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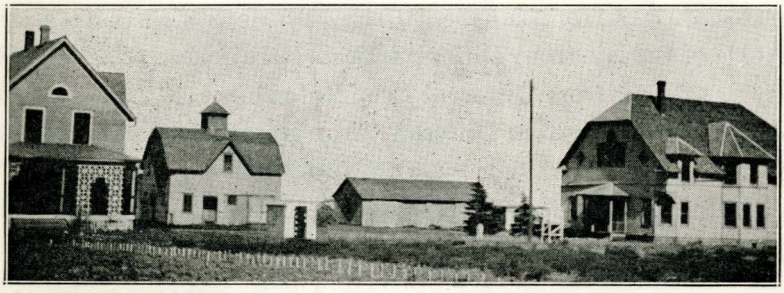

Agricultural Experiment Station
South Dakota State College
of Agriculture and Mechanic Arts
Agronomy Department

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Summary of Bulletin

The present report may be said to constitute a history of yields of staple crops from Highmore Experiment Farm secured within the period 1912 to 1930 inclusive.

These yields have been secured under the climatic variations that occurred within that period; from definite crop sequences or rotations. Results of this nature are the only reliable basis for land utilization.

In a number of instances the "odds" indicate that increases or decreases in yield are the resultant effect of the rotation in which the given crop occurs.

Crop producers inquire in effect whether the facts established about crop sequences and rotations can be formulated into rules which tell what crops to grow. Attempts to state such rules must be a matter of logical deduction, and not absolute proof. Such deductions are nevertheless the result of research and possess value both for what they say and what they refrain from attempting to conclude.

This history of crop yields points to the conclusion that the most efficient crop sequence at Highmore from the standpoint of getting value out of the soil in the form of crops is made up of the following balanced elements:

I. Cultivated Crop. 2. Small Grain Crop. 3. Legume Crop.

The foregoing statement is made from the standpoint of the present investigation, because of the following further considerations:

1. The highest yield of all grain crops was produced when such crop was seeded on land that was cultivated in the previous season, either in a cultivated crop or in the case of barley and oats on fallowed land.

2. Moreover some one of the small grain crops, whether wheat, rye, barley, oats, flax, is indicated as one element in an efficient cropping system in Highmore area because the money returns from them are comparatively high and they severally furnish a wide range of succession following any cultivated crop.

3. The inference is drawn that only one grain crop in succession of whatever kind should be utilized in a cropping system in Highmore area, in part because of the reduced yields of small grain from land in continuous small grain. Tables 2, 4, 6, 8, 10, 12, 14.

4. A legume crop is indicated as one element of the most efficient crop sequence for Highmore area, for the following reasons:

(a) The highest yield of corn per acre was produced in rotations where a legume was included. Table 15, page 27.

(b) Likewise the yields of winter rye, emmer, spring wheat, barley and winter wheat were increased in rotations where a legume (usually sweet clover) was introduced into the rotation, whether plowed under directly for green manure or harvested for hay or seed or both.

(c) The average gross money return from corn, wheat, oats, barley, flax, rye, emmer, was higher (88 cents per acre per year) where a legume (plowed under for green manure) was employed as one element in the rotation than where it was omitted. See Table 17, page 36.

5. The generalization that crop sequences should follow the plan indicated (1) cultivated crop, (2) small grain crop, (3) legume, may apparently be modified, without destroying efficiency, so long as the general order of the kind of crops in the sequence is preserved. Thus the highest money return from any one rotation came from No. 8—corn, barley + sweet clover, potatoes, barley (alfalfa), which preserves the order of crop sequence although extending the period of years covered.

6. The order of sequence is apparently more important from the standpoint of efficiency than the kind of crop itself. Thus winter wheat produces comparatively well directly after corn (see Table 14) but not better than after millet cultivated in rows. Again barley produces well following corn, but even better following potatoes, likewise a cultivated crop.

7. To summarize then as briefly as possible:

A crop producer in Highmore area may deviate concerning the particular crops he chooses to grow, no doubt according to the use intended for the given crops, but in order to produce such crops most efficiently he must adhere to the sequence (1) cultivated crop, (2) small grain crop, (3) legume.

A Report of

Yields from Several Cropping Systems and Crop Rotations at Highmore Experiment Farm and Some Deductions

A. N. Hume

Agronomist and Superintendent of Substations

Highmore Experiment Farm was established on land which was deeded for use in carrying out experiments in the production of crops by Frank Drew and his wife Lillie L. Drew in 1899. The experiment station was established on this land during the session of legislature in 1899. The farm consists of 117.15 acres of land, and is described as all that part of the NE¼, Sec. 11, T. 112 N., R. 72 W., lying north of the C. and N. W. R. R. right of way, Hyde county, South Dakota. The farm borders on the city of Highmore at its northwestern boundry. The state highway No. 14 passes by the farm directly on the north.

Soil of Highmore Experiment Farm

Two types of soil are comprised in Highmore Experiment Farm, namely: Williams Silt Loan, and Fargo Silt Loan (See appendix, page 65).

The soils of Hyde county, in which the Experiment Farm is located, have developed over glacial drift, a dark colored shale, and alluvial deposits, consisting of sediments derived from the two other materials.

The Williams soils (which include the largest area of the Experiment Farm) "are the most extensive and important in the county."

The soils of the farm may be considered generally representative of extensive areas in central South Dakota.

Climate and Topography

Highmore substation serves as a co-operative weather observation station with the United States Weather bureau, such observations being supervised for the Agronomy Department by J. G. Hutton, records being taken by the foreman, S. W. Sussex at Highmore.

The mean winter temperature is 16.2° F. and the recorded absolute minimum is —45°. The mean summer temperature is 69.8° and the absolute maximum is 108°. The average date of the last killing frost is May 14, and that of the first is September 27. This is an average frost-free season of 135 days. The latest killing frost recorded is June 6, and the earliest is September 8.

The mean annual rainfall recorded is 18 inches. The heaviest precipitation takes place during spring and summer and the lightest during the winter. The wettest year recorded was 1920, (See Table 14, Appendix, page 67), when there was 27.31 inches rainfall, and the driest year was 1890 when there was 10.28 inches.

The elevation at Highmore is 1887 feet. (See Soil Survey of Hyde county, U. S. Bureau of Chem. and Soils, So. Dak. Exp. Sta. No. 18, Ser. 1925, p. 3).

Conditions are Typical, and Long-Time Results are Trustworthy

The foregoing brief statements about Soil and Climate at Highmore are made for the purpose of indicating that farming conditions, and the conditions of life in general at Highmore Experiment Farm compare with those existing in wide areas of South Dakota and of the Great Plains Area of the United States. Likewise climatic and soil conditions where varieties and strains of crops grow at Highmore may be compared with those in other parts of the world; e. g., Russia, which was the source of [1]Kubanka wheat, [2]Sixty-day oats and [3]Kursk millet, all of which have been closely associated with Highmore Experiment Farm. Highmore was instrumental in introducing and disseminating these and other cereal and forage crops into South Dakota.

Moreover a number of the yields from crop experiments including crop-rotations and soil-fertility experiments are of duration long enough to be significant, which is not true of similar results covering only a short term of years. Highmore results are thus worth using as a basis for farming operations. Limited experiments were started at Highmore in 1897[4]. A number of observations of rainfall were taken at Highmore, by Mr. S. Drew, then Co-operator with the United States Weather Bureau, and such observations have been continued with minor interruptions till the present time. The Agronomy Department of South Dakota Experiment Station has recorded these Co-operative observations, and reported them in duplicate to the United States Weather Bureau since 1908.

Crop Sequences and Crop Rotations

In the present bulletin for purposes of discussion the term **Cropping System** is used to designate a general plan, or arrangement of crops; according to the broader classification of such crops; e. g., whether (1) Cultivated Crops, (2) Small Grain Crops, (3) Legume Crops.

Obviously, within each of these Cropping Systems, one or several crop-sequences or Rotations may be arranged. **Cropping System** is a broader and more inclusive term than **Crop Rotation.**

Crop Rotation in this discussion means a specific statement of the kinds of crops and the order with which they follow one another.

The one-tenth acre plots which serve as the basis for the systematic cropping systems to be discussed in the present bulletin were first laid out permanently in 1908. The original series of plots as laid out by C. Willis, then Agronomist, comprised 10 series, five of which embraced plots numbered consecutively from 1 to 69; the remaining five series embraces plots numbered consecutively from 1 to 33.

This original series of plots remained until 1911, when it was altered slightly by the writer. This alteration provided for a usual division of plot series into one acre units with driveways between the acres in both directions. Driveways had previously been laid out extending between series east and west—the change provided for new driveways between acres extending north and south. A number of these drives were made possible by utilizing the 11th plot between two series of ten each. The new change made it possible to lay out acres which might be devoted entirely to given crops in a system in every given year, being also possible to cultivate or harvest or otherwise handle those separate acres in their entirety with driving across them in either direction and having turn rows on all sides. The changes in plots made in 1912, involving the making of acre-units surrounded by drives or divisions were made with as small a number of changes in crop experiments on the ground as possible. Generally it was found possible to continue the actual crop which had been previously put out on a given piece of ground. Since 1911, namely in 1913 and 1914, three new series of acres have been laid out on the north side of Highmore experiment farm, thus making a total of 13 series.

A diagram of Highmore experiment farm, showing its topography and outline of experiment plots, arrangement of rotations and principal soil treatments. See Plate I, center of bulletin. An examination of the diagram may serve to explain the system of cropping more clearly than is possible otherwise.

Examination of the foregoing Plate I will make it evident that the following cropping systems or rotations are included among the trials conducted at Highmore. These are put down for comparison along with the numbers indicating the acres and corresponding plats where the crops are produced year after year.

Crop Sequences Under Comparison

Number of sequence as put down in Plate 1	Succession of Crops in given sequence by given rotation	Plots included in acres occupied
1	Corn, Wheat, Peas, Sorghum, Oats, (alfalfa)	101–110 201–210 301–310 401–410 501–510 601–610

2	Corn, Small Grain	701–710 801–810
3	Corn, Small Grain, Legume (plowed under)	901–910 1001–1010 1101–1110
4	Corn, Rye (and sweet clover), Legume (for hay and seed), Millets (in cultivated rows), Small Grains, Peas and rape (plowed under for green manure except plot 6, which is removed for check).	111–120 211–220 311–320 411–420 511–520 611–620
5	Fallow, Small Grain	711–720 811–820
6	Corn, Oats, Wheat	911–920 1011–1020 1111–1120
7	Corn, Barley and Brome grass, Brome grass, Brome grass (alfalfa) Grain and Livestock System	121–131 221–231 321–331 421–431 521–531
8	Corn, Small Grains and clover, Potatoes, Small grains and flax, (alfalfa for hay)	621–625 721–725 821–825 921–925 1021–1025
9	Continuous small grain	1121–1131
10	Corn, Wheat, Sweet Clover	1201–1210 1211–1220 1221–1231
15	Potatoes, Flax (alfalfa)	627–631 727–731 1027–1031
16	Corn, Oats, Wheat (winter)	1301–1310 1311–1320 1321–1331

Why Crop Rotations?

Any crop is produced in the last analysis for the return yields. Such return may usually be measured in terms of money value. The crops in any area that are likely to be produced are those that bring the greatest amount of money, directly or indirectly. In cases where two or more crops in an area are near the top in their ability to produce a money return, and

where also it is difficult to forsee from year to year which of the several crops will yield the highest return, the total land in crop is likely in practice to be divided among the crops in question.

The outcome will be that a given piece of land may produce one crop, one year and another, the next, perhaps another the next; this in a more or less systematic manner. A good deal has been written in English and other languages about the desirability of carrying out systematic crop rotations—agronomic, economic, pathologic.

The present idea is principally to discuss the outstanding effect upon the return by the most important crops on the same land year after year as compared with producing them in succession with one or more other crops. This on the basis of comparative crop yields from systematic rotations at Highmore.

Yields of Corn from Several Crop-Sequences

First are discussed yields of corn, produced in succession with other crops.

In order to make comparison more direct the average yields are arranged in the following Table 1:

TABLE 1.—Comparative average yields of CORN from different rotations at Highmore Experiment Farm; Cropping Systems—1, 2, 3, 6, 7, 8, 10

Year	Comparative Average Yield of Corn (bushels, 70 pounds ears) per acre from given Rotation in Given Year							
	No. 2 Corn, Wheat	No. 6 Corn, Oats, Wheat	No. 3 Corn, Wheat, Sw. Clover (plowed under)	No. 3-a Corn, Wheat Sw. Clover (for hay)	No. 7 Corn, Barley, Brome, Brome, Alfalfa	No. 1 Corn, Wheat, Peas (for crop), Sorghum, Oats, Alfalfa	No. 8 Corn, Wheat, Sw. Clover, Potatoes, Sm. Grain and Flax, Alfalfa	No. 10 Corn, Wheat, Sw. Clover (harvested for hay and seed)
1912	17.6	18.4	17.1	13.7	22.5	16.8	19.7	13.7
1913	9.5	6.5	7.1	8.5	8.7	8.6	6.9	3.7
1914	12.0	8.4	14.8	16.6	7.5	8.2	12.9	15.7
1915	24.9	25.6	28.9	28.9	35.0	31.5	21.5	26.4
1916	22.4	21.9	23.6	22.0	20.4	25.9	20.6	23.8
1917	17.8	12.3	18.0	18.8	6.9	17.7	12.9	6.1
1918	26.9	32.3	28.0	29.1	27.1	31.6	26.8	25.3
1919	23.4	27.6	23.9	24.7	24.0	22.7	23.7	22.9
1920	34.3	34.8	37.6	30.2	39.8	35.5	31.7	31.1
1921	7.0	18.7	21.8	31.0	11.2	6.9	00.0	14.7
1922	44.0	50.2	47.0	46.6	38.8	55.7	32.8	28.6
1923	40.7	41.4	37.1	34.4	38.4	38.8	45.8	40.1
1924	18.5	18.9	15.2	16.8	13.7	13.9	15.1	13.1
1925	3.2	10.0	5.4	4.0	5.0	8.4	0.0	0.0
1926	0.0	0.5	drought	0.0	0.0	0.0	0.0	0.0
1927	31.1	32.9	29.3	28.6	35.5	34.6	28.6	24.2
1928	5.6	5.2	9.3	13.0	2.9	3.4	1.9	2.1
1929	0.0	0.0	1.8	1.0	0.0	0.0	0.0	0.0
Av.	18.8	20.3	20.3	20.4	18.7	20.1	16.7	16.2

Concerning Yields of Corn from the Foregoing Crop Rotations

In the foregoing Table 1 the average yields put down in the lower horizontal line are not widely different from one another.

If one compares the yield from Rotation No. 2—corn, wheat—with the

yields from other rotations separately, it appears possible to arrange the following:

No. of Rotation	Crop Sequence	Corn yield from rotation No. 2 minus yeild of given rotation	Odds that the foregoing difference is significant
2	Corn, wheat	0.0	
6	Corn, oats, wheat	−1.5	10.4 :1
3	Corn, wheat sweet clover (plowed under)	−1.5	22.2 :1
3-a	Corn wheat sweet clover (hay or seed)	−1.6	5.12 :1
1	Corn, wheat, peas (for crop) sorghum, oats, brome, alfalfa	−1.3	7.6 :1
7	Corn, barley and brome, brome, brome, alfalfa	0.0	0.3 :1
8	Corn, wheat and sweet clover, potatoes, flax, alfalfa	2.1	81.6 :1
10	Corn, wheat, sweet clover (for hay and seed)	2.6	35.4 :1

Such a statement as the foregoing means substantially that corn yields from Rotations 1, 3 and 6 are all equivalent to one another and all of them are higher than corn yields from Rotations 7, 8 and 10.

Highmore Field Day, 1925

A group of interested growers examining a field of early oats.

Yields of Wheat from Several Rotations at Highmore

Nine of the cropping systems outlined ,page 7, of this bulletin which have been pursued at Highmore for a period of nineteen years produce wheat for one or more of the years in the succession. A summary of average yields of wheat from these several rotations is put down in Table 2 following.

Wheat in Rotation No. 2 produced the highest average money return among crops tabulated at Highmore, and stood next to winter rye (in Rotation 3). (See Table No. 16, page 30). The highest average yields of spring wheat were produced where land previously in corn was utilized for a seed bed.

TABLE 2.—Comparative Average Yields of WHEAT From Different Rotations at Highmore Experiment Farm

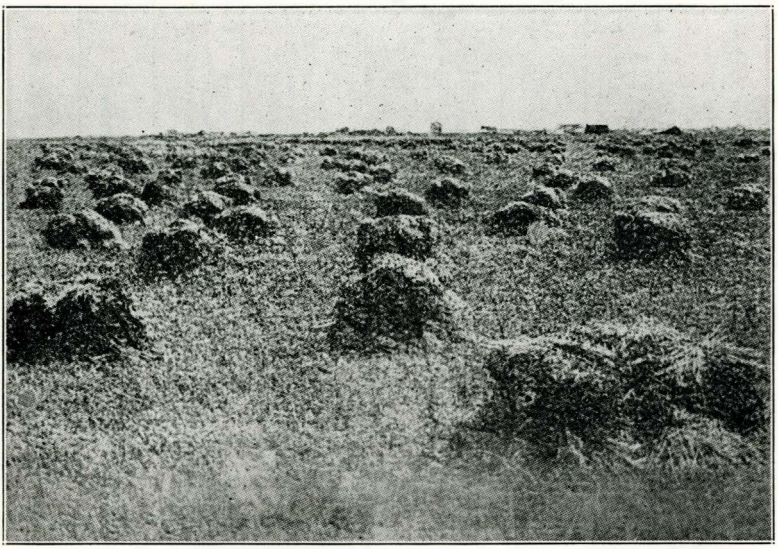
	Comparative Average Yield of Wheat Per Acre from Given Rotation in Given Year								
Year	No. 2 Corn, Wheat	No. 6 Corn, Oats, Wheat	No. 3-a Corn, Wheat Sw. Clover (for hay)	No. 3 Corn, Wheat, Sw. Clover (turned under)	No. 1 Corn, Wheat, Peas (for seed), sorghum, Oats, (alfalfa)	No. 8 Corn, Wheat and Sw. Clover, Potatoes, Grain and Flax, (alfalfa)	No. 10 Corn, Wheat, Sw. Clover (harvested for hay and seed)	No. 5 Fallow, Wheat	No. 9 Continuous Wheat
1912	3.7	0.4	0.3	0.4	0.5	† 1.2	* 0.4	0.6	0.3
1913	8.2	1.4	0.0	0.8	5.6	† 2.9	0.0	3.3	0.0
1914	9.5	9.9	10.3	10.4	9.7	† 9.8	10.6	10.1	8.2
1915	23.9	24.0	16.0	15.9	29.2	†22.2	25.3	19.3	18.9
1916	15.6	15.0	15.0	16.3	18.5	†15.6	18.1	13.3	12.4
1917	15.7	11.6	18.3	17.1	18.3	†17.5	15.9	15.6	7.4
1918	21.5	19.9	36.3	27.7	28.4	17.4	9.6	24.3	5.5
1919	18.8	16.3	17.5	17.5	20.0	21.9	17.7	20.8	16.1
1920	19.8	14.7	20.0	16.7	24.4	9.7	19.0	13.7	18.8
1921	12.0	2.4	12.7	7.9	10.0	10.4	6.3	10.3	3.4
1922	29.1	16.0	26.5	30.5	32.6	26.8	23.8	29.4	24.0
1923	23.9	13.4	23.9	24.1	24.8	26.0	22.6	25.4	14.2
1924	22.8	16.0	29.5	25.5	21.5	19.9	18.8	25.5	19.8
1925	19.6	5.7	18.5	19.5	17.1	17.3	12.4	22.5	9.5
1926	4.5	1.3	2.2	1.7	3.7	1.6	2.7	2.6	.1
1927	26.9	26.8	32.0	27.7	22.3	23.0	25.1	26.2	15.9
1928	15.2	0.9	16.8	14.3	13.8	7.4	12.2	14.7	.6
1929	9.3	10.1	12.8	12.1	12.6	9.0	4.2	7.5	2.0
1930	15.5	14.6	19.3	16.4	17.9	16.7	14.4	16.7	11.5
Av.	16.6	11.6	17.3	15.9	17.4	14.8	13.7	15.9	9.9

† Average of yields in other columns used for comparison.
* Yield from Rotation No. 3.

No. of Rotation	Crop Sequence	Average yield from rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, wheat	0.0	
9	Continuous small grain	6.7	9999:1
6	Corn, oats, wheat	5.0	4999:1
10	Corn, wheat, sweet clover (hay and seed)	2.9	624:1
8	Corn, wheat, sweet clover, potatoes, flax, alfalfa	1.8	98:1
5	Fallow, small grain	0.7	5.39:1
3	Corn, wheat, sweet clover (plowed under)	0.7	3.91:1
3-a	Corn, wheat sweet clover (removed)	−0.7	2.40:1
1	Corn, wheat, peas (for crop) sorghum, oats, alfalfa	−0.8	5.39:1

The preceding tabular statement is arranged to make more accurate comparison of the average yields of wheat (in this instance mostly durum) from the several rotations put down in foregoing Table 2.

The foregoing indicates that the highest yields of wheat from crop rotations put down in Table 2 were secured from Rotation 3a—corn, wheat, sweet clover (removed for hay), and Rotation 1, yields from these two being practically equal. The third highest yield of wheat was produced in Rotation No. 2—corn, **wheat,** somewhat arbitrarily selected as standard.



A Wheat Crop at Highmore

It may be noted at this point that the yield of wheat per acre produced from land occupied by that crop in the three foregoing rotations is the same, without significant difference.

Likewise this highest yield of wheat in all cases came from land previously in a cultivated crop, in this instance corn.

Yields of wheat from Rotations 9, 6, 5, with wheat on land not previously in a cultivated crop, were lower.

Yields of Corn from Crop Rotations Including Oats

The several cropping systems at Highmore which include combinations of (1) corn, (2) small grain, (3) legume, include rotations having corn and oats, either together or in combination with additional crops.

The following Table 3 summarizes the average yields of ear corn from the kind of rotations indicated, 1912-1929 inclusive.

TABLE 3.—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in Combination With Oats, or Oats and Other Crops

	Comparative Average Yield of Corn Per Acre From Given Rotation in Given Year					
Year	No. 2 Corn, Oats	No. 6 Corn, Oats Wheat	No. 3 Corn, Oats, Sw. Clover (plowed under)	No. 1 Corn, Wheat, Peas (for seed), Sorghum, Oats Alfalfa	No. 8 Corn, Oats*, Sw. Clover Potatoes, Sm. Grain—Flax (alfalfa)	No. 16 Corn, Oats Wheat (winter)
1912	7.3	18.4	17.5	16.8	17.5	†18.4
1913	6.2	6.5	9.1	8.6	6.0	† 6.5
1914	4.9	8.4	19.6	8.2	16.1	† 8.4
1915	28.9	25.6	31.1	31.5	26.0	†25.6
1916	24.1	21.9	24.7	25.9	20.8	†21.9
1917	19.2	12.3	21.1	17.7	12.4	20.3
1918	27.5	32.3	28.5	31.6	29.5	27.0
1919	23.2	27.6	23.1	22.7	21.6	22.4
1920	36.6	34.8	41.0	35.5	33.1	31.0
1921	1.1	18.7	20.6	6.9	00.0	7.0
1922	50.0	50.2	45.4	55.7	37.5	45.3
1923	37.4	41.4	41.2	38.8	54.1	43.9
1924	20.9	18.9	15.7	13.9	12.3	23.4
1925	0.0	10.0	2.3	8.4	0.0	3.3
1926	0.0	0.5	0.0	0.0	0.0	0.0
1927	31.7	32.9	30.0	34.6	25.6	33.5
1928	4.7	5.2	9.7	3.4	1.6	3.6
1929	0.0	0.0	2.3	0.0	0.0	0.0
Av.	18.0	20.3	21.3	20.0	17.5	19.0

* Oats was actually introduced into Rotation 8, in 1918.
† Yields appropriated from similar Rotation No. 6.

The odds that these differences in average yields of **corn** in the lowest horizontal line of Table 3 are significant are as follows:

No. of Rotation	Crop Sequence	No. of bushels (average) lower than Rotation No. 2	Odds that the foregoing difference is significant
2	Corn, oats	0.0	
3	Corn, oats, sweet clover (plowed under)	−3.3	49.5 :1
1	Corn, wheat, peas (for crop), sorghum, oats, (alfalfa)	−2.0	43.9 :1
6	Corn, oats, wheat, (stall manure plowed under)	−2.3	16.0 :1
16	Corn, oats, wheat (Tillage test)	−0.9	4.6 :1
8	Corn, oats and sweet clover, Potatoes, oats, flax, (alfalfa)	+0.5	very small

The indication of the foregoing is that the highest average yield of corn from the foregoing six crop rotations, all of which also include oats, was produced in the 3-year Rotation No. 3—corn, oats, sweet clover (plowed under).

