

EXPERIMENT STATION,
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DEPARTMENT OF AGRICULTURE.

C. C. GEORGESON, M.Sc.,
PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF FARM.
H. M. COTTRELL, M.Sc., ASSISTANT.
WM. SHELTON, FOREMAN OF FARM.

EXPERIMENTS WITH FORAGE PLANTS.

WHAT can we grow which, taking one year with another, will yield us a sure and profitable forage crop? This question is one of vital importance to the Kansas farmer. It yet remains unanswered, though it has ever been uppermost, in the thoughts of agriculturists; and it will yet take years of experience, experiment and interchange of views before a definite answer can be given. The problem is complicated in Kansas by the uncertainty of the rainfall, and by its unequal distribution. A crop which one year may give a satisfactory yield may utterly fail the next, and what is a success in the eastern part of the State will, for lack of rain, often prove a complete failure in the west. Confronted by such conditions, it is evident that to have a sure crop we must look mainly to those plants which are least affected by drouth, and place less dependence on plants which require full rainfall for their development. Corn is the universal forage plant in the West, and in good seasons it is doubtful if anything better can be grown; but for the greater part of Kansas it is too uncertain to be depended on to furnish the necessary forage. Owing to the drouth during July and August, and finally to an uncommonly early killing frost September 12th, the corn crop on the College farm in 1890 did not furnish more than one-third of the feed required to carry the herd through the winter. Had the season been like that of 1889, the crop would have been ample.

With a view to find something better suited to such precarious condi-

tions, a large number of forage plants was tried the past season. The dry weather which so disastrously affected the general crop, in a certain sense proved of value to these trials by rendering the test more crucial and thorough-going, and thus setting off the ability of the several crops to withstand drouth with greater clearness than would have been possible in an ordinary season. To show what the average rainfall in this part of Kansas is, and how it compares with the rainfall of 1889 and 1890, respectively, during the three growing months of May, June, and July, the following table is appended:

Month.	Average of 32 years.		1889.		1890.	
	Number of rains.	Total rainfall, inches.	Number of rains.	Total rainfall, inches.	Number of rains.	Total rainfall, inches.
May.....	8.5	3.93	7	6.15	10	1.80
June.....	8	4.39	5	3.56	7	1.85
July.....	8	4.65	8	8.14	7	2.89
Total number of inches for the three months.....		12.97		17.85		6.54

From this it will be seen that in 1890 we had but 6.54 inches of rain during these three months, which is but one-half of the average rainfall for the same period, and but little more than one-third of the rainfall for the same months in 1889.

It was with a view to finding suitable crops for such seasons that we undertook the following trials of

NON-SACCHARINE SORGHUMS.

This class of sorghums is as a rule vigorous growers, producing in good seasons heavy yields of leafy and palatable feed, which compares very favorably with corn fodder. In dry seasons they have the advantage over corn, that they are not affected by the drouth to the same degree. In continued dry weather they will remain nearly stationary, but when rain does come they again pick up and push ahead vigorously, whereas corn once stunted never recovers. They will also make a better growth on poor land than corn can do; and under the combination of a dry season and on poor land where corn will be a complete failure, these sorghums may still give a fair crop. But their drouth-resisting quality is not their only recommendation. The non-saccharine sorghums are as a class heavy yielders of seed, and the seed compares very favorably with corn in its composition and feeding properties. In the Second Annual Report of this station, p. 116, the Chemical Department gives the following analysis of the seed of two varieties of these sorghums in comparison with corn chop:

	Per cent. water.	In dry substance.			
		Per cent. crude fat.	Per cent. crude protein.	Per cent. crude fiber.	Per cent. nitrogen free ex- tract.
Kaffir Corn seed (white)	8.58	2.95	12.35	1.68	81.24
White Millo Maize seed.....	10.05	3.22	13.46	1.66	80.22
Corn chop.....	10.82	2.60	12.18	2.35	80.97

From this it will be seen that as far as analysis can indicate it, these two non-saccharine sorghums compare very favorably with corn in the nutritive properties of their grain.

Experience at this station indicates that the non-saccharine sorghums should always be planted in drills and cultivated the same as corn. It is often recommended to sow the seed broadcast, at the rate of half a bushel per acre. While this method will give a moderate crop, the plants cannot develop well and the yield is not equal to a crop grown in drills. The proportion of grain in the cured fodder is less and the fodder itself is inferior. The greater yield and better quality of the feed will amply repay the additional cost of cultivation. On the College farm the practice has been to plant in rows three (3) feet apart, with the stalks from four to eight inches apart in the rows. A greater yield per acre can be secured by planting the rows two feet or thirty inches apart, but the narrow space renders the work of cultivation much more difficult. As soon as the seed becomes hard the crop should be cut and shocked.

Regarding their use as feed, a common practice among our farmers is simply to haul the shocks from the field as they are needed and scatter the stalks over the barnyard, letting the cattle eat what they will and the balance is supposed to be picked up by hogs. This, however, is a very wasteful way of feeding. Not only is much of the fodder and grain tramped into the mud and completely lost, but a large proportion of the grain that is eaten passes through the animals whole, causing an undue laxity of the bowels. The heads should be cut off and thrashed and the grain ground as fine as possible for the best results, and the fodder should be fed in racks.

