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UNIVERSITY OF ILLINOIS,

Agricultural Experiment Station.

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FIELD EXPERIMENTS WITH CORN, 1890.

This article gives the results of the experiments with field corn in 1890, together with a summary of the results obtained in the same experiments in 1888 and 1889. The following are reported:

No. 1. Test of varieties. No. 3. Time of planting.
No. 4. Depth of planting. No. 5. Thickness of planting.
No. 6. Planting in hills or drills. No. 8. Frequency of cultivation.
No. 9. Depth of cultivation. No. 10. Effect of root pruning.
No. 54. Root growth. No. 11. Effect of fertilizers.
No. 23. Rotations of corn, oats, and meadow, and of corn and oats compared with continuous cropping with corn.

These experiments were made on a black loam about 20 in. deep, underlaid with yellow clay—the soil common to the prairies of central Illinois. Apparently the plats were notably uniform, and admirably adapted to field experimentation.

Judged by the results, 1888 was unusually favorable for the corn crop; 1889 much less favorable, and 1890 still less than 1889. The yield of air-dry corn per acre from the medium maturing varieties for the three years was 90, 75, and 62 bu. respectively.

In 1889, the rainfall was unfavorably distributed, and the temperature was below normal; in 1890, the rainfall was very deficient, but the temperature was more propitious during the corn months.

The aim is to state simply what the results have been; still it is believed that, with due regard for the circumstances, the average of the three years' results makes it possible to predict with some probability what will be.

Among the many varieties of dent corn tried one or more years, twelve have been tested in 1888, 1889, and 1890, and each has averaged 67 bu. per acre or more, the largest average yield being 80 bu. Of the yellow varieties, Leaming, Fisk, legal tender, Clark's Iroquois, and Riley's favorite are medium maturing, and will be found desirable for central Illinois. Steward's improved is too late for this locality. Murdock and Edmonds are early maturing, and may be grown farther north. Of white varieties, Champion white pearl or Burr's white, and Clark's 110-day are medium maturing and desirable for central Illinois. Helms improved is almost too late for this locality.

The stand of corn has been about 10 per cent. less than the per cent. of kernels sprouting under test conditions.

Barrenness does not seem to be a variety characteristic, but depends largely upon the season and the thickness of planting. The stalks had many more ears in 1889 than in 1888 and 1890. There were fewer barren stalks where corn was planted at the ordinary rate of 12,000 kernels per acre than at either thicker or thinner planting. When four times as many kernels were planted, one-half the stalks were barren.

Without exception the medium maturing varieties (maturing about September 20th) have given each year a higher average yield than either the early or late maturing varieties—from 7 to 20 bu. higher than the former, and from 2 to 7 bu. higher than the latter.

The per cent. of water in the kernel of the corn when husked varies with the variety and with the season. During the three years, the early maturing varieties have contained an average of 17.1 per cent. of water; the medium maturing, 21.3 per cent.; and the late maturing, 26.4 per cent. (Thoroughly air-dry corn contains about 11 per cent. of water.) Taking an average of the three seasons, the loss in weight of shelled corn from November 1st when the crop was gathered until it became thoroughly air-dry was for the medium maturing varieties, at the rate of 115 bu. in 1,000 bu. The loss from drying in 1890, was only about half that of 1888 and 1889. Seventy-five lb. of ear corn were ample to give for a bushel of corn on November 1, 1890; but in 1889, 80 lb. were not sufficient.

Good crops of corn were raised from a medium maturing variety when planted at any time during May. Planting in the last week of April gave somewhat poorer results, and the land uniformly required more cultivation to keep it equally free from weeds. When the corn was planted after the first of June, the yield was somewhat less and the corn did not always mature.

While during no season was there any direct relationship between the depth of planting and the yield, taking an average of the three seasons, the shallower planted rows gave the larger yield. It was found that, not counting the roots directly at the seed, which afterwards die, the first whorl of roots starts at from one to two in. from the surface, without reference to the depth at which the kernel has been planted.

Corn planted at the rate of one kernel every 12 in. in rows 3 ft. 8 in. apart, about 12,000 kernels per acre, gave a larger average yield of corn and a larger yield of good ears; contained more corn in proportion to stalk by weight, and a larger proportion of ears to number of stalks, than when planted either thicker or thinner. The thinner the planting the larger were the single ears and stalks.

If the average of the three years be taken, the yield of corn-fodder (corn and stalks) and corn-stover (corn-fodder after the corn has been husked) decreased constantly from the thickest to the thinnest plantings. Planting at the rate of one kernel every 3 in., 47,520 per acre, gave a little larger yield of dry matter and of digestible substance, than planting at twice that distance; but the yield of grain from the latter planting was so much better that it is believed the nutritive value of the crop for fodder purposes was greater where planted at the rate of one kernel every 6 in., about 24,000 kernels per acre. The average yield of field-cured corn-fodder from the five thicknesses of planting (one kernel every 3 in. to one kernel every 15 in.) during the three years, was nearly 6 tons per acre. Neither for fodder purposes, nor for the production of grain merely, was there any material difference in the yield whether one, two, three, four, or five kernels were planted per hill, the whole number of kernels planted per acre remaining the same, provided the land was kept equally clean.

In 1890, where the corn was planted in both hills and drills, and given an equal amount of cultivation, which kept the corn in hills cleaner than the corn in drills, the result was decidedly in favor of the corn in hills. In 1888, there was no practical difference.

During the three years, no appreciable benefit was derived from frequent cultivation, nor from cultivating after the ordinary time.

For the three years, the yield of corn has been increased by the shallow cultivation, one-tenth over the deep cultivation. The least increase in any one season was a little less than one-twelfth in 1890, and the greatest increase, one-eighth in 1889. In but one case in the three years did a deep cultivated plat yield more than a shallow cultivated plat. The plat which had no cultivation after planting, except that the weeds were removed by scraping with a sharp hoe, yielded more each season than the average of the deep cultivated plats; and in but two instances, once in 1889 and once in 1890, did any one of the deep cultivated plats yield more than the plat not cultivated. These experiments indicate that any cultivation of the soil which effectually removes the weeds, and at the same time disturbs the roots as little as possible, is the best; and that, on this soil, the stirring of the ground beyond what is necessary to kill the weeds is of little, if any, benefit. Undoubtedly it is better to disturb some roots than to allow weeds to grow.

Pruning the roots of corn to the depth of 4 in., 6 in. from the stalk, has reduced the yield 16 and 23 per cent. in 1889 and 1890, respectively. The reason that root-pruning reduced the yield to a greater extent than

deep cultivation, is probably, that the root-pruning was done on all four sides of the hill at each pruning. The depth at 6 in. from the plant has been determined with 251 roots, and 174 were found to be 4 in. or less from the surface; 108, 3 in. or less from the surface. In other words, a cultivator running 4 in. deep would disturb about 70 per cent. of the roots, and at 3 in. about 43 per cent. Of 115 roots on four plants examined June 21st and 28th, the end, or the point where broken, of 54 was 12 or more in. deep; of 33 was 18 or more in. deep; and of 17 was 24 or more in. deep.

Twelve trials have been made of the effect upon a corn crop of fertilizers when applied to the prairie soil of Illinois. No practical benefit was obtained from the use of commercial fertilizers. The increased yields from the use of stable manure probably repaid the cost of the application and left some profit; but clearly the value of stable manure was not equal to the estimates often made, based upon the cost of commercial fertilizers containing the same amount of plant food.

Good crops of corn have been raised during the past three years from land which has now been in corn for 15 successive years, and has received no manure of any kind; while somewhat better crops have been raised where the land has been in corn but one-third the time, and in timothy and clover one-half the time.

Experiment No. 1. Corn, Testing Varieties.

A test of varieties of dent corn has been made during the past four years. In 1887, 25 plats were planted; in 1888, 176; in 1889, 82; and in 1890, 52. The aim has been to sift out those varieties which, for one reason or another, did not promise special merit, and each succeeding year to plant only those of special or standard merit for comparison with the varieties which are put upon the market from year to year. In case a variety had been especially praised, though it did not prove of merit here, it was sometimes grown for two or three years. Reports of the tests made in 1888 and 1889, and many details of the methods employed, are given in *bulletins Nos. 4 and 8*.

The land used this season was tract [b] of that used in 1888 and 1889. The tract was divided into 56 plats, each 2 rods, 9 hills, square. Each plat was so planted that there was corn growing adjacent on every side. The land was plowed, without removing the stalks, April 23 and 24, 1890. The varieties given in the table were planted May 15th, the tract having been previously rolled and disked, and harrowed twice. In this, as in all these experiments, the hills were 3 ft. 8 in. apart, and four kernels were planted in a hill. The corn was covered about one in. deep with a hoe. Between May 29th and June 24th the tract was cultivated four times with a shallow cultivator. The weeds remaining in the hills were removed with a hoe June 25th.

Duplicate Plats.

In order to interpret intelligently the yields of the different varieties tested, it is necessary to know what would be the difference in yield from given plats if planted with the same variety under similar conditions. Below are given the results obtained with nine varieties from two or more plats each.

TABLE Showing Yield per Acre of Air-dry Corn upon Duplicate Plats, in 1890.

Variety.	a	b	c	d	e	Average
Burr's white	51.7	75	63.6	78.1	70	68
Leaming	72.6	65.2	70.4	.....	....	69
California yellow	56.7	52.6	.....	.....	....	55
Clark's Iroquois	63.1	54.8	.....	.....	.....	59
Clarke county champion	61.4	56.3	.....	.....	.....	59
Clark's 110-day	60.1	76.1	.....	.....	.....	68
Helms improved	42.2	60.1	.....	.....	.....	51
Fisk's white	64.1	67.4	.....	.....	....	66
Hickory king	51 8	53 7	63	....	....	56

The greatest difference in yield of any two plats of the 29 planted to medium maturing varieties was 28.6 bu. per acre. Two plats of Burr's white corn, planted similarly and in every way cared for as nearly alike as might be, yielded 78.1 and 51.7 bu. per acre, respectively—a difference of 26.4 bu. per acre. The largest yield of air-dry corn from any one of the 29 plats planted to medium maturing corn was from a plat planted with Burr's white corn, and the next to the least yield of any one of the hree plats was planted to the same variety of corn. The difference between two plats of Helms improved was 19.9 bu.; between two plats of Clark's 110-day, 16 bu.; between two plats of Hickory king, 11.2 bu.; between two plats of Clark's Iroquois, 8.3 bu., and so on down the list until the least difference between any two plats planted to the same variety was 1.9 bu.

These are greater differences than have been found in this experiment in former years. The meaning is that so far as yields from individual plats in a single season are concerned, the results are inconclusive. But a great deal may be determined in regard to the value of a variety of corn in other ways than from the yield. The date of maturity, height of stalk, and of ear, shape and size of ear, depth of kernel, etc., are all of importance, and should aid in judging of the value of a variety.

The Weather.

Indian corn seems, in growing, very susceptible to climatic conditions. A comparison of results during a series of years should include a comparison of the weather during the growing season of the corn.

The following table gives the two principal meteorological conditions, agriculturally considered, for the four years 1887 to 1890, inclusive. Unfortunately, a strict comparison can not be made between the first two and the last two years. The figures for the first two years were taken from the

records of the Illinois Weather Service for central Illinois, and those for the last two years from the Station records. The Station record began August 16, 1888, and the Illinois Weather Service was discontinued at the end of 1888.

TABLE SHOWING TEMPERATURE AND RAINFALL DURING THE CORN SEASON OF YEARS NAMED.

	Mean temperature, F.					
Year.....	May.	June.	July.	August.	Septemb'r.	Average.
1887*.....	67.9°	73.6°	80.4°	75.2°	66.4°	72.7°
1888. †.....	59.4°	71.3°	77°	72.4°	62.4°	68.5°
1889. **.....	59.2°	65.5°	72.7°	69.2°	61.3°	65 6°
1890. **.....	58.3°	74.6°	73°	68.7°	60.5°	67°
Average, 1878-87. *	64.6°	71°	77.5°	74.6°	66.5°	70.8°
	Rainfall, inches.					Aggregate.
1887. *.....	3.84	1.62	1.65	2.56	3.68	13.35
1888. †.....	6.84	5.75	5.34	3.14	1.95	23.02
1889. **.....	5.52	6.81	5.84	0.60	2.74	21.51
1890. **.....	3.56	3.80	2.83	1.93	1.19	13 31
Average, 1878-87. *	4.45	5.04	2.75	3.45	3.27	18.96

*Statistical Report, Illinois State Board of Agriculture, December, 1887.
†Monthly Weather Review of Illinois State Weather Service, December, 1888.
**Station record.

CLASSIFICATION OF VARIETIES.

On the next page is a classification of the dent varieties tested in 1890. It is based on the time of ripening, color, and smoothness or roughness of the outer end of the kernels. Varieties maturing on or before September 11th, are classed as early; those maturing September 12th to September 22d, as medium; and those maturing September 23d to October 2d, as late. If this classification were based on the results for the three or four years during which some of the varieties have been on trial, noteworthy changes would be made as to time of ripening. Thus, champion white pearl would be classed as medium, and Chester county mammoth and Steward's improved, as late, or non-maturing. But since varieties tested here in 1890 for the first time are included, it is better to base the whole classification on the results for that season. Some varieties are not uniform as to smoothness or roughness of the kernels, and the classification in this respect of a few varieties might be changed another year. The yield in bushels of air-dry corn per acre in 1890 is also given.

RESULTS.*

A summary of the results obtained from the varieties on 74 plats in 1888, on 67 in 1889, and on 51 in 1890, is given in table on page 404.

There has been from four-fifths to seven-eighths of an average stand each season, with seed of which 90 to 95 per cent sprouted in the Geneva

*In the tables on pp. 400–403, are given in detail the results obtained from the varieties tested.

TABLE SHOWING CLASSIFICATION OF VARIETIES OF DENT CORN AND YIELD PER ACRE IN BUSHELS, 1890.

					Yield.
Corn	Early	Yellow	Smooth	Murdock	61.6
				Profit	61
				Clarage	55.1
				Munn's	62.7
				Early Butler	31.9
			Rough	Hathaway	48.7
				Queen of the North	39.9
				Edmonds	55.9
		White	Smooth	Clarke county champion	58.9
				Champion white pearl	74.9
			Rough	Wisconsin early	49.9
				Dawn	61.9
				Beard's pearl	63.4
	Medium	Yellow	Smooth	Leaming	67.3
				Fisk	61.7
				Legal tender	60
				Clark's Iroquois	58.9
				Big Buckeye	52.6
			Rough	Riley's favorite	53.3
				Haber's yellow	63.2
				California yellow	54.6
				Clark's early mastodon	58.9
				Second premium yellow	64.3
				Chester county mammoth	49.5
				Steward's improved	54.7
		White	Smooth	Burr's white	67.7
				Boone county white	74.6
				Fisk's white	65.7
				Clark's 110-day	68.1
		Mixed	Smooth	Cranberry	67.4
	Late	Yellow	Smooth	Golden beauty	53
				Pride of Kansas	71.4
				Giant beauty	55.5
		White	Smooth	Helms improved	51.1
				Hickory King	56.1

apparatus. In 1888 and 1889, there were more stalks when the corn was ripe than after the corn was well up in the spring, showing that there had been some stooling. In 1890, there were fewer stalks in the fall than in the spring.

The percentage of barren stalks depends largely, if not entirely, upon the conditions of growth from season to season. With medium maturing varieties, there were 11 and 12 per cent. of barren stalks in 1888 and 1890, respectively; while in 1889, there was only a little over 1 per cent. Barrenness does not seem to be a variety characteristic.

The height of stalks and the height of ears on the stalks increase with the lateness of maturing. The same varieties vary considerably in height in different seasons. The medium maturing varieties averaged 11.5 ft. high in 1888, 8.9 ft. in 1889, and 9.6 ft. in 1890. The other varieties varied similarly.

In general, the size of the ears has increased and the number decreased with the lateness of maturing.

Without exception, the medium maturing varieties have each year given a higher average yield than either the early or late maturing varieties. The average yield of air-dry corn from 32 medium maturing varieties in 1888, was 90 bu.; from 42 in 1889, 75 bu., and from 29 in 1890, 62 bu. The yield of the early maturing varieties averaged from 7 to 20 bu. less, and the late maturing varieties from 2 to 7 bu. less.

The per cent. of water in the kernel of the corn when husked varies with the variety and with the season. During the three years the early maturing varieties have contained an average of 17.1 per cent. of water; the medium maturing varieties, 21.3 per cent.; and the late maturing varieties, 26.4; while during two years, the non-maturing varieties contained 36.8 per cent. of water.

In 1890, the corn was considerably drier than in 1888 or 1889. The total rainfall for August, September, and October was 9.99 in. in 1889, while in the same months in 1890 it was only 5.47 in. In 1888, 32 medium maturing varieties contained an average of 21.8 per cent. of water; in 1889, 42 medium maturing varieties contained 23.8 per cent.; in 1890, 29 medium maturing varieties contained 18.4 per cent. only of water. The percentage of water the corn contains when husked affects, of course, the loss that will be sustained by drying, and also affects largely the number of pounds of ear corn required to make a bushel of air-dry shelled corn.

It has been found that corn stored in a crib for a year, will contain about 11 per cent. of water. (*Bulletin No. 4, p. 44.*) In order to obtain the yield of dry corn from the several varieties on an equal basis, the yield of corn containing 11 per cent. of water is calculated. Subtracting this yield from the yield of shelled corn, as husked, gives the loss from drying. In 1888 and 1889, the loss of the medium maturing varieties was 12 and 13 bu. per acre, respectively; while in 1890, the loss was less than 6 bu. per acre. In 1888 and 1889, the loss from the late maturing varieties was each season between 18 and 19 bu. per acre. In 1890 it was 9 bu. per acre from these varieties. With the early maturing varieties the difference was not so large. The loss in 1888 was 7 bu., in 1889 and also in 1890, 3.7 bu. per acre. As there were only three early maturing varieties in 1889, it is a fair statement to say that the loss from drying in 1890 by these three classes of varieties was only half as great as in 1888 and 1889.

Taking an average of the three seasons, the loss in weight of the shelled corn from the time the crop was gathered until it became thoroughly air-dry was at the rate of 115 bu. in 1,000 bu. of the medium maturing varieties. Each season the corn has been husked and weighed during the last week of October and the first week of November. To make a bushel of thoroughly air-dry corn, it took, when the crop was husked in 1890, 70 pounds of ear corn in the early maturing varieties, 73 pounds

in the medium maturing, and 78 in the late maturing. The medium maturing varieties required 5 pounds more of ear corn in 1888, and 8 pounds more in 1889 to make a bushel of air-dry corn than in 1890, and the late maturing varieties required 10 and 12 pounds more, respectively, than in 1890. 75 pounds of ear corn were ample, November 1, 1890, to give for a bushel of corn, while in 1889, 80 pounds were not sufficient.

Eight varieties of corn have been tested continuously during the past four years; 15 have been tested during the three years, 1887, 1888, and 1889, and 12 have been tested during three years 1888, 1889, and 1890. The table below gives the yield for the several years as specified in the order of their largest average yield. It will be seen that almost any one of these varieties has given large enough average yields to commend it to the corn raiser.

TABLE SHOWING YIELD OF AIR-DRY CORN OF VARIETIES TESTED, FOR THE YEARS NAMED. [Seed from original sources each season.]

Eight varieties tested in—	1887.	1888.	1889.	1890.	Average.
Leaming	29.6	86 6	80 6	69.4	67
Burr's white	30.0	85.9	75 7	67.7	65
Champion white pearl	20.2	70.	94.8	74.9	65
Steward's improved yellow	32.4	91.2	68.7	54.7	62
Murdock	33 3	80.3	65	61.6	60
Legal tender	25.8	84.2	68 9	60	60
Edmonds	27.7	83 7	66.3	55.9	58
Riley's favorite	30.8	81.1	66.1	53.3	58

Fifteen varieties tested in—	1887.	1888.	1889	Average.
Leaming	29.6	86 6	80 6	66
Champaign	34.2	82.1	78.2	65
Steward's improved yellow	32.4	91.2	68.7	64
Burr's white	30	85.9	75.7	64
Champion white pearl	20.2	70	94.8	62
Smith's premium dent	30.2	90.9	62.2	61
Legal tender	25.8	84 2	68.9	60
Murdock	33.3	80.3	65	60
Riley's favorite	30.8	81.1	66.1	59
Edmonds	27.7	83.7	66.3	59
Smith's mixed dent	25.2	80 4	67.7	58
Howard's improved yellow	21.2	83.9	63.9	56
Improved orange pride	28.5	82	55.2	55
Champion of the north	28.1	70.1	63.3	54
Piasa King	30.9	56.2	43 9	44

Twelve varieties tested in—	1888.	1889.	1890.	Average.
Champion white pearl	70	94.8	74.9	80
Helms improved	84.8	102.6	51.1	80
Leaming	86.6	80.6	69.4	79
Burr's white	85.9	75 7	67.7	76
Clark's 110-day	84.6	65.5	68.1	73
Fisk's	76.6	79 5	61.7	73
Steward's improved	91.2	68.7	54.7	72
Legal tender	84.2	68.7	60	71
Clark's Iroquois	68.5	81.9	59	70
Murdock	80.3	65	61.6	69
Edmonds	83 7	66.3	55.9	69
Riley's favorite	81 1	66.1	53 3	67

Among the yellow varieties, Leaming, legal tender, Champaign, Fisk, Clark's Iroquois, and Riley's favorite, are medium maturing. Steward's improved, improved orange pride, and Howard's improved yellow, ripen too late to be depended on in this latitude. Murdock and Edmonds are early maturing and may be grown farther north. Among white varieties, Champion white pearl or Burr's white, and Clark's 110-day are medium maturing. Helms improved is rather too late in this latitude, while Piasa king will not ripen here. Champion of the north is an extra early variety. Other good varieties have been tested a less number of times, as may be seen by consulting tables giving results in detail.

Brazilian flour corn has been tested during two years, seed from two sources having been tested in 1890. It has proved entirely unsatisfactory. It does not ripen under the most favorable circumstances, and has no characteristics which would make it probable that it would be desirable if it did ripen.

Hickory king was tested in 1890, seed from three sources. It is characterized by a very small cob. It barely ripened this season, and would not ripen in an average season.

Explanation of Tables giving Results in Detail.

Table 1. The germinating power of 50 kernels of each of the varieties of seed planted, with the exceptions noted in the table, was tested in a Geneva apparatus* at an average temperature of 61° F. The number of plants growing on each plat was ascertained about three weeks after planting. The per cent. of kernels producing plants at the dates specified is given in the table. September 9th to 12th, the number of stalks and the number of barren stalks were ascertained. For comparison a full stand is considered to be four stalks to a hill, which was the number of kernels planted. The height of stalk and of the butt of the ear from the ground was ascertained by selecting and measuring what appeared to be an average hill, usually of four stalks each bearing an ear, and taking an average of the measurements thus obtained.

Observations were made upon the ripeness of the corn September 1st, September 11th, September 22d, and October 2d. The date given in the table indicates that maturity was reached during the eleven days preceding the observation.

Table 2. The number and weight of good ears and nubbins, and the proportion of the shelled corn from each was ascertained on one-third of each plat. The weights were taken nearly as fast as the corn was husked, and the corn was re-weighed before shelling. In shelling, any corn remaining on the cobs was removed by hand. The cobs were then weighed and the difference between this weight and the weight of the ear corn was the weight of the shelled corn. By the use of these data, the yield of corn on the other two-thirds of each plat was calculated from the field weights taken when the corn was husked. An average pint sample of the shelled

*Described in bulletin No. 4, p. 30, Illinois Experiment Station.

corn of each variety was sent to the Station laboratory and the per cent. of water ascertained. From these data there were calculated the yield per acre of corn containing 11 per cent. of water and the pounds of ear corn, as husked, that it would take to make a bushel of corn containing 11 per cent. of water, or air-dry. The corn was shelled within five to six days of the time it was husked. The per cent. of shelled corn in ear corn was calculated from the field weights.

Mr. Farrington makes the following statement in regard to the method of determining the water in the samples of shelled corn:

The samples of shelled corn were received at the Station laboratory in quart fruit jars, sealed. The per cent. of water in the corn was estimated in the following way:

Each fruit jar of corn was weighed before it was opened, and the weight recorded on the jar. The corn was then ground to meal, the mill thoroughly cleaned, the ground corn put back into the jar, and its weight, after grinding, recorded on the jar.

