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Sorghums for Forage in South Dakota

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AGRICULTURAL EXPERIMENT STATION

SOUTH DAKOTA
STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

Contribution from
AGRONOMY DEPARTMENT

A. N. Hume,
Head of Department

SORGHUMS FOR FORAGE IN SOUTH DAKOTA

BROOKINGS, SOUTH DAKOTA

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CottonwoodJackson County
Eureka.....McPherson County
HighmoreHdye County
Vivian.....Lyman County

SUMMARY.

1. Sorghum as a forage crop is worth considering carefully in South Dakota because it may be used as a catch crop due to the fact that it matures quickly, yields fairly well and is adapted to hot weather and limited moisture conditions. Sorghum as a forage crop is not superior to corn in seasons that are reasonably favorable to corn.

2. Several difficulties are encountered in growing sorghum due to the small seed, danger of planting too deep and the slow growth of the young plants.

3. Variety tests of sorghums in South Dakota indicate that Sudan grass is best for hay, the amber canes for coarse fodder and dwarf milo for silage.

4. The soil preparation necessary for corn is sufficient for sorghum.

5. Where moisture is plentiful Sudan grass gives best results drilled in 6 or 12-inch rows. It can be used as an intertilled crop if desired.

6. All varieties of sorghum except Sudan grass gave best results in method of seeding test when drilled in rows 36 or 42 inches apart and cultivated.

7. In date of seeding experiments Sudan grass gave best results when seeded between May 20th and June 1st. It is safe to assume that these dates are also best for the amber canes and dwarf milo, as these sorghums have practically the same temperature requirements.

8. Head selection should be practiced in securing sorghum seed.

9. Sorghum drilled in 36 or 42-inch rows may be harvested with an ordinary corn binder. Shocks must be built small.

10. Sorghum drilled in 6 or 12-inch rows or sown broadcast may be harvested with a mower or grain binder.

SORGHUMS FOR FORAGE IN SOUTH DAKOTA. 1

By Manley Champlin and George Winright.

Sorghum is commonly used for forage in South Dakota. In the United States, three-fourths of the total herbage produced by all sorghums is consumed as coarse forage. Forage sorghums include the species that are more valuable for their edible fodder than for their seed. The most promising of these are the black and red seeded amber canes and Sudan grass. Dwarf milo, Teterita, kafir, shallu and some others are also grown in some localities.

It is the purpose of this bulletin to give the results of comparative trials of the producing power of these crops and to give directions for growing the crop based on our experience at the South Dakota Experiment Station farms at Brookings, Cottonwood, Eureka, Highmore and Vivian. In order that the reader may form a correct idea of the value of sorghum, comparisons of various sorghums with such well known crops as corn and millet are inserted.

Reasons for Growing Sorghums.

One of the principal reasons for growing any of the sorghum crops is the fact that they may be used as catch crops. When cut worms, spring floods, poor seed or any other cause prevent one from securing a stand of corn or other crop, sorghum is a valuable substitute. They grow well during hot weather of midsummer and will often make a good yield of forage even though planted as late as the first of July. For some parts of the state this crop is desirable because of its adaptability to hot weather and limited moisture conditions. Sorghum gives good results in seasons which are too dry for corn as it is able to remain dormant during short periods of

1. The experiments reported were conducted on the Brookings, Cottonwood, Eureka and Highmore farms of the South Dakota Experiment Station under cooperative agreement between the Agronomy Department of the South Dakota Experiment Station and the Office of Forage Crop Investigations of the U. S. Department of Agriculture, until 1915, when cooperation was discontinued and the work has since been carried independently by the South Dakota Experiment Station.

drought and begin growth with the advent of favorable weather conditions. This power to resist drouth is thought to be partly due to the fact that the sorghum has an extensive root system in the upper 18 inches especially well adapted to use moisture in the upper layers of the soil promptly before it is lost by evaporation.

