, is likely to be present in toxic quantities in any of the sorghum varieties either grain or forage. It is especially dangerous to pasture the second growth from harvested sorghum until after a hard, killing freeze, and not even then until after the killed plant has become thoroughly dried from field curing. Then it is probably safe as an early winter pasture.

*Laude, H. H., and Swanson, A. F., "Sorghum Production in Kansas," Kans. Exp. Sta. Bul. 265.

Rotations

The sorghums follow other crops in rotation readily, but care should be exercised in choosing a crop to follow them. Sorghums are very heavy users of soil moisture, because they continue to grow as long as moisture is available or until killed by frost. They have a deleterious effect on any subsequent crop seeded too soon after the sorghums are harvested. Table 3 shows how the yield of oats was depressed at the Akron Station by sorghums as compared with corn.

TABLE 3.—*Yield of oats following corn and sorghums at the Akron, Colo., Field Station, 1909-36.*

Previous crop	Acre yield of oats (28-year average)
	Bushels
Corn in 44-inch rows	19.8
Kafir in 44-inch rows	16.6
Sorghum in 44-inch rows, forage type	14.9

An occasional practice in the grain sorghum region is to fallow sorghum land before seeding another crop. Sorghum land in Colorado should generally be reserved for fallow or for some one of the late spring-seeded crops, such as proso, beans, corn, or sorghum.

Sorghum will follow sorghum and yield well, even better than where it follows a small-grain crop. It will follow corn, beans, and proso in about that order better than it will follow small grains. Small-grain stubble will nearly always produce a creditable yield of forage sorghum, but rarely will it produce a creditable yield of grain.

The sorghums respond sharply to the increased moisture available in fallow land.

Adaptation

Sorghums may be rated as early, mid-season, or late with respect to the time it takes them to mature. They are often referred to as requiring a certain number of days from planting to maturity. These are fairly safe indices of adaptation as they pertain to maturity within any one region, but they are unsafe for estimating the ability of a variety to mature elsewhere. Altitude and latitude may so influence summer weather that a sorghum may not mature before frost, even though the growing period is long enough to mature the particular variety elsewhere. Sorghums are very sensitive to temperature for both germination and growth; hence, the mean

summer temperature, as well as the frost-free period, should be considered when a sorghum variety is being evaluated for any new region. Sorghums also differ in their response to environment and may not grow satisfactorily under cool conditions in Colorado. Only a few varieties ordinarily will mature in Colorado, and of these some are better grain yielders than others. The safest plan for determining the best adapted variety, or varieties, of sorghums anywhere is to consult your nearest experiment station or your local county extension agent. This is especially true when the best yielding grain varieties are sought. In Colorado only the eastern portion of the Arkansas Valley is an established grain sorghum region. The rest of the state is in need of early varieties for safe maturity. These are now becoming available, and past failures with the grain sorghums because of non-maturity or low yield should not discourage the trial of these newer, earlier maturing varieties.

Where the growing season is short, as it is all over northeastern Colorado, the earliest varieties are necessary. The factors that will be used in this bulletin for determining adaptation of the sorghums are as follows:

For the forage types: (1) Earliness; (2) yielding ability; (3) leafy, juicy, sweet stalks; and (4) seed that will thresh free from the chaff.

For the grain types: (1) Earliness; (2) yielding ability; (3) palatability of grain and stover; and (4) ability of grain to thresh free from the glumes.

Varietal Tests at Akron Station

Variety tests of forage and grain sorghums were started at the Akron Station in 1909. These plantings up to 1924 were mainly on fallowed land. Different workers connected with the Forage, the Cereal, and the Alkali and Drought Resistant Plant Investigation Divisions of the U. S. Department of Agriculture had supervision over these field experiments. From about 1915 to 1924, the comparative testing of the forage sorghums was carried on continuously. This was the basis for the forage sorghum variety recommendations from the Akron Station and the Colorado Agricultural Experiment Station for a number of years. Grain sorghum variety testing was not carried on with the same regularity during this period, because only a few would mature with any great degree of certainty.

Since 1925 the sorghum variety test has been planted both on fallowed and on either small grain or drilled Sudan grass stubble land. The stubble was oats and barley cut for hay from 1925 to 1930

and Sudan grass from 1931 to 1937. The variety recommendations in this bulletin are based on the experiments from 1925 to 1937.*

The land for the fallow was plowed with a moldboard plow as the initial working in 1924 and again in 1934. In the interim, the first spring working was with the duckfoot cultivator. These workings were uniform for an entire plot series. Exclusive of this initial working, it has required an average of 2.7 cultivations per year during this 12-year period to keep this land free from weeds as is required in good fallow. Some years the first spring working was timed to correct a soil blowing condition rather than for weed elimination. This land was always a vulnerable spot for the starting of soil blowing, because both the fallow and the closely harvested sorghum stubble were sparsely covered with vegetation over an area 377 feet wide by slightly more than a quarter of a mile long. Blowing nearly always developed first in the sorghum stubble, probably because the soil surface was pulverized from harvesting and hauling the crop. The adjacent roads also were dusty and more or less troublesome. Duckfoot cultivation upended the sorghum roots, lifted clods to the surface, and corrected any blow condition that developed. Rarely was it necessary to duckfoot a second time. Duckfoot cultivation also corrected any blow condition that developed on the fallowed land.

Comparative Forage Sorghum Yields in 13-Year Period 1925-37

The yields of the different varieties of forage sorghum on fallow and stubble land and the average of both compared with one standard variety are shown in table 4 and appendix tables 3, 4, and 5. These yields are based on field dry weights obtained usually in late October or early November, about 50 days after harvest. Since the late maturing varieties such as Kansas Orange, Sourless, and African Millet were usually only beginning to head when frosted and harvested, they contained more moisture than the earlier varieties when weighed. The yields of these late varieties are probably much higher than they would be had the weights been secured on a comparable moisture basis.

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*Department workers identified with the early experiments, Division of Cereal Crops and Diseases: Wilson G. Shelley, 1908 to 1910; Clyde McKee, 1911 to 1912; George A. McMurdo, 1913 to 1916; F. A. Coffman, 1917 to 1924. Division of Forage Crops and Diseases: G. E. Thompson, 1910 to 1911; George W. Morgan, 1912. Alkali and Drought Investigations: A. C. Dillman, 1913 to 1920. Superintendents of the Akron Station: J. E. Payne, 1909 to 1910; O. J. Grace, 1910 to 1920; J. F. Brandon, 1920 to date. D. W. Robertson has represented the Colorado Agricultural Experiment Station since 1922. The recent sorghum experiments have been conducted by the writers.

TABLE 4.—*Percentage forage yield ratings of the principal forage sorghums on stubble and on fallow land for varying periods from 1925-37, inclusive.**

Variety	Percentage yield rating		No. years in test
	On stubble land	On fallow land	
Kansas Orange, F. C. 9108	115.6	121.5	10
Sourless, F. C. 9074	111.0	121.3	5
African Millet, F. C. 9111	99.5	102.4	5
Atlas, C. I. 899	84.8	117.1	2
Early Sumac, F. C. 6611	77.0	93.4	12
Leoti Red, F. C. 3417	100.0	100.0	13
Black Amber, F. C. 7038	93.7	101.2	13
Fremont	85.9	91.6	12
Carson	85.4	87.7	4
Larson's Orange, local	105.6	89.6	3
Waechter's Orange, local	91.6	88.0	7
Minnesota Amber	82.7	78.6	13
Red Amber, 269	77.0	74.9	13
Dakota Amber, F. C. 1614	70.9	71.6	11
Sudan Grass	40.9	48.9	11

*Percentage based on number of years grown with Leoti Red.

Growers generally prefer a forage variety that will produce a maximum tonnage of good feed and mature regularly enough to enable them to maintain a seed supply. Feeding experiments show that the farmer is justified in growing a variety that regularly reaches at least the hard-dough stage of maturity.

Kansas Orange, Sourless, and African Millet can be considered as unadapted to the bulk of the sorghum-growing area of Colorado, despite their high yield, because they will not mature on the best soil preparations. Atlas, a dual-purpose, white-seeded sorghum that threshes free of the glumes also shows good comparative forage yields, but it will not mature grain with any more certainty than Kansas Orange. Its immaturity may be objectionable even for forage elsewhere in the state.

Leoti Red, Black Amber F. C. I. 7038, and Fremont have given good yields on the stubble land (table 4). They also respond well to the fallow preparation. These varieties will mature regularly at altitudes of less than 5,000 feet in the northeast and may possibly mature at slightly higher elevations in the southeast. They are all appreciably earlier than Early Sumac, which is adapted only to a narrow region in the southeast. Dakota Amber, Minnesota Amber, and Red Amber 269 were not only outyielded by the above-named three high-yielding varieties, but they do not respond as well to fallow nor to good seasons. These varieties, if grown at all, should be confined to the higher altitude sections of the plains of eastern Colorado. As a general rule, the later maturing the variety that may be grown suc-

cessfully, the more juicy and leafy the forage will be. It is generally advisable to grow the latest varieties that will mature safely.

Red Amber sorghum drilled at the same time outyielded Sudan grass similarly seeded. Sudan grass planted in rows, however, outyielded drilled Red Amber by about 20 percent. Drill seeding of the forage sorghums is not recommended for either hard or sandy lands, except for reasons other than high acre yields. If a fine-stemmed, hay-like forage is sought, this can be secured almost at will by thick seeding in regular cultivated rows.

Sudan grass seeded in rows at the same time and harvested mature produced about half the tonnage of the better yielding forage sorts (appendix table 5). There is, then, no justification for growing Sudan grass for the purpose of harvesting for mature feed. It has no especial feeding quality other than its fine-stemmed nature, and this can be realized quite successfully in the forage sorghums by thick seeding in the row.

The total production of Improved Coes is about one-half that of the recommended sorghum varieties. Highland produced only about 25 percent more fodder than Improved Coes. It is thus not advisable to plant these grain varieties for forage production. The stover of the two grain varieties is palatable.

Field corn in this experiment produced one-fifth less stover than Improved Coes and a little more than one-fourth of the total production of the better forage sorghums. Popcorn produced 18 percent more stover than the field corn and about the same as Coes sorghum.

Figure 8.—A uniform field of Improved Coes.

TABLE 5.—*Total yields of some forage sorghum varieties on stubble and fallow land compared. U. S. Dry-Land Field Station, Akron, Colo., 1925-37.*

Variety	Pounds per acre			
	Stubble land 1925-1930	Fallow land 1925-1930	Stubble land 1931-1937	Fallow land 1931-1937
Leoti Red, F. C. 3417	5665	6490	2797	5685
Black Amber, F. C. 7038	5101	6435	2684	6003
Red Amber, 269	4428	5280	1927	4067
Minnesota Amber	4249	5019	2423	4790
Av. of the 4 varieties	4861	5806	2458	5136
Percent of fallow	83.7		49.7	

Forage sorghums respond well to fallow and to good seedbed preparation. The increase in yield from fallow over stubble land during the 13-year period was almost one-third (table 5). However, when the stubble land was badly depleted of moisture before planting, as it was from 1930 to 1936, the yield from fallow was double that on Sudan grass stubble. Besides increasing the yield, fallow adds to the certainty of production each year. The lowest yield of Leoti Red on fallow during the 12 years was 2,415 pounds per acre in 1925 (appendix table 4). Stubble land produced only 248 pounds of stunted, immature forage of that variety per acre (appendix table 3). Forage sorghums are among the best adapted crops for the Colorado Plains and usually produce well on the poorest soil preparation.

Figure 9.—Sorghum variety test at the Akron Field Station: Highland on the left, Improved Coes on the right.

Leoti Red had only two successive yields of less than 1,000 pounds per acre on the stubble land in the 13-year period (appendix table 3). The careful farmer should be able to maintain a supply of this feed by stacking or otherwise preserving the excess of one season to fortify against the possible low production of the next. The trench silo is an excellent place for storing this and similar forages.

Comparative Yields of the Grain Sorghums

The grain yields of the different varieties of sorghums on combined fallow and stubble and the average of both in comparison with one standard variety are shown in table 6 and appendix tables 6, 7, and 8. Fifty grain, dual-purpose, and combine-type sorghums have been tested for yield during the 13-year period from 1925 to 1937. In the early years there was a dearth of varieties early enough to mature. As early varieties became available, they were included; and later-maturing, unadapted ones were dropped. By 1930 an appreciable list of early and near-early varieties was available for yield tests during the following 8 years.

