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KANSAS STATE AGRICULTURAL COLLEGE.

Sudan Grass in Kansas

MANHATTAN, KANSAS.

KANSAS STATE PRINTING PLANT.

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FOREWORD.

This bulletin was written by G. E. Thompson, crop specialist in the Extension Division, but superintendent of substations previous to January 1, 1916, to supply the demand for information regarding Sudan grass. It is intended to apply primarily to Kansas conditions. It gives briefly the adaptability of the crop, the methods of handling, the conditions under which it can be profitably grown, and the results that have been secured in this state in pasturing Sudan grass and in feeding Sudan-grass hay.

Credit is due to the superintendents of the various branch experiment stations for faithful work with the crop and for painstaking reports of tests of Sudan grass on their respective stations. Special credit is due the Fort Hays Branch Experiment Station for feeding tests in wintering stock cattle and in wintering horses and mules, and to Prof. W. A. Cochel, who outlined the above experimental work. Credit is also due to Professors O. E. Reed and J. B. Fitch, of this station, for feeding tests with dairy cows. Acknowledgments are also made to the office of Forage Crop Investigations of the Department of Agriculture, for coöperative data on yields from the Fort Hays Branch Experiment Station and for seed used in the tests of 1914. L. E. Melchers, of this station, has also contributed valuable information regarding various treatments for controlling smut and other diseases affecting Sudan grass.

L. E. CALL, *Agronomist.*

SUMMARY.

Sudan grass is an annual belonging to the sorghum family. It is a native of Africa, imported to this country by the United States Department of Agriculture in 1909.

It is primarily a hay crop.

Sudan grass is adapted to practically all soils of the state except those that are very wet and poorly drained, extremely alkaline or extremely sandy.

The crop may be planted and handled in much the same manner as an ordinary sorghum.

When planted in cultivated rows, two to four pounds of seed per acre are needed; in broadcast or drilled plantings, fifteen to twenty-five pounds are best.

Two or three cuttings for hay or one seed crop should be secured each season.

Four hundred pounds of seed per acre is an average crop, or two to four tons of hay may be expected as a season's crop.

The diseases affecting Sudan grass are largely the same as those affecting other sorghums, and the same methods of disease prevention are satisfactory.

Sudan grass makes a very palatable hay, richer in protein than prairie hay, but not as rich as alfalfa hay.

Feeding results have been uniformly good.

It appears to be valuable in a limited way for pasture purposes.

Sudan grass promises to replace a considerable portion of the millets and sorghums sowed for hay purposes.

SUDAN GRASS IN KANSAS.

By G. E. THOMPSON.

SUDAN GRASS is a tall, leafy annual grass belonging to the sorghum family. It grows to a height of six to eight feet under reasonably good conditions, and was first introduced into this country through the courtesy of the Sudan government at Khartoum, Africa, by the Department of Agriculture. C.V. Piper, chief of the Office of Forage Crop Investigations, first grew it in the United States at Chillicothe, Tex., and from this point it has been distributed throughout the Great Plains region. Sudan grass has proved well adapted to drouth, and is fast becoming recognized as a staple and dependable crop. It has now been grown from two to four years on all of the experiment stations in this state, and during the last two years has been widely distributed on farms. In 1915 there were approximately 20,000 acres of this crop grown within the state.

Favorable Climatic and Soil Conditions.

In so far as Kansas is concerned, Sudan grass is adapted to practically all soils except those which are very wet and poorly drained or those which are extremely alkaline or extremely sandy. The soil conditions generally favorable to Sudan grass are similar to those favorable to the other sorghums. It yields best in a rich loam to sandy loam soil that is well drained. Thinner and poorer soils necessarily produce lighter yields, although Sudan grass, like the other sorghums, is an extensive feeder, and is one of the profitable crops on thin, poor upland soils. Being a native of a hot, dry climate, it is naturally adapted to the relatively dry conditions of western Kansas, and it is in this part of the state that it will prove of most value.

The Place in Crop Rotations.

Sudan grass can readily be used in any ordinary farm rotation. It is an annual, and can be substituted in the average rotation in place of corn or any other sorghum crop, or it can be grown in the longer rotations instead of the perennial hay

or pasture grasses. It is not a legume, and will therefore not add nitrogen to the soil, although its extensive fibrous root system contributes to the supply of organic matter. Careful study of its moisture requirements under field conditions and examinations of the root system at all stages of growth show that Sudan grass can draw moisture from greater depths of soil than millet, but it does not draw its moisture supply from as great a depth as do the ordinary sorghums.

Uses of Sudan Grass.

Sudan grass is a crop that matures quickly and can often be used as a catch crop. Because it makes a much better sod than the ordinary annual grasses, and because its growth of foliage is rank and rapid, it has been, and no doubt will be,

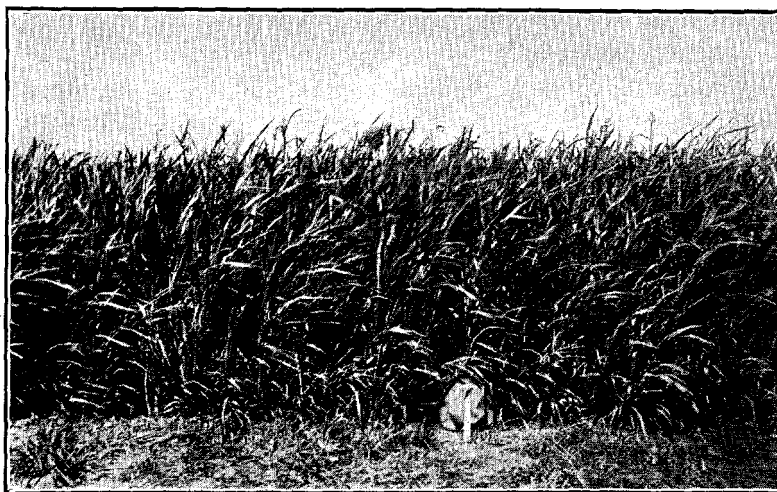


PLATE I.—Drilled Sudan grass, twenty-five pounds per acre.
Photographed fifty days after planting.

used to a considerable extent for pasture purposes. However, its primary use is as a hay crop. When once well started the forage growth is heavy and rapid and the hay produced cures easily and makes excellent feed. The plant produces seed readily and often makes a profitable crop to grow for seed purposes. It is also fairly well adapted for use as a soil-ing crop, and has been utilized to a limited extent for silage purposes, although for the latter purpose it can not compete with the larger growing sorghum crops in this state.

