UNIVERSITY OF IDAHO

AGRICULTURAL EXPERIMENT STATION

Department of Agronomy

NOVEMBER 1944 CIRCULAR NO. 97

Idaho Amber Sorgo

K. H. KLAGES*

Kinds of Sorghums and Uses

THE sorghums are grouped into four classes on the basis of their plant and seed characteristics and with regard to the uses made of them. These classes are the grain sorghums, the sweet sorghums, the grass sorghums, and broomcorn.

The grain sorghums are grown primarily for grain which may be used either for feed, as in the United States, or for human food as in Asia and Africa. At times, the grain sorghums may be used for the production of forage. In that event, they are most commonly utilized as silage; however, the sweet sorghums are generally superior to the grain sorghums for that purpose. The grain sorghums generally have rather heavy, dry, pithy stems, and as a whole larger, softer, and more palatable seeds than the sweet sorghums. The seeds of the grain sorghums are regarded as a valuable substitute for corn in the feeding of all farm animals.

The sweet sorghums, or sorgos, are grown for forage and for the manufacture of sirup. This group of sorghums is also commonly referred to under the name of "cane." The sorgos have sweet, juicy, and often rather tall, slender stems. The seeds are usually smaller and harder than those of the grain sorghums. They also frequently have a rather bitter taste which interferes with their palatability. The seeds of some varieties are so hard that a rather high percentage of them pass through animals undigested. The sorgos are ideally adapted for use as silage or may be fed directly as fodder after they are properly dried.

The grass sorghums, of which Sudan grass is the most important, are grown for the production of hay and pasturage. Sudan grass has relatively fine leafy stems and much the same habit of growth as the cereals. It is often used as an emergency or supplementary forage crop.

Broomcorn is grown primarily for the "brush" used in the manufacture of brooms.

Climatic Requirements of the Sorghums

The sorghums are of southern origin. All of them demand fairly high growing season temperatures. This more than any other factor limits

(———)

*Agronomist, Idaho Agricultural Experiment Station

their use in Idaho. They can be expected to become a crop of importance only in locations favored with high summer temperatures as at low elevations in parts of southern Idaho. Sudan grass can be grown under lower temperature conditions than the other sorghums; however, even this more tolerant plant cannot successfully compete with such cereals as oats and barley as a hay crop in northern Idaho or in the upper Snake River Valley, except in especially favored locations. The grain sorghums demand higher temperatures than corn. This limits their utilization to areas in the southwestern part of the state with low elevations where sufficient moisture is not available for the safe production of corn. Where moisture is available, corn is the more desirable grain crop. The production of sorghums for grain demands a longer growing season and higher temperatures in September than where they are intended for the production of forage. Where forage is the objective, it is best to grow the sorgos rather than the grain sorghums.

The outstanding characteristic of the sorghums in relation to climatic adaptation is their relatively high resistance to drought. This makes them an ideal crop for areas where low availability of moisture can be expected towards the end of the growing season. The sorghums may be grown to advantage to augment forage supplies in south-central and southwestern Idaho in areas where, or during years when water for irrigation may be low.

Corn and the sorghums have similar habits of growth and are produced under comparable cultural conditions. The main difference between the two crops is that corn has a definite critical period with regard to both moisture and temperature relationships at the time of tasseling. While the yields of sorghums are also influenced to a marked degree by unfavorable climatic conditions at flowering, the sorghums have one decided advantage over corn in that they are not forced ahead in their development during periods unfavorable to growth. The ability of the sorghums to remain for some weeks in an almost quiescent or semi-dormant stage when confronted with conditions unfavorable to growth is unique in the behavior of plants and of great value to the crop. With improvement in growing conditions, a vigorous growth rate is resumed, unless, of course, the drought or some other catastrophe was too severe. Thus the sorghums may make at least a partial crop under conditions of interrupted growth, under which a corn crop would be a complete failure.

The Sorghums as a Crop in Idaho

The grain sorghums do not have a place in Idaho agriculture. Their temperature requirements are too high to recommend their production except in a few isolated areas. Even in these areas, they should come up for consideration only where and when the amount of moisture is not sufficient for the production of corn. Under ordinary conditions the grain sorghums cannot compete successfully with either the cereals or corn as producers of feed grain.

