EXPERIMENT STATION

OF THE

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FARM DEPARTMENT

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## PART I—EXPERIMENTS WITH CORN.

Our last bulletin on corn, No. 45, details the experiments carried on in 1893. The corn crop was then only a partial success. In 1894 no bulletin on this crop was issued for the reason that the crop was a complete failure and there was hence nothing to report. In 1895 we succeeded in growing a moderate crop, and the experiments with this crop are reported in the present bulletin. In these experiments, we have followed the same general plan of former years. The conclusions are based on the average of several plats, usually five, each one-twentieth acre in extent, though sometimes only two or three plats are used when the available space, or the nature of the ground, does not admit of more. The plats in each series are so placed that they alternate with those with which they are to be compared, and all are distributed in such a manner that each series shall represent an average quality of the soil within the area covered by the experiment. Unfortunately the College farm is rolling, and it is, therefore, impossible to secure the same conditions for all experiments as regards soil and exposure. This will explain, in part, much of the variation which is apparent between different experiments. Variations may be due to

treatment, but they may quite as often be due, in some measure, to differences in soil and exposure. In the case of cultivated crops, like corn, Kaffir corn, etc., it is our custom to use long and narrow plats in order to facilitate the work of the cultivator And these, while they are always uniform in the same experiment, cannot always be uniform in shape for all experiments. There is, however, an exception to the long plats in the case of variety tests. To avoid cross fertilization as much as possible, each variety is grown in a compact body, that is, on a square, or nearly square plat; this does not prevent the evil, but it lessens it. All plats herein referred to are surface planted unless otherwise stated. The planting is done by hand, two kernels being dropped at places 16 inches apart, and when the corn is up the plants are thinned to one in a place.

## TIME OF PLANTING CORN.

Seven plantings were made at intervals of one week, covering the time from April 18th to May 30th, these being the dates of the first and last plantings. Five one-twentieth acre plats were given to each planting. The rows were 3 5 feet apart, and the stalks 16 inches apart in the row, and between adjoining plats was a guard row, which did not belong to the experiment. The ground was very dry when the first two plantings were made, on April 18th and April 25th. Heavy rains fell May 2nd and 5th, which proved of great advantage to the plantings of May 2nd and May 9th. Owing to the dry condition of the ground, the two first plantings were late in coming up, while the third and fourth plantings came up promptly, and by the end of May there was scarcely any appreciable difference between the four plantings. The plantings of May 16th, May 23d and May 30th never attained the vigor of the earlier plantings, and they matured from a week to ten days later. The variety used was the Improved Leaming. The results are shown in table I. which gives the averages of each set of five plats.

### TABLE I.

TIME OF PLANTING CORN.

AVERAGE OF FIVE PLATS FOR EACH TREATMENT 1895.

| Date of Seeding. | Rate of Yield per Acre in bushels. | | |
|---|---|---|---|
| | Good Ears. | Nubbins. | Total. |
| April 18 | 22.34 | 10.54 | 32.88 |
| April 25 | 22.59 | 9.08 | 31.67 |
| May 2 | 24.45 | 8.85 | 33.30 |
| May 9 | 23.22 | 7.54 | 30 76 |
| May 16 | 16.00 | 9.00 | 25.00 |
| May 23 | 10.65 | 7.97 | 18 62 |
| May 30 | 10.74 | 9.34 | 20.08 |

The planting of May 2nd gave the best total yield. The yield of good ears, shown in the first column, show a regular gradation from the planting of May 2nd, with diminishing yields from this date, for both the earlier and later plantings. This does not, of course, prove that corn should be planted in the first days of May, but it proves that in 1895, under the conditions here obtaining, this was the best time to plant, and if subsequently the same results should appear during a series of years, it might be regarded as proof that early May is the time to plant in this latitude. Late planting, all will admit, is not desirable, and, on the other hand the extra early spring planting, which is practiced by so many farmers, is of advantage in but few seasons. Ordinarily the ground is not warm enough to plant in April. Planted too early, the corn is slow in coming up, so that much of it rots in the ground, and what survives is apt to be stunted and sickly—conditions which will show in the yield, even though the rest of the season be favorable.

## FREQUENCY OF CULTIVATION

This experiment is designed to test the value of the theory often advanced that the proper way to treat the corn crop is to give it frequent and shallow culture. It has now been tested here for several years, and while these tests have not established just how often corn must be cultivated, they prove beyond a doubt, that it is possible to cultivate it too much. The drawback to the experiment is that frequent cultivation, as for instance twice a week or three times a week, necessitates the stirring of the soil at times when it is not in proper condition to be stirred. In the present case, when rains fell at such times that the ground would be too wet to cultivate on the assigned dates, the cultivation was postponed or omitted altogether. There were this year 30 plats devoted to the experiment, arranged as already explained. Each plat was a long narrow strip only four rows wide, and a guard row separated adjoining plats, so that the treatment of one plat could not affect its neighbor. The rows were 3.5 feet apart and the stalks 16 inches apart in the row The variety used was the Dole-90-day, an early corn. It was planted on April 25th and harvested on September 6th, when the crop was completely ripe and dry. The fact that it was an early variety and, therefore, a light yielder, also that it was planted perhaps a little too early, as frosts occurred after it was up, may account, at least in part, for the generally light yields.

## TABLE II.

FREQUENCY OF CULTIVATION

AVERAGE OF FIVE PLATS FOR EACH TREATMENT 1895.

| Times Cultivated. | Times cultivated during season. | Rate of Yield per acre in bushels. | | |
|---|---|---|---|---|
| | | Good Ears. | Nubbins. | Total. |
| Three times a week | 22 | 1.60 | 3.40 | 5.00 |
| Twice a week | 15 | 2 60 | 4.20 | 6.80 |
| Once a week | 7 | 6.71 | 6.22 | 12.93 |
| Once in two weeks | 5 | 6.94 | 7.97 | 14 91 |
| Once in three weeks | 3 | 12.14 | 8.31 | 20.45 |
| Once in four weeks | 2 | 12.65 | 7.82 | 20 47 |

AVERAGES FOR THREE YEARS.