Preparation of Seedbed.

As good preparation of the seedbed as is given to corn will pay in the growing of Sudan grass. Maximum yields will uniformly occur only on ground that has been prepared early by deep plowing, that is free from weeds, that contains plenty of available plant food and moisture, that is warm, and that does not blow. However, Sudan-grass seed germinates easily, and good results are sometimes secured on ground which has been poorly prepared.

In planting for hay purposes the seedbed should be comparatively smooth and well compacted. A seedbed that gives good results with millet will be satisfactory for Sudan grass. When the crop is planted in cultivated rows for seed production, ordinary preparation of the soil, such as is given to corn, is sufficient.

Seed for Planting.

Seed to be used for planting purposes should be of good germination, should weigh in the neighborhood of forty pounds to the bushel, should be uniform, contain no smut or other diseases of grains, and should be free from noxious weed seeds. The greatest danger in planting Sudan grass is adulteration with Johnson-grass seed, and it is most important to make sure that the seed planted is free from it. As a precaution, northern-grown seed only should be planted. The most desirable seed is called "cream hull," from the color of the hull on the seed. Dark-colored or black seeds are objectionable. They may be pure, but they are usually considered an indication of sorghum mixtures or of Johnson grass, and therefore, unless the seed is known to be pure, should be avoided. It is probable that temperature and moisture conditions affect the coloring of the seed considerably, and in many cases seed known to be pure is dark colored.

Time and Rate of Seeding.

Planting should be delayed in the spring until the ground is thoroughly warm. In general, the time for planting is the same as that for other sorghums, but may be a little later.

The rate of seeding should be governed by the purpose for which the crop is grown, by the type of soil, by climate, by rainfall, by the conditions of the seedbed, and by the time of



PLATE II.—Sudan grass in 22-inch rows, for hay. Six pounds of seed per acre.

planting. When the crop is planted for hay or for pasture purposes anywhere in the eastern half of Kansas, from twenty to twenty-five pounds will be more satisfactory than lighter seeding and more economical than heavier seeding. In the western part of the state from fifteen to twenty pounds will be better than heavier seeding. Where a lighter or smaller amount of seed is used, weeds are likely to give trouble. When an amount of seed as large as here recommended is used, it is best to plant with an ordinary grain drill. A wheat drill set to sow two pecks of wheat to the acre will ordinarily sow approximately three pecks of Sudan-grass seed.

When the crop is planted for seed production in the eastern half of the state three to four pounds of seed to the acre in rows forty to forty-four inches apart (ordinary distance of corn) has proved most satisfactory. In western Kansas, two to three pounds have given better results. With a seedbed well prepared and in good condition, with the ground well warmed, and with medium early planting, a slightly smaller amount of seed can be used than with a poorer seedbed and poorer planting conditions. When conditions are favorable, Sudan grass stools extensively, oftentimes fifty to one hundred stems being produced by a single seed, and cases are on record where approximately four hundred stems have been found on a single plant. In planting for seed production, usually the easiest,

most rapid and most convenient method is to use an ordinary corn planter or lister, running the seed through an ordinary milo plate. By testing the planter carefully, it can be regulated to sow the desired amount of seed with considerable accuracy. In case too much seed is being planted, a portion of the holes in the plate may be filled with lead; or if the seeding is too light, a portion of the holes may be reamed out from the under side until they are large enough to sow the desired amount of seed. Unless Sudan-grass seed has been very carefully threshed and well cleaned there is a small awn or beard on the seed, which sometimes causes the seed to clog in the drill plates. Care should be taken to clean the seed and thus prevent this difficulty.

Another method of planting which has proved very satisfactory at the Experiment Station at Hays has been to plant by the use of an ordinary corn planter, placing the rows forty-four inches apart. Then the field is planted again, splitting the middles of the first rows to make the final rows twenty-two inches apart. This uses about six pounds of seed to the acre. Yields approximating five tons of hay per acre in two cuttings have been secured by this method, the only cultivation being a single harrowing shortly after the grass was well started. As long as seed is exorbitantly high in price, this method is more economical than seeding with a grain drill.

The following tables give in detail the results secured by different rates of seeding and different times of seeding at the Tribune Experiment Station :

TABLE 1.—*Date of seeding tests, 1915.*

Tribune Substation, Greeley county. All plots seeded at the rate of 15 pounds per acre. All weights are in field-cured condition.

DATE SEEDED.	Tons per acre.			Remarks.
	First cutting.	Second cutting.	Total.	
May 15.	2.00	2.65	4.65	A light frost injured this planting.
June 1.	3.66	2.92	6.58	Best date of seeding in 1915. Other years two weeks earlier has been better.
June 15.	2.08	2.92	5.00	As late as seeding can be made and two cuttings secured.
July 1.	3.11	0.75	3.86	In some seasons planting at this time allows time for a seed crop.
July 15.	2.06	.....	2.06	One crop of hay only can be secured when planted at this date.
August 1.	1.17	.....	1.17	Too late for good results.

TABLE 2.—*Rate of seeding Sudan grass.*
Tribune Station, 1915. All plantings June 1. All weights field cured.

