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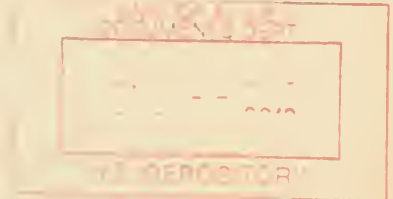
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SUDAN GRASS, A NEW DROUGHT-RESISTANT HAY PLANT.

BY

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SUDAN GRASS, A NEW DROUGHT-RESISTANT HAY PLANT.

INTRODUCTION.

For several years past, beginning with 1906, the writer and his assistants made a careful study of Johnson grass with the view of finding a strain lacking the underground rootstocks which make Johnson grass so objectionable. While variations in this character were found, no single plant was detected which had the rootstocks wholly absent. Coincident with these studies packages of Johnson grass seed were obtained from various foreign sources, in part with the assistance of the Office of Foreign Seed and Plant Introduction. Among those received are two other varieties bearing rootstocks like Johnson grass but differing in other characters, and two very distinct varieties that have the rootstocks wholly absent. The first of the latter was received in 1909 under the name "garawi," through Mr. R. Hewison, Director of Agriculture and Lands of the Sudan Government at Khartum. After growing this for one season at Chillicothe, Tex., it was inventoried as Seed and Plant Introduction No. 25017.

In further correspondence with Mr. Hewison some additional information has been secured. The Sudan botanists were under the impression that garawi is a form of *Andropogon halepensis*, or Johnson grass. According to Mr. Hewison, the following note appears in Brom's Catalogue of Sudan Flowering Plants:

Andropogon halepensis Brot. Adder or Adra (wild variety) and Garawi (cultivated), Arab. Tall grass cultivated for fodder. The seeds are eaten in times of scarcity. When wild it grows to a height of 12 feet and is found in damp localities along the river banks or edges of pools. Found in Sennar, White Nile, and Kordofan.

Whether the wild plant is the same as the cultivated Mr. Hewison is not sure, and promised specimens have not yet been received. In Sudan, garawi is cultivated only to a limited extent, mainly at the experiment station and at military hay farms, two cuttings of hay being secured there each season under irrigation. The seed was brought to Sudan from Egypt, where it is also cultivated to some extent under the same name. It is probable that it is the grass that all writers on Egyptian botany have called *Andropogon halepensis*.

The exact nativity of garawi is still a matter of doubt, nor is it clear that genuine *Andropogon halepensis* occurs in the same region.

A few plants of garawi lived over the winter of 1911-12 at Gainesville, Fla., without, however, forming any rootstocks.

The second variety was received on December 2, 1909, from Dr. L. Trabut, Algiers, Algeria, and given S. P. I. No. 26301. Dr. Trabut's original notes are as follows:

This grass is vigorous but not stoloniferous and would be interesting for hybridization with sorghum. It is moderately good forage like Johnson grass, but has the advantage of not stooling (i. e., suckering). This variety is perennial here and produces many seeds.

Under the conditions in the United States this variety has behaved purely as an annual. In further correspondence with Dr. Trabut, he writes that he believes this grass to be common in Africa and that he has received it from the arid regions between Algiers and Senegal.

The two varieties are quite distinct from each other and the name "Sudan grass" has been given to S. P. I. No. 25017 and "Tunis grass" to S. P. I. No. 26301. Botanically, they are both to be considered varieties of *Andropogon sorghum* and not of *Andropogon halepensis*, as the three known varieties of the latter all have vigorous underground rootstocks. Trials at numerous places have demonstrated that Sudan grass promises high value for hay, especially in the semiarid regions where no perennial grass has thus far been found suited to the conditions. Indeed, it is not too much to predict that it is there destined to become the leading grass for hay production. Under more humid conditions Sudan grass has also succeeded admirably and it will probably replace the foxtail millets to a large extent, as it produces better hay and usually larger yields. Tunis grass has not as yet been widely tested, owing to lack of seed. It is slower in starting growth and less tall than Sudan grass. As it shatters its seed very readily it is likely to be of only limited usefulness unless this character can be changed.

Sudan grass has been tested most carefully in Texas (fig. 1) and at Arlington Farm, Virginia, but at least one year's trial has been made at many places in the Great Plains and at various agricultural experiment stations. There is still much to be learned in regard to the crop, but the data at hand indicate approximately the best methods of culture. Sudan grass is a sorghum and requires practically the same temperature conditions as that crop. It is, however, earlier than any sorghum yet known and will probably mature in Montana and North Dakota, as it ripened seed in 1912 at Brookings, S. Dak.

Individual plants of Sudan grass under favorable conditions will attain a height of 8 to 10 feet and may possess 20 or more stalks to a plant. The stems seldom become larger than a lead pencil, even

in the largest plants. Broadcasted or drilled the height averages 3 to 4 feet, and the stems are much finer. The stems are mostly unbranched, strictly erect, and decidedly leafy, very much more so than Johnson grass. The sugar content is small, but enough to give a decided sweetish taste. The flower cluster is loose and open, pyramidal in form, and 6 to 12 inches long. There is practically no shattering of the seed at maturity.