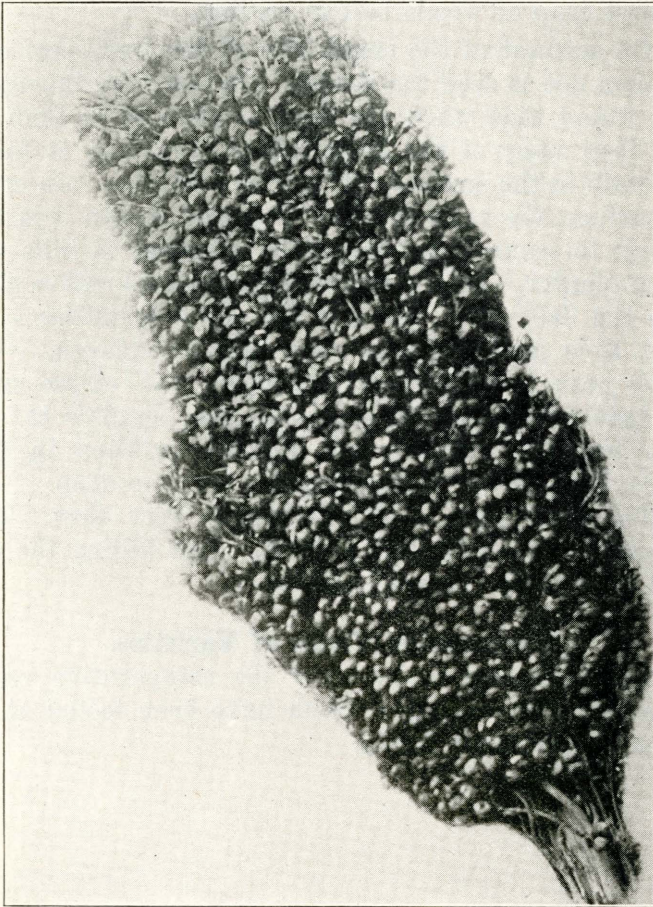


Figure 1.

Kao-liang, S. D. 289, is a valuable grain sorghum for South Dakota but it is not as good as amber cane for fodder or dwarf milo for silage.

Difficulties in Growing the Crop.

One of the chief difficulties encountered in growing sorghum is that the seeds are small and susceptible to cold moist weather. The remedy for this consists in waiting until the ground is warm and sufficiently dry before seeding. This will allow time for surface culture with disk and harrow, thus warming the soil and killing the first crop of weeds before seeding.

On account of the small size of the seed, care must be taken not to seed too deeply. In our experiments we have found that when the seed is sown more than one inch deep many of the seeds fail to germinate or fail to penetrate to the surface. If a heavy beating rain crusts the surface, the same is true. For this reason it is very difficult to secure good stands by planting in hills with a corn planter. It is better to drill the seed rather closely in the drill row. Even if the stand resulting is too thick, it is preferable to one that is uneven. Good stands have been secured year after year where sufficient care was taken to plant the seed shallow in drill rows, but hill planting has usually resulted in poor stands, largely due to planting the seed too deep.

The early growth of sorghum is very slow. That is another reason for late planting after killing the first weed growth by surface cultivation.

Comparative Yields of Varieties.

The following tables show the comparative values of the different varieties which have been tested at the various experiment farms.



Figure 2.

Three varieties of sorghum growing at the Highmore substation. The row in the center is dwarf milo, that to the left is Minnesota amber and on the right pink kaffir. Picture taken July 25, 1912.

TABLE I.

ANNUAL AND AVERAGE YIELDS OF FODDER IN COMPARISON
WITH CORN IN VARIETY TEST AT BROOKINGS,
IN 1914, 1915 AND 1916.

CROP	S. D. No.	Yield in pounds per acre			Average	Rank
		1914	1915	1916		
Minnesota Amber.....	740	8850	4200	2280	5110	1
Sudan.....	469	7440	2580	3720	4580	2
White Amber.....	479	8520	3180	300	4000	3
Freed Sorgo.....	744	7440	2880	720	3680	4
Dakota Amber.....	887	5760	3480	1800	3680	5
Kaoliang.....	90	5760	2940	1200	3300	6
Dwarf White Kafir.....	741	7320	1740	600	3220	7
Feterita.....	481	4560	2340	600	2500	8
Kaferita.....	743	4440	1320	240	2000	9
Brookings 13. Corn.....	86	4732	8040	7140	6637	-

TABLE II.

ANNUAL AND AVERAGE YIELDS OF FODDER SORGHUM IN COMPARISON WITH CORN AT EUREKA IN 1915 AND 1916.