| Times Cultivated. | Total Average per Acre in bushels. | 1895. | | 1893. | | 1892. | | 1891. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Times cultivated | Rate per Acre, bus | Times cultivated | Rate per Acre, bus | Times cultivated | Rate per Acre, bus. | Times cultivated | Rate per Acre, bus |
| Three times a week | 18.24 | 22 | 5.00 | 20 | 23.28 | 15 | 26 45 | .... | ..... |
| Twice a week | 20.36 | 15 | 6.80 | 14 | 26.05 | 11 | 28.25 | .... | ..... |
| Once a week | 22.89 | 7 | 12.94 | 7 | 28.65 | 6 | 27 08 | .... | ..... |
| Once in two weeks | 21.80 | 5 | 14.91 | 4 | 22 25 | 3 | 28.25 | .... | .. |
| Once in three weeks | 22.88 | 3 | 20.45 | 3 | 21.34 | 3 | 26.85 | .... | ..... |
| Once in four weeks | 21.43 | 2 | 20.48 | 2 | 18.02 | 2 | 25.80 | .... | ..... |

AVERAGES FOR FOUR YEARS.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Twice a week | 31.93 | 15 | 6.80 | 14 | 26.05 | 11 | 28.25 | 9 | 66 63 |
| Once a week | 34.53 | 7 | 12.94 | 7 | 28 65 | 6 | 27.08 | 6 | 69.45 |
| Once in two weeks | 34.59 | 5 | 14.91 | 4 | 22.25 | 3 | 28.25 | 4 | 72.97 |

It will be seen that the yield from the plats most frequently cultivated was exceedingly light, and that the plats cultivated once in three weeks and once in four weeks gave much the best yields. This wide variation is, undoubtedly, in large measure, due to the nature of the season. Heavy rains fell on several dates during May and June. This frequent softening of the ground, and the tramping of the team soon after, compacted the layer of the soil immediately below the surface to an injurious extent; and frequent cultivation was thus a hindrance rather than a help to the development of the crop. This result proves that iron clad rules cannot be laid down for the handling of the corn crop. In a dry season frequent stirring of the surface answers a good purpose in serving to retain moisture in the subsoil.

In the table of averages for three years, it will be seen that in '92 the plats cultivated once in two weeks gave exactly the same average as plats cultivated twice a week. In '93 the plats cultivated once a week gave the best yield, and there was a decrease by giving either more or less cultivation. The average for three years gives the best yield to plats cultivated once a week, though it is practically the same as the plats cultivated once in three weeks. We have averages for four years for cultivations of twice a week, once a week, and once in two weeks, the yields from the two latter treatments being the best and almost alike. The cultivator used on all occasions is the one known as the "Daisy Spring Tooth." The experiment should be studied in connection with the one on amount of cultivation, which follows.

## AMOUNT OF CULTIVATION

The plan of this experiment differs from the foregoing in that the cultivation is not given a set number of times a week, but a stated number of times during the entire season. It is thus possible to cultivate the ground when it needs it the most, namely when the crust begins to form soon after a rain. In all other respects the conditions of the experiment were the same as in the previous one. The corn was planted on the same date, April 25th; the same variety was used, Dole-90-day, it was planted the same distance apart and it was located in the same field, though perhaps on a little better soil. There were 30 plats arranged as already described.

TABLE III.

AMOUNT OF CULTIVATION.

AVERAGE OF FIVE PLATS FOR EACH TREATMENT 1895.

| Times cultivated during the season. | Rate of yield per acre in bushels. | | |
|---|---|---|---|
| | Good Ears. | Nubbins. | Total. |
| One time | 16.34 | 7.08 | 23.42 |
| Two times | 23.77 | 7.11 | 30.88 |
| Three times | 18.45 | 8.00 | 26.45 |
| Four times | 12.65 | 8.12 | 20.77 |
| Five times | 13 74 | 6.77 | 20.51 |
| Six times | 10.37 | 6.71 | 17.08 |

AVERAGE FOR TWO YEARS.

| Times cultivated during season. | Total average per acre in bushels | 1895. Rate per Acre in bushels. | 1891. Rate per Acre in bushels. |
|---|---|---|---|
| Two times | 49.45 | 30.88 | 68.03 |
| Four times | 48.41 | 20.77 | 76.06 |
| Six times | 43.58 | 17.08 | 70.08 |

The above table gives the average of each series of five plats for 1895 and also the average for two years in which two, four and six times have been tried. As in the previous case much cultivation appears to have been detrimental rather than beneficial. The best yield, 30.88 bushels was obtained from a series of plats cultivated only two times during the season, and from this there is a regular gradation downward in yield as the number of cultivations increase. The plats cultivated only once averaged even better than those cultivated four times or oftener. In the average for two years' cultivation, twice during the season gave better results than four times and six times respectively, though in '91 the plats cultivated four times yielded better than those cultivated either oftener or less often. The general tenor of the results of these cultivation experiments is that frequent culture is not only not desirable, but may even be injurious. There is not only a loss of labor, but a loss in crop as well.

## METHODS OF CULTURE.

The following series of experiments in methods of planting and cultivating were carried on the past season as they have been for some years previous.

(1) Corn listed and given deep culture;
(2) Corn listed and given shallow culture;
(3) Corn surface planted and given deep culture;
(4) Corn surface planted and given shallow culture;
(5) Corn surface planted and given both deep and shallow culture;
(6) Corn surface planted and given surface culture.

Listed and surface planted are terms which explain themselves; but the methods of culture require an explanation. By deep culture is meant the cultivation given by the old fashioned cultivator with large shovels. It was put into the ground to a depth of six inches. By shallow culture is meant the stirring of the surface soil to the depth of two inches; by shallow and deep culture is meant that the plats were plowed with a spring tooth cultivator the first time going over them, and the next cultivation was given with the large shovels and these run in to a depth of six inches, the purpose of this being to loosen the soil as deeply as possible before the roots had ramified through the surface layer. All succeeding cultivations were given with the spring tooth

run shallow. By surface culture is meant that the surface was worked very shallow with the Tower Surface cultivator. Each method was tested on five plats arranged as hereinbefore explained. The variety used was the St. Charles, a large white corn. The results are shown in the following table.

TABLE IV.

METHODS OF CULTURE.