SEEDING SUDAN GRASS.

Sudan grass may be sown broadcast, drilled, or in cultivated rows. Where there is sufficient moisture, broadcasting or drilling is prefer-



FIG. 1.—Fields of Sudan grass at Dalhart, Tex. On the right, uncultivated rows; on the left, broadcasted.

able; otherwise the grass is likely to be coarse. In seeding this way 3 pecks of seed to the acre should be used.

Under conditions of light rainfall Sudan grass is probably best sown in cultivated rows, though excellent results have been secured in dry regions from broadcasting. In rows 36 inches wide, 4 pounds of seed to the acre are sufficient, even with rather thick seeding, which is recommended when grown for hay. For seed production much thinner seeding has given excellent results.

It is sometimes practicable in humid regions to sow in 18-inch rows and cultivate. This is especially desirable where the land is very weedy. The grass grown under such conditions does not become too coarse, and, furthermore, the dense shade kills out the weeds. Five pounds of seed to the acre should be used when thus sown.

FEEDING VALUE OF SUDAN GRASS.

All reports agree on the high palatability of Sudan grass, either green or cured. At Chillicothe, Tex., the farm horses even ate readily the straw from which the seed had been thrashed. Until feeding experiments can be conducted no definite statement of the comparative feeding value of this grass can be made.

Table I shows the analyses of a series of hay samples cut at various dates at Arlington Farm, Virginia, in 1912. Perhaps the most interesting feature shown is the close comparison of the mature straw with hay cut at earlier stages.

TABLE I.—*Analyses of Sudan grass grown at Arlington Farm, Virginia, in 1912, cut at various dates in different stages of maturity.*

Substance.	Cut Aug. 7.				Cut Sept. 1, before heading.	Cut Oct. 1; seed was fully mature.
	Before heading.	Heads just appearing.	Just beginning to bloom.	In full bloom.		
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Moisture.....	4.13	3.54	3.46	3.51	4.82	4.38
Ash.....	6.61	5.55	5.02	5.64	7.12	5.59
Ether extract.....	1.72	1.39	1.23	1.27	1.49	1.48
Protein.....	7.75	6.06	5.16	4.66	5.63	4.19
Crude fiber.....	30.68	31.94	33.23	35.12	34.30	34.44
Pentosans.....	21.82	24.61	24.70	24.51	23.38	26.70
Undetermined.....	27.29	27.51	27.20	24.79	23.26	26.70

EXPERIMENTAL TRIALS WITH SUDAN GRASS.

Owing to the fact that Sudan grass came from a dry tropical country and that the quantity of available seed was very small, the preliminary tests were all made in Texas. The remarkable adaptation of the grass to Texas conditions led to its being tested in 1911 at Arlington Farm, Virginia, and in various Southern States. At the former place it succeeded beyond expectation, so that seed of it was sent in the spring of 1912 to many experiment stations with the request that it be tried, but for various reasons comparatively few stations made a test. The reports of these trials are given later in this circular. As most of these tests were very small the results can only be regarded as indications of its possible value. In most cases the grass was seeded in cultivated rows, under which condition it is usually too coarse for hay of high quality. By thick planting, however, this difficulty is easily overcome.

Practically every test of the grass made in the semiarid regions from South Dakota to Texas has given remarkably favorable results. There is scarcely room to doubt the very high value of the grass for this portion of the United States. A single test in eastern Oregon also gave very promising results, so the grass is doubtless adapted

to Columbia Basin conditions. Its wide adaptability to the climatic conditions of the United States east of the Rocky Mountains is noteworthy. While the original stock showed little variability, the grass has crossed very readily with sorghums, so that it is possible to select various hybrids differing especially in leafiness and date of maturity. Presumably all of the variants are due to crossing, but no isolated areas of the original seed have yet been grown to determine whether other factors are operative.

In the humid regions the results are not so uniformly satisfactory, and the future of the grass east of the 100th meridian can not be forecasted with confidence until much further evidence is available.

A few packages of seed were also sent in 1911 and 1912 to farmers for practical trials. The reports of several of these trials are cited as indicative of the value of the grass, and some of them are valuable as suggesting critical experiments.

RESULTS OF TESTS AT CHILLICOTHE.

Sudan grass was first tested at Chillicothe, Tex., in 1909, a single row being grown and all the seed saved. In 1910 this seed was planted in 30-inch rows on seven-fifteenths of an acre of land. Though the season was exceedingly dry it grew to a height of 4 to 4½ feet. A small portion of the plat, one-fifteenth of an acre, was cut for hay and yielded two cuttings. From the remainder, 134 pounds of seed were secured in two pickings, which is at the rate of 335 pounds per acre.

In 1911, plats were planted June 1 on newly broken sod land, from which two cuttings of hay were secured, each larger than the one cutting of German millet grown alongside. The total rainfall from April 1 to November 1 was 14 inches. The drought conditions of the season were such that both milo and kafir produced only about one-fourth of a normal grain yield.