CROP	S. D. No.	Yield in pounds per acre		Average	Rank
		1915	1916		
Dakota Amber.	887	5320	4710	5015	1
Eureka 13 Corn.	86	6570	2780	4675	2
Sudan Grass.	469	1750	3030	2390	3

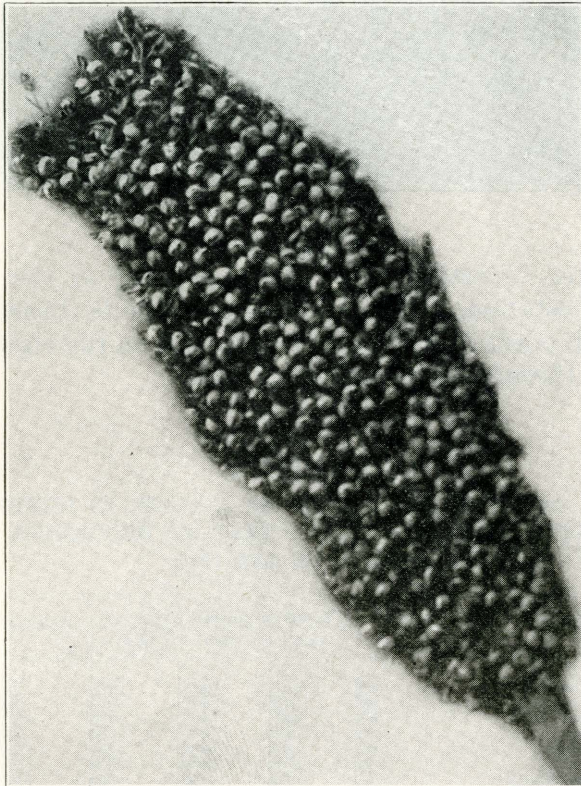


Figure 3.

Feterita, S. D. 481, has been widely advertised and is quite commonly grown in Kansas. It cannot be depended upon to mature a grain crop in South Dakota and as a forage crop it is easily out-classed by the amber cane and Sudan grass.

TABLE III.

ANNUAL AND AVERAGE YIELDS OF FODDER IN VARIETY TEST
OF SORGHUM AND ONE OF CORN AT HIGHMORE
IN 1912 TO 1916.

CROP	S. D. No.	Yield in pounds per acre					No. Yrs. Grown	Average in lbs. per acre		
		1912	1913	1914	1915	1916		2 years	4 years	5 years
Sudan Grass.....	469	3057	4255	2358	5320	2625	5	3656	3747	3523
Minnesota Amber.....	341	.....	.....	2235	.....	4747	2	3673	.....	.....
Dakota Amber.....	887	.....	2300	2600	2866	3002	4	2267	2000	.....
Red Amber.....	483	1624	3625	.....	.....	.....	2	2625	.....	.....
Minnesota Amber.....	482	1264	2950	.....	.....	.....	2	2107	.....	.....
Feterita.....	481	544	1650	900	.....	2072	4	1097	1688	.....
White Amber.....	479	900	.....	1450	.....	.....	2	1175	.....	.....
Kaferita.....	743	.....	1213	448	.....	.....	2	830	.....	.....
Highmore 13 Corn.....	86	7080	6360	2811	633	3768	5	6210	4216	4126

TABLE IV.

ANNUAL AND AVERAGE YIELDS OF SILAGE AND FODDER IN
VARIETY TEST OF SORGHUM COMPARED WITH CORN
AT VIVIAN IN 1915 AND 1916.

CROP	S. D. No.	Yield in pounds per acre				Av. yields per acre	
		1915		1916		Fodder	Silage
		Fodder Silage	Fodder Silage	Fodder Silage	Fodder Silage		
Dwarf Milo.....	332	1960	4360	1280	5220	1620	4790
Kaoliang.....	655	920	2280	1830	3400	1375	2840
Sudan Grass.....	469	4800	3280	3250	3500	4025	3390
Dakota Amber.....	887	250	1580	980	3060	615	4640
Vivian 13 Corn.....	86	480	5720	1040	7290	760	6505

