5-1-1937

Twenty-One Years of Crop Yields from Cottonwood Experiment Farm

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Bulletin 312 May, 1937

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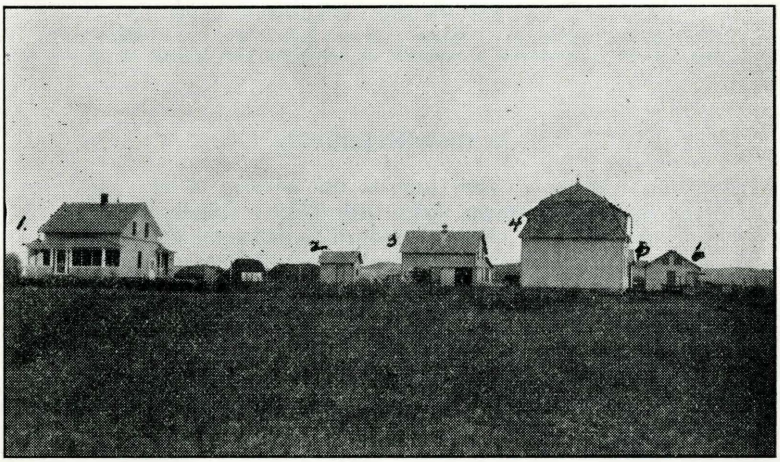
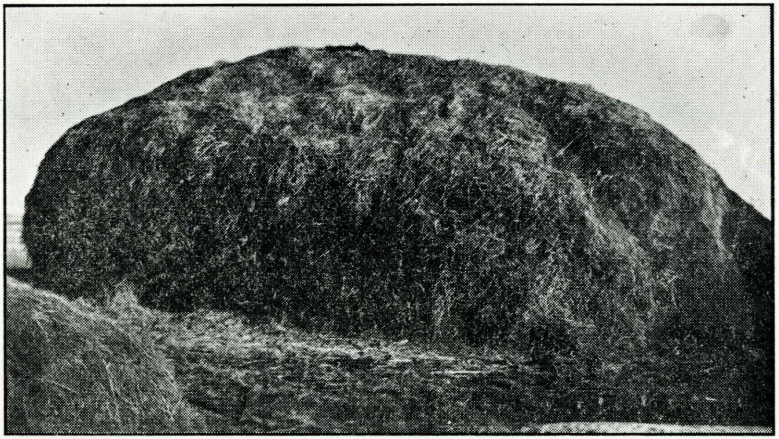


COTTONWOOD EXPERIMENT FARM BUILDINGS

1. House
2. Pump house
3. Barn
4. Seed House
5. Ice house
6. Machine Shed

Poultry house (right of dwelling)

South Dakota State College of Agriculture
and Mechanic Arts
Agronomy Department



HAYSTACK AT COTTONWOOD EXPERIMENT FARM, 1935

Production and utilization of forage, whether native hay, or introduced crops like alfalfa, sweet clover or sorghums, is evidently an important part of land use in this area.

Acknowledgements

Individuals who have contributed to this history of crop yields from Cottonwood Experiment Farm, along with others, include: Dr. N. E. Hansen, who pioneered in the establishment of Cottonwood Experiment Farm by the State; Edward Nelson, who took direct charge, even before buildings were established; S. W. Sussex who was the first foreman after present experiments were installed on the land, taking direct charge of laying out field experiments, under direction of the late Prof. C. Willis, then agronomist and Supt. of substations; Prof. Manley Champlin, Associate in Crops in this department; Prof. J. G. Hutton, in charge of Soils Investigations; Dr. K. H. Klages, lately in charge of Cereal Breeding in Agronomy Department; Mr. C. J. Franzke, who has helped in a far-sighted way to coordinate numerous details of experimental work over a number of years; Wesley Fuerstenau, for some years resident foreman; Edgar Joy, who is now foreman, and has directed and performed work on plot and other experiments and has been able to give sound advice because of first-hand knowledge of the area.

Records have been put down and tabulated and computations made by Miss Elva Fuerhelm, formerly Clerk in this department, and more recently by Miss Mabel Anderson, Clerk.

Summary and Table of Contents

The present report constitutes a history of yields of staple crops including native hay from Cottonwood Experiment Farm, 1912 to 1932 inclusive, under the climatic variations that occurred within that period; from definite crop sequences or rotations.

