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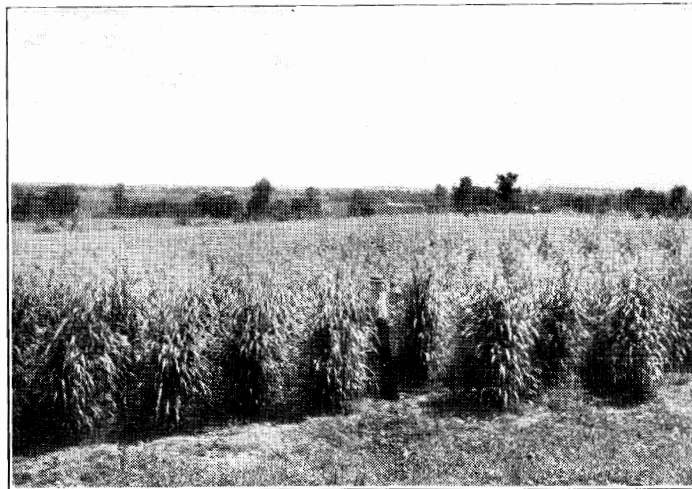
AGRICULTURAL EXPERIMENT STATION

BULLETIN No. 103

JANUARY, 1915

SUDAN GRASS

BY R. E. KARPER
DEPARTMENT OF AGRONOMY



STILLWATER, OKLAHOMA

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SUDAN GRASS

BY R. E. KARPER
Assistant Agronomist

INTRODUCTION

Sudan grass was introduced into the United States from Khartum, Sudan, in 1909 by the United States Department of Agriculture and was first planted in this country that spring under the direction of the Office of Forage Crops Investigations at the Forage Crop Field Station, Chillicothe, Texas. Since that time this crop has been grown at various points in the United States and has proven itself to be especially adapted to the conditions and needs of the semi-arid regions of Oklahoma, Texas, Kansas, Nebraska and South Dakota.

Sudan grass was first planted at the Oklahoma Agricultural Experiment Station in the spring of 1912 and in the past three years has given good results and proven its value as a hay crop under very adverse conditions. It has been tested at various points throughout the State and promises to hold a permanent place in Oklahoma agriculture, since it furnishes to the farmer a hay and pasture plant intermediate between the millets and the sorghums.

DESCRIPTION AND HABITS OF THE PLANT

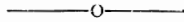
Sudan grass is a form of *Andropogon sorghum* closely related to the cultivated sorghums and crosses freely with the other forms. This plant is an annual similar to the cultivated sorghums and must be grown from the seed each year. It resembles Johnson grass to some extent, having a broader leaf, a somewhat more compact head, and is more erect and taller in its habit of growth. Sudan grass shows its closer relationship to the cultivated sorghums than Johnson grass in that it does not possess the creeping underground rootstalks which are characteristic of the Johnson grass and which makes the latter an obnoxious and persistent weed and pest. Sudan grass develops a root system of only fibrous roots which are similar to that of corn and the sorghums, and the growing plants can easily be distinguished from Johnson grass by this means.

When planted in wide rows and given plenty of room, Sudan grass shows a decided tendency to stool, and it is not uncommon for 100 to 200 stems to arise from the same crown. (See Figure 1.) When planted in wide rows, 36 to 42 inches apart, the stems are coarser and reach a height of from 5 to 7 feet in Oklahoma. If planted in drills or broadcasted the plant produces a finer growth, the stems being smaller in diameter and reaching a height of from 3 to 5 feet.



Figure 1—Showing the stooling habit of Sudan grass. Grown at Terrall, Oklahoma, by Dr. L. D. Ewing

The panicle or head is loose and open and slightly larger than that of Johnson grass. Ripe seed of Sudan grass are usually of a light yellow, cream or straw color. The size of the leaves ranges in between those of Johnson grass and cane, being more numerous and broader than the former and not so broad as the leaves of cane or other sorghums.



THE SEEDBED

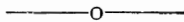
Almost any of the soils found in the State will be suitable for this crop. The well drained, rich loam soils will, however, give better returns than the lighter and poorer classes of upland soils.

The seedbed should be prepared for this crop by giving the ground practically the same treatment as for corn and sorghums. Plow to a depth of about seven inches during the fall or winter and allow it to lie in this rough, open condition until spring in order that the snow and rain which falls may be more readily taken up and stored in the soil for the use of the crop the following spring and summer.