Sorghums are able to resist drought by reason of their ability to suspend growth during periods of deficient soil moisture. For this reason, sorghums on fallow tend to mature earlier because their growth is not interrupted by lack of moisture. This is very important

Figure 10.—Comparative yield of corn, Improved Coes, and Highland Kafir at Akron for a 9-year period, 1929-37, inclusive. Corn, 10.6 bushels; Improved Coes, 16.9 bushels; Highland Kafir, 19.1 bushels.

in Colorado, where the growing season is short and most of the grain sorghums are grown on stubble or row-crop land. Grain sorghum variety recommendations from this study will be based largely on the yields from stubble land (table 6 and appendix table 6). To yield on this preparation, a variety must not only be drought resistant but early enough to mature even when held back in its development by one or more dry periods. The fallow yields will be consulted to determine whether the varieties have sufficient yielding capacity to take full advantage of an occasional season of heavy rainfall or to yield well on fallow or other good soil preparation. The varieties still in the experiment in 1937 had survived through their ability to meet continued adverse conditions.

TABLE 6.—*Percentage grain yield ratings of the principal grain sorghum varieties on stubble and on fallow land for varying periods from 1925-37, inclusive.*

Variety	Percentage yield rating		No. years compared
	On stubble land	On fallow land	
Early dual-purpose varieties			
Highland Kafir	149.4	155.9	10
Improved Coes	135.9	145.9	12
Dwarf Freed	126.9	140.6	12
Coes	112.8	122.6	12
Cheyenne	108.6	114.6	6
Freed	100.0	100.0	13
Dwarf Hegari	67.4	95.2	10
Early grain varieties			
Tribune 14	154.5	155.2	4
Extra Early Pink Selection	123.9	145.4	6
Early White Milo	106.6	113.0	12
Early combine varieties			
Pygmy	114.5	100.7	5
Sooner	103.3	113.7	9
Day	100.0	97.3	5
Colby	84.9	119.7	4
Mid-season dual-purpose varieties			
Greeley	132.2	132.6	7
Modoc	108.1	144.2	10
Mid-season grain varieties			
Kalo	143.1	176.0	8
Early Kalo	69.9	102.7	4
Very late combine variety			
Wheatland	27.1	63.7	9
Very late dual-purpose varieties			
Grohoma	3.4	32.6	7
Atlas	0	0	2

Highland, a white-seeded, dual-purpose variety that threshes free from the hulls, has given the highest yields on stubble land, with a percentage of 149 in comparison with Freed as 100. This variety yielded 57.2 bushels per acre on stubble land in the favorable season of 1930. Improved Coes is next with a rating of 136, followed by Dwarf Freed. Improved Coes produces the same type of desirable stover and a white palatable grain that threshes free from the glumes, hence must be considered superior to Dwarf Freed. Improved Coes has yielded practically the same as Highland since 1931 but was outyielded by that variety in 1930, when it produced only 42 bushels per acre on the stubble land, its best yield over the period (appendix tables 6 and 7). Improved Coes, released in 1936, yielded 23.1 percent higher on the stubble land preparation than the original Coes. Improved Coes also produced more uniform field stands. It carries apical hairs, called awns, on the outer glumes. Tribune no. 14 was dropped because the stalks did not stand until the grain was ripe. Its grain yield, however, is the highest among all the varieties tested. Greeley is a little late on the plains and must be considered as a midseason type. Its yield rating on stubble land is very near that of Improved Coes, but it does not show a similar response to fallow preparation. The grain does not thresh free from the hull. Cheyenne, sometimes locally called Sweetstalk kafir, ranked fifth among the varieties. It produces about the same type of stover as Highland, but the grain does not thresh free from the hulls.

Dwarf Hegari showed very poor adaptation to Akron conditions, although it is nearly early enough to mature. Its grain yield is exceeded by the Highland and Improved Coes. Early Kalo is too late for Colorado conditions at altitudes in excess of 4,000 feet in the northeast. It will not stand in the field until the grain is dry enough to combine harvest.[6] Grohoma is too late for Colorado conditions.

The milos which will mature in the northeast are Pygmy, Sooner, Day, and Colby, all reasonably close together in yielding ability but considerably below Highland. Custer is too late for Colorado. Pygmy, Day, and Colby are extremely short, stocky, straight-shanked milo types that lend themselves excellently to combine harvesting. Sooner is reasonably erect and a combine type, but in Colorado it usually lodges before the grain is dry enough to harvest. Early White Milo, a gooseneck type, is a little uncertain in maturity and is not superior in yield.

Kalo and Modoc probably are the most productive of the midseason types but are too late to mature regularly at Akron.

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[6]Swanson, A. F., "Weak Neck" in Sorghums, Jour. Amer. Soc. Agron., 30: 720-724, 1938.

Wheatland, the popular combine type of milo in certain sections of the grain sorghum belt, is entirely too late for Colorado. It usually just comes into head before frost at the Akron Station. Atlas is very late and has failed to mature grain on either fallow or stubble land with any regularity.

Field corn in this experiment (appendix table 8) yielded about the same quantity of grain as Freed on the two soil preparations and decidedly below Highland. It produced less grain than Pygmy, Sooner, Day, and Colby, which varieties might be used profitably to displace some of the corn acreage until seed of better adapted dual-purpose varieties becomes available.

Highland and Improved Coes produced 19.1 and 16.9 bushels of grain per acre on the two soil preparations in a directly comparable 9-year period. Field corn in this same comparison and in the same experiment produced only 9.9 bushels per acre (appendix table 10) (1929-1937).

In considering these recommendations, it must be borne in mind that the Akron Station has long-time weather records from which it can be shown that the past 7 to 10 years covered by the experiments have been very favorable for maturing grain sorghums. Many varieties not recommended as early enough have been matured by growers in northeastern Colorado during this period.

Highland and Improved Coes are free-shelling, white-seeded, straight-shanked varieties producing a very palatable stover and are well-adapted all over the sorghum-growing sections of Colorado. Improved Coes is slightly earlier, hence can be grown at slightly higher elevations. They show good adaptation to Colorado conditions, and have a yielding capacity sufficient to take full advantage of any better soil, or better soil preparaton, or of seasons of greater than average rainfall. While the season in the southeast may appear longer than necessary for these varieties, slightly delayed planting there adds time which might be used profitably for preparing a better seedbed.

Improved Coes probably will not stand in the field until the grain is dry enough to combine, although it does not go down immediately after ripening, as do Kalo and Early Kalo. Highland has a more sturdy stalk, the stem being larger at the base, but it will not stand in the field after the grain is dry enough to permit combine harvesting. The stover of either of these two recommended dual-purpose sorts, however, is well worth harvesting.

The stover yields of the grain and dual-purpose sorghums on the two soil preparations are shown in table 7 and appendix tables 9 and 10. The palatability of the stover of the grain-producing types

TABLE 7.—*Stover yields of grain sorghum varieties on stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1927 to 1937.*

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Percentage of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grain varieties																
Tribune 14	973	.....	.....	.....	5707	753	2189	2018	..	.....	.....	.....	2567	2727	94.3	4
Kalo	902	.....	.....	2145	6391	1406	1910	1855	0	.....	2335	1108	2143	1853	115.7	8
Extra Early Pink Selection	.....	.....	.....	783	4354	1320	1936	2161	..	.....	.....	931	1914	2190	87.4	6
Modoc, HC 2520	905	.....	2558	3177	6677	841	2739	2405	0	3713	2310	1347	2577	2095	123.0	10
Early White Milo, FC 5886	480	3820	.....	908	6072	427	1347	2090	0	3366	1634	1126	2079	2046	101.6	10
Dwarf Freed x Dwarf Feterita (971x867-2-1)	.....	.....	.....	.....	.....	.....	.....	.....	..	330	842	755	642	1991	32.2	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	.....	.....	.....	.....	.....	.....	1756	0	2530	1139	1180	1321	1602	82.5	5
Tribune 36	974	.....	.....	.....	4048	1001	2420	2590	0	.....	.....	.....	2012	2261	89.0	5
Feterita x Milo-Kafir, HC 301	965	.....	.....	.....	6275	680	1166	1342	0	.....	.....	.....	1893	2261	83.7	5
Hybrid Dwarf Feterita	867	.....	1815	957	2891	313	555	1089	0	.....	.....	.....	1089	2139	50.9	7
Dwarf Freed x Dwarf Feterita (971x867-1-4)	.....	.....	.....	.....	.....	.....	.....	.....	..	1023	825	536	795	1991	39.9	3
Manchu Brown Kaoliang	328	2112	1321	1848	836	214	891	986	0	1298	875	663	1004	2115	47.5	11
Feterita	182-1	.....	1403	1849	4009	570	1001	1674	0	2833	826	719	1488	2095	71.0	10
Early Kalo	1009	.....	.....	.....	.....	.....	.....	.....	0	3069	1931	704	1426	1493	95.5	4
Freed x Kafir (71-20-23-F5)	.....	2995	.....	.....	1870	691	2277	2101	..	.....	.....	.....	1987	2724	72.9	5
Milo x Hegari, HC 382	.....	.....	2228	4010	9823	1056	1595	2354	0	.....	.....	.....	3009	2139	140.7	7
Club Kafir	901	.....	.....	2253	6033	991	1650	1558	0	.....	.....	.....	2081	2028	102.6	6
Dwarf Yellow Milo	332	4868	1733	1898	7370	852	962	1584	0	3344	2228	1110	2359	2115	111.5	11
Sunrise Kafir	472	.....	.....	3597	9399	880	2057	.....	..	.....	.....	.....	3983	2534	157.2	4
Early Dwarf Milo (480-332-7-7)	.....	.....	.....	.....	1397	361	896	1386	..	.....	.....	.....	1010	2827	35.7	4
Early Dawn Kafir, HC 2421	904	6188	2393	2508	8613	649	2002	2068	0	5000	2228	1210	2987	2115	141.2	11
Early Pink Kafir, FC 9089	432	1238	.....	2847	8970	1204	1415	2172	0	5082	1898	1073	2590	2046	126.6	10

TABLE 7.—(*Continued.*)

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Kafirita	812	3383	1898	3053	.....	.....	.....	.....	..	.....	.....	.....	2778	1994	139.3	3
Weskan, FC 9126	.....	5445	.....	.....	.....	.....	.....	.....	..	.....	.....	.....	5445	2315	235.2	1
Chiltex	874	2805	825	.....	.....	.....	.....	.....	..	.....	.....	.....	1815	2560	70.9	2
Pink Freed, FC 9124	.....	1403	.....	.....	.....	.....	.....	.....	..	.....	.....	.....	1403	2315	60.6	1
Grohoma	920	.....	.....	.....	.....	660	1712	1760	0	4703	1320	1485	1663	1486	111.9	7
Ajax, FC 6620	968	.....	.....	.....	.....	440	.....	.....	..	.....	.....	.....	440	940	46.8	1
Premo	872	2703	1898	.....	.....	.....	.....	.....	..	.....	.....	.....	2301	2560	89.9	2
Dual purpose varieties																
Highland Kafir	.....	.....	.....	2212	6149	852	2310	1958	0	2723	1320	914	2049	2016	101.6	9
Improved Coes	.....	1799	1584	1378	3602	869	1833	2079	0	1766	1518	827	1569	2115	74.2	11
Greeley	972	.....	.....	.....	.....	1859	2244	2354	0	3135	2195	1105	1842	1486	124.0	7
Dwarf Freed, HC 2521	971	4208	2005	1683	6015	665	1591	1833	0	2871	1543	488	2082	2115	98.4	11
Coes	.....	3283	1584	1176	3800	713	1991	1683	0	2706	1304	844	1735	2115	82.0	11
Cheyenne	.....	.....	.....	.....	.....	.....	2002	1998	0	3036	1733	1023	1632	1577	103.5	6
Freed, FC 9033	350	2315	2805	862	6880	940	1452	2035	0	3317	1684	972	2115	2115	100.0	11
Kafir Selection 10	.....	.....	.....	1197	4185	698	1844	.....	..	.....	.....	.....	1981	2534	78.2	4
Dwarf Hegari	620	.....	2063	2574	7150	242	1463	2101	0	3779	1320	965	2166	2095	103.4	10
Otis Kafir	.....	924	1791	825	3063	346	.....	.....	..	.....	.....	.....	1390	2760	50.4	5
Combine varieties																
Yellow Highland Selection	.....	.....	.....	.....	.....	.....	.....	.....	..	.....	.....	908	908	972	93.4	1
Pygmy Milo	1010	.....	.....	.....	.....	.....	.....	1146	0	1568	933	537	837	1602	52.2	5
Sooner Milo	917	.....	.....	2038	4026	275	951	1485	0	2541	1337	776	1492	2016	74.0	9
Custer Milo	919	.....	.....	.....	7019	720	1160	1364	0	.....	.....	.....	1651	2261	73.0	5
Day Milo	959	.....	.....	.....	.....	.....	.....	1089	0	2327	1007	833	1051	1602	65.6	5
Colby 19	.....	.....	.....	.....	.....	.....	.....	.....	0	2096	891	702	922	1493	61.8	4
Colby 32	.....	.....	.....	.....	.....	.....	.....	.....	0	1782	971	922	920	1493	61.6	4
Colby (Colby 31)	.....	.....	.....	.....	.....	.....	.....	.....	0	1832	1131	856	955	1493	64.0	4
Colby 29	.....	.....	.....	.....	.....	.....	.....	.....	0	1766	949	878	898	1493	60.1	4
Colby 10	.....	.....	.....	.....	.....	.....	.....	.....	0	2228	.....	.....	1114	1659	67.1	2
Wheatland	918	2970	.....	1815	.....	.....	854	1402	0	2558	1568	825	1499	1580	94.9	8
Double Dwarf Yellow Milo	868	2063	.....	.....	.....	.....	.....	.....	..	.....	.....	.....	2063	2315	89.1	1

varies widely. Kafir stover is valued highly in the grain sorghum belt, while milo stover usually is not harvested. The dual-purpose varieties recommended are Highland and Improved Coes. They approach the kafirs in the quality of their stover, being very fine-stemmed, as well as leafy and juicy. Sooner stover is probably no better than other milos. Kalo and Early Kalo, other yellow-seeded sorts, are more leafy than Sooner, and the stover may be better; but the stalk is dry, resembling milo in this respect. The true combine types such as Pygmy, Day, and Colby are very short and produce relatively little stover which probably approaches milo in palatability.