There is great difference in the habit of growth among the several varieties, giving a choice suitable to almost any condition. The large-growing sorts like white Millo Maize and Brown Dhoura require a full season in which to mature, and they are liable to be injured by early frosts. They give a greater yield of fodder and less grain than the smaller varieties, and they are better adapted to rich soils. The smaller and earlier sorts, like the White and Red Kaffir Corn, give the largest yield of grain, and only a fair yield of fodder; they mature early, and are more particularly adapted to poor soils.

As hereinafter detailed, we made comparative tests of a number of va-

rieties, only a few of which, however, matured seed. The most important sorts were White Kaffir Corn, White Millo Maize, White African Sorghum, Red Kaffir Corn, Brown Dhoura, and Egyptian Rice. With the exception of the White African Sorghum, all are non-saccharine varieties. The seed was raised on the College Farm in 1889. The land is a heavy loam. It was in wheat the previous year. It was plowed and harrowed in the spring just before planting, and marked off in rows three feet apart. The seed was planted May 3d to 8th, 1890, with a one-horse corn drill, set to drop single kernels of corn eight inches apart. The seed germinated well, and the surplus plants were cut out with a hoe, leaving single stalks four to eight inches apart in the row. The ground was rolled June 4th and cultivated with a two-horse cultivator June 10th and 25th, and July 11th. The few weeds left by the cultivator were hoed out. Two plats were sown broadcast with White Kaffir Corn and White Millo Maize, respectively, the object being to compare this method of culture with row culture. The ground was dry at the time of planting, and the rainfall being insufficient, the growth was slow throughout the season. On September 12th all varieties were killed by frost, and September 22-25 they were all cut and shocked. The shocks were left standing in the field until December 20th, when the heads were cut off and threshed, and the whole product weighed. The following yields were obtained, and for comparison, the yields of 1859 are also given:

Varieties.	1890.		1859.	
	Dry forage per acre, tons.	Cleaned seed, per acre, bu. (60 lbs.)	Dry forage per acre, tons.	Cleaned seed per acre, bu. (60 lbs.)
Brown Dhoura.....	7.04	0.0*	13.5	49.0
Egyptian rice corn.....	3.47	16.5	.....	.....
Kaffir corn (white).....	3.31	6.0	7.0	64.0
Red Kaffir corn.....	4.29	13.1	9.0	71.0
White Millo maize.....	5.23	2.2	15.0	57.0
White African sorghum.....	5.43	13.3	.....	.....
White Kaffir corn, broadcast.....	0.99	0.0	.....	.....
White Millo maize, broadcast.....	4.56	0.0	.....	.....

* Killed by frost before seed matured.

The disparity in yield as compared with 1889 is due to the abundant rainfall in '89 on the one hand and the excessive drouth of last year on the other, and they were also shortened by the early frost. Not a single head of the Brown Dhoura had mature seed at the time of the frost September 12th, while a few heads of the Millo Maize had seed nearly mature. The Kaffir Corns were between one-fourth and one-third ripe--the red variety being the most advanced--and the Rice Corn and White African sorghums were ripe. This year's crop is therefore not a reliable showing of their productiveness.

DESCRIPTION.

BROWNDHOURA.--The plants grow vigorously and stool profusely, from five to ten full-sized stalks growing from a single seed. The stalks are tall, coarse, short-jointed, with very heavy foliage and juicy. The juice is slightly sweet. On rich ground and with sufficient rainfall the yield of fodder is large. It matures late and a large percentage of the heads will not reach full development before frost in this latitude. The heads are heavy, but short and thick, and hang pendent on a short goose-neck. The seed is light yellow, slightly flattened and larger than that of the other varieties tested. The fodder is hard to handle, for in addition to the stalks being tall and heavy the goose-necks lock with each other, making the separation of armfuls laborious. On this account it is preferable to cut the heads off before the stalks are cut, if the seed has matured.

Yield per acre, 1890, 7.04 tons dry forage, but no seed; 1889, 13½ tons dry fodder and 40 bushels seed.

As it cannot be depended on to mature seed, it is not equal to several other sorts as a substitute for corn.

EGYPTIAN RICE CORN.--The plant tillers very little, the stalks are of moderate height and rather long-jointed, with few leaves. The head is large and hangs on a goose-neck. The seeds are white, large and sweet. As soon as it begins to harden it is attacked by English sparrows, and usually a large part of the crop is lost either by being eaten or else scattered on the ground.

Yield per acre, 1890, dry forage, 3.47 tons; cleaned seed, 16½ bushels. In 1889 no seed was harvested, all being destroyed by birds. This variety cannot be recommended for general planting. The yield of forage is light, and too much of the seed is liable to be lost. The seed, however, is of the very best quality for feed, and it has the merit of ripening early. It should be cut before it is ripe, as it shells out easily in handling.