Average yields of crops produced by cultivation and put down here, are compared with yields of hay, made up of native vegetation, mainly wheat grasses. The broad question whether cultivation of any crops whatever shall be a part of land use and farm management in this or any area, must depend in great measure upon such relative yields.

In case it should be proved that native vegetation already on the ground could yield as much of valuable product as cultivated crops, cultivation would surely be a waste of time. Average yields of introduced forage herein, including alfalfa, sweet clover, sorghum and millets are notably higher than yields of native hay.

This fact amounts to a principle that the native vegetation of this and of other areas as well, through milleniums has prepared itself to survive, not necessarily to produce yields. Introduced crops may not survive, but they may and in this case do produce higher yields.

In a number of instances 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 rather than absolute proof. Such deductions are the result of research and possess value both for what they say and what they refrain from attempting to conclude.

Cultivated Crops, Small Grains and Legumes.—This bulletin tells, in the first place, what return in terms of bushels or tons per acre, staple crops like corn or sorghum; small grains like wheat, barley, rye, oats, flax; legumes, like sweet clover or alfalfa, have been obtained, over a period of 21 consecutive years.

Such a basis of knowledge is essential for arriving at an intelligent decision concerning whether given crops return enough to make their production tenable, or whether perhaps production of given crops should be foregone entirely. Statements have been made from time to time about what ought to be done with an area known as the Great Plains, by individuals who had less than that much information.

The specific yields produced at Cottonwood Experiment Farm from the following are put down:

1. Legumes: Sweet Clover and Alfalfa;
2. Small grain: Wheat, Barley, Rye, Oats, Flax;
3. Cultivated Crops: Sorghum and Corn.

The facts in this bulletin indicate that the foregoing crops are worth producing, upon occasion, within the area represented. The long-time crop lields put down herein not only lead to the foregoing conclusion, but indicate that care must be used to make conditions as favorable as may be. For example: (Table 23, page 29).

In all instances where it is indicated that small grains (wheat, barley,

rye, oats, flax) are worth producing, the yield data were secured where the small grain had been seeded on land utilized for a cultivated crop (sorghum or corn) the previous year. In other instances, where the same small grain crops were produced in successive years on the same land, the yields were reduced to a point where their production was not worthwhile.

A **Systematic Crop Rotation May Be a Deciding Factor.**—The foregoing briefly leads to the conclusion implied in the foregoing section, that the general plan or crop sequence on a given piece of land should consist of the following order: (1) cultivated crop, (2) small grain crop, (3) legume crop.

It is fairly obvious that numerous modifications of the foregoing system are available; e.g. depending on whether the cultivated crop is sorghum or corn, or possibly a mixture; depending on the kind of grain crop which may be utilized, (whether wheat, barley, rye, oats, flax); depending on whether the legume is sweet clover or alfalfa. Allowing for such variations in detail, the necessity for the kind of crop-sequence here pointed out amounts apparently to a principle in this section of the Great Plains.

Land Use?—It is indicated foregoing that:

1. Average returns from staple crops (Table (36) 37 page 42) may warrant their production.

2. It appears essential that a favorable crop system be observed for such production.

Further deductions are limited. It is hardly necessary to say that the acreage of land cultivated in Western South Dakota or in the Great Plains, or the percentage of such land which may or might be devoted to field crop production are not determined here. Likely such percentage would vary here as elsewhere with economic conditions and with population.

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Establishment

Cottonwood Experiment Farm was established on land which was set aside by the legislature of the State of South Dakota in 1907, from the common school endowment or indemnity lands in what was formerly Stanley County, but is now Jackson County. The Board of Regents was authorized to select one section, plow the lands and make permanent improvements thereon. "The said board shall be permitted the free use of such lands for such experimental farm purposes so long as the same is so occupied." The farm consists of 632 acres of land, and is described as Section 16, Township 1 South, Range 19 East, Jackson County, South Dakota.

The farm is located two miles east of the city of Cottonwood. The State Highway No. 14 passes by the farm directly on the north. The Chicago and North Western Railroad runs east and west past the section which includes the farm, and touches the highway at the northwest corner of the section.

