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GROWING CORN AND THE GRAIN SORGHUMS IN ARIZONA

UNIVERSITY OF ARIZONA COLLEGE OF AGRICULTURE
EXTENSION SERVICE

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TUCSON ARIZONA

Cooperative Extension Work in Agriculture and Home Economics University of Arizona College of Agriculture and U S Department of Agriculture Cooperating

GROWING CORN AND THE GRAIN SORGHUMS IN ARIZONA

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INTRODUCTION

In a State where a great variety of climatic conditions result from differences in elevation and topography it is difficult to prepare cultural directions for a given crop that will apply absolutely to all the conditions under which it may be grown. However, it is believed that the fundamental principles underlying the successful growing of corn and the grain sorghums, given in this circular, are generally adapted to most parts of Arizona. In order that this information might be brought up to date, investigators, extension workers, and farmers in different parts of the State have been asked to make suggestions for changes in or additions to the circular as first issued. Credit for many helpful suggestions is due to Messrs. Nicholson, Paschall, Armstrong, Fillerup, Bates, Wood, Smith, Spaulding, Berg, and Hodgson.

SOILS

It is essential that the soil for corn or the grain sorghums be well-drained and free-working. The sorghums will give profitable results in lighter, more sandy or gravelly soils than are suited to corn. The heavier soils of a clay or adobe nature are not so well adapted to these crops unless they have been thoroughly loosened up by the addition of organic matter. Decayed organic matter or humus is of the utmost importance for best results. An ideal soil for these crops should be a loam composed of a mixture of sand, silt, clay, and humus, which make it easy to work, retentive of moisture, rich, and well drained; it should have a uniform texture to as great a depth as possible. Such soils as this are frequently found in river valleys or bottoms, washes, or lands subject to

overflow. New desert soils are apt to be deficient in humus and nitrogen, and, under irrigation, require more water than old cultivated land. *The richer the soil, the less water is required per pound of dry matter produced.*

PREPARATION

Semi-arid or arid soils are usually deficient in humus and nitrogen because these elements are rapidly destroyed by the heat and rays of the sun, decomposition, and black alkali. Hence, it is very necessary that steps be taken to insure a sufficient amount of nitrogen and humus in the soil. By plowing under the following materials the soil may be put in excellent shape for corn or the grain sorghums. Corral manure, old straw, alfalfa or bermuda sod, green manure crops, green weeds, and crop residues such as stubble or stalks. Any of the foregoing materials should be plowed under as deep as possible, say, 7 to 10 inches.

UNDER IRRIGATION

The fall or early winter is the best time to turn under alfalfa sod, as well as cowpeas, second-growth sorghum, and other summer crops. It should be allowed to make a good, full growth before plowing under. A sharp moldboard plow is necessary for this operation In southern Arizona a crop of wheat, barley, garbanzo, vetch, or Canada field peas may well intervene, as a winter crop, between the sod and the corn or sorghum crop.

A bermuda sod is more difficult to handle. Water should be withheld throughout the winter. In the spring after the winter rains have ceased, it should be turned, with a sharp moldboard plow running about four inches deep. After standing cloddy or in turf for about three weeks it should be disked thoroughly. About the middle of June, when the surface layer loosened by the previous cultivation is thoroughly dry, the ground should again be turned 8 or 10 inches deep. No further treatment should be necessary until about June 15, (at elevations under 3500 feet) at which time, if the work has been thoroughly done, the bermuda will have been practically all killed. The ground is now ready to be bordered and irrigated for corn or grain sorghums.

Green manure crops, stubble of headed wheat, etc., should be plowed under at least one month before planting so that the soil may get settled and decomposition commence. When these crops are heavy, rolling or dragging them down, followed by double-disking thoroughly, will make them much easier to turn under. Green manure crops, such as barley, rye, wheat, vetch, Canada or

Colorado field peas, cowpeas, amber cane, etc, may be grown as pasture or catch crops for plowing under. A very economical practice is to pasture such crops for a month or two before allowing them to grow up for turning under; the pasturing will help pay for the cost of the crop. A crop of green weeds is beneficial to the soil when plowed under. Frequently where the soil is badly infested with weed seeds it is desirable to irrigate lightly to sprout the seed, and, after the weeds have commenced to grow, plow them under.

