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TEXAS AGRICULTURAL EXPERIMENT STATIONS

BULLETIN NO. 132

Report of the Co-operative Forage Crop Work By the United States Department of Agriculture and the Texas State Experiment Station at Chillicothe, Texas, 1909

BY

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POSTOFFICE

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79. Cotton Breeding.
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98. Summary of all Bulletins from No. 1 to 94, inclusive.
100. Chemical Composition of Some Texas Soils.
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H. H. HARRINGTON,
Director.

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REPORT OF THE CO-OPERATIVE FORAGE CROP WORK BY THE UNITED STATES DEPARTMENT OF AGRICULTURE AND THE TEXAS EXPERIMENT STATION AT CHILLICOTHE, TEXAS, 1909.

The co-operative forage crop work at Chillicothe, Texas, has this season embraced test plots of newly introduced sorghums and pennisetums, sorghum-breeding plots, seeding rates work with the sorgos, kaffirs and milo, and date-seeding plots of kaffirs and milo. This work has also included the growing of sorghum legume mixtures, varieties of cowpeas, Kulthi and Moth bean, peanuts, alfalfa, hairy vetch with oats, and other miscellaneous legumes. Plots of millet, grasses, leguna corn, small grains and laganaria have also been grown.

SEASONAL CONDITIONS.

This season has been an exceptionally dry one, in that the total precipitation was only twenty and one-half inches as compared to the normal twenty-six, and a good portion of this rainfall has either come within a short period of time or in alternating months. The total precipitation for the year up to June 10 was only 4.08, showing an entire lack of proper distribution in the first half of the year. From June 10 until June 30, 8.06 inches precipitation was recorded. This short period of heavy rainfall was followed by only 3.66 inches during the succeeding four months, and in considering the latter fall it must be remembered that several showers were recorded which were of no benefit to growing crops. The table below shows the monthly distribution of rainfall for the season of 1906 to 1909, inclusive.

Month.	1906	1907	1908	1909
January				
February				.22
March	.90	3.42	.28	1.89
April	3.92	.98	3.51	1.41
May	1.78	7.81	6.40	.56
June	4.20	2.58	8.41	8.06
July	8.71	1.46	5.68	.49
August	2.67	1.52		1.07
September	5.02	1.71	2.22	.26
October	4.58	6.60	1.84	1.84
November		.80	4.13	4.57
December				
	31.78	26.88	32.47	20.37

By observing the monthly rainfall for 1909, as compared to that of 1906-08, it will be seen that there was no spring season, the first good

rain coming in June. In each of the thre epreceding seasons good rains came as early as March or April. Furthermore, after the June rains, there was no precipitation sufficiently great to be of use to crops until November, which was long after the crop season was past. As will be seen, April, May, June and July are usually the seasonal months, but this year, April, May and July were exceptionally dry. Because of this such crops as alfalfa, corn, sorghum, wheat and oats were greatly affected.

SOIL PREPARATION AND SEEDING.

The Station field was plowed about four inches deep in December of last season and left through the winter without being harrowed because of the danger of blowing. This land was harrowed and thoroughly prepared for seeding in the first part of March. Perhaps because of the dryness of the season, very few weeds appeared and it was not difficult to keep the field in good condition until seeding time.

Seeding was done by opening a shallow furrow with a 16-inch sweep in front of the planter. In this furrow the planter followed and, by using a planter with a pack-wheel attached, no difficulty was experienced in getting a stand.

CULTIVATING AND HARVESTING.

All crops were cultivated well and as nearly flat as possible. The cultivation was sufficiently frequent to give a good surface mulch. A six-shoveled cultivator was used to great advantage throughout the season. After the crops were pretty well advanced the cultivation was shallow.

All plots were harvested as nearly as possible when the seeds were in the early dough stage. Except on a few plots, all harvesting was done by hand, using a corn hook. Plots were immediately shocked and left to cure as many days in each case as was thought necessary to make the data comparable. Seed yields were taken whenever seeds were produced.

SORGHUMS.

PROMISING NEW INTRODUCTIONS.

From the sorghum test plots grown in 1907, seven lots were picked as being promising sorts. These seven numbers were planted in one-tenth acre plots April 15. The germination was good and the growth made was very satisfactory. In these plots a considerable quantity of volunteer sorgo came up, making them somewhat less uniform than they should have been. The lots grown were Nos. 19744, 19749, 19751, 19775, 19695, 19517 and 21936. Of these only one, 19749, was considered worthless. The remaining six promise to be of some commercial value. No. 19744 is an excellent strain of Pink kaffir, apparently equal or superior to our Pink kaffir No. 19742. No. 19751 is a tall, slender sweet-stemmed Red kaffir, which may become a valuable dual purpose sorgo. Nos. 19596 and 19517 are excellent strains of white-hulled White kaffir and Feterita sorghum respectively. Figure 1 shows

a hill of Feterita sorghum. (Figures 1 and 2.) Nos. 21936 and 19775 are both promising sorgos, the former a leafy dwarf type (shown in figure 2), apparently very resistant to drought, while the latter is a tall, slender, sweet-stemmed type, entirely distinct from the other sorgos.

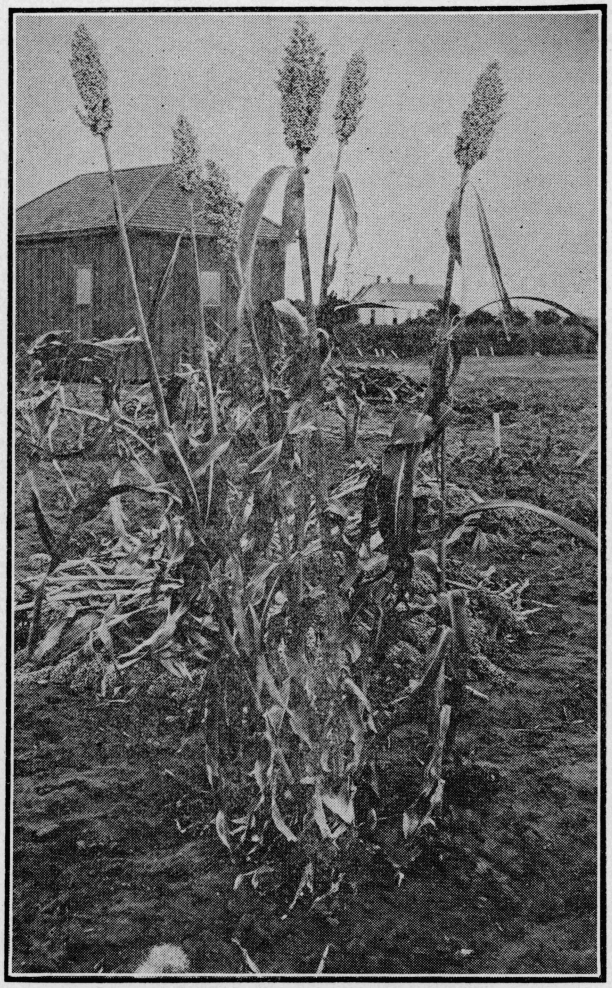

Fig. 1. Showing a hill of Feterita sorghum. This newly introduced sorghum promises to be of some considerable value for grain and perhaps for forage purposes.

RECENT SORGHUM INTRODUCTIONS.