Since a grain type should be grown primarily for grain, the stover tonnage and its palatability are of relatively little importance in most places. However, in Colorado where the very earliest varieties may occasionally fail to mature, a stalk also suitable for forage may be of considerable importance in some years. While the dual-purpose sorts recommended will produce only about one-half as much total feed as the better adapted forage sorghums, they still produce nearly double the stover yield of corn, at present a rather extensively used winter roughage of the region (appendix table 10).

Highland and Improved Coes produced 2,498 and 1,874 pounds, respectively, of stover per acre on the two soil preparations in a 9-year period. Field corn in the same comparison and experiment produced only 1,303 pounds of stover.

Broomcorn

A broomcorn test involving three varieties has been carried on at the Akron Station since 1930. The results are shown in table 8. Only on fallowed land has any variety produced an average yield approaching that obtained where broomcorn is grown as a commercial crop. There were two failures, even on fallow, in the 8-year period. The yield of the best variety on stubble land for the same period was only 196 pounds of brush per acre, or 58 percent of that on fallow. The experiments at Akron have shown that, besides being unreliable, the quality of the brush has generally been rather poor.

Broomcorn is not adapted to the hard lands of eastern Colorado. The demand for brush is limited, and the buyers usually are very discriminating regarding quality. Consequently, the extension of broomcorn much beyond the present producing area in Colorado probably is not justified. (For information on broomcorn varieties and culture, see U. S. D. A. Technical Bulletin No. 51 and Farmers' Bulletin 1631.)

TABLE 8.—*Broomcorn brush yields on fallow and stubble land, presented separately, U. S. Dry-Land Field Station, Akron, Colo., 1930-37.*

Variety	Pounds brush per acre								Aver. var. named	Black Spanish same year	Percentage of Black Spanish	No. of years grown
	1930	1931	1932	1933	1934	1935	1936	1937				
						On fallow land						
Black Spanish	1010	390	0	119	0	383	469	330	338	338	100.0	8
Scarborough	1043	324	0	145	0	198	152	231	262	338	77.5	8
Dwarf Evergreen	812	211	0	304	0	291	185	198	250	338	74.0	8
						On stubble land						
Black Spanish	924	68	0	79	0	469	0	26	196	196	100.0	8
Scarborough	957	99	0	92	0	357	0	0	188	196	95.9	8
Dwarf Everegreen	924	7	0	165	0	442	0	0	192	196	98.0	8

Figure 11.—Leoti Sorgo.

Description of Varieties

Leoti Red produces a semi-compact reddish head which droops slightly at the tip when ripe. The light-brown seeds usually remain enclosed in the yellowish-red glumes, which fade at the tips to a straw color, giving the ripe head a characteristic appearance. The glumes are awned. The awns are more or less deciduous. The average height of the stalks at Akron is about 52 inches. It matures at about the average fall frost date when planted about June 1 to 6 and produces a juicy, sweet, leafy stalk.

Black Amber, F.C.I. 7038, produces a medium-long, side-lobed, jet-black head. The light-brown seeds are only slightly exposed in the awned glumes after threshing. It is taller than Leoti Red, averaging 60 inches, and ripens about 4 days earlier. It produces a juicy, sweet, leafy stalk.

Fremont has a small, dark brown, compact, cylindrical head. The brown seeds thresh free from the dark-brown, awnless glumes which cover only the lower two-fifths of the seeds. It is slightly taller than Leoti, averaging about 54 inches. It matures in about the same time as Black Amber and about 3 to 4 days earlier than Leoti. It produces a juicy, sweet, leafy stalk. This variety was selected at the Akron Station from some local Orange sorgo purchased from

Bert Elrod as feed in 1923.

Highland is a white-seeded, dual-purpose variety originated at the Akron Station from a single head selected from Dawn Kafir in 1920. It produces a rather large open head on an erect shank. The seeds thresh free from the reddish-brown glumes, which are awnless and which cover about two-fifths of the lower part of the seed. The seeds are white, with small reddish-brown spots scattered sparingly over the seed coat. The grain will mature at Akron safely ahead of average fall frosts, when planted before June 10. It has an average height of 36 inches. The rather fine stalks are sturdy at the base, enabling them to stand in the field satisfactorily. Highland produces a juicy, leafy, fine-stemmed stalk. The leaves are relatively narrow.

Improved Coes is a white-seeded, dual-purpose strain originated at the Akron Station as a selection from Modoc 241 in 1926. It produces a long, semi-compact, cylindrical head on an erect shank. The heads have in some cases attained a length of 17 inches at the Akron Station. The average length under ordinary growing conditions is about 12 inches. The seeds are completely enclosed in awned glumes, from which they thresh readily. The seeds are white, with occasionally a very small red spot. The glumes of this variety are usually straw-col-

Figure 12.—Black Amber.

Figure 13.—Highland.

ored, varying in some seasons to red. The development of the red color appears to be influenced by environment. The grain matures slightly earlier than Highland. It is slightly taller, averaging about 39 inches. It produces a juicy, slightly sweet, leafy, very fine-stemmed stalk. Improved Coes will not stand in the field as long as Highland, but it does not go down immediately after ripening. The leaves, like those of Highland, are relatively narrow.

Greeley is a dual-purpose sort with a compact, cylindrical, straw-colored head on an erect shank. The white seeds do not thresh from the awnless, straw-colored glumes. The average height of the plant at Akron is about 46 inches. It matures in northeastern Colorado, producing a juicy, slightly sweet, medium-coarse stalk. The leaves are relatively narrow.

Cheyenne (Sweet Stalk Kafir) is a dual-purpose sort originated by Albert Weaver, at Bird City, Kans. The variety is not uniform in height and head type. The prevailing head type is short, semi-compact and straw-colored and is carried on a straight shank. The white seeds do not thresh entirely free from the closely adhering awnless, straw-colored glumes. The average height is about 45 inches at Akron. It produces a juicy, leafy, medium-coarse stalk. The leaves are relatively narrow. It

is not recommended for Akron conditions.

Kalo and Early Kalo are medium-early grain sorghums, having long, semi-compact, cylindrical heads on straight shanks. The yellow seeds are about the size of those of Kafir, and they thresh free from the awnless, short, brown glumes. The plants are relatively short, averaging about 30 inches. They produce a leafy, medium-sized, dry stalk which does not appear to be high in palatability. The crop lodges or falls soon after the seeds are fully mature. The leaves are narrow.

Hegari produces a compact, cylindrical, white head on a straight shank. The seeds are partly enclosed in dark, awned glumes and thresh free. The awns are shed at maturity. The chalky-white seeds are about the size of ordinary Kafir and blotched with reddish-brown spots. Hegari seeds have a brown undercoat. The average plant height at Akron is about 42 inches. It produces a leafy, juicy, slightly sweet stalk. The leaves are rather wide.

Sooner produces a rather compact, rounded head, typical of milo, borne usually on a somewhat leaning shank. The seeds develop in short, awned black glumes from which they thresh free. The average height at Akron is 28 inches. It produces a medium-wide leaf that tends to drop prior to full rip-

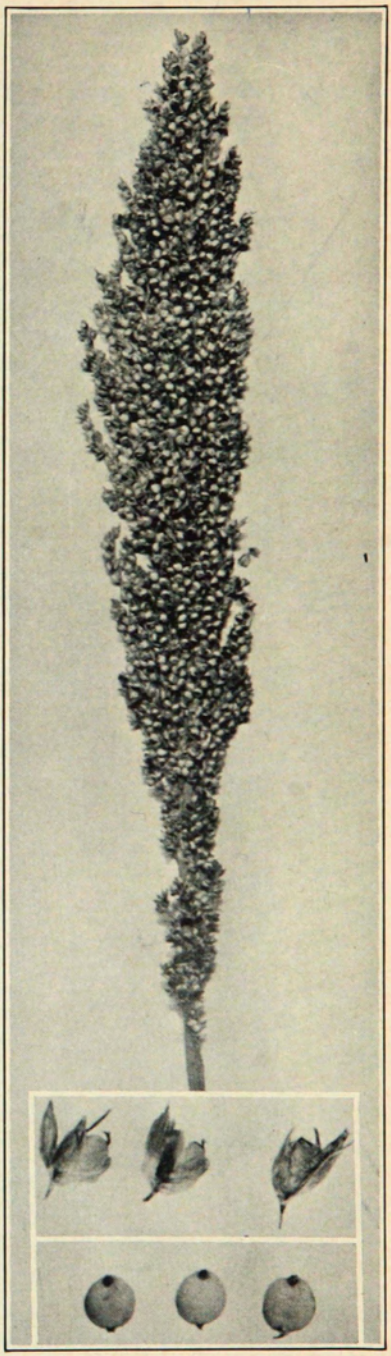

Figure 14.—Improved Coes.

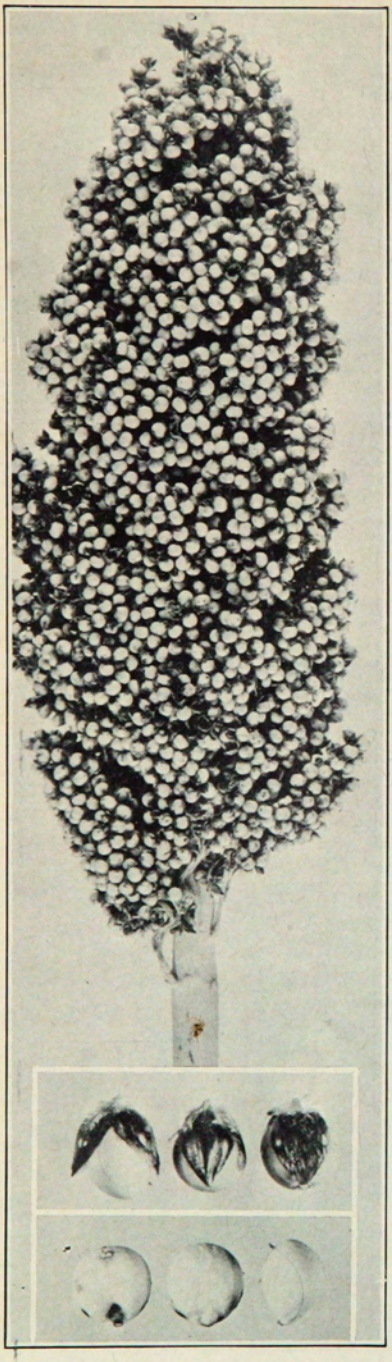

Figure 15.—Hegari.

ening. The stalk is slender and does not stand too well in the field, and it is dry and of relatively little feeding value.

Day, Pygmy, and Colby are even shorter in height, but the latter differs in head shape from the other two. They have erect or nearly erect heads and thresh free from the glumes. The seeds are yellow and approach those of milo in size and shape. They are extremely short; Pygmy, the shortest, averages 20 inches at Akron. They are leafy, but the stalk is dry and so short that little stover is obtained. They are strictly combine-type grain sorghums.