During the season of 1912 more detailed results were secured. Four cuttings of hay were obtained from a one-tenth acre plat, drilled on April 26 at the rate of 3 pecks of seed per acre. The date and amount of each cutting are as follows:

	Pounds
June 22	214
July 17	181
August 20	305
October 14	180
Total	880

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This yield is at the rate of 4.4 tons per acre. During this period the rainfall was as follows:

	Inches.
April 26 to 30.....	0.68
May.....	.52
June.....	4.69
July.....	1.39
August.....	3.35
September.....	2.92
October 1 to 14.....	1.97
Total.....	15.52

Two acres were also planted on April 20 in rows 36 inches apart. This crop grew to an average height of 6 feet 4 inches and was harvested for seed on August 3, 96 days after planting. It was a little overripe and probably 10 per cent of the seed was lost by shattering. The actual seed saved from the 2 acres was 708 pounds. By September 20 the grass was again about 18 inches high and beginning to head, when it was cut for hay in order to plow the ground. The yield was estimated at about 1,000 pounds per acre, but it was not weighed, owing to rainy weather.

Two fields of Sudan grass were grown for seed under contract with two farmers in the immediate neighborhood of Chillicothe. One farmer planted 12 pounds of seed on 13 acres in 42-inch rows and secured a yield of about 10 bushels per acre. The second farmer planted 4 pounds of seed on 2 acres in 42-inch rows and harvested 1,285 pounds of clean seed, or 15.3 bushels per acre.

The seed grown on the experiment farm weighed 40 pounds to the bushel; that grown by the first-mentioned farmer, 44 pounds, and by the second, 42 pounds per bushel. In contrast the seed grown on the experiment farm in 1911 weighed but 32 pounds per bushel.

RESULTS OF TESTS AT ARLINGTON FARM.

At Arlington Farm, Virginia, Sudan grass was tested in 1912, both broadcasted and in 18-inch rows (figs. 2, 3, and 4). The broadcasted plats were sown on June 3 at the rate of 10 pounds of seed to the acre. The broadcasted stand was not perfect, some comparatively sterile spots being almost bare of Sudan grass and occupied by pigeon grass. The crop in these plats grew to an average height of 5 feet. One twentieth-acre plat cut for hay on August 23 yielded 280 pounds, or at the rate of 2.8 tons per acre. The second growth on this plat was 30 inches high and was beginning to head on September 20. This grew to a height of about 3 feet, but the seed was not mature when killed by frost on November 4. Nine plats of one-twentieth of an acre each were cut for seed on September 20 and yielded, on the

average, 6 pounds, or 3.3 bushels per acre, only one-fourth of the quantity secured from the plats in rows.



FIG. 2.—A broadcasted field of Sudan grass at Arlington Farm, Virginia, 1912.

Eight plats of one-twentieth of an acre each were planted in 18-inch rows on June 3 at the rate of 5 pounds seed per acre and culti-



FIG. 3.—Rows of Sudan grass at Arlington Farm, Virginia, 1912. Each row is grown from the seed of a single plant. The three rows on the right are typical Sudan grass.

vated twice. Two of these plats cut on August 23 when fully headed and about 7 feet high yielded, respectively, 284 and 347 pounds per plat, or at the rate of 2.8 and 3.5 tons to the acre. This could have

been cut as early as August 10 with a very slightly smaller yield. The second growth on these two plats was over 3 feet high when killed by frost on November 4.

The remaining 8 plats were harvested for seed on September 20 and yielded an average of 23 pounds each, or 460 pounds per acre. Practically no seed was lost by shattering. The second growth in these plats was about 1 foot high when killed by frost on November 4.

A late seeding was made on August 7 in rows, and this was 48 inches high and fully headed when killed by frost on November 4.

There can be no doubt that by seeding not later than June 1 two full cuttings of Sudan grass for hay can be obtained each season in



FIG. 4.—Sudan grass at Arlington Farm, Virginia, 1912. This is another view of the right-hand row shown in figure 3. The tall plants in the background are hybrids between Sudan grass and some variety of sorghum.

Virginia. The grass has shown much stronger growth in cultivated rows than when broadcasted, but it still remains to be determined which method is most desirable.

The seed grown at Arlington Farm in 1912 weighed 36 pounds per bushel.

Mixtures of Sudan grass with cowpeas and with soy beans were also tested (fig. 5). A one-tenth acre plat was broadcasted on June 11 with 3 pounds of Early Black cowpeas and 2 pounds of Sudan grass. This was cut for hay on September 6 when the Sudan grass was in bloom and the first pods of the cowpeas were fully grown. The grass was 6 to 8 feet high and the cowpea vines were of about an equal length. The plat yielded 925 pounds of cured hay, about one-

fourth being cowpeas. This is at the rate of 4.6 tons of the mixture per acre.