KAFFIR CORN WHITE.--The stalk is short and stocky, short-jointed, very pithy with but little juice, leaves large and numerous. It tillers very little. The heads grow erect in large panicles and bear large white seeds. The short stalks bear winds better than the taller sorts. If checked by drouth the head does not push entirely out of the sheath, and the seeds thus covered are poorly developed and liable to mold. In ordinary seasons it ripens before frost and yields well, and the grain is equal to corn for feeding purposes.

Yield per acre 1890, dry forage, 3.31 tons; seed, 6 bushels; in 1889, dry fodder, 7 tons; and 60 bushels seed.

RED KAFFIR CORN.--This grows somewhat taller than the preceding; the stalks are slenderer but more juicy and very leafy. The heads are long, slender, compact, and grow erect. The seed is red, smaller than that of the preceding, and so hard and brittle that much of it breaks in threshing. In common with the preceding, this variety is one of the best drouth

resisters among all the non-saccharine sorghums. It does well on poor land and yields well. It ripens a little earlier than the last-named sort.

Yield per acre, 1890, 4.2 tons dry fodder and 19.1 bushels seed. In 1889, dry fodder 9 tons, and 71 bushels seed.

WHITE MILLO MAIZE.--The plant tillers well and produces tall, slender, juicy and leafy stalks. The heads grow erect in compact panicles with large, white seeds. Yield per acre, 1890, dry fodder 5.29 tons, seed 2.2 bushels; 1859, fodder 15 tons, seed 57 bushels. This variety may be depended on for a crop of fodder, but like the Brown Dhoura it matures late and seed is liable to be cut short by frost.

WHITE AFRICAN SORGHUM.--This is a saccharine variety. The stalks are juicy and very sweet, tall and leafy; the heads upright, panicles moderately compact, seeds white of medium size. This is the first trial of this variety for forage made at this station, and it promises well. It gives a good yield of excellent fodder, and a fair yield of seed which matures early.

Yield, 1890, fodder 5.48 tons, seed 18.3 bushels per acre.

The seed of the following forty-five varieties of non-saccharine sorghum was received from Mr. A. A. Denton, of Sterling, Kansas, all of which was imported, mostly from India and China. The names are those under which they were received, and the numbers refer to the number of the plat as well as to the number of the variety.

1. Black Cholum.
2. Black Kasrirathi or Kakkairathe.
3. Chitta Yellow Cholum.
4. Dhaval Jowaree.
5. Ellichpuri Jowaree.
6. Garyar Jowaree.
7. Khandeshi Nirmalee.
8. Kandeshi Jowaree.
9. Millo Maze.
10. Niriyonna.
11. Poona Nirnalee Jowaree.
12. Punasa Jonna, with husk.
13. Reddish White Cholum (close head).
14. Red Cholum.
15. Red Cholum (close).
16. Red Cholum thiwati Irukka (open headed).
17. White Periya Vellai Cholum.
18. White Cholum (open head).
19. White Cholum (close headed) Arischolum.
20. White Cholum.
21. White Cholum (close headed).

22. White Cholum Nattaliusi Cholum.
23. Yellow Ihovaran Cholum.
24. Yellow India Mavyal Cholum.
25. Yellow Chuina Mavyal Cholum.
26. Yellow Cholum (close headed).
27. White Yennai Vellai Cholum.
28. White Vellai Uppan Cholum.
29. White Jowar.
30. Sorghum Shadgaei Naudyal Ioti.
31. Sorghum Ratdia.
32. Sorghum Iarar Vielgari.
33. Sorghum Vulgaris.
34. Seed head from Shaze.
35. Seed head from India.
36. Seed head from Shanz.
37. Sorghum from U. S. Consul General, Calcutta, India.
38. Sorghum from U. S. Consul General, Calcutta, India.
39. Sorghum from U. S. Consul General, Calcutta, India.
40. Sorghum from U. S. Consul General, Calcutta, India.
41. Sorghum from B. F. Franklin, U. S. Consul, Hankow, China.
42. Sorghum from B. F. Franklin, U. S. Consul, Hankow, China.
43. Sorghum from B. F. Franklin, U. S. Consul, Hankow, China.
44. No label.
45. No label.

The seed of these varieties was planted May 12th to 19th, 1890, in rows three feet apart. The ground was plowed and repeatedly harrowed and rolled before seeding. It was thoroughly pulverized, but very dry, and the seeds were a long time in germinating. A good stand was finally secured of all of the varieties, and they grew well. Some of them, indeed, grew so exceedingly large as to surpass anything in this class of sorghums heretofore grown at this station. But these very vigorous growers proved to be much too late to mature seed. Many of them had not reached the blooming stage, or even headed out, at the time the frost killed them. A very few varieties had matured seed before the frost, none of which, however, were extra large. They are the following:

<i>Number.</i>	<i>Ripe.</i>	<i>Total yield per acre, tons.</i>	<i>Yield of seed per acre, bus.</i>
36	Aug. 28	15.8	19.0
37	" 18	7.7	12.08
38	" 18	16.2	22.7
39	" 18	6.7	14.2
40	" 18	11.14	15.3
41	" 10	4.73	8.8
42	" 15	6.08	23.0
43	" 18	4.5	10.1

Some of these are of sufficient promise to warrant a further trial. The following notes were taken in regard to their characteristics:

NUMBER 36.—Plants short and slender, joints and leaves of medium length; no tillering; but little juice and this slightly sweet; heads erect and open; seed red to brown, medium size, lower half inclosed by glumes, the latter light brown; headed in 84 days and ripe in 107 days from planting; average weight of green plant .47 pound, with 18.6 per cent. leaves, 25.6 per cent. top (including seed), and 55.8 per cent. stalk; total yield, green forage 15.8 tons, and 19 bushels cleaned seed, per acre.