RATE OF SEEDING. POUNDS PER ACRE.	Yield per acre in tons.		Total.
	First cutting.	Second cutting.	
15.....	3.10	3.66	6.76
20.....	2.70	3.19	5.89
25.....	2.20	2.73	4.93

Field observations of the results shown in the two preceding tables indicate that Sudan grass should be sowed about the same time as other sorghums; that is, two to three weeks later than Indian corn in the same locality. The thicker seedings produce a finer stem and a little better quality of hay, but do not produce as large yields and are not as profitable as the medium and thinner seedings. The danger of thin seeding is that in foul ground weeds may choke out the grass before it reaches the stage where it begins a rapid growth.

The following table gives the results secured by the Fort Hays Experiment Station in planting Sudan grass at different rates during the years 1913, 1914, and 1915:

TABLE 3. Summary of Rate of Seeding Tests of Sudan grass on Hays Station.

1913 weights are field cured. 1914 and 1915 weights are air dry.

1913.*			1914.			1915.			Average yield per acre in tons.
Pounds of seed planted per acre.	Space between rows in inches.	Tons of hay per acre.	Pounds of seed planted per acre.	Space between rows in inches.	Tons of hay per acre.	Pounds of seed planted per acre.	Space between rows in inches.	Tons of hay per acre.	
4.....	40	0.64	4.....	40	4.32	4.....	40	3.77	2.91
7.....	18	0.76	7.....	24	4.17	7.....	24	4.39	3.11
			10.....	6	4.18	10.....	16	4.21	.....
15.....	6	0.39	15.....	6	4.16	15.....	16	4.22	2.92
22.....	6	0.49	20.....	6	3.80	20.....	8	4.26	2.85
30.....	6	0.60	25.....	6	3.85	25.....	8	4.45	2.97
40.....	6	0.71	35.....	6	4.44	35.....	8	4.12	3.09

*Extremely bad growing season and all crops poor.

Examination of this table and field observations during the seasons when the yields were secured indicate that growing conditions have more to do with yield than rate of seeding. The best practical plan is to sow at the first favorable opportunity when the season has progressed far enough to allow seeding the other sorghums and to seed thick enough to prevent weeds choking out the grass.

Cultivation.

The objects of cultivation are the same as in cultivating any other crop; to keep out weeds, to keep the ground open and in shape to allow moisture to be absorbed readily, to aerate the ground and aid in the formation of available plant food, and to leave the soil in such condition that the crop can be easily harvested. When the crop is planted with an ordinary grain drill, no cultivation is necessary. When planted in cultivated rows, the ordinary corn-cultivating machinery can be used. However, since the grass grows slowly for the first three weeks, the ground should be in good condition at planting time, for it is seldom profitable to attempt cultivation while the crop is very small.



PLATE III.—Sudan grass in cultivated rows for seed production.
Note its height in comparison with Western Orange sorghum.

Yields to be Expected.

Sudan grass in Kansas should, under average conditions, yield two cuttings of hay each season. Under favorable conditions three cuttings will sometimes be secured, while under extremely unfavorable conditions only one cutting will be secured. Yields under average conditions should run from one to four tons or more for the season's crop.

Seed yields vary greatly. The average yield of the seed grown under field conditions without irrigation in this state has been in the neighborhood of 300 to 400 pounds per acre. Yields in excess of 600 pounds per acre have been secured; and on a field scale, yields in excess of 525 pounds per acre have been authentically reported. Much larger yields have been reported in other states.

The following table gives comparative yields of Sudan grass, Kansas Orange sorghum, Blackhulled White kafir and German millet when drilled thickly for hay purposes at the Manhattan station.

TABLE 4.

	Tons per acre.	
	1914,	1915.
Sudan grass.....	4.88	3.65
Sweet sorghum.....	4.93	3.05
Kafir.....	4.47	5.02
Millet.....	2.60	3.01

This table shows that Sudan grass has outyielded millet and made favorable yields when compared with sweet sorghum and kafir. The Sudan hay is more easily cured and handled than the kafir or sweet sorghum hay, there is less waste in feeding, and it is more marketable.

The following table shows the results of tests throughout the state in which Sudan grass is compared with coarse-growing sweet sorghum, silage and fodder crops:

TABLE 5.—*Comparison of forage yields of Sudan grass and sweet sorghums grown in cultivated rows, 1915.*

	Pounds of fodder per acre (dry).	
	Sudan grass.	Red Amber sorghum.
Reno county.....	5,799	*25,100
Cloud county.....	2,520	*8,280
Thomas county.....	3,540	7,740
Wichita county.....	2,150	4,400
Seward county.....	4,298	6,800
Lane county.....	2,170	7,470
Riley county.....	4,580	*21,840

*Kansas Orange sorghum.

This table confirms the statements made elsewhere in this bulletin that Sudan grass is primarily a hay crop and should not be grown for silage purposes, as the sweet sorghums will outyield it in cultivated rows.

TABLE 6.—*The yield of Sudan grass under irrigation at the Garden City Station in 1915.*

PLOT.	Yield per acre—pounds.	
	Seed.	Hay.
A 7.....	240	6,760
A 8.....	440	7,160
B 7.....	320	6,680
B 8.....	420	6,780
C 7.....	360	6,640
C 8.....	520	6,680
D 7.....	420	6,380
D 8.....	520	6,080
Field 8—7.8 acres: first cutting.....		6,860
second cutting.....		1,940
Total.....		8,800

In all cases except the last the crop was allowed to mature seed. This results in a smaller hay yield than is secured when two or more cuttings are made.

Harvesting.