Deep fall plowing alternating with fall listing or early spring disking will give good seedbed conditions. Fall listing is a good practice to follow in the western part of the State since it holds the snow and moisture and is one of the most efficient methods of preventing soil blowing.

Spring plowing may be more desirable in the eastern part of Oklahoma since this will tend to warm up the soil earlier in the spring and bring about more suitable conditions for the early planting and early growth of the crop. However, in the western two-thirds of the State, where moisture is the limiting factor, fall plowing or fall listing should be practiced wherever possible.

The ground should be harrowed down well early in the spring, and if possible again shortly before the crop is planted, since this will aid in warming up the soil and in establishing a firm seedbed, both of which are desirable for the germination of the seeds and the early development of the young plants.



TIME OF PLANTING

The date of planting will vary somewhat for the different latitudes in the State. Experiments at the Oklahoma Agricultural Experiment Station show that best results are obtained by planting the crop between April 15 and May 15. These dates will hold true approximately for the entire State.

The date of planting depends to a great extent upon the seasonal conditions. In any event Sudan grass does best when seeded in a warm seedbed, and as a rule should be planted a little later than the sorghums. If the spring is open and warms up early, which will permit an early planting, so much the better, since this will give the crop an earlier start and the first growth will mature earlier and may be cut and gotten out of the way so that the second crop can come on and likewise get an earlier start.

In the date of planting experiments with Sudan grass conducted by the

Agronomy Department of the Oklahoma Agricultural Experiment Station, the first planting was made on April 15 and continued plantings were made about a week apart until July 6, which was the date of the last planting. The results obtained in this experiment are shown in Table I as follows:

TABLE I
Showing Results from Eleven Different Dates of Planting

Plat	Date of Planting	Method of Planting	Date of First Cutting	Days to Mature	Tons Cured Hay Per Acre
1	April 15	42-inch rows	August 3	109	2.22
2	April 22	42-inch rows	August 3	114	2.35
3	May 6	42-inch rows	August 8	94	2.94
4	May 14	42-inch rows	August 20	98	2.7
5	May 22	42-inch rows	August 20	91	2.33
6	June 1	42-inch rows	August 26	87	.67
7	June 8	42-inch rows	August 26	79	.20
8	June 15	42-inch rows	} Only one cutting.	141	.18
9	June 22	42-inch rows		141	.95
10	June 29	42-inch rows		Cut	141
11	July 6	42-inch rows	October 28.	141	.88

It will be seen from Table I that the largest yields of hay were obtained from the plats planted the early part of May, the 6th to 14th. In an earlier season than this, earlier plantings may give the better yields.

The plats planted after June 8 made only the one cutting. The extreme dry condition of the soil at this late planting retarded the germination and growth on these plats and the crop did not mature until about October 28, at which time it was harvested. A rather poor stand was obtained on these late planted plats and a low yield resulted. A large amount of stooling was observed where the plants had plenty of room.

Method of Planting

Sudan grass gave the largest yields at this Station when planted in rows 42 inches apart and cultivated. In the sections of the State where moisture is limited and where evaporation is great this crop will give best results planted in rows 36 to 42 inches apart and cultivated the same as the sorghums. (See Figure 2.) This is especially true if it is grown for seed or for a hay crop. If grown for pasture the seeding should necessarily be thicker and may be sown in close drills or broadcasted. In the eastern part of the State where rainfall is more abundant and more humid conditions prevail, broadcasting or close drill seeding would naturally be expected to give better results than in Central or Western Oklahoma. The purpose for which the crop is grown, together with the section of the State, must be taken into consideration.

At this Station the past season Sudan grass was planted in rows of varying distances apart. The yields obtained from these different methods of planting are shown in Table II.