NUMBER 37.—Plants uniform in size, short (5 feet), rather slender, short-jointed, with broad, short leaves; no tillering; juice abundant but not sweet; heads erect, short (4 1/2 inches), very compact and nearly oval in shape, many of them moldy inside; seeds oval, whitish-yellow, medium size, with only base in glumes; the latter straw color to brown; headed in 84 days and ripe in 97 days from planting; average weight of green plant .61 pound, with 19.9 per cent. leaves, 27.9 per cent. top, and 52.2 per cent. stalk. Total yield per acre, green forage 7.7 tons, clean seed 12.08 bushels.

NUMBER 38.—Plants short (6 feet), slender and short-jointed, with broad short leaves; no tillering; heads short (5 inches) and compact, varying in form from egg-shaped to cylindrical, the latter type predominating; most of the heads erect, a few pendent on a goose-neck; many heads moldy on the inside and a few smutted; seeds large, yellow and flat, some of them white at base of head only, gradually growing darker toward apex, where they are red or brown. A few heads are large and open, with brown seeds. Headed in 80 days and ripe in 97 days from planting; average weight of whole plant, .74 pound, with 11.9 per cent. leaves, 28.2 per cent. top, and 59.9 per cent. stalk; total yield per acre, green forage 16.2 tons, seed 22.7 bushels.

NUMBER 39.—Identical with No. 37. Total yield per acre, green forage 6.7 tons, seed 14.2 bushels.

NUMBER 40.—Very similar to No. 38, but has a greater proportion of heads with white seeds at base of head, and a few stalks are a little later in heading out; headed in 72 days, and ripe in 91 days from planting; average weight of green plant .76 lbs., with 16.1 per cent. leaves, 25.7 per cent. top, and 58.2 per cent. stalk; total yield per acre, green forage 11.14 tons, seed 15.8 bushels.

NUMBER 41.—Plants short (4.7 feet), slender, weak and short-jointed, with short leaves of medium width; no tillering; very little juice in the ripe plant; heads erect, a few open, but mostly compact, 9 1/2 inches long; seeds red, white and black, sometimes all three colors in the same head, glumes black; headed in 59 days and ripe in 83 days from planting; average weight of green plant .38 pound, with 15.8 per cent. leaves, 31.6 per cent. top, and 52.6 per cent. stalk; total yield per acre, green forage 4.73 tons, seed 8.8 bushels. Its earliness is its chief recommendation.

NUMBER 42.—Plants short (6.2 feet), slender, weak, short-jointed, with short, narrow leaves; no tillering; stalks pithy and without juice when ripe; heads erect, open. 9 inches long, white-seeded with black glumes; headed in 67 days and ripe in 88 days from planting; average weight of green plant .39 pound, with 17.9 per cent. leaves, 30.8 per cent. top, and 51.3 per cent. stalk; total yield per acre, green forage 6.08 tons, seed 23 bushels.

NUMBER 43.—Plants short, (6.4 feet), very slender, weak and short-jointed, with medium-sized leaves; no tillering; heads open, 9 inches long; seeds varying from white to red, usually white with red tip; glumes black; headed in 59 days and ripe in 91 days from planting; average weight of green plant, .32 lbs. with 19.8 per cent. leaves, 32.4 per cent. top, and 47.8 per cent. stalk; total yield per acre, green forage 4 1/2 tons, seed 10.1 bushels.

Numbers 36, 38, 40 and 42 are especially meritorious varieties. Their earliness insures immunity to the seed from frost in the fall, and their yields are good for an adverse season. They will be tried again in 1891.

TEST OF VARIETIES OF MILLET.

Five varieties of millet were sown May 20, 1890. The land is a rich clay loam, and was in corn the previous year. It was put in good tilth; the seed was broadcasted and covered with a smoothing-harrow. The dry weather cut the crop short, and the yield was consequently light. The following table gives the most important facts obtained from the trial:

Name.	Yield of hay per acre. (Tons.)	Days from seeding to heading.	Days from seeding to cutting.	Seed from—
Broom-corn millet.....	2.35	42	51	Ki-Ote Seed Farm.
Common millet.....	2.40	50	65	F. Barteldes & Co.
German millet.....	2.68	50	85	F. Barteldes & Co.
Golden Wonder.....	1.95	.....	85	Northrop, Braslau & Goodwin.
Hungarian.....	2.55	44	51	F. Barteldes & Co.