In an adjacent one-tenth acre plat Johnson grass and cowpeas were seeded at the same rate; that is, 2 pounds of Johnson grass and 3 pounds of Early Black cowpeas in place of Sudan grass (fig. 5). The yield of the mixture was 561 pounds of air-dry hay, or 2.8 tons per acre.

A similar mixture of Sudan grass and Arlington soy beans, a twining variety, was sown the same date, using 3 pounds of soy beans and 2 pounds of Sudan grass. About one-fourth of the mixture was soy beans, which twined about the grass to a height of 4 to 6 feet. When



FIG. 5.—Plats at Arlington Farm, Virginia, showing mixtures of Sudan grass and cowpeas (right) and Johnson grass and cowpeas (left).

cut on September 6 the Sudan grass was in bloom and the soy-bean pods were about half grown.

This mixture cured more readily than the cowpea mixture and was superior in physical quality. The yield was 888 pounds of cured hay, or at the rate of 4.4 tons per acre.

Figure 6 shows a stand of Timis grass planted in rows at Arlington Farm for comparison with the Sudan grass shown in figure 3.

TESTS AT MISCELLANEOUS EXPERIMENT STATIONS.

TEXAS.

At the San Antonio (Tex.) Field Station Mr. S. H. Hastings tested Sudan grass in 1911 and 1912 and reported as follows:

From the growth of the plat tested in 1911 this appears to be the most promising grass that has been grown at the experiment farm. Two plats were

planted, one where it could be irrigated and the other without irrigation. The plat not irrigated made a good growth and proved to be as drought resistant as Johnson grass, although the plat was so small that the yield would not be reliable. Only one cutting was secured from this planting. Both plats were planted on March 31—somewhat later than is necessary. The first cutting of the irrigated plat was on July 31 and gave a yield at the rate of 3.49 tons per acre and a seed yield of at least 506 pounds per acre. The second cutting was made on October 10 and gave a yield of 3.11 tons per acre, making a total for the season of 6.60 tons per acre. At least three cuttings would have been secured had it been seeded earlier and the first cutting not allowed to seed, which would have increased the yield materially.

In 1912 we put in a planting of Sudan grass March 15, without irrigation, and the yield from two cuttings was 5.66 tons per acre. Sorghum planted under the same conditions gave a yield of 4.68 tons.



FIG. 6.—Rows of Tunis grass at Arlington Farm, Virginia, 1912. Note the very much thinner appearance of this grass as compared with the Sudan grass in figure 3.

At College Station, Tex., a test was made in 1912 by Mr. A. B. Conner, who sent in the following report:

Planted May 15 on one-fifth acre plat in rows 3 feet apart. Germination was fairly good, but stand not as uniform as desirable. Grass made very vigorous growth up to July 1. On July 7 was just coming into full boot. On July 15 it was in full head at a height of 7 feet and presented a very vigorous appearance. On August 8 the plat averaged 7 feet in height, and on account of the irregular stand each plant had put out a number of culms. Some were noted with as many as 40 to 50. Plants were very leafy to the top, showing superiority in this respect to Johnson grass. Harvested August 14 for seed and gave a yield of 57 pounds of thrashed seed. A second growth, which was produced without any rainfall, the season being exceptionally dry and not enough rain to produce a second growth on sorghums, attained a height of above 5 feet and

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was harvested for seed October 23, yielding only 8 pounds. The total yield of seed from the one fifth acre plat was 65 pounds, or at the rate of 325 pounds per acre. Seed tested 19 pounds per bushel, which gave the equivalent of 17+ bushels per acre.

A test at Dallhart, Tex., gave very promising results, thus reported by Mr. W. D. Griggs:

Two one-tenth acre plats of Sudan grass, one broadcast and one in rows, were seeded May 2, 1912 (fig. 1). The plat in rows failed to give a good stand and it was reseeded May 21. It was intended that these plats be harvested for hay, but owing to the local demand for seed among farmers it was decided to let the grass mature and harvest it for seed. Both plats were harvested September 7 and gave a total yield as follows: Broadcast, 515 pounds; in rows, 552 pounds of hay per plat. The former yielded 16 pounds of seed; the latter, 51 pounds. It is estimated that 25 per cent of the seed was lost in harvesting.

CALIFORNIA.

The following is a report on a trial at the Plant Introduction Field Station, Chico, Cal., by Mr. Roland McKee:

Two rows of Sudan grass, one 75 feet long and the other 150 feet long, were grown at Chico in 1912. It was grown on good loam soil and given irrigation. A fine growth was made, and without question this is the most promising grass for growing under irrigation in the Sacramento Valley that has yet been tried. The number of cuttings of hay that it is possible to secure was not determined, as with both the plantings a seed crop was allowed to mature, but it seems probable that three good cuttings of hay can be made. One of the plantings was allowed to produce a seed crop from the first growth. This was harvested late, but still a good hay crop was produced after that date. The other planting was cut for hay shortly after it came into bloom. A good crop of hay was secured and after that date a seed crop was matured.