Land which it is intended to irrigate should first be plowed. However, a light irrigation may first be given if the land is too hard to plow. If the soil is rather light and loose, it is not necessary to plow very deeply; sometimes such a soil may be sufficiently loosened by disking. The heavier types of soil should be plowed deeply (8 to 10 inches); in hard soils or tough sod disking before plowing is very desirable, subsoiling helps them to take the water better. The next steps depend on the method of preparatory irrigation that is to be used. In general terms, where irrigating water is scarce and expensive the furrow system is probably more economical; but where water is abundant and cheap the flooding system appears to be more advisable.

FURROW IRRIGATION

Strike out furrows 6 to 8 inches deep and 3 feet 6 inches apart with a "middle buster" or a double moldboard plow, or with two or more double moldboard plows attached to a two-row riding cultivator or a piece of joist, or with a home-made wooden furrow opener. Then run water slowly in the furrow or in successive installments until sufficient water has been absorbed by the soil. Planting may then proceed along the edges of the furrows.

FLOODING IN CHECKS

By this method certain pieces of ground are brought to a complete level and are surrounded by levees or borders 12 to 18 inches high. These inclosed areas are filled with water, which is then allowed to soak into the soil. This method is suited to very stiff, impenetrable soils upon which the water must be confined to make it soak in, and to the use of large heads of water on land which is naturally nearly level. It is also used on white akali land to drive the salt downward. With still higher borders (30 to 40 inches) this method is used for catching and holding flood waters.

FLOODING BETWEEN BORDERS

Irrigation by this method is in almost universal use in Arizona. This is due to the ease and economy with which medium or large

heads of water can be handled, and to the low cost of preparing the ground. In this method the water is confined between borders or low ridges which extend away from the supply ditch, usually in the direction of the greatest slope. These ridges may be formed with a buck scraper. After leveling, the scraper is run lightly at right angles to the slope. In each passage to and fro across the field, the scraper is dumped at the point where it is desired to build borders. This process is continued until enough soil has been collected to construct ridges of the desired height. After the rough formation of the ridges by the scraper, they may be finished into shape with a shovel, or, on a large scale, with a wooden V-shaped ridger. In this tool the apex of the V is left open and it is pulled astride the ridge, with the largest opening forward. In addition to the sideboards, boards on top will leave a ridge firmed and uniform on the top as well as the sides. The border ridges, when first made, are 10 to 12 inches high and 3 to 5 feet wide at the base. By the end of the first year, however, they have usually settled to 6 to 8 inches in height, which is ample for most situations.

The border ridges may also be formed quickly with a turning plow by throwing together the soil in a ridge with two or three furrows to the side. The ridges are then compacted by a V-drag, pulling the apex forward. The open furrows left are then filled by means of a disk or drag harrow. It is nearly impossible to do this satisfactorily, however, so that the borders next to the ridges are usually left slightly lower than the center. This causes the water to run faster at the sides than at the centers of the borders and results in uneven irrigation or waste of water. For these reasons the scraper is much to be preferred to the plow in the formation of borders, since with the former the land is left perfectly level between the ridges. The desirable length and width of these border strips or lands depend entirely upon the nature of the soil, the slope, and the head of water to be used. The larger the head of water, the broader and longer the lands may be. This method of irrigation is not often used with heads of water less than 2 cubic feet (80 miners' inches) per second. In such cases the lands should be narrow (25 to 30 feet) and the length not greater than 400 to 600 feet. With larger heads, amounting to 5 to 10 cubic feet per second, the lands may be 50 to 60 feet wide and the length 1,000 to 1,500 feet. On steep ground or stiff soil into which the water percolates slowly, the length of the borders may be greater than on the more open loams or sandy soils. Where the ground is very open or sandy much water will be wasted by percolation and lost in the underflow before

it can be carried to the end of long lands. This difficulty is overcome by using a larger head to force the water over the field more rapidly, by confining it in narrower lands and by shortening the length of the lands. The amount of slope allowed depends upon the nature of the soil. In the Yuma Valley, with a large head, muddy irrigating water, and some alkali, level lands are favored; the length should be not over 660 feet and the width varying from 50 feet for sandy soils to 150 feet for heavy soils. Light, easily permeable soils may have almost any slope below that which would cause washing. Heavy soils, on the other hand, should have less fall, so that the water will pass over them more slowly and have time to penetrate Very heavy and impenetrable soils should be made practically level and irrigated by check system with high borders, since by this means the water may be held on the ground until the soil is thoroughly saturated. Also, such soils may be made to take the water better by plowing under coarse manure, straw, stalks, or stubble, and by running a subsoil plow through every fourth furrow when plowing.