Sixty lots of recently introduced sorghums were planted April 30 in rod row test plots. Only four of these, Nos. 22913, 24897, 24899 and 21321b, failed to germinate. The growth of the remaining ones, although very slow until June 10, was good from that time until about July 8. At this time all plots ceased to make satisfactory growth, and thirty-nine lots, therefore, failed to head. Of these, four deserve spe-

cial mention, on account of their unusual leafiness. These were Nos. 22820, 22327, 22326 and 24128. The two former grew to a height of about three and one-half feet and carried from eighteen to twenty-three leaves (figure 3 shows a typical plant of No. 22820), while the stems were very tender and juicy. (Figure 3.) The two latter carried about seventeen leaves and were also quite promising. These leafy strains may be of some value for hybridization as well as of some probable value for soiling and ensilage purposes in the Southern States.

Of the seventeen that produced heads, all were more or less pithy and dry and lacking in sweetness. Five of these, Nos. 23355, 23356, 23357, 23358 and 22332 were white-hulled White kaffirs. Nos. 24123 and 24125 were pithy-stemmed black-hulled kaffirs, neither of which showed unusual promise. Nos. 23361 and 24126 were fairly good Red kaffir types, but other than being resistant to drought showed no especial value over the native Red variety. Nos. 20813 and 22942 were sorgo types; the former

Fig. 2. Showing a very dwarf type of sorgo, perhaps of considerable value for broadcast seedings.

very similar to our honey sorgo and possibly of some value; the latter a very ordinary amber type of no value over the common ambers. No. 22328 appeared to be a very poor type of Feterita, while Nos. 23331 and 26305 were tall djougara types of no value. No. 22010 is a dwarf red kowliang of considerable value, while No. 22664 is a tall white kowliang of no promise. Specimen heads were saved in all cases.

This test was by no means satisfactory, and it seems desirable to duplicate it another season, so as to get further and more accurate data as to the value of these sorghums.

NEW INTRODUCTIONS RECEIVED LATE.

During the first part of May, fifteen lots of sorghums, Nos. 25328-25342, inclusive, were received and, later, planted May 21 in rod row

test plots. The seeds were all apparently in good condition, and germination was perfect. The growth was very good until August 4, at which time most of the plants were about two and a half feet high and showing from two to four bottom leaves fired. The drought continued and the firing was greater and greater, until the plants were entirely dead.

Fig. 3, No. 22820. This plant is about 3½ feet high and carries 23 leaves. It promises to be valuable for use in hybridizing with other sorghum types and for soiling and ensilage purposes.

If some resisted drought more than others, it was scarcely noticeable. These lots should all be tested the coming season.

PENNISETUMS.

Eight pennisetums received from Africa and India were planted May 21 in rod row test plots. These germinated perfectly and made good

growth until about July 20, when they had reached a height of about two feet and begun to be affected by drought. This droughty condition continued through August and the firing was greater until the plants were entirely dead without having produced seed heads. These millets were farther advanced than the late sorghums and perhaps for that reason some were affected greater than others by drought. Nos. 25344, 24336 and 24445 were the first to be affected and by August 26 these three were entirely dead. Nos. 22643 and 24444 withstood the conditions somewhat better than the three just mentioned, being at this time (August 26) fired about two-thirds. In the course of a short time, however, these also succumbed to drought. Nos. 25343 and 24446 were much more resistant than any of the above. The latter number, which is a cross between the Common Country and the Pure African Bazra appears much more resistant than either. No. 24447, known in India as Bearded Bazra, was far more resistant to drought than any other of the eight tested. No material difference was noticeable in the foliage of this and other varieties.

These pennisetums were by no means as drought-resistant as the sorghums planted at the same date, since they not only first begun firing but were dead because of drought some days before the sorghums.

BREEDING.

The sorghum-breeding work this season has embraced the improvement of several varieties by selection, and the cross-pollination of certain other types.

Selections have been carried by the head to row method, using varieties as follows: Milo, Feterita, Black-hulled Kaffir, Red Kaffir, Minnesota Amber, Red Amber, Orange, Planter, Sumac, Little Dutch, and an open-headed Orange type. (Figures 4, 5 and 6.) From eight to ten rows of each variety was grown. Selections have been made with a view to increasing the leafiness, juiciness and sweetness of stem, and for increasing as well the seed yield where it was desirable to increase the feeding value of the variety in this manner. In making selections for leafiness, desirable rows and individuals have been determined by actual count. The sweetness and juiciness of stem has been determined as accurately as possible, and seed yields were observed where such was desirable. The seed heads of selected individual plants were bagged to prevent cross-pollination with other less desirable forms. Milo rows grown from different individual plants have been found this season to vary from 11.8 to 13.8 in leafiness. This variation is not as great as that credited heretofore; in fact, the average leafiness is considered lower that shown last season, though greater than unselected strains. Undoubtedly, seasonal conditions affect leafiness. Count has also shown that the rate of seeding, also the date of seeding, affect leafiness. These variations tend to complicate selections. On the whole, the selections this season have shown no advancement; nevertheless, future selections were rigidly made with the expectation of showing some progress in a reasonably favorable season.

A number of attempts were made to obtain cross-pollinated seeds

from the Feterita and the Black-hulled kaffir, but, for some reason, these attempts were without results. Numerous other trials were made without results. These attempts were attended with great care, bagging the flower early and removing the stamens before the pollen was scattered. Other pollen was distributed two and three times in each case but did not take. Seeds have been obtained hertofore, but in most cases have shown to be self-fertilized. Hereafter the flowers will be washed with the expectation of better results.

The cross-fertilized seed of kaffir and milo, which was this season in its second year, produced no seed other than a few poorly-filled kaffir heads. This planting will be made again this next season.

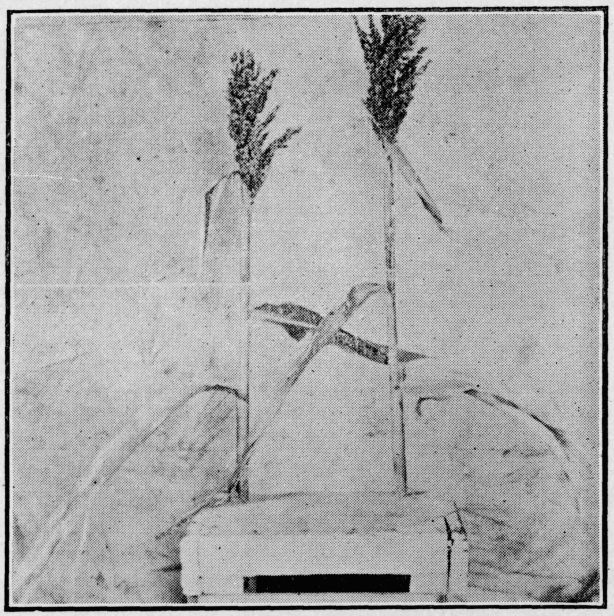

Fig. 4 An Orange selection showing the development of a loose, open type of seed head which may be valuable in sections where birds destroy the seed.

SORGO SEEDING RATES.

Five sorgo varieties, namely, Minnesota, Amber, Red Amber, Sumac, Orange and Planter were seeded, each at three different rates, both in close drills and in rows. The close-drill seedings were made June 6, while the row seedings were made April 26. This work is in continuation of a test begun in 1908. The seeding rates used were one-half, one and two bushels per acre in close drills and about five, ten and twenty pounds per acre in rows. All plantings were made without walks between plots, so that field conditions were obtained.

Soon after the close-drilled seedings were made, a heavy fall of rain packed the ground very hard, but, in spite of this, germination was perfect. This moisture was about all that was had by this crop and

was sufficient to put the growth about eighteen inches high. The plots were so affected by drought that they were harvested at this time. No difference was noticeable in the different varieties used, neither was there

Fig. 5. Showing head to row plot of Red Amber sorgo, No. 17548.