The following data give some idea of the growth of this crop:

May 2	Row 75 feet long; sown.
July 9	In full bloom and 48 to 72 inches high.
July 15	Cut for hay.
August 29	Second growth 60 to 90 inches high.
November 1	A good crop of seed was ripe.
May 13	Row 150 feet long; sown.
July 9	In first bloom and 36 to 40 inches high.
August 20	First seed ripe.
August 28	70 to 80 inches high.
September 11	Cut for seed; 18 pounds secured. Yield about 40 bushels per acre figured on basis of 4-foot rows and 30 pounds of seed per bushel.
November 1	Second growth 3 to 4 feet high.

SOUTH DAKOTA.

A small test made in 1912 at Brookings, S. Dak., is thus reported by Mr. Samuel Garver:

Three rows, 36 inches apart, each 8 rods long, were planted April 30. The grass grew very slowly during the cool spring, being only 3 or 4 inches high on June 10, and was not injured meantime by three or four frosts. At this time warm weather began and the grass grew rapidly, maturing its seed

September 16. The actual amount of seed harvested from the three rows was 18.5 pounds, which is at the rate of 678 pounds per acre.

June 12, two rows, 36 inches apart, each 8 rods long, were planted. One row was cut for hay September 16, when 6½ feet high, but it should have been cut earlier. The yield of this row was 110.5 pounds, or at the rate of 6.08 tons per acre. The second row was left for seed, but did not fully mature when killed by frost September 18, only 2 pounds of mature seed being secured.

OREGON.

Regarding a test at the cereal station, Moro, Oreg., in 1912, Mr. D. E. Stephens gave his experience as follows:

Of the several grasses planted this spring at this station, the Sudan grass is the only one that gave good results. It was planted in rows 3½ feet apart. An excellent stand resulted and it grew vigorously to a height of 4½ feet. It was cut for hay on September 26 and yielded at the rate of 1.08 tons per acre. Although we have but this one year's results with this grass, it is the most promising one we have tried, with the possible exception of slender wheat-grass. So far as moisture is concerned, this season was a favorable one, but if this grass can stand the usual dry weather of this locality there is a future for it here.

MINNESOTA.

At the Minnesota Agricultural Experiment Station Prof. A. C. Arny reported that Sudan grass was planted in two short rows, one 8 feet long, the other 6, the rows 2 feet apart.

It was apparently sown thicker than it need be, for the grass is very thick in the rows and grew to an average height of 58 inches. There is a great abundance of leaves at the bottom. The stems are not very coarse and it looks as though the grass might make a very good quality of hay. The cattle seem to like it green and there is apparently no reason why they should not like it cured. It is altogether probable that, cutting the crop at the right time after planting it early in the season, two crops could be secured. The new growth at the base of the roots makes me think that this would probably be the way it would turn out.

I am not sure whether the grass will mature seed this fall or not. It depends altogether on how the frost holds off.

A few of the seeds were planted much thinner and they have reached a height of over 100 inches, being higher than any of our sorghum plants. Sown thin this way the stalk is quite coarse and it would not do for hay; that, of course, is not the way it is meant to be grown.

WISCONSIN.

From the Wisconsin Agricultural Experiment Station, Prof. A. L. Stone wrote as follows:

The Sudan grass sent us last spring for trial came a little too late to give us an opportunity to get in as large a plot of it as we would have liked to do. We put in only a single row of the grass, this row being about 60 feet long. The grass came on very nicely and headed out in fine shape. It will be impossible under the circumstances to make any estimate of the yield per acre, but from its appearance I am of the opinion this grass might prove of value in some sections of the country and possibly right here in Wisconsin, although it would need some experimentation to determine whether it can compete with timothy. I like the appearance of the grass

INDIANA.

At the Indiana Agricultural Experiment Station Sudan grass was not a success, as is shown by the report of Mr. M. L. Fisher.

To say it plainly, I think Sudan grass is not worth the room it takes; at least such is its merit this present year. It has been a wet season and, of course, it could not show drought-resisting qualities. It is not at all equal to millet or sorghum. The plants which I have grown this year are not over 30 inches tall and never appeared to be very thrifty. I raised some Johnson grass some few years ago and the Sudan grass seems to be about the same for this section as the Johnson grass. I think the plant would not furnish two cuttings in this section, although I have not made an effort to determine that point.

OHIO.

At the Ohio Agricultural Experiment Station Sudan grass was tested in comparison with millets and sorghums. Prof. C. G. Williams gave the results as follows:

The yield of the Sudan grass and a few competitors are as follows:

	Tons, air dry weight.
Sudan grass	3.88
Hungarian millet	2.25
German millet	3.55
Japan barnyard millet	1.48
Early Amber sorghum	8.75

We did not get a chance to test them out under droughty conditions, for we had anything but a drought this season. I am not able to give any opinion as to its ability to furnish two crops, as we did not cut it early for a second crop. You see that it compared very favorably with the millets. We have not tested it as to quality or palatability.

LOUISIANA.