AVERAGE OF FIVE PLATS FOR EACH TREATMENT 1895.

| Treatment of plats. | Rate of Yield per acre in bushels. | | |
|---|---|---|---|
| | Good Ears. | Nubbins. | Total. |
| Listed, deep culture | 10.62 | 7.74 | 18.37 |
| Listed, shallow culture | 8.88 | 7.02 | 15.91 |
| Surface planted, deep culture | 11.74 | 6.20 | 17.94 |
| Surface planted, shallow culture | 7.57 | 6.22 | 13.80 |
| Surface planted, deep and shallow culture | 9.68 | 6.48 | 16.17 |
| Surface planted, surface culture | 5.74 | 4.57 | 10.31 |

AVERAGES FOR THREE YEARS.

| Treatment of plats. | Total average per acre in bushels | 1895. | 1893. | 1892. |
|---|---|---|---|---|
| | | Rate per Acre, in bushels. | Rate per Acre, in bushels. | Rate per Acre, in bushels. |
| Listed, deep culture | 23.97 | 18.37 | 30.33 | 23.22 |
| Listed, shallow culture | 23.06 | 15.91 | 26.13 | 27.14 |
| Surface planted, deep culture | 24.07 | 17.94 | 26.25 | 28.02 |
| Surface planted, shallow culture | 24.32 | 13.80 | 29.16 | 30.02 |
| Surface planted, deep and shallow culture. | 24 59 | 16.17 | 28.87 | 28.74 |
| Susface planted, surface culture | 22.17 | 10.31 | 28.60 | 17.62 |

The past season the listed corn given deep culture, gave the best returns, next surface planted and deep culture. In fact, the shallow and surface culture plats all gave poor returns the past year. This is not altogether in harmony with results in former years. In '92 surface planted and shallow culture plats gave the best yields; in '93 the listed and deep culture gave the best yields and surface planted and shallow culture gave the next highest. Listed corn with shallow culture has not given the best results in any year. In like manner surface planted and surface culture has not given high yields. The season and nature of the soil undoubtedly exercise much influence on the result. That one method is better than another in given seasons is evident, but just what the conditions are which demand deep or shallow plowing cannot yet be pointed out.

## SUBSOILING FOR CORN

We attempted this experiment two years ago but on account of crop failure we have nothing to report on subsoiling until now. The plats used in this experiment were one-eighth of an acre in extent and only three plats were given to each treatment. We compared the past season, plowed land with land which had been subsoiled in the spring of '94, in the fall of '94 and in the spring of '95, the treatment being the same except in the time of subsoiling. The variety grown on these plats was the St. Charles. It was surface planted, the rows being 3.5 feet apart and the stalks 16 inches apart in the row. The yields were light in all cases. The results are as follows:

TABLE V.

SUBSOILING FOR CORN.

AVERAGE OF THREE PLATS FOR EACH TREATMENT 1895.

| Subsoiled in Spring of 1894. | Fodder tons per acre th | Rate of Yield per acre in bushels. | | |
|---|---|---|---|---|
| | | Good Ears. | Nubbins. | Total. |
| Subsoiled | 1.96 | 6.42 | 8.79 | 15.21 |
| Plowed | 1.99 | 5.13 | 9.19 | 14.32 |
| SUBSOILED IN FALL OF 1894. | | | | |
| Subsoiled | 1.31 | 14.70 | 9.05 | 23.75 |
| Plowed | 1.40 | 13.65 | 8.46 | 22.11 |
| SUBSOILED IN SPRING OF 1895. | | | | |
| Subsoiled | 2.17 | 19.56 | 12.62 | 32.18 |
| Plowed | 2 28 | 22.56 | 12.70 | 35.26 |

It is noticeable that the plats subsoiled in the spring of '94 and in the fall of '94, i.e. 12 and 6 months respectively before the corn was planted, gave better yields than the plowed plats with which they are compared; whereas the plats subsoiled in the spring of '95 just before the corn was planted gave a smaller yield than the plowed plats. These results agree with the general experience, that to get the best yields of corn from subsoiling the soil should have time to settle well before the crop is put in. These plats have been marked permanently with iron stakes, and the effect this subsoiling has on future crops will be noted.

The method of subsoiling should be explained. A furrow ten inches deep was first turned by a fourteen inch walking plow, the subsoiler followed in the furrow of this plow running 5 inches deeper, so that the depth of the subsoiling measured 15 inches on the land side of the plow, while the loose soil was 18 inches deep. The subsoil plow used in these experiments was the John Deere

with a large wedge-shaped shoe which loosened and in a measure displaced the soil. Investigations after one of the heavy rains in the summer showed that the subsoiled ground was wet from six inches to a foot deeper than the plowed ground.

## BUTTS, MIDDLES AND TIP KERNELS OF CORN FOR SEED.

The old question as to what part of the ear produces the best seed corn has been tested in this experiment for several years. The plan has been, not only to use the kernels from the portions of the ear named, but to select the tip kernels from the crop raised from tip kernels, the butt kernels raised from butt kernels, etc, in order to see if there was any deterioration in the tip and butt seed. In '94 all our seed was lost, and in '95 we therefore had to make a new selection of seed. The variety selected was the Dole-90-day Each kind of seed was planted on five plats, the arrangement of these, distances and methods of planting, were as explained in other experiments. The results are given in the table herewith:

TABLE VI.

BUTT, MIDDLE AND TIP KERNELS OF CORN FOR SEED.

AVERAGE OF FIVE PLATS FOR EACH TREATMENT 1895

| Nature of Seed. | Rate of Yield per acre in bushels. | | |
|---|---|---|---|
| | Good Ears. | Nubbins. | Total. |
| Butt kernels | 12.97 | 5.85 | 18.82 |
| Middle kernels | 11.31 | 5.54 | 16.85 |
| Tip kernels | 9.94 | 6.20 | 16.14 |

AVERAGES FOR FOUR YEARS.

| Nature of Seed. | Total average per acre in bushels | 1895. | 1893. | 1892. | 1891. |
|---|---|---|---|---|---|
| | | Rate per Acre in bushels. | Rate per Acre in bushels. | Rate per Acre in bushels. | Rate per Acre in bushels. |
| Butt kernels | 35 82 | 18.82 | 30.96 | 27.40 | 66.11 |
| Middle kernels | 34.79 | 16 85 | 28 19 | 31.64 | 62.51 |
| Tip kernels | 35.64 | 16.14 | 34.73 | 30.57 | 61.14 |

The past season the butt kernels gave the best yield and the tips the poorest. This result corresponds almost exactly with the results of '91, as may be seen from the averages. In '92 the butts gave the poorest and the tips were

intermediate; in '93 the tips gave the best and the butts intermediate. It is not safe to draw conclusions in favor of one or the other as the case stands at present.