Soil of Cottonwood Experiment Farm.—The soils of Cottonwood Experiment Farm are comprised of Pierre Clays and soils closely allied to the same. The Pierre Clay soils include the "south farm" plots, and make up the larger area of the Experimental Farm. They are the most important in the vicinity, and are generally representative of extensive areas in the western part of South Dakota. The Pierre Clay is a heavy soil ranging in texture from a silty clay loam through a heavy clay. It is usually dark brown in color. The Pierre Soils are derived by weathering and the addition of organic matter from the Pierre Shales. The topography is gently rolling to hilly and broken. If plowed and cultivated when the soil has dried out just enough not to adhere to the implements, the soil breaks up into small granules, thus allowing the formation of a good mulch . When tilled properly, the soil becomes mellow, especially when a good supply of humus is present.

The "north farm" is a heavier phase and might be described as Orman Clay. This soil is closely associated with the Pierre Clay, and possesses many of its characteristics. Like the Pierre Clay it is sticky when wet, and when dry the surface cracks; and if it has been stirred while wet, hard clods will be formed. The Orman Clay represents Pierre shale or Pierre Clay material which has been reworked and redeposited by water. Level flats or gently inclined foothill slopes are the characteristic topographical features.

The South Farm is representative of the upland Pierre soils which cover a large portion of the West River Area. As already indicated, these upland soils are a lighter phase and easier worked, especially when moist, than the phase represented on the "North Farm." It has been noticed during the seasons of crop production that the land situated on the southeast part of the section is still more workable than either of the foregoing portions, especially under wet conditions.

In wet seasons it is possible to cultivate first on the fields in this southeast portion of the section; whereas it is necessary to wait two or three days longer for the land to dry in the southwest quarter; and still several days additional before being able to do field work on the north farm in the northwest quarter on the Orman Clay.

Climate and Topography.—Cottonwood Experiment Farm serves as a co-operative weather observation station with the United States Weather Bureau. Such observations are supervised for the Agronomy Department by J. G. Hutton, and records are taken by the foreman at the farm.

The mean summer temperature is 70.1 F., and the absolute maximum is 111F. The mean winter temperature is 20.52 F., and the recorded absolute minimum is -42 F. (1). The average date of the last killing frost is May 19, and that of the first is September 22. This is an average frost-free season of 126 days. The latest killing frost recorded is June 9, and the earliest is September 13.

The mean annual rainfall recorded its 16.3 inches. The heaviest precipitation takes place during spring and summer, and the lightest during the winter. The wettest year recorded was 1915 when there were 27.31 inches rainfall, and the driest year was 1931 when there were 7.36 inches.

The elevation at Cottonwood is 2,414 feet, as recorded by United States Weather Bureau.

Soil and Climatic Conditions are Typical, and Accurate Long-time Results are reliable.—The foregoing brief statements about soil and climate at Cottonwood are made for the purpose of indicating that farming conditions and the conditions of life in general represented by Cottonwood Experiment Farm compare with those existing in western South Dakota and other wide areas of the Great Plains region of the United States. Varieties and strains of crops which grow under climatic and soil conditions at Cottonwood may be compared with those in other parts of the world.

Cottonwood Experiment Farm has served a useful purpose in introducing varieties and strains of crops from other parts of the world having similar conditions of soil and climate. Such introductions have become the principal crops in the area. These crops include sorghums which originated in Africa, sudan grass which originated in Sudan, and early varieties of the cereal grains as Sixty-day Oats and Kubanka Wheat and their selections, both of which were introduced from Russia. Likewise alfalfa such as Cossack, forage grasses native to the area itself including Western Wheatgrass, Grama grass, Buffalo grass, and such special crops still in the experimental stage as sunflowers and Chee grass, have been and are being tested for forage. A number of these important introductions were among those brought in by Dr. N. E. Hansen from Russia and various parts of the Orient where conditions are similar to those in the area under discussion.

In order to arrive at average yields of staple crops including both cultivated grain and forage crops, and likewise native and introduced pasture, it is necessary to have yields covering a sufficient number of years to serve as a basis for computations. Such computations in turn having once become reliable may be used for several purposes, including the practical determination of the most suitable farming systems, and also the more theoretical computations necessary for figuring economic risks.

These wide variations in soil and climate make it necessary to have crop yields that cover a long series of years in order to make comparisons that are reliable and that arrive at truly statistcial data. A number

(1). Dates of killing frost and length of growing season are computed on the basis of a minimum temperature of 31 degrees F.

of the yieldsfrom crop experiments at Cottonwood, including crop-rotations and soil-fertility and cultivation experiments, are of long enough duration to be fairly significant as a basis for computation.