Prof. W. R. Dodson, of the Louisiana State Experiment Station, tested Sudan grass in 1912 and reported as follows:

Two rows, each 300 feet long, were planted at the experiment station at Baton Rouge. The first cutting was made when the grass was 5 to 6 feet high; the second, August 26, when 4 to 5 feet high; and a third cutting was expected. The grass was cut each time when it was heading out.

Prof. Dodson estimates the first crop at 3 tons per acre and the second at 2 tons. A portion of the row left to mature failed to produce seed, doubtless owing to the work of the sorghum midge. In a later report the opinion is expressed that "we can safely count on two good cuttings and one moderate cutting."

OKLAHOMA.

For the Oklahoma Agricultural Experiment Station Mr. A. H. Wright reported as follows:

The Sudan grass grew well, reaching a height of 6 to 6½ feet in rows, maturing 8 to 10 days earlier than any other sorghum. The plots were small, 2 rows

in one plat covering one twenty-fifth of an acre and 6 rows in another one twenty-fifth of an acre. These were sown May 1 and harvested for seed August 12, yielding, respectively, at the rate of 900 and 700 pounds of seed and 2,775 and 2,525 pounds of stover per acre.

ALABAMA.

In reference to a test at the Alabama Agricultural Experiment Station, Mr. E. F. Cauthen sent the following account:

The Sudan grass was planted June 15 and was mowed for hay on August 16. We planted it alone, in connection with cowpeas, in connection with Japanese millet, and in connection with German millet. The Japanese millet is too early for the grass. The German millet fits better with this grass for hay. The ordinary cowpea seems to be a little late as a combination crop.

The hay should have been cut about the 1st of August, but was left for the farmers attending the summer school to inspect.

I am inclosing a print showing the grass and cowpeas just before they were mowed. It looks to me that the Sudan grass will make a permanent hay crop for this section. I have one plat that I am saving for seed and will mow the other the second time if the grass gets sufficiently high.

TENNESSEE.

At the Tennessee Agricultural Experiment Station one-tenth of an acre was sown broadcast. Prof. C. A. Mooers wrote as follows:

Our test with Sudan grass will not allow me to draw all the conclusions that you want. This grass rusted rather badly this year but made a fair yield, and under favorable conditions I feel sure that a second crop could be cut to advantage. It stood the dry weather only fairly well.

Comments by Prof. Morgan and others who saw the plats are rather unfavorable to this grass, but I think the tonnage was greater than that of millet sown at the same time. Of course, common sorghum would outyield it greatly, but the difficulty with which it is cured hardly enables us to make a fair comparison between the two. I may add that some Rhodes grass planted at the same time far outyielded the Sudan grass and made a very attractive growth, indeed.

KENTUCKY.

In a small test at the Kentucky Agricultural Experiment Station the grass was allowed to mature for seed. Prof. H. Garman reported the following results:

Land plowed, disked, and harrowed. One-fortieth of an acre planted at rate of 26 pounds per acre. Drilled; rows 3 feet apart. Came up May 27, 1912. Stand perfect. Began to bloom July 15. In full bloom July 25. Last bloom August 5. Cut for hay October 24. Yield, fresh, 190 pounds. Yield, dry, 184 pounds. Height of plants, 75 inches. Seed saved for planting in 1913.

MARYLAND.

The results obtained at the Maryland Agricultural Experiment Station are thus reported by Mr. Nicholas Schmitz:

The Sudan grass was planted in rows on June 3 and July 13. The planting made on June 3 consisted of about one-fourth of an acre. It came up well, and there was a good stand to begin with, but owing to various accidents during the season there was not more than about one-third of a stand left to produce

seed. The yield of seed was about 3 bushels and was harvested the first week in November.

That planted on July 13 did not mature seed before frost, but was ready for cutting for hay after the middle of October.

The grass seems very promising for this section, and it appears from the late seedling that over a large part of Maryland it would be possible to sow the grass after wheat and harvest a crop of hay that year.

The hay was relished very much by our dairy cows, and our dairymen were so enthusiastic over it that they asked for a field of this for hay for the cows next year.

VIRGINIA.

At the Virginia Agricultural Experiment Station a small test gave the following data:

The Sudan grass was broadcasted on a plot of one-fiftieth of an acre, but was not harvested until nearly mature (September 11), when it was $8\frac{1}{2}$ feet tall. The plot yielded 200 pounds of coarse hay, or at the rate of 5 tons per acre. The chief criticism offered as a hay plant is its coarseness.

NEW JERSEY.

From the New Jersey Agricultural Experiment Station Director J. G. Lipman sent the following report:

The Sudan grass was seeded in the spring, and the seeding was followed by decidedly unfavorable weather conditions. We had a severe drought in June and July. Nevertheless, the crop in question made fairly satisfactory growth and yielded on poor land a crop equivalent to 1 ton of dry matter per acre. The hay made from the Sudan grass was better in quality than that we could have made from millet grown under the same conditions. It is Mr. Owen's opinion that on the whole Sudan grass will compare favorably with millet as to growth under trying climatic and soil conditions and that it will produce a hay of better quality. It is my impression that on better soil and under more favorable climatic conditions Sudan grass should yield a crop equivalent to 2 or even more tons of hay per acre.