## RED KAFFFIR CORN COMPARED WITH CORN

The details of an experiment designed to see how the two varieties of corn named below, compare in yield with red Kaffir corn are given in the accompanying table. There were but two plats of each kind. The plats were seeded May 20th and they ripened as noted in the table. The averages show that the red Kaffir corn yielded nearly twice as much grain as the best yielding corn.

TABLE VII.

RED KAFFIR CORN VS. CORN.

| No. of plat. | Variety | Date of ripening. | Grain per acre bushels. | Fodder per acre in tons |
|---|---|---|---|---|
| 12 | Brazilian Flour corn | Sept 11. | 21.90 | 1.59 |
| 13 | Dole 90-day | Sept. 11. | 16.77 | 1.51 |
| 14 | Red Kaffir corn | Sept 20 | 40.25 | 1.53 |
| 15 | Brazilian Flour corn | Sept. 11. | 23.91 | 1.69 |
| 16 | Dole 90-day | Sept. 11 | 20.26 | 1.69 |
| 17 | Red Kaffir corn | Sept. 20. | 46.05 | 1.53 |
| | AVERAGE. | | | |
| | Brazilian Flour corn | Sept. 11 | 22.76 | 1.64 |
| | Dole 90-day | Sept. 11. | 18.47 | 1.60 |
| | Red Kaffir corn | Sept. 20. | 43.07 | 1.53 |

## COMPARISON OF EARLY, MEDIUM AND LATE VARIETIES.

It is so frequently advocated to plant early corn that we have attempted to test the yield of three varieties named below The plats were surface planted April 27, and in all respects treated as in other experiments. The dates of tasseling, ripening and the yields are given herewith;

TABLE VIII.

EARLY, MEDIUM AND LATE VARIETIES.

AVERAGE OF FIVE PLATS FOR EACH TREATMENT

| Variety | Date of tasseling. | Date when ripe. | Rate of Yield per acre in bushels. | | |
|---|---|---|---|---|---|
| | | | Good Ears. | Nubbins. | Total. |
| Extra Early Huron Dent ..... ..... | July 1 | Aug. 8 | 12.68 | 8.20 | 20.88 |
| Early Mastodon..... ..... | July 15 | Aug. 28 | 14.71 | 8.25 | 22.96 |
| Golden Beauty..... ..... .. | July 15 | Aug. 31 | 17.94 | 7.37 | 25.31 |

It should be noted that Extra Early Huron Dent is a very small variety, its only merit being its earliness. Early Mastodon is a good medium variety of corn, but the Golden Beauty, as it turned out here the past season can scarcely be called a late corn, although it was later than either of the others. The Extra Early Huron Dent was obtained from Delano Brothers. Lee Park, Nebraska, and the other two from J. C. Suffern, Voorhies, Illinois. The results show that the late variety gave the best yield and the early one the poorest. The observation of the writer on this point is, that one year with another, medium to late varieties give better returns than early corn, although the early corn may in some seasons pass the critical stage before the hot winds and drought set in; the instances are but few where early corn has produced much when the late corn was a complete failure.

## VARIETIES OF CORN.

A short list of varieties was tested the past year, a few of which were grown on single plats, while others were grown in duplicate. The table gives both, and along with the yields it also shows the date of tasseling, date of ripening, height of stalk, and height of ear from ground:

# TABLE IX.

## VARIETIES OF CORN.

### YIELD OF SINGLE PLATS.

| Varieties. | When tasseling | When ripe. | Height of stalk in feet | Height of ear from ground in feet | Sound ears yield in lbs per plat | Nubbins yield in lbs per plat | Sound ears yield in bushels per acre | Nubbins yield in bushels per acre | Total yield in bushels per acre |
|---|---|---|---|---|---|---|---|---|---|
| Deland's Improved | July 15 | Aug. 29 | 8.4 | 4.0 | 55 | 38 | 16.67 | 11.38 | 28.05 |
| Nebraska White | " 12 | " 29 | 7.8 | 4.5 | 55 | 40 | 16.77 | 12.04 | 28.81 |
| Stooling Flour Corn | " 19 | Sept. 5 | 7.2 | 4.3 | 17 | 29 | 5.29 | 8.98 | 14.27 |
| Rig Buckeye | " 12 | Aug. 29 | 8.6 | 3.8 | 77 | 56 | 23.29 | 17.44 | 40.73 |
| Early Prairie King | " 9 | " 29 | 8.8 | 3.5 | 158 | 32 | 54.80 | 11.04 | 65.34 |
| Early Thompson | " 9 | Sept. 2 | 8.1 | 3.0 | 144 | 27 | 55.26 | 10.39 | 65.65 |
| Early Yellow Rose | " 9 | " 2 | 8.6 | 4.0 | 115 | 46 | 34.79 | 13.82 | 48.61 |
| Extra Early Huron | " 1 | Aug. 8 | 6.8 | 2.0 | 85 | 31 | 31.64 | 11.54 | 43.18 |
| Gold Mine | " 3 | " 19 | 8.0 | 3.5 | 96 | 40 | 31.98 | 13.30 | 45.28 |
| Nebraska Iron Clad | " 9 | " 23 | 8.3 | 3.3 | 120 | 34 | 36.82 | 10.44 | 47.26 |
| White Cap and Yellow Dent | " 2 | " 12 | 7.1 | 2.6 | 89 | 28 | 32.57 | 10.25 | 42.82 |