Ten portions of ten grams each were weighed out from one sample, put into a drying oven, at 100° to 103° C. At the end of two hours two portion were taken out, cooled and weighed. The other portions were withdrawn, cooled, and weighed, two each time, at the end of 4, 6, 7, and 24 hours, with these results:

Hours of Heating.	Per cent. of loss in weight on 10 grams.		
	1	2	Average.
2	17.05	17.35	17.2
4	17.66	17.84	17.75
6	17 90	17.94	17.92
7	17.88	17.78	17.83
24	16.70	16.22	16.46

In this sample the loss in weight was greatest by 6 hours heating; by longer heating there was an increase in weight, probably from oxidation. This seemed to be the general tendency of these samples, although some continued to lose weight till the 24th hour.

The course adopted with the samples right through was to weigh duplicate portions of ten grams of each sample after heating for 6 and for 24 hours. If the duplicate portions agreed in loss of weight within .2 of a per cent. at the end of 6 and also 24 hours, then the average loss of weight for the period showing the greatest loss was taken as the per cent. of water in the portions analyzed. In case the duplicates did not agree in loss of weight within .2 of a per cent. at the end of either period, other duplicates were tried until the agreement within the limit was attained. From the per cent. of water determined in these portions, the per cent. of water in the original samples as brought to the laboratory was calculated.

Table 3. A division into good ears and nubbins was made, and the calculated number per acre, and the average weight of one hundred of each is given in the tables. What constituted a nubbin was a matter of judgment, and varied with the character of each variety.

Table 4 gives a summary of the results obtained from the dent varieties on 74 plats in 1888, 67 in 1889, and 51 in 1890. The division was made strictly upon the observed date of ripening for each plat. Different divisions sometimes contain the same varieties grown on different tracts or in different seasons.

TABLE 1. VARIETY, GERMINATION IN APPARATUS; STAND; BARREN STALKS; SIZE OF EARS, OF COBS; DATE OF TASSELING, OF MATURITY.

Plat.	Name of Variety.	Seed received from		Perc'tage germ'g in Geneva apparatus.	Percentage germ.n ating in field.	Percentage of full stand of stalks.	Percentage of barren stalks.	Height, ft. Stalks.	Height, ft. Ears.	Average of 3 specimen ears. Length, ft.	Average of 3 specimen ears. Circumference, ear, in.	Average of 3 specimen ears. Circumference, cob, in.	First tassel in week ending	Full tassel in week ending	Maturity in period ending
	Yellow dent varieties.														
1	Leaming...	University farm...	Champaign, Ill....	96	82	91	14	8.63	4.38	8.2	6.3	3.6	July 14	July 21	Sept. 22
2	Edmonds.....	H. P. Edmonds	Taylor, Ill	100	84	82	13	8 25	3 44	8	6 9	3.8	July 14	July 21	Sept. 11
3	Murdock.....	University farm ...	Champaign, Ill. ..	97	87	84	8	8.75	3 75	8.1	6 4	3.8	July 14	July 21	Sept. 1
4	Haber's yellow.....	K. B. Morehouse...	Urbana, Ill.....	98	77	81	16	8.44	3.75	8.9	7.2	4.5	July 14	July 21	Sept. 22
5	Hathaway.....	D. M. Ferry & Co..	Detroit.....	78*	66	59	6	7.63	3.25	8.5	6.6	3.8	July 7	July 21	Sept. 1
6	Queen of the north.	J. A. Salzer Seed Co.	LaCrosse, Wis.....	98	68	44	17	6.50	2.88	7.5	5.8	3.3	July 7	July 14	Sept. 1
8	Early Butler.....	James J. H. Gregory	Marblehead, Mass..	98	72	73	16	7 31	3.19	.....	.....	.....	Jul 7	July 14	Sept. 1
9	Fisk.....	Eli Fisk.....	Havana, Ill.	100	89	81	13	10.13	2 25	8.4	6.3	3.6	July 14	July 21	Sept. 22
10	Legal tender.....	Nims Bros.....	Emerson, Iowa	98	88	84	16	10.50	5.31	8.8	6.4	3.3	July 14	July 21	Sept. 22
11	California yellow...	Nims Bros.....	Emerson, Iowa.....	100	86	83	8	9 69	4.44	7.4	6.1	3.4	July 14	July 21	Sept. 22
12	Leaming.....	University farm....	Champaign, Ill...	96	65	79	13	10.13	5	8.3	6 5	4	July 14	July 21	Sept. 22
13	Leaming.....	E. E Chester.....	Champaign, Ill....	99	70	72	9	9 06	4.19	8.7	6 3	3 8	July 14	July 21	Sept. 22
14	Clark's Iroquois...	H. H. Clark.....	Onarga, Ill.....	100	95	86	12	10.06	4.94	7.9	6.3	3 4	July 14	July 21	Sept. 22
15	Clark's ey.mastodon	Cole & Bro.....	Pella, Iowa.....	94	78	75	14	9 06	3 81	8.2	7.2	4.4	July 14	July 21	Sept. 22
16	2d premium yellow	R. P. Duncan.....	Moweaqua, Ill....	98	87	88	12	8.94	4.44	8.3	6.3	3.4	July 14	July 21	Sept. 22
17	Steward's imp.yel'w	L. W. Steward.....	Amanda, Ohio.....		98	87	16	10.25	5.31	8.8	6.8	4.0	July 14	July 21	Sept. 22
18	Munn's.....	James Riley.....	Thorntown, Ind	100	96	77	9	9.19	4.08	7.8	6.4	3.8	July 14	July 21	Sept. 11
19	Profit.....	Iowa Seed Co.....	DesMoines, Iowa ..	98	84	81	9	7.50	3 19	8.1	6.5	3.8	July 14	July 21	Sept. 1
20	Pride of Kansas....	Samuel Wilson.....	Mechanicsville, Pa..	100	91	90	10	10.38	5.16	9	6.4	3 8	July 14	July 28	Oct. 2
21	Clarage	A. Livingston's Sons	Columbus, Ohio....	98	85	80	8	8.63	3.75	7.8	6.1	3.4	July 7	July 14	Sept. 1
22	Riley's favorite....	James Riley	Thorntown, Ind...	100	74	68	8	9 63	4.25	8.6	6.6	3 5	July 14	July 21	Sept. 22
23	Leaming.....	University farm....	Champaign, Ill.....	96	85	85	14	9.81	4.31	9 2	6 4	4	July 14	July 21	Sept. 22
24	California yellow...	Nims Bros..... .	Emerson, Iowa.....	100	92	86	12	9 50	4.31	8	6.4	3.6	July 14	July 21	Sept. 22
25	Big Buckeye.....	A. Livingston's Sons	Columbus, Ohio....	98	76	73	10	10.13	4 25	7.8	7.1	4 3	July 14	July 21	Sept. 22
26	Clark's Iroquois....	H. H. Clark	Onarga, Ill.....	100	93	103	11	9	5.13	7.9	6.5	3.9	July 14	July 21	Sept. 22
27	Giant beauty.....			86	72	67	14	8.63	3.94	8.1	7.3	4	July 21	July 28	Oct. 2
28	Golden beauty	J. C. Suffern	Voorhies, Ill.....	90	69	65	11	9.63	4.69	9.4	6.8	3.9	July 21	July 28	Oct. 2

29	Chester Co. mam'th	J. C. Vaughn.....	Chicago.....	98	88	80	8	10.00	4.81	7.6	7.1	4.3	July 21	July 28	Sept. 22
	White dent varieties.															
30	Burr's white.....	University farm....	Champaign, Ill. ..	96	81	83	10	10.31	4.63	7.5	6.3	3.8	July 14	July 21	Sept. 22
31	Wisconsin early....	J. A. Salzer Seed Co.	LaCrosse, Wis.....	94	85	80	5	7.38	3.50	8	6.6	4.3	July 7	July 14	Sept. 11
32	Dawn	A. Livingston's Sons	Columbus, Ohio....	92	83	86	10	7.94	2.63	7.8	6.2	3.5	July 14	July 21	Sept. 11
33	Burr's white..... ..	University farm...	Champaign, Ill	96	87	82	8	10	4.69	8.3	6.6	3.8	July 14	July 21	Sept. 22
34	Boone county white	James Riley.....	Thorntown, Ind....	100	94	86	10	9.94	4.44	8.6	6.8	4.1	July 14	July 21	Sept. 22
35	Clarke Co. champi'n	J. D. Stewart S'd Co.	Springfield, Ohio...	94	85	80	6	8.13	3.31	8.8	6.3	3.8	July 7	July 14	Sept. 11
36	Beard's pearl	A. Livingston's Sons	Columbus, Ohio....	100	80	77	8	8.94	4.13	7.8	6.8	3.9	July 7	July 21	Sept. 11
37	Clark's 110 day	H. H. Clark.....	Onarga, Ill.....	100	77	71	14	9.75	4.31	8.8	7.2	4	July 7	July 21	Sept. 22
38	Helms improved....	Fred Helms.....	Belleville, Ill.....	100	81	71	17	10.94	5.69	9.3	6.3	3.8	July 21	July 28	Oct. 2
39					92	93	18	9.38	4.19	8.6	6.3	3.8	July 14	July 21	Sept. 22
40	Clarke Co. champi'n	J. D. Stewart S'd Co.	Springfield, Ohio...	94	81	112	9	8.50	4.13	8.2	6.1	3.7	July 7	July 14	Sept. 11
41	Clark's 110-day....	H. H. Clark.	Onarga, Ill	100	98	98	13	10.31	5.13	7.7	6.6	3.7	July 14	July 21	Sept. 22
42	Helms improved....	Fred Helms.	Belleville, Ill.....	100	99	91	13	10.75	5.94	8.9	6.1	3.6	July 21	July 28	Oct. 2
43	Hickory king.....	Samuel Wilson.....	Mechanicsville, Pa..	76	65	69	13	9.75	4.88	8.3	5.6	2.8	July 21	July 28	Oct. 2
44	Hickory king.....	S. F. Leonard	Chicago.....	76	68	77	14	10.13	5.38	8.6	5.8	2.6	July 21	July 28	Oct. 2
45	Hickory king.....	J. C. Vaughn.....	Chicago	88	76	67	8	10.94	5.50	7.4	5.3	2.3	July 21	July 28	Oct. 2
46	Fisk's white.	Eli Fisk.....	Havana, Ill.....		84	74	10	10.81	4.94	9	6.4	4	July 21	July 28	Sept. 22
47	Champ'n white per'l	J. C. Suffern	Voorhies, Ill.....	98	82	87	16	9.44	4.38	8.3	6.8	3.9	July 7	July 21	Sept. 11
49	Fisk's white.....	Eli Fisk.....	Havana, Ill		94	87	9	10.63	5.25	8.5	6.8	3.8	July 21	July 28	Sept. 22
53	Burr's white.	University farm....	Champaign, Ill....	96	81	84	11	9.75	4.94	9.5	6.3	3.7	July 14	July 21	Sept. 22
54	Burr's white	University farm....	Champaign, Ill....	96	83	79	15	9.13	4.56	8.3	6.9	4.1	July 14	July 21	Sept. 22
55	Burr's white	University farm....	Champaign, Ill....	96	87	85	9	9.63	4.56	9.2	6.8	4	July 14	July 21	Sept. 22
56	Burr's white	University farm....	Champaign, Ill....	96	87	84	9	8.63	4	9.2	6.3	3.7	July 14	July 21	Sept. 22
	Mixed dent varieties.															
48	Cranberry	J. C. Vaughn.....	Chicago.....	100	93	89	18	8.13	4.50	7	6.7	3.9	July 14	July 21	Sept. 22
	Flint variety.															
50	Hominy	A. Livingston's Sons	Columbus, Ohio....	96	91	91	10	8.38	4.06	10.5	5.5	3.7	July 7	July 14	Sept. 1
	Soft variety.															
51	Brazilian flour corn.	J. C. Vaughn.....	Chicago.....	100	95	119	24	11.31	6.38	8.3	5.2	3.2	July 21	Aug. 11		
52	Brazilian flour corn.	Experiment Station.	Champaign, Ill....		83	186	33	8.50	4.88	7.8	4.7	2.8	July 28	Aug. 11		

*Five kernels planted per hill. †Did not mature.

TABLE 2. NAME OF VARIETY; PERCENTAGE OF WATER; POUNDS OF EAR CORN TO A BUSHEL; BUSHELS SHELLED CORN PER ACRE; TOTAL AIR-DRY CORN; LOSS IN DRYING.

Plat.	Name of Variety.	Per ct. water in shelled corn when husked.	Pounds ear-corn per bu. when husked.	Pounds when husked to make bushel shelled corn when air-dry.	Bu. shelled corn per acre.				
					Good ears.	Nubbins.	Total, as husked.	Total air-dry.	Loss in drying.
1	Leaming	18.1	67.7	73.6	64.7	14.2	78 9	72.6	6.3
2	Edmonds	18.2	65.2	70.9	46.4	14.4	60.8	55.9	4.9
3	Murdock	16.6	67	71.6	53.4	12.4	65.8	61.6	4.2
4	Haber's yellow	18.1	66.6	72.4	53.9	14.8	68.7	63.2	5.5
5	Hathaway	15.3	66.7	70.1	38.7	12.5	51.2	48.7	2.5
6	Queen of the north	14.7	65.5	68.3	29.8	11.9	41.7	39.9	1.8
8	Early Butler	16.7	63.9	68	29.3	4.8	34.1	31.9	2.2
9	Fisk	18 6	68.3	74.6	56.3	11.1	67.4	61.7	5.7
10	Legal tender	20.3	66.9	74.6	51.3	15.6	66 9	60	6.9
11	California yellow	17.4	65.6	70.7	45	16.1	61.1	56.7	4 4
12	Leaming	20.0	67.9	75.3	57.9	14.6	72.5	65.2	7.3
13	"	18.6	68	73.4	57.1	9.1	66.2	61.3	4.9
14	Clark's Iroquois	19.4	65.9	72.7	56.3	13.3	69.6	63.1	6.5
15	Clark's early mastodon	20.6	67.7	75.9	54.8	11.2	66	58.9	7.1
16	2d Prem. yellow	19.1	65.3	71.8	59.9	10.8	70.7	64.3	6.4
17	Steward's improved yellow	15.5	67.2	70.7	34.6	23	57.6	54.7	2.9
18	Munn's	15.9	64.7	68.4	45.6	20.7	66.3	62.7	3.6
19	Profit	18.0	66.6	72.3	46.5	19 7	66.2	61	5.2
20	Pride of Kansas	21.6	69.8	79.2	57.1	23.9	81	71.4	9.6
21	Clarage	17.8	66.8	72.3	46.6	13.	59.6	55.1	4.5
22	Riley's favorite	17.9	65.4	70.9	42 4	15 3	57.8	53.3	4.5
23	Leaming	16.3	67.7	72	56.3	18.6	74.9	70.4	4.5
24	California yellow	16.5	67	71.3	25	31	56	52.6	3.4
25	Big Buckeye	19.0	68.1	74.9	47.9	15.1	63	57.3	5.7
26	Clark's Iroquois	17.9	65.7	71.2	43.7	15.7	59.4	54.8	4.6
27	Giant beauty	19.6	67.2	74.4	36.8	24.6	61.4	55.5	5.9
28	Golden beauty	20.2	69	74.7	50.7	8.4	59.1	53	6.1
29	Chester Co. mammoth	20.3	68.4	76.4	35.7	19.6	55.3	49.5	5.8
30	Burr's white	17.4	67.8	73.1	36.3	19.4	55.7	51.7	4
31	Wisconsin early	15	67	70.1	33.3	18 9	52.2	49.9	2.3
32	Dawn	17	65.6	70.4	39.9	26.5	66.4	61.9	4.5
33	Burr's white	17.2	67.2	72.2	...	....	80 6	75	5.6
34	Boone Co. white	17.5	68.3	73.6	46.8	33.6	80.4	74 6	5.8
35	Clarke Co. champion	16.7	65.9	70.4	....	....	65 6	61.4	4.2
36	Beard's Pearl	15.6	65.6	69.2	48.9	17.9	66.9	63.4	3.5
37	Clark's 110-day	19	64.2	70.5	52.4	13.6	66	60.1	5.9
38	Helms improved	23	68.	79.4	34.9	13.9	48.8	42.2	6.6
39		18.5	65.7	71.7	34.9	25.9	60 8	55.7	5.1
40	Clarke Co. champion	15.2	67	70.3	51.6	7.5	59.1	56.3	2.8
41	Clark's 110 day	18.1	65.7	71.4	51.8	30 9	82 7	76.1	6 6
42	Helms improved	25 2	70.	83.2	54.7	16.7	71.4	60.1	11.3
43	Hickory king	24.7	65.8	77.7	47.7	13.5	61.2	51.8	9.4
44	" "	28.5	65.9	82.1	50.7	16.2	66 9	53.7	13.2
45	" "	25	64.4	76.5	51.3	23.5	74.8	63	11.8
46	Fisk's white	18.3	69.7	75.9	55	14.8	69.8	64.1	5.7
47	Champion white pearl	17.8	69.6	73.7	68.2	12.9	81.1	74.9	6.2
48	Cranberry	21.3	68.5	77.4	34	28.6	62.6	55.4	7.2
49	Fisk's white	20	99.8	77.7	59.9	15.1	75	67.4	7.6
50	Hominy	16.6	70.6	75.4	46.7	13.6	60.3	56.5	3.8
51	Brazilian flour corn	23.5	73.3	85.1	27.8	14.7	42 5	36.6	5.9
52	" " "	33.1	84.6	112.7	16.4	12.1	28.5	21.4	7.1
53	Burr's white	17.7	....	.....	.....	.....	...	....	....
54	" "	18.3	67.1	73.1	52.4	16 9	69.3	63.6	5.7
55	" "	18.4	68	74.2	69.7	15.5	85.2	78.1	7.1
56	" "	17.1	67.2	72.2	60 7	14 5	75 2	70	5.2

TABLE 3. NUMBER OF EARS PER ACRE, AND WEIGHT OF 100 EARS, 1890.

Plat.	No. of ears per acre.			Wt. of 100 ears, lb.		
	Good ears.	Nubbins.	Total.	Good ears.	Nubbins.	Average ears.
1	6,240	3,240	9,480	64.9	29.6	53.2
2	5,040	3,240	8,280	57.7	28.7	46.4
3	7,200	4,320	11,520	48.3	20.1	38
4	6,240	3,120	9,360	53.8	29.8	46.2
5	4,320	2,520	6,840	58.3	33.3	49.1
6	4,560	4,080	8,640	41.4	19.1	31.3
8	3,960	1,680	5,640	51.5	21.4	43.1
9	6,360	2,760	9,120	59.9	29.3	51.3
10	5,760	3,480	9,240	60.4	31	50
11	6,000	4,080	10,080	55	29.4	44.9
12	5,880	3,020	8,900	69.4	34.6	58
13	5,160	2,040	7,200	69.2	30.9	59.2
14	6,720	2,760	9,480	57.6	33.7	50.6
15	5,160	1,920	7,080	72.1	39.1	63.6
16	6,480	2,640	9,120	64.8	29.5	55.3
17	4,200	5,040	9,240	50	28.6	39
18	5,840	4,220	9,260	57.7	30.6	45.2
19	4,800	4,560	9,360	61.9	28.9	46.2
20	5,280	3,960	9,240	69.3	40.2	57.5

Plat.	No. of ears per acre.			Wt. of 100 ears, lb.		
	Good ears.	Nubbins.	Total.	Good ears.	Nubbins.	Average ears.
21	5,640	3,600	9,240	58.5	25.8	46.1
22	4,440	3,000	7,440	64.9	35	53.2
23	5,280	3,720	9,000	65.3	31.5	52
24	3,000	7,320	10,320	54	28.3	36
25	5,040	2,880	7,920	68.5	38.5	57.6
26	5,040	4,440	9,480	56	23.6	40.8
27	3,600	4,080	7,680	69.2	40.4	53.9
28	5,280	1,680	6,960	68.2	35.7	59.5
29	4,320	4,300	8,620	59.7	34.	47.9
30	4,320	4,440	8,760	57.6	31.1	45.2
31	4,560	5,400	9,960	51.3	24.4	36.7
32	4,440	5,280	9,720	58.8	32.4	44.4
33	5,880	4,200	10,080	.....	......	51.8
34	4,440	5,160	9,600	65.5	41.3	53.8
35	6,720	3,360	10,080	......	......	43.4
36	5,760	3,600	9,360	54.2	32.5	46.2
37	4,680	2,280	6,960	62.8	34.2	53.6
38	3,960	2,880	6,840	56.1	31.3	44.7

Plat.	No. of ears per acre.			Wt. of 100 ears, lb.		
	Good ears.	Nubbins.	Total.	Good ears.	Nubbins.	Average ears.
39	3,120	4,200	7,320	56.7	32.9	41.8
40	6,000	1,440	7,440	52.5	33.3	49.2
41	5,520	5,880	11,400	59.2	33.7	46.3
42	5,400	3,840	9,240	63.9	30.5	51.6
43	5,280	3,240	8,520	55.1	36.9	45.1
44	5,040	......	5,040	64.9	......	......
45	6,000	4,200	10,200	54.5	35.7	47.4
46	5,760	3,120	8,880	61.5	32.7	51.7
47	7,200	3,240	10,440	64.6	28.7	56
48	3,360	5,280	8,640	59.8	32.4	43.8
49	6,360	3,480	9,840	61.3	31	50.9
50	6,720	4,080	10,800	48.2	23.5	38.9
51	5,400	5,360	10,700	37.2	18.4	28.1
52	3,000	6,960	9,960	35	14.7	21.4
53	5,400	4,080	9,480	58.3	19.9	43.7
54	5,760	4,080	9,840	60.4	29.4	47.9
55	7,080	3,120	10,200	63.1	33.7	55
56	5,880	3,720	9,600	63.3	25	48.8

TABLE 4. SUMMARY OF RESULTS WITH THE THREE CLASSES—EARLY, MEDIUM, LATE—FOR 1888, 1889, 1890.

	Average of plats 1888.			Average of plats 1889.			Average of plats 1890.		
	27 early maturing.	32 medium maturing.	15 late maturing.	3 early maturing.	42 medium maturing.	22 late maturing.	14 early maturing.	29 medium maturing.	8 late maturing.
Per cent. kernels germinating in Geneva apparatus	96	97	90	93	97	96	96	94	93
Per cent. full stand, 4 stalks per hill, May 25th	84	80	74	70	68	65	81	86	81
Per cent. full stand, 4 stalks per hill, July 5th	.....	.....	.....	81	82	80	.....	.....	.....
Per cent. full stand, 4 stalks per hill, Sept. 9th-12th	88	87	85	84	80	78	79	83	79
Per cent. barren stalks	8	11	13	1.7	1.2	0.5	10	12	13
Average height of stalk, feet	9.8	11.5	12.2	6.9	8.9	9.9	8.1	9.6	10.1
Average height of butt of ear from ground, feet	4.5	5.5	6.2	2.8	4.2	4.7	3.5	4.5	5.2
Average length of 3 specimen ears, inches	8.3	9	9.7	7.44	8.15	9.57	8.12	8.3	8.4
Average circumference of 3 specimen ears, inches	6.33	6.97	7.22	6.17	6.37	7.24	6.4	6.6	6.2
Average circumference of 3 specimen cobs, inches	3.71	3.97	4.17	3.42	3.86	4.32	3.75	3.84	3.35
Number of good ears per acre	7,597	7,482	6,263	6,520	6,695	6,055	5,374	5,292	4,651
Number of nubbins per acre	2,948	2,741	2,745	3,360	3,535	3,840	3,610	3,749	3,806
Total number of ears per acre	10,545	10,223	9,008	9,880	10,230	9,895	8,984	9,041	8,457
Weight of 100 good ears, lb	60	74	93	46	72	81	55	61.3	60.1
Weight of 100 nubbins, lb	35	33	51	26	40	43	28	31 9	34.1
Weight of 100 average ears, lb	53	68	80	39	61	67	44	50	48.7
Lb. of ear corn to make bu. when husked	67.2	68.4	71.4	66.1	69 6	72	66.2	67.2	67.1
Lb. of ear corn when husked to make bu. air-dry	73.3	78.1	87.8	70.6	81.1	90.2	70.4	73.3	78
Yield per acre from good ears, bu	67.5	84	81.2	45.8	68.8	70	44 5	50	47.1
Yield per acre from nubbins, bu	15.1	18	20.4	13.5	19.7	22.2	14.8	17 7	18.5
Yield per acre, total when husked, bu	82.6	102	101.6	59 3	88.5	92.2	59.3	67.7	65 6
Yield per acre air-dry corn, bu	75.6	89 8	83.2	55 6	75.4	73 5	55.6	62.0	56.6
Loss in drying in the crib during first year, bu	7	12.2	18.4	3.7	13.1	18.7	3.7	5.7	9.0
Per cent. water in corn when husked	18 33	21 8	27.2	16.6	23.8	28.8	16.5	18 4	23.2

Experiment No. 3. Corn, Time of Planting.