In the wet season of 1889, Golden Wonder gave promise of being the best yielder; but in 1890, when the conditions as to moisture were reversed, it yielded, as indicated in the table, less than any of the other kinds on trial. It appears, therefore, that this variety cannot be trusted to give the best returns in sections liable to be visited by drouth.

The Broom Corn millet is a new sort, tried for the first time at this station. It is a form of *Panicum miliaceum*, a species which is largely grown in eastern countries for its seed, which is used for food. It is readily distinguished by the loose, sprawling panicle, or head, which is quite different from the heads of other millets, and the seed is also larger. As a hay crop it compared well with common millet in yield, and was ready to cut two weeks earlier than the latter.

The German millet gave the best yield, as may be seen in the table. And generally this variety will be found to give the best results, especially

on good ground and in favorable seasons. On poor soil and in protracted drouth the smaller kinds, such as the Hungarian and common millet are often more reliable because they get ready to cut sooner, and are therefore not exposed to the drouth for so long a time. In ordinary seasons early seeding is essential to the best results in this part of the State. If millet does not get a good start before the hot and dry weather sets in it is doomed to failure.

MISCELLANEOUS FORAGE PLANTS.

TEOSINTÉ (*Euchlæna luxurians*).--This plant, which is a distant relative of Indian corn, has been grown on the College farm for three successive seasons. It is a native of the tropics and does not mature seed in this latitude, nor even reach the blooming stage; but it grows with unrivaled luxuriance until harvested or killed by frost, producing a large amount of most excellent feed. The plant reaches here a height of from six to nine feet, and grows in thick bunches produced by its wonderful tillering, which is perhaps unequaled by any other agricultural plant. It produces from 12 to 50 or more full-sized stalks from each seed, causing the rows to spread till they reach each other, and the whole patch toward the end of the season becoming an impenetrable thicket. The leaves resemble those of corn, but are longer and narrower, and they are closely set on the stalks nearly to the ground. It resists drouth well, as may be judged by a yield of 23 tons green forage per acre last season. Both the green and the dry fodder is greatly relished by stock, there being no waste at all. The following are the yields per acre of green forage secured at the different trials at this station :

1888.....	17 tons per acre.
1889.....	31 3/4 " " "
1890.....	23 " " "
Average of three years.....	23.9 tons per acre.

The severe frost of September 12, 1890, killed all the plants, which began to dry up and waste; on September 26th what remained was cut and shocked, giving a yield of dry fodder of 4.7 tons per acre.

Each year a portion of the crop has been cut in August, with a view to learn the value of the second growth. This, however, is evidently not the proper treatment. The cut plants make but a very feeble second growth, not nearly equal in amount to that made during the same period by the uncut plants. The proper management of this crop is to let it stand undisturbed till fall and then cut and dry it in time to save it from injury by frost. Owing to the thick stalks and heavy foliage it is difficult to cure. We have not as yet produced sufficient of it to try its value for ensilage, but there seems to be no reason why it should not answer for that purpose. It would be valuable for fall feed in seasons when the pastures are short. The main drawback to its general culture is the cost of the seed, which is quoted at \$2 a pound. It does not mature seed in this latitude, but Bulletin No. 22 of the Louisiana Station reports that it matured seed in that

State. We plant it in rows three feet apart, and thin the plants to one foot apart in the row. At this rate one pound of seed will plant an acre.

PEARL MILLET.—This forage plant has been tried in 1888-89 and '90 at this station, and each year proved a total failure. The difficulty arose mainly from the apparent impossibility of getting a stand; only a fraction of one per cent. of the seed would grow. The few plants that did appear made a feeble growth at first, but when a few inches high they would become more vigorous, stool profusely and finally attain a height of eight to ten feet. The stalks are short-jointed and very leafy, and the fodder of good quality. The seed does not mature in this latitude. It might be of some value if reliable seed could always be had, but from our experience we cannot recommend it.

SPRING VETCHES were tried for the first time in 1890 on a small scale. It is considered a valuable fodder crop in England and in central and northern Europe, but with us it was not a success. The stand was good, but the growth was so feeble that the crop afforded but little feed, whether used for pasture or for hay. As far as this one trial teaches anything, it is to the effect that spring vetches have no future in Kansas.

THE YELLOW LUPINE is another crop that has not proved a success here. It is a leguminous plant, which possesses the property of assimilating nitrogen in an eminent degree. Where it can be grown well it is considered a good fodder plant, and in some places, particularly in northern Germany, it has been very successfully used to renovate poor land. Our trial of the plant gave us an unsatisfactory stand, and the plants which appeared were killed by the drouth in July.

KANSAS STOCK MELONS.—Seed received under this name from F. Barteldes & Co. was planted May 22, 1890, in hills, 10 feet apart each way. It proved to be a non-saccharine variety of the watermelon, or possibly a cross between the citron and the watermelon, as the fruit partook of the solid character and lack of sweetness of the former, while it had the shape and size of the latter. The weather was very dry, and probably owing to this fact the plants grew extremely slowly during the first two months until after the rains in August, when they made a rapid growth till killed by frost. The fruit was set very late, and when killed by frost, September 12th, the crop was less than half grown. The melons, such as they were, were gathered and weighed. They gave a yield of 21.46 tons per acre, and there is no doubt at all but that this weight would have been doubled had the frost held off a month longer. The largest melons weighed only about 20 pounds. They were stored in an open room in the barn basement, and were fed both to cattle and hogs. Having been prematurely cut short in their growth, and exposed to frost, the conditions were not favorable to a fair test of their keeping qualities. Some of them showed signs of decay in three or four weeks after they were taken in, but by far the largest portion of the crop kept well till all had been fed out, which occurred January 1st.