Sudan Grass for Hay

Sudan grass may be mowed repeatedly, in pre-heading stage, and the total yield will be as great, or greater, than when it is allowed to mature. In the 5-year period from 1933 to 1937, Sudan grass sowed on sorghum stubble land at the Akron Station and harvested before heading yielded 73 percent as much hay as that produced in rows and harvested mature on the fallowed land. It produced 44 percent more hay than the similarly seeded and harvested Sudan grass on the stubble land in the same experiment. This drill-seeded Sudan grass averaged two cuttings of immature green hay per year from 1931 to 1937. The average yield for this 7-year period was 1,722 pounds of hay per acre, and for the 4-year

period, 1933 to 1936, it was 1,807 pounds. The average protein content of this hay was well above 12 percent. To secure this high percentage of protein in the hay, it is necessary to harvest not later than the boot stage and to cure without too much bleaching. Such hay fed as a part of the forage to growing animals during the winter should aid materially in maintaining steady growth. It might also be fed as a part of the winter forage ration to fattening, bred, or milking animals to effect a saving in the protein supplements necessary to balance the ration.

Sudan Grass for Pasture

Sudan grass occupies an important place in Colorado plains agriculture as a reliable annual midsummer and fall pasture. There is evidence that even pure Sudan grass may contain prussic acid poison. It is difficult not to recommend such a valuable pasture as it has proved to be, yet caution must be exercised, even if pure seed is planted. The experience of users of Sudan grass for pasture is that it is relished by all classes of livestock, even pigs. When seeded as early as possible, June 1 to 5, at an altitude of about 4,600 feet at the Akron Station, pasture is available soon after the first of July. Earlier seedings did not produce earlier pasture, even when satisfactory stands were secured. Sudan

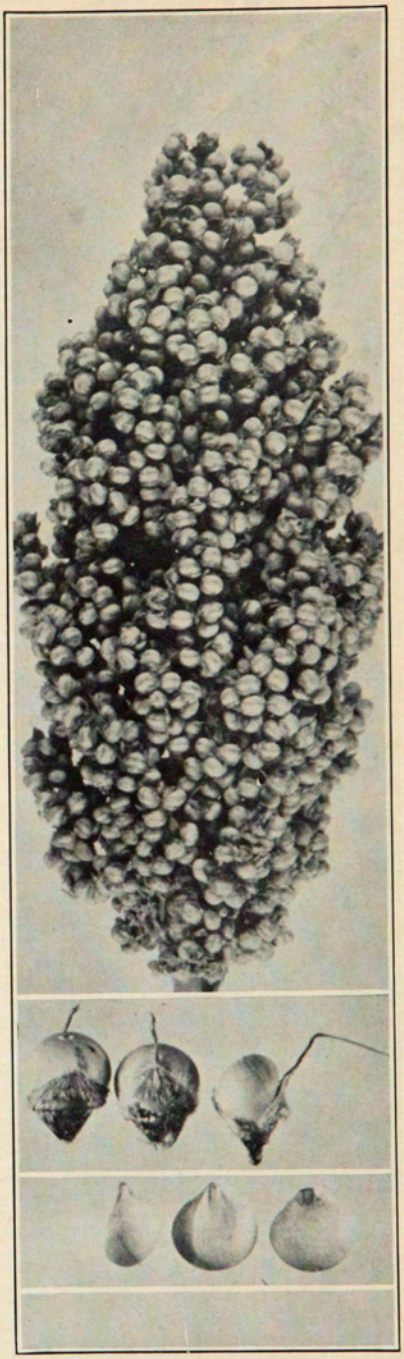

Figure 16.—Dwarf Milo type.

Figure 17.—Freed.

grass and the other sorghums will not make satisfactory growth until after the soil and weather have become warm.

Comparative Forage Yields

Many different kinds of crops make good hay, dry-cured forage or silage, when harvested at the proper stage. Table 9 shows comparative yields of several crops which are sometimes used for hay, forage, or silage purposes on the plains of eastern Colorado.

The sorghums merit their place as the leading forage crop of the plains. Foxtail millet yields well in comparative tests and easily occupies second place as a forage crop for this region. Proso does not produce as much hay as foxtail millet, hence it should be grown for grain production only. The small grains rank well above the remaining possible hay crops and may be sown for hay, or fields already sown may be mowed for midsummer forage.

Beans produce very low acre yields of hay. The ordinary Pinto beans will produce about 10 percent less forage than the Tepary beans reported in table 9. With Sudan grass already shown to yield about half as much as sorghum, and capable of being harvested when the protein content is about 12 percent, there would seem to be no justification for the growing of beans, even as a protein sup-

plement for livestock. Tepary beans outyield field peas, but they cannot compete successfully with Sudan grass.

That forage sorghums may be used for silage has been pointed out, and as such they may be classed with corn. The sorghums yield more than twice as much silage as does corn. Corn silage, however, is made up of one-fourth ear corn and thus may make a richer silage than that of sorghum. Improved Coes produces but little more than half of the total crop of the forage sorghums and is not recommended over these for silage purposes. It is first as a grain producer.

Corn outyields sunflowers by 8 percent. Sunflowers for silage purposes, then, are adapted only to the higher altitude portions of Colorado, where corn will not mature. There they yield well and can be made into a fairly satisfactory silage.[7]

Comparative Yields of Sorghum After Spring Grain Hay and After Drilled Sudan Grass

From 1925 to 1930 the stubble land on which the sorghums were grown was from mixed oats and barley, harvested in the soft-dough stage for hay. The crop was mowed in late June or early July, and the short stubble was kept clean by cultivation throughout the re-

[7]Colo. Exp. Sta., Animal Investigations Section.

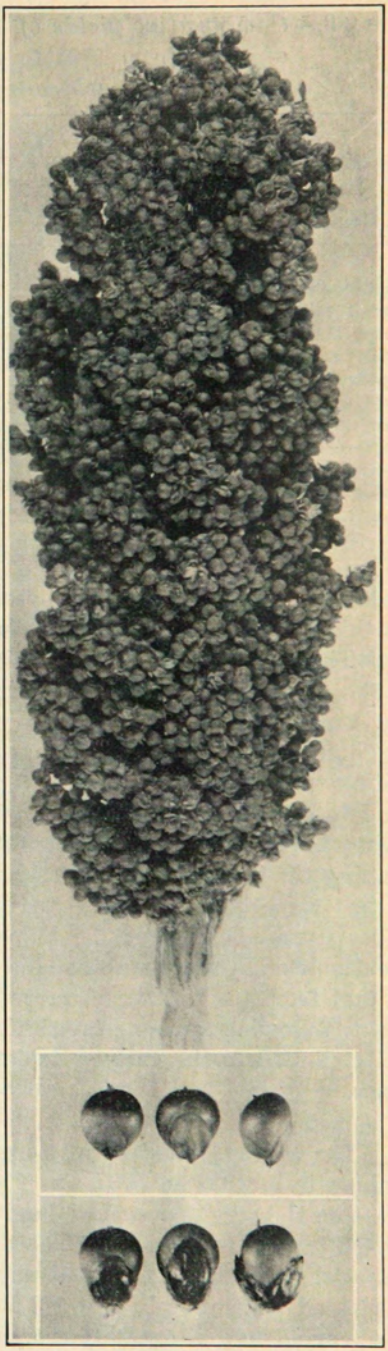

Figure 18.—Sumac Sorgo.

TABLE 9.—*Comparative yields of air-dry forage for varying periods of years from 1925 to 1934 at the Akron Field Station; total crop in each case (grain + stover).*

Crop	No. years grown	Average acre yield		
		Crop named	Black Amber, F. C. 7038 in same years	Percentage of Black Amber sorghum
		Pounds	*Pounds*	
Black Amber, F. C. 7038	10	4916	4916	100.0
Foxtail millet—drilled	10	3381	4916	68.8
Proso (Hershey)—drilled	10	2885	4916	58.7
Sudan grass—sowed	7	3001	5668	52.9
Improved Coes—in rows	9	2754	5307	51.9
Barley—drilled	10	2205	4916	44.9
Corn—in rows	9	2009	5307	37.9
Sunflowers—in rows	4	1118	3638	30.7
Tepary field beans—in rows	9	1558	5307	29.4
Spring rye—drilled	7	1416	4994	28.5
Field peas—drilled	10	1232	4916	25.1

mainder of the season. The 6-year average yield of sorghum forage on this stubble land was 84 percent of that on fallowed land (table 5). This preparation is more favorable to sorghum production than is the small-grain stubble land in this region, which ordinarily is not worked until the following year preceding the seeding of the sorghum crop. This plan permitted a partial season of fallow preceding the planting of the sorghum. It was desired to cultivate this land to control weeds and conserve all soil moisture possible, so the plan was changed to that of clean cultivation in the spring and later drilling the land to Sudan grass. Sudan grass grows until frost and in this respect may simulate weeds in stubble in exhausting the soil of moisture. During the 6-year period from 1931 to 1936, the forage yield on Sudan grass stubble land averaged only 49 percent as much as that from the fallow. A large part of the difference between the yields following spring grain and those following Sudan grass may be attributed to the greater depletion of soil moisture by the Sudan grass.

The average yield of all sorghum varieties on the Sudan grass stubble from 1931 to 1937 was 2,474 pounds and that of the Sudan grass on the sorghum stubble land 1,722 pounds, or a total in 2 years of 4,196 pounds per acre. The average yield of the same varieties after fallow in the same period was 5,268 pounds per acre. The clean-cultivated, continuously cropped land thus yielded 80 percent as much per year as land alternately cropped and fallowed in this experiment over this set of years.

SUMMARY

The sorghums are very sensitive to cool temperatures and cannot be planted in Colorado early enough to utilize the entire frost-free period for crop growth. They require a warm soil for satisfactory germination and early growth and should not be planted until the daily mean air temperature averages about 60° F. This condition is not reached until the first 10 days of June at Akron, in northeastern Colorado. The mean temperature at Akron for the first 5 days of June has varied from 52.2° F. to 78° F. during the 26-year period 1912-37.

The sorghums respond well to good seedbed preparation.

Results at Akron show that forage sorghums gave the highest yield of forage of any of the crops tested.

Forage sorghums should be planted thickly in cultivated rows. The plants should be spaced from about 1 to 3 inches apart, in rows from 40 to 44 inches apart. This requires from about 6 to 10 pounds of seed per acre.

The forage sorghum varieties best adapted to altitudes of less than 5,000 feet in Colorado are Leoti; Black Amber, C. I. 7038; and Fremont.

Dakota and Minnesota Amber can be recommended for the higher altitude sections (over 5,000 feet) and for late planting at the lower altitudes.

The better adapted forage sorghums produce about 50 percent more forage than do the recommended grain sorghum varieties.

The best adapted varieties for grain production are Highland and Improved Coes. These are not considered as combine types, but the heads are erect.

Sorghums for grain should be planted in a well-prepared seedbed free from weed growth. The plants should be spaced from 4 to 12 inches apart in from 40- to 44-inch rows; from 2 to 3 pounds of seed are required per acre.

The best combine types of grain sorghum for Colorado conditions are Sooner, Pygmy, Colby, and Day milo.

Sorghum grain should be well dried and cured before being stored in bins. The moisture content should be 14 percent or less.

All sorghums should be treated for smut and other seed-borne diseases before planting.

Sudan grass harvested at maturity yields less than half as much forage as the better adapted forage sorghums. When drilled about June 15 in a good seedbed containing ample moisture and mowed two or three times during the season, it produced as much hay as when allowed to mature, and the hay was very palatable and high in protein content.

It is dangerous to feed green or to pasture any of the forage or grain sorghums, but thoroughly cured forage or stover is safe if bright and not damp at the time of feeding.

Sorghum is extremely dangerous to grazing cattle or sheep until after it has been killed by freezing and is thoroughly field-cured or dried.

Forage sorghums produce about twice as much silage per acre as corn at Akron, and their total forage production is nearly three times the yield of corn stover.

The dual-purpose varieties recommended, Highland and Improved Coes, produced 37 and 18 percent more of an equally palatable stover than did corn at Akron. They also produced about a third more grain. The combine types of milo produced more grain than did corn at Akron.

The sorghums also will outyield corn on sandy soils, but the increase over corn is unlikely to be as great as on the hard lands.

Popcorn produces less grain than field corn, but about 18 percent more stover.