The Agronomy Department of South Dakota Experiment Station has co-operated with the United States Weather Bureau in recording weather conditions, including rainfall, since 1910, and has reported records in duplicate to the United States Weather Bureau from that time until the present. (See table appendix, page 79.)

Trees at Cottonwood.—In 1914 a tree planting demonstration was located north and west of the experiment buildings. The grove covered about an acre and was made up of a number of hard and soft wood forest trees and also lower growing perennials. The trees consisted of ash, honey locust, box elder, Russian olive, and black locust. A few lilacs were added, and a row of Caragana in the form of a plantation hedge along the west side. The trees were planted one rod apart from one another, and each row consisted of 27 trees of a given kind. The rows extended lengthwise east and west.

In September, 1914, the percentage of trees alive of the total number set out was as follows: Ash, 22 per cent, honey locust, 26 per cent, box elder, 52 per cent, Russian olive, 74 per cent, and black locust, 26 per cent. During the first few years the trees were given clean cultivation. Since that time they were cultivated only intermittently.

At the present writing there are 13 Russian olive and three ash trees alive. The Russian olives are about 9 inches in diameter at the base, and 18 feet high. The Caragana hedge and the lilacs have made good growth. This demonstrates their ability to make a satisfactory hedge in the area.

In 1933 another plantation was started consisting of American elm, ash, and hackberry, with a buckthorn hedge along the north and west sides. This plantation is cultivated so that a ridge is created between the tree rows and the moisture drains toward the trees.

The ordinary methods of tree cultivation often result in having the trees located in a row along a ridge of land. Such location on a ridge is not always intentional, but may result from repeated cultivations, throwing the soil toward the trees. (Illustration on page 9).

Such gradual ridging up of tree-rows may be prevented by utilizing a home-made road drag like one devised by Foreman Frank Hussey at Vivian Experiment Farm, made of 2 x 6 feet planks for blades set at a slight tilt. These blades were 6½ feet long and when made up into a drag of the design shown, it was possible to use the tool in such a way as to scrape surface soil away from the trees and throw it into a ridge midway between the rows of trees, leaving the tree-rows themselves in a moisture-holding depression.

Crop Sequences and Crop Rotations.—In the present bulletin the term 'cropping system," is used to designate a general plan, or arrangement of crops; according to the broader classification of such crops; viz., 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 discussian, means a specific statement of the kinds of crops and the order with which they follow one another.

The Tree Cultivator (S. D. Expt. Sta. Bu. 253)

The several acres sub-divided into one-tenth acre plots at Cottonwood, which serve as the basis for the systematic cropping systems were first laid out in 1909. The original series of plots as laid out by C. Willis, then agronomist, comprised four series, three of which embraced plots numbered consecutively from 1 to 30; the remaining series embraced plots numbered consecutively from 51 to 60. The total number of plots was 270. In 1912 more plots were added and many of the present day crop rotations were laid out by A. N. Hume, agronomist and superintendent of sub-stations.

Special methods of producing crops were installed and carried out as for instance, cereals planted in wide rows as compared with the usual close drilled rows. Thorough trials were made of various depths of plowing, and cultivation.

Subsoiling with the use of dynamite was attempted on a limited scale. Extreme depths of plowing were not necessarily profitable, but it was necessary to try out the matter experimentally to be able to make any statement as to the principle involved. The same is true of many trials where it is necessary for experimental purposes to try out practices in order to avoid failures or perhaps to arrive at success by such practices on farms of the vicinity.

A complete fertility test was installed at the beginning in connection with one of the standard cropping systems. In connection with fertility, extensive long trials were included, designed to determine the ultimate effect upon the soil as well as the economic value of stall manure when applied to various rotations.

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

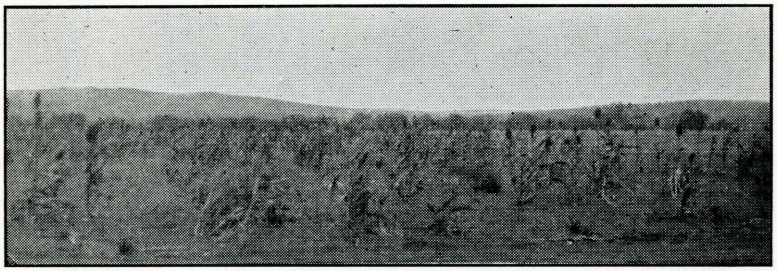
Examination of Plate I will help make it evident that the following cropping systems or rotations are included among the trials conducted at Cottonwood. For a more direct comparison of the crop sequences they are put down along with the numbers indicating the plots where the crops are produced year after year.