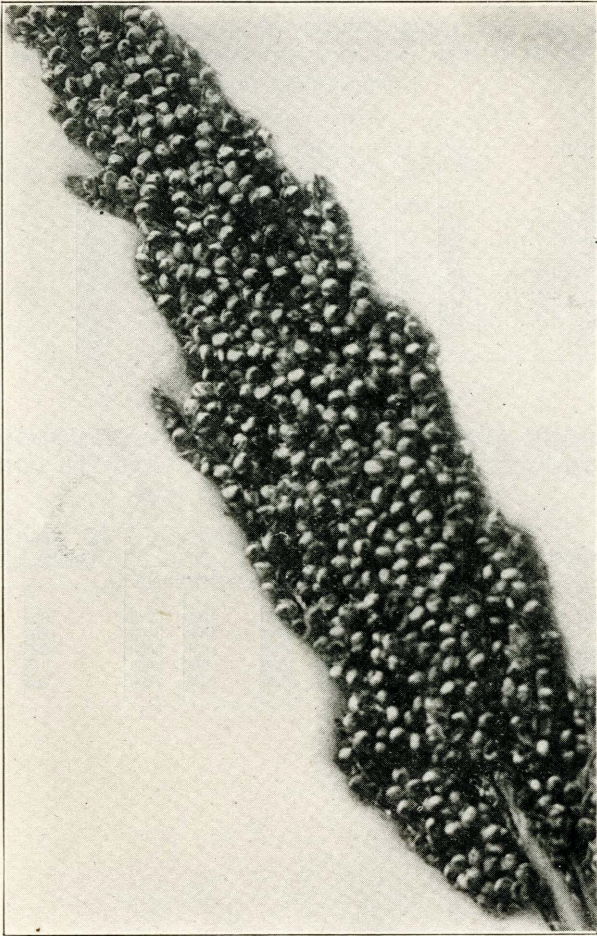


Figure 4.

Dwarf Kafir, S. D. 741, is more valuable as a grain crop than as forage and since it cannot be depended upon to mature seed it is not a desirable crop for our conditions.

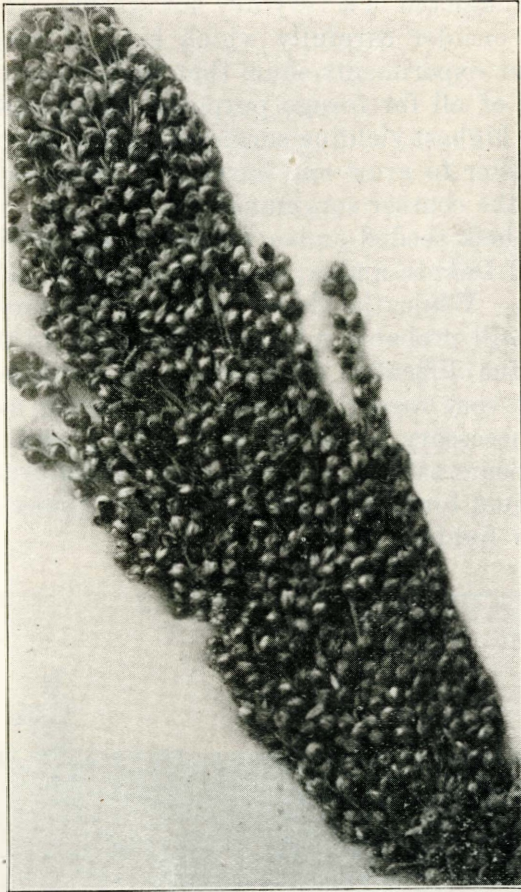


Figure 5.

White Amber, S. D. 479, has not proved quite as good a producer of forage as its black seeded relatives, the Minnesota and Dakota Amber.

The above data show that corn outyields all the sorghums in all cases when an average of two years or more are considered. For that reason we do not consider it advisable to plant sorghum of any kind instead of corn in any part of the state, but, as stated before, there are occasional conditions when it is desirable to grow some kind of sorghum, as a catch crop or to insure hav-

ing some roughage in a very dry hot season. It is worth while to consider carefully which kind of sorghum to grow. Our experiments show that Sudan grass is most promising of all for forage purposes. Fortunately it is one of the highest yielding sorghums and is finer in quality and easier to grow and harvest the crop than is the case with the coarser sorghums.

The black seeded amber canes, including Minnesota amber and Dakota amber, are also of value under some conditions. While the dwarf milo gives encouraging yields, it will probably not become popular in this state owing to the difficulty experienced in securing viable seed, as it very rarely ripens seed under our conditions and it is necessary to use southern grown seed.

It appears safe to conclude that Sudan grass is the best sorghum for hay or fine forage and amber cane for coarse dry fodder.



Figure 6.

Red Amber, S. D. 483, at Highmore. Picture taken July 25, 1912.

This variety yields heavily but is not advisable for this state as it does not mature seed here.