The flesh of these melons is firm and solid throughout, with comparatively few seeds. Cattle and hogs eat them greedily, but they have but little food value. An examination of them kindly made by the Chemical Department of this station showed them to contain 95 per cent. of water and only 5 per cent. of dry matter. They were fed experimentally to a portion of the herd, which will be reported on later. It may here be remarked that while they did not furnish much nourishment, they gave the animals a better appetite for dry feed, and thus indirectly influenced the productive capacity of the stock. They furnish in a cheap form the succulent food which is so intensely craved by cattle in the winter months. Farmers who do not use ensilage, and who will not undertake the trouble and expense of raising roots, can raise a crop of stock melons at little expense, which, fed along with hay and corn fodder, will make the ration more palatable, and result in a sharpened appetite, greater consumption, and as a consequence, better returns in meat or milk. Owing to the causes stated, we raised but half a crop; 40 tons per acre is not too much to expect in a moderately good season, and under very favorable conditions, 60 tons per acre ought to be produced.

THOUSAND-HEADED KALE.—In Europe, this plant takes a high rank as a forage plant for soiling purposes and for sheep lots. Its utility for Kansas is as yet problematical. The plants grow to a height of 3 to 4 feet, and branch profusely. They have a luxurious growth of large, crimped leaves, resembling those of certain coarse varieties of Scotch kale. We planted the seeds in rows 30 inches apart, and the plants were thinned to 8 to 10 inches apart in the row. On August 11th to 21st the plants were cut about 3 inches above ground, and gave a yield of nine (9) tons of green forage per acre. The tops were fed to both cattle and hogs. The hogs ate them well, but the cattle did not relish them, only a few of the animals consenting to eat them at all. This, however, is only a matter of education, as the feed is as good as cabbage, and has the peculiar taste characteristic of cruciferous plants.

SOY BEANS, *Glycine hispida*.—We tested several varieties of these beans the past season, the object being to learn something of their value for this country and climate. As noted below, one variety was obtained from Peter Henderson & Co. and one was from home-grown seed, having been raised on the farm in 1889; the others were imported direct from Japan. These beans did remarkably well, considering the drouth they went through, and the early-ripening varieties give promise of becoming valuable to this country. The good qualities in the Soy beans have long been known, but the great difficulty with most varieties that have heretofore been tried in the North and West has been that our season is rarely long enough for them to mature properly, and hence the yield has usually been cut short. The varieties which we imported are all early, and will mature here in any season. This fact, taken in connection with their highly nutritive qualities

both for man and beast, their heavy yields and easy culture, will in a measure forecast their usefulness. The average composition of Soy beans is as follows:

	<i>Per cent.</i>
Water	10.0
Ash	5.0
Crude protein	33.4
Crude fiber	4.8
Nitrogen free extract.....	29.2
Crude fat	17.6
	100.0

Of these contents, the following amounts are digestible in per cent. of the total:

	<i>Per cent.</i>
Crude protein	30.1
Carbohydrates.....	30.7
Fat	15.8
	1:2.3

It will be seen that these beans are rich in the flesh-formers (protein) and fat, which are the most costly elements in all cattle foods, and that they on that account would make an excellent concentrated feed to mix with other substances less rich in albuminoids. They have, in fact, the same nutritive qualities as good beef, and in Japan, where most of the people do not eat meat, they are extensively cultivated, and take the place in their diet that meat does here. The unexpected early frost injured the crop, first, by destroying the seed that was not fully ripe, and secondly, by causing the ripe pods to open, whereby a large portion of the beans were wasted before they could be harvested. Owing to this, we are not able to give an estimate of the yield per acre, but it was large.

The following are brief descriptions of the varieties:

Kuiske Daidzu.—Seed imported from Japan; plant upright, stiff, 1 1/2 to 2 feet tall; branches freely, but does not spread. The whole plant is compact in its growth; it is covered with short, woolly pods from the ground to the tips of the branches, each pod containing two beans—rarely three or one; usually three pods grow together in a cluster; beans yellow, roundish, though somewhat lens-shaped and slightly oblong, smooth, about the size of pease. They ripen by the close of August or the beginning of September.

Edamame.—Seed imported from Japan. Plant stiff, upright, resembling the preceding in growth, 2 feet tall; pods cover the plant from base to top, short and woolly, but broader than the preceding; beans greenish yellow, slightly oblong, the size of large pease, two in each pod. Heavy yielder; early.