The sorgos can be grown to advantage as a forage crop in low, protected, high-temperature areas in south-central and southwestern Idaho. They should be regarded as an emergency rather than as a standard crop

in most areas. The sorgos would compete with corn as producers of coarse forage. The merits of sorgo over corn in dry areas or in areas short of irrigation water during the summer and early fall months have already been pointed out. Corn should be regarded as a more desirable crop than the sorgos in areas where sufficient moisture is available for its safe production. However, under dry conditions, the sorgos make a very acceptable forage crop provided, of course, that temperatures are high enough for their growth requirements.

Sudan grass has a definite place in the agriculture of Idaho in the warmer areas of the state. Like the other sorghums, it should also be regarded as an emergency and supplementary crop. Alfalfa and in places alfalfa-grass mixtures make for the most economical and the greatest production of hay. Likewise, permanent grass and mixed pastures can be expected to produce the most reliable and economical pasture returns. However, occasionally, it is desirable to produce more hay than can be anticipated from meadows seeded to perennial plants. Also it may be found advisable to supplement permanent pastures. It is under these conditions that Sudan grass can be used to advantage either as a hay or pasture crop. The temperature limitations of all the sorghums also apply to Sudan grass, even though Sudan grass is less specific in its temperature requirements. The crop has not been especially successful in the upper Snake River Valley or in northern Idaho. In these areas, the amount of pasturage realized from Sudan grass seedings is low and the cereals are superior to it as producers of hay.

Varieties of Sorgos

A large number of varieties are available. Due to temperature limitations, the choice of varieties must be confined to early maturing types. The Early Amber sorgos come in for primary consideration. In selecting a variety, it is necessary to consider not only the total yield to be attained but also the quality of the feed produced. Medium and late maturing varieties produce a forage of low quality under Idaho conditions. There is also more danger of sorghum or prussic acid poisoning with the utilization of late than with early maturing varieties.

Development of Idaho Amber Sorgo

Five varieties of grain and sweet sorghums were grown on the University Farm at Moscow in 1940. Forty heads of Feterita and 80 of a commercial Early Amber sorgo were selected, selfed, and saved for planting. These 120 head selections together with rows of 31 varieties of grain and sweet sorghums were grown in 1941. None of the Feterita selections or any of the generally considered early grain sorghums such as the milos and kafirs produced viable seed. Of the 31 varieties planted, Fremont sorgo and Dakota Amber were the only ones that produced fair heads and seeds; in addition, partial seed crops were produced by Red Amber sorgo and Low Acid Dakota Amber No. 39-30-S. The 80 head rows of Early Amber varied widely in their habits of growth, height of plants, leafiness, head types, resistance to lodging, and seed-producing abilities. Any late maturing and otherwise undesirable lines were dis-

carded. Heads of 12 of the most promising rows were selfed and saved for seed. The same procedure was followed with the 31 varieties first planted in 1941 that were not too late to produce seed. In all, 125 selections were made in 1941. These were grown in a head row yield test in 1942. After discarding undesirable types, yield data were obtained on 30 selections which were tested again in 1943. In 1943 this number was again reduced on the basis of plant characteristics. The forage and seed yields of the remaining 16 selections for the years 1942 and 1943 are presented in Table 1. Selection 83-39 produced the highest forage and head yields. This selection has been designated as Idaho Amber.

Idaho Amber has been selected for yield, uniformity, standing ability, and quality of forage. Quality is evaluated on the basis of leafiness and ability to produce an abundance of well-filled heads. The stems of Idaho Amber are medium in height, averaging 69 inches in 1943, sturdy, resistant to lodging, and leafy. The heads are fairly compact and the seeds are large for a sweet sorghum; they do, however, in common with other sorgos have a slightly bitter taste.

Selection 5-71 from Dakota Amber produced higher head yields than Idaho Amber but failed to come up to the Idaho Amber in forage production. This particular selection was also less resistant to lodging than the Idaho Amber. Lack of ability to stand erect in the field is a common fault of the Amber sorgos. Commercial Early Ambers are characterized by rather tall slender stems which have a tendency to bend over and even to break off at the surface of the soil thus making it difficult to harvest the crop. This fault has been corrected in the Idaho Amber variety.

The Idaho Amber was not the earliest of the selections listed in Table 1. It was fully headed on August 26, as compared to August 18 for the earliest selections grown in 1943. The extremely early selections were poor forage producers. It is felt that while the Idaho Amber is not the earliest type that could have been selected; it is nevertheless early enough to be produced in any of the areas of Idaho adapted to sorghum production. The yielding ability and quality of the crop more than compensate for the fact that it is slightly later than some of the selections tested. The fact that it was able to produce seed in every one of the 5 years that it was grown on the University Farm at Moscow, in an area not adapted to sorghum seed production, gives evidence of its earliness.