Comparative Yields of Oats in Crop Rotations in Combination with Corn, with or Without Other Crops

The previous section had to do with **corn** yields, when that crop was planted in combinations with oats. The present section discusses the converse, namely yields of **oats** from several crop rotations and the differences which may arise in such yields as influenced by the position which that

crop may occupy in relation to corn alone and in some instances other crops.

Average yields of oats are put down in Table 4 following. These yields represent eight different crop rotations varying from continuous oats to a combination of five annual crops in succession.

TABLE 4.—Comparative Average Yields of OATS From Different Crop Rotations at Highmore Experiment Farm

	Comparative Average Yield of OATS Per Acre From Given Rotation in Given Year								
Year	No. 2 Corn, Oats	No. 6 Corn, Oats, Wheat	No. 3 Corn, Oats, Sweet Clover (plowed under)	No. 1 Corn, Wheat, Peas (for seed), Sorghum, Oats, Alfalfa	No. 8 Corn, Oats and Sw. Clover, Potatoes, Oats, Alfalfa	No. 8-a Corn, Oats and Sw. Clover, Potatoes OATS and Alfalfa	No. 5 Fallow, Oats	No. 9 Continuous Oats	No. 16 Corn, Oats, Winter Wheat
1912	* 0.0	0.0	* 0.0	0.0	* 0.0	* 0.0	* 0.0	* 0.0	† 0.0
1913	* 0.9	0.4	* 0.9	1.3	* 0.9	* 0.9	* 0.9	* 0.9	† 0.4
1914	*28.8	39.2	*28.8	39.7	*28.8	*28.8	*28.8	7.5	† 39.2
1915	98.4	101.0	92.5	99.7	*98.0	*98.0	102.5	93.8	†101.0
1916	60.3	76.6	69.7	72.7	*67.2	*67.2	70.0	54.1	76.6
1918	37.8	37.7	45.3	39.8	37.2	50.5	55.0	20.6	40.9
1917	35.9	35.2	33.4	36.0	*34.8	*34.8	49.7	18.7	37.3
1919	51.3	61.1	69.1	44.1	63.1	61.2	64.1	44.8	60.9
1920	67.5	59.2	69.2	60.0	62.5	67.8	80.0	50.5	23.3
1921	19.7	13.7	11.6	17.6	19.7	26.5	23.8	6.3	11.6
1922	59.7	68.7	69.1	62.8	50.9	70.1	65.1	52.2	50.4
1923	47.5	56.1	56.9	60.6	63.4	60.0	55.0	32.1	62.7
1924	58.4	56.1	68.7	37.1	71.3	81.5	86.8	50.0	40.3
1925	39.1	51.4	43.8	39.3	36.9	51.9	52.5	21.6	44.5
1926	1.9	2.7	0.0	2.7	0.0	0.0	0.0	0.0	0.7
1927	42.3	45.9	46.9	45.1	40.9	44.1	51.3	36.6	42.7
1928	21.6	25.5	16.3	18.4	14.7	17.2	23.1	4.7	17.5
1929	29.7	32.1	33.1	27.0	20.9	20.0	20.6	2.5	21.9
1930	40.6	37.4	41.3	30.6	37.8	44.7	45.6	38.1	26.3
Av.	39.0	42.1	41.9	38.6	39.4	43.4	46.0	28.2	36.7

* Average of yields with which this placed in comparison.
† Appropriated from similar Rotation No. 6.

Observation of the foregoing Table 4, including the average yields put down in the lowest horizontal line, with computation of odds indicating significance of the differences between said yields, leads to the following:

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, Oats	0.0	
9	Continuous oats	+10.86	very great
5	Fallow, oats	−7.21	1104 :1
8-a	Corn, oats and sweet clover, potatoes, oats (alfalfa)	−4.41	83.9 :1
6	Corn, oats, wheat	−3.05	35.61 :1
8	Corn, oats and sweet clover, potatoes, oats (alfalfa)	−0.4	negligible
3	Corn, oats, sweet clover (plowed under)	−2.91	25.75 :1
16	Corn, oats, winter wheat	+2.27	3.17 :1
1	Corn, oats, peas (for crop) sorghum, oats, (alfalfa)	+0.4	negligible

It seems evident from the foregoing, that the yield of oats per acre produced from any of the several crop rotations was appreciably higher than the yield from continuous oats, that is from land where oats is seeded directly following oats in successive years.

Comparative Yields of Corn from Different Crop Rotations at Highmore Experiment Farm, in Combination with Barley, or with Barley and Other Crops

The foregoing sections of this bulletin have discussed yields of **corn** from several rotations containing wheat and also from rotations containing oats. It is possible also to present comparative yields of **corn** from similar rotations containing barley. Average yields of corn from such rotations are presented in the following Table 5:

TABLE 5.—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in combination With Barley, or With barley and other crops.

	Comparative Average Yield of Corn Per Acre From Given Rotation in Given Year					
Year	No. 2 Corn, Barley	No. 3 Corn, Barley, Sw. Clover (plowed under)	No. 4-a Corn, Rye and Sw. Clover, Sw. Clover, Millets, Barley, Peas and Rape (removed)	No. 7 Corn, Barley, Grass, Grass, (Alfalfa)	No. 8 Corn, Barley and Sw. Clover, Potatoes, Barley, (alfalfa)	No. 4 Corn, Rye and Sw. Clover, Sw. Clover, Millets, Barley, Peas and Rape (plowed under)
1912	12.3	17.1	22.9	22.5	19.1	19.5
1913	9.8	11.6	11.9	8.7	4.6	11.5
1914	4.6	14.6	6.0	7.5	22.6	7.6
1915	29.4	32.0	26.1	35.0	22.1	25.5
1916	24.5	25.6	20.7	20.4	23.7	18.5
1917	20.3	20.2	16.1	6.9	12.3	14.6
1918	26.0	28.1	32.6	27.1	30.0	29.1
1919	28.8	28.1	16.1	24.0	22.2	16.8
1920	35.2	37.7	28.7	39.8	34.4	35.1
1921	13.4	20.6	22.7	11.2	7.4	13.4
1922	45.4	43.0	45.0	38.8	39.8	42.7
1923	44.8	43.4	30.2	38.4	53.7	30.6
1924	17.0	14.7	22.7	13.7	13.4	20.4
1925	4.4	2.9	5.4	5.0	0.0	7.9
1926	0.0	0.0	0.0	0.0	0.0	0.0
1927	33.1	28.6	27.7	35.5	28.6	29.4
1928	5.0	12.1	2.8	2.9	2.3	4.8
1929	0.0	1.9	3.7	0.0	0.0	2.9
Av.	19.7	21.2	19.0	18.7	18.6	18.3

Computation of odds based upon a comparison of average annual yields from the several cropping systems with those from Rotation 2, results in the following:

The following means that the yield of corn from Rotation No. 3. corn. barley, sweet clover (plowed under) was higher than the yield of corn in the other six rotations compared.

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, barley		
3	Corn, barley, sweet clover (plowed under)	–1.56	20.5:1
4	Corn, rye and sweet clover, sweet clover, millets, barley, peas and rape	1.32	9.4:1
7	Barley and grass, grass, grass, (alfalfa), corn	0.92	3.17:1
8	Corn, barley and sweet clover, Potatoes, barley	0.98	2.69:1
4-a	Corn, rye and sweet clover, sweet clover, millets, barley, peas and rape (removed)	0.70	1.96:1

Comparative Average Yields of Barley from Different Crop Rotations at Highmore Experiment Farm, in Combination with Corn, or with Corn and Other Crops

In the foregoing sections of this bulletin, yields of wheat and oats in crop sequences including corn have been discussed. In comparison with the foregoing rotations at Highmore crop rotations have been secured making yields of barley available from similar rotations containing corn, and also in some instances other crops. The yields of barley from these crop rotations are tabulated in the following Table 6:

TABLE 6.—Comparative Average Yields of BARLEY From Different Crop Rotations at Highmore Experiment Farm, in Combination With Corn, or With Corn and Other Crops

	Comparative Average Yield of Barley Per Acre from Given Rotation in Given Year								
	No. 2 Corn, Barley	No. 3 Corn, Barley, Sw. Clover (plowed under)	No. 4 Corn, Rye and Sw. Clover, Millets, Barley Peas and Rape (plowed under)	No. 4-a Corn, Rye and Sw. Clover, Sw. Clover, Millets, Barley, Peas and Rape (removed)	No. 5 Fallow, Barley	No. 7 Corn, Barley, Grass, Grass, Alfalfa	No. 8 Corn, Barley and Sw. Clover, Potatoes, Barley, (alfalfa)	No. 8-a Corn, Barley, Sw. Clover, Potatoes, Barley, (alfalfa)	No. 9 Continuous Barley
1912	* 0.6	* 0.6	0.4	0.3	* 0.6	0.5	* 0.6	* 0.6	*0.6
1913	* 1.2	* 1.2	1.5	2.1	* 1.2	3.0	* 1.2	* 1.2	*1.2
1914	*22.0	*22.0	24.4	30.2	*22.0	22.8	*22.0	*22.0	8.7
1915	51.2	49.3	51.4	48.9	48.5	46.1	*50.8	*50.8	55.7
1916	31.3	35.4	27.4	27.5	31.7	23.4	*29.9	*29.9	25.8
1917	28.9	28.9	13.4	12.9	27.5	19.6	*22.2	*22.2	22.3
1918	28.7	28.9	18.1	13.3	46.0	19.0	21.8	26.9	6.3
1919	31.6	38.1	31.6	34.5	38.1	35.4	38.7	40.0	26.5
1920	31.0	36.1	31.7	29.7	33.1	35.1	30.8	38.8	31.7
1921	20.3	14.0	10.2	9.4	28.7	6.9	15.2	24.8	9.2
1922	47.9	45.8	35.1	29.8	53.8	50.7	42.1	52.2	30.0
1923	32.1	40.4	33.2	27.9	40.4	39.1	68.1	39.0	8.1
1924	37.5	39.6	44.5	43.7	17.4	34.9	36.0	55.8	25.6
1925	21.5	27.3	23.8	28.3	39.8	26.1	20.4	28.8	15.6
1926	1.4	0.0	0.9	1.0	1.3	7.3	1.0	0.0	0.0
1927	25.9	29.0	29.9	32.3	38.5	31.6	29.0	28.0	26.3
1928	16.5	13.5	4.0	2.2	22.1	15.2	10.8	20.9	0.2
1929	14.6	21.5	12.7	12.7	18.5	13.7	13.7	11.5	2.7
1930	29.4	29.8	23.8	21.9	31.5	22.6	28.5	33.9	20.6
Av.	24.9	26.4	22.0	21.5	28.5	23.8	25.4	27.7	16.7

* These are computed by taking the average of all available yields for the given years in the comparative rotations.

Examination of the foregoing Table 6 and calculations of odds indicating the significance of the differences between average yields from the several crop rotations, makes it possible to put down the following:

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, barley		
9	Continuous barley	8.24	49.1:1
8-a	Corn, barley and sweet clover, potatoes, barley, alfalfa	−2.74	43.0:1
4	Corn, rye, sweet clover, sweet clover millets, barley, peas and rape (plowed under)	2.9	17.5:1
5	Fallow, barley	−3.53	22.8:1
4-a	Corn, rye and sweet clover, sweet clover, millets, barley, peas and rape (removed)	3.42	20.5:1
7	Corn, barley and grass, grass, grass, (alfalfa)	1.1	not significant
3	Corn, barley, sweet clover (plowed under)	−1.46	10.6:1
8	Corn, barley and sweet clover, potatoes, barley, alfalfa	0.50	not significant

It may be observed from the foregoing that yields of barley were higher in Rotations 8a, 5, and 3 than in Rotation No. 2.

The lowest yield of barley in any rotation was produced in No. 9, Continuous Barley.

Yields of Corn, from Crop Rotations in Combination with Flax, or with Flax and Additional Crops

Previous sections of this bulletin present yields of corn in several combinations, containing small grains, i. e. wheat, oats, barley. Table 7 following summarizes average yields of corn from crop rotations containing flax.

The following Table 7 must be presented as tentative, due partly to the necessity for utilizing a number of computed yields. The average yields put down in the lowest horizontal line of the table are the most accurate that are now available. It should further be noted that the yields of corn put down for Rotation No. 2 in the first vertical column are taken from land treated regularly with stall manure. Comparisons with untreated land are not available, nor is it attempted here to deduce what the effect of manure may have been on either this corn or flax.

A comparison of annual yields of corn in the other two rotations with those from Rotation No. 2, with computing odds based upon differences, reveals the following:

No. of Rotation	Crop Sequence	Corn yield from rotation No. 2 minus yeild of given rotation	Odds that the foregoing difference is significant
2	Corn, flax (with manure)	0.0	
3	Corn, flax, sweet clover (plowed under)	−0.8	not significant
8	Corn, flax, sweet clover, potatoes, barley, alfalfa	4.2	2666:1

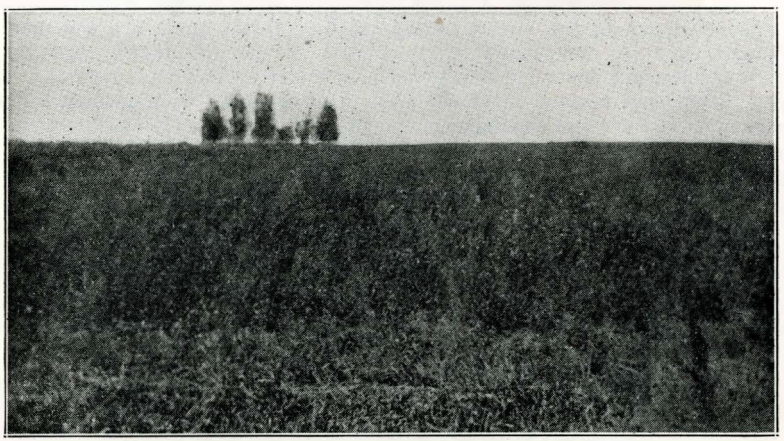
TABLE 7.—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in Combination With Flax, or With Flax and Other Crops

Year	Comparative Average Yield of Corn Per Acre From Given Rotation in Given Year		
	Rot. 2 Corn, Flax (with manure)	Rot. 3 Corn, Flax Sw Clover (plowed under)	Rot. 8 Corn, Flax Sw. Clover Potatoes Barley, Alfalfa
1912	*21.7	†21.1	19.7
1913	14.0	† 9.8	6.9
1914	16.8	†20.5	12.9
1915	28.9	†29.4	21.5
1916	24.6	†25.3	20.6
1917	22.0	21.5	13.0
1918	25.9	27.4	26.8
1919	25.1	24.0	23.7
1920	31.0	32.0	31.7
1921	9.4	20.6	0.0
1922	43.9	49.6	32.9
1923	41.2	38.1	45.8
1924	22.9	17.1	15.1
1925	7.4	8.4	0.0
1926	0.0	0.0	0.0
1927	32.4	28.6	28.7
1928	9.0	16.4	1.9
1929	0.0	0.9	0.0
Average	20.9	21.7	16.7

* Substituted from plots 6 and 10.
† Flax was not introduced in Rotation 3 till 1916.

Yields of Flax from Cropping Systems in Combination with Corn, or Corn and Additional Crops

The several rotations which call for corn and flax, either in direct succession, or in successions including the two crops mentioned and other crops, obviously produce yields of flax annually. These yields of flax from the several rotations may be compared with each other for the several years, also for a 19-year period, 1912-1930, in Table 8:



Flax in Comparative Rotations—Highmore

The flax above grew in 1928 where a seedbed was summer-fallowed in 1927. Such flax was mainly Russian Thistles. Flax in the rotation indicated yielded 4.6 bushels whereas flax seeded on corn ground yielded 6.3 bushels. (See Table8.)

TABLE 8.—Comparative Average Yields of FLAX From Different Crop Rotations at Highmore Experiment Farm, in Combination With Corn, or With Corn and Other Crops.

	Comparative Average Yield of Flax (bushels) Per Acre From Given Rotation in Year			
Year	Rot. 2 Corn, Flax	Rot. 3 Corn, Flax, Sw. Clover (plowed under)	Rot. 9 Continuous (flax)	Rot. 5 Fallow, Flax
1912	* 1.8	* 1.8	* 1.8	* 1.8
1913	* 4.5	* 4.5	* 4.5	* 4.5
1914	* 0.2	* 0.2	* 0.2	* 0.2
1915	*15.7	*15.7	18.6	*15.7
1916	15.5	16.6	5.9	12.9
1917	6.4	5.7	1.4	5.3
1918	6.7	7.8	3.2	3.8
1919	1.2	0.9	0.0	0.1
1920	1.8	7.9	0.0	1.3
1921	0.6	1.4	0.0	2.9
1922	* 9.8	* 9.8	8.2	* 9.8
1923	7.9	4.4	0.5	3.9
1924	10.7	15.0	2.7	10.1
1925	9.8	5.7	2.1	3.0
1926	0.8	0.0	0.0	0.0
1927	10.2	9.3	2.5	6.4
1928	4.5	2.6	0.1	1.2
1929	3.8	3.7	0.8	1.9
1930	5.4	5.1	0.0	4.0
Av.	6.3	6.2	2.8	4.6

* These yields are computed to be the average of those in other rotations with which this rotation is compared; including Rotation 8.

Comparison of anuual yields of flax in the several rotations of Table 8, with those from Rotation No. 2, as the standard, with subtracting the yields of the other three therefrom, and computing odds based on the differences, reveals the following:

No. of Rotation	Crop Sequence	No. of bushels lower than No. 2	Odds that the foregoing difference is significant
2	Corn, flax	0.0	
3	Corn, flax, sweet clover (plowed under)	0.1	negligible
9	Continuous flax	3.6	very great
5	Fallow, flax	1.7	410:1

The foregoing may be interpreted to mean that the crop rotations which produced the highest yields of flax were Rotations No. 2 and 3. The yields of flax in bushels per acre per year were practically equal from said rotations.

The yields from either continuous flax or fallow, flax were decidedly lower.

Comparative Yields of Corn from Three Separate Cropping Systems (rotations) Containing Emmer, or Emmer and Other Crops Along with Corn

The several cropping systems carried out at Highmore throughout an 18-year period have carried successions of corn and emmer with or without other crops. The following Table 9 gives a summary of yields of corn from three of the several rotations indicated:

TABLE 9—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in Combination With Emmer, or With Emmer and Other Crops.

	Comparative Average Yield of Corn Per Acre From Given Rotation in Given Year		
Year	Rot. 2 Corn, Emmer	Rot. 3 Corn, Emmer, Sw. Clover, (plowed under)	Rot. 8 Corn, Emmer, Sw. Clover, Potatoes, Barley (alfalfa)
1912	21.5	12.6	18.9
1913	13.6	10.6	5.0
1914	7.1	12.0	17.6
1915	27.3	31.6	25.1
1916	22.5	24.5	24.7
1917	21.6	18.5	12.3
1918	29.9	24.9	27.9
1919	26.5	26.7	22.6
1920	38.5	36.3	38.2
1921	12.0	15.9	1.4
1922	46.1	43.9	40.0
1923	46.2	48.8	52.1
1924	20.9	12.8	13.4
1925	7.9	3.7	0.0
1926	0.0	0.0	0.0
1927	34.7	28.3	28.9
1928	5.1	12.2	1.6
1929	0.0	1.1	0.0
Av.	29.9	20.2	18.3

In order to facilitate comparison the average yields of corn in the foregoing table are put down as follows:

No. of Rotation	Crop Sequence	No. of bushels lower than No. 2	Odds that the foregoing difference is significant
2	Corn, emmer	0.0	
3	Corn, emmer, sweet clover (plowed under)	0.7	2.2 :1
8	Corn, emmer, sweet clover, potatoes barley, alfalfa	2.6	18.5:1

The foregoing may be interpreted to mean that the highest yields of corn in the three comparative rotations which include emmer were produced in Rotations No. 2 and 3. The corn yield from Rotation No. 8 was noticeably lower.

Comparative Yields of Emmer from Five Different Crop Rotations at Highmore

The previous section of this bulletin set forth yields of corn from rotations containing emmer, either in alternation with emmer alone or in combination with other crops. The following Table No. 10 gives yields of

emmer from these rotations, and from two additional, namely, continuous emmer and the same in alteration with fallow.

TABLE 10.—Comparative Average Yields of EMMER From Different Crop Rotations at Highmore Experiment Farm, in Combination With Corn, or With Corn and Other Crops.

	Comparative Average Yield of Emmer Per Acre From Given Rotation in Given Year					
	Rot. 2 Corn, Emmer	Rot. 3 Corn, Emmer, Sw. Clover, (plowed under)	Rot. 5 Emmer, Fallow	Rot. 8 Corn, Emmer, Sw. Clover, Potatoes, Emmer, (alfalfa)	Rot. 8-a Corn, Emmer, Sw. Clover, Potatoes, Emmer, (alfalfa)	Rot. 9 Continuous Emmer
1912	* 0.6	0.6	* 0.6	* 0.6	* 0.6	* 0.6
1913	* 0.4	0.4	* 0.4	* 0.4	* 0.4	* 0.4
1914	*21.8	35.5	*21.8	*21.8	*21.8	8.2
1915	58.8	57.0	60.0	*58.9	*58.9	59.8
1916	45.9	44.4	46.9	*42.1	*42.1	31.3
1917	20.0	21.5	12.2	*15.9	*15.9	10.0
1918	25.5	19.7	28.0	16.2	28.5	9.2
1919	30.7	44.0	33.2	43.5	36.5	23.0
1920	25.7	28.7	27.2	25.0	35.0	27.5
1921	16.8	4.5	19.1	9.8	14.0	7.5
1922	33.9	32.7	33.9	24.6	40.2	27.9
1923	21.5	25.2	14.0	14.8	17.7	11.2
1924	46.0	40.0	40.0	37.3	42.5	32.0
1925	18.5	15.0	28.5	10.5	19.8	5.0
1926	4.0	0.0	0.0	0.0	0.0	0.0
1927	40.8	43.8	45.8	35.8	34.0	27.8
1928	20.8	12.8	15.8	6.8	13.5	1.2
1929	6.8	15.0	8.5	8.0	2.0	0.1
1930	21.8	25.0	23.8	18.0	25.0	12.8
Av.	24.2	24.5	24.2	20.5	23.6	15.5

* Yields which are computed by taking the average of those in the rotations with which the given one is placed in comparison.

A computation of the odds indicating the significance of differences between average yields of emmer in other rotations when compared with those of Rotation No. 2 gives the following:

No. of Rotation	Crop Sequence	No. of bushels lower than corresponding yield in Rotation No. 2	Odds that the foregoing difference is significant
2	(1) Corn, (2) emmer	0.0	
3	(1) Corn, (2) emmer (3) sweet clover (plowed under)	–0.3	negligible
5	(1) Fallow, (2) emmer	0.0	negligible
8	(1) Corn, (2) emmer, (3) sweet clover, (4) potatoes, (5) emmer (alfalfa)	3.7	184:1
8-a	(1) Corn, (2) emmer, (3) sweet clover, (4) potatoes, (5) emmer (alfalfa)	0.6	4.50:1
9	Emmer (continuous)	8.7	greater than 9999:1

It is evident from the foregoing that the average yields of emmer from Rotations No. 2, 3, and 5 are practically equal and likewise that they are appreciably higher than comparative yields from Rotations No. 8 and 9.

Yields of Corn from Three Comparative Crop Rotations at Highmore in Combination with Rye Alone or with Other Crops

Yields of corn for the several years 1912–1929 are put down in the following Table 11, the yields being taken from four different rotations.

TABLE 11.—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in Combination With Rye, or With Rye and Other Crops.

	Comparative Average Yields of Corn From Given Rotation in Given Year			
Year	Rot. 2 Corn, Rye (with manure)	Rot. 3 Corn, Rye, Sw. Clover (plowed under)	Rot. 4 Corn, Rye and Sw. Clover, Sw. Clover (for hay and seed), Millets, Sm. Grains, Peas and rape (gr. manure)	Rot. 4-a Corn, Rye and Sw. Clover, Sw. Clover (for hay and seed), Millets, Sm. Grains, Peas and Rape (removed)
1912	14.4	18.6	19.5	22.9
1913	7.1	10.7	11.5	11.9
1914	4.6	18.8	7.6	6.0
1915	30.4	26.3	25.2	26.1
1916	19.7	25.1	18.5	20.7
1917	17.1	18.1	14.6	16.1
1918	22.1	27.6	29.1	32.6
1919	22.7	22.0	16.8	16.1
1920	30.7	35.1	35.1	28.7
1921	1.9	24.9	13.4	22.7
1922	35.8	47.7	42.7	45.0
1923	37.0	38.8	30.6	30.2
1924	15.1	14.0	20.4	22.7
1925	0.0	11.9	7.9	5.4
1926	0.0	0.0	0.0	0.0
1927	29.7	29.4	29.4	27.7
1928	3.9	14.0	4.8	2.8
1929	0.0	0.6	2.9	3.7
Av.	16.2	21.3	18.4	19.5

The computation of odds indicating whether the difference in average yield of corn put down in the foregoing table from the four rotations are significant produces the following:

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, rye	0.0	
3	Corn, rye, sweet clover (plowed under)	−5.1	316.6 :1
4	Corn, rye, sweet clover (sweet clover for hay and seed), millets, small grain, peas and rape (green manure)	−2.1	19.7 :1
4-a	Corn, rye and sweet clover, sweet clover (for hay and seed) millets, small grain, peas and rape (removed)	−2.8	16.0 :1

The foregoing indicates that the highest average yield of corn from any of the four crop rotations with rye was produced in Rotation No. 3, corn, rye, sweet clover (plowed under).