With broadcast plantings for hay purposes, the ordinary mower is the best means of harvesting. The hay cures easily and small dews or light showers do not damage it as badly as they do alfalfa, Sudan grass in this respect being more like prairie hay. The hay is handled easily with pitchforks, stacks easily, and is not "slippery" like millet hay. The proper time to cut for hay is a debated question. There is little doubt but that more nutriment will be secured from a given amount of hay if it is allowed to stand in the field until the pollen has fallen and the seeds are forming than if cut at an earlier stage. However, experience in this state seems to indicate that for practical farm purposes it is more profitable to cut as soon as the grass begins to head, as by cutting at this period more hay will be secured during the season, and the hay seems a little more palatable than when cut at a later stage. Sudan grass hay is not washy or extremely laxative in effect, and consequently the objection to early cutting, which holds good with many crops, is not so important with Sudan grass.

In harvesting the seed crop, experience indicates that the highest percent of good-quality seed will be secured if the crop is not cut until after the earliest seed heads are fully mature. This may result in a small amount of shattering from the earlier ripening heads, yet there will also be a considerable number of immature late heads. The grower of the crop must watch conditions closely and use his own judgment as to the proper time under existing conditions. A bad guess may mean considerable loss, as a high wind on an overripe crop sometime results in severe shattering.

It is usually more profitable to harvest the first growth for seed purposes, and the second for hay, than to attempt to harvest the first growth for hay and the second for seed. Only in exceptional cases in Kansas can two seed crops be secured in a single season. In harvesting cultivated rows, the most rapid and most economical method is by the use of the ordinary row or corn binder. In case the season has been extremely unfavorable and the growth small, it is cheaper and more economical to use the ordinary grain binder, cutting two rows at once. This method has been successfully followed in several cases. The crop should then be shocked in the field and allowed to cure out thoroughly, after which it may be stacked to await threshing, or it may be threshed directly from the shock.

Determinations made at both the Manhattan and Hays stations show that Sudan hay, which would ordinarily be called field-cured or in shape for stacking, still contains more moisture than an ordinary hay, and unless special care is exercised there will be danger of heating in the stack or barn.

Threshing.

In threshing, the ordinary sieves used in handling flax or millet can be used in handling Sudan-grass seed. Some care must be taken that the seed is not blown over with the chaff, but usually little trouble is experienced in this matter. If dry, the straw runs through the machine easily without clogging. Under average farm conditions it is not a profitable practice to top the bundles before threshing, but if they are damp they are very hard to thresh, and under these conditions topping is advisable. Prices paid for threshing Sudan grass have varied from eight to twenty cents a bushel. Probably twelve cents a bushel of forty pounds is a reasonable and just price with an average crop. The seed does not heat as easily in storage as seed of the ordinary sorghums, and it can be kept in any manner that is satisfactory for keeping other seeds used for planting purposes.

Diseases Affecting Sudan Grass.

A number of the same diseases that affect sweet sorghums and kafir also attack Sudan grass. However, none of the diseases known to affect Sudan grass are particularly serious, and by planting clean seed and by using a proper system of crop rotation most of the diseases can be controlled.

Kernel smut of Sudan grass. The kernel smut of Sudan grass is caused by the same species or kind of fungus that produces the kernel smut of the sweet sorghums or kafir. It can be controlled by the same measures used in controlling the disease on these crops.

The disease is first noticeable after the Sudan grass has begun to head. Examination at this time shows that many of the seeds are replaced by smut balls or "false kernels." In most cases when any portion of a seed head is affected the entire head is affected, and the affected head is usually smaller in size than healthy heads. The smut balls or false kernels are usually about twice as large as a healthy kernel, being more

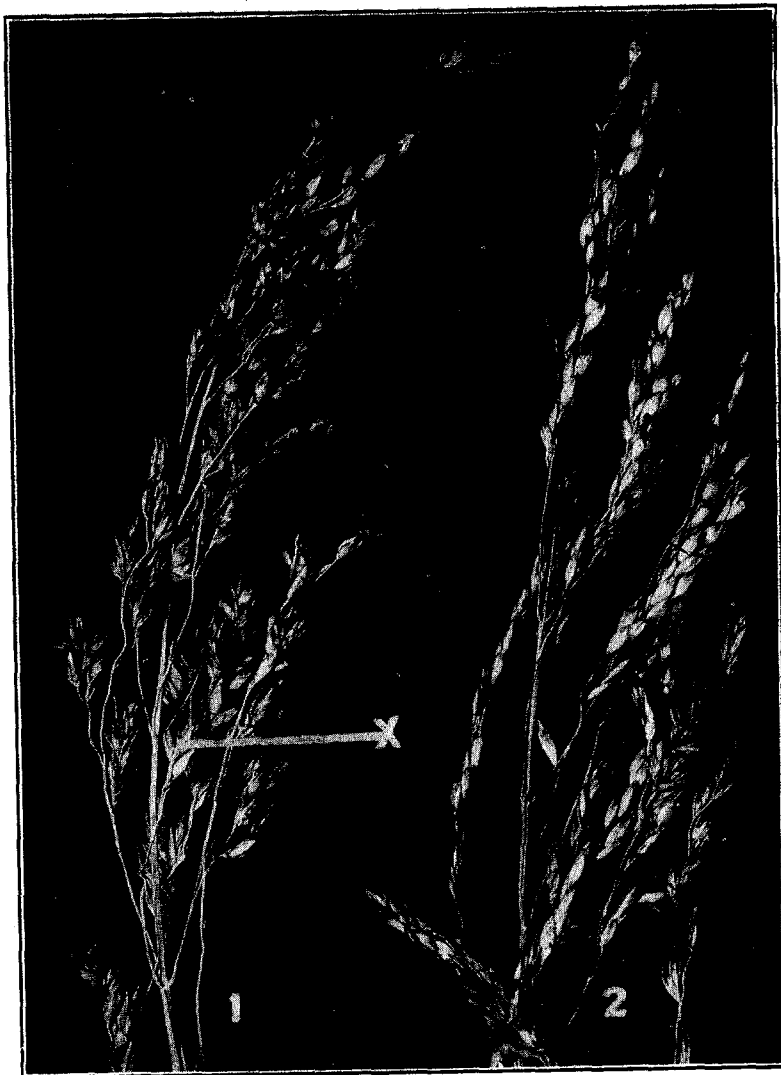


PLATE IV.