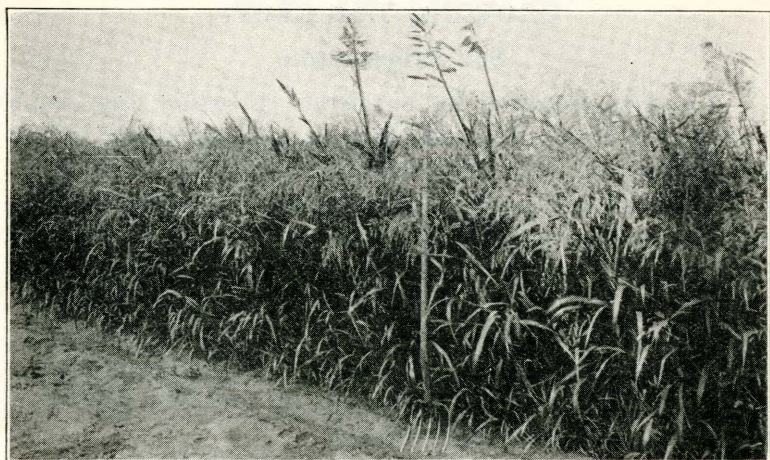


Figure 7.

This Sudan grass at Brookings was seeded May 1, 1912. The picture was taken September 1.



Figure 8.

The Sudan grass on the left is the same as that shown in Figure 7.

GROWING THE CROP.

Soil Preparation.

Land is prepared for sorghum in much the same way as for corn. The land may be plowed either in the fall or spring. Fall plowing should be done as early as possible and left rough until spring. As early as possible in the spring the land should be harrowed and later, when the weeds are started, it should be double disced, lapping half to avoid ridging the ground. The land can then be left until seeding time when it should be rolled and given another harrowing. Spring plowing should be harrowed as promptly as possible and then treated the same as fall plowing.

Method of Seeding.

Tests have been conducted at Brookings and Eureka for the purpose of determining the best method of seeding. The following table shows the results obtained.

TABLE V.
METHOD OF SEEDING TEST FOR SUDAN GRASS AT EUREKA

METHOD OF SEEDING	Yield in tons per acre		
	1912	1916	Averages
Drill rows 6 inches	3.62	2.06	2.84
Drill rows 12 inches.....	3.8	1.56	2.63
Drill rows 36 inches.....	2.05	2.22	2.14
Drill rows 42 inches.....	1.82	2.16	1.99
Double drill rows 36 inches.....	2.15	2.09	2.12

The above data indicates that the largest yield of Sudan grass can be obtained by seeding in drill rows six or twelve inches apart and that if one desires to grow it as an intertilled crop, the best yield is obtained by sowing two rows six inches apart with 36 inches between each pair of rows for cultivation.

The closer the drill rows were placed, the finer was the quality of the forage as the stems grew smaller and the proportion of leaf to stem was greater. While it is true that under favorable moisture conditions both yield and quality of forage is improved by solid planting, the



Figure 9.

Feterita, S. D. 481, on plot 243 at the Highmore sub-station. Picture taken July 25, 1912.

row planting method may still be recommended for the central and western portions of the state in order to insure a crop in dry seasons and to put the land in better shape for the crop of the following year.

Sudan grass is a crop that may be grown either as an intertilled or a solid drilled crop. Thus one may adjust its use to his individual farm needs.

The coarser stemmed sorghums such as amber cane, dwarf milo, etc., should be grown in cultivated drill rows either 36 or 42 inches apart. This insures a fair yield in dry seasons and leaves the land in good condition for the next year's crop. Furthermore, the experimental evidence which we have indicates that a higher yield of forage is obtained by cultivation.

A test of solid planting as compared with drilling in cultivated rows 44 inches apart was conducted at Highmore in 1912 with four varieties. The results as shown in Table VII were so conclusive in favor of the cultivated rows that it was not considered necessary to continue the test.

TABLE VII.

COMPARISON OF CULTIVATED ROWS AND SOLID PLANTING
AT HIGHMORE IN 1912.

CROP	S. D. No.	Yield in lbs. per acre for each method of seeding	
		Drilled in 44-inch rows	Broadcast plats
Red Amber.....	483	9800	2580
Minnesota Amber....	341	7300	2500
White Amber.....	479	6000	1875
Peterita.....	481	5600	1000



Figure 10.

Two rows of Sudan grass on plot 253 at Brookings. The above picture shows the method of seeding this crop in single drill rows.

Rate of Seeding.

The usual amount of Sudan grass seed required when sown in drills six inches apart is from 25 to 30 pounds per acre. With drills 12 inches apart 15 pounds is sufficient and less in proportion when the rows are wider spaced. Amber cane grown in rows far enough apart to permit cultivation should be planted at the rate of from 4 to 6 pounds per acre. When amber cane is sown broadcast, 40 pounds of seed per acre is required but as stated above, amber cane is not usually a desirable

crop for broadcast seeding in this state. Sudan grass is better for that purpose.

Time of Seeding.