Figure 2—Sudan grass growing at Goodwell, in the Panhandle of Oklahoma, in the season of 1914

TABLE II

Showing Yield per Acre from Plats of Different Widths of Rows

Plat	Date of Planting	Distance Between Rows	Yield Tons Cured Hay per Acre
1	April 15	6 inches	.675
2	April 15	6 inches	.515
3	April 15	21 inches	.305
4	April 15	21 inches	.390
5	April 15	42 inches	2.23
6	April 15	42 inches	2.35

It will be observed from the data given above that the 6-inch rows gave larger yields than the 21-inch and the 42-inch rows gave by far the largest yields. The increase of the 6-inch rows over the 21-inch rows was due to the fact that the crabgrass and other weeds grew up on the 21-inch plat and the rows were not of sufficient width to permit the use of the cultivator to keep them down, while the 6-inch rows were close enough together to smother out the majority of the weeds. The 6-inch and 21-inch plats did not come on again after the first cutting was made on account of lack of moisture. The plats of 42-inch rows made two cuttings which also helps account for their larger yields.

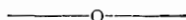
The plats planted in the 6-inch drills did not produce such a coarse growth and made a somewhat finer quality of hay than the 42-inch row plats. In no case will the stems be likely to make too coarse a growth in this State.

Seeding can best be accomplished by using the ordinary grain drill and stopping up a sufficient number of holes so as to plant in rows the desired

distance apart. Sudan grass seed feeds readily through an ordinary grain drill and should be planted to a depth of about one inch. It may also be planted satisfactorily with a surface corn planter or cotton planter by using special plates in the seed box.

Rate of Seeding

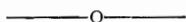
From two to three pounds of clean seed should be planted per acre when the crop is to be seeded in rows 42 inches apart. When sown broadcast or in close drills, fifteen to twenty pounds per acre should be sown. The plants will stool more in the drier portions of the State; also lighter seedings or thin stands have a greater tendency to produce more stooling.



CULTIVATION

Cultivation may be done with the same implements and in the same manner as for corn or sorghums. The frequency of the cultivations will be determined by the seasonal conditions which prevail. Care should be taken at the first cultivation not to cover up the small plants and to give such cultivation as is needed to destroy weeds. Later cultivations should be given as needed to break the surface crust after rains and to maintain the desired soil mulch in order to conserve the soil moisture.

Level cultivation should be practiced as much as possible since the more level the field the easier the crop can be cut with the mower, and the less trouble will be experienced by having trash and dirt gather in the sickle bar.



TIME AND METHOD OF HARVESTING

Hay Crop

The method of harvesting will be determined more or less by the purpose for which the crop is grown. When it is grown for hay the mower will provide the best means of harvesting. This grass cures readily and may be raked up the following day after it is cut, or the same afternoon if it is a good drying day. It should be bunched and left in this way until thoroughly cured, when it may be baled or hauled to the mow or stack.

The crop may be cut for hay about the time it is in full blossom and a good quality of hay obtained. The time of cutting need not be very definite, and where it is necessary it might well extend over a period of several weeks and not interfere to any extent with the quality or quantity of hay obtained. This is particularly true when the crop is planted in rows because of the fact that the stools which spring up from around the main stem mature at different times and furnish immature stalks over a long period of time. This makes it very convenient for the farmer to handle, since many times rush of other work at haying time would make it almost impossible to cut the crop at any specific time.

The best time to cut this grass for hay, however, is when it is in full

bloom, and where it is possible to get only one cutting it would be best to wait until this stage before harvesting and obtain the best quality of hay possible. If two or more cuttings are expected the same season it is advisable to cut early, as soon as the grass is fully headed or when the heads are well out of the boot. The leaves are well retained during the harvesting operations and the grass provides a bright, sweet and palatable hay.

Seed

When Sudan grass is grown for the seed crop it can very well be harvested with the ordinary grain binder or the rows may also be harvested with a corn binder. The bundles should be shocked the same as the small grains and allowed to cure in the shock. The crop may be threshed to best advantage with the regular grain threshing machine, and by harvesting with a binder the bundles will be easily handled in threshing.

One may expect a fairly large amount of seed from Sudan grass when it is grown for this purpose. It seeds freely, and comparatively little loss from shattering occurs because the seed is well retained even for some time after ripening. Experiments at this Station show that it should be cut when fairly well matured in order to obtain the maximum quantity of seed. Table III shows the results of an experiment on the time of cutting for seed production at this Station the past season.