In using the flooding method it is essential that the soil be thoroughly saturated with moisture before a crop is planted. After flooding, disk the land about two inches deep and follow with a smoothing tooth harrow The land should then be ready for planting.

UNDER DRY-FARMING

In the districts where the rainfall and other climatic factors make it possible to raise crops by dry-farming methods, the soils are apt to have a fair amount of humus and new land frequently yields a good crop if there is sufficient moisture. Nevertheless, humus is a vital factor under these conditions and provision must be made for keeping up the supply. This may be done by plowing under corral manure, stubble or headed grain straw, stalks, weeds, and green crops. It may be possible on the larger dry farms to arrange to keep a portion of the farm in grass, sweet clover, or some other pasture or hay crop which may be broken up and cultivated every four or five years, another piece of land of similar size having been meanwhile seeded down. Also both winter and summer crops may be systematically sown, pastured, and turned under. It is not expected that two crops would be grown in any one year, but that a considerable area would be devoted to these pasture-green-manure crops. Thus half the cultivated area would one year be in winter or summer pasture-green-manure crops, and the other half in cultivated money and forage crops. All land not in crops

or pasture would be kept plowed or harrowed to catch as much rainfall as possible for the coming winter or summer season.

Therefore, for corn or the grain sorghums the land should be plowed deeply in the fall and left rough-plowed all winter. In the late winter or spring as soon as the weather becomes dryer, and the rains cease, the land should be disked and harrowed. Tough sod should be first plowed 3 to 4 inches deep, turning sod completely over; let stand for three or four months; then replow deeply and fit with disk and spike-tooth harrows. A mulch composed of small clods of soil ranging from the size of a pea to the size of an egg should be carefully maintained. Crusts (surface or subsurface) should be broken up so far as possible. As soon as danger of frost is over corn and the grain sorghums may be planted provided sufficient moisture is present to supply the crop until the beginning of the summer rains. Frequently the mistake is made of planting so early that the young plants are killed by late frosts; this wastes the soil moisture. A better practice would be to hold the moisture as well as possible by cultivation until after the latest probable frost, and then plant.

VARIETIES AND TIME OF PLANTING

A difference of a few hundred feet in elevation usually means that the local climatic conditions vary sufficiently to affect crop growth in Arizona. For this reason it is necessary to adopt varieties of crops and times of planting that will suit the local climatic conditions. It should be remembered, however, that elevation is not the only factor in climate, and that frequently "rainfall belts" are found in dry districts and "dry spots" in sections where the rainfall is ordinarily good. Hence, the following table is only an approximate guide of the best varieties and times of planting and harvesting for corn and the grain sorghums. The raising of crops without irrigation is not usually considered sure at elevations of less than 5,000 feet.

With special regard to varieties of corn and the grain sorghums it should be understood that most of the varieties which do well under Arizona conditions are far from perfect; in fact, they all can be greatly improved by methods entirely within the control of the farmer. By starting with a good variety and employing these methods intelligently and persistently, any farmer or member of a boys' corn club may greatly increase the yield and quality of these crops. These methods are discussed more in detail later on in this circular under the head of "Crop Improvement."

VARIETY, PLANTING, AND HARVESTING TABLE FOR CORN AND THE GRAIN SORGHUMS IN ARIZONA

Elevation	Crop	Variety	Days for Maturity	Time of planting	Pounds of seed per acre	Time of harvesting	Farming methods
Under 3,500 feet	Corn	Sacaton June	90	June 15 to Aug. 1.	8	Sept. 15 to Nov. 30.	Irrigation.
		Hickory King	100				
		Hammond's Select	100				
		Navajo Dent	90				
3,500 to 5,000 feet	Corn	Sacaton June	90	April 20 to July 10.	8	Aug. 15 to Oct. 30.	Irrigation.
		Hickory King	100		4		Dry-farming.
		White Wonder	100				
		Navajo Dent	90				
5,000 to 6,500 feet	Corn	Navajo Flint	90	May 5 to June 15.	8	Sept. 1 to Oct. 15.	Irrigation.
		Bloody Butcher	to		4–6		Dry-farming.
		Colorado Yellow	100				
		White Wonder					
6,500 to 8,000 feet	Corn	Navajo Flint	90 to	May 25 to June 10.	8	September	Irrigation.
		Bloody Butcher	100		4–6		Dry-farming.
		Minnesota No. 13					
		Australian White Flint					
Under 3,500 feet	Feterita	Dwarf	90	Apr. 1 to Aug. 15.	3–4	July 15 to Nov. 15.	Irrigation.
					1–2		Dry-farming.
	Kafir	Dwarf Blackhull	120	Apr. 1 to July 1.			
	Milo	Dwarf Yellow	100	Apr. 1 to Aug. 1.			