Fig. 6. Side view of the Red Amber head to row plot showing the evenness of the crop.

any difference apparently in the amount of firing shown on the thick and thin plots. This hay was not weighed separately, as it was not considered sufficient to give accurate results. The test carried last season showed Sumac the best yielding variety, and that one bushel per

acre in all cases was the best rate for seeding in close drills at Chillicothe.

The row seedings all germinated well and grew to a height of six to seven feet, producing quite well, considering the dryness of the season. The stands averaged stalks about one inch apart in the row of each of the two thickest seedings, while the thinnest planting showed stalks about every two inches. All plots were harvested when the seed were in the late dough stage, and each was allowed to cure the same number of days before weighing. The table below shows the yields given by this test, as well as the yields from a similar series of plots planted in 1908.

ROW SORGOS.

Rate.	1908				
	Minn. Amber.	Red Amber.	Sumac	Orange	Planter
Rows 18″; Plants ½″; about 40 pounds	8,100	7,850	6,400	8,600	8,050
Rows 36″; Plants ½″; about 20 pounds	9,600	8,400	9,250	9,700	8,500
Rows 36″; Plants 1″; about 10 pounds	8,650	8,300	9,600	10,200	6,950
Total	26,350	24,550	25,250	28,500	23,500
	1909				
Rows 18″; Plants 1″; about 20 pounds	6,750	6,100	6,050	7,500	5,650
Rows 36″; Plants 1″; about 10 pounds	8,700	7,500	6,800	9,150	6,000
Rows 36″; Plants 2″; about 5 pounds	7,900	7,150	6,550	9,200	6,100
Total	23,350	20,570	19,400	25,850	17,750

The above table, for the past season, shows the Orange to be the heaviest yielding variety, with Minnesota Amber, Red Amber, Sumac and Planter ranking as given. The fact that the early-maturing varieties produced heavier yields than the late-maturing ones, is accounted for by the fact that they escaped drought to a greater extent than Sumac and Planter. This is considered an exceptional condition, although it will be noticed, from the figures of 1908, that the results obtained were almost identical. However, in that season, the August drought produced the same unusual condition.

As to seeding rates, the planting in thirty-six-inch rows with stalks one inch in the drill, gave the best yields consistently in 1909. In 1908, rows thirty-six inches apart, with stalks every half inch in the drill, gave the best yields from all varieties. It can, therefore, be pretty safely concluded that plantings in thirty-six-inch rows should have

stalks ranging somewhere between one-half and one inch in the drill for the best yields. Such a planting would also give a crop with stems sufficiently small to make it an excellent quality of feed.

From the results of the two seasons, it seems evident that row seedings will most likely give, in this section, the best average forage yields. Also that, in case of extreme drought, the early varieties may perhaps be the heaviest yielders. About twelve to fifteen pounds of seed per acre in rows and one bushel per acre in close drills can be recommended with reasonable certainty of good results.

KAFFIR AND MILO VARIETIES AT SEEDING RATES.

The purpose of this test, which is in continuation of work begun in 1907, is to secure relative data on the forage and seed yields of varieties at different seeding rates, as well as to afford an opportunity to study the effect of the seeding rate on the erectness of the seed head and leafiness of the milo. Accordingly, Blackhull, Red and Pink kaffir and Dwarf milo were seeded April 13 in one-tenth acre plots, each at eight different seeding rates in drills. These rates were two inches in eighteen-inch rows, and two, four, six, eight, ten, twelve and sixteen inches in thirty-six inch drills. No walks were made between plots, so that practically field conditions were obtained and plantings were made thicker than necessary, so as to be thinned to the desired rates. The cultivation was thorough and in all cases identical. Harvesting was done when the seed were in the late dough and each plot allowed to cure the same number of days. The table below shows the results obtained this season along with those of the two preceding seasons.

FORAGE AND SEED YIELDS OF KAFIR AND MILO AT SEEDING RATES.

1907

Rate.	Size of Plot.	Forage Per Acre.				Seed Per Acre.			
		B.H.K.	R. K.	P. K.	Milo.	B.H.K.	R. K.	P. K.	Milo.
Rows 21″; Plants 1″..	1-10 A.	9,100	8,000	.....	6,200	.....	.....	.....	.....
Rows 42″; Plants 1″..	1-10 A.	7,920	7,200	.....	6,850	.....	.....	.....	1,960
Rows 42″; Plants 3″..	1-10 A.	6,737	6,637	.....	6,258	.....	.....	.....	1,930
Rows 42″; Plants 6″..	1-10 A.	7,750	7,250	.....	6,075	2,110	1,870	.....	2,115
Rows 42″; Plants 10″..	1-10 A.	6,400	6,800	.....	6,000	1,400	1,470	.....	1,440
Rows 42″; Plants 12″..	1-10 A.	6,350	6,650	.....	4,460	1,670	1,590	.....	1,460
Rows 42″; Plants 14″..	1-10 A.	6,200	6,150	.....	5,100	1,660	1,510	.....	1,570
Rows 42″; Plants 16″..	1-10 A.	6,250	5,950	.....	5,550	1,680	1,290	.....	1,740
Total.....	.....	56,707	54,337	.....	46,493	8,520	7,730	.....	12,215

1908

Rate.	Size of Plot.	Forage Per Acre.				Seed Per Acre.			
		B.H.K.	R. K.	P. K.	Milo.	B.H.K.	R. K.	P. K.	Milo.
Rows 18″; Plants 2″..	1-10 A.	5,000	5,700	5,600	4,500	.....	.....	.....	.....
Rows 36″; Plants 2″..	1-10 A.	6,520	6,050	6,200	4,700	1,160	1,510	1,180	900
Rows 36″; Plants 4″..	1-10 A.	5,750	5,980	5,850	4,750	1,520	1,820	2,090	780
Rows 36″; Plants 6″..	1-10 A.	6,560	7,630	5,550	4,500	1,710	2,220	1,970	1,440
Rows 36″; Plants 8″..	1-10 A.	5,910	5,971	6,850	4,900	1,750	1,901	2,680	1,310
Rows 36″; Plants 10″..	1-10 A.	5,740	5,140	5,150	4,600	1,750	1,620	2,260	940
Rows 36″; Plants 12″..	1-10 A.	5,970	5,600	5,750	6,200	1,550	1,620	1,840	1,560
Rows 36″; Plants 16″..	1-10 A.	6,250	4,510	3,750	4,750	1,660	1,630	1,470	1,000
Total.....	.....	47,700	46,581	44,700	38,900	11,100	12,321	13,490	79, 30

1909

Rate.	Size of Plot.	Forage Per Acre.				Seed Per Acre.			
		B.H.K.	R. K.	P. K.	Milo.	B.H.K.	R. K.	P. K.	Milo.
Rows 18″; Plants 2″..	1-10 A.	5,550	4,500	6,000	4,450	.....	.....	.....	980
Rows 36″; Plants 2″..	1-10 A.	4,650	4,050	4,000	3,800	.....	.....	.....	660
Rows 36″; Plants 4″..	1-10 A.	4,000	4,200	6,350	3,460	*	*	*	580
Rows 36″; Plants 6″..	1-10 A.	3,700	3,500	4,000	3,000	*	*	*	620
Rows 36″; Plants 8″..	1-10 A.	4,000	2,850	4,100	2,850	*	*	*	590
Rows 36″; Plants 10″..	1-10 A.	4,200	3,750	4,000	2,350	*	*	*	630
Rows 36″; Plants 12″..	1-10 A.	4,000	4,050	4,100	2,500	*	*	*	610
Rows 36″; Plants 16″..	1-10 A.	3,450	3,450	3,700	1,700	*	*	*	390
Total.....	.....	34,550	30,350	36,250	24,100	.....	.....	.....	5,060

*Scattering heads.