### AVERAGES OF SIMILAR PLATS.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Leaming | July 9 | Aug. 27 | 8.3 | 3.4 | .. .. | .... | 35.11 | 12.27 | 47.38 |
| Blount's Prolific | " 17 | Sept. 7 | 8.3 | 4.5 | ..... | .... | 17.07 | 7.26 | 24 33 |
| Champion White Pearl | " 10 | " 2 | 7.5 | 3.6 | ..... | .... | 28.93 | 13.53 | 42.46 |
| Hickory King | " 15 | " 3 | 8.8 | 4.0 | ... | .... | 20.38 | 11.34 | 31.72 |
| Mammoth White Surprise | " 15 | " 8 | 9.1 | 4.9 | ..... | .... | 12.92 | 10.13 | 23.05 |
| Mosby's Prolific | " 27 | " 15 | 8.8 | 5.5 | ..... | .... | 10.00 | 15.77 | 25.77 |
| New England Flint | June 26 | Aug. 1 | 4.1 | .9 | ..... | .... | 5 28 | 18 15 | 23 43 |
| St. Charles | July 18 | Sept. 5 | 8.2 | 4.1 | ..... | .... | 16.57 | 11.56 | 28.13 |
| Champion Yellow Dent | " 8 | Aug. 28 | 8.2 | 4.0 | .... | .... | 36.04 | 14.11 | 50.15 |
| Chester County Mammoth | " 11 | " 30 | 8.3 | 3.4 | ..... | .... | 43 83 | 11 86 | 55.69 |
| Early Butler | " 1 | " 8 | 7.4 | 3.1 | ..... | .... | 27.38 | 9.73 | 37.11 |
| Early Mastodon | " 10 | Sept. 2 | 8.7 | 3 9 | ..... | .... | 41.47 | 10.07 | 51.54 |
| Fisk | June 30 | Aug. 8 | 6.5 | 2.5 | ..... | .... | 27.61 | 11 60 | 39.21 |
| Golden Beauty | July 13 | Sept 2 | 8.9 | 3.8 | ..... | ... | 38.02 | 8.47 | 46.49 |
| Sterling | " 14 | Aug. 29 | 7.7 | 3.4 | . .... | .... | 20.35 | 13.46 | 33.81 |
| Peach Blossom Mammoth | " 14 | Sept. 2 | 9 5 | 4.7 | ..... | ... | 34.07 | 8.67 | 42.74 |
| Reardon's Cross | " 15 | " 6 | 9.3 | 4.4 | .... | ... | 15.52 | 9 93 | 25.45 |

## PART II==EXPERIMENTS WITH KAFFIR CORN.

We have grown Kaffir corn at this Station on a more or less extensive scale since 1888. During this time it has gained great popularity, especially in the drier sections of the state, because of its drought-resisting qualities and the large yields of both grain and forage which it produces. That our Kansas farmers take a deep interest in this crop is manifested by the numerous inquiries in regard to its characteristics, culture and feeding value, which reach us almost daily The important role which it seems destined to play in the agriculture of the future is sufficient excuse for a brief review of the work of the Station with this crop, together with some experiments with its culture and use as a feed stuff not heretofore published.

In 1888 it was grown here for the first time, seed enough for a few rows having been obtained from a local seedsman. It was the White Kaffir corn, hereinafter described, which was then the only variety on the market. The result of this first trial is referred to in the First Annual Report of the Station.

In 1889 the White Kaffir corn was again planted on a somewhat larger scale than in the previous year, and a package of Red Kaffir corn seed was obtained from the U. S. Department of Agriculture and grown here for the first time Both varieties were planted May 6th. The rainfall being abundant and the season in other respects auspicious, their growth was most luxuriant. The White Kaffir corn yielded at the rate of 60 bushels of clean seed to the acre and seven tons of field cured forage. The Red Kaffir corn yielded at the rate of 71 bushels and 9 tons field cured forage. The details of this experiment are described in the Second Annual Report of the Station.

In 1890 both these varieties of Kaffir corn were again planted, and on a larger scale than in either of the previous years. We grew also that year a large number of varieties of other non-saccharine sorghums in comparison with the Kaffir corns; but for general utility and adaptation to Kansas conditions the Kaffir corns were deemed superior to all other sorts. The season was unfavorable, the rainfall being light, and the corn crop came near being a total failure. An early frost killed many of the varieties of non-saccharine sorghums under test before their seed matured. The Red Kaffir corn escaped injury from this frost which occurred September 12, the seed being mature at that date The White Kaffir corn, on the other hand, suffered somewhat, being less forward. The latter yielded only 6 bushels of seed and 3.33 tons of field cured forage to the acre. The Red Kaffir corn, on the other hand, yielded 19 bushels of seed and more than 4 tons field cured forage to the acre. The details of this experiment are described in bulletin No. 18 of this Station.

In 1891 the season was again favorable and the White Kaffir corn yielded 41.61 bushels clean seed and 8.23 tons fodder per acre, while the Red Kaffir corn yielded 98.7 bushels seed and 12.29 tons fodder per acre. This is the largest yield we have so far obtained. We grew the same year a large number of varieties of non-saccharine sorghums collected by U. S. Consuls in Africa, China and India; but nearly all of these required too long a season to mature seed in this latitude and none of those which did mature seed were as good as the Kaffir corns. They have, therefore, been dropped.

In 1892 the Red Kaffir yielded 50 bushels of seed and 5 tons of fodder to the acre whereas the White yielded but 22 bushels of seed and 2.6 tons fodder.

The yield of the White having been uniformly much less than that of the Red, up to this date, it was decided to drop it from the list and give more attention to the study of the Red.

The same year an experiment was planned to ascertain the best distance to plant the Red Kaffir corn, with a view to get the best yield. Forty-eight plats were laid out, on which the rows varied from 16 to 32 inches apart and the plants from 4 to 8 inches apart in the row. The seed was planted May 21, '92 and was ripe September 15th. The following table shows the averages of six plats under each treatment.

TABLE I.

AVERAGES UNDER SIMILAR TREATMENTS.

| | | Grain per acre, Bushels. | Fodder, Tons. |
|---|---|---|---|
| Rows 16 inches. | Stalks 4 inches | 30 51 | 3.28 |
| Rows 16 inches. | Stalks 6 inches | 34.00 | 2.95 |
| Rows 16 inches. | Stalks 8 inches | 41 80 | 2.33 |
| Rows 24 inches. | Stalks 4 inches | 32.30 | 2.84 |
| Rows 24 inches. | Stalks 6 inches | 34.70 | 3.12 |
| Rows 24 inches. | Stalks 8 inches | 36 64 | 3.45 |
| Rows 32 inches. | Stalks 4 inches | 35.01 | 2.88 |
| Rows 32 inches. | Stalks 6 inches | 33.39 | 2 30 |
| Rows 32 inches. | Stalks 8 inches | 37.33 | 2.78 |

In 1893 the same experiment was repeated with some alteration in the distance between the plants, as shown in Table II. The seed was planted June 7. This late seeding was due to the washing out of the first planting by heavy rains. The fact that the crop matured by September 21st, on which date it was cut and shocked, proves that early planting is not necessary. The seed was sown with a grain drill with press wheels and the plants thinned accurately to the distances given in the table.