VARIETY, PLANTING AND HARVESTING TIME FOR CORN AND THE GRAIN SORGHUMS IN ARIZONA—Continued.

Elevation	Crop	Variety	Days for Maturity	Time of planting	Pounds of seed per acre	Time of harvesting	Farming methods
3,500 to 5,000 feet. ..	Feterita. .	Dwarf.....	90	April 20 to July 15	2–4	Aug. 1 to Oct 15.	Irrigation.
	Kafir.....	Dwarf Blackhull. .	120	April 20 to June 15.	1–3		Dry-farming.
	Milo	Dwarf Yellow.....	100	April 20 to July 5			
5,000 to 6,500 feet ..	Feterita. ..	Dwarf	90	May 5 to July 1.	2–4	Aug 15 to Oct. 1.	Irrigation.
	Kafir... ..	Dwarf Blackhull.	120	May 1 to June 1.	1–3		Dry-farming
	Milo.....	Dwarf Yellow....	100	May 5 to June 20.			
6,500 to 8,000 feet. .	Feterita* .	Dwarf	90	June 5 to	2–4	Sept 5 to	Irrigation.
	Milo* .. .	Dwarf Yellow	100	June 15	1–3	Sept. 15.	Dry-farming.

* Growing season too cool tor these crops at the higher elevations

PLANTING

UNDER IRRIGATION

Corn and the grain sorghums are planted either by hand or by machine. In planting by hand two methods are used, depending on whether the preparatory irrigation has been by flooding or furrows. After plowing as soon as the ground is dry enough it should be harrowed or disked and a good mulch about 3 inches deep formed. It may then be laid off into furrows about 42 inches apart and the seeds dropped in these furrows in the moist soil and covered about 2 inches deep, using a small double-shovel plow. In the case of furrow irrigation it may be best to freshen the furrow by running a small shovel plow in it just before the seed is dropped. It may then be covered as already described. Care should be taken that the planting follow the opening or irrigating of the furrows closely enough so that the soil in the furrows does not dry out before the seed is dropped and covered.

Either a one or two- row corn planter may be used for planting corn and the grain sorghums. For the sorghums a special plate with holes to fit the seed must be used; if necessary a blank plate may be bored with holes of the proper size. Also, the sorghums may be sown with a grain drill by stopping up enough tubes to make the rows the right distance apart; the drill could not well be used, however, when planting along the edges of furrows. In planting on level mulched ground after flood irrigation, the planter or drill should penetrate the loose dry mulch into the moist soil, the soil should be firmed just over the seed by a press-wheel, and a mulch about 2 inches should be left over the compacted soil. When planting in furrows in irrigated land the seed should be planted on the edge of the furrows just above the water line but *in moist soil*. The furrows are left for the first irrigation a few days later.

The distance apart of the seed in the row varies with the crop. Corn should be dropped one seed every 18 to 24 inches, feterita every 6 to 8 inches, kafir every 12 to 15 inches, and milo every 8 to 10 inches.

UNDER DRY-FARMING

In soil which has a mulch with a moist layer beneath, practically the same methods of planting as already mentioned are used. Under dry-farming conditions the most important thing is *to get the seed into moist soil.* Oftentimes it may be necessary to plant as deep as six inches to do this. However, the seed would not come up through

six inches of soil, so that "listing" must be resorted to This consists in opening a furrow down into moist soil in which the seed is immediately planted and covered with *only about three inches of soil*, thus leaving a depression which is gradually filled in as the crop grows up. A regular lister or listing planter or a hoe- or double-disk drill without coverers may be employed for this operation.

The distance apart in the row should be for corn, one kernel every 24 inches or two kernels every 42 inches For planting 42 inches by 42 inches a check-row planter could be used; this method of planting would enable the farmer to cultivate in both directions, thus keeping the land free from weeds and well cultivated. Feterita should be planted one grain every 6 to 10 inches, milo every 8 to 12 inches, and kafir every 15 to 20 inches. When the moisture is deficient thick planting will tend to produce stalk and leaf but little or no grain. The lighter the rainfall the thinner the stand should be.