Special tests have been conducted at Brookings and Highmore for the purpose of determining the best time to seed Sudan grass. The following table shows the results obtained at various dates of seeding. As amber cane is very similar to Sudan grass in its temperature requirements it is safe to assume that the results of these tests will apply to it also.

TABLE VIII.

ANNUAL AND AVERAGE YIELDS IN A DATE OF SEEDING TEST OF SUDAN GRASS AT HIGHMORE IN 1913, 1914 AND 1915.

DATE SEEDED	Yield in pounds per acre			Averages in lbs. per acre
	1914	1915	1916	
May 1.....	1860	3230	Killed by frost May 15	1697
May 15.....	1970	3430		1767
June 1.....	1725	3450	1800	2325
June 15.....	1251	2250	3250	2250
July 3.....		2270	1150	1710



Figure 11.

White Amber, S. D. 479, at the Highmore substation.

The picture was taken on July 25, 1912. This variety is of secondary importance in South Dakota as a forage sorghum.

TABLE IX.

ANNUAL AND AVERAGE YIELDS IN A DATE OF SEEDING TEST
OF SUDAN GRASS AT THE BROOKINGS EXPERIMENT
STATION IN 1913, 1914 AND 1915.

DATE SEEDED	Yield in pounds per acre			Averages
	1913	1914	1915	
May 1.....	7455	5280	5520	6085
May 15.....	5541	7320	5940	6267
June 1.....	7850	8760	5820	7474
June 15.....	8052	8880	2040	6324
July 1.....		7080	2520	5100
July 15	2117	3840	1260	2406

The above data indicates that the best time to seed Sudan grass is about June 1. The averages show an increase for later seeding from May 1 to June 1 and after June 1 a decrease in yield for later seeding.

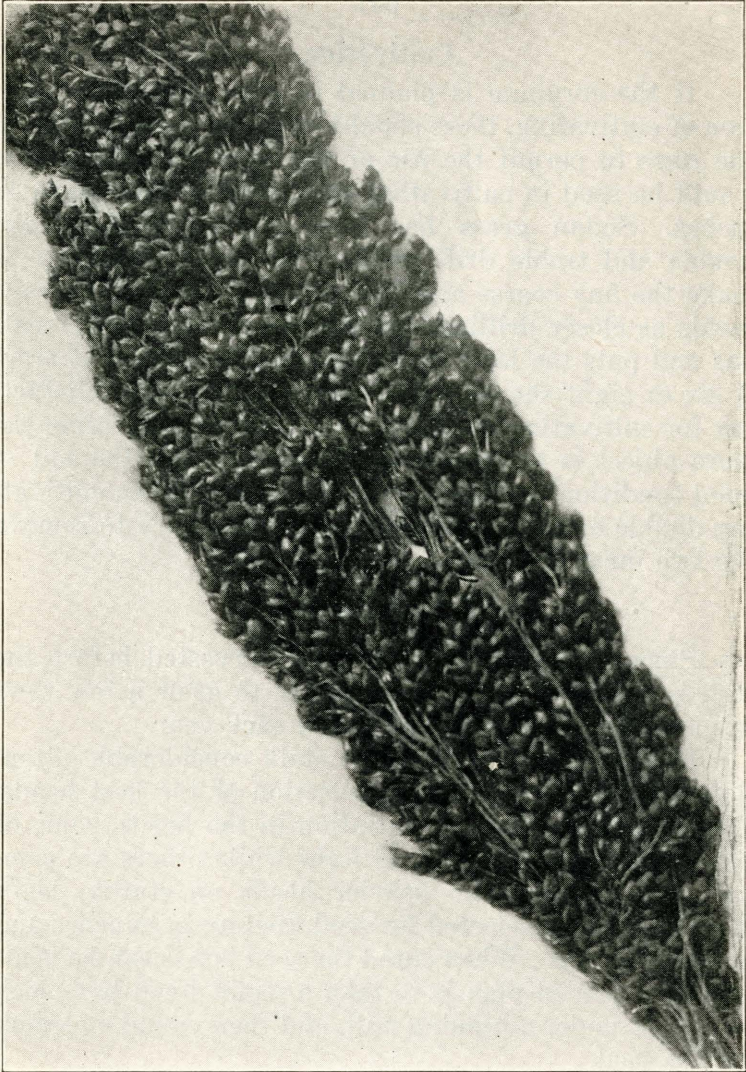


Figure 12.

Minnesota Amber, S. D. 341, is the most widely grown sorghum crop in South Dakota. It grows very tall and produces an abundance of leaves. This variety and a pedigreed selection from it named Dakota Amber, S. D. 887, are the best of the coarser kinds of sorghum for forage in this state.