TABLE II.

DISTANCE TO PLANT RED KAFFIR CORN 1893.

AVERAGE OF TWO PLATS FOR EACH TREATMENT.

| Distance between rows in inches | Distance between stalks in inches | Height of stalk in feet | Length of head in inches | Per cent of heads, | Per cent of leaves, | Per cent of stalks, | Grain per acre in bushels | Fodder per acre in tons | Rank. Grain. | Rank. Fodder |
|---|---|---|---|---|---|---|---|---|---|---|
| Broadcast. | .. .... | 3.5 | 5.0 | 15.5 | 51.5 | 33 0 | 17.31 | 5 70 | 14 | 2 |
| 8 | ..... | 3.6 | 6.5 | 15.5 | 48 0 | 36 5 | 20.90 | 5 89 | 13 | 1 |
| 16 | 4 | 5.2 | 8.5 | 27 0 | 31 0 | 42 0 | 32.06 | 4.47 | 12 | 4 |
| 16 | 8 | 5 2 | 10.0 | 30 5 | 28 0 | 41 5 | 35.80 | 3 86 | 9 | 6 |
| 16 | 12 | 5 0 | 10.5 | 34.0 | 25.5 | 40.5 | 33.70 | 3.17 | 11 | 9 |
| 16 | 16 | 4.9 | 11.0 | 35 0 | 25.0 | 40.0 | 35.22 | 3 07 | 10 | 10 |
| 24 | 4 | 5.5 | 9.0 | 31.0 | 26 5 | 42 5 | 45.05 | 4.54 | 3 | 3 |
| 24 | 8 | 5 1 | 10 5 | 32 0 | 25.0 | 43 0 | 42.35 | 3.53 | 5 | 7 |
| 24 | 12 | 5.0 | 11 5 | 40.5 | 21 5 | 38 0 | 44.56 | 3.00 | 4 | 11 |
| 24 | 16 | 4.7 | 12 5 | 41 0 | 21.0 | 38.0 | 39.04 | 2.53 | 6 | 13 |
| 32 | 4 | 5.5 | 11.0 | 34 5 | 24.0 | 41.5 | 49.81 | 3 96 | 1 | 5 |
| 32 | 8 | 5 0 | 12.0 | 33.5 | 22.0 | 39.5 | 45 12 | 3 24 | 2 | 8 |
| 32 | 12 | 4.8 | 13.5 | 42 5 | 20 0 | 37.5 | 38.25 | 2.58 | 7 | 12 |
| 32 | 16 | 4.7 | 13.5 | 44 0 | 21.0 | 35.0 | 37.75 | 2.14 | 8 | 14 |

The data given in the table were taken December 21st when the crop had stood in shock three months and was thoroughly dry. It is of much interest to note the effect that distance between plants has, not only on the yield, but on the height of stalk and length of head as well. It will be seen that moderate crowding lengthens the stalk and shortens the head. The first series of plats was broadcasted. These produced stalks which averaged but 3.5 feet high and heads five inches long. The second series was put in with a grain drill. These produced a trifle taller stalks and somewhat longer heads, with a better yield of both grain and fodder. Next we notice that the close planting had the effect of lengthening the stalk, while the wider distances made them shorter and more stocky This may be seen by comparing the height of stalk in distances 16x4, 24x4, and 32x4, with the same in distances 16x16, 24x16, and 32x16. The largest yield of grain was, in this instance, obtained when the rows were 32 inches apart and the stalks 4 inches apart in the row. The soil was of only moderate fertility. On rich soil the plants will grow larger and require more room.

In 1894 all our experiments with this and other crops were completely destroyed by the drought. Fifteen acres were planted to Red Kaffir corn, but unfortunately the ground was so situated that there could be no chance for the crop. It was on the lower slope of a limestone hill with a southern exposure, and

it consequentlv got the full effect of the hot, dry winds. No seed was produced except a few heads here and there, but the yield of fodder came within a small fraction of two tons to the acre.

In 1895 the same ground was again planted to Red Kaffir corn, chiefly because nothing else was suited to the situation. The rainfall was moderate and it yielded 41 bushels of grain and 2 tons of fodder to the acre.

These trials, and a thousand others made during the last two or three years on farms scattered all over the state, establish beyond dispute the facts that Red Kaffir corn is a heavy yielder both of grain and forage in ordinary years: and that in extreme drought, like that of '94, it yields a fair crop of forage when corn and nearly all other crops are complete failures.

A new variety of Kaffir corn with white seed was grown at the Station for the first time in '95 The seed was obtained from F Barteldes & Co., of Lawrence, Kansas, under the names of "African Millet" and "White Kaffir Corn." It has been grown also in Oklahoma and in some parts of this state. It differs in several respects from the old white variety above referred to, the most noticeable difference being that the seed is set in brown or black hulls. To distinguish the two we have called this the "Black-hulled White Kaffir." It appears to be much superior to the old White Kaffir corn in yielding qualities. The past season it produced at the rate of 34.03 bushels of grain and 1.23 tons of fodder to the acre. It must be tried further before its status can be definitely ascertained. To avoid confusion of these three varieties they are described in detail as follows:

RED KAFFIR CORN.—Plant from 4 to 6 feet tall according to soil, season and culture, Stalk close-jointed, producing 9 to 14 leaves. Leaves thick, somewhat rough and stiffer than corn leaves. The plant rarely suckers, but it will occasionally throw out branches from the upper joints. The sheaths are quite generally colored red or purple, due to a blight. (Described in First Annual Report, Kansas Station.) Head upright, long and narrow, always pushing clear of the sheath of the upper leaf, spikelets short, compact, and held close to the head. Seed red or light brown, small, almost round, brittle, starchy, and packed so closely in the head that the stems and hulls are scarcely visible. Glumes (hulls) small, thin, brown, covering less than half of each seed. Well grown heads frequently measure from 14 to 18 inches in length.