APPENDIX TABLE 1.—*Total yields of forage and grain sorghum varieties and Sudan grass mainly on fallow land, U. S. Dry-Land Field Station, Akron, Colo., 1909 to 1924.*

Variety	Pounds per acre														Av. var. named	Red Amber same years	Percentage of Red Amber	No. of years grown
	1909	1911	1912	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924				
Forage sorghums																		
Early Sumac, FC 02552	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14784	0	7392	3575	206.8	2
Black Amber, FC 7038	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13019	0	6510	3575	182.1	2
Leoti Red, FC 3417	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12817	0	6409	3575	179.3	2
Orange, local	14500	.....	12700	.....	13650	5970	9450	.....	.....	.....	7925	15850	10500	0	10061	9243	108.8	9
Red Amber, 269	12740	9690	10880	.....	13450	8180	7940	7280	2730	9666	12525	10325	7150	0	8658	8658	100.0	13
Minnesota Amber	11840	4880	7760	.....	.....	.....	.....	5310	3030	5078	.....	.....	.....	..	6316	8831	71.5	6
Freed, FC 9033, CI 350	.....	.....	.....	*6040	4250	3740	2420	.....	.....	.....	4888	5563	9617	0	4354	8510	51.2	7
White Amber	.....	3840	6060	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	4950	10285	48.1	2
Dakota Amber, FC 1614	.....	.....	.....	.....	5600	4180	1269	4890	2115	3584	2650	4875	5250	0	3441	7925	43.4	10
Grain sorghums																		
Modoc 238	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5600	0	2800	3575	78.3	2
Dawn Kafir	.....	.....	.....	.....	.....	.....	.....	.....	.....	7100	5250	8038	8250	0	5908	7933	74.5	5
Feterita, CI 182	.....	.....	.....	.....	.....	2890	1017	4700	1360	1292	.....	.....	.....	..	2252	7159	31.5	5
Sudan grass	.....	.....	.....	*3060	4510	2940	3080	3880	2185	3550	3150	4750	2917	0	3096	7925	39.1	10

*(1914) yields not included in the averages for the reason that Red Amber was not grown. No forage sorghum variety experiments conducted in 1910 and 1913.

APPENDIX TABLE 2.—*Yields of grain sorghum varieties mainly on fallow land, U. S. Dry-Land Field Station, Akron, Colo., 1911 to 1924.*

Variety	C. I. no.	Bushels per acre*														Av. var. named	Brown Manchu same years	Percentage of Brown Manchu	No. of years compared
		1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924				
Dwarf Yellow	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	.... ..	.... ..	.... ..	....
Milo	149	21.6	0	5.5	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	9.0	15.0	60.0	3
White Durra	81	18.9	0	32.7	27.7	0	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	15.9	15.4	103.2	5
White Kafir	370	13.5	10.7	0	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	8.1	15.0	54.0	3
Dawn Kafir	340	10.7	0	.... ..	4.9	.... ..	.... ..	.... ..	.... ..	.. ..	0	0	42.4	0	..	8.3	.... ..	.... ..	7
Freed	350	12.4	0	19.3	3.8	.... ..	.... ..	.... ..	.... ..	.. ..	1.0	14.0	28.8	14.7	..	11.8	.... ..	.... ..	8
Manchu Brown	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	.... ..	.... ..	.... ..	....
Kaoliang	328	14.9	11.5	18.7	20.3	11.7	24.1	10.4	17.9	0.5	13.6	2.9	.... ..	.... ..	..	13.3	13.3	100.0	11
Sunrise Kafir	472	8.7	0	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	0	.... ..	.... ..	..	2.9	9.8	29.6	3
Dwarf Yellow	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	.... ..	.... ..	.... ..	....
Milo	332	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	0	24.7	0	8.2	.... ..	.... ..	3
Modoc 231	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	34.5	0	17.3	.... ..	.... ..	2
Modoc 238	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... .	.... ..	33.2	0	16.6	.... ..	.... ..	2
Modoc 241	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	39.7	0	19.9	.... ..	.... ..	2
Modoc 243	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	35.8	0	17.9	.... ..	.... ..	2
Early White	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	..	.... ..	.... ..	.... ..	....
Milo	480	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	47.0	..	47.0	.... ..	.... ..	1
Early Pink Kafir	432	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	35.4	..	35.4	.... ..	.... ..	1
Dwarf Feterita	.....	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.... ..	.. ..	.... ..	.... ..	.... ..	.... ..	0	0	.... ..	.... ..	1

*Fifty-six pounds were used in calculating yields.

APPENDIX TABLE 3.—*Total yields of forage sorghum varieties and Sudan grass on stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	Pounds per acre													Av. var. named	Leoti Red same years	Percentage of Leoti Red	No. of years grown
	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Kansas Orange, FC 910S	.....	3795	11385	3878	3465	18233	.....	990	4818	.....	6820	1870	2970	5822	5035	115.6	10
Sourless, FC 9074	.....	3878	9983	3383	4125	14273	.....	.....	.....	.....	.....	.....	.....	7128	6419	111.0	5
Larson's Orange, local	.....	.....	5775	3218	1980	.....	.....	.....	.....	.....	.....	.....	.....	3658	3465	105.6	3
Leoti Red, FC 3417	248	5280	5940	2805	1650	16418	990	660	5170	330	7370	2420	2640	3994	3994	100.0	13
African millet, FC 9111	.....	3300	7673	2723	4620	13613	.....	.....	.....	.....	.....	.....	.....	6386	6419	99.5	5
Black Amber, FC 703S	248	5033	6765	2145	2970	12705	1210	1980	4466	440	6402	2640	1650	3743	3994	93.7	13
Waechter's Orange, local	.....	.....	.....	.....	.....	.....	770	1210	3960	330	6710	2970	1980	2561	2797	91.6	7
Fremont	.....	3630	6765	3630	2888	9488	880	1210	4334	770	6160	2970	1650	3698	4306	85.9	12
Carson, Diamond's Yellow Orange, local	.....	.....	.....	.....	.....	.....	.....	.....	.....	660	5830	2530	1870	2723	3190	85.4	4
Atlas, CI 899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1980	2310	2145	2530	84.8	2
Minnesota Amber	330	5033	5693	3548	3300	8085	1320	1980	4092	440	5500	2530	1100	3304	3994	82.7	13
Orange, commercial seed	660	3383	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2022	2764	73.2	2
Early Sumac, FC 02552, 6611	413	4373	4868	2805	990	10065	.....	1210	2618	440	6600	2090	2750	3269	4244	77.0	12
Red Amber, 269	248	5198	7425	3548	2805	7260	990	1320	3212	374	4070	2090	1430	3075	3994	77.0	13
Dakota Amber, FC 1614	413	3630	4620	3135	2805	7508	1210	1760	3520	440	4180	.....	.....	3020	4260	70.9	11
Sudan grass	825	2640	2558	1896	1152	5192	.....	.....	2002	110	1540	1540	1100	1869	4570	40.9	11

APPENDIX TABLE 4.—*Total yields of forage sorghum varieties and Sudan grass on fallow land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	Pounds per acre													Av. var. named	Leoti Red same years	Percentage of Leoti Red	No. of years grown
	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Kansas Orange, FC 9108	.....	6023	13943	6765	4538	18810	.....	4950	4950	.....	7700	11000	6160	8484	6983	121.5	10
Sourless, FC 9074	.....	6023	12293	7673	6023	14025	.....	.....	.....	.....	.....	.....	.....	9207	7590	121.3	5
Larson's Orange, local	.....	.....	5940	5445	2063	.....	.....	.....	.....	.....	.....	.....	.....	4483	5005	89.6	3
Leoti Red, FC 3417	2640	6930	6270	6105	2640	16005	5390	6050	5148	2530	7810	8250	4620	6184	6184	100.0	13
African millet, FC 9111	.....	5188	9075	5528	5775	13283	.....	.....	.....	.....	.....	.....	.....	7770	7590	102.4	5
Black Amber, FC 7038	2558	5775	8663	3465	4043	14850	6160	6820	4180	3850	8140	7700	5170	6260	6184	101.2	13
Waechter's Orange, local	.....	.....	.....	.....	.....	.....	4180	4840	4972	2970	6710	7150	4180	5000	5685	88.0	7
Fremont	.....	5033	6930	6518	3155	11055	5720	6050	5544	2640	6270	7810	4510	5935	6479	91.6	12
Carson, Diamond's Yellow Orange, local	.....	.....	.....	.....	.....	.....	.....	.....	.....	2750	6600	6270	4730	5088	5803	87.7	4
Atlas, CI 899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9350	5720	7535	6435	117.1	2
Minnesota Amber	2063	4538	6023	4620	3218	9158	4510	4840	4928	3410	5610	5830	4400	4858	6184	78.6	13
Orange, commercial seed	3795	4785	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4290	4785	89.7	2
Early Sumac, FC 02552, 6611	3383	6188	7673	6353	1238	10890	.....	5170	4642	2970	6930	8250	6380	5839	6250	93.4	12
Red Amber, 269	2228	5280	8003	3878	3960	8415	3300	4950	3498	2860	5390	5170	3300	4633	6184	74.9	13
Dakota Amber, FC 1614	1733	4125	4785	5115	3135	9653	3520	4620	3982	2750	4950	.....	.....	4397	6138	71.6	11
Sudan grass	2805	3135	4538	2475	2640	5808	.....	.....	1958	1012	2420	4290	2640	3066	6268	48.9	11

APPENDIX TABLE 5.—*Total yields of forage sorghum varieties and Sudan grass on fallow and stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	Pounds per acre													Av. var. named	Leoti Red same years	Percentage of Leoti Red	No. of years grown
	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Kansas Orange, FC 9108	.....	4909	12664	5322	4002	18522	.....	2970	4884	.....	7260	6435	4565	7153	6009	119.0	10
Sourless, FC 9074	.....	4951	11138	5528	5074	14149	.....	.....	.....	.....	.....	.....	.....	8168	7004	116.6	5
Larson's Orange, local	.....	.....	5858	4332	2022	.....	.....	.....	.....	.....	.....	.....	.....	4071	4235	96.1	3
Leoti Red, FC 3417	1444	6105	6105	4455	2145	16212	3190	3355	5159	1430	7590	5335	3630	5089	5089	100.0	13
African millet, FC 9111	.....	4244	8374	4126	5198	13448	.....	.....	.....	.....	.....	.....	.....	7079	7004	101.1	5
Black Amber, FC 7038	1403	5404	7714	2805	3507	13778	3685	4400	4323	2145	7271	5170	3410	5001	5089	98.3	13
Waechter's Orange, local	.....	.....	.....	.....	.....	.....	2475	3025	4466	1650	6710	5069	3080	3781	4241	89.2	7
Fremont	.....	4332	6848	5074	3022	10272	3300	3630	4939	1705	6215	5390	3080	4817	5393	89.3	12
Carson, Diamond's Yellow Orange, local	.....	.....	.....	.....	.....	.....	.....	.....	.....	1705	6215	4400	3300	3905	4496	86.9	4
Atlas, CI 899	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5665	4015	4840	4483	108.0	2
Minnesota Amber	1197	4786	5858	4084	3259	8622	2915	3410	4510	1925	5555	4180	2750	4081	5089	80.2	13
Orange, commercial seed	2228	4084	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3156	3775	83.6	2
Early Sumac, FC 02552, 6611	1898	5281	6271	4579	1114	10478	.....	3190	3630	1705	6765	5170	4565	4554	5247	86.8	12
Red Amber, 269	1238	5239	7714	3713	3383	7838	2145	3135	3355	1617	4730	3630	2365	3854	5089	75.7	13
Dakota Amber, FC 1614	1073	3878	4703	4125	2970	8581	2365	3190	3751	1595	4565	.....	.....	3709	5199	71.3	11
Sudan grass	1815	2888	3548	2187	1896	5500	.....	.....	1980	561	1980	2915	1870	2467	5419	45.5	11