The effect of the time of planting on the yield of corn has been studied during the past three seasons. The tract used in 1890 was similar and adjacent to the tract used in 1888 and 1889.

In 1888 and 1890 there were 7, and in 1889 there were 8 weekly plantings.

Each year the corn was planted on fall-plowed land and each plat was prepared in a similar manner just before it was planted.

As nearly equal cultivation with the hoe and shallow cultivator was given as the different dates of planting would permit. The cultivation in 1888 was given in detail in *bulletin No. 4, p. 93*, and that of 1889 in *bulletin No. 8, p. 247*.

The cultivation for 1890 is given below.

TABLE SHOWING DATE OF PLANTING; DATE OF CULTIVATION; IMPLEMENTS USED.

Plat.	Date of planting.	Dates of Cultivation.			
		With hoe.	With Cultivator.		
			First time.	Second time.	Third time.
1	April 28.....	May 26–7.....	June 2.....	June 17.....	June 25.....
2	May 5.....	May 26–7.....	" 2.....	" 17.....	" 25.....
3	" 15.....	June 2.....	" 17.....	" 25.....	.....
4	" 19.....	" 13.....	" 17.....	" 25.....	.....
5	" 26.....	" 16.....	" 25.....	" 25.....	.....
6	June 2.....	" 16.....	" 25.....	" 25.....	July 21. .....
7	" 9.....	" 24	" 25.....	" 25.....	" 21.....

The first two and the last two plantings were hoed once and cultivated three times, while the other three, from May 15th to 26th, were hoed once and cultivated twice. During the three seasons the earliest plantings have uniformly required more cultivation than those planted somewhat later; while the latest plantings have sometimes, although not always, required as much as the earliest plantings to keep the land equally free of weeds. *Experiment No. 8, Frequency of Cultivation,* indicates that the quantity of cultivation is not material so long as the land is kept equally free of weeds. If the planting may be timed so as to require cultivation but three instead of four times and yet give equally as good a crop, a gain has been made.

June 27th, the height of the upstretched leaves of the corn as it stood in the field was about as follows: Plat 1, five ft.; plats 2, 3, and 4, four ft.; plat 5, three feet; and plats 6 and 7, one foot.

July 7th, the corn on plat 1 had an occasional tassel, while on plats 2 to 7 there were practically none. The corn on plats 2 and 3 was about alike and much smaller than on plat 1; on plat 4 it was much smaller than on plats 2 and 3; on plat 5 it was some smaller than on plat 4, while on plats 6 and 7 it was very much smaller than on plat 5. August 4th, corn

on plats 1 to 5 was fully in tassel, and on plats 6 and 7 about one-fourth in tassel. September 26th, corn on plats 1 to 4 was practically ripe; on plat 5 nearly so; while on plats 6 and 7 the corn was decidedly green. October 2d, corn on plats 1 to 5 was ripe, while on plats 6 and 7 it was still green.

October 23d to 25th, the corn was husked and weighed. Fifty-pound samples were taken from each plat and October 28th they were shelled, the weight of shelled corn ascertained, and a sample of shelled corn taken to determine the per cent. of water.

TABLE SHOWING YIELD OF CORN AND PER CENT. OF WATER IN CORN FROM PLATS PLANTED AT DATES NAMED, 1890.

Plat.	Date of planting.	Ear corn per plat, lb.	Pounds of ear corn to make bu. as husked.	Pounds of ear corn to make bu. air-dry corn.	Per cent. of water in shelled corn.	Bu. per acre, as husked.	Bu. per acre, air-dry.
1	April 28	588	66 7	71.5	16.9	72.1	67.3
2	May 5	668	67.9	74.9	19.4	78.7	71.3
3	" 15	722	68.3	76.9	21	84.6	75.1
4	" 19	682	68.7	77	20.3	79.4	71.1
5	" 26	750	69.6	82.2	24.7	87.9	74.4
6	June 2	738	74.2	96.2	31.2	79.6	61.4
7	" 9	670	71.8	89.5	28.6	74.7	59.9

The yield of air-dry corn per acre was the least in the earliest and latest plantings and the best in the intermediate plantings; but good crops were obtained from all the plantings. The average yield of the four plantings during May was 73 bu. per acre, while the average yield of the three remaining plantings, one in April and two in June, was 63 bu. per acre. The percentage of water in the shelled corn increased in general from the earliest to the latest plantings, being nearly twice as great when corn was planted June 2d, as when planted April 28th. To produce a bushel of air-dry shelled corn required nearly 25 pounds more ear corn when taken from the latest than when taken from the earliest plantings.

TABLE SHOWING YIELD OF AIR-DRY CORN FROM PLANTINGS AT DIFFERENT DATES, 1888, 1889, 1890.

Plantings.	Bushels air-dry corn per acre.			
	1888.	1889.	1890.	Average.
April 22	.....	52	.....	.....
April 27–29	80	44	67	64
May 4–6	87	51	71	70
May 11–15	86	56	75	72
May 19–20	87	50	71	69
May 26–27	83	55	74	71
June 1–5	81	50	61	64
June 8–13	50	50	60	53

These data indicate that it is a safe practice in this locality to plant a medium maturing variety of corn any time in May. There is a period of three weeks at least (four plantings) within which the time of planting has made no material difference in the yield. When the planting was earlier, the yield has not been so good, as it has required more cultivation to keep the land clear. When the planting was after the first of June, the yield has been somewhat less and the corn has not always ripened.

Experiment No. 4. Corn, Depth of Planting.

May 4, 1888, six rows, each 8 rods in length, were planted with corn at depths varying from 1 to 6 in. May 6, 1889, six rows were planted in the same manner, and an extra row was planted on each side so that all the rows under test might be equally surrounded by corn. May 8, 1890, six rows, six rods long, were planted in the same manner as in 1889.

In 1888 and 1889, the land was similar in every respect to that used in *Experiment No. 3*, and in 1890 it was similar to that used in *Experiment No. 5*. The prior culture of the land had been the same and the cultivation of the corn was essentially the same. The cultivation of all the rows was similar. Four kernels of Burr's white corn were planted in each hill.

In 1888 and 1890, the shallower planted corn came up the first; in 1889, the deep planted rows started to grow quicker, but in four weeks were overtaken by the shallower planted rows.

TABLE SHOWING YIELD OF CORN FROM PLANTINGS AT DIFFERENT DEPTHS, 1888, 1889, 1890.

Depth, in.	Ears per acre.				Bushels per acre.				Ears in a bushel.			
	1888.	1889.	1890.	Average.	1888.	1889.	1890.	Average.	1888.	1889.	1890.	Average.
1	11,070	10,530	9,608	10,403	109.7	83	77.8	90.2	101	127	124	117
2	9,630	10,080	9,385	9,698	88.4	83	72.8	81.4	109	121	129	120
3	10,440	8,190	9,831	9,487	100.8	51	70.3	74	104	161	140	135
4	9,630	9,540	7,485	8,885	88	87	58.4	77.8	109	110	128	116
5	8,280	8,820	8,491	8,530	73.1	81	62.3	72.1	113	109	136	119
6	5,940	10,440	8,389	8,254	60 3	92	60.3	70.9	98	113	139	117

While during no season was there any direct relationship between the depth of planting and the yield, an average of the three seasons shows that the shallow planted rows gave the largest yield. This was principally due to the fact that more ears were produced per acre. There is no apparent reason why planting 3 in. deep gave poorer results than planting 2 or 4 in. deep.

Experiment No. 5. Corn, Thickness of Planting.

This experiment was conducted to determine not only the best thickness at which to plant corn, but also the best manner of distributing the seed at a given thickness—whether, for instance, to plant three kernels every 42 inches or one kernel every 14 inches.

This experiment has been conducted three years on the same tract of land. Each plat contained three rows about six rods long, and five rods of each were harvested. No space was left between plats, and extra rows were planted at the ends of the tract. The rows were 3 ft. 8 in. apart.

In 1888, the tract was spring-plowed just before planting, which was after stable manure, at the rate of 30 tons per acre, had been applied. In 1889, it had been fall-plowed, and in 1890, it was plowed April 24th. May 8 and 9, 1888, May 2, 1889, and May 7, 1890, Burr's white corn was planted on the 24 plats in quantity and manner given in the table, page 412, with the exception that in 1888, instead of plats of like thickness of planting being adjacent, plats containing the same number of kernels per hill were planted adjacent. The cultivation of all the plats was the same. In 1888, they were hoed twice, May 24th and June 21st, and cultivated once with a shallow cultivator; in 1889, they were hoed once, May 22d to 25th, and cultivated twice, June 14th and 26th; in 1890, they were cultivated three times, May 29th, June 5th, and 21st, and hoed twice, June 4th and 25th.

October 8 to 13, 1888, October 4, 5, 1889, and September 16, 17, 1890, the plats were cut and shocked. October 13 to 27, 1888, the corn-fodder on each plat was weighed, the corn husked, weighed, and shelled. In 1889, the corn was husked from the shock November 14th to 16th, and the corn weighed and shelled November 18th and 19th. The stover was not weighed until December 6th, with the exception of plat 1, the corn on which was husked and the stover weighed October 29th. In 1890, October 27th to 31st, husked corn and weighed stover, and November 1st weighed and shelled corn. A sample of shelled corn was taken each year when the corn was weighed, and the percentage of water in it was determined as follows: 1888, 22.7 per cent.; 1889, 24.4 per cent.; 1890, 19.6 per cent. The corn on the different plats ripened equally, so far as could be observed, and the corn on the different plats was assumed to contain an equal per cent of water.

The plats were planted at six different degrees of thickness as follows: 47,520, 23,760, 15,840, 11,880, 9,504, and 5,940 kernels per acre; and for the sake of brevity and clearness, the terms first, second, third, etc., plantings will be used in the discussion which follows: For example, in the first planting there are five plats each the same degree of thickness, but the seed in the several plats was differently distributed; in one plat there was one kernel every 3 in. in the row; in another, two every 6 in.; in another three every 9 in., and so on. There are five plats in the first, second, and third plantings, four plats in the fourth planting, three in the fifth, and two in the sixth planting. In the summaries which are given under the following headings, are averages of these plats. The results for 1890 are given in detail in the table on page 412, from which an idea of the scope of the experiment may be obtained. The results of 1888 and 1889 are given in detail in *bulletin No. 8, pp. 255, 256.*

Number of stalks harvested. The number of stalks harvested, because of its relation to the yield, is more important than the number of kernels planted. The number of stalks harvested for each 100 kernels planted, however, is important in arriving at a full understanding of the effect of different thicknesses of planting.

TABLE SHOWING NUMBER OF STALKS HARVESTED PER ACRE, AND NUMBER FOR EACH 100 KERNELS PLANTED, 1888, 1889, 1890.

Plantings.	Number of stalks harvested.				No. of stalks harvested for each 100 kernels planted.			
	1888.	1889.	1890.	Aver'ge.	1888.	1889.	1890.	Aver'ge.
First	29,460	36,700	37,430	34,530	62	77	79	73
Second.....	17,100	19,820	19,835	18,920	72	84	84	88
Third	13,940	13,270	13,940	13,715	88	84	88	87
Fourth	12,350	11,100	11,270	11,575	104	93	97	98
Fifth.	11,540	9,170	10,285	10,330	121	96	108	108
Sixth.....	8,200	6,260	7,320	7,260	138	105	123	122

In general, the stalks have stooled where the planting was at a less rate of thickness than one kernel every foot. This is an indication that not so many stalks were growing as could reach full development, and additional stalks were thrown out to supply the deficiency. Stooling is not in itself desirable, as extra stalks do not seem to bear so much corn as stalks grown directly from seed. This possibly accounts for the fact that there were more pounds of stover for each pound of shelled corn where the planting was at a less rate of thickness than one kernel every foot than at that thickness, as is shown in the table giving summaries of the yields of corn. From the fourth planting, or where the planting was at the rate of one kernel every foot, about as many stalks were harvested as kernels planted, while where the planting was thicker, fewer stalks were harvested for kernels planted.

Number of ears. When the corn is husked, the number of ears per acre materially affects the cost of harvesting, and unless the yield is larger, the larger number is manifestly objectionable.

TABLE SHOWING NUMBER OF EARS HARVESTED AND NUMBER OF EARS FOR EACH 100 STALKS, 1888, 1889, 1890.

Plantings.	Number of ears harvested per acre.				Number of ears harvested for each 100 stalks.			
	1888.	1889.	1890.	Aver'ge.	1888.	1889.	1890.	Aver'ge.
First	18,400	17,175	11,145	15,573	62	47	30	46
Second.....	12,750	14,500	12,420	13,223	74	73	63	70
Third,.....	10,000	11,600	9,760	10,453	72	87	70	76
Fourth.....	9,400	10,100	8,870	9,456	76	91	79	82
Fifth.....	7,600	8,400	7,385	7,795	66	91	74	77
Sixth.....	6,050	5,760	5,470	5,760	75	92	76	81

During the three years, an average of nearly three times as many ears as harvested from the thickest as from the thinnest plantings. It is

worth considering whether the smaller ears from the thicker plantings would have a tendency to reproduce small ears, and in a series of years still further reduce the size of ears where thickly planted. Such a result would be in accord with the general law of reproduction. Two of the three years and the average of the three years show fewer barren stalks when the planting was at the rate of one kernel every foot than at rates of planting either thicker or thinner. An average of about one-fifth of the stalks as barren where the conditions were most favorable, and at the thickest plantings over one-half were barren. There were fewer barren stalks in 1889 than in 1888 or 1890, and more barren in 1890 at the thickest planting than in 1888.

In 1888, there were more ears produced where there was but one kernel to the hill, and with two, three, and four kernels to the hill there was but little difference in the number produced. In 1889, the more kernels to the hill, the thickness remaining the same, the more the number of ears produced. In 1890, there were more ears produced where three kernels were planted per hill, and the least number was produced where but one kernel was planted per hill, the amount of seed planted being the same in each case.

The weight of stalks and ears. The size of stalk and ear for the different plantings, as indicated by their weight, is given for 1888, 1889, and 1890, in the following table:

TABLE SHOWING WEIGHT OF 100 EARS AND OF 100 STALKS OF STOVER.

Plantings.	Weight of 100 ears, lb.				Weight of 100 stalks of stover, lb.			
	1888.	1889.	1890.	Aver'ge.	1888.	1889.	1890.	Aver'ge.
First	33	24	16	24	40	23	23	29
Second	51	40	26	39	54	30	35	40
Third	60	54	38	51	63	36	36	45
Fourth.....	64	63	50	59	70	44	40	51
Fifth.....	63	67	56	62	74	52	40	55
Sixth	70	67	62	66	97	54	47	66

With a single exception, there was a constant increase from the thickest to the thinnest plantings, each of the three seasons, in the weight of 100 stalks of stover and of 100 ears. The average weight of 100 stalks of stover, and of 100 ears in each planting is nearly the same, except that the ears in the intermediate plantings were much heavier than in the thickest plantings, which rapid increase of weight was not continued through the thinnest plantings; while the increase in the weight of stalks was fairly uniform from the thickest to the thinnest plantings. It has made no difference practically to the size of the stalks or the size of the ear whether one, two, three, or four kernels were planted in a place as long as the same quantity of seed was planted per acre. The differences have always been very slight and not always alike during the three years. On the whole, the size of the ears has been slightly in favor of one stalk to the place.

Yield. The following table gives the average yield for the different degrees of thickness in planting for 1888, 1889, and 1890. Each result each season is the average of from two to five plats.

The average yield of corn-fodder (corn and stalks) and corn-stover (corn-fodder after corn is husked) decreased constantly, from the thickest to the thinnest plantings. Leaving out the thinnest planting, the average yield of field-cured corn-fodder for the three years from the five thicknesses of planting, which includes the average of 22 plats each season, was nearly 6 tons.

The fourth planting, 1 kernel every 12 in., 2 kernels every 24 in., etc., gave the largest average yield of shelled corn per acre for the three years, and the largest yield in 1889 and 1890, while the second planting 1 kernel every 6 in. 2 kernels every 12 in., etc., gave the largest yield in 1888. The average yield from the third and second plantings was but 4 and 5 bu. less than from the fourth planting. Each season the fourth planting gave the largest yield of shelled corn from good ears. The average yield of shelled corn from good ears from the third and second plantings was one-fourth and one-half less, respectively, than from the fourth planting.

To harvest an acre of the second planting would require the husking of 13,200 ears; of the third planting, 10,450; and of the fourth planting, 9,450 ears.

TABLE SHOWING YIELDS PER ACRE OF CORN-FODDER, CORN STOVER, AND SHELLED CORN; ALSO POUNDS OF STOVER FOR EACH POUND OF CORN, 1888, 1889, 1890.

Plantings.	Tons corn-fodder per acre.				Tons corn stover per acre.			
	1888.	1889.	1890.	Aver'ge.	1888.	1889.	1890.	Aver'ge.
First	9	6.3	5	6.8	6	4.2	4.3	4.8
Second.	8	5.9	4.8	6.2	4.8	2.9	3.4	3.7
Third.....	7.5	5.5	4	5.7	4.4	2.4	2.5	3.1
Fourth.	7.5	5.5	4 1	5.7	4.3	2.4	2.2	3
Fifth.....	6.8	5.2	3 8	5 3	4.2	2.4	2	2.9
Sixth	5.8	3.6	3.1	4.2	4	1.7	1.7	2.5
	Bushels of shelled corn per acre from good ears.				Bushels shelled corn per acre from nubbins.			
First.....	32	6	0	13	57	55	26	46
Second	64	36	11	37	31	50	36	39
Third	71	62	32	55	16	29	22	22
Fourth.	74	76	69	73	13	17	17	16
Fifth	61	71	52	63	11	11	10	11
Sixth	55	48	45	49	5	8	5	6
	Total bushels shelled corn per acre.				Pounds of stover for each pound of shelled corn.			
First.....	89	61	26	59	2.4	2.4	5.9	3.6
Second.....	95	86	47	76	1.8	1.2	2.6	1.9
Third	87	91	54	77	1.8	0.9	1.7	1.5
Fourth.....	83	93	66	81	1.8	0.9	1.2	1.3
Fifth... ...	72	82	62	72	2.1	1	1.2	1.4
Sixth.....	60	56	50	55	2.3	1.1	1.2	1.5

TABLE SHOWING RESULTS FOR 1890.

No. kernels in a hill.	Inches between hills.	No. kernels planted per plat.	Number of stalks harvested.	Ratio of kernels planted to stalks harvested.	Pounds per acre, stalks and corn.	Pounds per acre of stover.	Number per acre.			Average weight.		Ears harvested to 100 stalks.	Shelled corn per acre. Bu. as husked.			Bu. per acre of air-dry corn.		
							Good ears.	Nubbins.	Total.	100 stalks.	100 ears.		Good ears.	Nubbins.	Total.	1888.	1889.	1890.
1	3	990	769	.78	9,576	8,064	0	8,736	8,736	22	21	24	0	27	27	73	46.4	24.4
2	6	990	777	.78	9,888	8,448	0	12,384	12,384	23	14	33	0	25.7	25.7	87.4	46.2	23.2
3	9	990	773	.78	9,876	8,448	0	11,616	11,616	23	15	31	0	25.5	25.5	81.7	53.5	23.1
4	12	990	782	.79	9,756	8,448	240	10,896	11,136	23	14	30	1.3	22.1	23.4	76.5	45.3	21.2
5	15	990	798	.81	11,136	9,600	0	11,856	11,856	25	16	31	0	27.4	27.4	76	59.1	24.8
1	6	495	446	.90	9,576	7,104	912	11,040	11,952	33	25	56	7.1	37	44.1	88.5	68.8	39.9
2	12	495	404	.82	9,480	6,912	1,440	9,984	11,424	36	27	59	9.9	36	45.9	87.3	74	41.5
3	18	495	411	.83	9,444	6,720	2,016	13,776	15,792	34	21	80	15.6	33	48.6	75.2	70.4	43.9
4	24	495	400	.81	9,228	6,528	1,200	10,416	11,616	34	28	61	10.1	38.1	48.2	81.3	76.4	43.6
5	30	495	405	.82	9,828	7,008	1,920	9,408	11,328	36	31	58	15	35.4	50.4	85.5	77.2	45.6
1	9	330	306	.93	8,364	5,280	4,416	5,712	10,128	36	37	69	35.4	19.7	55.1	84.4	78.7	49.8
2	18	330	312	.95	8,388	5,280	3,888	6,528	10,416	35	36	70	30.6	24.9	55.5	76	81.9	50.2
3	27	330	299	.91	7,704	4,896	3,120	6,720	9,840	34	35	69	25.5	24.6	50.1	75.6	78.8	45.3
4	36	330	271	.82	7,632	4,800	3,840	5,040	8,880	37	38	68	31.1	19 5	50.6	81.7	71.4	45.7
5	45	330	264	.80	8,028	4,704	4,464	5,088	9,552	37	42	75	38.1	21.2	59.4	66.8	77	53 7
1	12	248	253	1.02	8,172	4,416	4,800	4,224	9,024	36	49	73	48.6	18 4	67.1	81.7	74.4	60.7
2	24	248	241	.97	8,316	4,512	4,416	4,224	8,640	39	52	75	49.5	18.4	67.9	79.5	81.5	61.4
3	36	248	227	.92	7,860	4,320	5,232	3,456	8,688	40	49	80	49.1	14.1	63.2	76	77.9	57.1
4	48	248	218	.98	8,268	4,512	5,280	3,840	9,120	43	49	87	49.1	18	67.1	70.4	80.6	60.7
1	15	198	240	1.21	7,656	4,224	4,560	2,976	7,536	37	54	65	46.5	14.8	61.3	71.9	67.2	57.6
2	30	198	212	1.07	7,524	4,128	4,896	2,352	7,248	41	57	71	51.9	8.8	60.7	61.7	69.6	54.9
3	45	198	191	.96	7,584	3,936	6,048	1,824	7,872	43	56	86	58.1	7.1	65.2	57.9	72.8	58.9
1	24	124	166	1.34	5,784	3,168	3,504	1,440	4,944	40	64	62	40.9	5.8	46.7	56.4	51.3	42.2
2	48	124	139	1.12	6,528	3,552	4,800	1,200	6,000	53	60	90	49.3	3.9	53.2	50 3	43.8	48.1

With the same rate of planting, the average shows no material difference in the yield when one or more kernels were planted to the hill. Two seasons the yield was slightly in favor of two kernels per hill, and in 1889 slightly in favor of four kernels per hill.

The yield of corn-fodder has been very slightly greater where one and two kernels were planted per hill than where three and four kernels were planted per hill.

Total Digestible Substance per Acre.

While there were 3,600 lb. more of corn-stover raised from the first planting than from the fourth planting, there were 22 bu., or 1,232 lb. more of grain from the latter than from the former. During twelve years (1876–1887) the average farm price* of corn in Illinois has been 35.7 cents per bushel. At that price for corn the corn-stover must be worth $4.49 per ton for the one crop to equal the other in value.

Comparing the second and fourth plantings, there were 1,400 lb. of corn-stover in favor of the second planting and 5 bu. of grain in favor of the fourth. At 35.7 cents per bushel for the corn, the corn-stover must be worth $2.55 per ton for the two crops to be equal in value.