Yellow Soy bean.—From Peter Henderson & Co. Grows 3 feet to 3 1/2 feet tall; growth upright, branches but little; whole plant woolly; pods not so numerous as on the two preceding sorts, short, containing mostly three and often but two beans each; beans yellow, almost as round as pease, and

of the size of pease; yield good, but mature later than the two first-named sorts.

Large Yellow Soy Bean.—Seed grown on the farm in 1889. Plant large, 3 1/2 to 4 feet tall, much branching and spreading; branches long-jointed, and whole growth open; pods short, woolly, two yellow, round beans in each. Only the earliest-set beans mature here, and can therefore never get a full crop. Nearly an acre was planted to this variety, with a view to cut it for fodder, but the frost overtook them before they were cut, and rendered them worthless.

We also obtained from Japan, seed of two varieties of *Dolichos radiatus*. The Japanese name for this class of beans is *Adzuki*. The two varieties grown here are known only by their native names, viz.: *Shiro Saya Shozo*. Plant 2 feet high, upright, branching and somewhat spreading; pods in clusters on the tips of the branches. 5 to 6 inches long, smooth, each containing 7 to 9 beans; the latter red, oblong, small, with a long, narrow white hilum; yields well and matures early.

Kuro Saya Shozo.—Almost like the last, except that the pods are longer, containing more beans, and that the pods also turn dark, almost black, when ripe; beans small, red, mature early and yield well.

Two other Japanese plants which grow luxuriantly in that country, were tried here in the hope that they might have some value for forage, but neither of them came to anything, owing mainly to the drouth. They were:

Coix lachryma (Job's Tears), a grass which grows 6 to 8 feet tall, and produces a large grain, rich in protein; and

Panicum frumentaceum, a grass much resembling millet, growing 4 to 5 feet tall, and yielding heavy crops of both fodder and seed.

TEST OF VARIETIES OF ENSILAGE CORN.

The varieties considered best for ensilage are as a rule of Southern origin; they mature late, and have a more vigorous growth than medium or early-maturing varieties. When the whole plant is utilized it is obviously desirable to grow varieties that will produce the heaviest possible yield. That there is much difference in the productive powers of different varieties is indicated by the table annexed hereto. The fourteen varieties named in the table were grown side by side under the same conditions in 1890. The land was old orchard ground from which the trees had been cleared the year before, and a sod consisting chiefly of orchard grass had been plowed under and the soil brought to a good tilth. They were all planted May 9th, and harvested September 3d. The rows were 3 1/2 feet apart, and single kernels were dropped eight inches apart in the row with a corn drill, and the subsequent culture was the same for all. The table gives the principal data for each variety. There is this difference to be noted, however, that since some of them were later than others, and they were all harvested on the same day, the earlier varieties were farther advanced than the later ones,

and their ears therefore make a greater percentage of the whole plant than is the case with the later ones; while the former had begun to harden the latter were still in the milk. In this respect, then, the comparison is not all that could be desired; but the harvest could not be postponed, for fear of frost. And because of this difference in maturity it was not thought worth while to make a direct comparison of the weight of the ears.

Variety.	Yield per acre, green, tons.	Height of stalk, feet.	Height of ear from ground, feet.	Ears per stalk.	Whole green plant.			Weight of ten stalks.		
					Per cent. leaves and husks.	Per cent. ears.	Per cent. stalks.	Green, Sept. 3d.	Dry, Dec. 27th.	Air-dry substance in one ton green fodder, pounds.
B. & W.	8.55	6.5	3.2	.52	39.3	9.8	50.9	24.81	6.	483.66
Blount's White Prolific.	8.96	6.0	3.5	1.16	37.6	10.7	51.7	20.72	5.	482.65
Brazilian Flour.	9.40	6.5	3.5	1.12	38.9	9.8	51.3	19.	4.06	427.36
Breck's Boston Market.	5.75	6.0	3.0	.60	40.9	13.6	45.5	16.88	4.44	526.05
Bullock's White Prolific.	10.82	7.0	4.0	1.46	38.1	10.2	51.7	29.88	7.38	493.94
Mosby's Prolific.	14.39	7.5	3.5	1.44	41.5	4.5	51.0	21.	4.63	440.96
Red Cob Ensilage.	8.47	7.0	3.6	.84	42.1	12.3	45.6	23.31	5.38	461.60
Salzer's Giant Ensilage.	10.98	6.0	3.2	.80	39.3	10.2	50.5	22.38	4.06	362.84
Sheep's Tooth.	12.92	6.5	3.5	1.24	41.8	11.2	47.0	30.	7.31	487.86
Shoe Peg.	12.15	7.5	3.9	.88	35.8	9.0	55.2	31.09	7.	450.31
Southern Horse Tooth.	12.37	8.5	4.0	.68	36.3	6.0	57.7	37.19	8.5	457.13
Thoroughbred White Flint.	6.94	5.3	2.8	1.20	40.8	18.4	40.8	18.	4.44	493.33
Normandy Giant.	10.35	6.5	3.5	1.64	40.0	12.0	48.0	22.19	5.69	512.84
White Flat Ensilage.	11.37	6.0	3.4	1.68	37.7	8.2	54.1	23.	5.63	489.58

While several of the varieties give, under the circumstances, good yields of green material, Mosby's Prolific outstrips them all. It is a late-maturing corn, and if the harvest could have been postponed for another couple of weeks it would have made a still better showing, especially in the per cent. of ears. We have been so favorably impressed by this variety that we plant it altogether for the general crop of ensilage. Sheep's Tooth, Southern Horse Tooth and Shoe Peg are also good varieties.