FIG. 1. A head of Sudan grass affected by kernel smut. X shows one of the "false" kernels protruding from between the glumes.

FIG. 2. A healthy head of Sudan grass.

nearly round and considerably longer, often nearly cone-shaped. These false kernels are covered with a grayish or dirty white membrane, within which are the spores or reproductive bodies of the fungus. When this membrane becomes broken the spores are allowed to scatter. Threshing is one of the most effective ways of scattering the spores and spreading the disease. The smut spores cling readily to healthy grain, and when contaminated seed is planted without seed treatment, diseased plants will result. The kernel smut of kafir and the sweet sorghums can be transferred to Sudan grass, and likewise the smut on Sudan grass can be transferred to the other sorghums.



PLATE V.—Kernel smut affecting Sudan-grass seed.

FIG. 1. Normal seeds of Sudan grass with and without the hulls. K, with glumes; L, without glumes.

FIG. 2. "False" kernels of Sudan grass, showing how they spread the glumes apart. (Greatly magnified.)

Treatment of seed to kill smut. Investigations by the botany department of this station show that both the hot-water and formaldehyde treatments will kill kernel smut on Sudan grass as well as on the other sorghums. It has also been found that extremes of treatment in either hot-water or formaldehyde methods cause a proportionate increase in seed injury. Likewise, seeds having the hulls removed are more easily injured than those which are protected by a hull.

For treatment under farm conditions the formaldehyde method is as good as any, and quite easily carried out. This method is as follows: Place one pound of standard-strength

formaldehyde in thirty gallons of water; soak the seed for one hour, and dry thoroughly before planting. It is necessary that the seed be planted immediately or dried carefully before being resacked, otherwise there is danger of heating and injuring the germination. Treated seed should not be placed in infected sacks or planted through an infected drill. Sacks may be soaked for a couple of hours in the solution used for treating seed, and drills may be washed out with a strong solution of the formaldehyde. A pound of standard-strength formaldehyde should not cost more than 50 or 75 cents.

Blight of Sudan grass. A blight or leaf spot similar to, if not identical with, the blight of sorghums is found on Sudan grass. Apparently it is a bacterial disease. Field observations indicate that it is more apt to be present in humid climates or in wet seasons than in semi-arid climates or dry seasons. There is little that can be done to control the disease, but it is not serious in this state. When it appears on a hay crop, early cutting may save some loss of hay. It is seldom indeed that the disease becomes bad enough to severely injure the seed. The disease is distinguished by the fact that it is confined almost entirely to the leaves, producing irregular, elongated, red blotches. In the later stages these blotches may become dark or blackish in color, and portions of the affected leaves may die.

Seedling root disease of Sudan grass. Occasionally a "wilt" caused by a fungoid attacks seedling, of Sudan grass. It is first indicated by a reddish color and wilted appearance of the leaves. Later the plant dies. At the present time the disease is not serious, as usually only a small number of plants in any one field are diseased. It seems probable that a proper crop rotation will control this trouble.

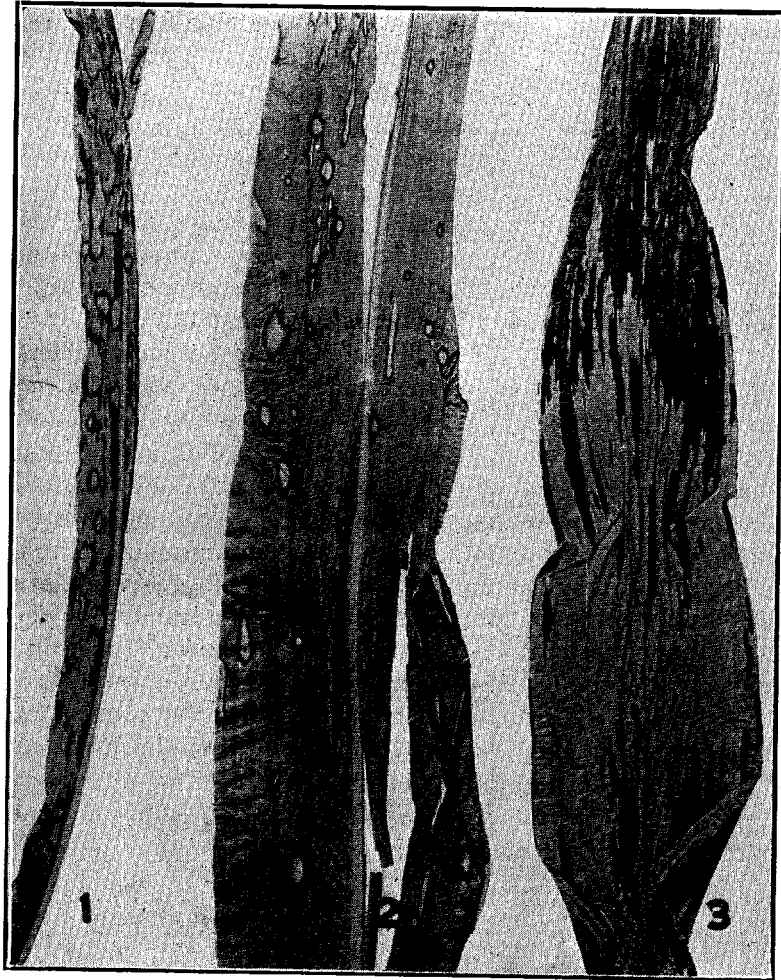


PLATE VI.