WHITE KAFFIR CORN.—Like the foregoing, the plant is short-jointed, and has an abundance of foliage, but does not grow quite so tall. In like manner the head is upright, slender, compact but it frequently fails to shoot out of the enveloping sheath, in which case the lower portion remaining covered is worthless, as it either fails to form seed, or the seed formed moulds and spoils. The seed is white, slightly flattened sidewise, starchy and pleasant to the taste. The hulls are gray or greenish white, hairy, somewhat larger and more conspicuous than those of the Red variety. The ripe seed shells out badly in handling. The heads average somewhat smaller than those of the Red variety.

BLACK-HULLED WHITE KAFFIR CORN. (AFRICAN MILLET.)—Plant like the foregoing. Head upright, rather shorter, broader and looser than that of the Red sort; sometimes narrow below and broad above, making it somewhat club-shaped. This is due to the fact that the spikelets are longer than those on the foregoing sorts and have a tendency to spread. Seed white, many grains having a reddish or brown spot, somewhat larger than the red sort. The head shoots clear of the enveloping sheath. Somewhat different types of this variety are frequently seen in the same field: some heads may have gray hulls, others brown and still others black. The heads differ also in shape, some being broad and almost diffuse, others slender and compact. It goes by the three names of Black-hulled White Kaffir corn, White Kaffir corn and African Millet. There is a strong tendency to variation in this whole group of sorghums. With skillful selection and breeding, varieties could doubtless be developed superior to any now known.

The Red and the White have been grown at this Station for several years, as above noted, and we have found them to compare about as follows; Under the same conditions the Red has invariably outyielded the White both in grain and forage; it grows from 6 to 9 inches taller; it matures its seed a little earlier, and the head always pushes clear of the upper sheath; it does not shell in handling and has a jucier stalk. On the other hand, the seed of the White has a pleasanter taste, being not at all astringent and is better relished by stock.

The Black-hulled White has been grown here the past season only, but it appears to have all the virtues of the Red and has in addition a white seed, the seed coat of which is not astringent, and has, therefore, a pleasanter taste than colored seed. If further tests shall show that the Black-hulled White yields as well as the Red it will undoubtedly take the lead.

## FEEDING VALUE OF KAFFIR CORN.

We have tested the feeding value of Red Kaffir corn for pigs in two experiments and for cattle in one experiment The first of the pig feeding experiments is reported in bulletin 53 and only the summary will be repeated here. Briefly stated it is as follows:

December 27, '94, twelve pigs, divided into three lots of four pigs each, were put in pens to be fed experimentally. They were selected with a view to equality of age and weight, the average weight being 153 pounds. Each pig was fed separately. Lot I. was fed on Red Kaffir corn meal, Lot II. on corn meal, and Lot III. on ground wheat. The experiment lasted during 77 days, from December 27th to March 14th. In that time Lot I., fed on Kaffir corn meal, made an average gain per pig of 106 pounds, or 1.37 pounds daily per head. The average consumption of feed was 545.1 pounds, 5.15 pounds meal for each pound of gain.

Lot II., fed on corn meal, had in the same time made an average gain per pig of 131 pounds, or 1.7 pounds daily per head. The average consumption of

eed by each pig was 573.5 pounds corn meal, which is equal to 4.38 pounds feed for each pound of gain.

Lot III., fed on ground wheat, in like manner made an average gain of 137 pounds a head, or 1.78 pounds daily and had consumed 564.16 pounds feed or 4.11 pounds for each pound of gain.

It will be seen that the Kaffir corn was not equal to either corn or ground wheat as a fattening feed for these pigs.

We have the present season carried on a similar experiment with four lots of pigs, three pigs to the lot. As in the former case each pig was given a separate pen and fed individually. They were smaller than in the previous experiment, averaging only 63 pounds each when the feeding began. Lot I., was fed on Red Kaffir corn ground to a meal; Lot II., on a mixture of two-thirds Kaffir corn meal and one-third soy bean meal; Lot III. was fed on corn meal, and Lot IV. on two-thirds corn meal and one-third soy bean meal. The feed was weighed to each pig and was put in soak 12 to 24 hours before it was fed. They had three meals daily. These rations continued for 77 days at the end of which time the results stood as follows:

Lot I., fed on Kaffir corn meal, had made an average gain per pig of 34.39 pounds, or .47 pound daily and they had consumed an average of 6.48 pounds meal for each pound of gain.

Lot II., fed on Kaffir corn and soy bean meal, had gained an average of 126.5 pounds each, or 1.64 pounds per pig daily, and had consumed 3 51 pounds feed for each pound of gain.

Lot III., fed on corn meal, had gained an average of 61.3 pounds each, or 79 pounds daily per pig and had consumed 4.88 pounds corn meal for each pound of gain.

Lot IV., fed on corn meal and soy bean meal, had gained 128.1 pounds per pig, or 1.65 pounds daily and had eaten 3.23 pounds feed for each pound of gain. The experiment will be reported in detail in a bulletin to be issued later. Here we will simply notice the effect of the Kaffir corn meal. In the previous experiment, if we put the efficiency of the Kaffir corn at 1, that of corn will be 1.176. In the present experiment corn has an efficiency of 1.33, placing Kaffir corn at 1, hence corn is worth a third more than Kaffir corn. This is when the two were fed singly. When they were mixed with a rich nitrogenous feed like soy bean meal, the efficiency of the two mixtures were nearly alike.

As noted the pigs in the last experiment were smaller than in the former one, and bearing in mind that the younger the animal the richer must be the food to supply the needs of the system, the inference would be that Red Kaffir corn lacks the protein needed for the development of muscle, even more than corn does. This is shown still better in bulletin 53 where the four pigs in the Kaffir corn lot weighed 113, 138, 140, and 222 pounds respectively, and in the same order, they required for one pound of gain 5.76, 5.29, 5.13, and 4.78 pounds of the meal. The four pigs in the corn meal lot of the same experiment weighed respectively 119, 149, 152 and 189 pounds at the beginning of the experiment and the corn meal required for a pound of gain, placed in the same order, 4.55, 4.41, 4.37, and 4.28 pounds. The two feeds approach each other in efficiency as the hogs gain in size, and if fed to large hogs there would probably not be much difference between them.