REPORTS OF EXPERIMENTAL TRIALS BY FARMERS.

TEXAS.

A detailed report of particular interest was received from Mr. F. J. McCarthy, Boerne, Tex., under date of September 4, 1912:

I deferred planting the seed. Seeing no sign of rain on April 18 and knowing there was not enough moisture in the soil to sprout the seed, I thought it best to plant the seed in the dust and take my chances of the first rain sprouting the seed. I had plowed a piece of new land in November, 1911. This land had received two harrowings; one December 10, 1911, the other February 14, 1912. This land is dry upland and was covered with a heavy growth of post oak, blackjack, and live-oak timber. April 18, 1912, I opened seven furrows, 100 yards long, 3 feet apart, and 2 inches deep. I planted the Sudan grass seed in furrows and covered the seed 2 inches deep with the dry dust. April 25 we had a drizzling rain which lasted from 8 a. m. until 10:30 a. m. May 1 the grass appeared above ground, about half of a stand. On investigation I found the other half of the seed dry and untouched by the moisture. May 4 we had a light rain, lasting from 6 a. m. to 7 a. m., not enough to sprout the dry seed.

We cultivated the Sudan grass with a 5-tooth cultivator, very shallow the first time, May 25. Second cultivation, June 6. Light rain, not enough to sprout the dry seed still in the ground. June 20, cultivated the third time with 5-tooth cultivator, shallow. July 1, cultivated the grass the fourth and the last time.

Being anxious to save the seed of this grass and thinking that every day would bring a rain to mature the seed I left it growing till August 18. On that date the grass was 8 feet 6 inches high and so dense was the growth one could not pass between the 3-foot rows.

I wish to state that on the same date, on the same land, and under the very same conditions, I planted kafir corn, milo maize, sorghum, and corn. All of these completely died out; they could not withstand the terrible heat and drought. The thermometer registered from June 1 to the date of this report (September 4, 1912) 105° to 110° F. in the shade. All vegetation was sear and dead except Johnson grass, which grew from 1 foot to 18 inches high. Sudan grass showed no effects of the drought except the seed heads, which remained white.

I do not know how far north this grass will grow, but I am satisfied there is no place too hot or dry for it if there is moisture enough to sprout the seed.

I am a stockman and I have been testing grasses and clovers for the last 35 years, with the result that I had to fall back on the sorghums, the very thing I was trying to avoid.

Additional data were supplied in a supplemental report dated January 24, 1913.

I herewith send you a supplemental report on the Sudan grass. The grass was first cut on August 14, 1912. It made a large amount of feed, I would say at the rate of 4 tons per acre.

A few days after being cut it began to grow from the stubble. Having no rain it grew slowly until September 21, 1912. On that date we had our first rain since June, 1912. After that date it began to grow quickly until November 6, 1912. November 1, 2, and 3 we had a severe frost which did not seem to hurt it at all. November 6, a dry blizzard came down on us. Being afraid I was going to lose the grass, I cut it and tied it, still green, in bundles and hauled it to the barn, where it cured and made me plenty of fine feed, it being 4 feet high at the time of cutting. If I had cut this at the proper time to make good feed, i. e., when the seed was in the boot, I could have cut it four times instead of twice, but I was anxious to save the seed. The terrible drought blasted the first crop and the frost prevented the second from maturing.¹ I exhibited at the Boerne fair, September 6 and 7, 1912, a bunch of this grass that measured 10½ feet high. Agents of the Agricultural Department, College Station, Tex., who acted as judges at the Boerne fair, were astonished. They told me they had the grass drilled just as I had drilled mine and it only grew 4 feet high for them.

Dr. W. O. Langdon, of Hutchins, Tex., grew Sudan grass in 1911 and again in 1912. He thus reported his 1912 results, under date of August 18:

The seed received this spring was planted in a little piece of ground in rows about 30 inches apart. It made a fine growth of an average of 6 feet. Much of it was nearly 8 feet high. When seed was ripe, about August 1, I cut it. It immediately began a second growth and is now nearly 3 feet high. The ground is covered with young plants from shattered seed. I think it is the greatest forage plant ever introduced into this section and that it will be worth millions to

¹ The blasting of the seed referred to by Mr. McCarthy is perhaps due to the work of the sorghum midge, which attacks Sudan grass, like other sorghums.

Texas and other semiarid sections. All stock eat it ravenously, as it is very sweet. The inclosed pictures will give you some idea of it, although it must be seen to be fully appreciated.

In a supplementary report dated January 20, 1913, he added:

In answer to your letter will inform you that the second growth of Sudan grass attained a height of at least an average of 6 feet. I cut and stored the hay from the first cutting, hoping to get the seed thrashed out, but did not succeed in doing so. I did not cut the second growth, but am sure it was as heavy as the first crop. I am sorry I can not give you more definite information as regards the amount of hay and seed produced, but have been very much "under the weather" for some months and so things have gone slack. Of one thing I am certain—there is no better forage plant for this section. It is a wonderful producer, very drought resistant, makes a most remarkably sweet-smelling hay with a very different odor from Johnson-grass hay, and will never become a pest.