- FIG. 1. Blight on Sudan grass blade.
FIG. 2. Blight on kafir foliage.
FIG. 3. Blight on broom-corn foliage.

Insects Affecting Sudan Grass.

The insects affecting Sudan grass are the same as those affecting the other sorghums. The sorghum midge in warm, damp seasons may prevent the setting of seed except on the early and late crops. In an average season it will do no damage in this state. Chinch bugs are apparently very fond of Sudan grass, and likewise grasshoppers eat it greedily. However, both of these insect pests can be controlled, and all farmers know the methods by which their damage can be prevented. Up to the present time there have been no other insects in this state which have given any serious or noteworthy trouble with Sudan grass.

Feeding Value of Sudan Grass.

There have been no extensive or conclusive feeding experiments made with Sudan-grass hay. The Kansas Experiment Station, however, in cooperation with the United States Department of Agriculture, has conducted the most extensive feeding tests completed up to the present time. In these tests all feeding work has been done by officials of the Kansas Experiment Station; the seed used in growing the hay fed or the pastures grazed was furnished by the United States Office of Forage Crop Investigations, Bureau of Plant Industry.

The following tables indicate the feeding value of Sudan-grass seed as shown by chemical analyses :

TABLE 7.—*Chemical analysis of Sudan grass compared with some more common crops.*

	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Moisture.	Ash.
Sudan seed.....	13.62	3.81	5.38	63.63	10.47	*3.09
Wheat.....	12.40	2.10	2.20	71.20	10.20	†1.90
Wheat bran.....	16.00	4.40	9.50	53.70	10.10	†6.30
Corn.....	10.10	5.00	2.00	70.90	10.50	†1.50
Oats.....	12.40	4.40	10.90	59.60	9.20	†3.50
Kafir.....	11.10	3.00	2.30	70.10	11.80	†1.70

*From Texas Ex. Station.

†Henry & Morrison.

From these figures it will be noted that Sudan grass seed is high in protein content and comparatively low in crude fiber.

TABLE 8.—Chemical analysis of Sudan-grass hay compared with more common hays.

	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Moisture.	Ash.
Sudan hay.....	9.13	1.60	26.70	48.40	5.60	*8.10
Alfalfa hay.....	14.90	2.30	28.30	37.30	8.60	†8.60
Prairie hay.....	8.00	2.60	30.50	44.70	6.50	†7.70
Sorghum fodder.....	7.40	3.10	26.10	45.90	9.70	†7.80

*United States Office of Forage Crops.

†Henry & Morrison.

This table shows that Sudan hay is richer in protein than prairie hay or ordinary sorghum hay, but not as rich as alfalfa hay.

The following is a brief summary of the experimental work carried on at Manhattan during the winter of 1914 and 1915 in feeding Sudan-grass hay to dairy cows:

Sudan-grass Hay in Comparison with Alfalfa.

Two lots of three cows each were fed in order that a direct comparison could be made as to the efficiency of Sudan grass as compared with alfalfa hay for milk production.

The cows were divided as evenly as possible in regard to period of lactation, and were fed in proportion to the milk produced. The ration was made up of corn silage; a grain mixture of four parts corn, two parts bran, and one part oilmeal; and cut alfalfa hay in one case and Sudan grass in the other.

Lot 1, composed of cows 1, 2 and 3, was first fed alfalfa hay with the above ration for a period covering fifteen days preliminary feeding and thirty days for the actual test. At the end of this time the cows in this lot were changed to Sudan grass, and after a ten-day change period they were fed a thirty-day test period.

Lot 2, composed of cows 4, 5 and 6, were first fed Sudan and then alfalfa hay under the above conditions. The cows were weighed daily, the milk weighed at each milking, and a composite sample of the two daily milkings tested by the Babcock method for butter fat.

The following results were obtained by adding the two Sudan periods from both lots and comparing with the two alfalfa periods from both lots :

TABLE 9.

<i>Milk.</i>		
	Sudan grass.	Alfalfa.
Lot 1	2,207.0	2,521.9
Lot 2	1,814.5	1,590.0
Total	4,021.5	4,111.9
Difference in milk in favor of alfalfa, 90.4 pounds.		
<i>Fat.</i>		
	Sudan grass.	Alfalfa.
Lot 1	101.56	116.68
Lot 2	66.75	61.62
Total	168.31	178.30
Difference in fat in favor of alfalfa, 10 pounds.		
<i>Average Body Weight.</i>		
	Sudan grass.	Alfalfa.
Lot 1	2,682	2,757
Lot 2	3,637	3,704
Total	6,319	6,461
Difference in body weight in favor of alfalfa, 142 pounds.		

In addition to the above, it will be noticed that by comparing the two feeding periods of the same lot of cows, Lot 1 produced 314.9 pounds more milk and 15.12 pounds more fat, and the cows averaged 75 pounds more in weight, on alfalfa than on Sudan grass. In this comparison no allowance is taken for the decline in production due to the advanced lactation. This is perhaps represented by the above difference of 314.9 pounds of milk and 15.12 pounds of fat, as the alfalfa was fed in the first period and the Sudan in the second.

In a similar comparison, Lot 2 produced 224.5 pounds more milk and 5.13 pounds more fat on Sudan hay, but the cows averaged 67 pounds less than on the alfalfa hay. This lot started with Sudan hay in the first period.

In comparing individuals in the lots, it will be noticed that in the case of Lot 1, which received alfalfa in the first period, the differences are all in favor of alfalfa; and in the case of Lot 2, fed Sudan hay first, the differences are all in favor of this feed, except in the case of the body weights.

For those who are particularly interested, the following tables are included, giving the exact records of each cow:

TABLE 10.

Lot. 1.