TABLE III
Time of Cutting Sudan Grass for Seed Production

Plat	Date of Planting	Distance Between Rows	Date Cut	Tons of Hay per Acre	Pounds of Seed per Acre	Days of Growth
1	May 6	42 inches	July 12	1.02	60	67
2	May 6	42 inches	July 17	1.46	160	72
3	May 6	42 inches	July 22	1.35	320	77
4	May 6	42 inches	July 28	1.44	350	83

In this test where the four plats were all planted on the same date and in rows the same distance apart and the cuttings made at intervals of about a week, beginning July 12, it will be noticed that the amount of seed produced increases as the date of harvesting becomes later. Much of the seed in the early harvested plats was chaffy and light, and a great deal of it lost by being blown over with the straw. The amount of seed will be greatly increased by allowing the first heads which appear to become thoroughly matured before harvesting. Some of the seed from these heads will probably be lost by shattering, but this will be more than equalized because of the fact that a maximum number of heads will have reached the proper stage of maturity for seed production by this time.

Several plats were also planted in order to compare planting in wide rows with close drills for seed production. Table IV shows the increased yield of seed and also of hay in favor of the plat planted in wide rows.

TABLE IV

Wide Rows vs. Drilling for Seed Production

Plat	Date Planted	Distance Between Rows	Pounds of Hay per Acre	Pounds of Seed per Acre
1	May 6	42 inches	2,550	324
2	May 6	6 inches	1,600	195

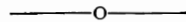
When grown for seed production the crop should be planted in rows and cultivated in order to obtain the maximum yield of well developed seed. The first cutting produces more seed and is the one that should be saved for this purpose where seed is desired.

Seed which has become crossed with other sorghums is undesirable for planting purposes. The cream-hulled seed is the most desirable type and should be used for seed purposes if possible. The black-hulled strain and its hybrids seem to make up a bulk of the seed this year, but this can be overcome by selecting the cream-hulled seed for further home planting.

Yields

The yield of both hay and seed will depend largely upon the amount of available moisture. From two to four cuttings of hay may be obtained in a season if carefully managed. Under favorable conditions from two to four tons or more of cured hay per acre will be produced.

A number of weight per bushel tests were made with the seed produced on the Experiment Station farm the past season. These tests averaged thirty-eight pounds. Good, clean seed should weigh from thirty-five to forty pounds to the bushel and from 300 to 500 pounds, or about ten bushels of seed per acre, is a fair yield.

**USES AND VALUE OF THE CROP**

Soiling and Silage.—This grass is well adapted for either a soiling or a silage crop. The green plants make palatable and succulent feed. Where the rainfall is sufficient in this State good results may be secured by growing the crop with cowpeas for the silo, for green feed or for hay. The ease with which this grass is cured for hay makes it less desirable for use as a soiling or silage crop.

Pasture.—The fact that Sudan grass is an annual and that the ground would be soft and the crop would suffer more or less from the tramping of the animals, and that the plants would be pulled out to some extent in grazing, renders it less valuable for pasture. It is also reasonable to expect that since this grass belongs to the sorghum family it may contain small amounts of the deadly prussic acid in the green feed under certain conditions of growth. The crop has not been pastured to any extent at this Station. It has given fair results, however, where it has been used for this purpose.

Catch Crop.—It is a common practice of many farmers in the State to sow a small acreage of grain sorghums or cowpeas as a catch crop after wheat or oats. Sudan grass may be used in this way to good advantage as a substitute for grain sorghums, since the latter usually fail to mature when planted as a catch crop. If there is sufficient moisture to germinate the seeds well and to give the young plants a good start, Sudan grass will give good results when planted for this purpose and will give larger yields of forage than will be obtained from either sorghums or cowpeas when grown as a catch crop.

Rotation.—When the hay crop is removed from the land little remains to add to the fertility of the soil. It takes fertility from the soil rather than adds to it. It cannot in any way compare with the legumes in this respect. Being an annual there is no difficulty experienced in working this crop into a rotation.

Forage.—Practically all the Sudan grass which has been grown in Oklahoma so far has been grown for seed production. This is due to the fact that the high price of the seed and the amount of seed that can be produced per acre makes it very profitable. The seed has been selling this season for from 50 cents to \$1.00 per pound, which is almost prohibitive to many of the farmers in the State. The Agronomy Department of this Station grew over two thousand pounds of seed on its farm the past season which was sold in small amounts in order to reach as many of the farmers as possible as long as the supply lasted. This seed was sold at 25 cents per pound. There will be a great deal of seed produced next year, and the price will undoubtedly be lowered considerably and should soon be selling for 5 to 7 cents per pound. In the meantime we are advising farmers to buy a few pounds and grow seed for their own use.