APPENDIX TABLE 6.—*Yields of grain sorghum varieties on stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grain varieties																		
Tribune 14	973	..	.. ..	.. ..	..	.. ..	47.4	12.1	13.2	9.0	.. ..	.. ..	.. ..	.. ..	20.4	13.2	154.5	4
Kalo	902	..	.. ..	.. ..	..	1.5	56.8	2.4	4.9	8.7	0	.. ..	7.0	0.9	10.3	7.2	143.1	8
Extra Early Pink Selection	.....	..	.. ..	.. ..	..	2.1	38.2	9.8	6.1	8.4	.. ..	.. ..	.. ..	4.0	11.4	9.2	123.9	6
Modoc, HC 2520	905	..	.. ..	.. ..	0	2.2	43.9	2.7	5.9	7.9	0	22.1	7.4	1.0	9.3	8.6	108.1	10
Early White Milo, FC 5886	480	0	7.4	2.5	..	1.5	42.8	6.2	0.5	5.3	0	19.5	9.2	2.0	8.1	7.6	106.6	12
Dwarf Freed x Dwarf Feterita (971xS67-2-1)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	15.7	8.6	4.2	9.5	9.7	97.9	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	7.7	0	15.7	7.7	2.5	6.7	6.9	97.1	5
Tribune 36	974	..	.. ..	.. ..	..	.. ..	31.8	7.8	3.8	7.6	0	.. ..	.. ..	.. ..	10.2	10.5	97.1	5
Feterita x Milo-Kafir, HC 301	965	..	.. ..	.. ..	..	.. ..	45.1	1.6	0.2	4.3	0	.. ..	.. ..	.. ..	10.2	10.5	97.1	5
Hybrid Dwarf Feterita	867	..	.. ..	.. ..	0	3.5	30.9	2.3	2.3	6.9	0	.. ..	.. ..	.. ..	6.6	8.1	81.5	7
Dwarf Feterita x Dwarf Freed (971xS67-1-4)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	11.2	8.9	3.7	7.9	9.7	81.4	3
Brown Manchu Kaoliang	328	..	10.0	15.3	5.9	0	13.0	2.1	5.7	2.4	0	12.2	5.0	2.9	6.2	7.8	79.5	12
Feterita	182-1	..	.. ..	.. ..	0	2.4	22.8	1.6	0.9	8.1	0	18.6	7.4	1.9	6.4	8.6	74.4	10
Early Kalo	1009	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	11.5	8.3	0.7	5.1	7.3	69.9	4
Freed x Kafir (71-20-23-F5)	.....	..	5.7	4.0	..	.. ..	9.8	3.4	10.4	8.2	.. ..	.. ..	.. ..	.. ..	6.9	10.1	68.3	6
Milo x Hegari, HC 382	.....	..	.. ..	.. ..	0	0.6	34.8	0.8	0.5	1.1	0	.. ..	.. ..	.. ..	5.4	8.1	66.7	7
Club Kafir	901	..	.. ..	.. ..	..	2.5	25.8	2.0	1.4	3.2	0	.. ..	.. ..	.. ..	5.8	8.9	65.2	6
Dwarf Yellow Milo	332	0	6.7	0	0	1.5	33.4	2.5	0.3	7.7	0	7.1	0	0.8	4.6	7.2	63.9	13
Sunrise Kafir	472	..	.. ..	.. ..	..	0.6	26.7	0	0.8	.. ..	.. ..	.. ..	.. ..	.. ..	7.0	12.0	58.3	4
Early Dwarf Milo (480-332-7-7)	.....	..	.. ..	.. ..	..	.. ..	16.3	3.4	0.9	9.1	.. ..	.. ..	.. ..	.. ..	7.4	13.2	56.1	4
Early Dawn Kafir, HC 2421	904	..	.. ..	0	0	0.9	30.9	0.2	1.8	4.7	0	9.4	0	0.5	4.4	7.9	55.7	11
Early Pink Kafir, FC 9089	432	..	6.1	0	..	0.8	40.2	0.1	2.1	2.1	0	0.6	0	0	4.7	8.2	57.3	11
Kafirita	812	..	2.4	0	0	2.1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	1.1	3.0	36.7	4
Weskan, FC 9126	.....	0	2.8	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0.9	2.7	33.3	3
Chiltex	874	..	2.4	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0.8	3.6	22.2	3

APPENDIX TABLE 6.—(*Continued*).

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Percentage of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Pink Freed, FC 9124	.....	0	0.8	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0.3	2.7	11.1	3
Grohoma	920	..	.. ..	.. ..	..	.. ..	.. ..	0.1	0.4	0.7	0	0	0	0	0.2	5.9	3.4	7
Ajax	968	..	.. ..	.. ..	..	.. ..	.. ..	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	6.8	0	1
Premo	872	..	.. ..	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	2.3	0	2
Dual purpose varieties																		
Highland Kafir	.....	0	.. ..	.. ..	..	4.7	57.2	6.4	10.8	7.7	0	22.1	10.3	4.3	12.4	8.3	149.4	10
Improved Coes	.....	..	9.3	3.3	8.5	2.0	41.8	8.1	11.8	14.1	0	18.6	5.3	4.4	10.6	7.8	135.9	12
Greeley	972	..	.. ..	.. ..	..	.. ..	.. ..	17.9	9.8	6.5	0	10.3	9.4	0.9	7.8	5.9	132.2	7
Dwarf Freed, HC 2521	971	..	7.4	7.4	5.5	3.8	51.8	5.8	1 8	10.8	0	20.9	2.0	1.6	9.9	7.8	126.9	12
Coes	.....	..	4.7	7.7	9.4	2.6	26.5	6.9	11.2	9.6	0	20.9	3.3	2.6	8.8	7.8	112.8	12
Cheyenne	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	3.6	9.3	0	20.9	3.0	0.9	6.3	5.8	108.6	6
Freed, FC 9033	350	0	6.4	1.6	2.9	0.9	40.2	6.8	0.2	5.5	0	24.8	2.4	1.8	7.2	7.2	100.0	13
Kafir Selection 10	.....	0	.. ..	.. ..	..	2.3	29.4	5.3	7.3	.. ..	.. ..	.. ..	.. ..	.. ..	8.9	9.6	92.7	5
Dwarf Hegari	620	..	.. ..	.. ..	0	2.7	45.2	0	1.2	2.1	0	3.3	0	3.4	5.8	8.6	67.4	10
Otis Kafir	.....	..	5.9	1.2	3.4	1.5	25.9	1.7	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	6.6	9.8	67.3	6
Combine varieties																		
Yellow Highland Selection	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2.6	2.6	1.8	144.4	1
Pygmy Milo	1010	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	5.3	0	25.1	6.9	2.2	7.9	6.9	114.5	5
Sooner Milo	917	..	.. ..	.. ..	..	4.9	36.2	3.0	0.7	8.7	0	25.0	4.2	2.4	9.5	9.2	103.3	9
Custer Milo	919	..	.. ..	.. ..	..	.. ..	46.1	0.9	0.3	6.3	0	.. ..	.. ..	.. ..	10.7	10.5	101.9	5
Day Milo	959	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	4.1	0	23.3	4.1	2.8	6.9	6.9	100.0	5
Colby 19	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	17.2	7.7	2.2	6.8	7.3	93.2	4
Colby 32	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	15.3	7.7	2.7	6.4	7.3	87.7	4
Colby (Colby 31)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	18.9	3.4	2.4	6.2	7.3	84.9	4
Colby 29	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	14.2	3.7	2.0	5.0	7.3	68.5	4
Colby 10	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	0	14.8	.. ..	.. ..	7.4	12.4	59.7	2
Wheatland Milo	918	..	5.3	0	..	0	.. ..	.. ..	0	6.5	0	0	0	0	1.3	4.8	27.1	9
Double Dwarf Yellow Milo	868	..	.. ..	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	1.6	0	1

*Fifty-six pounds were used in calculating yields.

APPENDIX TABLE 7.—*Yields of grain sorghum varieties on fallow land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Tribune 14	973	..	.. ..	.. ..	..	.. ..	51.3	31.5	14.8	22.6	.. ..	.. ..	.. ..	.. ..	30.1	19.4	155.2	4
Kalo	902	..	.. ..	.. ..	..	13.6	61.0	35.8	26.7	16.9	4.2	.. ..	35.8	11.9	25.7	14.6	176.0	8
Extra Early Pink Selection	.....	..	.. ..	.. ..	..	16.5	41.2	22.9	18.1	18.1	.. ..	.. ..	.. ..	15.6	22.1	15.2	145.4	6
Modoc, HC 2520	905	..	.. ..	.. ..	5.7	11.1	49.7	37.2	30.1	11.2	3.8	19.5	31.1	12.7	21.2	14.7	144.2	10
Early White Milo, FC 5886	480	6.3	8.3	2.9	..	3.6	47.0	21.0	4.7	11.7	6 4	18.0	32.8	15.2	14.8	13.1	113.0	12
Dwarf Freed x Dwarf Feterita (971xS67-2-1)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	17.1	13.7	16.7	15.8	18.9	83.6	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	11.8	2.0	12.6	34.8	17.4	15.7	14.7	106.8	5
Tribune 36	.....	..	.. ..	.. ..	..	.. ..	34.5	13.5	5.7	15.8	2.0	.. ..	.. ..	.. ..	14.3	15.9	89.9	5
Feterita x Milo-Kafir, HC 301	.....	..	.. ..	.. ..	..	.. ..	44.1	8.3	4.0	8.8	2.9	.. ..	.. ..	.. ..	13.6	15.9	85.5	5
Hybrid Dwarf Feterita	867	..	.. ..	.. ..	11.8	5.5	37.6	7.1	15.9	16.5	3.9	.. ..	.. ..	.. ..	14.0	12.9	108.5	7
Dwarf Freed x Dwarf Feterita (971xS67-1-4)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	13.6	15.2	15.2	14.7	18.9	77.8	3
Manchu Brown Kaoliang	328	..	10.6	13.9	3.0	0	11.5	5.4	10.0	6.1	3.4	15.3	5.5	9.7	7.9	13.3	59.4	12
Feterita	182-1	..	.. ..	.. ..	4.5	6.2	29.9	24.5	14.1	14.0	2.1	16.8	34.5	13.1	16.0	14.7	108.8	10
Early Kalo	1009	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	3.7	6.8	36.2	13.7	15.1	14.7	102.7	4
Freed x Kafir (71-20-23-F5)	.....	..	18.5	4.5	..	.. ..	8.6	16.6	25.2	16.5	.. ..	.. ..	.. ..	.. ..	15.0	15.0	100.0	6
Milo x Hegari, HC 382	.....	..	.. ..	.. ..	5.2	10.5	39.5	19.2	7.7	1.8	0.4	.. ..	.. ..	.. ..	12.0	12.9	93.0	7
Club Kafir	901	..	.. ..	.. ..	..	7.0	26.9	15.2	16.3	8.6	2.1	.. ..	.. ..	.. ..	12.7	13.6	93.4	6
Dwarf Yellow Milo	332	0.9	6.5	0	0	7.6	39.7	20.2	3.6	12.5	5.6	7.5	35.3	7.8	11.3	12.8	88.3	13
Sunrise Kafir	472	..	.. ..	.. ..	..	6.1	28.0	23.2	8.3	.. ..	.. ..	.. ..	.. ..	.. ..	16.4	16.2	101.2	4
Early Dwarf Milo (480-332-7-7)	.....	..	.. ..	.. ..	..	.. ..	21.6	15.4	9.0	16.3	.. ..	.. ..	.. ..	.. ..	15.6	19.4	80.4	4
Early Dawn Kafir, HC 2421	904	..	.. ..	0	0	4.3	32.4	14.5	18.2	10.4	1.8	4.5	21.5	11.4	10.8	13.7	78.8	11
Early Pink Kafir, FC 9089	432	..	13.1	0	..	6.9	39.4	8.8	22.6	4.2	1.6	0	4.5	0 9	9.3	13.7	67.9	11
Kafirita	812	..	7.3	0	0	6.8	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	3.5	5.7	61.4	4
Weskan, FC 9126	.....	0	7.7	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2.6	6.3	41.3	3
Chiltex	874	..	5.3	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	1.8	7.0	25.7	3

APPENDIX TABLE 7.—(*Continued*).