Cultivation.

If the sorghum is planted in rows, with the intention of cultivating, there should be space enough between the rows to permit the use of the same machinery that would be used in cultivating corn, that is from 36 to 42 inches. Sudan grass has been cultivated in single, double and treble drill rows. This has a tendency to make the hay coarse and has not given as high average yields as closer drilling, but insures a crop in dry seasons and puts the land in better shape for the next crop. A six or eight shovel riding cultivator is very satisfactory for cultivating sorghum. As with all cultivation the main object is to control the weeds and put the soil in good condition for the next year's crop. When cultivating double or treble rows it is often necessary to remove the two inner shovels.

Seed Selection.

Since forage sorghum will be harvested before the seed is fully ripened it is necessary to grow a few rows to maturity or purchase new seed each year.

In selecting seed from the stalk considerable attention should be given to the selection of the best heads. There is a great deal of variation in the heads, some of them being poorly filled and light while others are compact and heavy. The heavier heads on sturdy, leafy plants should be selected for seed, tied up in bunches and hung up to dry. When cured the seed heads can be beaten out. A good plan is to take a metal lined box, such as is used under a fanning mill, and then pound or tramp out the seed.

Since it requires but 4 to 6 pounds of seed per acre for cultivated sorghum a comparatively small number of heads will be sufficient to seed a considerable area. When a large amount of seed is required, the entire crop grown from the selected heads may be threshed for seed purposes with an ordinary thresher. The seed to be planted is selected from the bulk by cleaning and grading with a fanning mill.

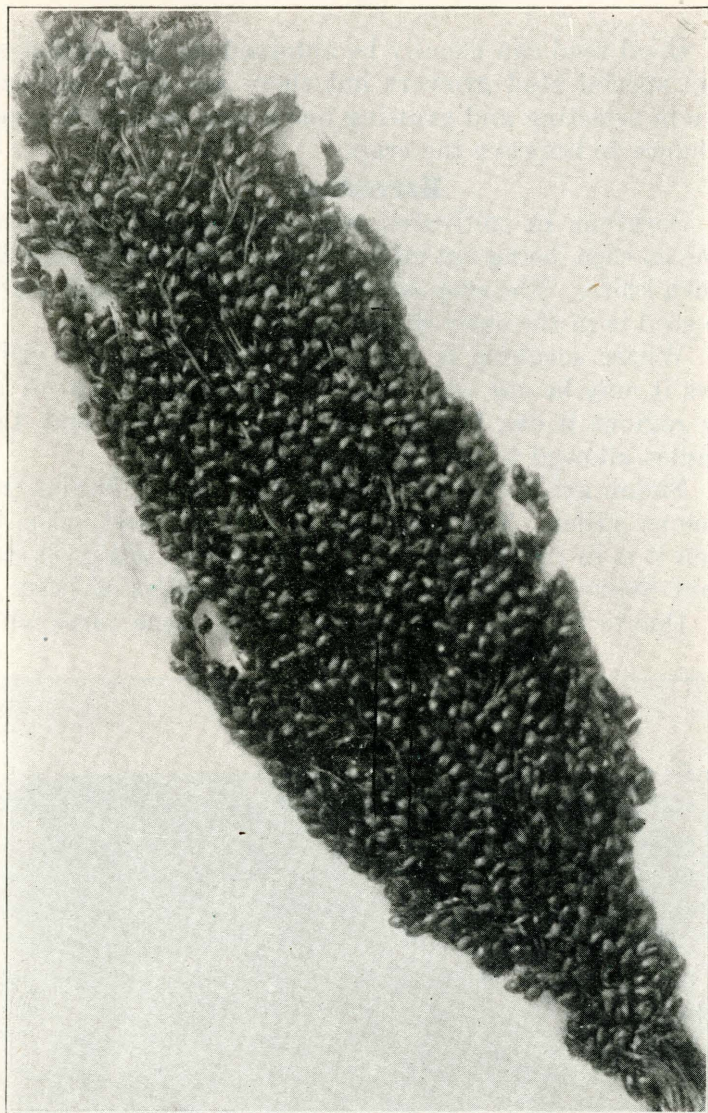


Figure 13.

Dakota Amber, S. D. 887, is a pedigreed selection from Minnesota Amber, S. D. 341, originated by A. C. Dillman at the federal experiment farm at Newell. It is early and drouth-resistant and has somewhat shorter, finer stems than its parent variety.