SORGHUM AND CORN FOR ENSILAGE.

This experiment was intended to bring out not only the comparative yield of corn and sorghum, but also the effect on the yield, if any, caused by the planting of a mixture of the two in the same row. The theory is sometimes advanced that a heavier growth can be obtained when several plants with different habits of growth and feeding powers are planted together, than when each is planted by itself. It was chiefly to test the truth of this theory that the experiment was devised. The results here obtained are, however, not by any means conclusive, because of several modifying circumstances. In the first place, the sorghum resisted the drouth much better than the corn, and it therefore makes a better showing compared with the corn than it probably would have done under normal conditions. Again, the corn had suffered much from chinch-bugs, while the sorghum had not, the bugs apparently having a preference for the corn.

And again, at time of harvesting the crop—September 3d—when the product was weighed the corn was further advanced than the sorghum, the stalks being nearly dry and the leaves beginning to wilt with ears in the dough, while the sorghum was still fresh and green, the seed being only in the milk and a portion of the plants still in bloom. The sorghum evidently contained a greater per cent. of water than the corn, which would appear in the weights to its credit. With this explanation the results are given for what they are worth.

Fourteen plats were sown, each nearly one-fifteenth acre in extent. The rows were 3 1/2 feet apart, with four rows to each plat. On four plats the corn and sorghum were sown in alternate rows; on four, corn and sorghum were sown in the same rows, and three plats of each contained corn or sorghum only. The land received a good coat of stable manure previous to planting. The following table shows the arrangement and the weights per plat and per acre. The corn was Normandy Giant and the sorghum Kansas Orange:

No. plat...		Weight per plat green, pounds.	Weight per acre green, pounds.
1	Corn and sorghum in alternate rows.....	1,305	19,157
2	Corn and sorghum in same rows.....	2,250	33,030
3	Corn only.....	1,515	22,240
4	Sorghum only.....	2,315	33,984
5	Corn and sorghum in alternate rows.....	1,835	26,937
6	Corn and sorghum in same rows.....	2,015	30,580
7	Corn only.....	1,175	17,249
8	Sorghum only.....	2,200	32,296
9	Corn and sorghum in alternate rows.....	1,845	27,084
10	Corn and sorghum in same rows.....	2,040	29,947
11	Corn only.....	1,425	20,919
12	Sorghum only.....	2,220	32,589
13	Corn and sorghum in alternate rows.....	1,715	25,176
14	Corn and sorghum in same rows.....	1,660	24,368

Averages.	Yield per acre, tons.
Corn and sorghum in alternate rows.....	12.29
Corn and sorghum in the same rows.....	14.74
Corn only.....	10.06
Sorghum only.....	16.42

The sorghum when grown alone thus outyielded any combination of the two; but it is worthy of note that while the average of the plats with corn and sorghum mixed in the same rows reached 14.74 tons per acre, the average of the plats on which corn and sorghum are grown singly reaches only 13.24 tons per acre, the result thus supporting the theory of the effect of a mixture.

SUMMARY.

1st. The non-saccharine sorghums are among our best drouth-resisting plants, and among them are several sorts that will yield good crops of seed in dry seasons, and the seed will compare favorably with corn for feed.

2d. Of several varieties of millet tested, German millet gave the best yield of hay, followed in order by Hungarian, Common millet, Broom Corn millet, and Golden Wonder.

3d. Teosinté yields heavy crops of excellent forage, much relished by stock. The average of a three-years test is a yield of 23.9 tons per acre.

4th. Pearl Millet has been a failure for three successive seasons, owing mainly to the apparent impossibility of getting a stand.

5th. Spring Vetches failed to produce a paying crop in 1890.

6th. The Yellow Lupine was a failure in 1890.

7th. When roots or ensilage are not grown, Kansas Stock Melons can be grown and fed to advantage along with hay or other dry fodder. The yield is heavy, and the cost of culture and handling but slight.

8th. Thousand-headed Kale will give a fair yield of forage, but heavier crops of more palatable feed can be grown at the same cost.

9th. Certain early varieties of the Japanese Soy bean promise to be of much value for this country as heavy producers of a highly nitrogenous feed.

10th. *Coix lachryma* and *Panicum frumentaceum*, two Japanese forage plants, were failures here in 1890.

11th. In a test during the past dry season of fourteen varieties of ensilage corn, only the following four kinds yielded more than twelve tons ensilage per acre, viz.: Mosby's Prolific 14.39, Sheep's Tooth 12.92, Southern Horse Tooth 12.37, and Shoe Peg 12.15 tons per acre.

12th. A verdict of "not proven" must be given in the trial of growing a mixture of corn and sorghum *versus* corn and sorghum grown singly, though there is some evidence in support of the theory that a mixture increases the yield.