CULTIVATING AND IRRIGATING

Before the corn or grain sorghums come through the ground the soil may be kept loose by cultivating with a spike-tooth harrow with the teeth set slanting backwards; this can not be done in listed or furrowed land. After the crop is up 2 to 4 inches, the harrow may still be used, but a flexible toothed weeder is better. The crop should not be irrigated until moisture in the soil is so deficient that it is necessary. There is no regular time to irrigate. Furrow irrigated land will need irrigating long before land which has been thoroughly flood irrigated. Irrigation water should be applied in the furrows along which the crop was planted or in temporary furrows opened in the middles of the rows

In the case of listed planting which has been rained on, with consequent surface crust before the plants emerge, it is quite necessary to break the crust. This may be done by drawing a medium weight fence post, into which about two dozen 20-penny spikes have been driven part way, through the listed furrow. Two such posts may be fastened together by means of a crossbar and chains or baling wire, and the animal driven in the ridge between the rows, thus covering two rows at a time. In case of level planting the crust may be broken by drawing a steel harrow with teeth set aslant over the field, or a disk harrow with the teeth set almost straight may be used.

Cultivation kills weeds, conserves moisture, admits air to the roots of the crop, stimulates beneficial soil bacteria and the formation of plant-food, and makes the soil "take water" better.

Clean cultivation also leaves the land in shape to be sown to small grains or other winter crops after the corn or grain sorghum is harvested and the land disked and harrowed. Listed crops must be cultivated carefully, using fenders on the cultivator, until the furrows are filled in about the growing crop. Cultivate level until the crop is "laid by," then leave a depression between the rows for late irrigation. After the plants are about 4 inches high it will be necessary to use a cultivator. There is no set rule as to how often to cultivate. Cultivate after every rain or irrigation and whenever the surface or subsurface crusts form. Never let the weeds get more than one-fourth inch high. Keep the soil loose to a depth of 2½ to 3 inches under irrigation and 3 to 4 inches under dry-farming. Two types of cultivators are recommended: (1) for small fields use the 12 or 14 tooth harrow-cultivator drawn by one horse, this may also be used for late cultivation after the crop is too high to permit the use of a riding cultivator. (2) For large areas use the two-row pivot wheel riding cultivator drawn by two horses. These machines should be equipped with nine 1¼-inch teeth per gang, or 18 teeth in all; they also have double moldboard plow attachments that can be used for opening irrigating furrows between the rows. For very weedy fields such as are infested with the silver-leaf horse nettle, wild potato (Hoffmanseggia), or other bad perennial weeds, buzzard-wing sweeps or shop-made knife blades attached to the cultivator shanks will do the most satisfactory work. These crops usually need irrigating when they are in bloom. This is particularly essential for corn, since the local humidity caused by irrigation prevents the pollen and silk from drying out, thus helping to insure fertilization. Light soils generally have to be irrigated more frequently than heavy soils.

HARVESTING

Corn may be cut by hand, shocked, cured, and later husked, or the ears may be snapped by hand from the stalks when ripe. When grown on a large scale corn may be cut economically with a corn binder and husked and shredded with a husker-shredder. Grain sorghum heads may be cut by hand, dried and later threshed. When uniform in height and not too high the grain sorghums may be headed with a grain header or with a home-made outfit consisting of a knife mounted on a wagon-box. Another satisfactory home-made implement is the corn sled, which any blacksmith can construct for from $8 to $12. When these crops are being cut for silage, a corn binder may well be used.

CROP IMPROVEMENT

CORN

Seed selection.—The time to select seed is just before the crop is harvested. This must be done in the field, so that the character of the cornstalk as well as of the ear or head can be judged. Two good ears to the stalk will make a yield of 100 bushels per acre where the rows are 3½ feet apart and the plants 18 inches in the row, provided there is a perfect stand. In order to resist the ear worm and smut the shuck should be thick, tough, and very closely fitting, especially over the tip of the ear. The ear should be large and drooping; if two or more be present, they should be nearly equal in size. A stalk with one large ear and a nubbin is objectionable. Stalks should be neither too tall nor too short; ears should be borne about waist-high. Communities should adopt one standard variety. Pick desirable ears into a sack carried for the purpose.