	Milk.	Fat.	Body weight.
Cow 1.—Alfalfa	1,291.6	55.91	942
Sudan	1,082.6	46.41	887
Difference	209.0	9.50	55
Cow 2.—Alfalfa	597.0	31.01	884
Sudan	527.4	26.14	877
Difference	69.6	4.87	7
Cow 3.—Alfalfa	633.3	29.76	929
Sudan	597.0	29.01	921
Difference	36.3	.75	8

Lot 2.

	Milk.	Fat.	Body weight.
Cow 4.—Sudan	547.8	21.44	1,402
Alfalfa	483.5	19.88	1,429
Difference	64.3	1.56	—27
Cow 5.—Sudan	663.5	22.98	1,203
Alfalfa	530.2	20.38	1,248
Difference	133.3	2.60	—45
Cow 6.—Sudan	603.2	22.33	1,032
Alfalfa	576.3	21.36	1,024
Difference	26.9	.97	8

Wintering of Beef Cattle.

On the Fort Hays Experiment Station during the winter of 1914 and 1915 a comparison was made of the value of Sudan hay, alfalfa hay, kafir hay and sweet-sorghum hay for wintering young beef cattle. One hundred head of long yearling heifers were divided into four equal lots. Each lot received the same amount of silage and the same amount of linseed meal. All lots had access to wheat straw. The only difference in feeds was that Lot 1 received Sudan hay, Lot 2 received kafir stover, Lot 3 received alfalfa hay, and Lot 4 received cane or sweet-sorghum hay until that feed was exhausted, and the feeding period was finished with Sudan hay. Inspection of the following table shows that all lots made practically the same gain in weight. For the 120-day feeding period, the alfalfa-fed lot cost 69 cents more per head than the Sudan-fed lot. There was but little difference in cost between the Sudan, kafir, and sweet sorghum fed lots.

Sudan Grass in Kansas.

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TABLE 10.—Comparison of Sudan hay with other feeds in wintering long yearling heifers, Fort Hays Branch Experiment Station.

Feeding period, 120 days—December 17, 1914, to April 15, 1915.
Number of heifers, 25 in each lot.

	Lot 1.	Lot 2.	Lot 3.	Lot 4.
Initial weight, pounds.....	15,520	16,265	16,525	16,390
Closing weight, pounds.....	17,530	18,330	18,500	18,410
Gain per lot, pounds.....	2,010	2,065	1,975	2,020
Gain per head, pounds.....	80.4	82.6	79	80.8
Average daily gain per head, pounds.....	0.67	0.688	0.658	0.673
Total feed consumed:				
Silage, pounds.....	30,000	30,000	30,000	30,000
Sudan hay, pounds.....	22,620	.....	.....	10,930
Kafir stover, pounds.....	.....	38,660	.....	.....
Alfalfa, pounds.....	.....	.....	24,520	.....
Cane stover, pounds.....	.....	.....	.....	19,780
Straw, pounds.....	7,920	11,330	9,310	7,800
Linseed meal, pounds.....	3,000	3,000	3,000	3,000
Total value of feed consumed....	\$149.73	\$152.02	\$167.09	\$150.15
Labor cost per lot.....	21.16	21.16	21.16	21.16
Cost per lot, 120-day period....	170.89	173.18	188.25	171.31
Cost per head, 120-day period....	6.84	6.93	7.53	6.85
Cost daily per head.....	0.057	0.0577	0.0628	0.057

Careful inspection of the lots indicated that those fed alfalfa had a better, smoother coat of hair and a better general appearance than any of the other lots. The lot fed kafir appeared to have slightly smoother coats than the Sudan-fed lot, while the Sudan-fed lot was better than the lot wintered on sweet-sorghum hay.

It should be further stated that the alfalfa fed was a second-grade hay, damaged considerably by weather conditions, and although easily worth \$6 per ton, its feeding value was no doubt less than that of good hay.

Test of Sudan Hay in Wintering Work Stock.

At the Hays Experiment Station during the winter of 1914-'15, Sudan grass was fed to idle work horses and mules in direct comparison with alfalfa and with kafir stover. In this test the animals were divided into three lots, each lot containing four horses and two mules. The animals had warm stalls during the night and ran in an open corral during the day.

The following table shows the initial weights and the weights each ten days thereafter until the completion of the test or during the fifty-day feeding period:

TABLE 11.—Comparison of Sudan-grass hay, alfalfa hay, and kafir stover in wintering idle work-horses and mules.
Each lot contained four horses and two mules.

	Weights of each lot.					
	Jan. 11.	Jan. 21.	Jan. 31.	Feb. 10.	Feb. 20.	Mar. 3.
Sudan.....	7,436	7,270	7,300	7,513	7,419	7,387
Loss— or gain+ from initial weight,		-166	-136	+77	-17	-49
Alfalfa.....	7,753	7,630	7,590	7,801	7,817	7,783
Loss— or gain+ from initial weight,		-123	-163	+48	+64	+30
Kafir.....	8,241	7,945	7,840	8,022	7,918	7,941
Loss— or gain+ from initial weight,		-296	-401	-219	-323	-300

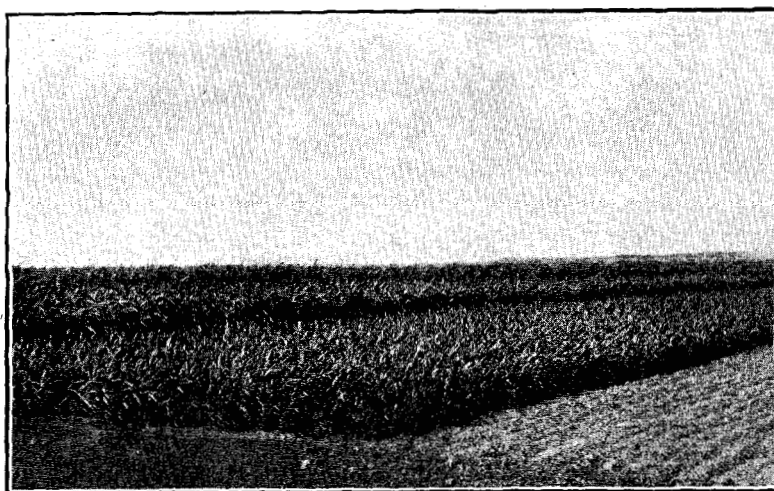


PLATE VII.—Date of planting test with Sudan grass; one, three, five and seven weeks after planting. Fort Hays Branch Experiment Station.