Yields of corn from all others of these rotations were significantly lower and the lowest was from the two year Rotation No. 2, corn, rye.

Yields of Rye from Five Comparative Crop Rotations at Highmore in Combination with Corn Alone, or with Corn and Other Crops

Table 12 following consists of yields of winter rye produced from five different cropping systems at Highmore, through 19 consecutive years, 1912–1930. The crop rotations concerned are those which are involved with corn and rye tabulated in the Table 12 following:

TABLE 12.—Comparative Average Yields of RYE From Different Crop Rotations at Highmore Experiment Farm, in Combination With Corn, or With Corn and Other Crops.

	Comparative Average Yield of Winter Rye From Given Rotation in Given Year					
Year	Rot. 2 Corn, Rye (with manure)	Rot. 3 Corn, Rye, Sw. Clover (plowed under)	Rot. 4 Corn, Rye and Sw. Clover, Sw. Clover, (hay and seed), Millet, Sm. Grain, Peas and Rape, (plowed under)	Rot. 4-a Corn, rye and Sw. Clover, Sw. Clover, (hay and seed), Millet, Sm. Grain, Peas and Rape (removed)	Rot. 9 Continuous Grains	Rot. 5 Fallow Rye
1912	* 5.3	* 5.3	5.3	* 5.3	* 5.3	* 5.3
1913	*11.1	11.1	11.1	13.8	*11.1	*11.1
1914	*10.8	*10.8	13.8	16.1	7.8	*10.8
1915	25.8	*26.8	24.7	23.1	*26.8	30.0
1916	28.6	33.9	25.4	22.3	18.9	38.4
1917	24.1	35.7	26.0	25.3	14.8	23.9
1918	16.4	30.4	16.7	18.9	10.2	31.3
1919	20.4	28.6	23.1	21.9	11.4	29.3
1920	9.3	24.6	23.3	24.6	0.0	33.0
1921	17.7	21.8	16.1	15.0	11.8	19.1
1922	49.1	48.0	40.8	48.9	24.3	34.1
1923	11.1	11.0	12.7	13.5	6.6	8.3
1924	19.8	35.2	24.7	23.9	16.8	31.9
1925	7.5	10.9	10.4	11.1	4.1	13.8
1926	1.8	2.0	1.8	1.2	0.1	0.6
1927	27.0	29.1	28.6	27.3	19.1	35.0
1928	16.5	17.9	17.4	19.6	0.2	13.8
1929	14.5	22.9	15.5	15.4	4.9	21.8
1930	28.0	33.9	27.8	23.4	12.3	32.5
Av.	18.2	23.2	19.2	19.5	10.9	22.3

* Yield computed by taking average yield of plots in comparison.

Comparison of yields of rye in the foregoing Table 12 from the several rotations by means of computing odds indicating whether the differences are significant produces the following:

The following indicates that the highest average yield of rye in six comparative rotations was produced in Rotation No. 3 corn, rye, sweet clover (plowed under); whereas the lowest average yield of rye was produced from No. 9, continuous rye.

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, rye		
3	Corn, rye, sweet clover (plowed under)	−4.9	1515 :1
5	Rye, fallow	−4.2	47.4 :1
4	Corn, rye, sweet clover, sweet clover (hay and seed), millet, small grain, peas and rape (plowed under)	−1.0	5.93 :1
9	Continuous grains	7.3	greater than 9999 :1
4-a	Corn, rye and sweet clover, sweet clover (hay and seed), millet, small grain, peas and rape (removed)	−1.3	9.4 :1

Comparative Average Yields of Corn from Four Crop Rotations Including Winter Wheat

The following Table 13 summarizes corn yields at Highmore taken for successive years, 1912–1929, from four separate crop rotations all containing winter wheat, in addition to corn, and in three instances one or more additional crops beside winter wheat.

TABLE 13.—Comparative Average Yields of CORN From Different Crop Rotations at Highmore Experiment Farm, in Combination with Winter Wheat, or With Winter Wheat and Other Crops.

	Comparative Average Yield of Corn From Given Rotation in Given Year			
Year	Rot. 2 Corn, Winter Wheat (with stall manure)	Rot. 3 Corn, Winter Wheat, Sw. Clover (plowed under)	Rot. 16 Corn, Oats, Winter Wheat	Rot. 4 Corn, Rye and Sw. Clover, Sw. Clover (hay and seed), millets, Sm. Grain, Peas and Rape (plowed under)
1912	18.9	15.0	*19.0	23.1
1912	8.8	12.1	*10.9	11.8
1914	8.8	17.9	*10.7	5.4
1915	26.9	24.8	*27.8	31.8
1916	19.8	28.0	*22.8	20.7
1917	18.7	19.1	20.3	16.4
1918	24.9	28.1	27.0	35.5
1919	25.9	26.1	22.4	21.1
1920	29.9	38.9	31.0	34.8
1921	6.3	25.1	7.0	13.9
1922	40.0	45.3	45.4	42.5
1923	37.5	38.6	43.9	35.6
1924	22.1	16.4	23.4	23.7
1925	0.0	18.4	3.3	5.7
1926	0.0	0.0	0.0	0.0
1927	32.1	28.6	33.5	27.9
1928	4.3	20.0	3.6	2.4
1929	0.0	0.6	0.0	2.4
Av.	18.1	22.4	19.6	19.7

* Calculated by taking average of yields in all rotations used for comparison.

The corn yields put down under Rotation 4 in the last column were necessarily taken from plots where stall manure was applied. It is esti-

mated the yield of corn was increased thereby 1.4 bushels. On that account any possible deductions from these yields must be made with that in mind.

Statement of computation of odds indicating the probability that differences in average yields of **corn** between these several rotations are significant is found to be as follows:

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation (no. of bu. av. lower than rotation No. 2	Odds that the foregoing difference is significant
2	Corn, winter wheat (stall manure)		
5	Corn, Winter Wheat, sweet clover (plowed under)	−4.2	62.3:1
4	Corn, rye and sweet clover, sweet clover (hay and seed), millets, small grain, peas and rape (plowed under)	−1.6	16:1
16	Corn, oats, winter wheat	−1.4	163:1

(1) The highest yield of corn produced in the four rotations containing winter wheat came from Rotation 3, corn, winter wheat, sweet clover (plowed under).

(2) The lowest yield of corn came from Rotation No. 2 (corn, winter wheat).

Comparative Average Yields of Winter Wheat from Six Rotations Including Corn, or Corn and Other Crops

Yields of winter wheat from six different cropping systems (rotations) at Highmore secured over a period of 19 years, 1912–1930, are put down in Table 14 following:

The odds that the differences in average yield of **winter wheat** from these several cropping systems comparing all of them with Rotation No. 2 are as follows:

No. of Rotation	Crop Sequence	Yield from Rotation No. 2 minus yield from given rotation	Odds that the foregoing difference is significant
2	Corn, winter wheat (stall manure)		
4	Corn, rye and sweet clover, sweet clover (for hay and seed), millet, winter wheat, peas and rape (plowed under)	−3.0	11.3:1
3	Corn, winter wheat, sweet clover (plowed)	− .3	negligible
5	Fallow, winter wheat	1.9	5.94:1
16	Corn, oats, winter wheat (unmulched)	+3.3	16.4:1
16	Corn, oats, winter wheat (mulched)	+1.9	5.1:1
9	Continuous winter wheat	+5.0	131.6:1

It is apparent from the foregoing that the highest average yield of winter wheat at highmore has been produced in the six-year Rotation No. 4 where winter wheat is seeded directly in the stubble of millet in rows 36 inches apart. The winter wheat is thus evidently protected by the millet stubble.

The second highest yield of winter wheat was produced in Three-year

Rotation No. 3 where the crop was seeded into standing corn and, therefore, was protected by the stalks.

The lowest yield of winter wheat from the several rotations was produced in No. 9 where winter comes continuously on the same ground.

TABLE 14.—Comparative Average Yields of WINTER WHEAT From Different Crop Rotations at Highmore Experiment Farm in Combination With Corn, or With Corn and Other Crops

	Comparative Average Yield of Winter Wheat From Given Rotation in Given Year						
Year	Rot. 2 Corn, Winter Wheat	Rot. 3 Corn, Winter Wheat, Sw. Clover (plowed under)	Rot. 4 Corn, Rye and Sw. Clover, Sw. clover (for hay and seed), Millet, Winter Wheat, Peas and Rape (plowed under)	Rot. 5 Winter Wheat, Fallow	Rot. 9 Continuous Winter Wheat	Rot. 16 Corn, Oats, Winter Wheat	
						Mulch	Unmulch
1912	0.0	* 0.0	* 0.0	0.0	* 0.0	* 0.0	* 0.0
1913	0.0	* 1.5	* 1.5	3.1	* 1.5	* 1.5	* 1.5
1914	0.0	* 0.0	* 0.0	0.0	* 0.0	* 0.0	* 0.0
1915	19.0	* 6.3	* 6.3	0.0	0.0	* 6.3	* 6.3
1916	30.0	25.8	*22.9	19.2	16.7	*22.9	*22.9
1917	0.0	0.0	* 0.0	0.0	0.0	0.0	0.0
1918	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1919	20.6	20.5	28.1	24.8	15.3	11.0	6.9
1920	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1921	12.0	11.2	11.8	9.3	8.8	8.9	7.7
1922	35.7	48.2	42.7	36.5	17.3	24.2	14.0
1923	0.0	0.0	7.5	7.1	0.0	0.0	0.0
1924	31.3	42.2	53.2	28.1	17.3	38.5	27.8
1925	7.0	2.7	21.0	1.3	4.2	3.5	4.3
1926	2.3	3.7	1.3	0.9	0.0	0.6	0.9
1927	3.8	0.8	24.2	15.0	12.3	24.5	23.9
1928	15.4	13.2	10.7	0.0	0.0	1.1	0.5
1929	13.8	20.2	13.8	8.8	0.0	11.3	9.7
1930	0.0	0.0	0.0	0.0	1.7	0.0	0.0
Av.	10.0	10.3	12.9	8.1	5.0	8.1	6.7

* Yield computed by taking average yield of plots in comparison.

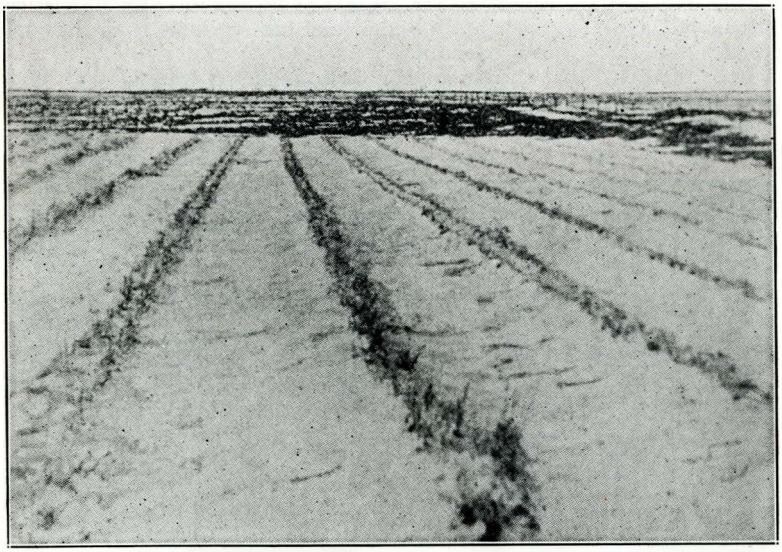
A Summary of Average Yields of Corn (1912–1929) from Nine Crop-sequences and Thirty-one Crop Rotations Included Thereunder

It is possible to put down all of the average yields of corn, computed in the foregoing tables of this bulletin on one page. This is done in order to make more direct comparison (1) between corn yields from different cropping systems, (2) between yields of corn from several rotations or crop sequences, within each of the foregoing cropping systems. Such a summary is put down in Table 15 following.

Deduction Concerning Corn Yields From Comparative Crop Rotations

Examination of the Comparative Average Yields of Corn put down in the foregoing Table 15 indicates:

The highest average yield of corn as put down in the lowest horizontal line of this table (21.2 bushels) was produced in Crop Sequence No. 3. That sequence was (1) Corn, (2) Small Grain, (3) Legume (plowed under).



Stubble from Millet in Cultivated Rows
Highmore, March 14, 1914

Millet may be seeded in close drills or in cultivated rows. Standing stubble from the latter method, furnished seedbed for the highest yield of winter wheat. See Table 14, page 26.

TABLE 15.—Average Yields of CORN, From Nine Cropping Systems, Thirty-one Crop Rotations, in Foregoing Pages.

Crop included in rotation along with corn with or without other crop	Cropping System and Number								
	3.—Corn, Grains, Sw. Clover (plowed)	2.—Corn, Grains	6.—Corn, Oats, Wheat	16.—Corn, Oats Winter Wheat	1.—Corn, Wheat, Peas (for crop), sorghum, Oats, Alfalfa	7.—Corn, Barley, Brome (3 yrs.) (alfalfa)	8.—Corn, Grains and Sw. Clover, Potatoes, Grains, Flax, (alfalfa)	10.—Corn, Wheat, Sw. Clover (harvested)	4.—Corn, Rye, Sw. Clover, Millets, Barley, Peas, Rape (plowed under)
Wheat	20.3	20.1	20.3		20.1	18.7	16.7	16.2	
Oats	21.3	18.0	20.3	19.0	20.0		17.5		
Barley	21.2	19.7				18.7	18.6		18.3
Flax	21.7	20.9					16.7		
Emmer	20.2	20.9					18.3		
Rye	21.3	16.2							18.4
W. Wheat	22.4	18.1		19.6					19.7
Av.	21.2	19.1	20.3	19.3	20.1	18.7	17.6	16.2	18.8

Not only was the foregoing the highest as an average; its several constituent yields were consistently higher and less variable than the yields produced in other Crop Sequences.

It is indicated that the three-year Crop Sequence wherein corn is followed by small grain, followed by legume is one to employ for securing relatively high yields of corn.

A Growing Field of Alta Corn at Highmore

Nearly all small grain crops produced highest yields when seeded on land cleanly cultivated in corn the previous year. Corn yields equally well regardless of the kind of small grain or flax used with it in the crop sequence. See Table 15, p. 27.

Deductions Concerning Small Grain Yields From Comparative Crop Rotations

It is not so easy to prescribe a single crop sequence that will produce highest yields of the several kinds of small grain as for corn—for the reason that with the former more than one crop is involved.

It appears, however, from examining the several tables where the yields of small grain are summarized (Tables 2, 4, 6, 8, 10, 12, 14) that, the highest yields (or yields with no significant difference) of flax, emmer, winter rye come from the same three-year crop sequence, which produces the highest yield of corn.

Both spring wheat, and winter wheat produced highest yields in Crop Sequence No. 4, where the seed-bed for wheat is prepared by millet cultivated in rows. These are special instances however, because spring wheat comes on manured land in this rotation with millet, and also specifically millet stubble appears to furnish needed protection for winter wheat. The second highest yield of spring wheat was produced in the three-year crop sequence where the legume (sweet-clover) of the third year was removed for hay. Winter wheat likewise produced second highest yield in the three-year sequence following corn.

Barley and oats were the two small grain crops that produced slightly higher yields on land that was fallowed in alternate years.

It is certain that the highest yields of all small grains and flax were produced on land that had been cultivated in the previous season.

The foregoing leaves reason to believe that the highest yields per acre per year for ordinary crops are produced in the three-year crop sequence (1) Cultivated Crop, (2) Small Grain, (3) Legume.

Also assuming that the apparent exceptions in the case of spring wheat, oats, barley, and winter wheat, actually depend upon some peculiarity of these particular crops, it is still possible that the three-year crop sequence might be slightly altered to meet those peculiarities.

If, for instance, it be tentatively assumed that spring wheat in a three-year sequence of (1) Corn, (2) Wheat (3) Sweet Clover produces more wheat when the legume crop is removed for hay, rather than turned under for green manure, such modification still admits a three-year crop sequence as most productive of wheat on a given area. Likewise if winter wheat, as seems apparent, could be helped to withstand winter conditions at Highmore by being seeded directly upon land previously in millet, in cultivated rows, this latter crop might still be adapted in the three-year crop sequence.

It remains then, considering possible modifications, one of the outstanding facts which may be utilized as a basis for farm practice, that the three-year Crop Sequence (1) Cultivated Crop, (2) Small Grain Crop, (3) Legume Crop, may produce the highest yields of small grain from land in the given crop.

Money Returns from the Several Crop Rotations at Highmore

The foregoing sections of this bulletin have developed the conclusion that the highest yields of the greatest number of staple farm crops at Highmore have been secured from the three-year crop sequence—(1) Cultivated Crop, (2) Small Grain, (3) Legume.

This is important when it comes to deciding upon a plan for a permanent cropping system, on any farm or group of farms.

In order to make some further comparisons it is possible to compute and tabulate the returns from land in money value from crops produced in several rotations. These returns are arrived at in all cases with multiplying the actual average yields of crops in units per acre, by the South Dakota farm price per unit for the given year. Usually the price used is the one put down in the Year Book of the United States Department of Agriculture.

A table of South Dakota farm prices for the several crops and years with which this bulletin is concerned is put down in the appendix (Table 12, page 55).

The money returns thus calculated for the several separate crops in the several crop sequences are put down in appendix, (Table 13, p. 57).

The separate values thus put down are used as a basis for computing the average money returns from the several crops in crop sequences at Highmore.

These average returns are put down in Table 16, following:

TABLE 16.—Average Returns (Dollars) Per Acre Per Year From Several Crops, and Average Value Per Acre From Corresponding Rotation.
(Values Summarized from Tables)

Number of Crop Sequence	Succession of Crops in Rotation	Farm Value of Given Crop From Sequence										Return Per Acre from Land Occupied	Av. Return Per Acre Per Year from all Land included in Rotation Opposite
		1.—One-Year Sequence (Continuous Cropping)											
		Wheat	**Barley**	**Oats**	**Flax**	**Rye**	**Corn**	**W.Wheat**	**Emmer**	**Fallow**	**Sw.Clo.**		
9	Wheat (continuous)	12.29										12.29	12.29
9	Barley (continuous)		10.41									10.41	10.41
9	Oats (continuous)			10.68								10.68	10.68
9	Flax (continuous)				5.74							5.74	5.74
9	Rye (continuous)					9.54						9.54	9.54
9	W. Wheat (continuous)							7.03				7.03	7.03
9	Emmer (continuous)								9.72			9.72	9.72
		2.—Two-Year Sequence, Alternate Fallow											
		Wheat	**Barley**	**Oats**	**Flax**	**Rye**		**W.Wheat**	**Emmer**	**Fallow**	**Sw.Clo.**		
5	Fallow, wheat	20.06								0.00		20.06	10.03
5	Fallow, barley		17.03							0.00		17.03	8.52
5	Fallow, oats			18.04						0.00		18.04	9.02
5	Fallow, flax				9.85					0.00		9.85	4.93
5	Fallow, rye					20.61				0.00		20.61	10.31
5	Fallow, winter wheat							11.10		0.00		11.10	5.55
5	Fallow, emmer								14.88	.00		14.88	7.44
		3.—Two-Year Crop Sequence											
		Wheat	**Barley**	**Oats**	**Flax**	**Rye**	**Corn**	**W.Wheat**	**Emmer**	**Fallow**			
2	Corn, wheat	21.10					13.16					17.13	17.13
2	Corn, barley		15.07				13.07					14.07	14.07
2	Corn, oats			17.00			12.23					14.62	14.62
2	Corn, flax				13.92		13.77					13.85	13.85
2	Corn, rye					15.69	10.86					13.27	13.27
2	Corn, winter wheat						12.10	13.05				12.57	12.57
2	Corn, emmer						13.77		15.22			14.50	14.50

TABLE 16.—Average Returns (Dollars) Per Acre Per Year From Several Crops, and Average Value Per Acre From Corresponding Rotation. (continued)

Number of Crop Sequence	Succession of Crops in Rotation	Farm Value of Given Crop from Sequence									Return Per Acre from Land Occupied	Av. Return Per Acre Per Year from all Land Included in Rotation Opposite
		4.—Three-Year Crop Sequence (including legume plowed under)										
		Wheat	**Barley**	**Oats**	**Flax**	**Rye**	**Corn**	**Sw.Clo.**	**Emmer**	**W.Wheat**		
3	Corn, wheat (sw. clover) plowed	20.26					13.01	0.00			16.64	11.09
3	Corn, barley (sw. clover) plowed		16.19				13.77	0.00			14.98	9.99
3	Corn, oats (sw. clover) plowed			16.37			13.61	0.00			14.99	9.99
3	Corn, flax (sw. clover) plowed				13.56		13.95	0.00			13.76	9.17
3	Corn, rye (sw. clover) plowed					21.27	13.45	0.00			17.36	11.57
3	Corn, emmer (sw. clover) plowed						13.10	0.00	15.66		14.38	9.59
3	Corn, w. wheat (sw. clover) plowed						14.37	0.00		13.33	13.85	9.23
		(not plowing under legume)										
3A	Corn, wheat, sw. clover (hay)	22.07					13.11	6.06			13.75	13.75
		(including legume for hay and seed)										
10	Corn, wheat, sw. clover (hay and seed)	16.83					10.35	9.44 12.90			16.50	16.50
		5.—Three-Year Crop Sequence (continued)										
		Wheat	**Barley**	**Oats**	**Flax**	**Rye**	**Corn**	**Sw.Clo.**	**Emmer**	**W.Wheat**		
		(including no legume)										
6	Corn, oats, wheat	14.84		16.27			13.15				14.56	14.56
16	Corn, oats, w. wheat			14.70			12.62			10.44	12.59	12.59

TABLE 16.—Average Returns (Dollars) Per Acre Per Year From Several Crops, and Average Values Per Acre From Corresponding Rotation. (continued)

Number of Crop Sequence	Succession of Crops in Rotation	Farm Value of Given Crop from Sequence								Return Per Acre from Land Occupied	Av. Return Per Acre Per Year from all Land included in Rotation Opposite
		5.—Five-Year Sequence, Combined With Alfalfa									
		Wheat	**Barley**	**Oats**	**Flax**	**Potatoes**	**Corn**	**Alfalfa**	**Emmer**		
8	Corn, wheat and sw. clover potatoes, flax (alfalfa)	18.33			12.24	49.84	11.13	17.91		21.89	21.89
8	Corn, oats and sw. clover potatoes, oats (alfalfa)			15.36 16.74		51.13	11.44	13.09		21.55	21.55
8	Corn, barley and sw. clover potatoes, barley (alfalfa)		15.14 16.50			55.54	12.05	13.21		22.49	22.49
8	Corn, emmer and sw. clover, potatoes, emmer (alfalfa)					55.72	11.88	12.23	13.45 14.72	21.60	21.60
		Wheat	**Sorghum**	**Oats**	**Legumes**	**Rye**	**Corn**	**Alfalfa**			
1	Corn, wheat, legumes, sorghum, oats (alfalfa)	21.88	9.69	15.03	10.30		13.13	12.31 .76		13.85	13.85
			Barley			**Rye**	**Corn**	**Sw.Clover**	**Millet**		
4	Corn, rye and sw. clover, sw. Clover, (hay and seed), millet, barley, peas and rape (plowed under)		13.18			17.17	11.76	4.15 8.32	10.87	13.09	10.91
4-a	Corn, rye and sw. clover, sw. clover (hay and seed) millet, wheat, peas and rape (plowed under)	22.84									
			Barley	**Brome**	**Brome**		**Corn**	**Alfalfa**			
7	Corn, barley and brome grass, brome gr., brome gr., (alfalfa)		14.34				11.75				

The amounts received for crops produced at Highmore put down in the foregoing table reveal certain facts.

Yield and Returns from an Acre of Wheat

In the third column, the highest average amount received for wheat from one acre was $22.07. This return came from Rotation 3-A as indicated. This fact makes it obvious that the highest money return per acre from any single one of the staple crops included in this record of crop yields in Highmore area came from wheat. Potatoes are here considered a special, rather than a staple crop.

Yield and Returns from an Acre of Barley

It appears from the fourth column that the highest return from any acre of barley came from Rotation 5: fallow, barley; the amount being $17.03. The return from Rotation 3 was next in rank being $16.19. Rotation 3 is corn, barley, sweet clover (plowed under).

Yield and Returns from an Acre of Oats

It appears from the fifth column that the highest amount received for oats from one acre was produced in Rotation 5: fallow, oats, $18.04. A somewhat lower amount was received for an acre of oats from Rotation 2: corn, oats; $17.00. Since making the foregoing calculation a closer examination makes it appear that the land devoted to Rotation 2, corn, oats, may be less favorable to oats than that of Rotation 5, fallow, oats. See Plate I, center of bulletin.