Seed of Idaho Amber was increased on the University Farm in 1944 in sufficient quantity to supply the needs of sorghum producers in the state.

Table 1.—Air dry forage and head yields of sorghum selections grown on the University Farm in 1942 and 1943

Selection number	Source of original seed	Forage yields in tons per acre 1942	1943	Av.	Head yields in pounds per acre 1942	1943	Av.
83-39[1]	Early Amber	5.26	9.09	7.18	4756	1430	3039
83-108	" "	4.80	7.92	6.36	3740	1227	2484
44-88	" "	4.25	8.43	6.34	4040	1043	2542
8-83	Fremont Sorgo	4.80	7.88	6.34	3151	917	2034
2-77	" "	4.44	8.06	6.25	2297	879	1583
83-109	Early Amber	4.82	7.23	6.03	4118	1043	2581
68-104	" "	4.58	6.96	5.77	4434	1190	2812
60-22	" "	4.72	6.67	5.70	3697	970	2334
100-56	" "	4.30	7.04	5.67	4209	1172	2691
60-98	" "	4.82	6.42	5.62	3571	1137	2354
78-106	" "	4.49	6.60	5.55	3685	1245	2465
83-111	" "	4.31	6.71	5.51	4296	1336	2816
108-64	" "	5.17	5.72	5.45	4828	1172	3000
50-95	" "	3.96	6.67	5.33	3462	1210	2336
50-97	" "	3.86	6.71	5.29	2342	844	1593
5-71	Dakota Amber	5.30	4.62	4.96	5523	1447	3485
Commercial early amber		.....	6.30	.....	.....	478	.....
Averages		4.62	7.00	5.83	3884	1102	2513

[1] Idaho Amber Sorgo

Soils for Sorghums

The sorghums are grown over a wide range of soil conditions. While the crop can be grown on rather poor soils, it nevertheless responds to an abundance of organic matter and a liberal supply of plant nutrients. The sorghums can be grown on fairly light soils not well adapted to the production of the small grains or corn. They also do well on heavy soils, even on soils with relatively impermeable sub-soils; good aeration is, however, essential to proper growth.

Young sorghum plants develop slowly during the early part of the season; they offer little or no competition to weeds. Fields heavily infested with annual weeds should, therefore, be avoided. Since low temperatures constitute the main limiting factor to sorghum production in Idaho, soils selected for the crop should be well drained so that they may warm up rapidly in spring.

Planting of Sudan Grass and Idaho Amber Sorgo

Since all of the sorghums demand high temperatures, they should not be planted until the soil is fairly warm. A safe rule is to plant not earlier than 2 weeks after corn planting time. By delaying planting until the last week in May an opportunity is offered to kill weeds by working the soil several times prior to planting. The sorghums make a slow growth after emergence; they are easily smothered out by weeds. Good soil prepara-

tion and the development of a firm seedbed are essential to the establishment of full stands of all of the sorghums.

Sudan grass may be seeded either in rows or in drills. Under conditions of light rainfall, seeding in rows 3 feet apart, followed by cultivation after the crop is up, is preferred to broadcasting or drilling. Row plantings require only 3 pounds of seed per acre. Where the crop can be irrigated, broadcasting or drilling is preferable. The crop is seeded in the same manner as the cereals. The usual rate is from 20 to 25 pounds per acre.

Idaho Amber sorgo is best planted in rows 36 to 42 inches apart. The ordinary corn planter, if provided with sorghum plates, will plant the seed satisfactorily. The selection of the proper plate depends upon the size of the seed. The number of holes in the plate may be varied from 12 to 24, the holes should be from three-sixteenth to one-fourth inch in diameter and to avoid being stopped up should be reamed on the lower side. The number of seeds to be dropped can also be regulated by varying the speed at which the selected plate revolves. Where a corn planter is not available, a beet planter may be adapted to planting sorghums. The rate of planting should be determined by the availability of moisture to the crop. Where moisture is limited, 3 to 4 pounds of seed per acre is sufficient for a good stand. The placement of a seed every 3 to 4 inches in the row is close enough in dry areas. When the crop is grown for fodder or silage and an ample supply of irrigation water is available, the rate may well be increased up to 8 to 10 pounds of seed per acre.

None of the sorghums should be planted deeper than necessary to place the seeds in contact with soil moisture. Sorghum seeds are small and young plants are not able to push their way through much soil. If the soil is moist, it is best to plant only deep enough to cover the seeds. In any case, avoid planting deeper than 1 inch.