Fig. 7. Rate seeding of blackhulled kaffir, showing the 2-inch rate in 18 and 36-inch rows. The 18-inch rows gave the heaviest forage yield.

The above figures indicate that Blackhull kaffir is the heaviest forage-yielding variety, with Red kaffir or perhaps Pink kaffir as second, while milo is the lowest in forage field. The percentage of grain, however, included in the total forage affects to some degree its feeding value. The six-inch plots of Blackhull kaffir and milo in 1907 show a difference of 7 per cent grain in favor of milo. In 1908 this difference was 6 per cent, whereas in 1909 the difference in the percentage of grain was 15 per cent in favor of milo. Such a difference is not considered sufficiently great to make the feeding value of the total milo forage had from a given area equal to that of the forage received from the same area of kaffir from these plots. However, this difference in percentage of seed indicates that in certain dry regions milo is preferable as a forage crop to the kaffirs. This region is undoubtedly in the high altitudes and drier sections. In total seed yield these varieties rank as follows: Blackhull kaffir, Pink kaffir, Red kaffir and milo.

The heaviest forage yield was had from the thickest rate in 1907, from the second thickest rate in 1908, and the thickest rate in 1909, The percentage of grain in each of these cases, except that in 1908, was

Fig. 8. Blackhulled kaffir at 4 and 6-inch seeding rates in 36-inch rows.

Fig. 9. Blackhulled kaffir seeding rate, showing 12-inch seeding in rows 36 inches apart. The yield from this seeding rate was not as large as that from thicker plantings.

very small and would lessen their feeding value considerably. In 1907 the six-inch rate was the thickest that gave a high percentage of grain. During the present year the four-inch rate gave about as much seed as

any thicker planting. It seems safe to assume that the greatest feeding value will be had from seedings as thick as two or four inches in rows three feet apart. (Figures 7, 8 and 9.) None of the kaffir rates this season produced more than an estimated amount of 5 per cent seed. While the thickest milo rate produced 20 per cent of total forage or nineteen and a half bushels per acre weighed. In previous years the kaffirs gave the highest seed yield at the six-inch rate, while milo in 1907 gave approximately the same seed yield at the two-inch rate. This yield was also nearly as good as the six-inch and greater than the four, eight or ten-inch seeding. One the whole, it seems that milo or kaffir in rows three feet apart, and with stalks every four inches will give more satisfactory seed yields than thinner seedings.

Observation shows that plantings of milo four inches in the drill or thicker will give a high percentage of erect heads. The two-inch seeding will ordinarily give at Chillicothe 100 per cent erect heads, barring the ends the plots where moisture is more abundant. Plots thinner than four inches give a greater proportion of goose-necked plants. At ten or twelve inches, nearly all plants produce goose-necked heads.

It was also observed during the past season that thick seedings have a tendency to reduce the leafiness of individual milo plants. The average leafiness of individual plants in milo seedings were as follows: Four-inch rate, 9.2; six-inch rate, 8.6; eight-inch rate, 9.4; ten-inch rate, 9; twelve-inch rate, 10, and sixteen-inch rate, 10 leaves per plant. This phase will be considered in the future.

KAFFIR AND MILO DATE SEEDINGS.

Blackhull kaffir, Red kaffir, Pink kaffir and milo were seeded through the season at intervals of fifteen days, beginning April 15 and ending July 15. These seedings were all made in the same manner and at the same rate, and cultivation for all plots was as nearly the same as possible. Where the plantings were made late the land was clean fallowed. The table below shows the forage and seed yields, not only for the season of 1909 but for the two preceding seasons, during which this same test was conducted.

FORAGE AND SEED YIELDS FROM KAFFIRS AND MILO SEEDED AT DIFFERENT DATES.

1907

Date of Seeding.	Size of Plot.	Forage Per Acre.			Seed Per Acre.		
		B H.K.	R. K.	Milo.	B.H.K.	R. K.	Milo.
April 15	1-10 A.	7,600	6,700	5,450	2,070	1,890	1,620
May 1	1-10 A.	7,200	6,800	6,200	1,920	1,790	2,000
May 18	1-10 A.	4,450	4,050	5,650	720	830	680
June 4	1-10 A.	6,900	5,900	7,000	660	600	860
June 15	1-10 A.	8,650	6,550	5,850	440	830	1,100
July 1	1-10 A.	5,400	4,150	5,100	290	590	350
July 15	1-10 A.	.....	.....	.....	.....	.....	.....

1908

Date of Planting	Size of Plot.	Forage Per Acre.				Seed Per Acre.			
		B.H.K.	R. K.	P. K.	Milo.	B.H.K.	R. K.	P. K.	Milo.
Apr. 27	1-10 A.	7,050	5,800	5,650	4,700	1,740	1,700	1,350	1,200
May 1	1-10 A.	7,800	6,300	6,350	6,200	1,240	1,810	1,610	1,560
May 15	1-10 A.	7,200	6,700	9,400	6,500	1,860	870	1,140	1,450
June 1	1-10 A.	11,400	9,500	7,350	6,650	1,010	1,040	870	1,690
June 15	1-10 A.	8,600	7,400	6,500	6,750				
July 1	1-10 A.	5,800	5,300	5,500	5,050				
July 15	1-10 A.	6,200	6,600	5,600	3,900				

1909

Date of Seeding	Size of Plot.	Forage Per Acre.				Seed Per Acre.			
		B.H.K.	R. K.	P. K.	Milo.	B.H.K.	R. K.	P. K.	Milo.
Apr. 15	1-10 A.	6,400	6,500	5,200	3,300				830
May 1	1-10 A.	4,150	5,000	5,150	3,860				710
May 15	1-10 A.	4,600	4,150	6,400	5,100				360
June 1	1-10 A.	2,350	2,150	2,650					
June 15	1-10 A.	2,850	2,250	2,900					
July 1	1-10 A.								
July 15	1-10 A.								

The above figures for the past season (1909) show the heaviest forage yields from the earliest plantings, while the two last seedings gave no forage. No seed yields were had from the kaffirs this season, while the first three plantings of milo gave fair seed crops. The later plantings gave none. Undoubtedly, in this case, early seeding was desirable without regard to variety. Since the milo gave considerable seed, its feeding value would this season have approached very close to that of the kaffirs, although the yield was considerably less. In 1908, the heaviest forage yields were had from the June seeding, which grew, on account of the season, unusually tall. This planting produced about half a crop of seed. The early plantings which gave fair forage yields also gave good yields of seed which added to their feeding value, making the early seedings most profitable. The results in 1907 were much the same. (Figures 10, 11 and 12.)

On the whole, it seems conclusive that, without regard to the variety, the early seedings (April 15 to May 1) give the most and the best forage and seed. The results also indicate that seeding as late as June 15 or later are undesirable. These results are much the same for all varieties.

SORGHUM LEGUME MIXTURES.