SILAGE

Corn and the grain sorghums are the best crops that can be grown in Arizona for the silo. Live-stock growing combined with crop production will make the most profitable type of farming for our State. The silo is indispensable where stock is grown, and every farmer should make provisions for the construction of a silo if he has not already done so. In growing these crops for silage the same methods of culture can be followed as recommended for grain production, with this difference, the seeding should be, under irrigated conditions, corn dropped one seed every 12 to 14 inches, feterita every 4 to 6 inches, kafir every 6 to 8 inches and milo every 6 inches. Under dry-farming the moisture is the deciding factor and it is not wise to plant closer than recommended for grain production. In growing cane or sudan grass for the silo the seed can be drilled in, where the water supply is ample, and harvested with a grain or corn binder. The best silage is made from a crop with some grain in it, so an endeavor should be made to produce as much stalk and leaves as possible with as much grain as can be developed.

When cut for the silo, the crop should be harvested before the stalks begin to discolor with much ripening or drought. In case a frost hits the crop it should be cut at once and placed in the silo. The secret of good silage is to cut it fine and pack it WELL in the silo. In packing silage, keep the center higher than the sides. The silage will mold if air is allowed to get into the mass,

hence it must be well packed by tramping, and if too dry to pack well, water should be added in such amount as to allow it to pack solidly and not leak. For cattle and sheep there is no roughage better than good silage, and horses have been fed silage with very good results, even at a time when they were working hard in spring work.

EAR OR HEAD-TO-ROW METHOD OF SEED BREEDING

The selection of seed each year as above described will serve to maintain the standard of purity in a variety and will also bring about a gradual improvement if followed persistently with an ideal type always kept in mind. More rapid improvement, however, can be made with either corn or the grain sorghums by using the ear or head-to-row method. Select, in the field, one hundred ears or heads; store them over winter where they will dry out thoroughly and be protected from birds and mice. In the spring, before the planting season, secure one hundred paper bags and shell off each ear or head separately into the bags. These may then be placed in a basket and taken to the field for planting. There will be ample seed in each bag to plant one row across an acre. A convenient method is to have a large sack for surplus seed at the end of each row. On starting on a "round," two bags of seed are taken up, one being used for planting on the way out and the other rolled up and carried in the pocket to plant the next row back. At each end the surplus seed is discarded into the large sacks. In practical breeding no label stakes or row numbers are necessary. After the crop is planted cultivation proceeds in the usual manner.

As the ripening season approaches, the characters and peculiarities of the different rows should be closely studied, and from the ten best rows the ten best ears or heads from each should be selected to form the basis of the next year's row test. The remainder of the good ears or heads from these ten selected rows should be used for seed in the general field planting of the crop in question.

In preserving the one hundred ears or heads selected each year, no effort should be made to keep the ten ears or heads selected from a given parent row together. In fact it is better in the following years' planting not to have related rows close together; however, indiscriminate planting will sufficiently take care of this matter without any conscious effort on the part of the farmer.

If as many as one hundred rows are planted each year, and not more than ten selections are made from any given row in any

year, breeding by the above method may be carried on for at least ten years without danger of too close inbreeding.

SCORE CARD FOR CORN

(1) Trueness to type 10

All of the ears of an exhibit should be of the same variety and must be uniform in type, size, length, color, etc. When a single ear is being judged under a variety name, it should conform to the type of that variety.

(2) Shape of ear. 5

The ideal ear should be as nearly cylindrical as possible Short-eared varieties admit of more visible taper than long-eared sorts

(3) Purity of color in grain and cob 5

All cobs in an exhibit should be of the same color and true to the type of the variety exhibited. Color of grain should be uniform throughout the ear and between different ears of the same exhibit. In the case of "Strawberry" varieties of mixed colored popcorns and native Indian corns, the distribution of the vari-colored grains on the cob should be uniform throughout the different ears of the exhibit

(4) Tip of ear (resistance to worms and mould)..... 10

The tip of the ears should be well and evenly filled with no worm-eaten, decayed, or partially developed grains If the point of the cob protrudes beyond the grain, it should be clean and whole (not broken or cut off), with the grains ending abruptly (not diminishing gradually in size) and evenly around the tip.

(5) Butt of ears..... 5

Should be even, well filled, and abrupt.

(6) Uniformity of kernels..... 5

Kernels should be uniform in size, shape, and arrangement on the cob.

(7) Shape of kernels..... 10

The face and back of the grains should be parallel and the sides should taper toward the lower end just enough so that a prolongation of these sides would meet at the center of the cob.

(8) Length of ear..... 10

The ear should be as long as possible, provided a diameter consistent with the type-shape of the variety is maintained.

(9) Circumference of ear 10

The circumference of the ear should be as great as possible, provided a length consistent with the type-shape of the variety is maintained.

(10) Furrows between rows 10

Furrows between rows should be as narrow as possible.