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Percentage of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Pink Freed, FC 9124	.....	0	7.7	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2.6	6.3	41.3	3
Grohoma	920	..	.. ..	.. ..	..	.. ..	.. ..	3.3	4.3	1.2	0	0	18.4	3.8	4.4	13.5	32.6	7
Ajax, FC 6620	968	..	.. ..	.. ..	..	.. ..	.. ..	4.7	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	4.7	16.6	28.3	1
Premo	873	..	.. ..	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	5.5	0	2
Dual purpose varieties																		
Highland Kafir	.....	5.8	.. ..	.. ..	..	12.8	55.2	27.1	33.0	15.5	3.7	27.4	25.8	19.5	22.6	14.5	155.9	10
Improved Coes	.....	..	13.1	5.0	20.7	6.4	36.5	22.0	25.5	20.6	3.3	31.0	29.5	23.0	19.7	13.5	145.9	12
Greeley	972	..	.. ..	.. ..	..	.. ..	.. ..	37.9	8.5	17.4	3.3	12.7	35.7	9.9	17.9	13.5	132.6	7
Dwarf Freed, HC 2521	971	..	18.9	7.1	10.2	14.2	53.1	19.3	9.0	23.0	1.9	22.4	28.6	16.2	18.7	13.3	140.6	12
Coes	.....	..	7.4	7.1	10.6	4.8	28.9	12.2	25.6	14.7	2.4	30.7	28.6	23.0	16.3	13.3	122.6	12
Cheyenne	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	5.1	16.3	2.6	24.5	26.6	14.5	14.9	13.0	114.6	6
Freed, FC 9033	350	6.8	9.9	2.2	8.8	1.8	41.5	16.6	4.9	14.7	1.9	21.5	23.4	11.8	12.8	12.8	100.0	13
Kafir Selection 10	.....	10.6	.. ..	.. ..	..	3.0	33.0	14.6	29.6	.. ..	.. ..	.. ..	.. ..	.. ..	18.2	14.3	127.3	5
Dwarf Hegari	620	..	.. ..	.. ..	12.8	14.0	50.9	3.9	17.8	5.9	0	0	18.7	16.0	14.0	14.7	95.2	10
Otis Kafir	.....	..	10.6	1.8	10.2	3.8	27.3	5.5	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	9.9	13.5	73.3	6
Combine varieties																		
Yellow Highland Selection	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	14.7	14.7	11.8	124.6	1
Pygmy Milo	1010	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	10.2	2.8	19.2	30.2	11.8	14.8	14.7	100.7	5
Sooner Milo	917	..	.. ..	.. ..	..	11.4	38.0	17.6	6.2	13.1	2.4	18.0	37.7	11.8	17.4	15.3	113.7	9
Custer Milo	919	..	.. ..	.. ..	..	.. ..	45.6	7.9	1.9	6.8	1.0	.. ..	.. ..	.. ..	12.6	15.9	79.2	5
Day Milo	959	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	8.9	1.3	16.2	33.2	11.8	14.3	14.7	97.3	5
Colby 19	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	4.9	9.1	28.2	10.9	13.3	14.7	90.5	4
Colby 32	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	6.3	12.1	29.9	15.3	15.9	14.7	108.2	4
Colby Milo (Colby 31)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	7.9	20.4	28.6	13.4	17.6	14.7	119.7	4
Colby 29	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	4.2	16.5	28.5	13.2	15.6	14.7	106.1	4
Colby 10	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	4.9	8.6	.. ..	.. ..	6.8	11.7	58.1	2
Wheatland Milo	918	..	17.4	0	..	2.8	.. ..	.. ..	0	7.9	1.1	0	22.1	7.0	6.5	10.2	63.7	9
Double Dwarf Yellow Milo	868	..	.. ..	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	2.2	0	1

*Fifty-six pounds were used in calculating yields.

APPENDIX TABLE 8.—*Yields of grain sorghum varieties and corn and popcorn on fallow and stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1925 to 1937.*

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grain varieties																		
Tribune 14	973	..	.. ..	.. ..	..	.. ..	49.4	21.8	14.0	15.8	.. ..	.. ..	.. ..	.. ..	25.3	16.3	155.2	4
Kalo	902	..	.. ..	.. ..	..	7.6	58.9	19.1	15.6	12.8	2.1	.. ..	21.1	6.4	18.0	10.9	165.1	8
Extra Early Pink Selection	.....	..	.. ..	.. ..	..	9.3	39.7	16.4	12.1	13.3	.. ..	.. ..	.. ..	9.9	16.8	12.3	136.6	6
Modoc, HC 2520	905	..	.. ..	.. ..	2.4	6.7	46.8	20.0	18.0	9.6	1.9	20.8	19.3	6.9	15.2	11.7	129.9	10
Early White Milo, FC 5886	480	3.2	7.9	2.7	..	2.6	44.9	13.9	2.6	8.5	3.2	18.8	21.0	8.6	11.5	10.3	111.7	12
Dwarf Freed x Dwarf Feterita (971xS67-2-1)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	16.4	11.2	10.5	12.7	14.3	88.8	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	9.8	1.0	14.2	21.3	10.0	11.3	10.8	104.6	5
Tribune 36	974	..	.. ..	.. ..	..	.. ..	33.2	10.7	4.8	11.7	1.0	.. ..	.. ..	.. ..	12.3	13.2	93.2	5
Feterita x Milo-Kafir, HC 301	965	..	.. ..	.. ..	..	.. ..	44.6	5.0	2.1	6.6	1.5	.. ..	.. ..	.. ..	12.0	13.2	90.9	5
Hybrid Dwarf Feterita	S67	..	.. ..	.. ..	5.9	4.5	34.3	4.7	9.1	11.7	2.0	.. ..	.. ..	.. ..	10.3	10.5	98.1	7
Dwarf Freed x Dwarf Feterita (971xS67-1-4)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	12.4	12.1	9.5	11.3	14.3	79.0	3
Manchu Brown Kaoliang	328	..	10.3	14.1	4.5	0	12.3	3.8	7.9	4.3	1.7	13.8	5.5	6.3	7.0	10.6	66.0	12
Feterita	182-1	..	.. ..	.. ..	2.3	4.3	26.4	13.1	7.5	10.6	1.1	17.7	21.0	7.5	11.2	11.7	95.7	10
Early Kalo	1009	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	1.9	9.2	22.3	7.2	10.2	11.0	92.7	4
Freed x Kafir (71-20-23-F5)	.....	..	12.1	4.3	..	.. ..	9.2	10.0	17.8	12.4	.. ..	.. ..	.. ..	.. ..	11.0	12.6	87.3	6
Milo x Hegari, HC 382	.....	..	.. ..	.. ..	2.6	5.6	37.2	13.0	4.1	1.5	0.2	.. ..	.. ..	.. ..	8.7	10.5	82.9	7
Club Kafir	901	..	.. ..	.. ..	..	4.8	26.4	8.6	8.9	5.9	1.1	.. ..	.. ..	.. ..	9.3	11.3	82.3	6
Dwarf Yellow Milo	332	0.5	6.6	0	0	4.6	36.6	11.4	2.0	10.1	2.8	7.3	17.7	4.3	8.0	10.0	80.0	13
Sunrise Kafir	472	..	.. ..	.. ..	..	3.4	27.4	11.6	4.6	.. ..	.. ..	.. ..	.. ..	.. ..	11.8	14.2	83.1	4
Early Dwarf Milo (480-332-7-7)	.....	..	.. ..	.. ..	..	.. ..	19.0	9.4	5.0	12.7	.. ..	.. ..	.. ..	.. ..	11.5	16.3	70.6	4
Early Dawn Kafir, HC 2421	904	..	.. ..	0	0	2.6	31.7	7.4	10.0	7.6	0.9	6.5	10.8	6.0	7.6	10.8	70.4	11
Early Pink Kafir, FC 9089	432	..	9.6	0	..	3.9	39.8	4.5	12.4	3.2	0.8	0.3	2.3	0.5	7.0	11.0	63.6	11
Kafirita	812	..	4.9	0	0	4.5	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2.4	4.4	54.5	4
Weskan, FC 9126	....	0	5.3	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	1.8	4.5	40.0	3
Chiltex	871	..	3.9	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	1.3	5.3	24.5	3
Pink Freed, FC 9124	.....	0	4.3	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	1.4	4.5	31.1	3

APPENDIX TABLE 8.—(*Continued*).

Variety	C. I. no.	Bushels per acre*													Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grohoma	920	..	.. ..	.. ..	..	.. ..	.. ..	1.7	2.4	1.0	0	0	9.2	1.9	2.3	9.8	23.5	7
Ajax	968	..	.. ..	.. ..	..	.. ..	.. ..	2.4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2.4	11.7	20.5	1
Premo	875	..	.. ..	0	0	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	3.9	0	2
Dual purpose varieties																		
Highland Kafir	.....	2.9	.. ..	.. ..	..	8.8	56.2	16.8	21.9	11.6	1.9	24.8	18.1	11.9	17.5	11.4	153.5	10
Improved Coes	.....	..	11.2	4.2	14.6	4.2	39.2	15.1	18.7	17.4	1.7	24.8	17.4	13.7	15.2	10.6	143.4	12
Greeley	972	..	.. ..	.. ..	..	.. ..	.. ..	27.9	9.2	12.0	1.7	11.5	22.6	5.4	12.9	9.8	131.6	7
Dwarf Freed, HC 2521	971	..	13.2	7.3	7.9	9.0	52.5	12.6	5.4	16.9	1.0	21.7	15.3	8.9	14.3	10.6	134.9	12
Coes	.....	..	6.1	7.4	10.0	3.7	27.7	9.6	18.4	12.2	1.2	25.8	16.0	12.8	12.6	10.6	118.9	12
Cheyenne	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	4.4	12.8	1.3	22.7	14.8	7.7	10.6	9.4	112.8	6
Kafir Selection 10	.....	5.3	.. ..	.. ..	..	2.7	31.2	10.0	18.5	.. ..	.. ..	.. ..	.. ..	.. ..	13.5	12.0	112.5	5
Freed, FC 9033	350	3.4	8.2	1.9	5.9	1.4	40.9	11.7	2.6	10.1	1.0	23.2	12.9	6.8	10.0	10.0	100.0	13
Dwarf Hegari	620	..	.. ..	.. ..	6.4	8.4	48.1	2.0	9.5	4.0	0	1.7	9.4	9.7	9.9	11.7	84.6	10
Otis Kafir	.....	8.3	1.5	6.8	2.7	26.6	3.6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	8.3	11.7	70.9	6
Combine varieties																		
Yellow Highland Selection	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	8.6	8.6	6.8	126.5	1
Pygmy Milo	1010	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	7.8	1.4	22.2	18.6	7.0	11.4	10.8	105.6	5
Sooner	917	..	.. ..	.. ..	..	8.2	37.1	10.3	3.5	10.9	1.2	21.5	21.0	7.1	13.4	12.3	108.9	9
Custer Milo	919	..	.. ..	.. ..	..	.. ..	45.9	4.4	1.1	6.6	0.5	.. ..	.. ..	.. ..	11.7	13.3	88.0	5
Day Milo	959	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	6.5	0.7	19.8	18.7	7.3	10.6	10.8	98.1	5
Colby 19	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	2.5	13.2	18.0	6.6	10.1	11.0	91.8	4
Colby 32	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	3.2	13.7	18.8	9.0	11.2	11.0	101.8	4
Colby Milo (Colby 31)	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	4.0	19.7	16.0	7.9	11.9	11.0	108.2	4
Colby 29	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	2.1	15.4	16.1	7.6	10.3	11.0	93.6	4
Colby 10	.....	..	.. ..	.. ..	..	.. ..	.. ..	.. ..	.. ..	.. ..	2.5	11.7	.. ..	.. ..	7.1	12.1	58.7	2
Wheatland Milo	918	..	11.4	0	..	1.4	.. ..	.. ..	0	7.2	0.6	0	11.1	3.5	3.9	7.6	51.3	9
Double Dwarf Yellow Milo	868	..	.. ..	0	..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0	1.9	0	1
Field corn	.....	..	6.2	12.9	6.2	13.9	25.1	2.3	11.4	10.2	2.8	9.5	9.7	1.5	9.3	10.6	87.7	12
Popcorn	.....	..	3.5	8.7	3.9	11.7	25.4	4.0	0.7	7.0	0	13.7	6.1	0	7.1	10.6	67.0	12

*Fifty-six pounds were used in calculating yields.

APPENDIX TABLE 9.—*Stover yields of grain sorghum varieties on fallow land, U. S. Dry-Land Field Station, Akron, Colo., 1927 to 1937.*

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Percentage of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grain varieties																
Tribune 14	973	.....	.....	.....	5159	2528	3245	2394	.....	.....	.....	.....	3332	4191	79.5	4
Kalo	902	.....	.....	4108	6924	2308	3399	2288	1452	.....	2764	2303	3206	3152	101.7	8
Extra Early Pink Selection	.....	.....	.....	3548	5725	2678	3465	2920	.....	.....	.....	1684	3337	3410	97.9	6
Modoc, HC 2520	905	.....	6203	4167	7557	3311	4374	3278	1925	3944	3655	2589	4100	3314	123.7	10
Early White Milo, FC 5886	480	3383	.....	2277	6391	1683	2178	2519	1908	3944	2690	2449	2942	3172	92.7	10
Dwarf Freed x Dwarf Feterita (971x867-2-1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	858	1477	1461	1265	3061	41.3	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	.....	.....	.....	.....	.....	.....	2317	1111	2376	2673	2244	2144	2788	76.9	5
Tribune 36	974	.....	.....	.....	4339	1446	4048	3355	1958	.....	.....	.....	3029	3662	82.7	5
Feterita x Milo-Kafir, HC 301	965	.....	.....	.....	6770	968	2592	1930	654	.....	.....	.....	2583	3662	70.5	5
Hybrid Dwarf Feterita	867	.....	2970	669	3839	592	1149	1767	770	.....	.....	.....	1679	3422	49.1	7
Dwarf Freed x Dwarf Feterita (971x867-1-4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	561	1147	1130	946	3061	30.9	3
Brown Manchu Kaoliang	328	2277	972	660	2216	357	1551	1393	1282	1232	1345	1522	1346	3279	41.0	11
Feterita	182-1	.....	3216	3631	5148	3030	2431	2288	1324	3350	2508	1906	2883	3314	87.0	10
Early Kalo	1009	.....	.....	.....	.....	.....	.....	.....	1236	3993	2674	2289	2548	2682	95.0	4
Freed x Kafir (71-20-23-F5)	.....	3625	.....	.....	3696	1710	3487	2849	.....	.....	.....	.....	3073	3939	78.0	5
Milo x Kafir, HC 382	.....	.....	3667	4850	9119	5307	4299	3533	2314	.....	.....	.....	4727	3422	138.1	7
Club Kafir	901	.....	.....	4315	6418	2453	4158	2508	1595	.....	.....	.....	3575	3269	109.4	6
Dwarf Yellow Milo	332	5445	4126	3482	7566	2392	2854	1771	994	3322	3376	3028	3445	3279	105.1	11
Sunrise Kafir	472	.....	.....	6188	9212	7612	5456	.....	.....	.....	.....	.....	7117	3714	191.6	4
Early Dwarf Milo (480-332-7-7)	.....	.....	.....	.....	2090	1232	1545	1848	.....	.....	.....	.....	1679	4191	40.1	4
Early Dawn Kafir, HC 2421	904	7590	4041	4546	9185	3916	4163	3377	1881	5858	5891	3982	4948	3279	150.9	11
Early Pink Kafir, FC 9089	432	1980	.....	4315	9344	4900	4649	3641	1870	6023	7261	2414	4740	3172	149.4	10
Kafirita	812	4208	3795	3416	.....	.....	.....	.....	.....	.....	.....	.....	3806	2858	133.2	3
Weskan, FC 9126	.....	7178	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7178	2929	245.1	1

APPENDIX TABLE 9.—(*Continued*).

