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E. DAVENPORT, DIRECTOR.

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EXPERIMENTS IN CORN CULTIVATION.

The most exhaustive experiment ever conducted by this Experiment Station upon the cultivation of corn was carried on by Professor Holden last summer.

The details were assigned as class work to Mr. A. D. Shamel, at that time a senior in the agricultural course, and taking special work in agriculture.

The results were as valuable as those of a single season could possibly be, and, with those of other seasons, will appear in due time in a regular bulletin of the Experiment Station. This brief circular is issued now in response to the earnest request of many who heard Mr. Shamel speak upon these experiments at the meeting of the State Farmers' Institute, and at other institute meetings.

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These experiments were undertaken in order to determine the effect of different depths of cultivation upon the growth, development, and yield of corn; to find the influence of several of the most important cultivators in common use upon the moisture of the soil; to test their efficiency in removing weeds and their final effect upon the soil; to note the condition of the soil at the end of the season, and the yield of ears and stalks as the result of the various methods of cultivation.

The plan of the experiment was as follows: A piece of ground was selected that was as nearly level as possible. It was plowed about six inches deep with a three horse breaking plow the last of April and harrowed immediately after plowing. The corn was planted the 8th of May and after it came up the whole field was

harrowed once and then rolled. Four rows running the length of the field were devoted to each kind of treatment, and each treatment of four rows was divided into twenty divisions, one of which was cut out to find the effect of the cultivations upon ground on which no crop was grown. In this way each experiment was divided into twenty sections, in order that any difference in yield that might be due to a possible difference in soil could be detected and eliminated. Four rows on either side of the field were cultivated in the ordinary way, about three inches deep with a small shovel cultivator throughout the season in order to get a standard for comparison. In finding the yield, the two inside rows of each treatment were taken and the outside rows discarded, for the reason that they might have been influenced by the different treatments of the rows adjoining. The weight and number of ears, and the weight of stalks were found separately for each plat. The yields added together gave the total yield for each treatment.

The rate of growth of the corn was determined with special instruments, and the height of the corn was found at 8 o'clock a.m., and 6:30 p.m. every day during the growing season for each system of cultivation. This was done to find the effect of the different cultivations upon the growth and development of the plant throughout the growing season.

Experiments were conducted to learn the effect of root pruning. A special instrument was devised to cut off the roots and at the same time not disturb the ground, so that the resulting difference in yield would not be due to any disturbance of the soil. The pruning was done three times during the season at the time of the other cultivations, and to depths of two, four and six inches.

The percentage of moisture in the soil under the various systems of treatment was found by accurately testing the amount of moisture of the ground for three depths,—nine, eighteen, and twenty-seven inches, respectively. This was done for each kind of cultivation, once a week during the entire season, and the results here given are the totals for the season.

TABLE SHOWING EFFECT OF DIFFERENT DEPTHS OF CULTIVATION.

| | Two inches. | Four inches | Six inches. |
|---------------------------|-------------|-------------|-------------|
| Weight of ears, lb..... | 466.5 | 466 | 437 |
| Weight of stalks, lb..... | 465 | 485 | 431 |
| Numbers or ears..... | 1003 | 1086 | 1168 |
| Per cent of moisture..... | 451 | 474 | 468.5 |

An ordinary small shovel cultivator with four shovels on a side, was so arranged that the shovels could be set to run accurately at 2, 4 or 6 inches in depth and maintain this depth throughout the cultivation.

The shallow, or two-inch cultivation required hand-weeding, but the deeper cultivations thoroughly removed all of the weeds. The deep cultivation left the ground ridged at the end of the season, while the shallow cultivation left the soil in a level condition. The corn grew most rapidly during the early part of the season upon the deeply cultivated plats, but during the latter part of the season the corn on the shallow cultivated plats developed most rapidly. The vigorous early development of the corn on the deep cultivated plats was due to the opening up of the soil to the air and sunshine, while root pruning at the latter end of the season tends to retard growth. Briefly summing up the results of the different depths of cultivation we can say that these facts seem to indicate that deep cultivation removes weeds thoroughly and tends to conserve soil moisture, but that it leaves the ground in a bad condition at the end of the season, and by reason of severe root pruning injures the plant so much that the yield of ears and stalks is greatly reduced. Shallow cultivation does not thoroughly remove weeds, is not as efficient in conserving moisture, does not tend to induce as vigorous early development as does deep cultivation, but it leaves the ground in good condition at the end of the season, and does not injure the plant by root pruning as does deep cultivation.