(11) Space between kernels at cob 10

Grains should fit compactly together throughout the ear

(12) Length of grain 10

Grain should be as long as possible

Total 100

After the full grade is made up, subtract four times the estimated percentage of unsound grains in the exhibit from it and give the remainder as the final grade of the exhibit.

PRESERVATION OF SEED

Hang up the ears with binder twine or wire hangers in a dry place where they can not freeze or be attacked by mice, rats, or insects. The ears should be left until thoroughly dry. They should be tested before planting.

TESTING SEED CORN

Only good ears should be used for testing. A good ear of corn should be of about the length and diameter which are typical of the variety to which it belongs. In general the rows should be straight, even, and close together. Ear should be slightly tapering. Kernels should be uniform, long, close-fitting and tight on the cob; should have large proportion of germ. Butts should be well filled, and it is desirable but not essential that tips be well covered. A large proportion of grain to cob is desirable. Uniformity of ears and grain is of great importance.

Every ear should be tested as follows: A box 3 inches deep by 10 inches long by 5 inches wide, inside measurement, is secured or made and a piece of white flannel (which should be previously boiled) is cut to fit the box; this piece is then ruled off into 2-inch squares, making 50 squares; these squares should be numbered consecutively. About two inches of sawdust or sand should then be placed in the box with the ruled piece of flannel on top. Moisten the sawdust thoroughly when ready to proceed. The ears of corn to be tested should be numbered consecutively by fastening a slip

of paper to the butt of each ear with a nail. From different portions of each ear are taken six kernels which are placed in the square with the same number as the ear. When all the squares are filled cover with another layer of flannel. Keep the lower layers moist but not wet and leave the box in a warm place (80 degrees F.) in the house. After six days if every grain in each square has not germinated strongly, discard the ears represented by those squares All the other ears are saved for planting. Shell seed ears by hand, throwing away the kernels taken from the butts and tips. The seed saved should be uniform in size and shape so that it will pass evenly through a corn planter. Fourteen to twenty-eight ears will be required to plant an acre, according to the ear size of the variety and distance apart of planting. A "rag-doll" or a dinner-plate tester may also be used for testing seed.

GRAIN SORGHUMS

Grain sorghum stalks and heads should be uniform in height, all conforming to the standard chosen, 4 to 5 feet is high enough. In fact, the shorter the stalks are the better, so long as the size of head is not reduced, since a header may then be used for harvesting; uniformity of height is of extreme importance for the same reason. The ideal is one stalk and head per plant; stalks should have as few leaves as possible; straight necks are essential; branches are undesirable. Heads should be as long and as big around as can be found. The head standards for the various sorghums are: Kafir, length 10 to 14 inches; weight at least 5 to 6 ounces; milo, length 6 to 8 inches; weight at least 3 to 4 ounces; feterita, length 7 to 9 inches; weight at least 3 to 4 ounces. These standards should be minimum; the larger and heavier the heads, the better. In general, heads should be well filled at tips and butts. Heads should be entirely clear of "boot." Early maturity and uniformity of ripening are other desirable qualities. The various kinds of sorghums cross easily; hence different varieties should be at least 100 yards apart. Communities should adopt one standard variety. Pick the desirable heads into a sack carried for the puspose. (See "Ear-to-row Method of Seed Breeding," under "Corn.")

PRESERVATION OF SEED

Hang up the heads with binder twine in a dry place where they can not freeze or be attacked by mice, rats, or insects. The heads should be left until thoroughly dry, tested, and ready to plant. Before planting all grain sorghum seed should be treated with formalin

to prevent smut. Directions for smut treatment are given in Timely Hint No. 97, published by the University of Arizona Agricultural Experiment Station.

TESTING SEED OF GRAIN SORGHUMS.

The same box as was constructed for testing seed corn may be used. The procedure, moreover, is the same, except that since the grains of sorghum are so much smaller than those of corn, a larger number of seeds can be tested in each square. Ten from each head is a convenient number. Four to six pounds of seed will be required to plant an acre, according to the size of the variety and the distance apart of planting.

SCORE CARD FOR GRAIN SORGHUMS

(1) Conformity to type..... 10

(a) Considered as an exhibit of several heads, this point should cover uniformity in size and shape as well as conformity to the ideal type of the variety.

(b) Considered in the grading of a single head, it covers conformity to the ideal type of the variety Size should be as great as possible.