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Chiltex	874	2888	4455	.....	.....	.....	.....	.....	.....	.....	.....	.....	3672	3635	101.0	2
Pink Freed, FC 9124	.....	1567	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1567	2929	53.5	1
Grohoma	920	.....	.....	.....	.....	3338	4609	2860	1771	5198	5239	3580	3799	2782	136.6	7
Ajax, FC 6620	968	.....	.....	.....	.....	3811	.....	.....	.....	.....	.....	.....	3811	2044	186.4	1
Premo	872	5199	3713	.....	.....	.....	.....	.....	.....	.....	.....	.....	4456	3635	122.6	2
Dual purpose varieties																
Highland Kafir	.....	.....	.....	3408	6259	2447	3751	2614	968	3416	2022	1631	2946	3199	92.1	9
Improved Coes	.....	2030	2721	1708	3789	1298	3223	2079	1192	2475	2145	1947	2237	3279	68.2	11
Greeley	972	.....	.....	.....	.....	2612	2948	3223	1819	4406	3202	2500	2959	2782	106.4	7
Dwarf Freed, HC 2521	971	4224	2649	3168	6030	2110	3151	2858	1364	3119	2228	2475	3036	3279	92.6	11
Coes	.....	3234	2789	2041	4133	1188	3747	1969	1283	3399	2690	2591	2640	3279	80.5	11
Cheyenne	.....	.....	.....	.....	.....	.....	3219	2988	1518	3911	2806	2821	2877	2905	99.0	6
Freed, FC 9033	350	2929	4340	1304	8019	2044	3487	3214	1544	3581	3210	2392	3279	3279	100.0	11
Kafir Selection 10	.....	.....	.....	1238	4647	1054	3487	.....	.....	.....	.....	.....	2607	3714	70.2	4
Dwarf Hegari	620	.....	3738	4249	8151	4515	5203	2750	2002	5528	6295	2239	4467	3314	134.8	10
Otis Kafir	.....	1469	2220	1601	3971	352	.....	.....	.....	.....	.....	.....	1923	3727	51.6	5
Combine varieties																
Yellow Highland Selection	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1815	1815	2392	75.9	1
Pygmy Milo	1010	.....	.....	.....	.....	.....	.....	1184	418	2145	1114	1073	1187	2788	42.6	5
Sooner Milo	917	.....	.....	2923	4147	1439	1712	1485	803	3696	2426	1568	2244	3199	70.1	9
Day Milo	959	.....	.....	.....	.....	.....	.....	1569	610	2558	1906	1403	1609	2788	57.7	5
Colby 19	.....	.....	.....	.....	.....	.....	.....	.....	720	2046	1230	631	1157	2682	43.1	4
Colby 32	.....	.....	.....	.....	.....	.....	.....	.....	671	2294	1576	1122	1416	2682	52.8	4
Colby Milo (Colby 31)	.....	.....	.....	.....	.....	.....	.....	.....	578	2162	991	734	1116	2682	41.6	4
Colby 29	.....	.....	.....	.....	.....	.....	.....	.....	935	2459	1576	1241	1553	2682	57.9	4
Colby 10	.....	.....	.....	.....	.....	.....	.....	.....	726	2244	.....	.....	1485	2563	57.9	2
Wheatland Milo	918	3135	.....	3401	.....	.....	1782	1771	1082	3135	2723	1677	2338	2708	86.3	8
Double Dwarf Yellow Milo	867	2458	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2458	2929	83.9	1
Custer Milo	.....	.....	.....	.....	5808	1870	1485	2068	803	.....	.....	.....	2407	3662	65.7	5

APPENDIX TABLE 10.—*Stover yields of grain sorghum varieties and corn on fallow and stubble land, U. S. Dry-Land Field Station, Akron, Colo., 1927 to 1937.*

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Per-cent-age of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Grain varieties																
Tribune 14	973	.....	.....	.....	5433	1641	2717	2206	.....	.....	.....	.....	2999	3509	85.5	4
Kalo	902	.....	.....	3126	6658	1902	2655	2072	726	.....	2550	1704	2674	2503	106.8	8
Extra Early Pink Selection	.....	.....	.....	2166	5040	1999	2701	2541	.....	.....	.....	1308	2626	2800	93.8	6
Modoc, HC 2520	905	.....	4381	3672	7117	2076	3557	2842	963	3829	2983	1968	3339	2704	123.5	10
Early White Milo, FC 5886	480	3602	.....	1593	6232	1055	1763	2305	954	3655	2162	1788	2511	2609	96.2	10
Dwarf Freed x Dwarf Feterita (971xS67-2-1)	.....	.....	.....	.....	.....	.....	.....	.....	.....	594	1160	1108	954	2526	37.8	3
Dwarf Feterita x Dwarf Freed, HC 336	.....	.....	.....	.....	.....	.....	.....	2037	556	2453	1906	1712	1733	2195	79.0	5
Tribune 36	974	.....	.....	.....	4194	1224	3234	2973	979	.....	.....	.....	2521	2962	85.1	5
Feterita x Milo-Kafir, HC 301	963	.....	.....	.....	6523	824	1879	1636	327	.....	.....	.....	2238	2962	75.6	5
Hybrid Dwarf Feterita	867	.....	2393	813	3365	453	852	1428	385	.....	.....	.....	1384	2781	49.8	7
Dwarf Freed x Dwarf Feterita (971xS67-1-4)	.....	.....	.....	.....	.....	.....	.....	.....	.....	792	986	833	870	2526	34.4	3
Manchu Brown Kaoliang	328	2194	1147	1254	1526	286	1221	1190	641	1265	1110	1095	1175	2696	43.6	11
Feterita	182-1	.....	2310	2740	4579	1800	1716	1981	662	3092	1667	1313	2186	2704	80.8	10
Early Kalo	1009	.....	.....	.....	.....	.....	.....	.....	618	3531	2303	1497	1987	2088	95.2	4
Freed x Kafir (71-20-23-F5)	.....	3310	.....	.....	2783	1201	2882	2475	.....	.....	.....	.....	2530	3332	75.9	5
Milo x Hegari, HC 382	.....	.....	2948	4430	9471	3182	2947	2944	1157	.....	.....	.....	3868	2781	139.1	7
Club Kafir	901	.....	.....	3284	6226	1722	2904	2033	798	.....	.....	.....	2828	2649	106.8	6
Dwarf Yellow Milo	332	5157	2929	2690	7468	1622	1678	1678	497	3333	2802	2069	2902	2696	107.6	11
Sunrise Kafir	472	.....	.....	4893	9306	4246	3757	.....	.....	.....	.....	.....	5551	3124	177.7	4
Early Dwarf Milo (480-332-7-7)	.....	.....	.....	.....	1744	797	1221	1617	.....	.....	.....	.....	1345	3509	38.3	4
Early Dawn Kafir, HC 2421	904	6889	3217	3527	8899	2283	3083	2723	941	5429	4060	2596	3968	2696	147.2	11
Early Pink Kafir, FC 9089	432	1609	.....	3581	9157	3052	3032	2907	935	5553	4580	2244	3665	2609	140.5	10
Kafirita	812	3796	2847	3235	.....	.....	.....	.....	.....	.....	.....	.....	3293	2426	135.7	3
Weskan, FC 9126	.....	6312	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6312	2622	240.7	1
Chiltex	874	2847	2640	.....	.....	.....	.....	.....	.....	.....	.....	.....	2744	3098	88.6	2

APPENDIX TABLE 10.—(*Continued*).

Variety	C. I. no.	Pounds per acre											Av. var. named	Av. Freed same years	Percentage of Freed	No. of years grown
		1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937				
Pink Freed, FC 9124	.....	1485	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	1485	2622	56.6	1
Grohoma	920	.....	.....	.....	....	1999	3161	2310	886	4951	3280	2733	2731	2134	128.0	7
Ajax, FC 6620	968	.....	.....	.....	.....	2121	.....	.....	.....	.....	.....	.....	2126	1492	142.5	1
Premo	873	3951	2806	.....	.....	.....	.....	.....	.....	.....	.....	.....	3379	3098	109.1	2
Dual purpose varieties																
Highland Kafir	.....	.....	.....	.....	2810	6204	1650	3021	2286	484	3070	1671	1273	2498	2608	95.8	9
Improved Coes	.....	1915	2153	1543	3696	1084	2528	2079	596	2121	1831	1387	1903	2696	70.6	11
Greeley	972	.....	.....	.....	.....	2236	2596	2789	910	3771	2699	1803	2401	2134	112.5	7
Dwarf Freed, HC 2521	971	4216	2327	2426	6033	1388	2371	2346	682	2995	1886	1487	2560	2696	95.0	11
Coes	.....	3259	2187	1609	3052	951	2869	1826	642	3053	1997	1718	2188	2696	81.2	11
Cheyenne	.....	.....	.....	.....	.....	.....	2611	2493	759	3474	2270	1922	2255	2241	100.6	6
Freed, FC 9033	350	2622	3573	1083	7450	1492	2470	2625	772	3449	2447	1682	2696	2696	100.0	11
Kafir Selection 10	.....	.....	.....	1218	4416	876	2666	.....	.....	.....	.....	.....	2294	3124	73.4	4
Dwarf Hegari	620	.....	2901	3412	7651	2379	3333	2426	1001	4654	3808	1602	3317	2704	122.7	10
Otis Kafir	.....	1197	2006	1213	3517	349	.....	.....	.....	.....	.....	.....	1656	3244	51.0	5
Combine varieties																
Yellow Highland Selection	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1362	1362	1682	81.0	1
Pygmy Milo	1010	.....	.....	.....	.....	.....	.....	1165	209	1857	1024	805	1012	2195	46.1	5
Sooner Milo	917	.....	.....	2481	4087	857	1332	1485	402	3119	1882	1172	1869	2608	71.7	9
Custer Milo	919	.....	.....	.....	5409	1295	1323	1716	402	.....	.....	.....	2029	2962	68.5	5
Day Milo	959	.....	.....	.....	.....	.....	.....	1329	305	2443	1457	1118	1330	2195	60.6	5
Colby 19	.....	.....	.....	.....	.....	.....	.....	.....	360	2071	1061	667	1040	2088	49.8	4
Colby 32	.....	.....	.....	.....	.....	.....	.....	.....	336	2038	1275	1020	1167	2088	55.9	4
Colby Milo (Colby 31)	.....	.....	.....	.....	.....	.....	.....	.....	289	1997	1061	795	1036	2088	49.6	4
Colby 29	.....	.....	.....	.....	.....	.....	.....	.....	468	2113	1263	1060	1226	2088	58.7	4
Colby 10	.....	.....	.....	.....	.....	.....	.....	.....	363	2236	.....	.....	1300	2111	61.6	2
Wheatland Milo	918	3053	.....	2608	.....	.....	1318	1587	541	2847	2146	1251	1919	2144	89.5	8
Double Dwarf Yellow Milo	868	2261	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2261	2622	86.2	1
Field Corn	.....	1469	1374	1364	1643	426	1925	1372	704	1568	1188	1540	1325	2696	49.1	11
Popcorn	.....	2195	1871	2486	2585	769	1757	2123	165	2459	1788	1659	1803	2696	66.9	11

Notes

Notes

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