The best means at hand of determining the total food value at each planting is by ascertaining the total quantity of digestible substance per acre. To do this, it is first necessary to ascertain the total yield of water-free substance. The per cent. of water in the shelled corn has been determined each season as already given, and from that the water-free substance in the shelled corn as given in the table has been calculated. The per cent. of water in the corn-stover as it was brought from the field in these experiments was not ascertained. Neither has there been any systematic attempt to determine the per cent. of moisture in corn-stover under these conditions. Mr. Farrington† determined the per cent. of water in seven samples of corn-fodder taken weekly between February 14th and March 12th and found they contained an average of 32.19 per cent. of water. The grain would pretty certainly have contained a considerably less per cent. of water, and hence the corn-stover a larger per cent. of water. On the other hand, if the sample of corn-fodder had been taken at the time when the weights of corn-stover were taken in these experiments, it would undoubtedly have contained a less per cent. of moisture. Provisionally, therefore, 33⅓ per cent. will be taken as representing the average per cent. of moisture in the corn-stover when weighed direct from the field.

The following table gives the yield of water-free substance in the corn stover on this basis.

Wolf** gives the digestibility of the kernel of Indian corn as 88.5 per cent. and Armsby†† the digestibility of corn-stover as 62 per cent. Apply-

*See Report U. S. Dep't. of Agriculture, 1887, p. 536.

†Ill, Exp't Sta. Bull., No. 9, pp. 315–7.

**Mentzel and Lengerke, Kal. 1888, p. 86

††Penn. State College Experiment Station Re ort 188

ing these coëfficients of digestibility, the yield of digestible matter per acre is estimated as given in the table.

TABLE SHOWING YIELD OF DRY MATTER AND DIGESTIBLE SUBSTANCE PER ACRE.

Plantings.	Yield of water-free substance per acre, lb.			Yield of digestible substance per acre, lb.		
	Stover.	Kernel.	Total.	Stover.	Kernel.	Total.
First	6,400	2,542	8,942	3,968	2,250	6,218
Second	4,933	3,302	8,235	3,058	2,922	5,980
Third	4.133	3,364	7,497	2,562	2,977	5,539
Fourth	4,000	3,518	7,518	2,480	3,113	5,593
Fifth	3,867	3.143	7,010	2,398	2,782	5,180
Sixth	3,333	2,419	5,752	2,066	2,141	4,207

According to these estimates there is, with the exception of the fourth planting, a constant decrease in the total yield of digestible substance per acre from the thickest to the thinnest plantings. In the yield of digestible substance from the stover the decrease is constant throughout; but in the yield from the kernel, the largest yield is from the fourth planting, and there is a constant decrease from this thickness to both the thickest and thinnest plantings. While the total yield of digestible substance was 238 lb. more where the planting was at the rate of one kernel every 3 in. than where it was at the rate of one kernel every 6 in. The yield of digestible substance from the stover was 910 lb. more at the former, and that from the kernel 672 lb. more at the latter, thickness. On account of the superior composition of the kernel, it is probable that the nutritive value of the digestible substance would be greater at the latter thickness. For fodder purposes, therefore, these experiments gave the best results where the planting was at the rate of one kernel every 6 in., or about 24,000 kernels per acre.

GENERAL STATEMENT AS TO THICKNESS OF PLANTING.

Corn may be planted both too thick and too thin for its best development. The proper distance for any given locality depends largely upon the latitude, the variety, and the soil. In the experiments here reported a medium maturing variety was grown on a fertile black prairie loam, whose physical properties with reference to soil water were of the highest order, a very important consideration.

In general, planting at the rate of one kernel every 12 in., or about 12,000 kernels per acre, gave the largest yield of corn (grain), and, without exception, the largest yield from good, well developed ears. While the total yield of corn from this thickness was not much more than where the thickness was at the rate of one kernel every 9 or 6 in., the yield of corn from good ears was considerably more. Planting at the rate of one kernel every 12 in. gave the largest yield of corn in proportion to stover or stalks, and the largest number of ears in proportion to stalks;

that is, the least number of barren stalks. The weight of single ears and stalks increased from the thickest to the thinnest plantings.

While planting at the rate of one kernel every 3 in. or 47,520 kernels per acre, gave a little larger yield of dry matter and of digestible substance than planting at half that thickness, the yield of grain from the thinner plantings was so much greater that it is believed the nutritive value of the crop for fodder purposes was greater where planted at the rate of one kernel every 6 in. or about 24,000 kernels per acre.

Neither for fodder purposes nor for the production of grain merely was there any material difference in the yield whether one, two, three, four, or five kernels were planted per hill, the number of kernels planted per acre remaining the same, provided the land was left equally clean by the cultivation.

The result of this season's experiment upon the effect of the method of distribution where the cultivation was similar in amount, but not equally effective in keeping the land free from weeds, is given below, and is in favor of planting in hills. In a similar experiment in 1888 there was practically no difference whether the corn was planted in hills or drills.

Experiment No. 6. Corn, Planting in Hills or Drills.

Three plats containing 0.433 acre each were planted with the same quantity of Burr's white corn. The tract was fall-plowed after being manured. May 3, 1890, tract was disked twice. May 5th, tract was harrowed twice and planted. Plat 1 was planted in drills 3 ft. 8 in. apart and one kernel placed every 11 in. in the drill row. Plats 2 and 3 were planted in hills, 4 kernels every 3 ft. 8 in. each way. Each plat was cultivated with a shallow cultivator four times, May 23d, June 3d, 17th, and 24th. Plats 1 and 2 were cultivated but one way. Plat 3 was cultivated twice each way. October 15th to 18th, corn was husked and weighed.

TABLE SHOWING YIELDS FROM PLATS PLANTED IN HILLS AND IN DRILLS; ALSO FROM CULTIVATION "ONE WAY" AND "BOTH WAYS."

Plat.	Planting and cultivation.	Yield of car corn per plat, lb.	Bu. shelled corn per acre.	Relative Yield.
1	Drills, cultivation one way	1,720	60.8	78
2	Hills, cultivation one way	2,030	71.7	92
3	Hills, cultivation both ways	2,198	77.7	100

The fact that where the plats were planted in hills and cultivated one way, the yield was greater than when they were planted in drills, does not indicate that planting in hills is of itself any better, as was shown in *Experiment No. 5*, for it was undoubtedly due to the fact that the land was kept cleaner with the same cultivation when planted in hills than when planted in drills. The larger yield where the planting was in hills and the cultivation both ways instead of but one way, was also probably due to the fact that the land was thereby kept very much freer of weeds.

Experiment No. 8. Corn, Frequency of Cultivation.

Experiments Nos. 8, 9, and 10 are but different phases of the general subject of the cultivation of corn. All these were conducted on the same tract of land, hence its preparation, the planting of the seed, and the cultivation of the crop are identical, and will be given under this experiment.

The land is the black prairie loam common to central Illinois, of about 20 inches in depth, and underlaid with yellow clay. The tract is high enough to drain naturally and is not tile drained, although there are tile laid in the same field not far distant.

In the season of 1887, the land was in mammoth clover. In 1888 and 1889 these experiments were conducted on this same tract, used in 1890 for the third time.

The method of conducting the trial has been substantially the same each season. The details for 1888 are given in *bulletin No. 4,* and those for 1889 are given in *bulletin No. 8.*

In 1890, the tract was plowed April 24th, 25th without removing the stalks. May 2d, 3d, the tract was rolled, disked, harrowed, and marked. May 3d, 8 plats, each 2 x 8 rods, or $\frac{1}{10}$ acre were planted, four kernels to the hill, with Burr's white corn.

This experiment was made to determine the effect of different quantities of cultivation on the yield of corn whether the cultivation was deep or shallow. For this purpose it was arranged to cultivate very frequently plat 8 with a deep cultivator, the "John Deere" or a similar implement being used, and plat 7 equally frequently with a shallow cultivator, the "Tower" being used; to cultivate plat 6 with the deep and plat 5 with the shallow cultivator, the ordinary amount of cultivation being given; and to cultivate plats 3 and 4 as plats 5 and 6, except that the cultivation was to be continued past the ordinary time of laying corn by. For the purposes of comparison, in *Experiment No. 9, Depth of Cultivation,* the weeds were removed from plat 2 without any cultivation and with the least possible disturbance of the soil; and plat 1 was hoed in the ordinary way, but not otherwise cultivated.

The following table gives the quantity and kind of cultivation of the different plats. The cultivation of the plats was all one way, as cross-cultivation was not practicable since the plats receiving different kinds and quantities of cultivation were adjacent. This made it necessary to remove the weeds in the row with a hoe, as shown in the table, but this was done with as little disturbance of the soil as possible.

From this table it will be seen that plat 5 was cultivated shallow and plat 6 deep four times, which is the customary number of times with farmers in this state. Plats 3 and 4 were cultivated in the same way, except that in addition they were cultivated once, August 5th, after the corn was fully tasseled. Plats 7 and 8 were cultivated 13 times.

TABLE SHOWING THE CULTIVATION OF PLATS IN EXPERIMENTS NOS. 8, 9, 10, 1890.

Date, 1890.	Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.	Plat 6.	Plat 7.	Plat 8.
May 24	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
May 27	Hoed.	Scraped.	Shallow.	Deep.	Shallow.	Deep.	Shallow.	Deep.
May 29	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
May 31	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 2	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 4	Hoed.	Scraped.	Shallow.	Deep.	Shallow.	Deep.	Shallow.	Deep.
June 6	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 10	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 16-17.	.....	Scraped.	Hoed in row.	Hoed in row.	Hoed in row.	Hoed in row.	Hoed in row.	Hoed in row.
June 19	Hoed.	.....	Shallow.	Deep.	Shallow.	Deep.	Shallow.	Deep.
June 21	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 23	.....	.....	.....	.....	.....	.....	Shallow.	Deep.
June 25-26	.....	Scraped.	.....	.....	.....	.....	Shallow.	Deep.
June 28	Hoed.	.....	Shallow.	Deep.	Shallow.	Deep.	Shallow.	Deep.
August 5	.....	.....	Shallow.	Deep.	.....	.....	.....	.....

Yield. October 25th, each of the 36 rows of 9 hills or two rods long of each plat was husked and weighed so that the yield of the pruned and unpruned rows might be determined, as explained under *Experiment No. 10, Effect of Root-Pruning.* The table on page 422 gives the weight in detail. The table on page 418 gives a summary of the results for the three seasons, 1888, 1889, and 1890, and the diagram represents the average yield per acre for the three seasons on each plat.

In 1888, there was, practically, no difference in yield between the two plats which were given the ordinary amount of cultivation, and those which were given three times the ordinary amount of cultivation; neither was there any better yield from those plats which were cultivated twice after the usual time of laying corn by. In 1889, those plats which were given the ordinary amount of cultivation yielded 4½ bu. more than those that received 3½ times as much cultivation; while those that were cultivated once after the ordinary time of laying corn by, yielded a little over 2 bu. more than the ordinary cultivated plats. It was evident throughout the season that plats 7 and 8 were less thrifty, apparently on account of the too frequent cultivation. There were no less weeds on plats 3 and 4 this season on account of their later cultivation last year.

In 1890, those plats which were cultivated 13 times yielded 6½ bu. more than those cultivated the ordinary number of times and nearly 7½ bu. more than those cultivated once after tasseling, in addition to the ordinary quantity.

If the yields of each pair receiving the different quantities of cultivation be averaged for the three years the result will stand thus:

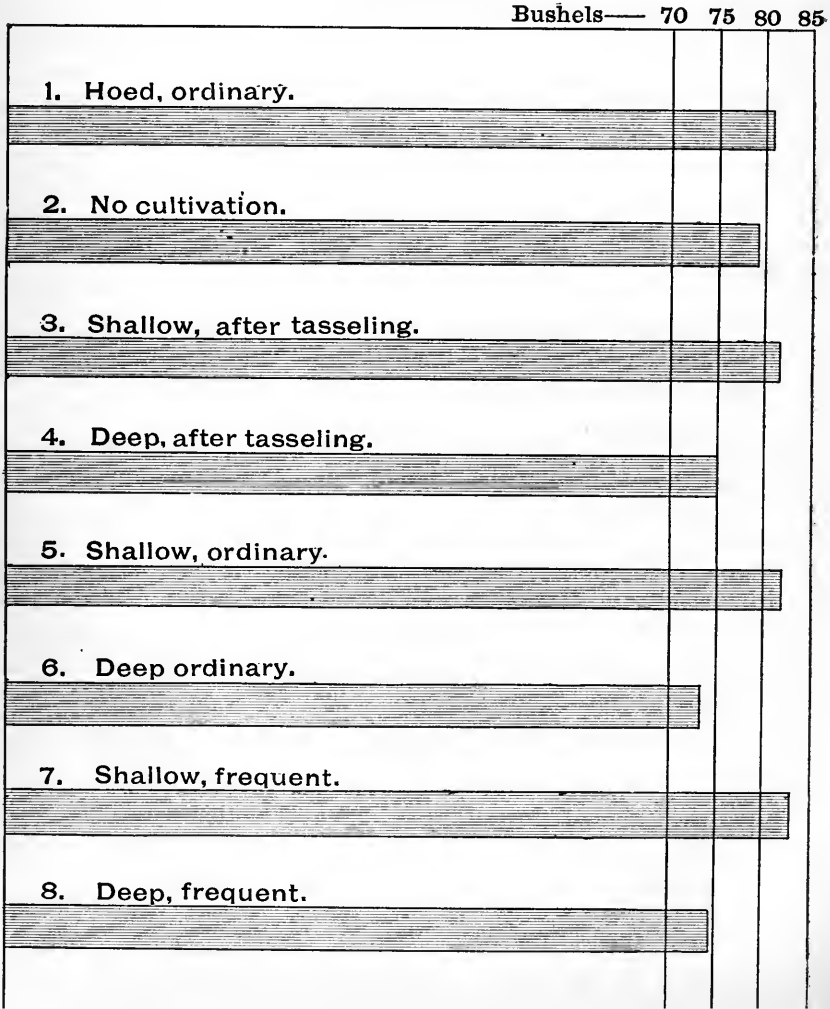
Plats receiving ordinary cultivation.....77.5 bu. per acre
Plats cultivated after tasseling in addition to ordinary cultivation.....78.1 bu. per acre
Plats cultivated frequently.....78.3 bu. per acre

TABLE SHOWING FOR 1888, 1889, 1890—CULTIVATION; YIELD.

Plat.	Kind of cultivation.	1888.		1889.		1890.	
		Bu. per acre.	Aver'ge.	Bu. per acre.	Aver'ge.	Bu. per acre.	Aver'ge.
1	Hoded, ordinary	96	.....	77.8	.....	69.4	.....
2	None, w'ds scrap'd fr'm surf.	90	.....	77.1	.....	69.1	.....
3	Shallow, once after tasseling	*94.1	*89.7	83.8	81.6	66.4	62.9
4	Deep, once after tasseling	*85 2		79.3		59.3	
5	Shallow, ordinary	93.8	89.4	84 6	79.4	66 8	63.8
6	Deep, ordinary	84.9		74.2		60.8	
7	Shallow, frequent	94.6	89.6	80.9	74.9	71.1	70.3
8	Deep, frequent	84.5		68.8		69.4	

*Twice after tasseling.

DIAGRAM SHOWING CULTIVATION AND AVERAGE YIELD PER ACRE FOR THE THREE YEARS, 1888-90.



No appreciable benefit was derived from frequent cultivation, nor from cultivating after the ordinary time during the three years in which the trials have been made.

Experiment No. 9. Corn, Depth of Cultivation.

The care of the crop in this experiment has been discussed under *Experiment No. 8.*

This experiment has been conducted three years on eight separate but adjacent plats. Three were cultivated with a shallow cultivator, with varying frequency, as explained under *Experiment No. 8*, and three others were cultivated with a deep cultivator with the same varying frequency. On one plat corn has been grown during three years without any stirring of the soil after planting. The surface was merely scraped with a sharp hoe to remove the weeds. Another plat was hoed in the ordinary way but not otherwise cultivated.

The following table gives the results:

TABLE SHOWING THE YIELD PER ACRE FROM SHALLOW AND DEEP CULTIVATED PLATS IN 1888, 1889, AND 1890.

Plat.	Kind of cultivation.	Bushels per acre.			
		1888.	1889.	1890.	Aver'ge.
1	Hoed, ordinary	96	77.8	69.4	81.1
2	None, weeds scraped from surface	90	77.1	69.1	78.7
3	Shallow, once after tasseling	94.1	83 8	66.4	81.4
4	Deep, once after tasseling.	85.2	79.3	59.3	74.9
5	Shallow, ordinary	93.8	84.6	66.8	81.7
6	Deep, ordinary	84 9	74.2	60.8	73.3
7	Shallow, frequent	94.6	80.9	71.1	82.2
8	Deep, frequent	84.5	68.8	69.4	74.2
	Shallow, average 3 plats	94.2	83.1	68.1	81.8
	Deep, average 3 plats	84.9	74.1	63.2	74.1
	Increase with shallow, bu. per acre	9.3	9	4.9	7.7
	Per cent. increase with shallow	11.	12.1	7.8	10.3

Inspection of this table will show that for the three years the yield of corn has been increased one-tenth by the shallow cultivation over the deep cultivation, the least increase any one season was a little less than one-twelfth, in 1890, and the greatest increase one-eighth in 1889. In only one case in any one of the three years did a deep cultivated plat yield more than any one of the shallow cultivated plats. The plat which had no cultivation, but had the weeds removed by scraping with a sharp hoe, yielded more each season than the average of the three deep cultivated plats—from 3 to 6 bu. more—and in only two instances, once in 1889, and once in 1890, did any one of the deep cultivated plats yield more than the plat not cultivated.

The meaning of these experiments seems to be that that cultivation of the soil which will effectually remove the weeds, and at the same time

disturb the roots as little as possible, is the best. The experiments indicate that on this soil the stirring of the soil apart from that necessary to kill the weeds is of little benefit. In practice, it is necessary to stir the soil more or less to kill the weeds. Undoubtedly, it is better to disturb some roots than to allow weeds to grow. Given good soil, a good seed-bed, a good variety of corn of good vitality, and favorable climatic conditions, the first essential to secure a good crop of corn is to keep the land clean, and the second is to do this with as little injury to the roots as possible. It is not a question of any particular style of implement, but a question of securing the desired result in any way practicable.

EFFECT OF DIFFERENT DEPTHS OF SEED-BED WITHOUT CULTIVATION OF THE CORN.

In order to study the effect of no stirring of the soil after the corn was planted, the seed-bed of five plats each 2 x 4 rods, or $\frac{1}{20}$ of an acre, was prepared at different depths. After the corn was planted the weeds were removed by scraping the surface with a sharp hoe.

The land was similar and adjacent to the tract used in *Experiment No. 8.* The land being in clover was plowed about 4 in. deep in the spring of 1888 and planted in corn. In the fall of 1888, the tract was drilled to wheat without plowing. Hence, when used in this experiment, the seed-bed had not been plowed for two years.

May 14, 1890, on plat 1, the stubble was raked up and burned, and the plat disked once, stirring the ground 1 in. deep, possibly. Plat 2 was plowed 2 in. deep; plat 3, 4 in.; plat 4, 6 in; and plat 5, 8 in. All the plats were harrowed twice and planted with Burr's white corn, four kernels to the hill, which were covered with a hoe about 1 in. deep. May 23d the tract was rolled, at which time the corn was coming up. The tract was scraped with sharp hoes to remove weeds with the least possible disturbance of the soil, three times between May 28th and June 27th.

The yield of corn in bushels per acre was as follows:

TABLE SHOWING THE EFFECT OF PREPARATION OF SEED-BED UPON YIELD, 1890.

Plat	Preparation of seed-bed.	Yield bu. per acre.
1	Not plowed	56.4
2	Plowed 2 inches deep	59.9
3	Plowed 4 inches deep	69.4
4	Plowed 6 inches deep	69.3
5	Plowed 8 inches deep	71.7

It is evident that on this soil good crops of corn may be raised with differently prepared seed-beds, without any stirring of the soil after the corn is planted, if the weeds are thoroughly removed. The indications are that for this soil deep plowing in preparing the seed-bed for corn is the best; but one trial with one series of plats is not sufficient to establish a general conclusion.

Experiment No. 10. Corn, Effect of Root-pruning.

Every other row of the thirty-six rows two rods long of each of the eight plats described in *Experiment No. 8*, was root-pruned 4 inches deep.

The object was to cut the corn roots at the distance from the hill and to the depth which an ordinary so-called deep cultivator would break them, but without disturbing the soil, so that it might be determined whether such mutilation of the roots by the cultivator, without reference to the stirring of the soil, was harmful.

After some observation and measurements, it was decided that 6 in. from the hill would be a fair distance at which to sever the roots. A frame one foot square, therefore, was placed over the hill, and a knife, to which was attached a gauge, was drawn along the edge of the frame. In 1888, the root-pruning was only 3 in. deep, and it was found that although the unpruned portion gave the largest yield in every instance, the average difference was not very large, being 4 bu. per acre in favor of the unpruned portion. A careful examination of the roots of several growing corn plants showed that three-fourths of the roots would not have been broken by root-pruning or cultivating 3 in. deep.

It is believed also that the deep cultivator usually goes 4 in. deep. In 1889 and 1890 the corn was root-pruned 4 in. deep. The root-pruning was done in 1890 at the second, third, and fourth, or last ordinary cultivations. At the first pruning June 3d, 4th, the corn was about 12 in. high when the leaves were upstretched. At the second pruning, June 17th, the apparent height of the corn was about 20 in., while the height to tip of upstretched leaf was 30 in. At the last pruning, June 26th, 27th, the apparent height varied from 3 to 4 ft. The effect of the root-pruning was marked, the pruned rows being almost a foot less in height than the unpruned rows. The pruned rows were distinctly smaller than the unpruned July 2d. July 7th, although smaller, the difference was not so apparent as hitherto. After the corn tassels the difference is not so apparent.

The yields of the 18 pruned and unpruned rows are compared in detail on p. 422. There are given 288 weights, involving 144 comparisons. In 134 of these comparisons the unpruned rows yielded more than the pruned; in 4 the pruned and unpruned rows yielded alike; and in 6 instances only did the pruned yield more than the unpruned. With so many comparisons it is perfectly conclusive that the difference in yield was directly the result of root-pruning.

Each season the pruned portion of each of the 8 plats yielded less than the unpruned portion. In 1889, pruning 4 in. deep decreased the average yield 13.6 bu., or 16 per cent., and in 1890 pruning the same depth decreased the yield 17. 3 bu., or 23 per cent. In 1888, as already explained, pruning was but 3 in. deep, which severed a small portion only of the roots, as shown by *Experiment No. 54*, and decreased the yield but 4½ per cent.

The least decrease in yield from pruning 4 in. deep in any plat either season was a little less than 12 per cent. while the greatest decrease was 30 per cent. There can be no doubt that this decrease in yield was directly due to cutting the roots. It will be noticed that while the root-pruning decreased the yield 16 per cent. in 1889 and 23 per cent. in 1890,

the decrease in yield in the deep cultivated plats was 10.8 and 7.2 per cent., respectively, less than on the shallow cultivated plats. The cultivation was all one way, while the root-pruning was on all four sides at each pruning. This is quite sufficient to account for the greater decrease in yield from root-pruning over that from deep cultivation. While it is probable that the decrease in yield from deep over that from shallow cultivation would have been greater had the cultivation been in both directions, it is not probable that the decrease would have been as great as that caused by the root-pruning of these experiments; for the roots were pruned on all four sides of the hill at once, while the cultivation would break the roots on but two sides at a time, the roots on the other sides being left undisturbed until the next cultivation. Moreover, judging from the growth of the corn, the greatest injury to the corn is done at the last cultivation. At this time the roots on but two sides are disturbed, while in the experiments in root-pruning, they were severed on four sides to the depth of 4 in. In

TABLE SHOWING EFFECT OF ROOT-PRUNING; YIELD, POUNDS OF EAR CORN, 1890.