Yield and Return from an Acre of Flax

The highest return from a single acre of flex produced in either Rotation 2 or 3. The difference in return from flax in these two rotations was not "significant." The value of flax produced in Rotation 3, corn, flax, sweet clover (plowed under) was $13.56.

Yield and Return from an Acre of Rye

The seventh column of the table reveals that the highest return from rye was produced in Rotation 3: corn, rye, sweet clover (plowed under) $21.27. A somewhat lower amount was produced from an acre of rye in Rotation 5: fallow, rye, $20.61.

Yield and Return from an Acre of Corn

Returns from corn are put down in column eight, under Farm Value. The highest return per acre came from crop sequence No. 3: corn, small grain, sweet clover (plowed under). The return from corn itself was not greatly affected by the kind of small grain following the corn in one crop rotation or another.

The average money return from corn in all seven rotations of the three-year crop sequence No. 3 viz. corn, small grain, legume (plowed under) was higher than the average return of corn from any other sequence.

Comparative Highest Money Returns (gross) From Staple Crops

It becomes apparent from the foregoing paragraphs that the highest average money returns from an acre of land at Highmore for eighteen years, 1912–1930 from eleven staple crops, were as follows:

Crop	Highest Money Return From One Acre	Sequence in Which Foregoing Return Was Made
Potatoes	$55.72	No. 8—Corn, emmer and sweet clover, POTATOES, emmer (alfalfa).
Wheat	22.07	No. 3a–Corn, WHEAT, sweet clover (for hay).
Rye	21.27	No. 3—Corn, RYE, sweet clover (plowed under).
Oats	18.04	N. 5—Fallow, OATS.
Alfalfa	17.91	No. 8—Corn, wheat and sweet clover, potatoes, flax (ALFALFA for hay).
Barley	17.03	No. 5—Fallow, BARLEY.
Emmer	15.66	No. 3—Corn, EMMER, sweet clover (plowed under).
Corn	14.37	No. 3—CORN, winter wheat, sweet clover (plowed under).
Flax	13.92	No. 2—Corn, FLAX
Winter wheat	13.33	No. 3—Corn, WINTER WHEAT, sweet clover (plowed under).
Sweet clover	12.90	No. 10–Corn, wheat, SWEET CLOVER (hay and seed).

(1) Return from Land in Crop. (2) Average Return From All Land in Rotation.

In considering returns, it is important to find out how much money was received per acre from land actually devoted to cultivated crops in a rotation, and to compare that with the income from all land involved in the same, where part of the land is devoted to fallow or green manure turned under. Obviously land in fallow or in green manure incurs a given amount of expense but it yields no direct income as far as crop is concerned.

In the last column of Table 16 are put down average returns per acre per year from several rotations.

These values are computed by adding the returns of all crops secured from the given rotations, and dividing that total by the number of acres involved, including those actually in crops plus those devoted to such purposes as fallow or green manure.

In the last column of the table it appears for instance that the highest avrage return per acre per year from any rotation came from Rotation 8,—corn, barley and sweet clover, potatoes, barley (alfalfa). The return from that rotation was $22.49 per acre. One reason for such a relatively high return was that a portion of it was utilized for potatoes, and potatoes although they may or may not yield high net profits, go far toward indicating high gross returns.

This crop sequence No. 8, containing potatoes (and alfalfa) produced generally lower returns from corn and other cereals than the simple two or three-year crop sequences.

No. 2—Corn, Small Grain. No. 3—Corn, Small Grain, Legume

The highest average returns in dollars per acre for short term rotations come from the two-year sequences. This appears from looking at the last column of the table. The highest average amount received from an acre of land in any two-year rotation comes from the simple rotation—corn, wheat, $17.13 per acre. A closer examination of the other two-year rotations in this series makes it clear that where corn was alternated with other small grains than wheat, the return from land in the rotation was lower.

It would appear that the way to get the highest returns from the smallest amount of land would be to use the two-year sequence of corn with wheat, or perhaps with whatever kind of small grain might appear desirable te grow. The foregoing statement applies no doubt to the outstanding staple crops which are fitted by conditions of soil and climate to central South Dakota, namely, corn, wheat, barley, oats, flax, rye, emmer (speltz).

Continuous Cropping in Cereals Reduces Income

It seems obvious from the last column of this table that an attempt to produce the foregoing small grain crops year after year on the same land without alternating them with a cultivated crop, like corn, materially reduces the gross income from an acre of land.

Summer Fallow Causes Further Reduction in Income

On a basis of this history of crop production if one attempts to produce acreage of these several small grains on land that has been previously summer fallowed, the average return per acre from land is further reduced in comparison with land in grain continuously.

Careful examination further in the last column of the table of a three-year crop sequence of the general type—corn, small grain, legume (plowed under), makes it appear that the gross return from such rotation is lower than that from land devoted to the same crops in a two-year sequence. This was due to the fact that land in such a rotation may be considered (for present calculation as producing cash returns in only two years out of three.)

The two simple sequences now under discussion may be examined not only from the standpoint of average return from all the land in the rotation but from the standpoint of average return from the land occupied in crop. The return from an acre of land occupied by crop is higher for the three-year crop sequences than for the analogous two-year sequences. It is not difficult to compute that the average return from the two-year sequences of corn, small grain is $14.29 per acre for the land actually occupied by crop, and the comparative return from seven three-year sequences involving a legume turned under is $15.14, a difference of 85 cents per acre in favor of the sequence with the legume plowed under.

Average Yield and Return in Dollars from Land in Cereals Greater from 3-year Sequence, Including Legumes

In order to make comparison of the average returns from the several crops secured from this three-year rotation with legumes turned under and

from the two-year rotation without any legume the comparison is put down in Table 17 as follows:

TABLE 17.—Average Gross Return (dollars) From Several Crops (18-19 years) at Highmore From 3-year Sequences With Legume Turned Under, and 2-year Sequence Without Legume.

Crop	Corn	Wheat	Oats	Barley	Flax	Rye	Emmer	Av.
Return from 3-year with legume turned under ------	13.61	20.26	16.37	16.19	13.56	21.27	15.66	16.70
Return from 2-year without legume ----------	12.60	20.46	17.00	15.07	13.92	15.69	15.22	15.82
Difference in favor of sequence with legume plowed under ----------	1.01	−0.20	−.63	1.12	−.36	5.58	.44	.88

The foregoing enables one to decide at a glance which crops yielded higher in the three-year rotations. Those which produced higher in two-year rotations without legume turned under were wheat, oats, flax. Whether or not the differences with these particular crops were incidental or exceptions to the general rule, cannot be decided at the present moment.

In making further consideration one should look at the comparative returns from the three-year rotation containing legumes, where the legume is not plowed under but rather harvested for hay. One such rotation is No. 3-A—corn, wheat, sweet clover (hay).

Another is Rotation 10—corn, wheat, sweet clover (for both hay and seed). In order to compare returns especially from corn and wheat in the two rotations just mentioned wherein the legume is plowed under and also to compare total returns, the following Table 18 is arranged.

TABLE 18.—Comparative Returns From 3-year Rotations With Legume Crop Either (1) Plowed Under or (2) Harvested.

Rotation	Rturn in Dollars From Given Crop		
	Corn	Wheat	Legume
No. 3—Corn, wheat, legume (legume plowed under for green manure)-------	13.01	20.26	
No. 3-a—Corn, wheat, legume (legume harvested for hay) ----------	13.11	22.07	6.06
No. 10—Corn, wheat, legume (legume harvested for hay and seed) ----------	10.35	16.83	9.44 (hay) 12.90 (seed)

One may observe from the foregoing that in Rotation 3-A where a legume was harvested for hay the return from corn was higher. Likewise the return from wheat in that rotation was higher in comparison with the returns from crops in Rotation No. 3, where the entire legume crop was plowed under. Furthermore it is very evident in these particular trials that the yields of both corn and wheat in Rotation 10 where the legume was harvested for both hay and seed were decidedly lower than in either of the other rotations.

The foregoing table not only brings out the apparent fact that yields and consequent returns from corn and wheat are influenced by the removal or non-removal of the legume crop; likewise the use and valuation placed upon the legume crop itself would have much to do with determining the total return measured in dollars or otherwise, from the rotation.

It is likely to be accepted as a fact indicated by these results that a legume should be included in a three-year crop sequence; whether plowed under directly for green manure or harvested for hay, or harvested both for hay and seed is not here taken up in detail.

Acknowledgments

The process of laying out and conducting a crop rotation experiment involving 5171 separate crop yields accumulated year after year for more than twenty years on measured areas of land, is one the nature of which may best be appreciated by those who have taken part in such enterprises. This work could only be completed with the cooperation of a number of persons, the greater number, though not all, of whom have been members of the South Dakota State college agronomy department.

The present record of crop yields which furnishes scientific information about the possibilities of farming, would not have been begun nor completed without the original donation of land for Highmore Experiment farm to the State of South Dakota by Mr. Drew. He stated in effect at the time of making the gift that knowledge secured from this land would serve as a basis for farming. His foresight should be recalled.

The present rotation experiments were outlined by the late Clifford Willis, then agronomist. These original outlines were completed, and additions made under the direction of the writer.

Among those who contributed valuable details referring particularly to the rotation experiments were John S. Cole, J. G. Hutton, Manley Champlin, the late George Janssen, Clifford Franzke. Suggestions concerning statistical data have been made by K. H. Klages. The transferring and transcribing of records has been accomplished by Miss Elva Feuerhelm, clerk of the agronomy department.

Special acknowledgment should be made of the continuous and dependable service of Mr. S. W. Sussex, who has remained in direct charge of the details of cultivation, planting and harvesting the crops in these experiments, putting down field records, without which trustworthy summaries would be impossible.

The writer believes that this outline of crop yields from several important rotations recorded with accuracy, albeit without wide comment, constitutes a record of agriculture that could have been secured in no other way. Appreciation of the assistance of those mentioned and of numerous other members of the agronomy department is acknowledged.

Appendix

More than Five Thousand Separate Crop Yields

The numerous yields of the various crops secured in nineteen successive years at Highmore are put down in detail in Appendix; Tables 1 to 11 inclusive.

The number of measured crop yields thus assembled is 5171. These yields represent the labor of carrying out usual operations of soil preparation, seeding, harvesting on small fields, usually one-tenth acre. Added thereto was the labor of weighing the crops at harvest time, and making

record of the weights. These were later computed and put down in terms of bushels (or units) per acre as they appear in the tables following.

Obviously these separate yields may not be read one by one by the general reader of this bulletin and they are therefore put down in an appendix, rather than being included in the text of the bulletin. They are assembled thus for two reasons, first they furnish the basis for the averages put down in the earlier tables of this bulletin, and consequently for the limited deductions attempted. Second, they are thus made available for anyone who may wish to make further computations from them. Agronomists and others having acquaintance with statistical methods, will of course understand that limited conclusions may be drawn from more than five thousand yields, covering nineteen seasons. Twice that number of seasons would equalize seasonal variations more accurately. These yields, however, constitute as complete a series as is available at the present time in the area represented by Highmore.

South Dakota Farm Prices

Likewise in this Appendix Farm Prices (Dec. 1) are put down in Appendix Table 12, for South Dakota for the years 1912–1930. These prices are used in computing the evarage returns from crop sequences in Table 16 of this bulletin (page 31). Average yields of the several crops for the several years from crop sequences as put down in the main portion of this bulletin were used as factors to be multiplied by these prices in order to compute average returns.

Computed Money Returns from Several Crops Produced on Separate Plots in Crop Sequences

As indicated in the foregoing sections actual yields from 5171 separate plots of land are recorded in Tables 1 to 11 of the appendix. Likewise South Dakota farm prices are put down in Appendix Table 12. Computations have been made by multiplying the several yields indicated by the corresponding farm prices for the years in which said yields were produced. The computed returns thus arrived at are put down in Appendix Table 13.

Soil and Climate

The two principal soil types upon which these experiments at Highmore were carried out are described in the Appendix, page 65. These are Williams Silty Clay Loam and Fargo Silt Loam. Rainfall at Highmore for the years 1908 to 1930 is put down by months, page 67. Soil and climate constitute two important conditions of crop growth, and these are included without discussion.

APPENDIX TABLE 1.—Crop Sequence No. 1—Corn. Wheat Peas, Sorghum, Oats, (alfalfa). Fertility Applied to Cereals as Indicated.

	Yield in Bushels Per Acre of Given Crop																			
	CORN										WHEAT									
Year	0	N35	P20	K20	0	P20 N35	K20 N35	K20 P20	K20 P20 N35	0	0	N35	P20	K20	0	P20 N35	K20 N35	K20 P20	K20 P20 N35	0
1912	14.3	11.3	8.5	14.4	15.9	10.8	10.5	14.1	15.8	20.3	0.8	0.3	0.8	0.9	0.7	0.4	0.2	0.1	0.1	0.1
1913	8.6	7.3	7.2	7.3	8.2	11.9	11.1	7.4	7.7	8.9	7.2	4.3	3.8	6.3	5.0	3.1	3.8	4.3	4.6	4.6
1914	7.9	5.0	5.0	2.9	11.7	6.7	8.6	10.0	6.3	5.1	11.0	9.2	10.3	9.7	9.5	10.0	9.5	10.3	9.3	8.5
1915	28.7	30.4	34.0	32.2	33.9	38.3	37.6	35.1	37.2	31.8	30.8	30.5	31.8	30.0	26.8	26.2	28.0	27.3	31.2	30.0
1916	25.9	28.8	32.1	30.1	27.7	27.8	23.6	22.0	22.0	24.2	19.0	15.2	18.7	18.0	18.3	17.2	15.0	21.3	16.0	18.3
1917	16.9	17.4	16.4	20.1	19.4	16.5	17.5	15.6	19.4	16.9	18.8	16.8	21.3	18.3	17.7	20.1	17.7	18.8	18.8	18.5
1918	33.4	33.2	32.9	29.2	30.2	30.7	30.5	30.0	29.9	31.1	33.0	24.5	22.0	28.2	27.5	19.8	22.0	22.3	20.5	24.6
1919	20.6	22.8	22.4	19.4	24.5	19.9	24.2	24.1	20.5	23.1	16.0	17.9	20.8	20.1	21.1	17.7	20.5	21.9	18.5	22.9
1920	33.9	36.2	39.2	35.3	36.2	44.6	42.2	36.3	44.1	36.3	23.2	26.3	25.0	28.1	24.9	26.7	27.5	25.0	28.1	25.1
1921	7.3	3.9	10.1	9.4	12.3	6.9	0.0	0.0	1.0	1.1	10.2	8.5	10.0	10.5	10.5	7.0	9.2	12.5	7.3	9.2
1922	54.3	47.5	46.6	51.1	56.3	47.5	46.1	50.7	49.4	56.6	32.3	30.0	38.0	32.0	33.2	37.3	29.0	30.3	31.8	32.3
1923	37.0	40.1	40.9	41.4	41.4	43.6	34.0	41.4	39.6	37.9	23.5	26.9	26.1	22.5	25.1	30.5	31.0	27.9	32.5	25.7
1924	10.7	13.9	15.1	10.7	15.6	17.9	13.1	10.9	10.9	15.4	22.5	25.0	26.2	21.3	21.3	25.7	23.3	22.5	22.7	20.7
1925	11.4	0.0	0.0	3.6	10.0	0.0	0.0	5.3	0.0	3.9	16.0	16.0	18.8	18.2	18.5	18.2	19.0	17.0	17.8	16.7
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	1.9	2.5	2.5	2.9	1.1	1.1	2.1	2.1	3.7
1927	35.9	31.0	32.9	34.6	33.6	29.4	28.9	32.4	30.7	34.3	21.2	22.0	24.8	23.3	21.5	24.0	22.3	25.7	26.3	24.3
1928	5.1	3.7	2.3	2.3	2.1	1.6	1.4	1.4	1.7	3.1	11.4	12.2	11.2	15.2	15.7	14.1	10.8	13.0	11.5	14.2
1929	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	14.0	15.3	12.5	12.2	13.2	11.5	13.2	11.2	12.7
1930	14.9	16.3	16.1	16.7	17.0	17.7	17.0	18.3	16.4	15.4	16.3	17.2	19.5	20.3	20.5	27.2	24.3	20.5	21.7	16.8

APPENDIX TABLE 1 (continued).—Crop Sequence No. 1—Corn, Wheat, Peas and Oats, Sorghum, Oats (alfalfa). Fertility Treatment Applied to Cereals as Indicated.

	Yield in Bushels Per Acre of Given Crop																			
	PEAS (for seed, forage, or both)*										SORGHUM									
Year	0	N	P	K	0	NP	NK	PK	NPK	0	0	N	P	K	0	NP	NK	PK	NPK	0
1912	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	640	595	625	730	655	805	715	1335	107	1005										
1913	3.0	2.5	5.5	4.0	4.5	4.5	3.5	2.5	3.0	3.5	11.0	13.1	11.9	13.6	18.8	17.2	19.2	15.2	12.2	11.0
	925	1044	1175	1264	1232	1594	1700	1741	1665	1226										
1914	2.3	1.8	1.9	2.1	2.1	1.3	1.2	1.8	1.4	2.2	10.6	13.8	15.9	14.4	13.7	16.4	11.3	11.8	12.2	11.1
1915	3800	5200	5000	5750	5600	5850	5850	5100	6350	5600	0.0	0.3	1.1	0.9	0.0	1.1	0.3	3.1	2.6	0.1
1916	3660	4490	3920	3650	3940	6280	4430	3750	5920	3800	3.4	4.6	4.8	1.2	2.6	2.8	1.2	3.8	3.4	1.6
1917	2210	2890	2540	2210	2300	4000	2000	2480	4100	2230	14.5	16.0	18.4	12.6	12.4	14.2	13.8	13.6	9.6	10.6
1918	2470	2430	1300	1140	2090	2730	1900	1650	2250	1020	24.0	24.8	19.8	23.0	33.6	30.2	28.8	26.4	22.8	20.8
1919	3750	3980	4380	3830	3950	4220	3950	2380	3850	3500	22.6	20.4	20.6	20.8	23.6	22.4	20.2	17.4	21.6	26.6
1920	4750	6400	6150	5000	4850	5750	5850	5250	5600	4350	30.4	38.0	44.0	36.0	37.4	50.6	40.8	47.8	52.2	39.4
1921	640	520	810	610	420	660	440	1060	1100	770	31.6	32.6	23.4	22.6	25.6	20.4	25.2	20.0	23.0	27.2
1922	3920	5100	4900	4300	4200	6300	5730	4750	6350	4600	31.1	37.2	30.6	24.0	26.4	34.0	35.2	39.4	36.0	31.6
1923	3170	5050	3220	2960	3000	5130	5300	3510	3600	3250	32.0	26.2	29.8	27.8	28.0	20.6	21.6	23.4	23.2	26.2
1924	3770	3250	3650	3000	2840	4750	3460	3750	5000	2770	12.0	16.0	17.2	11.0	13.0	19.2	13.0	11.4	15.9	12.0
1925	2000	2000	3350	1800	1850	2700	1900	2200	3120	2250	12.3	7.2	6.7	8.7	9.9	6.6	5.0	5.7	5.1	9.0
1926	00	00	00	00	00	00	00	00	00	00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1927	1480	2400	2100	1750	1600	2950	2470	2060	3220	1780	24.0	30.8	28.2	25.6	28.2	39.4	30.0	34.6	39.4	26.8
1928	1170	910	660	670	630	1160	800	790	1280	850	2.2	1.0	0.5	0.7	1.4	1.2	1.7	0.8	0.5	0.7
1929	1430	2170	1750	1580	1580	2410	2010	1710	2430	1010	4.6	6.4	6.4	5.8	5.0	5.0	2.8	0.6	2,2	1.1
1930	1700	2200	1630	1540	1510	2400	2060	1790	2530	1710	23.4	25.5	24.6	21.8	24.3	26.1	26.6	24.4	26.0	22.3

* Canada peas were seeded for seed or forage or both until 1915; afterward peas and oats together for hay. A price of $4.00 per bushel was assumed for seed, and the annual price of clover hay.

APPENDIX TABLE 1 (continued).—Crop Sequence No. 1—Corn, Wheat, Peas, Sorghum, Oats (alfalfa). Fertility Treatment Applied to Cereals as Indicated.

	Yield in Bushels Per Acre of Given Crop																			
	OATS										ALFALFA									
Year	0	N	P	K	0	NP	NK	PK	NPK	0	Yield of Hay (pounds); Seed (bushels)									
1912	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1913	0.4	0.5	0.3	0.4	2.1	0.9	1.9	2.1	1.0	1.5	1400	1600	1550	1220	1120	2400	1800	1500	2700	1800
1914	44.2	30.9	28.1	32.2	38.8	41.6	41.3	35.9	36.8	36.2	2600	3200	2650	1940	1620	3380	3550	1980	3820	2570
1915	99.1	105.9	98.4	92.2	93.8	112.2	106.3	108.1	85.0	106.3	7180	7610	7730	6900	6090	8110	6850	7040	7610	6990
1916	71.9	65.0	68.8	69.4	71.2	60.0	65.0	74.4	63.8	75.0	4660	4700	5120	4180	3840	5860	4800	5770	5520	5630
1917	35.6	35.3	47.8	34.4	35.9	39.7	31.9	41.6	42.2	36.6	2160	3520	3870	3010	2570	3890	3940	3590	3480	3390
1918	36.5	48.8	47.2	36.8	40.6	40.3	42.1	55.0	55.0	42.2	—	—	—	—	reseeded		—	—	—	—
1919	37.5	35.6	43.1	43.4	42.8	41.5	51.9	50.6	45.6	51.9	3800	3400	4330	3900	5000	4850	4430	4050	3780	3450
1920	57.2	82.5	51.9	50.6	54.1	75.9	79.1	66.7	71.9	68.7	7210	7630	8240	8030	8560	9150	8330	7910	8390	7100
1921	17.5	15.9	19.1	16.9	18.7	19.1	18.4	20.3	18.4	16.6	4070	2980	4120	4950	6030	6070	5100	4290	4890	4480
											0.7	0.2	0.4	0.5	0.7	0.4	0.5	0.3	0.2	0.2
1922	55.9	65.3	71.3	62.6	64.7	72.2	68.8	71.6	77.6	67.9	5020	3810	5960	5700	5410	5510	4930	4760	4570	4200
											0.7	1.0	0.9	0.8	0.9	0.5	0.7	0.7	1.0	1.2
1923	63.1	66.8	67.8	62.5	63.4	66.8	55.9	49.4	66.2	55.3	3290	3190	3880	3460	3970	3880	3500	3540	3580	3540
											0.7	1.7	0.9	1.6	1.9	2.1	2.3	1.6	1.9	1.2
1924	35.9	68.8	44.1	32.8	33.1	78.8	70.6	32.2	80.3	42.4	3450	3470	4090	3210	3760	3960	3130	3850	3760	2950
1925	36.3	40.9	37.0	33.7	41.9	48.8	39.8	40.3	43.4	39.7	2800	2270	2610	2400	2600	2580	2200	2600	2500	2230
1926	4.1	3.1	2.3	3.6	2.8	1.9	1.5	0.5	1.6	1.2	00	00	00	00	00	00	00	00	00	00
1927	42.3	51.9	51.6	44.8	45.2	52.7	42.9	50.3	58.7	47.7	4660	3890	4300	3690	3900	4440	3540	4230	4200	3480
1928	15.2	17.0	24.4	24.1	25.3	23.1	22.5	20.3	13.4	14.7	1040	780	1020	910	1090	1120	780	920	870	830
1929	31.2	28.7	22.3	27.2	31.3	24.1	30.3	27.2	19.8	18.4	2260	1820	2320	1860	2100	2270	2070	2340	2430	2130
1930	28.4	41.9	31.6	28.1	26.6	48.1	41.3	38.1	48.1	36.9	1950	1980	1030	1120	1570	1990	1870	800	2640	780

APPENDIX TABLE 2.—Crop Sequence No. 2.—Corn, Small Grain. Stall Manure Applied as Indicated.