This test was conducted to secure data as to the best proportions and varieties of sorghums and legumes to use in preparing and planting mixtures for hay. Accordingly, thirteen mixtures were prepared and

planted June 5, both in rows and in close drills, using in each case plots one-tenth acre in size. The mixed seed were planted with a wheat drill set for seeding four pecks of wheat per acre. It was found that the

Fig 10. Blackhulled kaffir seeded April 15 and May 1, showing little or no difference in the two date seedings.

ig. 11. Blackhulled kaffir, seeded May 1[5], and June 1. The center of the picture divides the two plots. The earliest seeding in this figure shows the best yield while neither appears to be as good as the April planting shown in the previous figure.

mixed seed did not feed out evenly and, for that reason, the plots were somewhat uneven. Otherwise the germination was good and the growth at first very satisfactory. The row seedings grew about five feet high

whenever amber was used in the mixture, but where a late maturing sorghum, such as Sumac, Orange or kaffir was used, the growth was only about three feet. The seedings in close drills grew only about eighteen inches high and were harvested before entirely dead.

Amber-Whippoorwill mixtures were prepared, mixed and planted, using parts by measure of sorghum and cowpeas as follows: 1-2, 1-5, 1-7, and 1-10. In both the row and the close drilled seedings the 1-7 mixture gave the most satisfactory stand and crop. There seemed in both cases to be somewhat more legume plants than sorghum. It is judged that one part of sorghum to six or seven parts of cowpeas will give about the right proportionate mixture.

Amber sorgo was used in mixtures with Brabham, Iron, Blackeye, Dolichos biflorus and the Moth bean. These mixtures were propor-

Fig. 12. Blackhulled kaffir seeded June 15, and July 1. The July seeding is only about 18 inche high and not at all equal to the seeding of June 15 At this time these plots had made their maximum growth.

tioned as nearly alike as possible, using the relative sizes of the seeds as a basis. Results in both cases indicate that Brabham, Iron and Dolichos biflorus are the best legumes for mixtures. While Brabham and Iron cowpeas made better growth than Dolichos biflorus, neither was considered as drought-resistant as the latter in mixture. Amber, Sumac, Orange and kaffir sorghums were grown in mixtures with Whippoorwill cowpeas, both in rows and in close drills for the best sorghum variety to use in making mixtures. In the row mixtures this season Amber gave decidedly the best growth and results. The late varieties, Sumac, Orange and kaffir did not make as good growth but seemed to divide moisture with the legume better than early varieties. In close drills, no difference was noticeable in favor of any sorghum variety. The close-drilled seedings were not weighed separately. Yields are given below

from the row seedings; however, they are not considered altogether dependable:

SORGHUM LEGUME MIXTURES IN ROWS.

Mixture.	Proportion.	Rate Planted.	Approximate Stand.	Forage Per Acre.
Amber Whip	1 – 2	4 pks. oats	5 – 1	3,300
Amber Whip	1 – 5	4 pks. oats	3– 1	3,000
Amber Whip	1 – 7	4 pks. oats	1 – 1½	3,600
Amber Whip	1 –10	4 pks. oats	1 – 2	3,150*
Amber Brab	1 – 4	4 pks. oats	3 – 1	2,450*
Amber Iron	1 – 4	4 pks. oats	3 – 1	3,400*
Amber Blk. Eye	1 – 4	4 pks. oats	5 – 1	2,450*
Amber Dol. biflo	1 – 2	4 pks. wh't	1 – 1	4,400*
Amber Moth	1 – 1	2 pks. wh't	1 – 2	2,950
Sumac Whip	1 – 8	4 pks. oats	1 – 2	†
Orange Whip	1 – 5	4 pks. oats	1 – 2	†
Kafir Whip	1 – 2	4 pks. oats	4 – 1	†
Kafir Whip	1 – 5	4 pks. oats	1 – 3	†

*Stands not regular, due to planting mixed seed.
†Too short to harvest separately.

Undoubtedly, the most satisfactory way to grow these mixtures in this locality is in close drills, as this compels the legume to grow more erect than when planted in rows. Furthermore, some considerable difficulty was experienced in harvesting the row mixtures at Chillicothe. A vertical corn harvester was used, and although in most cases it seemed to get all the legume it was not at all satisfactory, because the cowpeas invariably drop their lower leaves when jarred, as when struck by the sickle. These leaves fall in the butter trough and by some means get packed under the lower elevator chains and in the bottom of the trough, so that in order to avoid breaking the chains or the supporting boards it is necessary to stop the machine and remove the leaves. This must be done every two hundred or four hundred yards. No one can realize how thoroughly these leaves can be packed without having had the experience of removing them a few times. This difficulty may be a great factor to be considered in growing mixtures in rows.

In seeding, it is found impracticable to plant the seeds mixed, and no doubt better results will be had by drilling the parts of the mixture separately, although this will require somewhat more labor.

LEGUMES.

COWPEAS.

Five cowpea varieties, Brabham, Iron, Whippoorwill, Cream and Chinese Whippoorwill, were planted May 3, each at two different seeding rates. These rates were approximately twelve and six pounds per acre, planted in eighteen and thirty-six-inch rows, respectively. Since the same drill was used for each planting, their relative stands were accurately two to one. All plantings germinated perfectly and made

good growth through May and June; however, with July begun a very severer drought, which not only soon checked vine growth, but as well prevented the setting of a heavy seed crop. The table below gives yields of the different varieties at each of the two seeding rates.

COWPEA VARIETY YIELDS IN 18 AND 36-INCH ROWS.

S.P.I. No.	Variety.	Size of Plot.	Date Planted.	Date Harvested.	Yield in 18″ Rows.	Yield in 36″ Rows.
.....	Brahbam	1-5	May 3	Aug. 23	3,350	3,350
.....	Iron	1-5	May 3	Aug. 23	3,000	2,100
.....	Ch. Whip	1-5	May 3	July 20	2,325	2,675
.....	Cream	1-5	May 3	July 27	2,525	2,175
6	Whip	1-5	May 3	Aug. 27	2,375	2,050

Fig. 13. Brabham cowpeas, seeded in 18 and 36-inch rows. These plots gave equal forage yields, although the peas (to the right of the picture) planted in 36-inch rows, show a taller growth.

These figures show Brabham in both rates to be decidedly the best variety. The Iron and Chinese Whippoorwill were also heavier crop-yielders than the Common Whippoorwill or the Cream; however, the Chinese Whippoorwill was earlier and, therefore, not so affected by drought, as was the Common Whippoorwill and other varieties. In drought-resistance, the Iron was decidedly superior to the other cowpeas, holding its leaves on the lower part of the plant with persistence. Whippoorwill also showed considerable resistance to drought, while Brabham appeared less resistant than either, although the total growth was greater than either. Chinese Whippoorwill and Cream were both early varieties and, therefore, were not so subjected to drought as the other three. There are no consistent differences in the yields given by

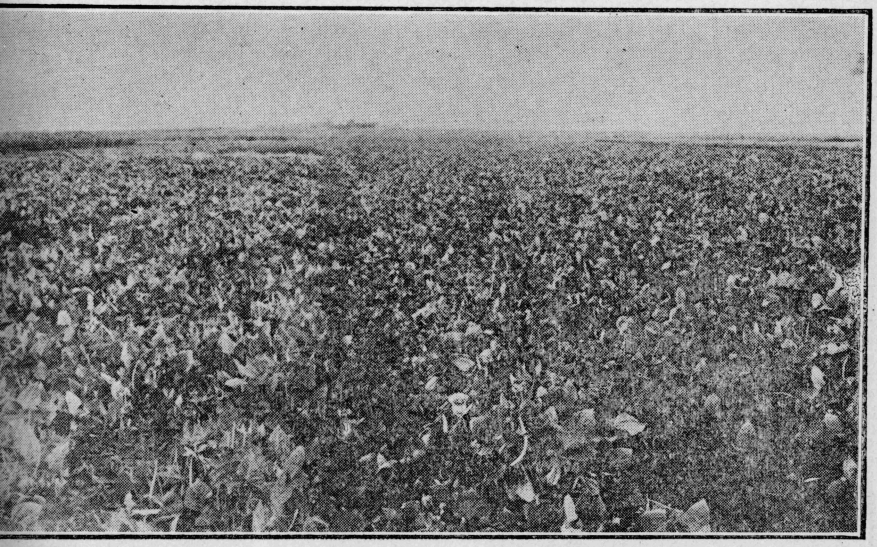

Fig. 14. Whippoorwill peas, planted in 18-inch rows, shown on the left of the picture. On the right, Brabham cowpeas are shown in 36-inch drills.