	Row.	Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.	Plat 6.	Plat 7.	Plat 8.
1	Pruned	10	8.5	8.5	9	7	8	12	12.5
	Unpruned	14.5	13	13.5	13	13	12.5	15.5	15
2	Pruned	8.5	8	9.5	9.5	9.5	9.5	12	10
	Unpruned	14	12.5	13	11	13.5	11.5	10.5	15.5
3	Pruned	11	12	8.5	10	11	8.5	11.5	11
	Unpruned	11	14.5	13.5	11.5	15.5	12.5	14.5	15
4	Pruned	10	9.5	12.5	7	9.5	9	11	11.5
	Unpruned	16	13.5	12.5	14	12.5	12	10	13.5
5	Pruned	13	11	9	8.5	11	8	11	10
	Unpruned	13.5	14.5	13.5	12.5	16	11	14	17
6	Pruned	12.5	12.5	12	10	10	8	11.5	11
	Unpruned	13.5	15	14.5	14.5	14	12	12	13.5
7	Pruned	13.5	10.5	9.5	11	10	7.5	12	11.5
	Unpruned	11	16	12	15.5	14.5	15	15.5	13
8	Pruned	11	12.5	13	6	9	8	10.5	12
	Unpruned	13	14	15	14	17	15.5	16.5	13
9	Pruned	12	12	11	11.5	9.5	9	12	13
	Unpruned	15	16	13.5	12.5	13	15	12	13.5
10	Pruned	11	14.5	10.5	8	9	11	10	11
	Unpruned	14	16	14	12	15	13	16.5	14
11	Pruned	10.5	13	9.5	9	12	12	10.5	11
	Unpruned	15	13	13.5	12	15	12.5	15.5	13
12	Pruned	10.5	12.5	11	8.5	10	8	11	12
	Unpruned	16	12	13.5	13.5	15.5	13	14.5	14
13	Pruned	10.5	9.5	10.5	8.5	10.5	11.5	12	9
	Unpruned	15.5	14.5	15	12	14	12.5	13.5	13.5
14	Pruned	12	12.5	12.5	9	10.5	10.5	13	10
	Unpruned	13.5	10	12	10.5	12.5	13.5	13.5	13
15	Pruned	12	11	11.5	10	11.5	10	12	12
	Unpruned	15.5	14.5	14.5	10.5	13	15	13	13
16	Pruned	13.5	10.5	12	8.5	11.5	9.5	14	11
	Unpruned	14.5	13.5	15.5	10	13.5	10.5	16.5	15.5
17	Pruned	10.5	11	8	9.5	9.5	8.5	12.5	11.5
	Unpruned	10	14.5	13	13.5	16	12.5	16	13
18	Pruned	13	10.5	9.5	8.5	9	9.5	13	11
	Unpruned	14	14	14.5	14	13	12.5	14.5	15.5
Total	Pruned	205	201.5	188.5	162	180	166	211.5	201
	Unpruned	249.5	251	246.5	226.5	257.5	232	254	253.5

TABLE SHOWING EFFECT OF ROOT-PRUNING; YIELD IN BUSHELS PER ACRE FROM PRUNED AND UNPRUNED PARTS OF PLATS WITH DIFFERENCE, 1888, 1889, 1890.

Plat.	Kind of cultivation.	1888.			1889.			1890.		
		Pruned.	Unpruned.	Difference.	Pruned.	Unpruned.	Difference.	Pruned.	Unpruned.	Difference.
1	Hoed, ordinary	92.3	98.2	5.9	69.4	86.2	16.8	62.6	76.2	13.6
2	None, weeds scraped off	85.5	94	8.5	68.4	85.8	17.4	61.5	76.7	15.2
3	Shallow, once after tasseling	93.4	95.3	1.9	76.9	90.8	13.9	57.6	75.3	17.7
4	Deep, once after tasseling	85.2	86.6	1.4	73.3	85.4	12.1	49.5	69.2	19.7
5	Shallow, ordinary	91	97	6	78.3	90.9	12.6	55	78.7	23.7
6	Deep, ordinary	83.2	87	3.8	67.6	80.9	13.3	50.7	70.8	20.1
7	Shallow, frequent	92.8	95.5	2.7	75.8	85.9	10.1	64.6	77.6	13.
8	Deep, frequent	83.2	86.9	3.7	62.4	75.2	12.8	61.4	77.4	16.
	Average	88.3	92.5	4.2	71.5	85.1	13.6	57.9	75.2	17.3

the cultivation, doubtless, more than one-half the roots to the depth of 4 in. are disturbed, but at a greater distance from the hill than as root-pruned in these experiments.

On the other hand, the experiments indicate clearly that the injury from deep cultivation is due to the breaking of the roots, and that the stirring of the soil to the depth employed has in itself no compensating advantage.

Experiment No. 54. Corn, Root-growth.

As stated in former bulletins, the particular object of inquiry in this experiment was to ascertain the number of the roots of corn, and their depth at the points where they were likely to be disturbed by cultivation, and what proportion of all the roots was likely to be so injured.

A detailed account of the roots of nine plants examined in 1888 was given in *bulletin No. 4*, of which the following is a summary:

Nine plats, which averaged 12 in. high to tip of highest leaf, had altogether 94 roots, or an average of over 10 apiece. The longest root traced was 35 in., the plant being 22 in. high. A plant 4½ in. high had a root 13 in. long. Twenty-four roots were examined at 6 in. from their base. One was 4½ in. deep; five, 4 in.; twelve, 3½ in.; one, 2½ in.; four, 2 in.; and one, ¾ in., at this distance from the base of the root. Three-fourths of the roots, therefore, would not have been broken by root-pruning or cultivating 3 in. deep; but all except one would have been, at 4 in.

In 1889, the roots of seven plants were examined, and the following is a summary of the data given in *bulletin No. 8:*

Of seven corn plants planted April 29th, 4, averaging from 5 to 6 in. high, were examined May 21st and 22d, and 3, averaging 15 in. high were examined June 15th. These 7 plants had 97 roots of which 78 were traced, with a few exceptions, throughout their entire length. Forty-eight roots were examined at 6 in. from their base. At this point their depths were: three, 2 in. deep; one, 2½ in.; seven, 3 in.; three, 3½ in.; seventeen, 4 in.; two 4½ in.; five, 5 in.; two, 5½ in.; five, 6 in.; three went straight down.

Rather more than three-fourths of the roots would not have been broken by root-pruning or cultivating 3 in. deep; nearly two-thirds would have been broken at four inches deep.

May 15, 1890, 60 kernels of Burr's white corn were planted in a row singly, 3 ft. 8 in. apart, at depths—one-third, 1 in.; one-third, 3 in.; and one-third, 5 in. The land was a black prairie loam similar to that used in *Experiment No. 8.* May 24th there were 16 plants up at 1 in. deep; 11 at 3 in., and 1 at 5 in.

Fifteen plants containing 254 roots were examined as given in the table on pp. 425-427. In numbering the roots of each plant the primary root is marked 0. This season this tedious work of tracing the roots was done by Mr. C. A. Shamel, a senior student in agriculture, who has been a valuable assistant during the past year.

The following are additional data:

Plant 1. Examined May 24th. Planted 1 in. deep. Height to tip of tallest leaf, 2½ in. One leaf expanded, second expanding. Plant had four roots; the primary and 3 roots on the seminal whorl.

Plant 2. Examined May 24th. Planted 3 in. deep. Height, ½ in. No leaf expanded. Plant had 3 roots; the primary root and 2 on the seminal whorl.

Plant 3. Examined May 31st. Planted 1 in. deep. Height, 7 in. Had 7 roots on upper whorl and 4 on lower whorl. Whorls, ⅜ in. apart.

Plant 4. Examined May 31st. Planted 3 in. deep. Height to tip of tallest leaf, 6 in. Had 10 roots; 5 on lower and 5 on upper whorl. Whorls, 1.5 in. apart.

Plant 5. Examined May 31st. Planted 5 in. deep. Height to tip of highest leaf, 9½ in. Had 11 roots; 7 on the upper and 4 on the lower whorl. Whorls, 2 in. apart.

Plant 6. Examined June 7th. Planted 1 in. deep. Height, 18.5. Had 14 roots; 6 on the lower and 8 on the upper whorl. Whorls, 1½ in. apart.

Plant 7. Examined June 7th. Planted 3 in. deep. Height, 16 in. Had 14 roots; 2 on the lower and 12 on the upper whorl. Whorls, 1.5 in. apart.

Plant 8. Examined June 8th. Planted 5 in. deep. Height, 16 in. Had 15 roots; 3 on the lower and 12 on the upper whorl. Whorls, 2 in. apart. Upper whorl, spread over 1 in.

Plant 9. Examined June 14th. Planted 1 in. deep. Height, 28.5 in. Had 21 roots; 4 on the lower and 17 on the upper whorl. Whorls, ½ in. apart. Diameter of stalk between whorls, ⅛ in. or less. Above the upper whorl it is ½ in. x ¾ in.

Plant 10. Examined June 14th. Planted 3 in. deep. Height, 25.5 in. Had 21 roots. The lower whorl, either dead or broken off. The upper whorl, 1.5 to 2 in. from the surface of the ground.

Plant 11. Examined June 14th. Planted 5 in. deep. Height, 21 in. Had 19 roots. The seminal whorl had one root, the primary. Upper whorl, 18 roots. The upper whorl was 3 in. above lower or seminal whorl; the stem between the two was 1-16 in. diameter. Above the upper whorl the stem is ⅜ x ⅝ in.

Plant 12. Examined June 21st. Planted 1 in. deep. Height, 43.5 in. Had 23 roots. Upper whorl, 1 in. from surface of the ground.

Plant 13. Examined June 21st. Planted 3 in. deep. Height, 38 in. Had 22 roots. Upper whorl, 1.5 in. from surface of the ground.

Plant 14. Examined June 28th. Planted 1 in. deep. Height, 65 in. Had 35 roots. Upper whorl. 1 in. from surface of the ground.

Plant 15. Examined June 28th. Planted 3 in. deep. Height, 62 in. Had 35 roots, of which 11 (Nos. 25 to 35 of the table) were what are known as brace roots.

TABLE SHOWING THE LENGTH, DEPTH AT THE END, AND 6 INCHES FROM THE PLANT OF 254 ROOTS BELONGING TO 15 CORN PLANTS EXAMINED IN 1890.

No. of plant.	Number of root traced.	Length of root, inches.	Depth at end of root, inches.	Depth at 6 inches from base of root, inches.
1	0	9	6	4
	1	5	2.5	.....
	2	6	3.5	3.5
	3	6	5	5
2	0	8	4.5	4
	1	4.5	5	.....
	2	3.5	5	.....
3	0	12	6	5
	1	5	.....	.....
	2	11	5.5	3.5
	3	3	1.5	.....
	4	5	2	.....
	5	2	1.5	.....
	6	1	.....	.....
4	0	*9	4	4
	1	5	3.5	.....
	2	7	5	5
	3	2.5	3.5	.....
	4	4.5	5.5	.....
	5	5	3	.....
	6	4	3	.....
	7	2.5	2	.....
	8	2	1.5	.....
	9	1	.....	.....
5	0	10	7	.....
	1	4.5	4.5	.....
	2	5.5	5.5	.....
	3	10	7	.....
	4	4 5	5	.....
	5	4	4.5	.....
	6	3.5	3.5	.....
	7	4	3	.....
	8	5.5	3.5	.....
	9	1.5	4.5	.....
	10	1.5	3.5	.....
6	0	14	6	3.5
	1	8	3.5	3.5
	2	*4.5	.....	.....
	3	3	5	3
	4	3	.....	.....
	5	*6	3	3
	6	31	19	3
	7	20	7	4
	8	11	7	5
	9	11	2.5	2.5
	10	2.5	3	.....
	11	5.5	2	.....
	12	1	.....	.....
	13	2	.....	.....
7	0	28	15	3
	1	*1.5	.....	.....
	2	8	4	3.5
	3	22	8	2
	4	12.5	5.5	3
	5	7	2.5	2.5
	6	2	2	.....
	7	17.5	4	2
	8	7.5	2	2
	9	12	2	2
	10	*2.5	.....	.....
	11	12	5.5	2
	12	13	5.5	2
	13	2.5	.....	.....
8	0	*8	6.5	.....
	1	7	4	3.5
	2	*1.5	.....	.....
	3	13	3	2
	4	*8	2	2
	5	*3	.....	.....
	6	7.5	4	3.5
	7	6	4	4
	8	7	2.5	2.5
	9	8	2	.....
	10	5	3	.....
	11	11.5	5	3
	12	7	3	3
	13	2	.....	.....
	14	1	.....	.....
9	0	*9	5	.....
	1	*37.5	7	3
	2	*7	4	4
	3	17	5.5	3.5
	4	11	5.5	3.5
	5	*23.5	9	2
	6	9.5	4	3
	7	29	5	3
	8	15.5	5	3
	9	†6	4	4
	10	*20	7	3
	11	*19	12	7
	12	*15	.....	5
	13	19	7	3
	14	11	4	2.5
	15	*36.5	14.5	3
	16	*12	.....	3
	17	1	.....	.....
	18	15	5	2
	19	6	2.5	2.5
	20	22.5	.....	2
10	1	*23	11	2.5

TABLE—*Continued.*

Number of plant.	Number of root traced.	Length of root inches.	Depth at end of root, inches.	Depth at 6 inches from base of root, inches.
10	2	7.5	3.5	3.5
	3	24	7	2.5
	4	*28	7	2.5
	5	†7	3	3
	6	17.5	6	3
	7	13	.....	3
	8	8	.....	.....
	9	8	.....	.....
	10	23.5	7	2.5
	11	*32	10	3
	12	15	5.5	2.5
	13	*36	18	4
	14	*18	9	3.5
	15	4.5	3	.....
	16	*18.5	9	3
	17	12	5.5	3
	18	11	5	2
	19	.5	.....	.....
	20	.5	.....	.....
	21	.5	.....	.....
11	0	*27	14.5	5
	1	*19.5	8	4
	2	*5	.....	.....
	3	9	8	6
	4	3	.....	.....
	5	9	.....	.....
	6	*14	14	6
	7	*9.5	8	5
	8	*22	7	4
	9	34	10	4
	10	3.5	3	.....
	11	16.5	11	5
	12	18.5	10.5	5.5
	13	10.5	7	5
	14	*21	10	4
	15	*23	8	3
	16	10	6.5	5
	17	19.5	8.5	3.5
	18	*19	9.5	3.5
12	1	28	20	2.5
	2	10	5	4
	3	18	7	2.5
	4	*25.5	24	4
	5	*30	88	5
	6	*22	15	5.5
	7	16	16	6.5
	8	32	21	1
	9	4	5.5	.....
	10	1	2	.....
	11	12	13	7
	12	36	10	6
	13	*53	36	5.5
12	14	16	17	8
	15	*32	19	4
	16	*36	23	5
	17	39	10	4
	18	17	7	4.5
	19	15	14	6
	20	6	7	7
	21	26.5	12	4
	22	16	17	7
	23	33	12	1
13	1	*20	4	2
	2	*9	5	4
	3	26	6	4
	4	32	6.5	4
	5	*18.5	8	2
	6	*9	10	7
	7	12	13	7.5
	8	27	8.5	5.5
	9	36	6	5
	10	*8	10	7
	11	*34	14	3
	12	25	9	4
	13	*11	9	6
	14	22.5	7	4
	15	*30.5	7	3
	16	9	2	1
	17	25	9	5
	18	13.5	9	5
	19	7.5	8.5	7
	20	30	8	3
	21	15.5	12	3
	22	33	7	4
14	1	5	.5	.....
	2	6	.5	.5
	3	6	3	3
	4	6	4	4
	5	*48	24	3
	6	*28	9	3
	7	*52	23	2.5
	8	49	19	3
	9	*9	4	3
	10	*34	20	2.5
	11	40	32	6
	12	5	1	.....
	13	5	1	.....
	14	6	5	5
	15	*45	25	3
	16	6	3	3
	17	13	7	4
	18	4	.....	.....
	19	*39	13	4.5
	20	28	28	7

TABLE—*Continued.*

Number of plant.	Number of root traced.	Length of root, inches.	Depth at end of root, inches.	Depth at 6 inches from base of root. inches.	Number of plat.	Number of root traced.	Length of root, inches.	Depth at end of root, inches.	Depth at 6 inches from base of root, inches.
14	21	31	31	7	15	11	14	15	7
	22	18	29	7		12	15	16	7
	23	19	20	7		13	*35.5	30	4.5
	24	23	24	7		14	*26	24	7
	25	8	3	2		15	23	22	7
	26	9	3.5	2		16	15	2	1
	27	*16	8	4.5		17	*44	28	4
	28	8	3.5	3		18	16	15	6
	29	*20	21	7		19	*21	11	5
	30	*50	33	2.5		20	51.5	30	2
	31	*25	20	.....		21	*43	17	2
	32	*42	33	4		22	40	10	2
	33	44	29	....		23	53	23	2.5
	34	37	32	5		24	25	7	1.5
	35	*32.5	32	7		25	1.5	.5	.....
						26	2.5	1	.....
15	1	26	12	2		27	4	1.5	.....
	2	42	10	2		28	1.5	.5	.....
	3	23	18	6		29	2	.5	.....
	4	48	15	2		30	2.5	.5	.....
	5	*24	15	4		31	2	1	.....
	6	*15	14	6		32	5	1.5	.....
	7	21	22	7		33	4	1	.....
	8	22	23	7		34	4	1	.....
	9	48.5	10	3		35	3	.5	.....
	10	20	21	7					.....

*Broken off at the length given.
†Rotted off at the length given.

Summary. In 1890, fifteen corn plants were examined during five weeks of corn cultivation from May 24 to June 28, and were found to contain 254 roots. At the first week of examination, when the plants were from 1 to 2½ in. high, there were 3 and 4 roots per plant. At the last examination, when the plants were 62 to 65 in. high, they had 35 roots apiece. The longest root traced was 53 in., while another was found which was 51.5 in. long. Three were broken off at 50 in. or more, probably near their end. Twelve were traced between 40 and 50 in. some of which were broken at the lengths given.

The depth of the root at six inches from its base, where it is likely to be disturbed by cultivation, was ascertained in 179 instances.

Two-thirds of the roots would have been broken by root-pruning 4 in. deep; more than two-fifths would have been broken at 3 in. deep; and one-seventh at 2 in deep. [*See table, p. 228.*]

In 1890, as in 1889, it was found that the depth of planting had little or nothing to do with the depth at which the roots grew. The first whorl of roots, other than those distinctly at the seed, which generally, if not always, die, began to grow at from 1 to 2 in. from the surface of the soil, without reference to the depth at which the seed was planted. The stem

TABLE SHOWING DEPTH IN INCHES OF 179 ROOTS OF CORN PLANTS AT 6 INCHES FROM THEIR BASES.

Number of roots.	Depth 6 in. from base.	Number of roots.	Depth 6 in. from base.
1	0.5	4	4.5
4	1	18	5
1	1.5	4	5.5
22	2	9	6
16	2.5	1	6.5
35	3	21	7
13	3.5	1	7.5
28	4	1	8

between the seed and the first nodal whorl of roots is simply elongated and more slender if the seed is planted deeper. Nothing is gained, therefore, by planting deeper than two or three inches in this soil, unless the dryness of the soil makes it essential. On the other hand, if it is necessary to plant deeper on account of the dryness of the soil, or to plant some of the corn deeper where planting with a corn planter on uneven ground so that all the corn may be covered, both the study of the roots and the results of *Experiment No. 4, Depth of Planting*, indicate that little, if any, harm will result.

Experiment No. 24. Corn, Effect of Fertilizers.

Nine trials of the effect of fertilizers when applied to corn on the prairie soil of Illinois were reported in *bulletin No. 8, pp. 266–272.* In these trials no practical benefit was obtained from the use of commercial fertilizers, and moreover, but little effect, if any, of any kind. The conditions of soil, climate, and culture under which those trials were made were not, it was pointed out, very different from those under which the bulk of this great crop is raised. The increased yields from the use of stable manure probably repaid the cost of the application and left some profit; but clearly the value of the stable manure was not equal to the estimates often made, based upon the cost of commercial fertilizers containing like quantities of plant food.

Under this heading will be reported two more trials, and under the next heading one more, from which essentially the same results have been obtained as heretofore.

Two tracts have been used in this experiment. Tract [a] was used in 1888, 1889, and 1890. The tract consists of twelve plats each 2 x 8 rods, or one-tenth of an acre. The preparation of the seed-bed and the planting of corn was each year the same as described in *Experiment No. 8.*

In 1890, the stable manure was spread on April 17th. In 1889, the commercial fertilizers were sown broadcast just after the corn was planted; and in 1888, they were spread about the hills. As neither of these methods gave any results, in 1890, the plan of applying in handfuls directly to the hills was adopted to ascertain whether a comparatively concentrated application would have any effect, good or bad. The fertilizers were put on

immediately after the corn was planted. The corn was cultivated with a shallow cultivator five times in 1888 and 4 times in 1889 and 1890. Any weeds remaining in the hills were removed with a hoe or by hand.

Of the fertilizers used in 1890, the dissolved bone-black was from a lot purchased in the spring of 1888. A sample of this was analyzed at that time with results as shown in the following table. Samples of the other fertilizers were analyzed in January, 1891, with results as shown in the table. These last samples were all very dry when analyzed.

TABLE SHOWING PARTIAL ANALYSIS OF FERTILIZERS USED IN 1890, PERCENTAGES.

Laboratory No.		Nitrogen.	Equivalent to ammonia.	Potash K^2O.	Phosphoric acid.				Equivalent to		
					Total.	Soluble.	Reverted.	Insoluble.	Muriate of potash.	Nitrate of soda.	Sulphate of potash.
24	Dissolved bone-black	3.36	4.08	.....	20.75	20.24	....	....	....	.....	.....
214	Nitrate of soda	16	19.43	.....	..	....	...	.....	97.17	.....	.....
215	Dissolved bone	1.26	1.53	.....	11.72	0.73	9.57	1.42	.....	.....	.....
514	Sulphate of ammonia	21.20	25.75	.....	.....	.....	....	...	....	.....	.....
515	Muriate of potash	.....	....	56.08	.....	.....	..	....	.....	88.29	.....
518	Sulphate of potash	.....	.....	23.39	.....	.....	....	...	.....	.....	43.28
516	Hog tankage	6.20	7.53	0.27	12.79	.....	....	....	.....	.....	.....
517	Cattle tankage	3.84	4.66	0.21	23 93	....	....	....	.....	.....	.....

A mechanical analysis of the cattle tankage and hog tankage gave the following results:

	Hog tankage, per cent.	Cattle tankage, per cent.
Passed holes, 1-50 inch	53	61.7
" 1·25 "	18.8	20.5
" 1-12 "	13.4	10.6
" 1·6 "	7·5	3·9
Coarser than 1-6 "	7·3	3·3
	100.0	100.0

No difference was observable in the date of tasseling or maturity, or at any time in vigor of growth, that could be attributed with any certainty to any of the fertilizers used, with the exception of plat 1, on which in 1889 and 1890 the corn made a somewhat stronger growth than on the other plats.

October 23, 24, 1890, the corn was husked and weighed. October 28th, a 50-pound sample yielded 40.25 lb. of shelled corn containing 17.6 per cent. of water. It would take 75 lb. of ear-corn, therefore, to produce a bushel of air-dry shelled corn.

There was an increased yield of 9 bu. per acre on the plat fertilized with stable manure each season over those plats receiving no manure. The average yield of corn on the 8 plats treated with commercial fertilizers was about 1 bu. less than on the 2 plats receiving no manure. On no plat so treated was the yield over 2 bu. more than on those receiving no fertilizers.

TABLE SHOWING RESULTS FROM APPLICATION OF FERTILIZERS NAMED UPON CORN PLATS, 1888, 1889, 1890.

	Fertilizers applied in 1888 and 1889.	Pounds per acre.	Ear corn, lb. pr. plat, 1890.	Bushels of shelled corn per acre.			
				1888	1889	1890	Average
1	[1]Stable manure	40,250	530	97	82	71	83
2	Hog tankage	350	.....	99	69	.....	.....
3	Muriate of potash	100	392	99	75	52	75
4	Hog tankage Muriate of potash	350 100	412	99	74	55	76
5	None	.....	408	99	70	54	74
6	Cattle tankage	200	392	96	67	52	72
7	[2]Superphosphate Muriate of potash Sulphate of ammonia	400 100 125	408	95	74	54	74
8	Superphosphate	400	414	95	73	55	74
9	[3]Muriate of potash Sulphate of ammonia	100 125	446	95	75	59	76
10	None	.....	412	94	74	55	74
11	Sulphate of ammonia	125	332	90	69	42	67
12	Nitrate of soda	160	366	94	70	49	71

[1]In 1889, 51,650 lb.; in 1890, 20 loads. [2]In 1888, Bone meal, 200 lb. [3]In 1888, Dissolved bone-black, 300 lb.