(2) Structure..... 10

Center stem should be long, with the greatest possible number of joints and side branches

(3) Length..... 10

Should be as long as possible consistent with compactness and proportionate thickness

(4) Diameter..... 10

The diameter should be as great as possible consistent with compactness. Large diameter resulting from weakness of side branches and consequent looseness of structure should be discounted.

(5) Compactness..... 10

The side branches should be densely crowded with grain, should be strong enough to hold the grain up without drooping and spreading apart, and should be close enough together to form a compact, solid head.

(6) Tendency to shatter..... 10

The glumes should sufficiently closely invest the grains as to hold them in place without shattering under ordinary handling, but the chaff should not be so tight as to remain clinging to the seed after they are threshed.

(7) Size of seed 15
Seed should be as large and plump as possible.

(8) Tip and base. 10
Tip and base should be abrupt or well rounded (not tapering)

(9) Color 5
Color should be uniform throughout the head.

(10) Maturing..... 10
The grains should be thoroughly developed and matured throughout the head from butt to tip.

Total 100

(11) Soundness. 100
This point is given a negative value. Perfectly sound grain being graded —0, i. e., with nothing deducted from its positive score. Partially unsound (mouldy or decayed) heads should be given a minus grade whose value is at least four times the percentage of the unsound grain on the head. Thus a head which has a positive grade of 80 and on which an estimated 2% of the seed are unsound would be graded as follows:

Positive grade..... 80%

4 times 2 per cent unsound equals..... 8%

Final grade..... 72%

CROP STANDARDIZATION

One of the most potent means for keeping crops pure and thus hastening their improvement is what is known as crop standardization. The introduction of pure-bred seed is futile so long as the pollen from inferior varieties grown nearby is allowed to contaminate the improved variety. Yet this is what actually is happening in many Arizona communities. Both corn and the grain sorghums are wind-pollenated, and different varieties of corn will readily cross with each other, as will *all* the sorghums (including Johnson grass), if they are within one hundred yards of each other, Thus Farmer A may be trying to grow better corn by introducing a pure-bred, high-yielding, well-adapted variety and improving it still further by seed selection. But Farmers B and C, his neighbors, continue to raise a poor, low-yielding scrub corn which constantly produces an abundance of pollen that soon spoils the pedigreed corn by cross-fertilization. In this way poor farmers frequently nullify the

efforts of good, progressive farmers. Again, the very presence of inferior seed in the community is a menace, because there are always certain farmers who will buy cheap seed, cheapness being the only quality which appeals to them. From the marketing standpoint it is essential that any community which is going to sell seed or grain be able to ship a uniform product. Buyers do not want white and yellow corn or kafir and milo mixed. Seed *must be pure* beyond any doubt. Hence it will be clearly seen that it is a dollars-and-cents business proposition for communities, and even counties, where possible, to adopt standard varieties of corn and the grain sorghums for general planting.

HOW TO ADOPT STANDARD CROPS

The first step in crop standardization is to determine which variety or varieties are best adapted to the local conditions. The most important conditions to be considered are those of climate, soil, pests, labor, transportation, and market. Thus climate determines the source of moisture, whether dry-farming or irrigation, the length of the growing season, the temperature, and the humidity; the soil may be best adapted to certain special varieties; insect and disease pests will not permit any but resistant varieties to thrive; labor determines whether hand or machine work shall be done and may limit the improvement of the variety by selection; transportation may make it more profitable to feed than to sell the grain or the whole plant; and the market requirements may limit the kinds that may be sold. For instance, the climate at less than 3,500 feet elevation requires a quick-maturing corn which will make its growth in about 90 days after July 1 and will pollenate in spite of heat and dryness. Resistance to ear worms and smut will overcome pest limitations, and a white corn instead of a yellow meets the requirements of the Mexican trade. Many of the qualities of certain varieties, including high yield and manner of growth, can not be determined except by careful experiments, and often special new varieties have to be produced for special conditions by plant breeders. So it is evident that the farmers should secure the advice of experts before selecting a crop variety for standardization.

Even though a crop variety may be deemed best for a certain locality, it is difficult to secure its general adoption because of the extreme individualism of the farmers. The best way to accomplish this is undoubtedly through the local Farm Improvement Associations and other farmers' organizations. These organizations may

vote to adopt certain crop varieties as standards and may get their members to all agree to grow no others. Once this has been done it is comparatively easy to get new settlers to adopt the same varieties. In Arizona in new communities still in their formative period it should not be difficult to have standard varieties of corn and the grain sorghums adopted in each.