Good seed can usually be obtained on the market or from special seed growers but there are many advantages in selecting and growing one's own seed as it gives a chance to improve the crop.

Harvesting.

Sorghum in cultivated rows is harvested much the same as corn, being cut either with a corn binder or with a corn knife. The crop is commonly cut for forage when the seed is in the early dough stage.

Where sorghum is sown broadcast or in close drill rows it may be cut with a mower the same as hay or in dry regions it can be cut with a grain binder and the bundles allowed to dry in the field.

Sudan grass can be cut with a mower or binder the same as millet. The best time to cut the first crop is when it is in full bloom. The second crop, if any, is cut about September 1st to 10th to avoid danger of frost.

Due to the thick juicy stems, amber cane cures with



Figure 14

A growing crop of Minnesota Amber, S. D. 341, at Highmore. This variety and its daughter variety Dakota Amber, S. D. 887, give the best results when a coarse fodder crop is desired.

difficulty. For this reason it is best to begin the curing by having the stalks in small shocks. The shocks may then be stacked in long, narrow stacks or fed directly from the shock. The shocks will stand up well for several weeks if well set up and tied with a band near the top of the shock. The same will apply to Sudan grass when cut with a grain binder or corn binder. When cut with a mower the Sudan hay is handled the same as millet. The time required to cure the hay will depend upon the yield and weather conditions. If the growth is very heavy it should be allowed to lie in the sun for about one day before raking. It should then be raked into

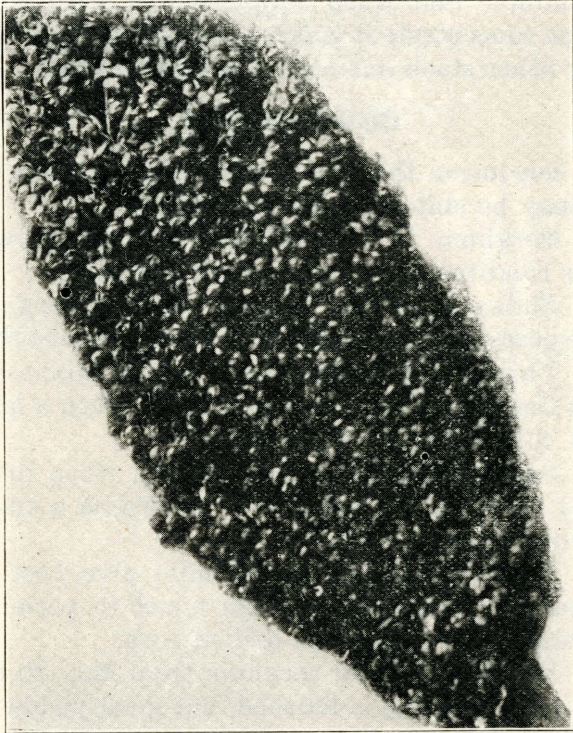


Figure 15.

Dwarf milo, S. D. 747, ranks first in trials at Vivian as a silage sorghum but is not as desirable as amber cane for fodder.

small windrows and allowed to dry another day before stacking. A light or medium growth can usually be stacked after drying for one day.

Sorghum is often used for silage. The same method is used with this crop as with corn except that if sweet varieties such as amber cane are used it is advisable to mix in a load of hay or straw every third or fourth load as the silo is filled the amount to be regulated according to the maturity of the crop. This will absorb part of the juice from the sorghum and help to prevent the silage from souring. Sorghum silage is not as good as that made from well matured corn but it is succulent and palatable and when supplemented with good hay and some concentrate it makes an excellent feed for dairy cows or other stock during the winter months.

CONCLUSIONS.

In conclusion the facts established by these experiments may be stated briefly as follows:

1. Sorghum is a profitable crop to grow when weather conditions are unfavorable for corn.
2. Sudan grass has proved the best sorghum for hay purposes and for solid drilling or broadcasting.
3. Varieties of amber cane, such as Minnesota amber and Dakota amber, are best to grow when a high tonnage of coarse forage is desired.
4. Sudan grass gives best results when drilled in rows six inches apart but can be grown as a cultivated crop if desirable.
5. Amber cane and dwarf milo give best results when grown in rows far enough apart to permit cultivation similar to that given drilled corn.
6. It is best to seed sorghum from May 20 to June 1, after corn planting is finished, but good yields are obtained from later seeding, making it possible to use the sorghums as catch or substitute crops.
7. Sorghum seed should be planted shallow, the object being to put the seed as close to the surface as possible and still be covered with soil.