the eighteen and the thirty-six-inch seedings. (Figures 13 and 14.) Figures 13 shows apparently some difference in the heights of the Brabham from the two seeding rates, but the yields were about the same because of the thicker growth made by the eighteen-inch planting. This can be accounted for only by the fact that the severe drought through July would only allow a certain amount of foliage growth dependent on the moisture and not on the thickness of seeding, as in either case the crop was amply large to harvest. Inasmuch as the total yields are about equal in this, an unusually dry season, it may be safely assumed that ordinarily the heaviest crops would be had from the thicker seeding. However, for drier regions, the results indicate that eighteen-inch seedings would be of questionable value. The cowpeas appear to be the best annual legumes for Chillicothe and adjacent regions, although Kulthi and Moth Bean have heretofore compared favorably.

KULTHI AND MOTH BEAN.

The Kulthi and the Moth Bean were planted at the same time and in the same manner as the cowpeas. The table below shows the yield of each of these crops, both in eighteen and thirty-six-inch seedings.

KULTHI AND MOTH BEAN YIELDS.

S.P.I. No.	Name.	Size of Plot.	Date Planted.	Date Harvested.	Yield in 18″ Rows.	Yield in 36″ Rows.
21600	Moth bean	1-5	May 3	Sept. 30	1,300	1,425
21286	Kulthi	1-5	May 3	Sept. 30	*825	*1,300

*A small portion lost in harvesting.

The Moth Bean in this case gave a better yield than the Kulthi, though in harvesting the latter a small portion of the hay was lost, yet not a sufficient amount to more than balance the yields. However, in

Fig. 15. This figure shows the relative growths made by Dolichos biflorus and Phaseolus aconitifolius. The upright growth is the Dolichos biflorus.

Fig. 16. This figure shows Phaseolus aconitifolius, growing in 18 and 36-inch rows.

my judgment, the Kulthi should outyield Moth Bean and even rival the cowpeas. It showed considerable more drought-resistance than the Moth Bean or any of the cowpeas for that matter, having kept its foliage in

excellent condition all through July, August and September. The Moth Bean, this season, showed a lack of resistance to drought, as it fired considerably at the base. (Figure 15 shows the growth made by Kulthi and Moth Bean.) (Figure 15.) It was perhaps resistant to about the same degree as the Brabham cowpea. Neither of the two crops produced seed. The yields show the best results from the thinner seedings. Figures 16 and 17 show the growths made by eighteen and thirty-six-inch seedings of Kulthi and Moth Bean. (Figures 16 and 17.) These two legumes have heretofore been quite promising, but this season in yield did not compare with the cowpeas. They will be tested further.

Fig. 17. Showing Dolichos biflorus growing in 18 and 36-inch rows. The best yield was had from the 36-inch row.

PEANUTS.

The peanut plots this season consisted of the small Spanish, the Tennessee Red and a spreading type planted for field yields, and in addition to this, row test plots of nine other peanuts.

The field plots were planted May 18 in rows three feet apart and all germinated to a good stand. The growth made until through June was quite satisfactory and carried the peanuts up to the period of flowering. At this time the July drought, which was very severe, begun to affect all varieties alike and, although the cultivation was more frequent and better than the ordinary farmer would have given, neither of the three types produced good seed. There were a good number of pods set, but these were small and immature, because of the continued dry weather. The forage secured, therefore, consisted almost altogether of vines and probably gave about one-half ton of cured forage per acre. It was intended to weigh these plots, but before the hay was cured rainfall and

succeeding cloudy weather so damaged it that it was necessary to move it time and again to prevent molding. In spite of moving, it molded to some extent and also shattered the leaves so that the weights were considered inaccurate; however, it was judged that the small Spanish and the Tennessee Red were about equal in the production of forage, while the flat, spreading type was inferior to either. There is little doubt that either the small Spanish or the Tennessee Red is the best type for forage in this region.

The nine new lots were planted June 7 and all germinated to a fair stand. Six of these, Nos. 18,295, 18,523, 18,524, 16,940, 22,032 and 24,114, were the flat, spreading sort with dark green leaves and usually a large or medium large seed pod. The first two numbers made the best growth, the vines of each measuring about three feet in diameter, but only five or six inches high. The four latter numbers measured about two feet across, or, in other words, were about two-thirds as good as the first two. None of these, however, produced more than a few seed, although the pods seemed well formed. No. 18,296 was a Tennessee Red type and grew about thirteen inches high. It produced a few very poorly filled pods. It is considered not very promising. Nos. 18,337 and 16,944 were both the small Spanish type and grew about fourteen inches high, the former was perhaps slightly the best of the two. Each of these produced quite a good many well filled seed pods. These two are considered promising sorts.

ALFALFA.

The several alfalfas which were thinned to eighteen and thirty-inch rows last fall, for the purpose of getting seed yields, had to be rethinned this spring. These plots were cultivated and the first crop, which was very short, harvested during the first part of May. The second crop grew very ragged and uneven until the June rains came and caused it to put out new growth. This produced a fair cutting of hay, but, of course, gave no seed. During the remaining part of the season the growth was not sufficient for either hay or seed. For some reason, probably the time of clipping, the conditions were not favorable for seed production and the entire plots, from that standpoint, were failures. These alfalfas will be cultivated next season with a view to getting seed yields.

On October 16, 1908, one-fourth acre plots of alfalfas, Nos. 18,628 and 21,769, were broadcasted on an adjoining farm with the expectation of later securing seed. The germination was fairly good, but during the severe dry winter these plots were killed.

Fifteen lots of alfalfa were seeded at the Station in rows during April of this season. These came to a fair stand, but, in spite of cultivation, the weeds and grass came so thickly that it was necessary to plow under the entire lot. These were reseeded October 21, but the stand secured was not very good. These alfalfas were Nos. 19,508, 19,968, 19,556, 19,240, 19,522, 19,534, 18,751, 19,822, 19,558, 18,827, 18,829, 19,969 and three samples received from the Texas Seed and Floral Company, Dallas, Texas. These will be cultivated next season for seed.

It is considered useless to attempt to seed alfalfa in rows in the spring

in this region. It is more difficult to get satisfactory results than when planted broadcast.

HAIRY VETCH WITH OATS.

About one-tenth acre was seeded October 16, 1908, to hairy vetch with oats. The germination was fairly good and the plot came through the winter in fairly good condition. The oats made good growth in the spring, but for the most part the vetch was not over four to six inches high and had thinned out to spots. Hairy vetch apparently does not make satisfactory growth in this region.

MISCELLANEOUS.