TABLE SHOWING EFFECT OF ROOT PRUNING.

| | Pruned 6 inches. | Unpruned. | Pruned 4 inches. | Unpruned. | Pruned 2 inches. | Unpruned. |
|---------------------------|---------------------|-----------|---------------------|-----------|---------------------|-----------|
| Weight of ears, lb. ... | 38.75 | 60.25 | 51 | 63.25 | 63.5 | 65.5 |
| Weight of stalks, lb. . . | 31.75 | 47.25 | 41.75 | 50.25 | 48 | 48 |
| Number of ears | 133 | 132 | 116 | 146 | 144 | 146 |

It can be seen at a glance that the root pruning done three times during the season had a very serious effect upon the yield, which varies almost directly with the depth of pruning. That which was pruned six inches deep was reduced to about one-half of the yield of that not pruned which grew alongside. The injury in the case of that pruned two inches is very slight and hardly noticeable. Here we find the explanation of the low yields in the case of the deep cultivation which causes a severe root pruning. In order to find what is the effect of late deep cultivation an experiment was carried on in which the pruning was done at the time of the last cultivation.

TABLE SHOWING EFFECT OF LATE ROOT PRUNING.

| | Pruned 6 inches. | Unpruned. | Pruned 4 inches. | Unpruned. | Pruned 2 inches. | Unpruned. |
|-----------------------------|---------------------|-----------|---------------------|-----------|---------------------|-----------|
| Weight of ears, lb. | 25.75 | 45.5 | 41.87 | 49.37 | 46 | 51.87 |
| Weight of stalks, lb. . . | 50.75 | 53.75 | 56.25 | 55 | 56 | 56.25 |
| Number of ears | 93 | 129 | 121 | 128 | 128 | 140 |

The effect of one root pruning at the time of last cultivation was almost as great as root pruning done repeatedly during the season.

It shows that most of the injury due to deep cultivation is done at the time of the last cultivation, and that during the early part of the season deep cultivation is of little or no danger to the crop.

TABLE SHOWING EFFECT OF DIFFERENT SYSTEMS OF CULTIVATION.

| | Mulched. | Ordinary. | Tower. | Six inch shovels. | Ridged. |
|---------------------------|----------|-----------|--------|-------------------|---------|
| Weight of ears, lb..... | 551 | 474.5 | 441.25 | 444.25 | 440.75 |
| Weight of stalks, lb..... | 490 | 455 | 453 | 359 | 405 |
| Number of ears..... | 1065 | 1037 | 1094 | 1072 | 1099 |
| Per cent of moisture..... | 493 | 455 | 479.7 | 469 | 467.4 |

The mulching was done with grass put on to a depth of about 4 inches just after the corn came up. The yield from the mulched plat is above that of all cultivations as is the weight of stalks and the amount of moisture in the soil. The corn grew slowly at first, but later very rapidly until at the end of the season it stood, on an average, about one foot above that of the cultivated plats. The high yield of the mulched plat is probably due to the combined effect of the high per cent of moisture conserved by the mulch and the perfect root system undisturbed by cultivation.

In the ordinary cultivation, about three inches deep, the yield is comparatively high, but the percentage of moisture is low, due, as in the previous cases, to shallow cultivation.

The Tower cultivator did not thoroughly remove the weeds. It operated to ridge and to pack the soil, and resulted in a lower yield than either mulching or ordinary cultivation.

In the case of the six-inch shovels, (the ordinary big shovel cultivator,) the yield was reduced and the ground was left somewhat ridged, but the percentage of moisture was high, and the weeds were thoroughly removed.

The ridging was done with a disc cultivator throwing up a ridge about 7 inches high along the row. In this the yield was low, the ground was left in bad condition, but the weeds were thoroughly removed. About two weeks after ridging a severe wind blew down all the corn and the ridged was blown down as much as if not more than the other cultivations. During the winter heavy rains washed out the soil between the ridges and carried it off the field making spring plowing exceedingly difficult.

A system of cultivation that will give highest yield under ordinary conditions seems to be about as follows: Cultivate deep during the early part of the season to remove weeds, conserve moisture and allow the plant an early vigorous development. Then gradually decrease the depth as the corn grows, until near the end of the season when the cultivation should be shallow, and as far from the hill as is consistent with removing weeds, in order to avoid root pruning and to leave the soil in the best mechanical condition.