Crop Sequences Under Comparison

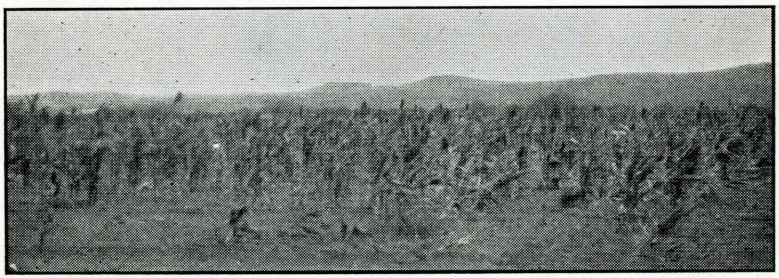
Number of Sequence as Shown in Plate I	Succession of Crops in Given Sequence	Plots Included in Acres Occupied by Given Rotation
1.	Corn, wheat, legumes (green manure), alfalfa (5-10 years), potatoes (variety), flax (date of seeding), (manure vs. none)	101-110 201-210 301-310 401-410 501-510 601-610
2.	Corn, wheat, oats (rate of seeding), (Manure versus no manure)	441-420 511-520 611-620
3.	Corn, wheat, legumes (fertility test)	111-120 211-220 311-320
4.	Sorghum (method of planting), barley, legumes	121-130 221-230 321-330
5.	Sunflowers, barley, legumes	421-430 521-530 621-630
6.	Sorghum, or small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd gr. manure)	151-160 251-260 351-360 451-460 551-560 651-660
7.	Corn, wheat	751-760 851-860
8.	Continuous small grain (method of tillage)	951-960
9.	Rye, corn, winter wheat, sorghum (tillage test)	901--910 1001-1010
10.	Forage (method of planting), Millet, oats, sudan, oats, Dakota amber, oats, sorghum	131-140 321-240 331-340
14.	Forage grasses and combinations of them. Brome, Grimm ÷ slender wheat, Grimm ÷ Brome, Grimm, Grimm ÷ native grass, native grass	431-440 531-450 631-640 731-740 831-842 451-460
	Stages of cutting alfalfa. Bud, 1/10 bloom, 1/2 bloom, full bloom.	
	Alfalfa varieties test, Turkestan, Orenburg, N Sweden	701-710
	Vale, Turkestan, Grimm	201-210
	Methods of seeding alfalfa varieties. Cossack, Common S. D. 12, Semipalatinsk, Grimm, Turkestan	711-720 721-730 801-810 811-820 821-830

Why Crop Rotations.—These crop rotations carried out as they are through successive years give a chance to measure not only the effect of one rotation against another but also the production from different crops that may possibly be raised under the prevailing conditions. One may thus ultimately learn the productive capacity of the land and learn what crops are best and most worth while to use in making land return the most for a given amount of labor and expense. It is worth while, other things equal, to cultivate the crops in any given area that make these best returns and forego the production of others.

The present bulletin will discuss the effect upon the return of producing the same crop upon the same land year after year as compared with producing several crops in succession in a systematic rotation. The discussion will be based upon the yields secured from the crop systems and rotations over a twenty-one year period at Cottonwood Experiment Farm.



Altamont Sorghum following 10-inch plowing at Cottonwood Experiment Farm



Altamont Sorghum following 5-inch plowing at Cottonwood Experiment Farm

Yields of Corn from Several Crop-Sequences

Yields of corn produced in succession with other crops are shown in table I. The farm values of the corn (grain) crops are in table II. These farm values are computed with using the corn yields in table I and the South Dakota farm price Appendix table 13, page 73.

Such an arrangement makes possible a direct comparison of not only the yields of corn secured from the separate rotation, but also the gross farm value of the corn from each rotation for that year.