The greatest value of this crop to the farmers of Oklahoma lies in the fact that it produces large yields of hay of good quality. The hay does not have the high protein content of alfalfa, but may be compared with prairie hay and timothy in its chemical composition and feeding value. This Station has as yet conducted no feeding experiments with Sudan grass. We are feeding it to our work horses, however, and they take to it greedily and do well on it. It makes a good feed either when fed alone or when supplemented with alfalfa.

Table V shows the chemical composition of Sudan grass hay in comparison with other crops, most of which are commonly grown in this State for hay and forage purposes.

These analyses were made under the direction of Dr. C. K. Francis in the Chemical Department of the Oklahoma Agricultural Experiment Station.

TABLE V
Composition of Sudan Grass and Other Hays

Hay	Water	Ash	Protein	Fiber	Nitrogen-Free Extract	Fat
Sudan grass	7.20	5.60	7.94	31.56	45.45	2.25
Prairie hay	8.12	7.67	4.34	35.06	42.66	2.04
Cane fodder	8.38	6.31	6.62	23.43	52.01	3.25
Kafir fodder	6.96	8.94	8.75	27.87	45.51	1.97
Alfalfa	8.40	7.40	14.30	25.00	42.70	2.20
Bermuda	6.52	8.03	11.91	24.85	46.60	2.09
Millet	7.70	6.00	7.50	27.70	49.00	2.10
Timothy	13.20	14.40	5.90	29.00	45.00	2.50

The analyses represent well cured hays and are of average quality. The analysis of Sudan grass hay is of one sample, cut at the early seed formation stage and well cured under cover.

Sudan grass is a hay plant, and when it becomes more generally distributed it will and should be grown primarily for its forage.

CROSSING WITH OTHER SORGHUMS

Sudan grass crosses very readily when planted close to fields of cultivated sorghums. It is best to avoid planting near other sorghums, thus keeping the original strain as pure as possible. This should be especially observed when the crop is to be saved for seed. When such crossing takes place the hybrids should be closely rogued out before they have put out their blossoms in order to avoid further crossing. The hybrids or crosses can readily be recognized by the vigorousness of the plant, the larger stems and broader leaves.

WEEDS

Weeds are not usually an important factor in the growing of this crop. When planted in rows weeds are easily kept under control by cultivation, and when planted in close drills or broadcasted the growth of the crop keeps the weeds well in check.

As previously stated, Sudan grass closely resembles Johnson grass in its habit of growth, but they are readily distinguished by their root systems; the Sudan grass lacking the underground rootstalks which make Johnson grass obnoxious. The seeds are likewise very similar, and when they have become mixed it is almost impossible to distinguish between them even upon close examination.

The seeds of Sudan grass are slightly larger and somewhat more plump than the seeds of Johnson grass, and ordinarily they break off with a piece of the rachis attached to them.

To avoid introducing Johnson grass on your farm in this way it will be best to purchase seed from reliable parties or where there is no Johnson grass growing.