The following miscellaneous legumes were planted May 7 in rod row test plots:

No. 22,732—Indigofera Glandulosa.
No. 23,535—Indigofera Glandulosa.
No. 22,734—Unidentified legume.
No. 23,626—L. tuberosus.
No. 24,205—Vicia leavenworthii.
No. 24,266—Lupinus sp.
No. 24,120—Dolichos.
No. 17,077—Astragulus falcata.

Of the above only one, No. 24,266, Lupinus species, germinated. This plot appeared thrifty but died at a height of about four inches. The results with this lot of legumes, therefore, was very unsatisfactory.

MILLETS.

Thirty-one lots of millet were planted in rows May 7, for the purpose of comparing the different strains, and of securing a greater quantity of seed of the best of these. The sizes of these plots depended on the amount of seed available. Germination was fairly good on all but three lots, Nos. 24,110, 24,111 and 24,112. All millets, being planted in rows thirty-six inches apart, were given about the same cultivation that any other crop planted in this manner would receive. They, therefore, had every opportunity to produce good yields regardless of the droughty season. The table below gives a list of the different lots grown, the dates when in full head, the average height and the amount of seed of each secured.

MILLETS—1909.

S.P.I. No.	Name.	Date Planted.	Date Headed	Average Height.	Amount Seed Sown.	Promise.
0841	C. italica	May 7	7- 5 Full head	3½ ft.	6 lbs.	Promising Big German type.
15827	C. italica	May 7	7-10 Full head	4 ft.	None	Promising.
15888	C. italica	May 7	No heads	3 ft.		Too coarse and late.
18376	C. pachy	May 7	7-15 Full head	2 ft.	None	Too small.
18505	C. italica	May 7	7-17 Full head	3 ft.	25 lbs.	Promising Big German.
18621	C. italica	May 7	7-15 Full head	2½ ft.	None	N. G.
18622	C. italica	May 7	7- 5 Full head	3½ ft.	14½ lbs.	Promising Big German.
20653	C. italica	May 7	6-28 Full head	2½ ft.	8 lbs.	Fine stemmed common mille
20694	C. italica	May 7	7-15 Full head	3½-4 ft.	46 ibs.	Very Promising Big German
20701	C. italica	May 7	7- 2 Full head	3½ ft.	10 lbs.	Of some promise.
21073	C. italica	May 7	7- 2 Full head	3 ft.	5½ lbs.	Not promising.
21076	C. italica	May 7	7- 5 Full head	3½ ft.	15 lbs.	Not promising.
22489	C. italica	May 7	6-26 Full head	2½ ft.	21 lbs.	N. G.
22491	C. italica	May 7	6-24 Full head	3 ft.	76 lbs.	Good common millet.
24810	C. italica	May 7	7- 5 Full head	3½ ft.	16 lbs.	Big German sort.
25104	C. italica	May 7	7-17 Full head	3½ ft.	½ lbs.	Fairly promising.
25105	C. italica	May 7	7-14 Full head	3½ ft.	¼ lbs.	Fairly promising.
0846	Pan mil	May 7	6-25 Full head	1½ ft.	None	N. G.
18620	Pan mil	May 7	7- 2 Full head	2 ft.	None	N. G.
21074	Pan mil	May 7	6-28 Full head	2 ft.	None	N. G.
24110	Pan mil	May 7	No germination			
24111	Pan mil	May 7	No germination			
24112	Pan mil	May 7	No germination			
20363	P. crusgalli	May 7	6-28 Full head	2½ ft.	None	N. G.
24113	P. crusgalli	May 7	7- 2 Full head	2½ ft.	None	N. G.
21540	P. frumentaceum	May 7	7-13 First heads	2½ ft.	None	N. G.
22565	Eleusine cor.	May 7	No heads	2 ft.		N. G.
23722	Eleusine cor.	May 7	7-10 First heads	2 ft.		N. G.
24335	Eleusine sp.	May 7	No heads	2 ft.		N. G.
24343	Eleusine cor.	May 7	7-10 First headf	2½ ft.	None	N. G.
25106	C. italica	May 7	7-17 First heads	3½ ft.	1 lb.	Fairly promising.

Of the eighteen Fox-tail millets grown, about nine numbers (0841, 15,827, 18,505, 18,622, 20,653, 20,694, 20,701, 22,491 and 24,810) were quite promising sorts. Seven of these were big German types, while the two remaining ones, Nos. 20,653 and 22,491, were very leafy, fine stemmed common millets. Of the big German types, No. 20,694 deserves special mention, having grown to a height of about four feet. It was somewhat later in maturing than the other big German sorts, but produced a heavy yield of forage. The fodder was considered a bit coarse. (Figures 18 and 19.) This plot appears to be mixed about half and half with a red-seeded and a yellow-seeded sort. The remaining big German types mentioned above were about equal in promise. Three other millets were considered worthy of further trial. These were Nos. 25,104, 25,105 and 25,106, all from Burmah. These made very promising growth and reached a height of about three feet, but were somewhat later than the other millets, and produced fodder perhaps a little coarse. Of the three numers, 25,105 was perhaps three days earlier in maturity than the other two, but showed no special drought resistance; in fact, all three of these millets seem to lack in drought resistance. Only a small quantity of seed of each of these were secured.

Only three of the six Proso millets germinated. These were Nos. 0846, 18,620 and 21,074. Neither of these grew taller than two feet, and, although they came into full head, produced little or no seed, being attacked by chinch bugs. The Prosos are considered of no value in this locality for forage purposes.

Seven of the thirty-one millets grown were barnyard sorts. Four of

these were Eleusine, none of which produced seed. The average height was about two to two and a half feet. No. 24,343 made perhaps the best growth of the four. No. 20,363 and No. 24,113, both Panicum crus-

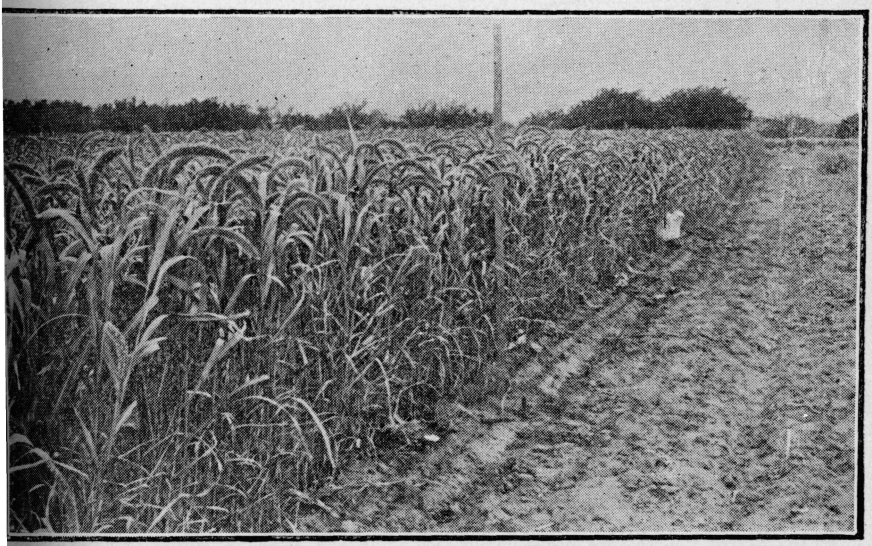

Fig. 18. Showing a growth of about 4½ feet made by Millet No. 20694.

Fig. 19. The shock on the right shows the coarseness of Millet No. 20694.

galli, grew to a height of about two and a half feet, and began to put out heads but produced no seed. The former number made the most growth. No. 21,540, Panicum frumentaceum, made about the same

growth and produced no seed. Apparently the barnyard millets were in nowise resistant to droughty conditions.