	CORN										SMALL GRAIN									
	Yeild in Bushels Per Acre (70 lbs.) From Plot										Yield in Bushels Per Acre of Given Crop									
	1	2	3	4	5	6	7	8	9	10	Acme Wheat	Cole Oats	Odessa Barley	Khapli Emmer	Acme Wheat	Acme Wheat	Flax	Kharkof Wheat	Advance Rye	Acme Wheat
Year						M	M	M	M	M						M	M	M	M	M
1912	12.6	7.3	12.3	21.5	30.3	33.3	21.7	18.9	14.4	10.0	0.3	ununiform in rotation			10.7	10.7				0.2
											Pres'n				Pres'n	Pres'n				
1913	6.3	6.2	9.8	13.6	17.1	16.4	14.0	8.8	7.1	5.0	6.9	ununiform in rotation			10.8	10.8				7.0
											Pres'n				Pres'n	Pres'n				
1914	8.6	4.9	4.6	7.1	22.4	27.1	16.8	8.8	4.6	5.0	9.2	ununiform in rotation			10.7	11.7				8.5
											Pres'n				Pres'n	Pres'n				
1915	28.2	28.9	29.4	27.3	25.1	27.1	28.9	26.9	30.4	21.4	24.3	98.4	51.2	58.8	21.2	21.7		19.0	25.8	26.3
											Kub'ka	60-da.	H'chen		Kub'ka	Kub'ka				Kub'ka
1916	23.7	24.1	24.5	22.5	23.6	25.0	24.6	19.8	19.7	19.8	15.3	60.3	31.3	45.9	16.3	17.8	15.5	30.0	28.6	15.3
											Kub'ka	60-da.	H'chen		Kub'ka	Kub'ka				Kub'ka
1917	16.6	19.2	20.3	21.6	21.6	20.3	22.0	18.7	17.1	15.3	15.7	35.9	28.9	20.0	19.7	21.3	6.4	0.0	24.1	11.7
1918	25.3	27.5	26.0	29.9	29.5	30.5	25.9	24.9	22.1	25.8	18.3	37.8	28.7	25.5	30.2	31.0	8.7	0.0	16.4	16.0
1919	20.4	23.2	28.8	26.5	26.9	24.5	25.1	25.9	22.7	22.8	19.0	51.3	31.6	30.7	18.3	19.8	1.2	20.6	20.4	19.1
1920	32.9	36.6	35.2	38.5	35.1	32.1	31.0	29.9	30.7	35.0	24.2	67.5	31.0	25.7	15.3	17.7	1.8	0.0	9.3	19.8
1921	0.0	1.1	13.4	12.0	15.6	8.1	9.4	6.3	1.9	5.4	9.8	19.7	20.3	16.8	14.7	14.0	0.6	12.0	17.7	11.5
1922	48.6	50.0	45.4	46.1	45.5	43.6	43.9	40.0	35.8	37.8	29.2	59.7	47.9	33.9	30.5	38.5		35.7	49.1	27.5
1923	38.9	37.4	44.8	40.2	41.6	41.0	41.2	37.5	37.0	41.6	23.0	47.5	32.1	21.5	22.1	26.0	7.9	0.0	11.1	26.5
1924	17.3	20.9	17.0	20.9	23.1	26.5	22.9	22.1	15.1	15.1	18.5	58.4	37.5	46.0	25.5	32.0	10.7	31.3	19.8	24.3
1925	— Drought —		4.4	7.9	9.7	12.6	7.4	—	Drought	—	15.3	39.1	21.5	18.5	24.5	29.5	9.8	7.0	7.5	19.0
1926	—	—	—	—	Drought		—	—	—	—	3.4	1.9	1.4	4.0	5.9	5.0	0.8	2.3	1.8	4.2
1927	28.3	31.7	33.1	34.7	35.7	33.3	32.4	32.1	29.7	29.3	24.3	42.3	25.9	40.8	30.7	33.9	10.2	3.8	27.0	25.8
1928	4.6	4.7	5.0	5.1	8.0	6.4	9.0	4.3	3.9	4.3	11.3	21.6	16.5	20.8	18.0	19.3	4.5	15.4	16.5	16.3
1929	—	—	—	—	Drought		—	—	—	—	10.0	29.7	14.6	6.8	10.8	12.8	3.8	13.8	14.5	7.0
1930	13.3	14.3	13.6	10.1	7.0	8.7	9.7	10.9	13.1	12.1	13.3	40.6	29.4	21.8	16.8	18.2	5.4	winter killed	28.0	16.5

APPENDIX TABLE 3.—Crop Sequence 3.—Corn, Small Grain, Legume (plowed under for green manure except plot 6, which is removed for check).

CORN											SMALL GRAINS										SWEET CLOVER	
Yield in Bushels Per Acre of Given Plot											Yield in Bushels Per Acre of Given Crop										Legume - Weight Tons Per Acre	
Year	1	2	3	4	5	6	7	8	9	10	Durum Wheat	Oats	Barley	Emmer	Durum Wheat	Durum Wheat	Flax	Winter Wheat	Rye	Durum Wheat	Plot No. 6	
1912	11.8	17.5	17.1	12.6	19.0	13.7	21.1	15.0	18.6	20.5	0.2 Pres'n			0.6	0.2 Pres'n	0.3 Pres'n				0.7 Pres'n	Peas	1.1
1913	6.6	9.1	11.6	10.6	7.1	8.5	9.8	12.1	10.7	7.5	2.4 Pres'n			0.4	0.0 Pres'n	0.0 Pres'n				0.0 Pres'n	Peas	0.2
1914	13.3	19.6	14.6	12.0	15.6	16.6	20.5	17.9	18.8	15.4	10.7 Pres'n			35.5	10.0 Pres'n	10.3 Pres'n				10.5 Pres'n	Peas	0.5
1915	30.1	31.1	32.0	31.6	29.1	28.9	29.4	24.8	26.3	27.6	17.2 Kub'ka	92.5 60-da.	49.3 H'chen	57.0	14.0 Kub'ka	16.0 Kub'ka				16.5 Kub'ka	Sw. Clover Hay	0.2
1916	23.2	24.7	25.6	24.5	23.1	22.0	25.3	28.0	25.1	24.5	16.8 Kub'ka	69.7 Kub'ka	35.4 H'chen	44.4	14.8 Kub'ka	15.0 Kub'ka	16.6	25.8	33.9	17.2 Kub'ka	Sw. Clover Hay	0.1
1917	20.1	21.1	20.2	18.5	18.6	18.8	21.5	19.1	18.1	15.3	16.7	33.4	28.9	21.5	18.0	18.3	5.7	0.0	35.7	16.5	Sw. Clover Hay	0.3
1918	28.5	28.5	28.1	24.9	24.9	29.1	27.4	28.1	27.6	30.6	29.2	45.3	28.9	19.7	26.0	36.3	7.8	0.0	30.4	27.8	Sw. Clover Hay	0.2
1919	23.9	23.1	28.1	26.7	23.1	24.7	24.0	26.1	22.0	24.7	19.0	69.1	38.1	44.0	16.0	17.5	0.9	20.5	28.6	17.5	Sw. Clover Hay	0.2
1920	40.1	41.0	37.7	36.3	35.0	30.2	32.0	38.9	35.1	37.8	16.3	69.2	36.1	28.7	17.3	20.0	7.9	0.0	24.6	16.5	Sw. Clover Hay	0.4
1921	20.3	20.6	20.6	15.9	20.1	31.0	20.6	25.1	24.9	25.0	6.7	11.6	14.0	4.5	8.8	12.7	1.4	11.2	21.8	8.2	Sw. Clover Hay	0.1
1922	46.8	45.4	43.0	43.9	45.2	46.6	49.6	45.3	47.7	48.9	34.5	69.1	45.8	32.7	27.3	26.5		48.2	48.0	29.8	Sw. Clover Hay	0.8
1923	40.0	41.2	43.4	48.8	33.7	34.4	38.1	38.6	38.8	37.5	25.5	56.9	40.4	25.2	21.7	23.9	4.4	0.0	11.0	25.1	Sw. Clover Hay	0.3
1924	15.0	15.7	14.7	12.8	14.0	16.8	17.1	16.4	14.0	16.7	24.2	68.7	39.6	40.0	27.0	29.5	15.0	42.2	35.2	25.2	Sw. Clover Hay	0.7
1925	5.6	2.3	2.9	3.7	2.1	4.0	8.4	18.4	11.9	8.4	19.3	43.8	27.3	15.0	18.5	18.5	5.7	2.7	10.9	20.7	Sw. Clover Hay	0.4
1926	—	—	—	Drought			—	—	—		1.5	0.0	0.0	0.0	1.6	2.2	0.0	3.7	2.0	1.9	Sw. Clover Hay	0.0
1927	32.9	30.0	28.6	28.3	28.0	28.6	28.6	28.6	29.4	27.1	25.7	46.9	29.0	43.8	30.5	32.0	9.3	0.8	29.1	27.0		0.0
1928	7.7	9.7	12.1	12.2	9.7	13.0	16.4	20.0	14.0	10.6	12.7	16.3	13.5	12.8	13.8	16.8	2.6	13.2	17.9	16.5	Sw. Clover Hay	1.5
1929	3.8	2.3	1.9	1.1	1.1	1.0	0.9	0.6	0.6	0.4	12.2	33.1	21.5	15.0	12.3	12.8	3.7	20.2	22.9	11.8	Sw. Clover Hay	2.8
1930	13.6	16.4	14.9	10.6	11.7	12.0	12.8	10.3	11.9	9.4	14.0	41.3	29.8	25.0	18.3	19.3	5.1	winted killed	33.9	17.0	Sw. Clover Hay	0.2

APPENDIX TABLE 4.—Crop Sequence No. 4.—Corn, Rye (and sweet clover), Legume (for hay and seed), Millets (in cultivated rows), Small Grains, Peas and Rape (plowed under for green manure except plot 6, which is removed for check).

	Yield in Bushels Per Acre of Given Crop																			
	CORN										RYE (and sweet clover)									
Year	O	M	M	M	O	O	M	M	M	O										
1912	20.0	15.9	12.5	12.6	20.6	22.9	22.5	23.1	15.6	17.8	2.7	5.2	8.0	8.8	6.5	5.3	5.5	5.7	5.7	6.8
1913	11.6	10.2	11.5	11.0	12.0	11.9	11.1	11.8	11.7	10.9	10.0	15.0	13.5	11.4	12.7	13.8	14.8	15.7	13.6	10.5
1914	7.4	10.6	11.6	7.4	6.0	6.0	4.9	5.4	5.4	9.3	12.1	12.9	15.5	12.9	13.4	16.1	17.9	20.4	20.2	15.9
1915	23.1	31.3	28.1	28.1	24.9	26.1	32.5	31.8	32.7	28.5	26.7	26.9	28.8	28.1	24.9	23.1	26.3	29.4	29.9	22.4
1916	16.6	16.8	16.0	19.0	17.7	20.7	19.5	20.7	21.0	21.2	26.1	22.9	29.5	27.5	23.6	22.3	27.7	32.1	34.3	26.6
1917	13.4	13.3	14.3	14.6	17.0	16.1	15.9	16.4	18.3	13.3	23.4	22.1	23.7	25.0	26.8	25.3	29.6	33.2	31.0	27.8
1918	25.5	26.8	28.2	30.9	32.2	32.6	32.7	35.5	34.3	29.6	13.3	11.1	17.5	22.5	17.1	18.9	25.0	24.8	25.3	19.8
1919	18.4	16.9	19.3	18.6	16.6	16.1	20.1	21.1	18.4	15.3	22.3	21.3	26.7	30.3	24.6	21.9	26.4	24.1	30.3	22.3
1920	33.8	37.9	37.8	37.9	35.6	28.7	34.8	34.8	39.0	36.0	22.5	19.3	25.7	26.4	24.8	24.6	29.3	24.5	27.1	22.5
1921	9.4	7.3	11.0	9.1	15.1	22.7	13.6	13.9	14.7	15.6	18.2	19.6	19.1	19.8	15.7	15.0	17.0	16.6	17.1	14.5
1922	41.3	40.5	40.4	42.0	43.8	45.0	43.2	42.5	42.5	43.0	37.1	42.0	44.1	43.4	43.8	48.9	47.3	49.8	46.1	41.6
1923	30.0	36.9	36.0	36.2	33.5	30.2	34.9	35.6	32.6	28.2	11.8	10.5	12.7	15.7	13.4	13.5	14.3	12.1	14.3	12.8
1924	16.4	18.6	14.8	21.0	21.5	22.7	22.0	23.7	22.7	23.2	22.1	35.0	35.7	36.4	24.8	23.9	36.1	37.8	37.8	27.1
1925	7.7	8.3	8.9	8.0	8.6	5.4	4.3	5.7	5.3	7.3	11.3	10.7	10.0	13.2	9.6	11.1	14.6	13.4	13.6	10.4
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	2.0	2.4	1.7	1.7	1.2	1.3	1.2	1.0	1.1
1927	27.4	26.9	25.9	25.0	31.1	27.7	29.1	27.9	28.3	29.6	30.5	32.7	37.9	38.9	30.0	27.3	32.3	29.5	28.6	25.4
1928	6.4	4.9	2.9	3.4	2.9	2.8	2.4	2.4	2.8	5.2	15.0	21.9	22.1	21.5	20.4	19.6	25.0	21.4	22.3	16.9
1929	1.4	1.4	3.0	2.3	3.0	3.7	2.0	2.4	1.4	4.3	14.5	11.1	12.9	12.5	13.6	15.4	15.0	15.4	14.1	18.4
1930	13.6	13.5	14.5	15.1	17.6	17.1	17.7	18.3	19.8	17.1	25.4	30.2	29.1	31.3	27.5	28.4	31.3	35.7	32.5	30.4

APPENDIX TABLE 4 (continued)—Crop Sequence No. 4—Corn, Rye (and sweet clover), Legume (for hay and seed), Millets (in cultivated rows), Small Grains, Peas and Rape (plowed under for green manure except plot 6, which is removed for check).

	Yield Per Acre of Given Crop																			
	LEGUME										MILLETS									
Year	Yield Per Acre—Hay (pounds); Seed (bushels)										O	M	M	M	O	O	M	M	M	O
1912	peas 00	soyb's 00	cowp's 00	peas 00	peas 00	peas 00	peas 00	soyb's 00	cowp's 00	peas 00	2.4	4.8	1.9	5.2	4.0	7.2	5.6	0.8	0.3	6.0
1913	peas 0.4	soyb's 0.7	cowp's 4.7	peas 0.7	peas 0.7	peas 1.0	peas 0.9	soyb's 0.6	cowp's 0.6	peas 1.0	5.6	5.6	1.1	4.4	5.2	6.8	8.3	9.0	18.0	10.4
1914	peas 2.7 1160	soyb's 0.0 1740	cowp's 1.8 2250	peas 2.7 1530	peas 2.7 1380	peas 2.7 1780	peas 2.3 2580	soyb's 0.0 2280	cowp's 1.9 2390	peas 2.3 1880	0.9	2.1	1.6	3.8	4.2	4.0	2.5	10.6	9.4	3.4
1915	3.8 3600	3.2 3790	5.0 3940	4.6 4340	6.0 4900	5.0 5310	5.3 4270	6.0 4070	3.0 4120	4.1 5000	19.8	32.0	23.2	29.6	25.8	26.0	26.2	24.0	27.2	22.4
1916	3.4 1250	3.2 1750	3.3 1300	2.8 1600	2.2 2600	2.2 2950	1.8 2050	2.3 1550	1.9 1650	2.2 2550	26.6	27.2	21.2	25.0	24.6	24.0	20.6	10.4	10.0	22.8
1917	0.8	0.3	0.4	0.6	0.9	1.3	1.7	1.8	1.3	1.8	9.0	13.4	4.6	10.2	9.6	4.4	2.6	4.2	5.8	2.4
	Peas (for seed)																			
1918	7.8 1640	4.2 1640	5.5 1560	5.5 1260	9.5 1070	13.3 1400	7.1 1240	6.8 1380	7.0 1060	10.5 1410	24.2	26.4	17.2	24.4	33.0	37.4	37.0	34.0	35.6	30.0
1919	1.0	2.9	2.3	1.9	1.9	2.9	2.7	2.3	1.2	2.1	20.6	13.0	17.6	18.0	22.0	21.4	22.0	16.6	17.0	23.8
	Peas (for hay)																			
1920	1890 3080	2570 3780	1610 3600	2060 3600	3030 3850	2090 4240	1990 4480	2550 4630	1470 4760	2020 4340	34.4	30.6	35.0	29.0	28.5	30.8	32.6	20.4	27.6	35.0
1921	1.2	2.1	2.8	2.0	1.8	1.3	3.0	2.8	2.0	1.8	26.6	24.8	25.2	25.9	25.9	30.4	29.5	15.0	14.6	25.8
1922	00	00	00	00	00	00	00	00	00	00	19.5	20.0	18.0	18.8	17.3	18.0	15.7	10.9	19.6	18.2
	Soybean seed																			
1923	9.1 6250	10.1 5630	10.6 6220	10.0 6800	9.5 6820	9.6 7240	11.6 7580	10.3 6720	9.5 6960	7.5 6600	32.6	35.6	35.0	37.0	31.4	29.6	37.6	18.8	23.4	31.6
1924	2.1	0.8	1.1	2.2	2.9	3.5	2.8	3.6	3.3	2.9	11.8	12.6	12.0	14.6	16.2	16.6	16.4	10.4	13.0	14.0
	Soybeans for seed																			
1925	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.6	0.2	0.2	0.7	0.9	0.5	7.4	5.6	1.6
	Soybeans for seed																			
1926	4.3	4.2	4.0	3.3	3.2	3.8	4.5	4.3	3.5	2.9	2.8	3.8	1.9	3.3	4.6	6.2	5.0	2.1	1.0	4.6
1927	00	00	00	00	00	00	00	00	00	00	29.4	34.4	28.6	33.4	27.0	27.2	35.8	20.2	20.1	29.8
1928	00	00	00	00	00	00	00	00	00	00	2.2	4.8	3.5	3.8	6.6	3.0	2.3	3.6	4.8	3.7
	Soybean seed																			
1929	350	400	520	400	400	630	610	500	550	410	1.0	3.3	1.8	1.0	2.6	0.9	0.8	1.5	0.8	0.4
1930	00	00	00	00	00	00	00	00	00	00	12.8	11.8	11.1	9.3	13.0	13.6	9.9	7.3	7.9	9.4

TABLE 4 (continued)—Crop Sequence No. 4—Corn, Rye (and sweet Clover), Legume (for hay and seed), Millets (in cultivated rows), Small Grains, Peas and Rape (plowed under for green manure except plot 6, which is removed for check.)

	Yields of Given Crops by Plots in Given Years										
	SMALL GRAINS										PEAS and RAPE
Year	Barley	Oats	Wheat	Barley	Barley	Barley	Barley	Flax	Wheat	Barley	Yield of Plot 6, lbs. Hay or Gr. wt.
1912	0.8	1.1	4.1	1.2	0.3	0.3	0.2	0.1	0.1	0.1	130 lbs. green weight
1913	1.0	2.7	4.4	1.0	1.2	2.1	1.4	3.1	1.7	2.3	270 lbs. green weight
1914	22.7	19.4	18.3	18.7	25.0	30.2	18.7	26.5	31.2	25.4	650 lbs. green weight
1915	56.4	66.6	60.3	56.6	50.5	48.9	44.5	41.8	45.3	47.4	485 lbs. hay
1916	29.2	45.9	41.1	33.8	24.6	27.5	33.4	31.3	27.9	28.4	170 lbs. hay
1917	14.6	29.4	11.2	18.5	12.5	12.9	16.2	2.1	13.2	13.1	115 lbs. hay
								W.Wheat	Rye		
1918	20.8	31.3	13.8	21.7	16.7	13.3	19.3	0.0	9.6	16.7	96 lbs. hay
1919	29.8	54.1	19.5	34.3	33.5	34.5	37.7	28.1	29.1	31.5	305 lbs hay
1920	32.5	78.7	22.0	36.4	34.2	29.7	35.9		24.8	28.3	215 lbs. hay
1921	9.2	10.9	5.4	15.6	10.8	9.4	16.0	11.8	14.5	10.7	60 lbs. hay
1922	45.0	74.4	40.8	46.5	34.4	29.8	43.1	42.7	38.4	26.0	1055 lbs. green weight
1923	40.8	61.2	28.3	40.4	31.0	27.9	36.2	7.5	17.1	27.7	591 lbs. green weight
1924	48.7	99.0	28.1	59.0	47.1	43.7	58.9	53.2	36.1	37.7	1000 lbs.
1925	17.9	42.2	15.0	28.1	27.3	28.3	34.6	21.0	13.2	26.3	400 lbs.
1926	1.4	0.0	0.9	0.0	0.8	1.0	0.0	1.3	1.1	0.6	00 lbs.
1927	28.9	50.6	23.3	33.3	30.8	32.3	35.2	24.2	32.1	30.1	625 lbs. green weight
1928	5.0	10.9	3.3	4.0	1.9	2.2	4.6	10.7	17.0	5.0	167 lbs. green weight
1929	9.4	14.4	5.2	11.9	11.7	12.7	10.6	13.8	15.4	16.9	274 lbs. green weight
1930	27.1	51.9	19.8	30.6	24.6	21.9	25.0	0.0	24.3	19.8	460 lbs. green weight

APPENDIX TABLE 5.—Crop Sequence 5—Fallow and Small Grain

	Yield in Bushels Per Acre for Given Crop									
Year	Fallow	Wheat	Oats	Barley	Emmer	Wheat	Wheat	Flax	W.Wheat	Rye	Wheat
1912		0.3				0.7	1.3		0.0		0.7
1913		3.8				2.8	3.5		3.1		3.3
1914		9.3				10.0	11.1		0.0		11.0
1915		20.7	102.5	48.5	60.0	18.0	17.5		0.0	30.0	19.3
1916		14.0	70.0	31.7	46.9	12.7	12.7	12.9	19.2	38.4	13.3
1917		15.3	49.7	27.5	12.2	15.8	18.0	5.3	0.0	23.9	15.7
1918		27.0	55.0	46.0	28.0	21.2	29.0	3.8	0.0	31.3	24.8
1919		20.7	64.1	38.1	33.2	20.0	20.3	0.1	24.8	29.3	21.7
1920		12.5	80.0	33.1	27.2	13.3	14.0	1.3	0.0	33.0	15.3
1921		9.8	23.8	28.7	19.1	11.7	12.1	2.9	9.3	19.1	9.5
1922		32.8	65.1	53.8	33.9	26.5	36.5		36.5	34.1	29.0
1923		22.5	55.0	40.4	14.0	27.0	28.6	3.9	7.1	8.3	26.6
1924		27.5	86.8	17.4	40.0	23.6	28.8	10.1	28.1	31.9	25.3
1925		22.0	52.5	39.8	28.5	23.7	21.7	3.0	1.3	13.8	21.9
1926		4.3	0.0	1.3	0.0	1.7	0.7	0.0	0.9	0.6	1.7
1927		25.0	51.3	38.5	45.8	27.7	28.3	6.4	15.0	35.0	26.0
1928		17.3	23.1	22.1	15.8	14.4	12.9	1.2	0.0	13.8	12.5
1929		6.7	20.6	18.5	8.5	8.5	9.0	1.9	8.8	21.8	7.2
1930		16.5	45.6	31.5	23.8	18.3	18.3	4.0	winter killed	32.5	15.3

APPENDIX TABLE 6.—Crop Sequence No. 6—Corn, Oats, Wheat
Yield in Bushels Per Acre of Given Crop

Year	O	M							M	O
						CORN				
1912	21.5	16.4	3.4	15.3	31.8	27.3	6.3	2.0	9.0	15.3
1913	4.8	4.3	5.2	4.4	6.2	7.3	8.2	8.4	6.8	8.2
1914	4.1	4.9	7.7	7.8	8.3	6.3	3.8	5.8	8.4	12.6
1915	19.1	29.7	10.3	2.9	— water —		5.7	11.4	34.3	32.1
			alfalfa +				alfalfa +			
1916	20.2	20.5	brome		— trees —		brome		24.3	23.5
1917	11.3	13.6	15.8	15.6	17.1	12.0	10.4	12.0	13.5	13.2
1918	36.7	36.3	— grass —		— trees —		— grass —		32.6	27.8
1919	26.5	24.9	— grass —		— trees —		— grass —		24.9	28.6
1920	36.3	43.4	42.1	43.3	43.7	44.0	43.7	42.4	47.2	33.3
1921	17.0	17.4	— millet —		— trees —		— millet —		31.4	20.4
			brome +				brome +			
1922	43.9	41.4	alfalfa		— trees —		alfalfa		52.7	56.4
1923	44.0	42.0	44.9	41.4	44.3	49.1	46.5	47.5	44.7	38.8
1924	21.4	21.4	— grass —		— trees —		— grass —		26.1	16.4
1925	0.0	0.0	— grass —		— trees —		— grass —		15.9	20.0
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.9
1927	30.9	28.6	— grass —		— trees —		— grass —		36.4	34.9
1928	4.1	2.6	— grass —		— trees —		— grass —		4.7	6.3
1929	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1930	Failure		— grass —		— trees —		— grass —		13.5	10.0
						OATS				
1912	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1913	0.5	0.2	0.3	1.1	6.3	3.1	0.3	0.0	0.0	0.3
1914	36.2	21.4	34.7	35.0	41.9	42.5	44.9	56.7	41.6	42.2
1915	101.3	90.6	91.9	105.6	93.8	100.0	92.2	78.2	69.7	100.6
			alfalfa +				alfalfa +			
1916	76.7	76.7	brome		— trees —		brome		85.9	76.4
1917	33.4	32.2	— grass —		— trees —		— grass —		38.1	36.9
1918	33.8	34.4	39.4	37.8	36.9	33.4	30.0	35.0	45.0	41.6
1919	61.2	55.6	— grass —		— trees —		— grass —		51.5	60.9
1920	58.1	64.4	— grass —		— trees —		— grass —		54.7	60.3
1921	15.0	13.4	15.0	14.1	13.7	15.0	14.7	17.8	20.3	12.3
1922	68.8	70.4	— millet —		— trees —		— millet —		70.4	68.5
1923	52.5	57.8	— grass —		— trees —		— grass —		66.6	59.7
1924	51.8	66.8	67.1	60.9	63.7	63.4	63.4	64.6	74.1	60.3
1925	53.1	57.5	— grass —		— trees —		— grass —		52.5	49.7
1926	2.1	0.0	— grass —		— trees —		— grass —		3.9	3.3
1927	42.3	47.9	42.2	41.0	42.8	44.1	42.2	43.1	50.9	49.4
1928	26.3	28.7	— grass —		— trees —		— grass —		25.6	24.7
1929	24.7	23.7	— grass —		— trees —		— grass —		26.3	39.4
1930	33.1	36.6	32.2	32.5	33.1	35.6	35.6	39.1	45.0	41.6
						WHEAT				
1912	0.4	0.4	1.7	1.2	0.2	0.4	1.0	4.2	2.7	0.3
1913	1.3	0.7	0.3	1.5	1.2	1.1	0.7	1.0	1.8	1.5
1914	10.0	4.8	4.0	7.8	10.7	8.5	7.5	11.7	9.4	9.7
1915	25.7	26.7	18.3	25.0	20.8	15.0	17.2	16.7	20.0	22.2
1916	15.8	9.0	13.3	17.2	13.8	13.3	21.6	40.0	22.0	14.2
			brome +				brome +			
1917	14.7	10.8	alfalfa		— trees —		alfalfa		11.3	8.5
			brome +				brome +			
1918	16.3	14.0	alfalfa		— trees —		alfalfa		27.5	23.5
1919	16.8	18.8	15.0	13.1	13.1	15.5	19.1	17.6	19.1	15.8
			brome +				brome +			
1920	14.8	17.0	alfalfa		— trees —		alfalfa		19.5	14.5
1921	1.0	2.3	alfalfa		— trees —		alfalfa		9.5	3.7
1922	14.7	15.0	12.7	13.5	15.0	16.0	16.5	16.8	18.7	17.3
1923	12.3	17.3	— brome —		— trees —		— brome —		16.8	14.5
1924	16.0	17.5	— brome —		— trees —		— brome —		17.3	16.0
1925	6.3	7.8	7.5	7.2	7.0	8.2	7.0	6.0	7.7	5.0
1926	1.7	1.7	— grass —		— trees —		— grass —		1.6	0.8
1927	24.7	27.2	— grass —		— trees —		— grass —		34.5	28.8
1928	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.7
1929	10.2	9.8	— grass —		— trees —		— grass —		11.7	10.0
1930	13.2	15.5	— grass —		— trees —		— grass —		19.8	16.0

APPENDIX TABLE 7.—Crop Sequence No. 7—Corn, Barley, Grass, Grass (alfalfa), Yields of Corn and Barley Available.