Cultivation

One of the main drawbacks to sorghum production in northern areas is the slow rate of growth of the seedlings during the early part of the season. This necessitates being on guard against competing weeds which may easily smother out the seedlings. The first step in avoiding this is to work the soil thoroughly and at intervals prior to planting. On well-prepared seedbeds, the harrow may be used after planting and before the seedlings are up. This will kill many small weed plants. After the plants are up an inch or more, the harrowing can be repeated. Ordinary row cultivators can be used in subsequent cultivations. Care must be used during early cultivations to prevent covering the small plants. The number of cultivations necessary per season will depend primarily upon the prevalence of weeds.

Irrigation

While the sorghums have a well-earned reputation for drought resistance, this does not mean that they will not respond favorably to an abundance of moisture. Irrigations should be timed to provide a uniform supply of available moisture during the season and especially during the

period of most rapid growth or at heading time. Avoid excessive moistening of the soil during the early part of the season. Excessive applications of water and applications at greater frequencies than necessary to insure uninterrupted development of the plants have a tendency to lower soil temperatures and thus slows down rates of growth. Irrigation should be avoided after the seeds are well formed, late season applications of water may prevent the crop from reaching maturity before frost occurs.

Harvest and Utilization

Sudan grass is usually grown for summer pasture in Idaho. When used for that purpose the field should not be grazed until the plants have attained a height of 1 foot. Premature pasturing reduces final returns. Where the crop is to be used for hay, it may be cut either with a mower or with a grain binder and handled in the same manner as grain hay. For the production of hay of highest quality, it is best to cut at the full bloom stage. If moisture conditions and the length of the season allow for the development of two hay crops, it is advisable to cut the first crop as soon as the first heads appear; this allows ample time for the growth of the second crop.

The sorgos are best harvested with a corn binder. In the event of a light crop, a grain binder can be used. The plants should be fairly mature before being cut for forage, that is either for fodder or for silage. At maturity, the tonnage of dry matter is at its height, the feed is most palatable, the plants contain less prussic acid, the fodder is not as likely to sour, and silage made from mature sorghums keeps better than if made from inmature plants. In the case of the sorghums, the seeds mature while the stems and leaves are still green.

Diseases

The sorghums are relatively free from diseases. The diseases most likely to cause concern are red spot, kernel smut, and head smut.

Red spot is perhaps the most troublesome of all sorghum diseases from a forage standpoint. It manifests itself in red or purple spots which may also become elongated into streaks and stripes. When these discolored areas become very numerous, the leaves cease to function, and growth of the plant stops. Fortunately, this disease is not severe enough to cause much loss under Idaho conditions. It becomes most destructive in warm humid climates. No remedy or prevention is known for this disease.

Kernel smut affects individual grains or kernels in the head, changing them into a mass of dark colored spores. This disease can be controlled by the same seed treatments as those used in the control of stinking smut or bunt in wheat. Smutty seed should be sifted and fanned well to remove smut balls, and then treated with organic mercury compounds or copper carbonate. For details of seed treatments see Idaho Extension Circular No. 69. *Treatments for Control of Grain Smuts.*

Head smut is less common than kernel smut. It differs from kernel smut in that the whole head when it emerges is a mass of dark colored spores mingled with the remnants of the host tissue and enclosed within a grayish membrane. Upon rupture of the membrane, the spores escape

to infest healthy kernels. Head smut cannot be controlled by seed treatment. Avoid planting seed from infested fields.

Sorghum Poisoning

A serious disadvantage in the use of sorghums and especially of the sorgos as a pasture and green feed crop is the danger from cyanide or prussic acid poisoning. More trouble has been experienced from sorghum poisoning in the northern than in the southern states.

Any condition retarding the growth of sorghum plants such as drought or low temperatures has a tendency to increase the prussic acid content of the plants and particularly of the second growth, young branches, and suckers. Sudan grass is less likely to build up prussic acid in concentrations sufficient to kill livestock than are the sorgos or the grain sorghums. But, even Sudan grass should be regarded with suspicion during periods unfavorable to its growth.

The prussic acid content of sorghums decreases as the plants approach maturity. Mature plants with ripe seed are seldom dangerous if the growth has been normal and few young suckers or branches are present, most of the prussic acid is found in the leaves and particularly in the younger leaves of the plant. To be on the safe side, it is best not to feed the sorghums until the fodder is thoroughly cured. Partly cured fodder may be dangerous. Sorghum silage can be fed with safety.

R. G. BAILEY PTG. CO. 2 LEWISTON, IDAHO