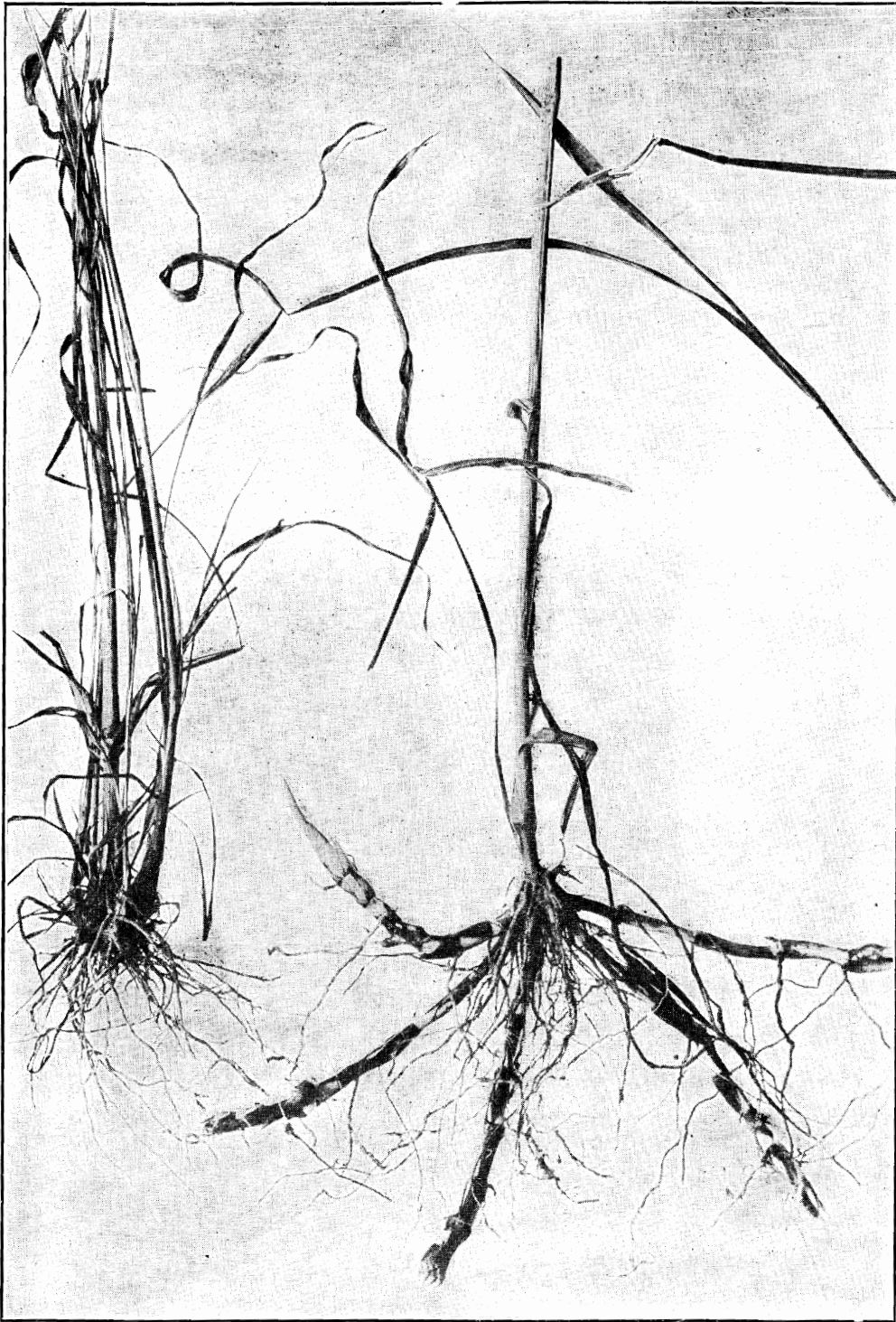


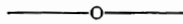
Figure 3.—Young plants of Sudan Grass (left) and Johnson Grass (right), showing the vigorous root stocks of Johnson Grass and their entire absence on Sudan Grass

INSECT ENEMIES

The grasshopper and chinchbug are the most serious insect enemies attacking Sudan grass in Oklahoma.

In seasons when the grasshoppers are numerous, the crop will suffer greatly from the ravages of this pest. Grasshoppers are very fond of Sudan grass. The most satisfactory way of combating this pest is by scattering poisoned bran mash around the edges of the field.

Chinchbugs are also fond of Sudan grass. In the season of 1913 this pest practically destroyed the crop at this Station. Little can be done to prevent invasion by chinchbugs. The dust furrow or oil barrier may be used to good advantage in preventing their entrance to the field. The most effective means of dealing with this pest is by burning the bunch grass and trash in which they are passing the winter.

**SUMMARY**

1. Sudan grass is an excellent forage plant, well adapted to Oklahoma conditions.
2. It belongs to the sorghum family and crosses readily with other forms.
3. It is an annual and must be grown from the seed each year.
4. This plant resembles Johnson grass in appearance, but does not possess the underground rootstalks which make the latter a pest.
5. The crop should be planted in the spring after the soil warms up well. Between April 15 and May 15 gave the best results at this Station.
6. Largest yields were obtained where the crop was planted in 42-inch rows and cultivated.
7. When seeded in rows, two to three pounds of seed should be planted per acre.
8. Sudan grass is a hay plant and will eventually be grown primarily for that purpose. Growing for seed is the more profitable at this time.
9. Seed should be purchased only from reliable parties or where Johnson grass is not found growing.
10. Grasshoppers and chinchbugs are the worst insect enemies attacking this crop.