We have likewise just concluded an experiment with Kaffir corn as feed for cattle. Three pure bred Aberdeen-Angus heifers, which were to be fed for

the butcher, were tied up in the stable and fed, one on Kaffir corn meal and cut corn stover, and two on corn meal and cut corn stover. The gains of both lots were small from the fact that they were almost fat when tied up.

During the first six weeks one (1) pound of live weight was gained on 15 46 pounds Kaffir corn meal and 1.65 pounds corn fodder by the heifer fed this ration; while one (1) pound gain was made on 18.47 pounds corn meal and 2.4 pounds corn fodder as the average of the two fed corn meal. Here the Kaffir corn made decidedly the best gain. It was apparent, however, that the heifers could not be fattened satisfactorily on these rations. The corn fodder was, therefore, changed to alfalfa, and oil meal was added to the grain ration in the same proportion for both lots. With this change the experiment went on for six weeks longer.

The results for the whole period of 12 weeks stand as follows: The heifer on Kaffir corn had eaten during this time 11 pounds Kaffir corn meal, 54 pound oil meal, .68 pound corn fodder and 1.21 pounds alfalfa for each pound of gain she made, or a total of 13.43 pounds food for each pound of gain.

The average amount eaten by the two on the corn meal ration for each pound of gain was 9 77 pounds corn meal, .63 pound oil meal, .65 pound corn fodder and 1.26 pounds alfalfa, a total of 12.31 pounds food for a pound of gain. It should be noticed that this lot ate .09 pound oil meal and .05 pound alfalfa for each pound of gain more than the Kaffir corn lot. The total amount of Kaffir corn meal eaten by this one animal was 1199.28 pounds. The gain was 109 pounds. The average amount of corn meal eaten by the two, per head, was 1,422.35 pounds, and the average gain 145.5 pounds.

The grain of all varieties of Kaffir corn is so small and hard that it should be ground to get the best effects. Fed whole a large proportion is swallowed without being masticated, and it consequently passes through the alimentary canal without it being acted upon by the digestive juices and, of course, cannot nourish the animal.

Further experiments are needed to ascertain just where Kaffir corn stands in comparison with our better known feeds. The probability is that the white seeded varieties will be found more nutritious than the Red.

## CULTURE OF KAFFIR CORN

So many inquiries in regard to the treatment of this crop reach this Station that it is deemed best to add a few words on its culture. Kaffir corn is adapted to all soils. While it reaches its best development on rich soil, it will also produce profitable crops on soil too poor for corn. It can be grown in regions too dry for corn. In common with other varieties of sorghum it does not succumb to hot winds as readily as corn does. In a season of drouth it may cease to grow and its leaves may curl as corn leaves do, but it remains green, and when rain comes it starts out with renewed vigor, and, if the season is long enough, it will still produce a crop of grain. Corn that has once been stunted by dry weather never amounts to anything. This reserve force in Kaffir corn is a most important characteristic. It makes it possible to grow it in semi-arid regions where corn rarely succeeds. This same tenacity of life is also manifested by its sprouting again from the roots and producing a second, and even a third crop, after it has been cut.

The seed bed should be prepared in all respects as for corn. The finer the tilth the better. It can be planted either in hills or in drills. The writer prefers the latter method. It is not so tall as corn and the leaves are shorter than

corn leaves; it can, therefore, stand much thicker than corn. But as has been shown in the experiments reported herein, there is a limit to the crowding process which should not be passed when a maximum crop is desired. As to methods of seeding, we have adopted the plan of seeding with a grain drill with press wheels and it works satisfactorily. It is an eight-shoe drill with the shoes eight inches apart. By leaving the first and the fifth feeds open and closing all the others in the seed box, we plant two rows at a time 32 inches apart; and by experimenting with the amount discharged it will soon be seen how to set the feed bar in order to sow the right quantity. Six to seven pounds to the acre is an abundance, and if the seed is clean and not cracked in threshing, less will answer. The richer the soil the larger the plants will grow and the more room they must have. Rows 32 inches apart allows sufficient space for cultivation and the stalks should stand from 4 to 9 inches apart in the row according to the richness of the soil.

If listing is practiced at all it should be very shallow. The plants are of slow growth during the first six weeks, and deep lister furrows do not admit of proper cultivation for so small plants. Surface planted seed should be harrowed with a smoothing harrow soon after it is up, in order to kill the weeds just germinating. In other respects cultivate as for corn. Cultivate shallow, especially near the row. We use a spring tooth cultivator in preference to the old-fashioned large shovel plows. Cultivate enough to keep the weeds down and the surface mellow until it begins to head.

In an average season Red Kaffir corn will mature in about 12 to 14 weeks. Planted in the middle or latter part of May the seed is ripe by the middle of September, and it should be harvested at once. The fodder will remain green until frost, but this fact should not be made an excuse for putting off the harvesting. The earlier it is cut after the seed is ripe the more time will there be for the stalks to cure, which is an essential point, especially if the fodder is stacked. Any of the many good corn cutters now on the market will doth e work. When the seed has dried out sufficiently so it can be stored, which condition it will not reach until the end of November, it should be threshed. It is true that many growers feed the crop as it comes from the shock, seed and all, but it is a wasteful way of handling it, though of course the cost of threshing and grinding must be taken into consideration, and, doubtless, there are conditions under which this cost will exceed the value of the waste incurred by feeding without threshing or grinding. One way of proceeding is to gather the heads in the field, as corn is gathered, before the crop is cut. A better way is to cut the heads off in the shock after the seed is dry, and thresh them at once. We have on one occasion threshed the whole stalk, but this has the objection that the fodder is badly broken up and it also requires that the stalks shall be well cured in order to avoid heating when stacked. We have also threshed it by taking each armful of fodder and sticking the heads into the cylinder for an instant; but this method requires too much handling of the whole crop and is, therefore, not desirable unless the fodder in the process of stacking or storing away must be handled anyway. As in the handling of corn fodder, it is desirable to save as much time as possible. The seed is hard and brittle, especially the red sort, and will sometimes crack badly in threshing. When this is the case it can largely be remedied by removing the concave in the thresher and putting in boards instead.

For the reasons noted above, the seed should be ground and the finer the better in order to utilize it to best advantage.