CORN

Yield in Bushels Per Acre of Given Crop

Year	1	2	3	4	5	6	7	8	9	10	11
1912	21.5	20.0	18.5	19.9	20.9	22.1	22.4	25.3	35.8	28.1	12.5
1913	8.9	8.3	8.7	9.3	9.1	9.8	9.0	6.9	7.7	8.6	9.0
1914	7.3	6.7	6.3	7.9	6.3	3.3	3.6	3.6	3.7	12.7	21.3
1915	33.5	37.2	34.6	31.6	32.1	36.4	35.5	36.5	36.9	38.0	33.1
1916	18.7	19.5	23.8	20.0	18.6	19.1	19.3	27.0	25.0	19.7	14.0
1917	7.1	6.8	7.1	11.5	16.6	10.5	7.0	4.4	2.3	1.9	0.9
1918	26.0	25.8	25.8	29.1	26.1	24.8	25.9	26.1	28.3	29.2	31.5
1919	23.0	25.9	26.5	26.0	26.3	23.5	23.4	24.5	23.8	20.5	21.0
1920	41.6	42.6	42.3	43.8	42.6	37.8	38.1	38.3	36.5	35.4	39.0
1921	11.1	15.9	11.4	13.1	11.6	7.4	8.1	9.1	15.3	13.0	7.7
1922	39.1	35.7	40.2	38.2	33.9	33.9	34.3	41.8	46.4	44.8	39.1
1923	36.9	38.9	39.4	39.8	39.5	40.2	41.9	40.4	36.0	35.5	33.9
1924	23.4	19.7	13.1	11.4	12.5	10.4	13.0	12.7	12.0	11.1	11.5
1925	8.0	4.7	3.1	3.0	3.0	0.0	0.0	0.0	7.3	11.7	14.3
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1927	34.0	36.6	38.6	36.0	34.0	37.1	37.9	36.7	37.1	32.4	29.6
1928	4.0	3.4	2.9	1.9	1.9	1.6	1.6	3.3	3.3	4.1	4.3
1929	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1930	14.2	16.2	17.1	14.1	14.6	13.6	13.3	12.7	14.0	15.0	15.1

BARLEY

Year	1	2	3	4	5	6	7	8	9	10	11
1912	0.4	0.1	0.2	0.4	0.5	1.0	0.4	0.3	0.3	0.2	0.2
1913	0.0	5.5	5.2	5.9	0.0	0.0	0.6	4.0	5.8	6.5	0.0
1914	24.2	19.2	22.7	25.0	25.6	17.9	18.1	22.9	30.4	22.7	21.9
1915	48.4	45.4	34.3	38.3	47.8	52.2	49.1	39.1	43.7	54.9	54.1
1916	25.0	20.8	20.2	20.6	23.4	25.0	25.4	20.4	23.4	28.1	25.0
1917	22.1	18.7	13.7	16.6	18.9	16.9	16.9	13.9	21.2	29.2	27.3
1918	18.8	7.9	20.8	19.5	15.2	14.3	6.2	20.8	39.8	32.3	13.1
1919	28.3	29.1	32.3	33.7	37.7	38.7	37.8	36.0	46.9	34.2	34.2
1920	30.2	28.8	29.6	25.0	28.8	37.9	41.2	42.7	41.9	40.2	40.2
1921	4.4	5.3	7.5	9.2	8.8	7.5	5.8	6.3	8.8	6.3	6.3
1922	43.1	46.0	44.8	40.6	41.0	51.3	52.1	56.7	61.4	62.5	58.7
1923	38.9	36.0	37.3	37.7	40.8	39.6	40.2	35.4	41.8	39.6	42.5
1924	24.7	25.6	27.1	30.4	31.0	33.1	38.4	41.4	42.3	44.3	44.7
1925	26.5	23.8	22.7	22.5	27.5	27.1	27.3	28.1	28.5	26.5	26.7
1926	14.4	12.1	7.9	7.1	8.5	14.6	1.0	1.3	2.5	4.2	6.5
1927	29.6	32.6	31.5	33.9	32.1	30.8	31.0	29.2	29.8	34.2	32.8
1928	16.7	18.8	16.0	19.2	20.3	12.8	8.6	10.3	15.0	14.8	14.2
1929	11.9	14.2	13.1	13.9	14.8	8.5	9.8	12.7	16.7	17.7	16.9
1930	18.5	19.2	23.5	26.5	28.5	29.4	27.3	26.0	26.0	24.4	25.2

APPENDIX TABLE 8.—Crop Sequence No. 8—Corn, Small Grains + Clover, Potatoes, Small Grains + Flax, (alfalfa for hay).

Yield in Bushels Per Acre of Given Crop

	CORN						SMALL GRAINS—CLOVER						POTATOES					
Year	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
							wheat	oats	barley	emmer	wheat	wheat						
1912	19.0	17.5	19.1	18.9	18.3	21.7							49.5	67.7	77.6	50.5	55.8	48.0
1913	7.8	6.0	4.6	5.0	4.9	8.1							60.2	30.5	29.8	50.6	58.0	50.9
1914	12.6	16.1	22.6	17.6	16.0	10.0							71.2	85.8	69.0	68.5	73.7	67.5
1915	24.6	26.0	22.1	25.1	21.7	18.3							83.5	85.8	106.3	98.5	113.8	98.0
1916	19.8	29.8	23.7	24.7	23.1	19.0							70.1	85.3	73.5	81.0	84.8	74.9
1917	13.0	12.4	12.3	12.3	12.5	13.4							54.3	89.3	62.0	62.1	58.1	51.3
1918	28.6	29.5	30.0	27.9	27.1	24.8	19.3	37.2	21.8	16.2	15.8	17.0	27.8	30.5	120.8	114.3	27.1	22.0
1919	21.1	21.6	22.2	22.6	25.4	24.6	21.3	63.1	38.7	43.5	22.3	22.0	45.5	31.7	43.0	38.8	48.0	39.3
1920	32.9	33.1	34.4	38.2	32.1	30.2	10.3	62.5	30.8	25.0	10.7	8.0	80.8	70.3	68.5	67.1	87.3	68.0
1921	00.0	0.0	7.4	1.4	0.0	0.0	8.2	19.7	15.2	9.8	10.5	12.4	86.6	96.1	121.6	128.6	132.3	120.9
1922	32.2	37.5	39.8	40.0	32.5	33.9	23.8	50.9	42.1	24.6	29.0	27.5	90.0	108.3	125.7	131.0	97.9	102.5
1923	49.1	54.1	53.7	52.1	46.0	42.4	26.8	63.4	68.1	14.8	24.5	26.6	37.3	35.5	88.0	77.0	43.7	36.5
1924	14.7	12.3	13.4	13.4	12.9	17.6	19.5	71.3	36.0	37.3	20.8	19.5	39.7	28.2	46.7	36.7	44.8	61.7
1925	0.0	0.0	0.0	0.0	0.0	0.0	15.2	36.9	20.4	10.5	16.3	20.3	35.9	50.2	32.8	34.0	36.7	36.7
1926	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.0	0.0	1.1	2.3	34.8	27.5	23.3	29.5	36.7	26.5
1927	32.7	25.6	28.6	28.9	29.0	24.3	21.8	40.9	29.0	35.8	23.3	24.0	59.0	70.4	56.4	57.0	66.2	36.0
1928	1.6	1.6	2.3	1.6	2.0	2.1	10.0	14.7	10.8	6.8	7.0	5.3	52.0	48.3	40.3	34.7	40.2	41.3
1929	0.0	0.0	0.0	0.0	0.0	0.0	7.0	20.9	13.7	8.0	8.8	11.3	45.0	49.7	55.2	53.2	54.2	48.0
1930	13.7	16.9	17.4	15.1	14.2	13.3	14.2	37.8	28.5	18.0	17.0	18.8	39.5	42.2	40.7	38.3	48.0	50.3

APPENDIX TABLE 8 (continued).—Crop Sequence 8—Corn, Small Grains + Clover, Potatoes, Small Grains + Flax, (alfalfa for hay).

Year	Yield in Bushels Per Acre of Given Crop											
	SMALL GRAINS—FLAX						ALFALFA (pounds per acre)					
1912	1.3	1.7	1.2	0.4	1.6	2.6	00	00	00	00	00	00
1913	3.9	5.5	4.5	4.8	4.8	4.7	00	00	00	00	00	00
1914	0.0	0.1	0.0	0.2	0.1	0.3	00	00	00	00	00	00
1915	15.7	Minn. 20.5 N. D. 7.5	20.5	15.0	12.9	9.5	7280	7280	6880	6310	6810	6840
1916	14.0	10.4	13.1	14.1	13.4		5780	6250	6240	5350	5430	5870
	flax	wheat	oats	barley	flax	flax						
1917	5.3	17.5	39.4	35.4	6.4	6.0	3150	3390	3280	2650	2830	3320
	flax	oats	barley	emmer	flax	flax						
1918	3.9	50.5	26.9	28.5	4.5	5.7	3571	4131	4238	3664	3535	4005
1919	0.0	61.2	40.0	36.5	0.0	0.0	5610	5790	5750	4830	5610	5930
1920	14.6	67.8	38.8	35.0	15.9	11.6	7390	7300	7260	7760	8130	8120
1921	3.8	26.5	24.8	14.0	4.3	4.5	3370	3020	3320	3570	3680	3560
1922	7.8	70.1	52.2	40.2	13.1	13.4	00	00	00	00	00	00
1923	8.0	60.0	39.0	17.7	8.0	5.9	5290	4310	4710	4025	4135	4695
1924	11.4	81.5	55.8	42.5	11.9	12.8	4800	4350	3210	3680	3270	4310
1925	5.5	51.9	28.8	19.8	2.1	3.9	2230	2000	2310	1850	2230	2770
1926	0.0	0.0	0.0	0.0	0.0	0.0	00	00	00	00	00	00
1927	8.2	44.1	28.0	34.0	7.9	7.7	2190	2410	2630	2210	2520	2530
1928	1.8	17.2	20.9	13.5	0.9	1.2	1480	2010	2540	2700	3190	3400
1929	3.0	20.0	11.5	2.0	0.7	1.3	3240	3840	4010	4130	4140	4280
1930	5.7	44.7	33.9	25.0	4.3	5.2	3160	3680	3180	4140	3940	3660

APPENDIX TABLE 9.—Crop Sequence 9—Small Grain (continuously).

	Yield in Bushels Per Acre of Given Crop										
	Acme Wheat	Cole Oats	Odessa Barley	Khapli Emmer	Acme Wheat	Acme Wheat	N.D.R. 114 Flax	Kharkof Wheat	Advance Rye	Acme Wheat	Acme Wheat
Year	1	2	3	4	5	6	7	8	9	10	11
1912	0.1				0.3	0.2				0.5	0.6
	Preston				Preston	Preston				Preston	Preston
1913	0.0				0.0	0.0				0.0	0.0
	Preston				Preston	Preston				Preston	Preston
1914*	8.2	7.5	8.7	8.2	8.2	8.5			7.8	8.2	9.7
1915	18.8	93.8	55.7	59.8	17.8	19.8	18.6			20.2	18.0
	Kubanka	60-Day	Hannchen		Kubanka	Kubanka				Kubanka	
1916	11.0	54.1	25.8	31.3	12.5	11.3	5.9	16.7	18.9	13.7	14.5
	Kubanka	60-Day	Hannchen		Kubanka	Kubanka				Kubanka	
1917	6.7	18.7	22.3	10.0	8.2	9.5	1.4	0.0	14.8	7.2	9.0
	Kubanka	60-Day	Hannchen		Kubanka	Kubanka				Kubanka	
1918	5.8	20.6	6.3	9.2	3.6	2.8	3.2	0.0	10.2	7.1	12.5
1919	11.8	44.8	26.5	23.0	20.1	18.7	0.0	15.3	11.4	16.3	11.5
1920	20.0	50.5	31.7	27.5	19.8	21.3	0.0	0.0	0.0	16.7	16.3
1921	1.8	6.3	9.2	7.5	4.0	3.5	0.0	8.8	11.8	4.3	6.0
1922	21.7	52.2	30.0	27.9	23.2	27.2	8.2	17.3	24.3	27.2	29.0
1923	15.5	32.1	8.1	11.2	14.0	22.5	0.5	0.0	6.6	13.0	11.7
1924	19.8	50.0	25.6	32.0	18.3	20.0	2.7	17.3	16.8	21.3	18.8
1925	9.2	21.6	15.6	5.0	9.7	10.7	2.1	4.2	4.1	9.5	10.7
1926	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
				Spr. Wheat							
1927	14.8	36.6	26.3	27.8	18.0	20.5	2.5	12.3	19.1	15.0	15.5
1928	1.2	4.7	0.2	1.2	0.4	0.0	0.1	0.0	0.2	0.1	0.5
1929	0.4	2.5	2.7	0.1	0.5	0.5	0.8	0.0	4.9	5.0	6.6
1930	13.0	38.1	20.6	12.8	12.8	17.8	0.0	1.7	12.3	8.8	11.0

* In 1914, entire acre sown to Preston, except plot 11, which was Kubanka.
White Spring emmer has been employed since 1926, replacing Khapli.

APPENDIX TABLE 10.—Crop Sequence 10—Corn, Wheat (Kubanka), Sweet Clover.
Differential Depth of Tillage as Indicated.

CORN
Yield in Bushels Per Acre From Given Plot

	1	2	3	4	5	6	7	8	9	10	11
Year	FP 7	FP 4	FP 6 SS 6	FP 6 SS 10	FP 7	SS 8	Sp 8	Sp 10	Sp 12	FP 7	FP 12
1913	3.5	3.2	4.9	4.0	3.9	6.4	3.6	3.1	3.4	3.6	
1914	13.1	14.6	21.6	18.6	15.1	13.1	15.7	19.6	18.6	19.0	19.9
1915	29.1	29.3	27.2	25.9	19.9	18.4	27.2	34.9	31.6	30.1	
1916	23.7	23.8	24.5	25.7	25.3	20.1	25.1	25.4	26.1	22.5	
1917	5.1	7.3	8.9	10.6	8.3	8.1	7.4	7.3	7.1	4.8	6.4
1918	25.6	24.2	24.7	24.6	27.9	26.1	28.9	29.1	30.8	22.5	
1919	22.2	22.2	23.4	24.8	22.5	14.2	25.4	24.5	24.9	24.0	
1920	26.6	36.6	36.6	40.1	32.6	26.9	31.6	33.0	37.6	34.0	36.9
1921	5.0	3.6	4.4	14.0	27.3	26.7	25.3	16.0	19.1	11.7	
1922	35.3	22.9	29.1	29.1	25.1	28.6	28.4	25.3	27.6	25.3	
1923	41.2	41.5	42.8	42.1	43.8	31.2	41.2	38.8	38.1	35.4	37.4
1924	6.9	5.0	8.9	14.6	23.9	22.1	22.3	12.0	11.1	8.6	
1925	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1926			—	—	Drought		—	—			
1927	24.3	22.6	22.9	22.9	25.4	17.7	25.4	25.0	25.0	22.9	
1928	2.3	2.0	2.7	1.7	1.1	0.5	3.1	3.7	2.9	3.0	
1929	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1930	13.6	10.4	7.8	8.6	9.0	0.0	12.9	15.1	16.0	14.3	

APPENDIX TABLE 10 (continued).—Crop Sequence10—Corn, Wheat (Kubanka), Sweet Clover.
Differential Depth of Tillage as Indicated.

WHEAT
Yield in Bushels Per Acre From Given Plot

	1	2	3	4	5	6	7	8	9	10	11
Year	FP 7	FP 4	FP 6 SS 6	FP 6 SS 10	FP 7	SS 8	Sp 8	Sp 10	Sp 12	FP 7	FP 12
1913		—	—	Drought — Cut for Hay				—	—		
1914	11.2	10.2	10.2	10.7	10.0	11.0	10.5	10.2	9.7	10.5	
1915	27.8	23.5	23.7	21.8	22.7	21.7	22.3	22.2	23.8	25.3	22.8
1916	19.3	16.8	16.3	17.3	16.7	17.0	17.2	18.2	19.2	18.3	
1917	15.5	14.0	14.0	15.7	15.5	14.8	17.2	16.7	16.7	16.7	
1918	10.2	11.0	17.3	15.5	12.0	16.2	10.7	12.7	11.3	6.5	12.7
1919	18.7	18.0	16.7		15.7	12.7	15.3	19.7	19.7	18.7	
1920	19.7	18.7	17.3	17.8	18.5	12.5	16.2	15.7	16.2	18.8	
1921	6.7	7.0	6.8	7.2	7.2	6.0	5.7	6.0	6.2	5.0	6.3
1922	20.8	19.7	20.4	25.5	27.8	30.5	35.7	28.5	26.7	22.7	
1923	23.9	20.7	21.3	21.1	21.0	21.7	23.0	23.5	23.5	22.9	
1924	19.8	17.8	17.2	20.3	18.5	16.2	19.3	18.3	18.5	18.2	21.2
1925	10.3	9.3	10.8	13.0	15.7	21.0	17.9	12.3	9.2	11.3	
1926	2.7	1.1	2.3	2.0	1.8	2.2	2.2	2.7	2.7	3.6	
1927	27.2	24.2	22.5	23.2	28.2	30.0	22.5	22.7	21.3	20.0	22.7
1928	9.0	9.2	9.2	12.3	16.7	15.5	19.8	14.4	12.2	10.8	
1929	5.0	5.8	7.7	6.7	4.5	8.5	4.3	4.0	2.8	3.2	
1930	15.3	13.3	12.2	13.3	15.3	16.5	14.7	13.5	12.3	12.5	

APPENDIX TABLE 10 (continued).—Crop Sequence 10—Corn, Wheat (Kubanka), Sweet Clover.

Differential Depth of Tillage as Indicated.

SWEET CLOVER
Yield Per Acre—Hay (pounds); Seed (bushels)

	1	2	3	4	5	6	7	8	9	10	11
Year	FP 7	FP 4	FP 6 SS 6	FP 6 SS 10	FP 7	SS 8	Sp 8	Sp 10	Sp 12	FP 7	FP 12
1913	850	1000	1060	1010	1080	1240	920	940	880	840	900
1914	4.0	4.9	4.3	4.4	4.3	3.4	3.2	3.9	3.6	3.4	
1915	3640	3180	2790	3080	3200	3550	3800	4170	4060	3740	
1916	2350	3200	3350	3300	3220	3150	2750	3400	3000	3200	2650
	1.1	1.3	1.0	1.0	1.3	1.3	7.1	2.1	2.0	1.7	2.6
1917	3000	2800	3000	3100	3250	3350	4040	5650	4350	3800	
	1.7	1.3	2.1	2.1	1.9	1.1	1.8	3.6	2.8	2.1	
1918	2770	2950	3420	3340	2300	2560	3030	3590	3780	3410	
	3.5	3.1	3.8	3.2	2.7	2.8	3.2	3.8	4.2	3.7	
1919	2400	1850	2050	2120	2320	2650	2530	2050	1850	2050	2250
	1.4	0.7	0.8	1.1	2.1	1.9	0.8	1.1	0.8	1.2	1.8
1920	4420	3780	4060	4700	4820	2720	3680	4650	5020	4110	
1921	2360	1680	2080	1890	2100	1650	2260	2150	2270	2000	
	0.7	0.6	0.7	0.7	0.7	0.3	0.7	0.8	0.8	0.6	
1922	3800	2780	3500	3420	3510	3360	4320	3980	3920	4170	4350
	1.0	0.7	1.7	1.5	1.8	1.2	1.6	1.0	1.0	1.0	1.3
1923	270	00	120	790	1690	1500	1570	1470	1200	520	
	1.7	0.7	1.6	3.9	5.0	6.6	7.1	5.7	4.8	2.7	
1924	6750	4800	5000	4940	4830	5300	5250	5450	5430	5280	
	1.3	0.4	0.7	0.5	0.4	0.9	0.7	0.5	0.8	0.6	
1925	2200	2000	1600	2000	2520	2500	2500	1880	1800	1920	1820
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1926	2.5	2.7	1.9	3.0	3.0	2.0	3.5	3.8	3.0	2.5	
1927		—		—	Drought		—		—		
1928	1150	690	1030	1100	1670	1340	1340	1070	1220	1040	1200
1929	1830	1380	1560	2400	3190	2080	3610	3470	2810	1650	
1930	00	00	00	00	00	00	00	00	00	00	

APPENDIX TABLE 11.—Crop Sequence No. 16—Corn, Oats, Wheat (winter).

CORN
Yield of Given Crop Per Year in Bushels Per Acre

Year	1	2	3	4	5	6	7	8	9	10	11
1917	17.3	18.1	17.0	16.9	17.0	29.1	29.1	20.5	19.0	18.9	
1918	25.6	24.7	28.1	29.2	28.2	24.9	27.1	27.2	28.1	26.7	25.9
1919	22.5	22.9	22.3	22.2	21.2	27.1	21.6	26.7	18.9	18.1	
1920	28.3	33.8	32.1	33.5	32.9	30.1	28.9	29.3	29.6	31.8	
1921	3.1	5.8	8.7	11.4	9.1	5.3	3.6	7.1	10.3	5.8	5.9
1922	37.1	38.0	40.0	45.7	45.9	46.6	48.8	49.8	49.8	51.4	50.0
1923	41.6	44.0	47.4	44.8	45.4	49.4	43.2	40.0	43.5	39.4	
1924	18.4	22.6	23.7	26.1	22.1	22.9	22.9	24.6	27.0	23.7	24.3
1925	0.0	0.0	0.0	0.0	3.4	2.1	4.3	5.9	11.1	6.3	
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1927	32.4	32.6	33.0	34.4	33.4	34.1	33.6	36.3	33.9	31.6	33.3
1928	2.0	1.4	1.1	1.9	2.9	4.3	4.9	5.7	7.3	4.3	
1929	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1930	10.3	11.9	14.6	15.8	14.8	13.3	10.9	13.5	14.2	12.6	12.3

APPENDIX TABLE 11 (continued).—Crop Sequence No. 16—Corn, Oats, Wheat (winter).