It will be noted that at the completion of the test, the lot of six head which had received alfalfa only had gained 30 pounds in weight; the lot which received Sudan grass only had lost 49 pounds; and the lot which received the kafir stover only had lost 300 pounds. It should be further stated that during this test feed was given twice daily, each lot receiving twenty pounds per head each day. No animal received as much feed as it would have liked; all feed was eaten up, so there was practically no waste, and no grain of any kind was given during the test. The feeder in charge of the experiment states that the kafir-fed animals were more hungry than those in the

other lots. He also states that the alfalfa-fed animals seemed more salt hungry than the others. The appetite of all animals was good throughout the test. This experiment is not sufficiently extensive to be conclusive, but it is in keeping with the practical results which many farmers throughout the state have reported from feeding limited amounts of Sudan-grass hay on their own farms. The reports which have come to this experiment station are unanimous in stating that all animals like the hay and that it has no injurious effects.

Pasturing Sudan Grass.

Although Sudan grass is primarily a hay crop, it has given reasonably good results in pasture experiments. No extensive pasturing has been done in Kansas, but careful records have been taken at the Dodge City station. Some pasturing has also been done at the Hays station, and more or less incomplete records are available from individual farms throughout the state.

In the pasture experiment at Dodge City during the summer of 1914, three acres were planted at the rate of twenty-three pounds per acre on May 20, using an ordinary grain drill for seeding. A good stand was secured and stock turned into the pasture June 24. They were turned off on July 8, and the pasture rested until July 27, at which time it was again pastured until August 12. The pasture was allowed to rest until September 14 and again pastured for one week. During the season the three acres produced the equivalent of 375 days pasture for one mature animal, and the milk records of the dairy herd show that the milk flow of the cows increased an average of 3.2 pounds daily per head each time they were turned upon the Sudan-grass pasture. At other times the cows were grazed upon a good native pasture containing both buffalo grass and bunch grass. This pasture record should be considered in connection with the rainfall for the season, which was as follows:

May	3.47 inches
June	3.82 inches
July .....	.36 inches
August	1.23 inches
September .....	.53 inches

or a total of only 9.41 inches from May 1 to October 1. In other words, midsummer and early fall were exceptionally dry.

The results of pasturing tests in 1915 substantiate results secured in other years, and in addition indicate that Sudan grass may have an important place on many farms in furnishing grazing for hogs. The wonderful ability of the plant to continue growth and throw out more suckers when cut or eaten off adds to its value for grazing purposes.

In the pasturing of Sudan grass it should be remembered that Sudan grass belongs to the sorghum family. On certain occasions a form of prussic acid has been found present in most of the sorghums, and this acid is one of the most dangerous poisons known to live stock. Although no trouble has been experienced as yet in pasturing Sudan grass, chemical analyses of a considerable number of samples at the Kansas Experiment Station have revealed a slight trace of the poison, and it is to be expected that sooner or later the poison will be found in dangerous amounts. This poison is most apt to be present in an immature crop after a period of drouth or after the growth of the plant has been arrested in some manner. As long as the crop grows without being stunted, there is very little danger in pasturing.

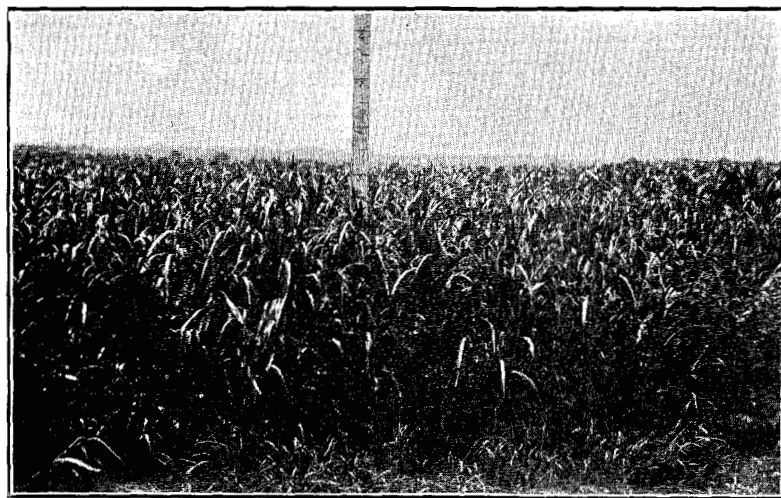


PLATE VIII.—Sudan grass in mixture with cowpeas. The cowpeas are practically crowded out by Sudan grass.

The Place of Sudan Grass in Kansas Agriculture.

The future place of Sudan grass in Kansas agriculture is to replace to a large extent the use of millets as hay and to replace broadcast or drilled sorghums for hay. It will also be used to a limited extent for pasturing, being especially valuable to the small farmer who has only a few acres of ground that can be spared for grazing purposes. It will probably never successfully compete with the sweet sorghums, kafir, or corn for silage. It will prove most valuable in the western part of the state where rainfall is limited, on uplands where alfalfa can not be successfully grown, and on the shale soils in southeastern Kansas. It can not compete with alfalfa for hay purposes on land that is adapted to alfalfa, and the successful alfalfa grower should give but little consideration to Sudan grass.