The promising lots were all Chaetochloa forms.

GRASSES.

About fourteen grasses were planted, most of them in rod row plots. Except in the case of the Rescue, which was planted in the fall preceding, all lots were seeded May 8. The germination throughout was very poor. No germination was recorded from the following numbers: 16,953, 17,185, 22,966, 23,382, 23,660 and 23,712.

RESCUE GRASS.

In October of 1908 a plot of Rescue grass was seeded for the purpose of determining whether or not it would be possible to secure, in addition to the grass, a summer crop each year without destroying or injuring the Rescue so as to make it necessary to reseed. Although the stand secured was rather poor it came on beautifully and produced a good crop of seed early in the spring. As soon as a portion of this seed had shattered the grass was turned under and the land seeded to cowpeas in rows. The soil was pretty dry, but for the most part a reasonably fair stand of peas was secured. Through the season these cowpeas were cultivated three times and the growth was about sixteen to eighteen inches high. The crop was left unharvested and no evidence of the Rescue grass was seen until the latter part of October, when it seemed to germinate spontaneously. The stand appeared to be about four times too thick, showing that no injuries were done the seed by summer cultivation. By the last of November this Rescue grass would have afforded excellent grazing. Although our experience with this system is limited it can undoubtedly be recommended safely to this region. There is no reason why kaffir, milo or the sorgos could not be utilized as the summer crop instead of cowpeas were it desirable.

SORGHUM HALAPENSE.

Of the plots that germinated, two were Sorghum Halapense. These were Nos. 25,017 and 23,488. The former germinated perfectly and came into full head about two months after being planted. On examination, this strain of Johnson grass was found entirely devoid of root stocks. It grew to a height of about four and one-half or five feet and seemed to sucker to about the same degree as the native Johnson grass. It is perhaps more seriously affected by drought, but after the first crop was cut it put out new growth quickly, even under droughty conditions. Careful examination shows the seed to be slightly larger but the same shape as seed of native Johnson grass. If this grass proves to be a perennial in the Southern States it will be of great value. About one pound of seed was saved. The latter number (23,488) proved to be ordinary Johnson grass with the averaged sized root stock. It is of no value.

CHLORIS GAYANA.

Chloris gayana, No. 19,959, germinated scatteringly along the row. These plants seemed to grow off rather slowly, but before frost had reached a height of about three feet. Although it put out seed heads it did not set seed. The thinness of this grass in the row seemed to be favorable to its stoloniferous habit, and by this means it seemed to spread considerably.

Two plots of Eragrostis, Nos. 13,871 and 15,338, were planted, but in each case only one plant germinated. Each of these grew about two or two and a half feet high and were fairly leafy at the base, but otherwise made a very poor showing. They are considered of no value in this region. Two other grasses, Astreble Triticoides, No. 15,950, and Andropogon Leucopogon, No. 24,658, were planted and in both cases germination was poor. The former produced a very leafy plant about eighteen inches high and resembling, on account of its coarse alternating leaves, the Southern wire grass. Its root stocks appeared to have a tendency toward knuckling down. It is not considered of any value. The latter number (24,658) appeared about the same as the native Andropogon Sachroides. It is apparently of no special value.

LEGUNA CORN.

A plot of Leguna corn was seeded April 14 and made excellent growth until the first part of July. The drought came on about this time and the corn, which was beginning to tassel, was affected very severely, the leaves firing almost to the top. This corn was cut before it was entirely dead and utilized as forage. In grain production this variety, which is one of the most drought resistant June corns, was in nowise equal to milo or kaffir planted at the same time. An earlier seeding would have produced some seed.

LAGANARIA.

Four gourd plants volunteered from seed shattered last season. These plants were cultivated well and appeared reasonably thrifty but produced only two or three poorly shaped gourds per plant. Only one from the whole lot could have been utilized for pipe making. It is evident that this plant is not adapted to the drier regions. It requires considerable moisture for the best gourd production. The vines were not attacked by bugs this season as is usually the case when there is a greater amount of moisture.

SUMMARY AND CONCLUSIONS.

1. Close drilled seedings of sorghums were severely injured by drought and harvested when eighteen inches high. No difference was observable in varieties or amount of firing. Last season Sumac was the best yielding variety, and one bushel per acre in all cases was the best rate for seeding in close drills at Chillicothe.

2. Stalks in thirty-six-inch rows somewhere between one-half and one inch apart gave the best yield. Such a distance also gives a stem sufficiently small to make an excellent quality of feed.

3. Black hull kaffir yields the most forage, with red kaffir or perhaps pink kaffir as second, while milo is the last. The milo, however, carries about 1 per cent more grain, which increases the feeding value, but not sufficiently for milo to excel kaffir in this locality. In total yield of seed, the varieties ranked as follows: Black hull kaffir, red kaffir and milo.

4. It seems safe to assume that the greatest feeding value of milo or kaffir will be had from seeding as thick as two or four inches in rows three feet apart.

5. Milo or kaffir in rows three feet apart, and with stalks every four inches, will give more satisfactory yields of seed than thinner seedings.

6. Planting of milo four inches in the drill or thicker will give a high percentage of erect heads. The two-inch seeding will ordinarily give, at Chillicothe, 100 per cent erect heads, barring the ends of plots where moisture is more abundant. Plots thinner than four inches give a greater proportion of goose-necked plants. At ten or twelve inches nearly all plants produced goose-necked heads.

7. Thick seedings have a tendency to reduce the leafiness of individual milo plants. The average number of leaves per individual plant in milo seedings was as follows: Four-inch rate, 9.2; six-inch rate, 8.6; eigh-inch rate, 9-4; ten-inch rate, 9; twelve-inch rate, 10, and sixteen-inch rate, 10 leaves.

8. Early seedings, such as from April 15 to May 1, give the most and the best forage and seed. Seedings as late as June 15, or later, are undesirable. These results are much the same for all varieties.

9. One part of sorghum to six or seven parts of cowpeas will give about the right proportion for mixtures.

10. Results in these cases indicate that Brabham and Iron cowpeas, and *Dolichos biflorus* are the best legumes for these mixtures, but the cowpeas do not resist drought so well as the other plant.

11. The most satisfactory way to grow these mixtures in this locality is in close drills, as this compels the legume to grow more erect than when planted in rows.

12. In seeding it is found impracticable to plant the seeds mixed, and no doubt better results will be had by drilling the parts of the mixture separately, although this will require somewhat more labor.

13. Brabham was decidedly the best variety of cowpeas tested. The Iron and Chinese Whip-poor-will were also heavier yielders than the common Whippoorwill or the Cream. The Chinese Whippoorwill were earlier and, therefore, not so affected by drought as was the common Whippoorwill and other varieties.

14. In drought resistance the Iron was decidedly superior to other cowpeas.

15. There is little doubt that either the small Spanish or the Tennessee Red is the best peanut for forage in this region.

16. It is useless to attempt to seed alfalfa in rows in the spring in this region. It is more difficult to get satisfactory results than when planted broadcast.

17. Of the eighteen lots of Fox-tail millets grown, about nine lots were quite promising. Seven of these were big German types, while the two remaining ones were very leafy, fine stem common millets.

18. Of the big German types, No. 20,694 deserves special mention, having grown to a height of about four feet.

19. Three other millets were considered worthy of further trial. These were from Burmah. They made very promising growth and reached a height of about three feet, but were somewhat later than the other millets, and produced fodder perhaps a little coarse. All three of these millets seemed to lack in drought resistance.