OATS
Yield of Given Crop Per Year in Bushels Per Acre

Year	1	2	3	4	5	6	7	8	9	10	11
1917	31.2	35.3	38.7	41.5	39.6	35.9	35.9	38.7	37.8	38.7	
1918	23.7	28.3	24.1	28.4	32.2	44.1	57.2	58.2	56.8	56.2	
1919	58.4	58.4	55.5	57.1	67.2	61.2	67.2	62.4	60.9	60.9	54.1
1920	54.7	49.7	45.0	40.9	43.1	—	too wet to seed			—	
1921	6.6	9.1	12.5	13.1	12.2	10.6	10.6	11.3	15.3	15.0	
1922	36.2	42.5	58.8	59.1	63.8	33.8	45.3	53.1	52.8	58.1	53.8
1923	59.0	59.7	66.5	61.9	68.7	61.9	62.7	62.7	63.1	60.3	
1924	26.3	37.2	45.0	48.4	47.5	30.0	34.4	40.0	48.4	45.9	
1925	39.7	37.2	42.8	46.3	43.1	42.5	51.3	50.9	48.4	42.8	45.9
1926	0.0	0.3	0.7	0.6	0.4	0.0	1.3	1.1	0.6	1.7	
1927	40.0	39.4	43.5	45.4	44.1	42.5	41.6	44.1	42.9	43.1	
1928	22.5	15.8	17.8	14.4	13.8	15.6	20.3	21.2	20.0	13.4	
1929	8.1	10.0	10.3	14.7	18.1	16.3	34.1	35.0	36.6	35.3	
1930	20.9	20.3	30.0	30.9	34.1	19.4	20.6	28.4	29.7	28.4	

APPENDIX TABLE 11 (continued).—Crop Sequence No. 16—Corn, Oats, Wheat (winter).

WINTER WHEAT
Yield of Given Crop Per Year in Bushels Per Acre

Year	1	2	3	4	5	6	7	8	9	10	11
1917											
	M	M	M	M	M						
1918	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	M	M	M	M	M						
1919	6.5	13.0	8.1	11.8	9.3	11.0	7.1	7.5	4.7	4.0	
	M	M	M	M	M						
1920	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	M	M	M	M	M						
1921	6.2	8.8	9.7	10.2	9.7	4.2	8.5	8.0	8.0	9.7	
	M	M	M	M	M						
1922	25.2	24.5	23.0	24.5	24.0	16.2	15.8	12.5	12.8	12.8	
						M	M	M	M	M	
1923	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
						M	M	M	M	M	
1924	26.3	25.2	28.8	29.5	29.2	36.5	39.3	41.3	37.5	38.0	
						M	M	M	M	M	
1925	3.5	3.7	4.7	4.8	4.8	4.0	3.8	3.2	3.2	3.2	
	M	M	M	M	M						
1926	1.1	0.3	0.7	0.7	0.3	0.5	1.1	1.8	1.0	0.3	0.4
	M	M	M	M	M						
1927	24.0	24.5	26.2	24.2	23.8	27.2	26.0	19.7	23.3	23.5	
						M	M	M	M	M	
1928	0.1	0.2	0.7	0.7	0.7	0.5	0.7	0.8	1.5	1.9	
	M	M	M	M	M						
1929	10.5	11.2	10.8	11.7	12.2	9.2	9.7	10.3	10.2	9.3	8.8
						M	M	M	M	M	
1930	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

M—indicates that winter wheat was mulched in late fall by applying 6 tons of rotten straw per acre.

APPENDIX TABLE 12.—South Dakota Farm Price Per Unit for Given Crops for Given Years (Dec. 1).
(Mainly taken from Yearbooks, U.S. Department of Agriculture)

Year	Corn	Wheat	Barley	Oats	Flax	Rye	Winter Wheat	Potatoes	Clover (hay)	Sw. Clover Seed	Millet*
1912	.37	.69	.42	.25	1.13	.52		.36	6.10	9.00	.68
1913	.56	.71	.46	.34	1.20	.50	.71	.63	6.50	7.70	.68
1914	.50	.94	.50	.38	1.23	.78	.94	.47	8.70	8.12	.68
1915	.49	.86	.46	.28	1.67	.76	.86	.35	7.40	10.01	.68
1916	.77	1.50	.83	.46	2.47	1.18	1.50	1.37	8.00	9.40	.68
1917	1.20	1.96	1.10	.61	2.99	1.55	1.96	1.11	16.50	13.53	.88
1918	1.10	1.99	.78	.59	3.25	1.41	1.99	.93	15.40	20.67	1.00
1919	1.19	2.40	1.15	.63	4.25	1.25	2.40	1.90	16.60	27.63	1.00
1920	.42	1.15	.52	.33	1.65	1.09	1.15	.97	10.80	5.70	.38
1921	.26	.87	.29	.20	1.39	.58	.87	1.07	8.00	3.00	.38
1922	.50	.92	.42	.32	2.01	.58	.92	.44	12.00	4.29	.50
1923	.52	.81	.40	.31	2.08	.49	.81	.44	9.80	5.82	.75
1924	.80	1.25	.64	.40	2.23	1.02	1.25	.48	10.20	4.83	.75
1925	.60	1.28	.47	.28	2.25	.67	1.28	1.80	13.00	4.50	1.00
1926	.58	1.18	.52	.36	1.90	.73	1.18	1.59	13.00	7.30	.75
1927	.57	1.06	.58	.36	1.85	.79	1.06	.55	11.91	4.20	.58
1928	.62	.85	.48	.33	2.01	.79	.85	.40	13.05	3.00	.58
1929	.62	.93	.45	.34	2.80	.76	.93	1.15	11.97	3.30	.50

* Millet prices, based (1917-1930) on price per cwt. paid by a local firm in Brookings, S. D. Prices supplied from courtesy of their records.
Sweet clover seed: 1912-1919, inclusive, U. S. farm price for Dec. 1 on all clover; 1920-1929 inclusive covers South Dakota farm price on sweet clover.
Price of hay for 1912 and 1913 includes all hay; all other years, prices strictly for clover hay.

In foregoing Table 12, South Dakota farm prices are mainly abstracted from the Yearbook of the United States Department of Agriculture.

The prices put down under clover hay, for 1912 and 1913, include all hay of whatever kind, the prices for the other years being classified as clover hay.

Prices used for sweet clover seed, for 1912–1919 inclusive, are United States farm prices for clover seed, and those for 1920–1929 are South Dakota farm prices for sweet clover seed, as compiled by United States Division of Crop and Livestock Estimates.

Farm prices for millet seed were not available at this writing from official documents. Prices for the years 1917–1930 were supplied by courtesy of a local firm in Brookings from their records. Millet prices put down for the years previous to 1917 were computed somewhat arbitrarily.

APPENDIX TABLE 13.—Total Farm Value of Crops Secured From Given Rotations for Given Years Based Upon Yields Reported Herein and Reported Farm Prices.

Year	Rotation No. 2			Rotation No. 3				Rotation No. 3-a			
	Corn	Wheat	Total Av. Value	Corn	Wheat	Sweet Clover	Total Av. Value	Corn	Wheat	Sw. Clo. (hay)	Total Av. Value
1912	7.96	3.80	5.88	6.33	0.28	Sweet clover plowed under for green manure in this rotation	2.21	5.07	0.21	6.71	4.00
1913	6.55	6.32	6.44	3.98	0.57		1.52	4.76	0.00	1.30	2.02
1914	7.75	9.40	8.58	7.40	9.78		5.73	8.30	9.68	4.35	7.44
1915	13.08	19.61	16.35	14.16	13.67		9.28	14.15	13.76	1.48	9.80
1916	18.25	23.70	20.98	18.17	24.45		14.21	16.94	22.50	0.80	13.41
1917	22.92	34.69	28.80	21.60	33.52		18.38	22.56	35.87	4.95	21.16
1918	30.14	48.36	39.25	30.80	55.12		28.64	32.01	72.24	3.08	35.78
1919	28.20	44.88	36.54	28.44	42.00		23.48	29.39	42.00	3.32	24.90
1920	14.28	22.77	18.53	15.79	19.21		11.67	12.68	23.00	4.32	13.33
1921	2.03	10.70	6.37	5.67	6.87		4.81	8.06	11.05	0.80	6.64
1922	23.55	27.51	25.53	23.50	28.06		17.19	23.30	24.38	9.60	19.06
1923	20.96	18.31	19.64	19.29	19.52		12.94	17.89	19.36	2.94	13.40
1924	16.16	27.50	21.83	12.16	31.88		14.68	13.44	36.88	7.14	19.15
1925	2.94	25.47	14.21	3.24	24.96		9.40	2.40	23.68	5.20	10.43
1926	0.00	5.55	2.78	0.00	2.01		0.67	0.00	2.60	0.00	0.87
1927	18.24	29.15	23.70	16.70	29.36		15.36	16.30	33.92	0.00	16.74
1928	3.91	12.50	8.21	5.77	12.06		5.98	8.06	14.28	19.58	13.97
1929	0.00	9.67	4.84	1.12	11.25		4.12	0.62	11.90	33.52	15.35
Av.	13.16	21.10	17.13	13.01	20.26		11.09	13.11	22.07	6.06	13.75

The difference between Rotations number 3 and number 3-a is that in the former sweet clover was plowed under for green manure, and in 3-a it was harvested for hay.

APPENDIX TABLE 13. (Continued)

Year	Rotation No. 6				Rotation No. 10				
	Corn	Oats	Wheat	Total Av. Value	Corn	Wheat	Sw. Clo. (hay)	Sw.Clo. (Seed)	Total Av. Value
1912	6.81	0.00	0.28	2.36	5.07	0.28	*6.71	0.00	3.82
1913	3.64	0.14	0.99	1.59	2.07	0.00	2.22	0.00	1.43
1914	4.20	14.90	9.31	9.47	7.85	9.96	0.00	31.67	16.48
1915	12.54	28.28	20.64	20.49	12.94	21.76	9.66	0.00	14.79
1916	16.86	35.24	22.50	24.87	18.33	27.15	8.66	13.16	22.43
1917	14.76	21.47	22.74	19.66	7.32	31.16	20.48	25.71	28.22
1918	35.53	22.24	39.60	32.46	27.83	19.10	16.12	68.21	43.75
1919	32.84	38.49	39.12	36.82	27.25	42.48	13.87	44.21	42.60
1920	14.62	19.54	16.91	17.02	13.06	21.85	17.80	0.00	17.57
1921	4.86	2.74	2.09	3.23	3.82	5.48	6.38	2.10	5.93
1922	25.10	21.98	14.72	20.60	14.30	21.90	17.02	5.46	19.56
1923	21.53	17.39	10.85	16.59	20.85	18.31	3.01	18.04	20.07
1924	15.12	22.44	20.00	19.19	10.48	23.50	21.23	3.86	19.69
1925	6.00	14.39	7.30	9.23	0.00	15.87	10.65	0.00	8.84
1926	0.29	0.97	1.53	0.93	0.00	3.19	0.00	19.71	7.63
1927	18.75	16.52	28.41	21.23	13.79	26.61	0.00	0.00	13.47
1928	3.22	8.42	0.77	4.14	1.30	10.37	6.22	0.00	5.96
1929	0.00	7.77	9.39	5.70	0.00	3.91	9.86	0.00	4.59
Av.	13.15	16.27	14.84	14.75	10.35	16.83	9.44	12.90	16.50

* Yield of Peas from rotation No. 3 used for 1912. Weights—Evidently green hay divided by 135 per cent for other years.

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value									
	Rotation No. 1								Rotaion No. 9
Year	Corn	Wheat	*Peas (Seed)	Sorg'm	Oats	†Alfalfa (Hay)	Alfalfa (Seed)	Total Av. Value	Wheat (Continuously)
1912	6.22	.35	.00	.00	.00	0.00	0.00	1.09	0.21
1913	4.82	3.98	14.80	7.62	0.44	3.47	0.00	5.86	0.00
1914	4.10	9.12	8.80	5.90	15.09	7.29	0.00	8.35	7.71
1915	15.44	25.11	13.70	0.00	27.92	18.51	0.00	16.78	16.25
1916	19.94	25.75	11.26	1.95	33.44	13.96	0.00	18.05	18.60
1917	21.24	35.87	13.73	15.00	21.96	16.54	0.00	20.72	14.50
1918	34.76	56.52	10.61	28.71	23.48	0.00	0.00	25.68	10.95
1919	27.01	48.00	22.94	28.92	27.78	25.10	0.00	29.96	38.64
1920	14.91	28.06	18.60	14.99	19.80	30.49	0.00	21.14	21.62
1921	1.79	8.70	1.80	7.31	3.52	14.40	0.00	6.24	2.96
1922	27.85	18.84	14.85	20.10	21.67	29.99	2.23	22.57	22.08
1923	20.18	20.09	11.40	14.98	18.79	13.07	5.41	17.32	11.50
1924	11.12	26.88	11.81	9.84	14.84	12.79	6.11	15.56	24.75
1925	5.04	21.89	9.79	6.24	11.00	12.25	0.00	11.04	12.16
1926	0.00	4.37	0.00	0.00	0.97	0.00	0.00	.89	0.12
1927	19.72	23.64	7.15	14.99	16.24	17.70	0.00	16.57	16.85
1928	2.11	11.73	4.27	0.87	6.07	4.77	0.00	4.97	0.51
1929	0.00	11.72	5.94	2.21	9.18	9.59	0.00	6.44	1.86
Av.	13.13	21.88	10.30	9.69	15.03	12.31	.76	13.85	12.29

* Rotation No. 1 above are values of seed for 1913 and 1914 and forage for additional years.

† Rotation No. 1 above in computing the above values for hay, field weights of alfalfa were assumed to be 135 per cent of air dried marketable hay.

A price for peas in 1912-1914 (Rotation No. 1) was assumed at $4.00 per bushel.

A price for grain Sorghum was assumed to be the same as corn.

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value							
	Rotation No. 8						Rotation No. 9
Year	Corn	Oats	Potatoes	Alfalfa	Oats	Total Av. Value	Oats (Continuously)
1912	6.48	0.00	24.34	0.00	0.00	6.16	0.00
1913	3.36	0.31	19.22	0.00	0.31	4.64	0.31
1914	8.05	10.94	40.33	0.00	10.94	14.05	2.85
1915	12.74	27.44	30.03	19.98	27.44	23.53	26.26
1916	16.02	30.91	116.86	18.52	30.91	42.64	24.89
1917	14.88	21.23	99.12	20.72	21.23	35.44	11.41
1918	32.45	21.95	28.37	23.56	29.80	27.23	12.15
1919	25.70	39.75	60.23	35.60	38.56	39.97	28.22
1920	13.90	20.63	68.19	29.20	22.37	30.86	16.67
1921	0.00	3.94	102.83	8.95	5.30	24.20	1.26
1922	18.75	16.29	47.65	0.00	22.43	21.02	16.70
1923	28.13	19.65	15.62	15.64	18.60	19.53	9.95
1924	9.84	28.52	18.34	16.43	32.60	21.15	20.00
1925	0.00	10.33	90.36	9.63	14.53	24.97	6.05
1926	0.00	0.00	43.73	0.00	0.00	8.75	0.00
1927	14.59	14.72	38.72	10.63	15.88	18.91	13.18
1928	0.99	4.85	19.32	9.72	5.68	8.11	1.55
1929	0.00	5.02	57.16	17.02	4.80	16.80	0.85
Av.	11.44	15.36	51.13	13.09	16.74	21.55	10.68

Rotation No. 8 above alfalfa, on basis of yields from plot 2 reduced to air dry weight by dividing by 1.35—using S. Dak. Clover Hay farm prices.

APPENDIX TABLE 13. (Continued)

Year	Number of Cropping System and Names of Crops and Value						
	Rotation No. 2			Rotation No. 3			
	Corn	Oats	Total Av. Value	Corn	Oats	Sw. Clover	Total Av. Value
1912	2.70	0.00	1.35	6.48	0.00	0.00	2.16
1913	3.47	0.31	1.89	5.10	0.31	0.00	1.80
1914	2.45	10.94	6.70	9.80	10.94	0.00	6.91
1915	14.16	27.55	20.86	15.24	25.90	0.00	13.71
1916	18.56	27.74	23.15	19.02	32.06	0.00	17.03
1917	23.04	21.90	22.47	25.32	20.37	0.00	15.23
1918	30.25	22.30	26.28	21.35	26.73	0.00	19.36
1919	27.61	32.32	29.97	27.49	43.53	0.00	23.67
1920	15.37	22.28	18.83	17.22	22.84	0.00	13.35
1921	.29	39.40	19.85	5.36	2.32		2.56
1922	25.00	19.10	22.05	22.70	22.11		14.94
1923	19.45	14.73	17.09	21.42	17.64		13.02
1924	16.72	23.36	20.04	12.56	27.48		13.35
1925	0.00	10.95	5.48	1.38	12.26		4.55
1926	0.00	.68	.34	.00	0.00	Plowed under	0.00
1927	18.07	15.23	16.65	17.10	16.88		11.33
1928	2.91	7.13	5.02	6.01	5.38		3.80
1929	0.00	10.10	5.05	1.43	7.94		3.12
Av.	12.23	17.00	14.62	13.61	16.37		9.99

APPENDIX TABLE 13. (Continued)

Year	Number of Cropping System and Names of Crops and Value									
	Rotation No. 5			Rotation No. 16				Rotation No. 2		
	Fallow	Oats	Total Av. Value	Corn	Oats	W. Wheat	Total Av. Value	Corn	Barley	Total Av. Value
1912		0.00	0.00	7.03	0.00	0.00	2.51	4.55	0.25	2.40
1913		0.31	0.16	6.10	0.14	1.07	2.60	5.49	0.55	3.02
1914		10.94	5.47	5.35	14.90	0.00	6.75	2.30	11.00	6.65
1915		28.70	14.35	13.62	28.28	5.42	15.41	14.41	23.55	18.98
1916		32.20	16.10	17.56	35.24	34.35	29.05	18.87	25.98	22.42
1917		30.32	15.16	24.36	22.75	0.00	15.70	24.36	31.79	28.08
1918		32.45	16.22	29.70	24.13	0.00	17.94	28.60	22.39	25.50
1919		40.38	20.19	26.66	38.37	26.40	30.48	34.27	36.34	35.30
1920		26.40	13.20	13.02	7.70	0.00	6.91	14.78	16.12	15.45
1921		4.76	2.38	1.82	2.32	7.74	3.96	3.48	5.89	4.69
1922		20.83	10.41	22.65	16.13	22.26	20.35	22.70	20.12	21.41
1923		17.05	8.52	22.83	19.44	0.00	14.09	23.30	12.84	18.07
1924		34.72	17.36	18.72	16.12	48.13	27.66	13.60	24.00	18.80
1925		14.70	7.35	1.98	10.24	4.48	5.57	2.64	10.11	6.38
1926		0.00	0.00	0.00	0.25	0.71	0.32	0.00	0.73	0.37
1927		18.47	9.23	9.10	15.37	25.97	20.15	18.87	15.02	16.95
1928		7.62	3.81	2.23	5.78	0.94	2.98	3.10	7.92	5.50
1929		4.94	2.47	0.00	7.45	10.51	5.99	0.00	6.57	3.29
Av.		18.04	9.02	12.62	14.70	10.44	12.59	13.07	15.07	14.07

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value

	Rotation No. 3				Rotation No. 5			Rotation No. 9
Year	Corn	Barley	Sw. Clover	Total Av. Value	Fallow	Barley	Total Av. Value	Barley (Continuously)
1912	6.33	0.25		2.19		0.25	0.13	0.25
1913	6.50	0.55		2.35		0.55	0.28	0.55
1914	7.30	11.00		6.10		11.00	5.50	4.35
1915	15.68	22.68		12.79		22.31	11.16	25.62
1916	19.71	29.38		16.36		26.31	13.16	21.41
1917	24.24	31.79		18.68		30.25	15.13	24.53
1918	30.91	22.54	Plowed under	17.82		35.88	17.94	4.91
1919	33.44	43.82		25.75		43.82	21.91	30.48
1920	15.83	18.77		11.53		17.21	8.61	16.48
1921	5.36	4.06		3.14		8.32	4.16	2.67
1922	21.50	19.24		13.58		22.60	11.30	12.60
1923	22.57	16.16		12.91		16.16	8.08	3.24
1924	11.76	25.34		12.37		11.14	5.57	16.38
1925	1.74	12.83		4.86		18.71	9.36	7.33
1926	0.00	0.00		0.00		0.68	0.34	0.00
1927	16.30	16.82		11.04		22.33	11.17	15.25
1928	7.50	6.48		4.66		10.61	5.31	.10
1929	1.18	9.68		3.62		8.33	4.17	1.22
Av.	13.77	16.19		9.99		17.03	8.52	10.41

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value

	Rotation No. 4							
Year	Corn	Rye and Sw. Clo.	Sw.Clo. Seed	Sw.Clo. Hay	Millet	Peas	Barley	Total Av. Value
1912	7.22	2.76	drought	drought	2.79		.17	2.16
1913	6.44	5.55	failure	failure	4.80		.69	2.91
1914	3.72	10.76	failure	failure	1.92		12.20	4.77
1915	12.50	18.77	46.35	4.04	15.41		23.64	20.12
1916	14.25	29.97	24.44	13.33	16.80		22.74	20.26
1917	17.52	40.30	15.69	13.04	6.16		14.74	17.91
1918	32.01	23.55	failure	failure	29.10	Turned under	14.12	16.47
1919	19.99	31.19	45.87	8.44	22.10		36.34	27.31
1920	14.74	25.40	failure	failure	12.39		16.48	11.50
1921	3.48	9.34	4.80	11.13	9.92		2.96	6.94
1922	21.35	23.66	0.00	failure	9.15		14.74	11.48
1923	15.91	6.22	failure	failure	23.90		13.28	9.89
1924	16.32	25.19	12.56	24.77	10.50		28.48	19.64
1925	4.74	6.97	failure	failure	1.00		11.19	3.98
1926	0.00	1.31	failure	failure	3.00		.47	.80
1927	16.76	22.59	0.00	drought	16.65		17.34	12.22
1928	2.98	13.75	0.00	drought	2.41		1.92	3.51
1929	1.80	11.78	failure	failure	6.50		5.72	4.30
Av.	11.76	17.17	8.32	4.15	10.81		13.18	10.90

Yields of hay above are figured averages plots 1, 5, and 10, which recived no stallmaure—with green manure turned under. Field weights of hay are arbitrarily considered 135 per cent of air dry hay, then multiplied by farm price of clover hay.

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value

Rotation No. 8

Year	*Corn	Wheat	Sw. Clover	Potatoes	Flax	Alfalfa	Total Av. Value
1912	7.29	0.83	Seeded in grain to turn under same year. No crop harvested.	18.40	2.03	0.00	5.71
1913	3.86	2.06		35.53	5.40	0.00	9.37
1914	6.45	9.21		33.28	0.25	0.00	9.84
1915	10.54	19.09		34.44	21.21	25.90	22.24
1916	15.86	23.40		104.94	33.59	22.40	40.04
1917	15.48	34.30		60.61	17.64	26.40	30.89
1918	29.48	34.63		23.81	15.75	29.26	26.59
1919	28.20	52.56		84.17	0.00	48.14	42.61
1920	13.31	11.16		76.34	23.10	42.12	33.21
1921	0.00	9.05		121.23	5.84	13.60	29.94
1922	16.40	24.66		42.59	22.91	0.00	21.31
1923	23.82	21.06		17.25	15.18	23.52	20.17
1924	12.08	24.88		23.38	26.76	21.42	21.70
1925	0.00	22.14		65.52	8.55	22.36	15.60
1926	0.00	1.89		51.93	0.00	0.00	10.76
1927	16.30	24.38		29.55	14.62	14.29	19.83
1928	1.18	6.29		17.80	2.61	16.97	8.97
1929	0.00	8.37		56.47	4.76	22.74	18.47
Av.	11.13	8.33		49.84	12.24	17.91	21.89

* Above based on yields of plots No. 1–5–6.