Table 1.—Comparative Average Yields of Corn from Different Rotations at Cottonwood Experiment Farm

Comparative Average Yield of Corn (bushels, 80 pound ears) per acre from given rotations						
Year	Rotation No. 1 Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax	Rotation No. 2 Corn, Wheat, Oats	Rotation No. 3 Corn, Wheat, Legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd gr. manure)	Rotation No. 7 Corn, Wheat	Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum
1912	36.7	29.4	26.9	26.0	22.7	
1913	0	0	0	0	0	
1914	0	0	0	0	0	
1915	0	0	0	0	0	
1916	9.7	11.5	7.1	10.6	6.7	9.5
1917	10.0	4.9	5.4	7.4	0.8	2.6
1918	19.5	19.0	17.8	20.4	21.2	12.5
1919	0.8	0	0	0	0	0
1920	13.5	17.9	14.3	19.2	19.3	15.9
1921	0	0.4	0.1	.2	0.5	0.3
1922	18.7	17.0	18.0	19.2	16.0	12.6
1923	50.4	34.3	59.5	26.8	41.0	21.1
1924	2.8	6.0	2.2	2.7	9.2	16.8
1925	3.8	1.8	2.5	0	0	0
1926	6.7	8.4	5.9	4.5	3.3	4.9
1927	33.7	55.0	21.6	26.9	24.3	23.8
1928	0	1.1	1.9	.2	2.1	2.7
1929	7.7	15.8	7.6	5.5	11.9	1.0
1930	1.2	7.8	0.6	2.4	12.0	0.9
1931	0.8	2.3	2.8	1.0	1.7	3.6
1932	16.9	12.9	12.1	9.1	13.7	14.5
Av.	11.1	11.7	9.8	8.6	9.8	8.4

Table 2—Farm Values of Corn

Comparative Gross Returns from Corn per Acre from Given Cropping Systems							
Year	South Dakota Farm Price of Corn	Rotation No. 1 Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax	Rotation No. 2 Corn, Wheat, Oats	Rotation No. 3 Corn, Wheat, Legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd gr. manure)	Rotation No. 7 Corn, Wheat	Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum
1912	$ .37	$13.60	$10.88	$ 9.95	$ 9.62	$ 8.40	$
1913	.56	0	0	0	0	0	0
1910	.50	0	0	0	0	0	
1915	.49	0	0	0	0	0	0
1916	.77	7.47	8.86	5.47	18.16	5.16	7.32
1917	1.20	12.00	5.88	6.48	8.88	.96	3.12
1918	1.10	21.45	20.90	19.58	22.44	23.32	13.75
1919	1.19	.95	0	0	0	0	0
1920	.42	5.67	7.52	6.00	8.07	8.11	6.68
1921	.26	0	.10	.03	.05	.13	.08
1922	.50	9.35	8.50	9.00	9.60	8.00	6.30
1923	.52	26.21	17.84	30.94	13.94	21.32	10.97
1924	.80	2.24	4.80	1.76	2.16	7.36	13.44
1925	.60	2.28	1.08	1.50	0	0	0
1926	.58	3.89	4.87	3.42	2.61	1.91	2.84
1927	.57	19.21	31.35	12.31	15.33	13.85	13.57
1928	.62	0	.68	1.18	.12	1.30	1.67
1929	.62	4.77	9.80	4.71	3.41	7.38	.62
1930	.47	.56	3.67	.28	1.13	5.64	.42
1931	.41	.33	.94	1.15	.41	.70	1.48
1932	.13	2.20	1.68	1.57	1.18	1.78	1.89
Av.	$ .60	$ 6.29	$ 6.64	$ 5.49	$ 5.58	$ 5.49	$ 4.95

Corn, Yield and Value

Observations from foregoing Tables I and II.—Examination of comparative gross returns per acre from corn in several rotations, as put down in the lowest horizontal line of foregoing Table 2 indicate that the one from Rotation 2 (Corn, Wheat, Oats) was somewhat higher than the others.

The other rotation where corn produced nearly the same yield as the foregoing was Rotation 1, (Corn, Wheat, Legumes, (Alfalfa) Potatoes, Flax.

Without making long discussion, it seems possible that the two foregoing rotations made somewhat more moisture available for the corn crop than was available for corn in the other rotations brought into comparison, and that the yield of corn was higher in Rotations 1 and 2 than in the others for the reason indicated.

Yields of Sorghum Grain from four Crop Rotations

Grain yields from sorghum produced in the rotations as listed are given in table 3. The computed farm value of the grain from the sorghum is found in table 4.