Mr. J. R. Stegall, of Detroit, Tex., wrote concerning his 1912 experience as follows:

I sowed the Sudan seed that you sent me, half in bottom on strong land and the other half on sandy, thin land. The results on both are most wonderful. I prepared a good seed bed by breaking deep and then harrowed both ways. I sowed seed April 25, making the first cutting May 20. I have cut the twentieth of every summer month, June, July, and August. I am cutting to-day (August 20, 1912). The yield is larger every cutting, as it stools out from the root. The piece in the bottom I sowed by the side of a small spot of Johnson grass. I have cut the Johnson grass twice and the Sudan grass four times. Stock eat Sudan grass hay with more relish than Johnson grass hay, as the texture is not so coarse. This Sudan grass is the most wonderful thing in the way of hay I ever saw. I have had a great many applications for seed, but I have none to sell.

In a postscript Mr. Stegall added:

I neglected to mention we have had quite a long, dry time; no rainfall. Not all the crops were damaged. The Sudan grass has resisted the drought, the grass on the bottom land standing better than that on the sandy soil.

In a subsequent report additional data were given as follows:

You sent me 2 pounds of seed. I sowed it on one-eighth of an acre. I got 400 pounds of nice, cured hay at each cutting. Some of my neighbors told me I sowed it too thick, but for cutting in milk I am satisfied I sowed it about right. When I turned my cattle, hogs, and horses in the field, I had goobers, peas, corn, and crab-grass, but they would not eat any of these until the Sudan grass was completely consumed. Stock love it better than anything else they can get to eat.

I had a small patch of Johnson grass right by the side of the seed I sowed in the bottom. I cut the Johnson grass twice and the Sudan grass five times. The weather was dry and I got a nice cure every time I cut. Stock would eat the Sudan grass before they would the Johnson grass.

Mr. W. W. Price, Mount Pleasant, Tex., recorded his experience as follows:

On April 3 I sowed 5 pounds of Sudan-grass seed on one-half of an acre of light, sandy land. The grass reached a height of 7 feet and matured 64 days from the date sown, the cutting yielding $1\frac{1}{2}$ tons of hay.

The experience of Mr. H. N. Montgomery, of Austin, Tex., is thus reported:

We planted the Sudan grass broadcast, about like oats, on a rich but rather droughty piece of land (black waxy) which, however, had been well prepared and was in good condition. Since planting, May 7, we have had one good rain, June 17. The grass had withstood the drought well and made a very rapid growth, attaining an average height of 5 feet. Although very similar in appearance to Johnson grass, I consider it far superior as a forage crop, as it is much more bunchy, putting out more stems and a great many more leaves than Johnson grass. The stems are very sweet, containing a great deal of sugar, and are eaten greedily by both cows and horses, none of it being wasted, as is so often the case with the coarser grasses. I should judge that it would make double the amount of hay made by Johnson grass under the same conditions. The root system is very much like that of oats or crab-grass and there is no danger of the land becoming infested, as it is easy to kill out. I plowed across one end of my patch of Sudan grass with a sweep, turning the bunches up, and there has been no sign of its reappearance.

I cut the hay after saving all the seed, and the grass is again sprouting, although there has been no rain.

Next year I expect to plant all the seed I have, as Sudan grass has proved itself far superior in quality and quantity to any of the grasses in this locality. I shall also try it on land infested by Johnson grass, as I have an idea that if planted thick enough it will choke out the Johnson grass in the course of two or three years.

KANSAS.

Mr. J. M. Gilman, of Leavenworth, Kans., made a small trial in 1912 with the following results:

I made two plantings of Sudan grass, one early and one later. The early planting, April 25, in 12-inch rows, was of much less growth and fell down and shattered seed badly. The later planting, May 20, was one-fifteenth of an acre in rows 42 inches wide and was cut twice, the first cutting yielding 346 pounds and the second 267 pounds of cured hay. The first cutting was left a little too long, but was cut about September 10; the next cutting was made October 14.

ALABAMA.

Mr. Charles Anderson, of Axis, Ala., grew Sudan grass in 1912 and gave his experience as follows:

I planted the Sudan grass seed May 2 and cut it twice. I am unable to give you the amount in pounds, as I had no way of weighing. It grew very rapidly and made a very heavy crop, which I would estimate at $1\frac{1}{2}$ tons to the acre per cutting. The stock ate it greedily, but I did not have enough to demonstrate what it did for them, though they were fond of it. I would consider it a valuable crop to grow.

SOUTH CAROLINA.

Mr. R. Bates, of Jackson, S. C., made the following report:

I cut this grass twice. It went to seed twice, once from the grain and again from the stubble. The seed yield was poor, being but 10 bushels per acre for both harvests. It makes a hay yield fully equal to Johnson grass.