In *bulletin No. 8, pp. 270–2*, was reported a trial in 1889, on tract [b] of the application of very large quantities of commercial fertilizers—much larger than would be profitable—to determine whether on the soil in this locality any result whatever could be obtained.

The tract of land selected, which was considered relatively poor, was divided into 7 plats, each 2 x 4 rods. In 1890 no fertilizers were applied, but the tract was again planted to corn to determine whether any effect might be obtained the second season. The tract has since been sown to wheat to ascertain whether any benefit will result to the wheat.

May 6, 1890, the tract was plowed, harrowed twice, and planted to Burr's white corn, four kernels to a hill. The corn was cultivated four times with a shallow cultivator and the weeds remaining in the hills were removed with a hoe.

The corn was cut and shocked September 16th; husked corn and weighed stover October 18th to 20th, and weighed corn November 1st.

Each season the average yield from the three unfertilized plats was a little more than the average yield from fertilized plats.

In the principal markets for fertilizers the cost per acre for the fertilizers used, which were purposely made excessive in amount, was for plat 1, $56; for plat 3, $26; for plat 5, $9; and for plat 7, $21. In 1889, the average yield per acre of the plats so treated was 86.3 bu.; and for the three receiving no manure, it was 87.5 bu. In 1890, for the plats treated the yield was 55.8 bu., and for the plats receiving no manure it was 57.7 bu.

TABLE SHOWING YIELDS IN 1889 AND 1890 FROM PLATS UPON WHICH HAD BEEN PUT COMMERCIAL FERTILIZERS IN LARGE AMOUNTS IN 1889.

	Fertilizers applied in 1889 only.	Pounds pr. acre.	No. of ears per acre.		Pounds stover per acre.		Bu. air-dry corn pr. acre	
			1889.	1890.	1889.	1890.	1889.	1890.
1	Dissolved bone-black	2,000	9,940	7,480	5,900	3,200	85	50
	Sulphate of potash	600						
	Sulphate of ammonia	600						
2	None		10,620	8,480	5,160	3,800	89	58
3	Dissolved bone-black	2,000	10,260	7,520	4,700	3,480	86	53
4	None		11,140	8,180	4,620	3,800	89	55
5	Sulphate of potash	600	10,280	8,620	4,880	4,040	85	60
6	None		10,420	8,580	4,560	4,000	85	60
7	Sulphate of ammonia	600	10,140	8,200	4,920	3,840	90	60

Experiment No. 23. Rotations with Corn, Oats, and Meadow, and with Corn and Oats compared with continuous Culture of Corn.

This experiment is introduced here on account of its bearing upon the question of the application of fertilizers for the production of corn.

Briefly, ten half-acre plats, 5 by 16 rods, have been cropped during the past 14 years as follows: Plats 1, 2, and 3 have been in corn continuously; plat 4 in corn and oats alternately; and plats 5, 6, 7, 8, 9, and 10 have had this rotation: Corn, 2 years; oats, 1 year; meadow, clover, timothy, or both, three years.

From plats 1, 2, and 3 both corn and stalks have been removed. Plat 1 has had a liberal application of stable manure each year. There was applied per acre in 1888, about 20 tons of stable manure, and in 1889, a little over 28 tons, and in 1890, about 20 tons. Plat 3 has had no fertilizer of any kind applied. Up to 1881, plat 2 had an occasional application of commercial fertilizers, but none since. May 17 and 18, 1888, two weeks after corn was planted, and after it was well up, the following fertilizers were applied along the row, care being taken not to have them come in contact with the corn.

Dissolved bone-black	150 lb.
Muriate of potash	50 "
Sulphate of ammonia	62.5 "

In 1889 and 1890, a similar application of fertilizers was made, with the exception that sulphate instead of muriate of potash was used, and the fertilizer was applied before the corn was up.

The half acre which had been manured 13 years successively with stable manure yielded in 1888 about one-fourth; in 1889, after another liberal application of stable manure, about three-fourths; and in 1890, after still another liberal application of stable manure, about one-third more corn than the unfertilized half acre upon which corn has been raised continuously for 15 years. Averaged for the three years, the plat which received stable manure yielded about 38 per cent. more than the plat not fertilized. The average increase in yield was 18.4 bu. per acre. At 35.7

TABLE SHOWING FOR 1888, 1889, AND 1890 RESULTS WITH ROTATION EXPERIMENT.

Plat.	Crop grown, 1888.	Bushels per acre.	Stover, straw, hay, lb. per acre.	Crop grown, 1889.	Bushels per acre.	Straw, hay, lb. per acre.	Crop grown, 1890.	Bushels per acre.	Stover, straw, hay, lb. per acre.
1	Corn.....	68.7	4,640	Corn.....	77.4	.....	Corn.....	55.1	3,392
2	Corn.	57.4	3,840	Corn.....	45.9	.....	Corn.....	41.5	2,680
3	Corn.....	54.3	2,575	Corn.....	43.2	.....	Corn.....	48.7	2,380
4	Corn.....	49.5	3,070	Oats..... ...	37.4	1,775	Corn.....	54.3	1,332
5	Oats.....	48.6	2,145	Med'm clover.	....	8,080	Med'm clover.	....	3,010
6	Oats.....	48	1,665	Med'm clover.	....	6,665	Med'm clover.	....	2,900
7	Mam'th clover.	....	3,030	Mam'th clover.	...	3,060	Corn.....	61.9	2,988
8	Med'm clover.	...	3,045	Corn.....	56.4	.....	Corn..... ..	58.2	2,664
9	Corn.....	61.2	3,120	Corn.....	50.3	.....	Oats..... ...	....	.....
10	Corn.....		3,750	Oats.....	59	3,650	Med'm clover.	...	4,680

cents per bushel, the average farm price* of corn in Illinois during 12 years [1876–1887] this increase would be worth yearly $6.56. The plat receiving commercial fertilizers yielded during the three years, a little less, although practically the same, than the plats receiving no fertilizer of any kind.

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GARDEN EXPERIMENTS WITH SWEET CORN, 1890.

Experiment No. 49. Sweet Corn, Testing Varieties.

In the following article the grouping of sweet corn, described in *bulletins Nos. 4 and 8*, has been revised so as to bring together those so-called varieties that were nearly enough the same to appear to justify such a classification. Several of the varieties still left as distinct are so much alike that for all practical purposes they might be considered the same. There are but very few varieties so distinct that each does not approach one or more other varieties so nearly that the line of separation is very faint. The method of selection is evidently different among the various seed growers, and their facilities for keeping varieties separate must in many cases be very imperfect, since we get from the same dealer in different years seed under the same name, but differing so much as not to be recognized as the same. For instance, *Creedmoor* was described in

*See Report U. S. Dep't of Agriculture, 1887, p. 536.

1889 as a distinct variety, and certainly was not like *Hickox;* while in 1890, corn grown from *Creedmoor* seed from the same dealer could not be distinguished from the *Hickox.* In a majority of cases when seed of the same name has been purchased from different sources the crop harvested has been different, in many cases the differences being as great as would be seen on comparing the crop with some other recognized variety. Not only that, but in many cases the varieties as sent out by the same dealer at the same time were each so lacking in uniformity that they might easily have been separated into two or more groups, each group having the appearance of a distinct variety.

In giving time of reaching edible maturity from planting, the earliest ears of each plat were the ones taken for the plat. The differences in average time for the three years is attributed to the differences of seasons, since corn grows and matures faster in hot than in cold weather. But the differences in plats of the same variety, the same season, must come from other causes. Those most likely to produce this effect are [1] using the earliest ears, and saving the latest for seed, and [2] mixing with the earlier or later varieties. In the case of *Stowell's evergreen* the different plats showed a variation in time of reaching edible maturity of five days in 1888, of 10 days in 1889, while in 1890, three plats grown from seed of our own saving were all ready for use at the same time. The typical ear of *Stowell's* is large, tapering but little; the kernels very deep, much wrinkled, and very loose on the cob. The earlier plats varied more from this type than the later ones, plainly showing mixture with the smaller eared, shallow grained, earlier varieties. Until *gold coin* was introduced, two years ago, *Stowell's* was as late as any other variety of sweet corn so that mixing would not make it later, but it could be made later, and at the same time could be more easily kept pure by using the early ears and planting the late.

In arranging names and synonyms, the rules formulated by a committee of the horticulturists of the Experiment Stations have served as a guide. In the case of such a name as *extra early red Naragansett sugar,* the single word *Naragansett* serves every purpose in distinguishing the variety. The term *hybrid,* sometimes used, can be properly applied only to a cross between different species, as between wheat and rye, and not to crosses between different varieties of the same species.

According to the tests so far made, there are still 49 varieties of sweet corn distinct enough to be left separate. Of these there are several in each group so much alike that it would not pay to grow more than one of them at a time.

Dreer's, a selection from *Cory,* is the earliest corn. It does not all ripen at the same time, and will afford a supply until something better can be had. *Ford's* or *Crosby* would be selected for the next early variety. *Ford's* is very similar to *Minnesota,* but larger, clearer in color, and of better quality. *Crosby* has 10 to 14 rows of kernels, is below medium size, white, and of very good quality.

In the medium early groups, *Stabler's* early is as good as any. The ears are of medium size, white, with 12 to 14 rows of kernels. This variety differs in merit so little from *Concord, Shakers,' pee and kay, Squantum,* and *asylum,* that there is practically no choice. *Stabler's* is given the preference, because more dealers keep that seed than seed of the others.

Of late varieties *Old Colony* is of better quality than *Stowell's evergreen,* and it remains in condition for use nearly as long. The ears are above medium size, tapering, deep grained, white. It is not so large as *Stowell's,* and for canning factories would not be so valuable. Of the shallow grained late varieties there would be little choice between *mammoth, Hickox,* and *Henderson.* All produce large ears, and are of very good quality.

For farmers who do not care to plant more than a single variety, *Crosby,* planted at different times, would be as good as anything.

The new varieties sent out every year at high prices, are almost certain to be a disappointment to the grower, since they nearly always fail to fulfill the claims of the introducer.

In the classification of sweet corn the varieties are divided according to the time reaching edible maturity after planting into: *Early, Medium, Late.* Also on color: *Yellow, White, Colored not yellow.* A further division of varieties is made into *8-rowed* and *Having more than 8 rows.*

Circumstances have made it impracticable to give any estimates of yields of corn grown the past season. For yields in 1889, see *bulletin No. 8, pp. 283–286.*

EARLY VARIETIES—*Yellow*—8-rowed.

Early orange; Dreer, Cole & Bro. *Synonym—Golden sugar;* Henderson.

Stalk, 5 to 6½ ft. high, slender, pale green, easily blown down. Ear, small, slender, 5 to 6½ in. long. A variety easily distinguished, as there is only one other variety of yellow sweet corn, *gold coin,* and that is large and late.

EARLY VARIETIES—*White*—8-rowed.

Northern pedigree—Haskell, Salzer, Vaughan.

Stalk, very small and slender, 3 to 4 ft. high, without suckers; tassel, very simple and stiff. Ear, 4 to 5½ in. long, and quite slender. It is smaller than any other variety of sweet corn grown and has not proved any earlier than some of the larger kinds. Its small size makes it quite distinct. A very large proportion of the ears are too small for use.

Burbank's. Synonyms—Burbank's early; Vaughan. *Burbank's early Maine;* Vaughan.

Stalk, 3½ to 4½ ft. high, rather stout, producing no suckers; tassel, short, stiff, simple. Ear, 4½ to 6½ in. long, irregular in shape, usually enlarged at the butt. Kernels, very large and irregular. It was first fit for use in 7 days from planting in 1889 and in 69 days in 1890. It yielded at the rate of 9 bu. in 1889 and 20.2 bu. per acre in 1890. It produces a very large proportion of nubbins too small for use.

Minnesota. Synonyms—Early Minnesota; Vaughan. *Extra early Minnesota sugar;* Landreth. *Dolly Dutton;* Landreth. *Tom Thumb;* Bridgeman. *Extra early Tom Thumb;* Henderson. *Early Boynton;* Ferry. *Pratt's early;* Gregory. *Extra early dwarf;* Bridgeman. *Hawaii sugar;* Wilson.

CLASSIFICATION OF SWEET CORN *(Synonyms in parenthesis.)*

- Sweet corn.
  - Early.
    - Yellow
      - 8-rowed
        - Early orange (Golden sugar).
        - Northern pedigree.
        - Burbank's.
      - Having more than 8 rows.
        - Minnesota (Dolly Dutton, Tom Thumb, Boynton, Pratt's, Extra early dwarf, Hawaii sugar).
        - Ford's.
        - Darling (early sweet, or sugar).
    - White
      - Having more than 8 rows.
        - Original Crosby.
        - Durkee.
        - Boston Market.
        - Leet's.
        - Crosby (Des Moines).
        - Early Southern.
        - * Early Adams. Adams. Landreth Market (Burlington hydrid).
    - Colored, not yellow...
      - 8-rowed
        - Dreer's.
        - Cory (No. 48, La Crosse, Rockford Market).
        - Marblehead.
        - Narragansett.
      - Having more than 8 rows.
        - Chicago market (Ballard's).
        - .....(golden sugar, early orange).
  - Medium.
    - White
      - Having more than 8 rows.
        - Albany (Breck's premium).
        - Perry's (Perry's hybrid).
        - Concord.
        - Shakers'.
        - Pee and kay (western queen, Maule's XX sugar).
        - Squantum (early bonanza, early Concord).
        - Stabler's early.
        - Asylum.
        - Russell's prolific.
        - Red cob (large red cob Perry's, Livingston's evergreen).
    - Colored, not yellow...
      - 8-rowed
        - Black Mexican (black sugar).
    - Yellow
      - Having more than 8 rows.
        - Gold coin.
  - Late.
    - White
      - 8 rowed
        - Eight-rowed (large 8-rowed, Rochester 8-rowed, New England 8-rowed, Darling's sugar).
        - Triumph.
        - Early mammoth (Marblehead mammoth, etc).
        - Mammoth (late mammoth, Maule's mammoth).
        - Hickox (Creedmoor).
        - Henderson.
        - Honey.
        - Excelsior.
      - Having more than 8 rows.
        - Ruby.
        - Roslyn (Roslyn hybrid, Simpsonia).
        - Old colony (Landreth sugar, Sonyea intermediate).
        - Stabler's nonpareil (Stabler's pedigree).
        - Egyptian (improved evergreen).
        - Stowell's evergreen (evergreen sweet).
        - Little gem (ne plus ultra, shoe peg).
    - Colored, not yellow..
      - Having more than 8 rows.
        - Amber cream.

*These three varieties, though not sweet, are included because commonly sold for table use.

Dolly Dutton as grown in 1888 was somewhat different from *Minnesota* but not as grown in 1889. *Tom Thumb* as grown in 1888 differed slightly from what was grown under that name in 1889 or 1890, while in both the latter years it could not be distinguished from *Minnesota*. In 1888, that grown under the name of *Dolly Dutton* was three days earlier and that called *Tom Thumb* one day earlier than *Minnesota*. In 1889, the *Dolly Dutton* was one day earlier, *Tom Thumb* four days later, *Boynton* one day earlier, and *Pratt's early* two days earlier than *Minnesota*, and *Hawaii sugar* and *Extra early dwarf* ripened at the same date as *Minnesota*. In 1890, *Tom Thumb*, *Pratt's early*, and *Boynton's* were two days earlier than *Minnesota*.

Stalk, 4½ to 5 ft. high, somewhat slender; tassel, slender, drooping; suckers, few, small. Ear, borne from 12 to 18 in. from the ground, dull white, rather slender, 5 to 7 in. long, cylindrical; kernels, scarcely even at the butt; tips, fairly well filled; rows of kernels, regular. The different plats reached edible maturity in 1888, in from 58 to 62 days from planting, in 1889, in from 79 to 84 days, in 1890, in from 71 to 74. A popular and valuable early variety.

Ford's. Synonym—Ford's early; Vaughan.

Similar to *Minnesota*. The ear is some larger, of a cleaner color, white with a reddish tinge sometimes, cylindrical or slightly tapering; rows of kernels, regular; pairs of rows, sometimes separated at the butt; cob, white or reddish in color. It reached edible maturity in 1889 in 80 days from planting, in 1890 in 72 days.

Darling; Landreth. *Synonym—Early sweet or sugar;* Ferry.

Has larger, somewhat later, and more perfect ears than *Minnesota*. Stalk, 5½ to 7 ft. high; rather slender; suckers, numerous, reaching nearly the size of the parent stalk; tassel, slender and drooping. Ear, about 2 ft. from the ground, white, with a white cob, cylindrical, 7 to 8 in. long, 1.4 to 1.6 in. in diameter; kernels, even at the butt; tip, well filled; rows of kernels, regular; pairs of rows, separating toward the butt of the ear. Kernel is broader than deep, krinkled, less shriveled than most sweet corn. It reached edible maturity in 63 to 64 days from planting in 1888 and in 77 to 79 days in 1890. It yields well and the corn is of good quality.

EARLY VARIETIES—*White*—Rows, more than eight.

Original Crosby; Gregory.

Stalk, about 5 ft. high, slender; tassel, slender and drooping; suckers, very numerous, small to three-fourths size of the parent stalk. Ear, 12 to 18 in. from the ground, dull white, tapering, with a white cob, 4½ to 6 in. long, 1.3 to 1.6 in. in diameter, with 10 to 14 rows of kernels. Kernel very irregular in shape, about as deep as broad, flattened over the top. It was first fit for use in 80 days from planting in 1889 and in 74 days in 1890. It produces so many small nubbins in proportion to the good ears as to be worthless. In 1889, there were 58 good ears to 91 nubbins and in 1890, 10 good ears to 135 nubbins.

Durkee; Gregory.

Differs from *Original Crosby* in being larger with a better proportion of good ears to nubbins, but it could not be recommended for cultivation.

Boston market. Synonym—Early Boston market; Gregory.

Stalk, 4 to 5 ft. high, heavy, large leaved; tassel, small, stiff. Ear, 12 to 14 in. from the ground, dull white, nearly cylindrical, 5½ to 7 in. long, 1.4 to 1.7 in. in diameter; kernels, even at the butt; tip, not well filled; rows of kernels, 10 to 12, not very regular. Kernel, large, irregular. A rough, irregular ear, fit for use in 1889 in 81 days from planting. Not very productive; quality, only fair.

Leet's. Synonym—Leet's early; Ferry.

Stalk and ear, of larger size than the last, otherwise very similar. Stalk, 5 to 6 ft. high, heavy, leafy, short-jointed. Ear, 18 to 24 in. from the ground, dull white, 6 to

in. long, 1.4 to 1.7 in. in diameter; rows of kernels, 10 to 12, not very regular. Ears and kernels, coarse, rather rough; quality, only fair.

Crosby. *Synonyms—Crosby's early;* Vaughan. *Crosby's early sugar;* Henderson. *Crosby's extra early sugar;* Dreer, Smith, Landreth. *Early Des Moines;* Iowa Seed Co.

Stalk, 6 to 7 ft. high, rather slender; tassel, slender and drooping; suckers, numerous, reaching ½ to ¾ the size of the parent stalk. Ear, 18 to 24 in. from the ground, white, tapering, 5 to 7 in. long, 1.4 to 1.9 in. in diameter; kernels, even or slightly rounded past the butt; tip, well filled; rows of kernels, 10 to 14, regular. Kernel below medium size, as deep as broad, crinkled. The corn is below the medium size, of good shape and good quality. A valuable and popular variety. In 1888, the various plats were fit for use in from 62 to 64 days from planting; in 1889, in from 83 to 85 days; and in 1890, in 79 days.

Early southern; Ferry.

Stalk, 5 to 6 ft. high, heavy, leafy; tassel, bunchy, stiff. Ear, dull white, nearly cylindrical, 24 to 30 in. from the ground, 6 to 8 in. long, 1.6 to 1.9 in. in diameter; kernels, rounded past the butt; tip, not well filled; rows of kernels, 8 to 10, not regular. Kernel, deep, broad, flat. Appears more a dent than a sweet corn; quality, poor. This variety may be of value for the South where the better kinds of sweet corn cannot be grown. It was fit for use in 1889 in 85 days from planting and in 1890 in 77 days.

**Early Adams;* Haskell, Vaughan. *Synonym—Extra early Adams;* Hallock, Landreth.

Stalk, 4½ to 5½ ft. high, rather short-jointed; tassel, stiff. Ear, 16 to 20 in. from the ground, white, cylindrical, tapering at the tip, 4½ to 6 in. long, 1.6 to 1.9 in. in diameter; kernels rounded over the butt; tip, fairly filled; rows of kernels, 10 to 12, regular; pairs of rows, not very distinct; cob, 1 to 1.2 in. in diameter. Kernel very solid, rounded over the top, about as deep as broad, creased or smooth. It is smaller, earlier, and less dented than the following. It was fit for use in 1888 in 57 to 60 days from planting and in 1889 in 78 days.

Adams. *Synonyms—Early Adams;* Haskell, Vaughan. *Extra early Adams;* Henderson.

Stalk, 5 to 6½ ft. high, strong, short-jointed, leafy; tassel, short, stiff, bunchy. Ear, 24 to 30 in. from the ground, white, cylindrical, tapering bluntly at the tip, 5½ to 7 in. long, 1.4 to 1.9 in. in diameter; kernels, rounded over the butt; tip, fairly filled; rows, 10 to 14, regular; pairs of rows, not very distinct; cob, white, .7 to 1.1 in. in diameter. Kernel, very solid, rounded over the top, dented or nearly smooth, about as deep as broad. Seedsmen seem to send out this and the preceding indifferently. It was first fit for use in 1888 in 70 days and in 1889 in 85 days from planting.

Landreth market. *Synonyms—Early Landreth market;* Landreth. *Burlington hybrid;* Johnson & Stokes, and Northrup, Braslan & Goodwin Co.

Stalk, 4½ to 6½ ft. high, leafy, short-jointed; tassel, slender and drooping; suckers, very few. Ear, 16 to 20 in. from the ground, white, cylindrical, tapering at the tip, 5 to 7½ in. long, 1.4 to 1.8 in. in diameter; kernels, even at the butt; tip, fairly filled; rows, 8 to 12, regular; cob, white, 1 to 1.2 in. in diameter. Kernel, solid, rounded over the top, broader than deep, smooth. Has the appearance of a flint corn when ripe. It was first fit for use in 1888 in 56 days from planting, in 1889 in 80 days, and in 1890 in 77 days. This is a cross between *Early Adams* and an early sweet corn, probably *Minnesota*, and is not of so good quality as the pure sweet corn. It would probably be of value at the South where pure sweet corn can not be successfully grown.

EARLY VARIETIES—*Colored, not yellow*—8-rowed.

Dreer's. *Synonym—Dreer's first of all;* Dreer.

Only distinguished from *Cory* by being smaller and according to the past season's notes two days earlier. Stalk, 3½ to 4 ft. high, slender. Ear, 8 to 12 in. from the

*This and the two varieties which follow are sold for table use but are not sweet.

ground, 4 to 5½ long, 1.3 to 1.6 in. in diameter. It was first fit for use the past season in 63 days from planting.

Cory. Synonyms—Early Cory; Smith. *Cory early sugar;* Henderson. *Extra early Cory;* Haskell. *No. 48;* Salzer. *La Crosse;* Salzer. *Earliest Rockford market;* Shumway.

Stalk, 4 to 4½ ft. high, slender; tassel, short, stiff; suckers, few, small. Ear, 10 to 12 in. from the ground, 4 to 6 in. long, 1.4 to 1.7 in. in diameter, dull white to red; butt, enlarged; tip, round-pointed, well filled; rows, nearly regular. Kernel, large, rounded over the top, broader than deep, crinkled or smooth. Type, not well fixed. The various plats of this variety were first fit for use in 1888 in from 54 to 56 days from planting, in 1889 in 77 to 80 days, and in 1890 in 65 days. This variety though of recent introduction (1885) is very popular as an early corn. It lasts but a few days and many of the later kinds are of better quality.

Marblehead. Synonyms—Marblehead sugar; Dreer. *Marblehead early;* Vaughan. *Extra early Marblehead;* Ferry. *New Cory;* Nellis.