APPENDIX TABLE 13. (Continued)

Number of Cropping System and Names of Crops and Value

	Rotation No. 5			Rotation No. 5		
Year	Fallow	Wheat	Total Av. Value	Fallow	Flax	Total Av. Value
1912		0.41	.20		2.03	1.01
1913		2.34	1.17		5.40	2.70
1914		9.49	4.75		0.25	0.13
1915		16.60	8.30		26.22	13.11
1916		19.95	9.98		31.86	15.93
1917		30.58	15.29		15.85	7.93
1918		48.36	24.18		12.35	6.18
1919		49.92	24.96		0.43	0.22
1920		15.76	7.88		2.15	1.08
1921		8.96	4.48		4.03	2.02
1922		27.05	13.52		19.70	9.85
1923		20.57	10.29		8.11	4.06
1924		31.88	15.94		22.52	11.26
1925		28.80	14.40		6.75	3.38
1926		3.07	1.54		0.00	0.00
1927		27.77	13.89		11.84	5.92
1928		12.50	6.25		2.41	1.21
1929		6.98	3.49		5.32	2.66
Av.		20.06	10.03		9.85	4.93

APPENDIX TABLE 13. (Continued)

	Rotation No. 2			Rotation No. 3				Ro'tion No. 9
Year	Corn	Rye	Total Av. Value	Corn	Rye	Sw. Clover	Total Av. Value	Rye (cont'ous)
1912	5.33	2.76	4.04	6.88	2.76		3.21	2.76
1913	3.98	5.55	4.77	5.99	5.55		3.85	5.55
1914	2.30	8.42	5.36	9.40	8.42		5.94	6.08
1915	14.90	19.61	17.26	12.89	20.37		11.01	20.37
1916	15.17	33.75	24.46	19.33	40.00		19.78	22.30
1917	20.52	37.36	28.94	21.72	55.34		25.69	22.94
1918	24.31	23.12	23.72	30.36	42.86		24.41	14.38
1919	27.01	25.50	26.26	26.18	35.75		20.64	14.25
1920	12.89	10.14	11.52	14.74	26.81		13.85	0.00
1921	0.49	10.27	5.38	6.47	12.64		6.37	6.84
1922	17.90	28.48	23.19	23.85	27.84		17.23	14.09
1923	19.24	5.44	12.34	20.18	5.39		8.52	3.23
1924	12.08	20.20	16.14	11.20	35.90		15.70	17.14
1925	0.00	5.03	2.52	7.14	7.30		4.81	2.75
1926	0.00	1.31	.66	0.00	1.46		0.49	0.07
1927	16.93	21.33	19.13	16.76	22.99		13.25	15.09
1928	2.42	13.04	7.73	8.68	14.14	Sweet Clover Plowed Under	7.61	0.16
1929	0.00	11.02	5.51	0.37	17.40		5.92	3.72
Av.	10.86	15.69	13.27	13.45	21.27		11.57	9.54

APPENDIX TABLE 13. (Continued)

	Rotation No. 2			Rotation No. 3				Ro'tion No. 9
Year	Corn	Flax	Total Av. Value	Corn	Flax	Sw. Clover	Total Av. Value	Flax (cont'ous)
1912	8.03	2.03	5.03	7.81	2.03		3.28	2.03
1913	7.84	5.40	6.62	5.49	5.40		3.63	5.40
1914	8.40	0.25	4.38	10.25	.25		3.50	.25
1915	14.16	26.22	20.19	14.41	26.22		13.54	31.06
1916	18.94	38.29	28.61	19.48	41.00		20.16	14.57
1917	26.40	19.14	22.77	25.80	17.04		14.28	4.19
1918	28.49	28.28	28.39	30.14	25.35		18.50	10.40
1919	29.87	5.10	17.49	28.56	3.83		19.80	0.00
1920	13.02	2.97	7.99	13.44	13.04		8.83	0.00
1921	2.44	.83	1.64	5.36	1.95		2.44	0.00
1922	21.95	19.70	20.83	24.80	19.70		14.83	16.48
1923	21.42	16.43	18.92	19.81	9.15		9.65	1.04
1924	18.32	23.86	21.09	13.68	33.45		15.71	6.02
1925	4.44	22.05	13.25	5.04	12.83		5.96	4.73
1926	0.00	1.52	.76	0.00	0.00		0.00	0.00
1927	18.47	18.87	18.67	16.30	17.21		11.17	4.63
1928	5.58	9.05	7.31	10.17	5.23	Sweet Clover Plowed Under	5.13	.20
1929	0.00	10.64	5.32	0.56	10.36		3.64	2.24
Av.	13.77	13.92	13.85	13.95	13.56		9.17	5.74

APPENDIX TABLE 13. (Continued)

Year	Corn	Barley	Potatoes	Barley	Alfalfa	Total Av. Value	W. Wheat (cont'ous)
	Number of Cropping System and Names of Crops and Value						
	Rotation No. 8						Ro'tion No. 9
1912	7.07	0.25	27.94	0.25	0.00	7.10	0.00
1913	2.58	.55	18.77	0.55	0.00	4.49	1.07
1914	11.30	11.00	32.43	11.00	0.00	13.15	0.00
1915	10.83	23.37	37.21	23.37	18.86	22.73	0.00
1916	18.25	24.82	100.70	24.82	18.49	37.42	25.05
1917	14.76	24.42	68.82	24.42	20.04	30.49	0.00
1918	33.00	17.00	112.34	20.98	24.17	41.50	0.00
1919	26.42	44.51	81.70	46.00	35.35	46.80	36.72
1920	14.45	16.02	66.45	20.18	29.04	29.23	0.00
1921	1.92	4.41	130.11	7.19	9.84	30.69	7.66
1922	19.90	17.68	55.31	21.92	0.00	22.98	15.92
1923	27.92	27.24	38.72	15.60	17.10	25.32	0.00
1924	10.72	23.04	22.42	35.71	12.13	20.80	21.63
1925	0.00	9.59	59.04	13.54	11.12	18.66	5.38
1926	0.00	0.52	37.05	0.00	0.00	7.51	0.00
1927	16.30	16.82	31.02	16.24	11.60	18.40	13.04
1928	1.43	5.18	16.12	10.03	12.28	9.01	0.00
1929	0.00	6.17	63.48	5.18	17.78	18.52	0.00
Av.	12.05	15.14	55.54	16.50	13.21	22.49	7.03

APPENDIX TABLE 13. (Continued)

Year	Fallow	Rye	Total Av. Value	Corn	Em'er	Total Av. Value	Corn	Em'er	Sw. Clov.	Total Av. Value
	Number of Cropping System, Names of Crops and Values									
	Rotation No. 5			Rotation No. 2			Rotation No. 3			
1912		2.76	1.38	7.96	2.52	5.24	4.66	0.25		1.64
1913		5.55	2.78	7.62	0.18	3.90	5.94	0.18		2.04
1914		8.42	4.21	3.55	10.90	7.23	6.00	17.75		7.92
1915		22.80	11.40	13.38	27.05	20.22	15.48	26.22		13.90
1916		45.31	22.66	17.33	38.10	27.72	18.87	36.85		18.57
1917		37.05	18.53	25.92	22.00	23.96	22.20	23.65		15.28
1918		44.13	22.07	32.89	19.89	26.39	27.39	15.37		14.25
1919		36.63	18.32	31.54	35.31	33.48	31.77	50.60		27.46
1920		35.97	17.99	16.17	13.36	14.77	15.25	14.92		10.06
1921		11.08	5.54	3.12	4.87	4.00	4.13	1.31		1.81
1922		19.78	9.89	23.05	14.24	18.65	21.95	13.73		11.89
1923		4.07	2.04	20.90	8.60	14.75	25.38	10.08		11.82
1924		32.54	16.27	16.72	29.44	23.08	10.24	25.60		11.95
1925		9.25	4.63	4.74	8.70	6.72	2.22	7.05		3.09
1926		0.44	0.22	0.00	2.08	1.04	0.00	0.00		0.00
1927		27.65	13.83	19.78	23.66	21.72	16.13	25.40		13.84
1928		10.90	5.45	3.16	9.98	6.57	7.56	6.14		4.57
1929		16.57	8.29	0.00	3.06	1.53	0.68	6.75		2.48
Av.		20.61	10.31	13.77	15.22	14.50	13.10	15.66		9.59

plowed under

APPENDIX TABLE 13. (Continued)

	Number of Cropping System, Names of Crops and Values									
	Rotation No. 5			Rotation No. 9	Rotation No. 8					
	Emmer	Fallow	Total Av. Value	Emmer (Continuously)	Corn	Emmer	Potatoes	Emmer	Alfalfa	Total Av. Value
1912	0.25		0.13	0.25	6.99	0.25	18.18	* 0.25	0.00	5.13
1913	0.18		0.09	0.18	2.80	0.18	31.88	* 0.18	0.00	7.01
1914	10.90		5.45	4.10	8.80	10.90	32.20	*10.90	0.00	12.56
1915	27.60		13.80	27.51	12.30	27.09	34.48	*27.09	17.29	23.65
1916	38.93		19.47	25.98	19.02	34.94	110.97	*34.94	15.85	43.14
1917	13.42		6.71	11.00	14.76	17.49	68.93	*17.49	16.19	26.97
1918	21.84		10.42	7.18	30.69	12.64	106.30	22.23	20.90	38.55
1919	38.18		19.09	26.45	26.89	50.03	73.72	41.98	29.70	44.46
1920	14.14		7.07	14.30	16.04	13.00	65.09	18.20	31.04	28.67
1921	5.54		2.77	2.18	0.36	2.84	137.60	4.06	10.58	31.11
1922	14.24		7.12	11.72	20.00	10.33	57.64	16.88	0.00	20.97
1923	5.60		2.80	4.48	27.09	5.92	33.88	7.08	14.61	17.72
1924	25.60		12.80	20.48	10.72	23.87	17.62	27.20	13.90	18.66
1925	13.40		6.70	2.35	0.00	4.94	61.20	9.31	8.91	16.87
1926	0.00		0.00	0.00	0.00	0.00	46.91	0.00	0.00	9.38
1927	26.56		13.78	16.12	16.47	20.76	31.35	19.72	9.75	19.61
1928	7.58		3.79	0.58	0.99	3.26	13.88	6.48	13.05	7.53
1929	3.83		1.92	0.05	0.00	3.60	61.18	0.90	18.31	16.80
Av.	14.88		7.44	9.72	11.88	13.45	55.72	14.72	12.23	21.60

* The emmer yields utilized for plot 2 in this rotation were also substituted in computing these values.

APPENDIX TABLE 13. (Continued)

	Number of Cropping System, Names of Crops and Values					
	Rotation No. 7					
Year	Corn*	Barley	Grass	Grass	Alfalfa	Total Av. Value
1912	8.33	0.21				
1913	4.87	1.38				
1914	3.75	11.40				
1915	17.15	21.21				
1916	15.71	19.42				
1917	8.28	21.56				
1918	29.81	14.82				
1919	28.56	40.71				
1920	16.72	18.25				
1921	2.91	2.00				
1922	19.40	21.29				
1923	19.97	15.64				
1924	10.96	22.34				
1925	3.00	12.27				
1926	0.00	3.80				
1927	20.24	18.33				
1928	1.80	7.30				
1929	0.00	6.16				
Av.	11.75	14.34				

Financial returns from Rotation number 7, corn, barley plus brome, brome, brome, (alfalfa) are not put in here for comparison so far as the total rotation is concerned because the yields secured from seeding brome grass up to date have included so many failures, and therefore so many substitutions and have been so erratic that they would not furnish a reliable basis for comparison. In fact the weights of material taken from the several plots would not be correctly designated as yields of brome grass.

* Above average of all 10 lots.

APPENDIX TABLE 13. (Continued)

	Number of Cropping System, Names of Crops and Values										
	Rotation No. 2			Rotation No. 3					Rotation No. 5		
Year	Corn	W. Wheat	Total Av. Value	Corn	W. Wheat	Legume	Total Av. Value	Fallow	W. Wheat	Total Av. Value
1912	6.99	0.00	3.50	5.55	0.00		1.85		0.00	0.00
1913	4.93	0.00	2.47	6.78	1.07		2.62		2.20	1.10
1914	4.40	0.00	2.20	8.95	0.00		2.98		0.00	0.00
1915	13.18	16.34	14.76	12.15	5.42		5.86		0.00	0.00
1916	15.25	45.00	30.13	21.56	38.70		20.09		28.80	14.40
1917	22.44	0.00	11.22	22.92	0.00	plowed under	7.64		0.00	0.00
1918	27.39	0.00	13.70	30.91	0.00		10.30		0.00	0.00
1919	30.82	49.44	40.13	31.06	49.20		26.75		59.52	29.76
1920	12.56	0.00	6.28	16.34	0.00		5.45		0.00	0.00
1921	1.64	10.44	6.04	6.53	9.74		5.42		8.09	4.05
1922	20.00	32.84	26.42	22.65	44.34		22.33		33.58	16.79
1923	19.50	0.00	9.75	20.07	0.00		6.69		5.75	2.88
1924	17.68	39.13	28.40	13.12	52.75		21.96		35.13	17.57
1925	0.00	8.96	4.48	11.04	3.46		4.83		1.66	.83
1926	0.00	2.71	1.36	0.00	4.37		1.46		1.06	0.53
1927	18.30	4.03	11.17	16.30	0.85		5.72		15.90	7.95
1928	2.67	13.09	7.88	12.40	11.22		7.87		0.00	0.00
1929	0.00	12.83	6.42	0.37	18.79		6.39		8.18	4.09
Av.	12.10	13.05	12.57	14.37	13.33		9.23		11.10	5.55

Williams Silty Clay Loam

"The surface soil of Williams silty clay loam is very dark grayish brown or almost black heavy silt loam or silty clay loam about 5 inches thick. Below this layer there is in most places a grayish yellow heavy silt loam or silty clay loam layer which is slightly heavier than the surface soil. Lime, either in finely disseminated form or in concretions, is abundant. This layer, which is present in most areas of Williams silty clay loam, ranges in thickness from 4 to 24 inches. Below it and continuing to a depth varying from 36 to 42 inches is dark olive-brown or olive-gray clay. This material has no definite structure and breaks up into coarse clods. Lime is abundant but is apparently less abundant and less segregated than in the layer above. Small partly weathered rock fragments, mainly shale, are abundant. The next lower layer, which reaches an average depth of about 54 inches, is olive brown clay, discolored by faint streaks of lime and iron-oxide strains. The shale fragments are more abundant than in the overlying layer and are less weathered. This subsoil material is similar to that of the subsoil of the Pierre soils. Underlying this layer is the slightly weathered shale, which appears to have been broken up and moved a short distance by the ice. This soil owes its heavier texture and the olive-brown color of the subsoil to the large amount of shale in the parent drift."

U. S. D. A. Bureau of Soils, with South Dakota Soil Survey of Hyde County, South Dakota, Exp. Sta. No. 18, Series 1925, P. 13.

Fargo Silt Loam

"The surface soil of Fargo silt loam, to an average depth of 7 inches is very dark grayish-brown or black friable silt loam. On close examination a laminated or small platy structure may be seen in many places.

Under cultivation this structure is destroyed, and the soil becomes loose and friable. Underlying this surface soil is a layer, varying from 8 to 18 inches in thickness, which consists of dark-gray or black, coarsely granular, heavy noncalcareous silty clay or clay. When dry it also shows some columnar breakage, in which the columns range from 2 to 4 inches in height and are not well defined. Here and there a small number of rounded gravel are present. This layer continues to an average depth of about 35 inches, where it is underlain by gray or light grayish-brown, somewhat friable material in which there is a large accumulation of lime in masses and concretions. In this layer a few rounded gravel are also found."

Exp. Sta. No. 18, Series 1925, P. 13.
U. S. D. A. Bureau of Soils, with South Dakota Soil Survey of Hyde County, South Dakota,

Kubanka

"The variety is much grown by the Kirghiz and Turghai people on the Siberian border, where it is absolutely impossible to grow ordinary wheats of any kind because of extreme drought, the rainfall being as low as 10 inches per annum. It is cultivated throughout the entire Volga river region from Kazaii to the Caspian sea, and eastward into the Kirghiz steepes and Turkestan. It is the most popular bread wheat of the lower Volga region." (B.P.I. Bu. No. 3).

"So also the best Kubanka is found east of the Volga on the Siberian border." (B.P.I. Bu. 3).

"Kubanka (S.D. 75) from U. S. Dept. Agr., B.P.I. (C.I. No. 1440) from East Russia, probably same as C.I. 1516.

"Kubanka (S.D. 73) (C.I. 1516).

"Two other similar strains are S.D. 356 and S.D. 152."

S.D. Exp. Sta. Bu. No. 146, Page 290.

Sixty Day(S.D. 165)

"Sixty Day oats was introduced into the United States from Proskurov, Russia, in 1901 by the United States Department of Agriculture. It has become the leading early variety in South Dakota. Among the first growers and distributors of the variety in South Dakota was Mr. Isaac Lincoln, of Aberdeen. This led to the naming of the variety Lincoln Oat in some localities."

S. D. Exp. Sta. Bu. No. 146, Page 290.

Millets

"With the exception of German, Hungarian and Common, all of these varieties were introduced from East Central Russia and Siberia by the Bureau of Plant Industry, United States Department of Agriculture. When these introductions were made, the varieties were usually named after the locality from which they came. For example, both Red and Black Voronezh came from the Province of Voronezh; Kursk No. 80 came from the Province of Kursk; and the other Kursk numbers, 78 and 79 were separated according to seed color by W. A. Wheeler, formerly of the South Dakota State College Agriculture Experiment Station."

S. D. Exp. Sta. Bu. No. 146, Page 290.

APPENDIX TABLE 14.—Rainfall, Highmore Farm
(inches per month)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1908	T	0.53	0.00	1.35	2.68	5.78	2.49	3.53	0.62	2.19	1.39	0.31	20.87
1909	0.26	0.34	0.13	0.30	4.72	1.69	1.81	3.74	1.70	1.04	0.71	1.41	17.85
1910	0.82	0.19	0.58	1.40	0.94	3.74	0.85	0.66	0.89	0.24	0.40	0.44	9.05
1911	0.11	0.39	2.54	0.32	2.31	0.09	2.69	2.52	3.06	1.05	0.35	0.44	15.87
1912	0.13	0.11	0.27	1.05	2.20	1.31	1.44	3.39	0.71	0.20	0.0	0.35	12.00
1913	0.05	0.30	0.87	1.27	4.56	0.97	1.79	1.20	0.53	0.61	0.03	0.28	12.46
1914	0.13	0.62	0.45	3.65	2.23	4.09	2.01	1.16	1.01	1.92	—	0.25	17.52
1915	0.43	1.28	0.37	2.50	3.48	4.87	5.55	0.78	2.36	1.15	0.32	0.20	23.29
1916	1.40	0.27	0.74	0.89	4.15	4.54	2.10	4.10	2.75	0.58	0.13	0.47	22.12
1917	1.12	0.52	1.27	2.79	2.04	2.04	1.91	0.68	2.03	0.06	0.07	0.27	14.80
1918	0.60	0.25	0.45	2.57	3.57	1.59	5.26	1.88	0.62	0.49	1.10	0.86	19.24
1919	0.10	1.35	1.24	1.96	6.63	1.95	2.65	0.82	0.54	2.16	1.80	0.15	21.35
1920	0.27	0.33	1.20	2.56	6.04	7.05	3.56	2.47	1.51	0.75	0.34	0.20	27.08
1921	0.25	T	0.49	1.78	2.60	0.55	3.10	3.68	4.79	1.20	0.33	0.20	18.97
1922	0.45	0.93	1.05	0.93	2.78	3.65	2.85	0.41	0.48	0.39	2.83	0.35	17.10
1923	0.42	0.01	1.01	1.63	2.04	5.15	3.81	5.01	1.17	0.87	0.21	0.19	21.52
1924	0.07	0.58	1.63	1.40	0.50	5.66	2.11	1.13	2.69	1.10	0.34	0.82	18.03
1925	0.60	0.21	0.08	1.30	1.08	5.39	0.70	1.49	0.71	0.12	0.20	0.52	12.40
1926	1.56	0.0	0.03	0.16	1.96	9.50	2.53	2.09	1.07	2.78	0.16	0.36	14.20
1927	0.21	0.08	0.85	3.35	5.80	2.22	1.04	1.77	1.47	0.83	0.71	0.76	19.09
1928	0.04	0.22	0.48	1.11	0.96	2.94	2.50	2.32	0.76	1.66	0.91	0.09	13.99
1929	0.67	0.22	1.75	2.76	1.89	1.71	0.69	1.55	1.76	3.08	0.33	0.05	16.46
1930	0.07	1.36	0.74	2.90	4.37	2.48	0.55	2.45	0.74	2.69	0.81	T	19.15

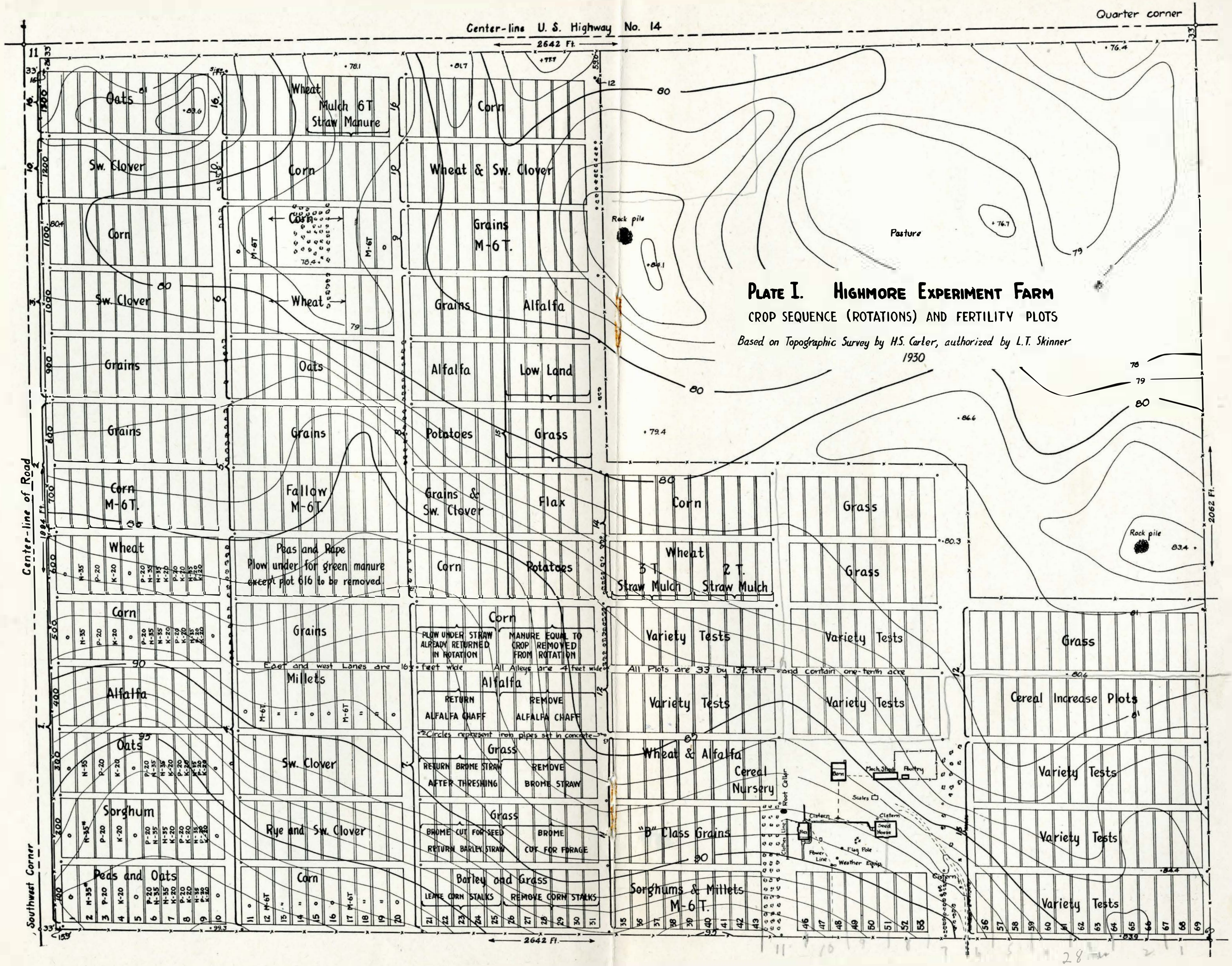


PLATE I. HIGHMORE EXPERIMENT FARM
CROP SEQUENCE (ROTATIONS) AND FERTILITY PLOTS
Based on Topographic Survey by H.S. Carter, authorized by L.T. Skinner
1930
Center-line U. S. Highway No. 14
Quarter corner
2642 Ft.
Center-line of Road
Southwest Corner
2062 Ft.
Pasture
Rock pile
Rock pile
Oats
Wheat
Mulch 6T
Straw Manure
Corn
Sw. Clover
Corn
Wheat & Sw. Clover
Corn
Corn
Grains
M-6T.
Sw. Clover
Wheat
Grains
Alfalfa
Grains
Oats
Alfalfa
Low Land
Grains
Grains
Potatoes
Grass
Corn
M-6T.
Fallow
M-6T.
Grains &
Sw. Clover
Flax
Corn
Grass
Wheat
Peas and Rape
Plow under for green manure
except plot 616 to be removed.
Corn
Potatoes
Wheat
3 T.
Straw Mulch
2 T.
Straw Mulch
Grass
Corn
Grains
Corn
PLOW UNDER STRAW ALREADY RETURNED IN ROTATION
MANURE EQUAL TO CROP REMOVED FROM ROTATION
Variety Tests
Variety Tests
Grass
East and west Lanes are 16½ feet wide
All Alleys are 4 feet wide
All Plots are 33 by 132 feet and contain one-tenth acre
Alfalfa
Millets
Alfalfa
RETURN ALFALFA CHAFF
REMOVE ALFALFA CHAFF
Variety Tests
Variety Tests
Cereal Increase Plots
Circles represent iron pipes set in concrete
Oats
Sw. Clover
Grass
RETURN BROME STRAW AFTER THRESHING
REMOVE BROME STRAW
Wheat & Alfalfa
Cereal Nursery
Variety Tests
Sorghum
Rye and Sw. Clover
Grass
BROME CUT FOR SEED RETURN BARLEY STRAW
BROME CUT FOR FORAGE
"B" Class Grains
Variety Tests
Peas and Oats
Corn
Barley and Grass
LEAVE CORN STALKS
REMOVE CORN STALKS
Sorghums & Millets
M-6T.
Variety Tests
Barn
Mach. Shed
Poultry
Scales
Root Cellar
Cistern
Cistern
Seed House
Clothes Line
Flag Pole
Flower Line
Weather Equip.
Cistern