Stalk, 4 to 5 ft. high, rather stout; tassel, small, stiff; suckers, few, not reaching more than half size. Ear, 12 to 18 in. from the ground, nearly white to light red, with a red cob, cylindrical, enlarged at the butt; tip, round-pointed, well filled, 5 to 7 in. long, 1.4 to 1.6 in. in diameter; rows, not crowded, regular; pairs of rows, quite distinct or entirely separated. Kernel, below medium size, rounded over the top, crinkled or nearly smooth. This is probably the parent variety from which *Cory* was produced by selection. It differs from *Cory* in being of larger growth, ears longer, more slender and more regular in shape. In 1888, it was fit for use in 55 to 56 days from planting; in 1889, in 76 to 77 days; and in 1890, in 69 days.

Narragansett. Synonyms—Early red Narragansett; Ferry. *Extra early Narragansett sugar;* Landreth.

Stalk, 4½ to 5 ft. high, rather stout, leafy, marked with purple; tassel, short, stiff; suckers, few, not reaching more than half size. Ear, 16 to 20 in. from the ground, light to dark red, nearly cylindrical; tip, round-pointed, well filled, 6 to 7.5 in. long, 1.5 to 1.8 in. in diameter; pairs of rows, frequently separated. Kernel, rather large, broader than deep, crinkled or crimped. This variety may be easily distinguished from the preceding three varieties by being larger and darker in color. It was first fit for use in 1888 in 57 to 59 days from planting.

EARLY VARIETIES—*Colored, not yellow*—Having more than 8 rows.

Chicago market; Vaughan, Haskell, Leonard. *Synonym—Ballard's extra early;* Storrs & Harrison.

Stalk, 4 to 5 ft. high, rather slender; tassel, small, stiff or drooping; suckers, few, not usually reaching more than half the size of the parent stalk. Ear, 12 to 15 in. from the ground, cylindrical or tapering, white to pale red or flesh color; kernels, even or slightly rounded past the butt; tip, well filled, 5 to 6½ in. long, 1.4 to 1.8 in. in diameter; rows of kernels, 10 to 12, regular. Kernel, below medium size, flatly rounded over the top, nearly as deep as broad, crinkled or nearly smooth. This variety differs from the preceding in the number of rows of kernels and in color, being much nearer white than any of them. It differs from the next following in being lighter colored and much smaller. It was fit for use in 1888 in from 57 to 59 days, in 1889 in 78 to 81 days, and in 1890 in 65 days from planting.

Golden sugar; Landreth. *Early orange sweet;* Farm, Field and Stockman. *Early orange;* Vandercook. Neither the term *golden* nor *orange* is applicable to this variety, and both have been already applied by other seedsmen to another variety.

Stalk, 5 to 6½ ft. high, variable in appearance. Ear, 18 to 24 in. from the ground, white to red, tapering, 6 to 7½ in. long, 1.6 to 1.8 in. in diameter; kernels, even at the butt of the ear; tip, well filled; rows of kernels, 12 to 14, regular. Kernel, as deep as

broad, wrinkled. This variety was first fit for use in 1888 in 63 to 65 days from planting, and in 1889 in 86 days.

MEDIUM MATURING VARIETIES—*White*—Having more than 8 rows.

Albany. Synonyms—Albany sugar; Dreer. *Breck's premier;* U. S. Department of Agriculture.

Stalk, 5½ to 6½ ft. high, strong, leafy, dark green; tassel, rather stiff; suckers, many. Ear, 24 to 30 in. from the ground, dull white, tapering, blunt-pointed, 6 to 8 in. long, 1.6 to 1.9 in. in diameter; kernels, even at the butt; not filled out at the tip; rows, 10 to 12, regular; pairs of rows, not very distinct; cob, white, 1.1 to 1.3 in. in diameter. Kernel, rounded over the top, nearly as deep as broad, thick, crinkled or crimped. It was fit for use in 1888 in 64 days from planting, in 1889 in 85 days, and in 1890 in 71 days. Type, irregular.

Perry's. Synonym—Perry's hybrid; Hallock, Salzer, Vaughn.

Stalk, 5 to 6 ft. high; tassel, small; suckers, few, small. Ear, dull white or reddish, cylindrical, 1 to 2 ft. from the ground, 6 to 8 in. long, 1.6 to 2 in. in diameter; rows of kernels, 8 to 12. Kernel, flatly rounded over the top, crinkled or smooth. Not of good quality. It was fit for use in 1888 in 64 days from planting in 1889, in 82 to 85 days, and in 1890 in 74 days. It is so variable as scarcely to deserve to be classed as a variety.

Concord. Synonyms—Moore's early Concord; Ferry, Vaughn. *Early Concord sugar;* Landreth.

Stalk, 5 to 7 ft. high, short-jointed; tassel, long, slender and drooping; suckers, numerous. Ear, 18 to 24 in. from the ground, dull, white, cylindrical, round-pointed at the tip, 6 to 8 in. long, 1.6 to 2 in. in diameter; kernels, even at the butt, nearly filling out the tip; rows. 12 to 14, regular; cob, white, 1.1 to 1.3 in. in diameter. Kernel, flatly rounded over the top, nearly as deep as broad, very thick, crimped and wrinkled. It was fit for use in 1888 in 65 to 68 days from planting, in 1889 in 85 to 87 days, and in 1890 in 84 days.

Shakers'. Synonym—Shakers' early sweet; Henderson.

Stalk, 5 to 7 ft. high, rather heavy; tassel, heavy, stiff. Ear, 18 to 24 in. from the ground, dull white, cylindrical or tapering, round-pointed, 5½ to 7 in. long, 1.6 to 1.9 in. in diameter; kernels, even at the butt, not filling out the tip; rows, 10 to 12, regular; pairs of rows, distinct; cob, white, 1 to 1.2 in. in diameter. Kernel, rounded over the top, broader than deep, thick, crinkled or nearly smooth. This variety reached edible maturity in 1888 in 66 days from planting, and in 1889 in 85 days.

Pee and kay. Synonyms—Western queen; Shumway. *Maule's XX sugar;* Maule.

Stalk, 4½ to 6½ ft. high, short-jointed, leafy, dark green; tassel, stiff. Ear, 16 to 18 in. from the ground, tapering, sometimes compressed at the butt, very dull white, 6 to 8 in. long, 1.6 to 2 in. in diameter; kernels even at the butt, not quite filling out the tip; rows, 10 to 12, regular; cob, white, 1.1 to 1.3 in. in diameter. Kernel, flatly rounded over the top, crinkled or crimped, nearly as deep as broad, very thick. Similar to *asylum sugar*, but smaller and earlier. This variety was fit for use in 67 days from planting in 1888, in 83 to 85 days in 1889, and in 73 days in 1890.

Squantum; Landreth. *Synonyms—Squantum sugar;* Henderson. *Early bonanza;* Wilson. *Early conqueror;* Faust.

Stalk, 6 to 7 ft. high, leafy, short-jointed, heavy; tassels, stiff; suckers, few. Ear, 18 to 24 in. from the ground, very dull white, tapering, rounded at the tip, 5½ to 7½ in. long, 1.6 to 1.8 in. in diameter; kernels, even at the butt, nearly filling out the tip; rows, 12, regular; cob, white or pink, 1 to 1.2 in. in diameter. Kernel, flatly rounded over the top, crinkled or crimped, nearly as broad as deep, rather thick. This variety was first fit for use in 1888 in 69 days from planting, in 1889 in 85 to 89 days, and in 1890 in 81 days. That sent out as *early conqueror* was not at all uniform, but was more like this

than any other variety. Ears might have been selected from it that would have answered to the description of either *8-rowed* or *Stowell's*.

Stabler's early; U S. Department of Agriculture. *Synonyms—Stabler's early sugar;* Henderson. *Stabler's extra early sweet or sugar*; Dreer, Smith.

Stalk, 5 to 7 ft. high, rather long-jointed, pale green; tassel, drooping or stiff; suckers, not many. Ears, 16 to 24 in. from the ground, white, tapering, rounded at the tip, 6 to 7½ in. long, 1.5 to 1.9 in. in diameter; kernels, even at the butt, filled out at the tip; rows, 10 to 14 regular; cob, white, 1 to 1.1 in. in diameter. Kernels, flatly rounded over the top, crinkled and crimped, as deep as broad. It was fit for use in 1888 in from 66 to 71 days from planting, and in 1889 in 87 days.

Asylum; Vaughan.

Stalk, 6 to 8 ft. high, rather long-jointed, blades large; tassel, many-branched, drooping; suckers, not many. Ear, 24 to 30 in. from the ground, tapering; tip, bluntly rounded; very dull white, 7½ to 9½ in. long, 1.6 to 1.9 in. in diameter. Kernels, even at the butt, nearly filling out the tip; rows, 10 to 12, regular; cob, white, 1.1 to 1.3 in. in diameter. Kernel, broadly rounded over the top, not so deep as broad, thick, crinkled, and crimped. This variety was fit for use in 71 days from planting in 1888, in 89 days in 1889, and in 86 days in 1890.

Russell's prolific; Vick.

Stalk, 6 to 7 ft. high; tassel, long, drooping; many small suckers. Ear, dull white, with white cob, cylindrical, 6 to 8 in. long, 1.5 to 2 in. in diameter; kernels, even at the butt of the ear; tip, fairly filled; rows of kernels, 10 to 12. Kernel, flatly rounded over the top, crinkled or smooth. Approaching flint; quality poor. It was fit for use in 1890 in 81 days from planting. It yields less than many other better varieties.

Red cob. Synonyms—Red cob sugar; Landreth, *Early red cob;* Johnson & Stokes. *Early large red cob Perry's;* Landreth. *Livingston's evergreen;* Vaughan.

Stalk, 6½ to 8½ ft. high, heavy, dark green, characteristically marked with purple; tassel, slender and drooping; suckers, many. Ears, 2½ to 3 ft. from the ground, reddish white, generally cylindrical, rounded at the tip, 7 to 8½ in. long, 1.6 to 2.1 in. in diameter; kernels, even at the butt; fairly well filled at the tip; rows, 10 to 12, regular, sometimes spirally arranged; cob, red, 1 to 1.4 in. in diameter. Kernel, flatly rounded over the top, as deep as broad, rather thick, crinkled and wrinkled. This was fit for use in 1888 in from 70 to 71 days from planting, in 1889 in 88 days, and in 1890 in 84 days. It is the only variety in the group that is easily distinguished.

MEDIUM MATURING VARIETY—*Colored, not Yellow*—8-rowed.

Black Mexican; Vaughan. *Synonyms—Black Mexican sweet;* Smith. *Black Mexican sugar;* Henderson. *Black sugar;* Cowan.

Stalk, 6 to 7 ft. high, rather slender, light green; suckers, few. Ear, 24 to 30 in. from the ground, cylindrical, tapering at the tip, 6 to 7½ in. long, 1.3 to 1.7 in. in diameter; kernels, even at the butt; not filled out at the tip; regular; pairs of rows, usually but little separated; black or slate color; cob, white, .7 to 1.1 in in diameter. Kernel, rounded over the top, crinkled or crimped, broader than deep. It was fit for use in 1888 in 66 to 68 days from planting, in 1839 in 84 to 92 days, and in 1890 in 79 to 81 days. There is only one variety of black sweet corn.

LATE VARIETY—*Yellow*—Having more than 8 rows.

Gold coin; Livingston, Vaughan.

Stalk, 8 to 9 ft. high, very strong, leafy; not many suckers; tassel, large, full, stiff. Ears, 2½ to 3½ ft. from the ground, light yellow, cylindrical or tapering, 7 to 10 in. long, 2 to 2.4 in. in diameter; kernels, rounded past the butt; tip, fairly filled; rows, 16 to 24, regular; cob, white, 1 to 1.4 in. in diameter. Kernels, very loose, rather flat on the top,

above the medium size, 1½ times as deep as broad, wrinkled. This is a cross between a yellow dent and *Stowell's evergreen.* It is a fine looking corn, but is lacking in quality and is not so tender as the pure sweet varieties. It was fit for use in 1889 in 103 days from planting. In 1890, that from home-grown seed was fit for use in 86 to 88 days, and that from seed from Livingston and Vaughan in 96 to 98 days.

LATE VARIETIES—*White*—8-rowed.

Eight-rowed. Synonyms—Early 8-rowed; McAllister. *Large 8-rowed;* Nellis. *Large early 8-rowed sweet;* Henderson. *Darling's sugar;* McAllister. *Rochester 8-rowed;* Barnard. *New England 8-rowed;* Currie Bros.

Stalk, 6½ to 8½ ft. high, rather slender; tassel, slender, drooping; suckers, not many. Ear, 20 to 30 in. high, white, tapering, 8 to 10 in. long, 1.5 to 1.8 in. in diameter; kernels, even at the butt; tips, well filled; rows, regular; pairs of rows, distinct, sometimes entirely separate toward the butt; cob, white, 1 to 1.1 in, in diameter. Kernel, broadly rounded over the top, broader than deep, crinkled, large. A very prolific variety of good quality, It was fit for use in 1888 in 69 to 74 days from planting, in 1889 in 88 to 94 days, in 1890 in 86 days.

Triumph; Vaughan. *Synonyms—Triumph sugar;* Landreth. *Triumph sweet;* Smith.

Stalk, 6 to 8 ft. high, stout, short-jointed; tassel, full and heavy; suckers, few. Ear, 24 to 30 in. from the ground, white, cylindrical, tapering roundly at the tip, 7½ to 9½ in. long, 1.6 to 2 in. in diameter; kernels even at the butt; filled out at the tip; rows, 8; pairs of rows, distinct to entirely separate; cob, white, 1 to 1.4 in. in diameter. Kernel, rounded over the top, very large, broader than deep, crinkled or crimped. It was fit for use in 1888 in 72 to 76 days and in 1889 in 94 days from planting. This differs from the preceding in having larger ears, larger kernels, the rows of kernels not so regular, and sometimes 10 instead of 8 rows.

LATE VARIETIES—*White*—Having more than 8 rows.

Early mammoth. Synonyms—Early mammoth sugar; Landreth, Vaughan. *Mammoth early;* Faust. *Marblehead mammoth;* Gregory.

Stalk, 6 to 8 ft. high, stout, short-jointed, large-leaved; tassel, drooping; suckers, few. Ear, 24 to 28 in. from the ground, dull white, tapering, rounded at the tip, 7.5 to 10 in. long, 1.7 to 2.2 in. in diameter, even at the butt; tips, fairly filled; rows, 12 to 14, regular; cob, white, 1 to 1.4 in. in diameter. Kernel, flatly rounded over the top, as deep as broad, thick, crinkled. It was fit for use in 1888 in 72 days from planting, and in 1889 in 86 to 91 days.

Mammoth; Bridgeman, Hallock, Storrs & Harrison. *Synonyms—Late mammoth;* Vaughan. *Mammoth sugar;* Salzer. *Maule's mammoth;* Maule.

Stalk, 7 to 8½ ft. high, strong, leafy, pale green; tassel, large, many-branched, drooping. Ear, 28 to 33 in. from the ground, dull white, tapering, round-pointed, 8.5 to 11.5 in. in length, 1.8 to 2.4 in. in diameter, kernels, even at the butt, nearly filling out the tip; rows, 12 to 18; cob, white, 1.2 to 1.8 in. in diameter. Kernel, flatly rounded over the top, as deep as broad, thick, crinkled. This variety was fit for use in 1888 in 76 to 80 days, in 1889 in 96 to 98 days, and in 1890 in 92 days from planting. It differs from the preceding, which has much more slender though nearly as long an ear. The kernels of the former are also more nearly smooth.

Hickox; Hallock, Salzer. *Synonyms—Hickox improved;* Landreth. *Hickox improved sugar;* Henderson, Vaughan. *Creedmoor;* Hallock (as grown in 1890).

Stalk, 6 to 8 ft. high, heavy, leafy, short-jointed; tassel, full, rather stiff. Ear, 30 to 36 in. from the ground, white or bleached white, cylindrical, round-pointed at the tip, 8 to 10 in. long, 1.7 to 2 in. in diameter, kernels scarcely even at the butt; tip, fairly filled; rows, 10 to 14, regular; cob, 1.3 to 1.4 in. in diameter. Kernel, flatly rounded over the

top, nearly as deep as broad, thick, crinkled or crimped. This variety was first fit for use in 1888 in 71 to 74 days, in 1889 in 91 to 95 days, and in 1890 in 84 days from planting.

Henderson; Henderson.

Stalk, 6½ to 8 ft. high, heavy, leafy, short-jointed; tassel, much-branched, rather stiff. Ear, 28 to 30 in. from the ground, dull white; cylindrical or tapering, tip, blunt, 8 to 11 in. long, 1.6 to 2 in. in diameter; kernels, even at the butt; tip, fairly filled; rows, 10 to 16, not very regular; cob, white, 1 to 1.4 in. in diameter. Kernels, flatly rounded over the top, irregular in shape, above medium size, as deep as broad, wrinkled and crimped, or smooth. This was fit for use in 1889 in 94 days and in 1890 in 84 days from the time of planting. This and the preceding are quite similar. *Hickox* is a rougher looking ear and has larger kernels than *Henderson.* Both resemble *mammoth* in many ways, but are smaller.

Honey; Storrs & Harrison.

Stalk, 6 to 7½ ft. high, leafy, stout; tassel, rather stiff; suckers, numerous. Ear 24 in. from the ground, dull white, cylindrical, 6 to 8 inches long, 1.4 to 1.8 in. in diameter; kernels, rounded over the butt; tip, well filled; rows of kernels, 10 to 12, regular. Kernel, rounded over the top, crinkled, as deep as broad. A very prolific variety. It was fit for use in 1889 in 94 days and in 1890 in 84 days from planting.

Excelsior; Hallock. *Synonyms—Potter's excelsior;* Vaughan. *Excelsior sugar;* Maule. *Large excelsior:* Thorburn.

Stalk, 8 to 9 ft. high, rather strong, short-jointed, pale green; tassel, many-branched, drooping. Ear, 2 to 3 ft. from the ground, dull white, cylindrical, rounded at the tip, 6 to 8 in. long, 1.5 to 1.8 in. in diameter; kernels, even at the butt, filled out at the tip; rows, 10 to 12, regular; cob, white, 1 to 1.2 in. in diameter. Kernel, flatly rounded over the top, broader than deep, wrinkled. It was fit for use in 1888 in 72 to 74 days, in 1889 in 90 days, and in 1890 in 84 days from planting.

Ruby; Vaughan.

Stalk, 6 to 8 ft. high, heavy, short-jointed, large-leaved; tassel, large, full, drooping; suckers, many, large. Ear, 24 to 30 in. from the ground, a rich, creamy white, tapering, rounded at the tip, 6½ to 10 in. long, 1.9 to 2.3 in. in diameter, slightly rounded over the butt, nearly filling out the tip; rows, 12 to 20, regular; cob, white or purplish, 1.2 to 1.6 in. in diameter. Kernel, flatly rounded over the top, wrinkled, very thick, deeper than broad, large. Stalks, vary in color from dark green to dark purple. Quality very good. It was fit for use in 1888 in 91 days and in 1890 in 84 to 88 days from planting. A variety easily distinguished by the dark purple found on many of the cobs and stalks.

Roslyn. Synonyms—Roslyn hybrid; Dreer, Johnson & Stokes. *Simpsonia;* Wilson.

Stalk, 7 to 8½ ft. high, heavy, leafy; tassel, much-branched, heavy, rather stiff; suckers, few. Ear, 24 to 30 in. from the ground, cream to dull white, tapering, 7 to 10 in. long, 1.9 to 2.4 in. in diameter; kernels, even at the butt; tip, well filled; rows, 12 to 16, regular; cob, white, 1.2 to 1.4 in. in diameter. Kernel, flatly rounded over the top, one and one-fourth times as deep as broad, wrinkled, above medium size. This variety was fit for use in 1889 in 86 days from planting, and in 1890 in 88 days. The quality is rather poor.

Old Colony; Vaughan. *Synonyms—Sonyea intermediate;* Barnard. *Landredth's sugar;* Landreth.

Stalk, 6 to 7½ ft. high, very heavy, leafy, dark green; tassel, stiff and heavy. Ear, 24 in. from the ground, clear white, tapering abruptly, 6½ to 8 in. long, 1.6 to 2 in. in diameter; kernels, rounded over the butt; not quite filled out at the tip; rows, 12 to 14, regular, cob, white, .9 to 1.1 in. in diameter. Kernel, flatly rounded over the top, deeper than broad, wrinkled. It was fit for use in 1888 in 71 to 74 days, in 1889 in 87 to 90 days, and in 1890 in 86 days from planting.

Stabler's nonpareil; Dreer. *Stabler's pedigree;* Burpee.

Stalk, 7 to 8 ft. high, heavy, large-leaved, dark green; tassel, long, drooping. Ear, white, tapering, 2 to 3 ft. above the ground, 7 to 8 in. long, 1.8 to 2.2 in. in diameter; rows of kernels, 12 to 16, not regular; kernels, even at the butt; tip, well filled. Kernel, one and one-fourth times as deep as broad, wrinkled. It was fit for use in 1890 in 84 to 86 days from planting. It shells from the cob more easily when ripe than any other variety. Differs but little from *Old Colony.*

Egyptian; Dreer, Vaughan. *Synonyms—Egyptian sugar;* Landreth. *Improved evergreen;* Salzer, U. S. Department of Agriculture.

Stalk, 6½ to 8 ft. high, leafy, heavy, short-jointed; tassel, heavy, rather stiff. Ear, 2 to 3 ft. high, tapering, bluntly rounded at the tip, 6 to 8 in. long, 1.5 to 2 in. in diameter; kernels, even or slightly rounded over at the butt; filled out at the tip; rows, 12 to 14, regular; white, clear color; cob, white, 1 to 1.2 in. in diameter. Kernel, flatly rounded over the top, as deep as broad, not large, wrinkled. The various plats were fit for use in 1888 in 73 to 80 days, in 1889 in 92 to 94 days, and in 1890 in 86 to 91 days from planting.

Stowell's evergreen; Haskell and others. *Synonym—Evergreen sweet;* Landreth.

Stalk, 6 to 8 ft. high, strong, short jointed; tassel, many-branched, rather stiff, heavy. Ear, 24 to 28 in. from the ground, white, usually tapering, 7½ to 10 in. long, 1.9 to 2.3 in. in diameter; kernels, even at the butt; tip, fairly filled; rows, 14 to 16, regular; cob, white, 1.1 to 1.4 in. in diameter. Kernel, flatly rounded over the top, wrinkled, deeper than broad. *Stowell's evergreen,* as sent out by different seedsmen varies greatly, often being so mixed as not to be recognized except by a few ears. The various plats were fit for use in 1888 in 69 to 74 days, in 1889 in 87 to 97 days, and in 1890 in 86 days from planting.

Little gem; Vaughan, Dreer. *Synonyms—Ne plus ultra;* Gregory. *Shoe peg;* Johnson & Stokes.

Stalks, 6 to 7 feet high, slender, pale green; tassel, short, bunchy, stiff. Ear, usually tapering, white, 2 to 3 ft. from the ground, 5 to 6 in. long, 1.4 to 1.7 in. in diameter. Kernels, usually not in rows, wrinkled, nearly twice as deep as broad, very small and slender, irregular in shape. It was fit for use in 1888 in 74 to 76 days, in 1889 in 98 days, and in 1890 in 86 to 91 days from planting.

LATE VARIETY—*Colored, not yellow*—Having more than 8 rows.

Amber cream; Landreth, Henderson.

Stalk, 6 to 7½ ft. high, short-jointed, stout; tassel, many-branched, rather slender, drooping. Ear, 20 to 24 in. from the ground, reddish white to flesh color, cylindrical, long, and rather slender, 8 to 10½ in. in length, 1.5 to 1.8 in. in diameter; kernels, even at the butt, not filled out at the tip; rows, 10 or 12, regular; cob, white, .9 to 1.1 in. in diameter. Kernel, flatly rounded over the top, as deep as broad, rather thick, crinkled. This was fit for use in 1888 in 71 to 72 days, in 1889 in 91 to 93 days, and in 1890 in 84 days from planting.

Pop Corn, Tests of Varieties.

A report upon varieties of pop corn is here inserted as collateral to that upon sweet corn, both being classed as garden crops. The pop corn varieties were primarily grown for botanical and other closely related studies, and especially in tests of cross fertilization, from which interesting results are to be reported at another time.

The list of varieties of pop corn grown the past season by the Station is as full as it was possible to make it from the seedmen's lists received. As pop corn is not so generally grown as either sweet or field corn, there has not been the same inducement to bring out or produce new varieties. So far, all the varieties of pop corn may be readily divided into two very distinct types or classes. One class is very commonly known as *rice corn*, and has kernels more or less pointed, with the outer coat, where the silks were attached, continued into a sort of spine, which may either stand almost erect or may be depressed by the crowding of the husk on the ear. The ears in either case are rough to handle. The other class, of which the white at least is frequently known as *pearl corn*, has kernels rounded or flattened over the top and very smooth, the point of the attachment of the silk being lower down on the same side of the kernel as the germ. The two classes thus distinguished may be divided, as with sweet and field corn, into *early*, *medium*, and *late*, and these again into *white*, *yellow*, and *colored, not yellow*.

All the varieties of corn cross with each other so readily that it is difficult under ordinary methods to keep a variety strictly to any given type; and so we find frequently that corn sent from different sources under the same name will differ as much as corn from the same source under different names, and that there is room for question as to whether a given lot belongs in this or that group which we class as a variety.

The plats were 1-80 of an acre each. Plats of this size, even with a uniform stand are not large enough from which to make a safe estimate of what the varieties will do under field culture; and with the great variations in stand, calculations of yield are untrustworthy. Any correction of calculated yield on account of stand only makes matters worse. For illustration, see *bulletin No. 8, p. 280, table.* The poor stand noted in so many cases may be fairly attributed to the condition of the seed when received here, as was shown by germination tests.

RICE VARIETY—*Early maturing*—White.

Blush; Farm, Field and Stockman.

Stalk, 5 to 7 ft. high, rather slender; blades, small, dark green or purple; tassel, long, drooping, much-branched; suckers, few, reaching only about half the size of the parent stalk. Ear, 2 to 3 ft. from the ground, tapering, dull white to purplish, 4.5 to 6 in. long, 1.2 to 1.5 in. in diameter; cob, .75 to .9 in. thick; kernels, rounded over the butt; tip, fairly filled; rows, regular or irregular, 16 to 20. Kernel, rather slender, .15 in. broad, .25 to .3 in. deep, sharp-pointed; the spines usually erect. A single plat with 90 per cent. of a stand yielded at the rate of 20 bu. per acre. One plat with 94 per cent. of a stand yielded in 1889 at the rate of 26.7 bu. per acre. The ears and kernels are below medium size and the ears are very rough. It would not be profitable to grow here. It was ripe enough to cut in 118 days from planting.

RICE VARIETY—*Medium maturing*—White.

Monarch rice; Suffern, Iowa Seed Co.

Stalk, 7½ to 8½ ft. high; joints, medium or rather short, leafy; tassel, with few branches, long, slender, drooping; suckers, many, reaching nearly the size of the parent stalk; husk blades, very small. Ear, 3½ to 5 ft. from the ground, dull white, with a

white cob, tapering, 6.5 to 8 in. long, 1.25 to 1.5 in. in diameter; cob, .65 to .85 in. thick; kernels, rounded over the butt; tip, well filled; rows, 14 to 18, usually regular; pairs of rows, not distinct. Kernel, .2 to .25 in. broad, .3 to .35 in. deep, pointed. There were two plats of this variety with 92 and 66 per cent. of a stand, respectively, which yielded at the rate of 46.1 and 27 bu. per acre. A single plat of the same kind with 96 per cent. of a stand yielded in 1889 at the rate of 78.7 bu. per acre. The ears are of good size and shape with large kernels, but are very rough. It was ripe enough to cut in 135 days from planting.

White rice; Harris, Iowa Seed Co. *Snowball;* Landreth, Salzer. *Wisconsin prolific;* H. G. Faust.

Stalk, 7 to 8 ft. high, rather short-jointed, leafy, dark green; tassel, long, slender, with few branches, drooping; suckers, many, growing to about half the size of the parent stalk; very few husk blades. Ear, 3 to 5 ft. from the ground, strongly tapering, dull white, with a white cob, 5 to 7 in. long, 1.3 to 1.75 in. in diameter; cob, .65 to .8 in. thick; kernels, rounded over the butt of the ear and usually filling out the tips; rows of kernels, 14 to 20, regular; pairs of rows, not very distinct. Kernel, pointed, the tip being continued into a spine which is either depressed or nearly erect, .15 to .2 in. wide, .3 to .35 in. deep. Five plats of this variety, with 47, 58, 71, 79, and 42 per cent. of a full stand, respectively, produced at the rate of 25.3, 19.1, 31.2, 29.5, and 15.7 bu. per acre. The corn was ripe enough to cut in 132 days from planting. A single plat yielded in 1889 at the rate of 86.3 bu. per acre. This differs from *monarch rice* in having a shorter ear with a greater number of rows of kernels, and the kernels more slender.

Silver lace; Wilson, of which only two kernels grew out of the 200 that were planted, seems to be the same as *white rice.*

Egyptian; Gregory.

Stalk, 7½ to 9 ft. high, rather slender, pale green; tassel, long, slender, with few branches, drooping; suckers, many, reaching nearly the full size of the parent stalks. Ears, 4 to 4½ ft. from the ground, tapering, clear white, with white cob, 6.5 to 7.25 in. long, 1.2 to 1.5 in. in diameter; cob, .7 to .8 in. thick; kernels, even at the butt; tip, well filled; rows of kernels, 14 to 18, regular. Kernel, .2 in. wide, .3 to .4 in. deep, pointed. A single plat of this variety with 79 per cent. of a full stand gave a yield of 30½ lb. of ears, or at the rate of 34.3 bu. per acre. The ears are of good size and are smoother than the other varieties of rice corn. Kernel, very large. It differs from *monarch rice* and *white rice* in its lighter color, and is intermediate between them in size. It was ripe enough to cut in 132 days from planting.

RICE VARIETY—*Medium maturing*—Colored, not yellow.

Page's striped rice; Iowa Seed Co.

Stalk, 6½ to 7 ft. high, slender; joints, long; blades, dark green; tassel, long, slender, drooping, with but few branches; suckers, few, small; husk blades, small. Ear, 2 to 3 ft. from the ground, tapering or nearly cylindrical, usually white and red striped, with speckled cobs, 4.5 to 6.5 in. long, 1.2 to 1.5 in. in diameter; cob, .5 to .75 in. thick; kernels, even or rounded at the butt; tip, well-filled; rows, regular, 12 to 16. Kernel, .15 to .25 in. broad, .3 to .4 in. deep, sharp-pointed; spines, usually depressed. A single plat with 68 per cent. of a stand yielded 13¾ lb. of ears, or at the rate of 15.5 bu. per acre. The ears are below and the kernels above the average size. The ears are very rough. It was ripe enough to cut in 132 days from planting.

RICE VARIETY—*Late maturing*—White.

California; Wilson.

Stalk, 4 to 5 ft. high, heavy, short-jointed, leafy, dark green; tassel, short stiff, much-branched, bunchy; suckers, many, about half the size of the parent stalk. Ear,

2 to 3 ft. from the ground, nearly cylindrical, creamy white, with a white cob, 2½ to 3¼ in. long, 1 to 1.15 in. in diameter; cob, .5 to .6 in. thick; kernels well rounded over the butt; tip, perfectly filled; rows of kernels, usually so irregular as to be indistinguishable. Kernel, very slender, .1 to .15 in. broad, .3 to .35 in. long, pointed; the spine, usually depressed. A single plat with 12 per cent. of a stand yielded 2½ lb. of ears, or at the rate of 2.8 bu. per acre. The ears and kernels are both very small. It pops well and is of very good quality. This was the latest variety of pop corn grown this season, being ripe enough to cut in 146 days from planting.

PEARL VARIETY—*Early maturing*—White.

Nonpareil; Gregory.

Stalk, 5 to 6 ft. high, slender, not very leafy, dark green; tassels, long, with few branches, drooping; suckers, few, small; husk blades, small. Ear, 1½ to 2 ft. from the ground, cylindrical, sometimes enlarged at the butt, dull white, with a white cob, 6 to 8½ in. long, .9 to 1.1 in. in diameter; cob, .45 to .6 in. thick; kernels, barely even at the butt; tip of ear, well filled; rows of kernels, 8, very regular; pairs of rows, separated at the butt. Kernel, flattened across the top, .25 in. broad, .2 in deep. A plat of this variety with 67 per cent. of a full stand, yielded 16 lb. of corn, or at the rate of 18 bu. per acre. The ears are long, slender, smooth, and the corn pops well. It is entirely distinct from any other variety of pop-corn in having only 8 rows of kernels to the ear. It was ripe enough to cut in 118 days from planting.

PEARL VARIETIES—*Medium maturing*—White.

Common white; Landreth.

Stalk, 10 to 12 ft. high, rather slender, short-jointed; blades, large, dark green; tassel, short, much-branched, drooping; suckers, many, reaching nearly the full size of the parent stalk. Ear, from 5 to 7 ft. above the ground, cylindrical, white, with a white cob, 6 to 8 in. long, 1.1 to 1.4 in. in diameter; cob .65 to .85 in. thick; kernels, even or only slightly rounded past the butt; tip, fairly filled; rows of kernels, 12 to 16, very regular. Kernel, .25 in. broad, .25 in. deep, rounded over the top, smooth. This variety yields well. One plat with 78 per cent. of a full stand, yielded this year 45¼ lb. of ears, or at the rate of 50.9 bu. per acre. A plat of the same variety in 1889 with 91 per cent. of a stand yielded at the rate of 98.3 bu. per acre. It pops well; the ear is above medium size, very smooth though slender; kernels of medium size. It was ripe enough to cut in 139 days from planting.

Pearl; Dreer.

Stalk, 7 to 8½ ft. high, rather large; blades, large, dark green; tassel, long, with few branches, drooping; suckers, many, reaching about three-fourths the size of the parent stalk. Ear, 3.5 to 4 5 ft. from the ground, nearly cylindrical, clear white, with a white cob, 6 to 8 in. long, 1 to 1.4 in. in diameter; cob .55 to .65 in. through; kernels, even at the butt; tip, usually well filled; rows of kernels, 10 to 14, regular. Kernel, .2 in. broad, .25 in. deep, very smooth, somewhat flattened over the top. One plat with 88 per cent. of a full stand yielded 41 lb. of ears, or at the rate of 46.1 bu. per acre. The ears are long, slender and smooth. It differs from the *common white* in having longer and more slender ears and in making a much smaller growth of stalk. It was ripe enough to cut in 125 days from planting.

Maple Dale prolific; Wilson.

Stalk, 6 to 8 ft. high, rather heavy, short-jointed, leafy, dark green; tassel, slender, with few branches, drooping; suckers, many, reaching about three-fourths the size of the parent stalk. Ear, 3 to 4½ ft. from the ground, nearly cylindrical, dull white, with a white cob, 5 to 6.5 in. long, 1.1 to 1.5 in. in diameter; cob, .6 to .7 in. thick; kernels, rounded over the butt; tip, well filled; rows of kernels, 12 to 14, regular. Kernel, .2 to .25 in. broad, .25 to .3 in. deep. A single plat with 23 per cent. of a stand yielded 8¾

lb. of ears, or at the rate of 9.8 bu. per acre. This variety is smaller and apparently no more prolific than the *common white* or *pearl*. Its chief attraction is in the name. It was ripe enough to be cut in 139 days from planting.

Silver lace; Burpee.

Stalk, 6 to 7 ft. high, short-jointed, leafy, dark green; tassel, much-branched, slender, drooping; suckers, many, reaching nearly the full size of the parent stalk. Ear, 3 to 4 ft. from the ground, tapering, dull white, with a white cob, 4.5 to 6 in. long, 1 to 1.25 in. in diameter; cob, .55 to .75 in. through; kernels, even at the butt; tip, poorly filled; rows of kernels, 14 to 18, regular or irregular. Kernel, .15 to .2 in. broad, .2 to .25 in. deep, smooth. A single plat with 11 per cent. of a full stand yielded 3 lb. of ears or at the rate of 3.4 bu. per acre. The ears are rather small and all were poorly filled. Its only merit seems to be that it is different from the other varieties. It was ripe enough to cut in 125 days from planting.

PEARL VARIETY—*Early Maturing* —Yellow.

Golden Tom Thumb; Wilson, Burpee.

Stalk, 2 to 3 ft. high, slender, blades small; tassel, short, stiff, few or no branches; no suckers; husk blades, very small. Ear, 6 to 12 in. from the ground, yellow, with a white cob 2.25 to 3.25 in. long, .75 to .9 in. in diameter; cob, .5 to .6 in. in diameter; kernels, even at the butt; tip well filled, but the cob, poorly filled as a whole; rows of kernels, 8 to 12, very irregular. Kernel, smooth, .15 to .2 in. broad, .2 to .25 in. long.

This small corn is not worth growing, except as a curiosity. It ripens earlier than any other variety, being ripe enough to cut in 97 days from planting. Two plats with 22 and 51 per cent. of a stand, respectively, gave yields of 2.8 and 3.9 bu. per acre.

PEARL VARIETIES—*Medium Maturing*—Yellow.

Queen's golden; Rawson, Station.

Stalk, 7 to 8 ft. high, rather heavy; joints, medium length, leafy; tassel, slender, much branched, drooping; suckers, few, small; husk blades, very small. Ear, 4 to 4½ ft. from the ground, light, or lemon yellow, with a white cob, tapering, 6½ to 8½ in. long, 1.25 to 1.55 in. in diameter; cob, .75 to .9 in. thick; kernels, rounded over the butt; tip, well filled; rows of kernels, 12 to 16, regular. Kernel, we ll rounded over the top, .25 to .3 in. broad, .3 to .35 in. deep, smooth, slightly inclin ed to dent, as shown by the texture which is not of a flinty character throughout. This variety produces a large yield; 2 plats with a full stand gave an average yield in 1889 of 112.1 bu. per acre. Two plats with 52 and 17 per cent. of stand, respectively, gave yields in 1890 of 31.8 and 9 bu. per acre. The ears are large, smooth, and of good shape. It pops well, has a yellowish color when popped, and has the taste peculiar to yellow corn. It was ripe enough to be cut in 132 days from planting.

Dwarf golden; Gregory.

Stalk, 7 to 8½ ft. high, slender, rather long-jointed, dark green; tassel, short, stiff, many branches; suckers, few, small. Ear, 12 to 18 in. from the ground, tapering, orange yellow, with a white cob, 6 to 8 in. long, 1.2 to 1.6 in. thick; cob, .7 to .9 in. thick; kernels, even or rounded over the butt; tip, well filled; rows of kernels, very regular; pairs of rows, indistinct. Kernel, short, smooth, .25 to .3 in. broad, .3 to .35 in. deep, slightly inclined to dent. This variety yields well; a single plat with 76 per cent. of a full stand yielded at the rate of 52.6 bu. per acre; in other words, a plat of 1-80 of an acre yielded 46¾ lb. ear corn. The ears are of large size and good shape, with very large kernels. It pops well, retaining a yellowish color when popped, and has the taste peculiar to yellow corn. It differs from *queen's golden* in the color being darker and in having the ears borne much lower on the stalk. It was ripe enough to cut in 132 days from planting.

THOMAS J. BURRILL, PH. D., *Horticulturist and Botanist.*
GEO. W. MCCLURE, B. S., *Assistant Horticulturist.*

GROWTH AND INCREASE OF DRY MATTER IN CORN.

Experiment No. 90.

The following preliminary report is made of a series of observations on the rate of growth of field corn, as determined by measurements and by ascertaining the quantity of dry matter at different dates. The design is to attempt to determine by a series of such observations the relations between growth, both of the whole plant, and of its different constituents, and meteorological conditions; and also to help to determine the stage of growth at which the plant has the greatest food value.

The plan adopted is to cut, to measure, and to examine by chemical analysis at stated intervals during the season of growth, the stalks of duplicate or triplicate hills grown under conditions as nearly similar as possible. The average results of the examination of six or nine stalks will usually give a fairly correct basis for comparison. Work of this nature has been done during 1889 and 1890, under very similar conditions of soil, cultivation, time of planting, etc., but with different varieties.

The condensed table on p. 449 shows that corn planted the first week of May reached its maximum height (about 10 ft.) August 5th in 1889, and July 21st in 1890. In each year a growth of 25 in. was made in seven days; July 8th to 15th in 1889, and June 23d to 30th in 1890. In the latter year a growth of 48 in. was made in 14 days, from June 16th to June 30th. With the average temperature nearly the same, but with two inches greater rainfall in May, 1889, than in May, 1890, the corn made much less growth during the month in the former year. With the average temperature nine degrees lower and the rain-fall much greater in June, 1889, than in June, 1890, the corn had not half the height at the end of the month in the former that it had in the latter year. With the average temperature nearly the same, but with a much greater rain-fall in July, 1889, than in July, 1890, the growth in the latter year was much more rapid.

The results each year show that the quantity of solid or dry matter in the corn plant is relatively very small in the early stages of its growth. When the corn had reached half its total height it had but about seven per cent., and when in full tassel about 36 per cent. of its maximum weight of dry matter. When the kernels were in the soft milk stage, the plants contained about 62 per cent. of the maximum weight of dry matter in 1889, and about 78 per cent. in 1890. In 1889, there was a continuous increase of weight, with but a single exception, until the corn was ripe. In 1890, there was greater variation, but the greatest weight was at the final cutting, when the corn was thoroughly ripe. Some of the variations near the close of the season are partly explained by the dropping of the dried leaves and tassels.

In *Experiment No. 71, Corn-Fodder, Effect of Ripeness*, an early maturing variety of dent corn was planted May 5, 1890. One plat was cut when in the milk or roasting-ear stage; one when the kernels were dented and fairly hard; and one when the corn was fully ripe. The weights for

equal plats when thoroughly field-cured were 1,328, 1,710, and 1,810 lb. The weights of the ear corn from three plats, each one-tenth of an acre, were 302.50, 425.75, and 475.25 lb. The weights were determined of several samples of 100 kernels each from the corn on these three plats, and found to be 19, 29, and 31 grams per 100 kernels.

The indications of these trials clearly are that, so far as quantity of dry matter is concerned, there is a great loss in cutting corn before it is fairly matured, whether it is designed for field-cured fodder or for ensilage;

TABLE SHOWING AVERAGE HEIGHT AND GRAMS OF DRY MATTER OF CORN PLANTS CUT AT DATES AND STAGES OF GROWTH GIVEN.

Date of cutting.	Av. height of stalk, in.		Grams dry matter per hill.	Stage of growth.
	To top of leaf.	To top of tassel.		
1889.				
June 10.....	7.6	.....	.5	.....
" 17.....	14.7	.....	2.48	.....
" 25.....	26.7	.....	10.11	.....
July 1.....	42.5	.....	33.84	.....
" 8.....	53.3	.....	75.45	.....
" 15.....	78.2	.....	197.98	.....
" 22.....	92	75.2	322.90	Tassels showing.
" 30.....	103.5	100.8	408.07	All in tassel, bloom, and silk.
Aug. 5.....	121.8	120	589.09	.....
" 12.....	110.5	111.6	681.54	Silk dead or partly dead.
" 19.....	110.3	109.8	724 50	Soft milk stage.
" 26.....	110.8	108.1	949.52	Milk stage or past.
Sept. 2.....	106 9	103.5	906.21	Mostly glazed.
" 10.....	108	108	1,034.55	Milk stage to ripe.
" 16.....	106.3	106	1,176	Ripe, except one ear.
1890.				
June 2. ...	14.3	.....	2	.....
" 9.....	23	.....	8.45	.....
" 16.....	38.3	.....	30.17	.....
" 23.....	61.3	.....	96.84	.....
" 30.....	86.6	.....	174.4	.....
July 7.....	98	.....	405 85	.....
" 14.....	110.6	102.6	502.7	In tassel.
" 21.....	118.6	117	687.47	.....
" 28.....	114.6	113	868.86	.....
Aug. 4.....	109.3	110.3	892.93	.....
" 11.....	106.3	109.3	878.83	.....
" 18.....	113.3	106	1,033.6	Milk stage.
" 25.....	115.6	118.3	1,180.45	Mllk stage.
Sept. 2.....	113.6	113.3	*1,155.	Kernels, dented; husks, partly dry; bottom leaves, dry.
" 8. ..	112.6	110.6	1,264.33	Ears, dented except one; husks, mostly dry; leaves, one-half dry.
" 15.....	106	104	*1,032.4	Nearly or entirely ripe.
" 22.....	114	117.6	1,046.1	.....
" 30.....	112	111.3	1,327	.....

*Field notes show that September 2d, the stalks in one hill had been blown down and the ears had not developed, and that September 15th, one stalk had been broken off and two others were of less than normal size.

that to cut it for soiling or summer feeding, when it is in tassel even, is to lose more than half its possible food supply; that to cut it when the kernels are in the soft milk stage causes a loss of one-fourth or more of the possible yield of dry matter; that the dry matter of the corn kernels increases relatively more than that of the stalks in the later periods of growth.

Other considerations will greatly affect the decision as to the best time for cutting. This preliminary report does not take account of the digestibility or palatability of the fodder at different stages of maturity, nor of the greater or less degree of loss in curing or from exposure, as affected by cutting at earlier or later stages. In case wet weather follows the cutting, the immature corn would probably be most injured. In some years corn cut when in the milk stage and left in the field in ordinary sized shocks would become unfit for food. On the other hand the longer the corn is left uncut the greater the danger of injury from storms or from the loss of leaves, etc. When fed fresh, the immature corn is usually very palatable—much more so than when dried. In some cases, at least, the earlier cut corn-fodder is less palatable when dried than is that cut when more mature.

In 1889, the variety of corn used was Edmonds, an early maturing yellow dent variety. It was planted May 4th, in rows 3 ft. 8 in. apart each way. Fifteen pairs of hills were selected and thinned to three stalks each June 10th. The plants were quite uniform throughout the plat. Two hills were cut close to the ground at the dates given in table on page 449 and the averages in height and weight are given.

In 1890, Burr's white, a medium maturing variety, was planted May 5th in rows as in 1889. Twenty-one sets of three hills each were selected as nearly alike as possible and thinned to three stalks each June 2d. These hills were cut at dates specified in the table on p. 449, which gives the average of the results.

The field work of this experiment during 1889 and 1890 was under the direct charge of Professor T. F. Hunt, now of the State College and Agricultural Experiment Station of Pennsylvania.

G. E. MORROW, A. M., *Agriculturist.*

WEIGHT OF EAR CORN PER BUSHEL OF SHELLED CORN.

Several inquiries have been received as to the number of pounds of ear corn required to make a bushel, 56 lb., of shelled corn at different seasons of the year, the implication or direct statement being that the common practice of requiring 70 lb. is, this season, more to the interest of the buyer than of the seller. The percentage of water in corn in central Illinois when

husked in the autumn of 1890 was considerably less than in the years immediately preceding. We have found 70 lb. for the early; 73 for the medium; and 78 for the late maturing varieties tested at this Station, was sufficient to produce a bushel of air-dry corn at the last of October.

Tests have been made Feb. 14, 1891, in which a trifle over 65 lb. of Murdock, an early maturing; 66½ lb. of Leaming; less than 67 lb. of Burr's white; and a little over 66 lb. of mixed varieties of yellow dent made 56 lb. of shelled corn. The ears were not especially selected. The corn was taken from the crib in three cases and from shocked corn in the fourth. Probably a little more would be required if large quantities of either variety tested were shelled by large power-shellers. The indications are clearly that 70 lb. is more than is necessary to make a bushel of shelled corn this season in central Illinois.

When thoroughly air-dry, 12 lb. of cob per bu. or 68 lb. of good ear corn for 56 lb. of shelled corn would seem a maximum for any variety suitable to be grown in this latitude. When the ears have been carefully selected, as in selecting corn for seed, less than this should be sufficient. When delivered to the buyer in the ear, there are often many partly shelled ears, inferior ears, some dirt, etc.

No fixed rule can be given for determining the proper weight of ear corn for a bushel of shelled corn soon after husking. The per cent. of moisture in both cob and kernel varies greatly in different seasons and in different varieties.

G. E. MORROW, A. M., *Agriculturist.*

All communications intended for the Station should be addressed, not to any person, but to the

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The bulletins of the Experiment Station will be sent free of all charges to persons engaged in farming who may request that they be sent.

SELIM H. PEABODY,
President Board of Direction.

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*Resigned January 15, 1891.