Table 3—Comparative Average Yields of Sorghum Grain from Different Rotations at Cottonwood Experiment Farm

Year	Rotation No. 4 Sorghum, barley, legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd gr. manure)	Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum	Rotation No. 10 Millet, Oats, Sudan, Oats, Dakota Amber, Oats
1912	24.1	8.8	11.9	
1913	0	1.7	2.3	
1914	5.2	3.7	3.6	
1915	2.3	0	0	
1916	.5	1.6	0.3	
1917	0	0.6	0	
1918	7.7	0	0.9	
1919	2.4	0	2.1	
1920	0	25.8	14.0	31.4
1921	2.6	14.1	4.2	4.2
1922	13.2	21.6	24.6	20.1
1923	48.3	65.0	22.0	41.9
1924	4.9	5.8	35.0	8.0
1925	0	0	1.7	0
1926	1.1	6.7	6.6	4.5
1927	31.4	35.6	3.3	18.7
1928	0	0.5	0	0.1
1929	4.4	1.9	7.3	1.5
1930	2.4	14.0	3.1	2.9
1931	0	0	0.6	3.1
1932	32.2	14.0	8.4	7.9
21 yr. Av.	8.7	10.5	7.2	
11 yr. Av.	12.8	18.6	11.9	11.1

Table 4—Farm Value of Sorghum Grain from Given Cropping Systems

Year	Rotation No. 4 Sorghums, barley, legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn small grains, legumes (1st hay) (2nd gr. manure)	Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum	Rotation No. 10 Millet, Oats, Sudan, Oats, Dakota Amber, Oats
1912	$ 8.91	$ 3.26	$ 4.40	
1913	0	.95	1.12	
1914	2.60	1.85	1.80	
1915	1.13	0	0	
1916	.39	1.23	.23	
1917	0	.72	0	
1918	8.47	0	.99	
1919	2.86	0	2.50	
1920	0	10.84	5.88	$13.19
1921	.68	3.67	1.09	1.09
1922	6.60	10.80	12.30	10.05
1923	25.12	33.80	11.44	21.79
1924	3.92	4.64	28.00	6.40
1925	0	0	1.02	0
1926	.64	3.89	3.83	2.61
1927	17.90	20.29	1.88	10.66
1928	0	.31	0	.06
1929	2.73	1.18	4.53	.93
1930	1.13	6.58	1.46	1.36
1931	0	0	.25	1.27
1932	4.19	1.82	1.09	1.03
21 yr. Av.	$ 4.15	$ 5.04	$ 3.99	
13 yr. Av.	$ 4.84	$ 7.52	$ 5.60	$ 5.42

Observations from Tables 3 and 4.—A comparison of the average grain yields secured shows that the yield of grain from Rotation 6 (Sorghum, small grains, legumes for crop, corn, small grains, legumes first hay, second green manure) is higher than the others.

It is believed that this crop rotation would be as favorable as any for the growth of sorghum and production of grain. Not too much stress is here laid on this particular comparison, it being also recognized that the location of Rotation 6 is on favorable soil.

Yields of Sorghum in Comparison with Yields of Corn

In the following Table 5 are presented yields of grain in bushels and yields of forage in pounds per acre secured from corn and from sorghum when both are produced in the same rotation. From such yields a direct comparison of the productive capacity of the two crops is secured, while in Table 6 their relative farm returns are given based on estimated farm price.

Deductions for Following Tables 5 and 6 from Rotation 6.—The acres included in this rotation are situated on Pierre soil, on the southwest quarter of the experiment farm.

The average yield of grain for the 21-year period of sorghum was 10.5 bushels (50 lbs. per bu.), whereas the comparative yield of corn for the same period was 8.2 bushels per acre (80 lbs. ears). The average

Table 5.—Comparative Yields of Forage in Pounds and Grain in Bushels from Corn and Sorghum at Cottonwood Experiment Farm

	Rotation 6: Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd green man.)				Rotation 9: Rye, Corn, Winter Wheat, Sorghum			
	Corn		Sorghum		Corn		Sorghum	
Year	Grain	Forage	Grain	Forage	Grain	Forage	Grain	Forage
1912	15.8	2435	8.8	1916	23.1	1916	11.9	1445
1913	0	688	1.7	868	* 0	868	2.0	687
1914	0	1038	3.7	1494	0	335	3.6	708
1915	0	3100	0	1807	0	0	0	0
1916	8.1	3830	1.6	670	9.5	1990	0.3	327
1917	6.9	1350	0.6	608	2.6	798	0	0
1918	21.9	3153	0	0	12.5	2244	0.9	284
1919	0	1510	0	0	0	1876	2.1	412
1920	19.1	2838	25.8	3472	15.9	2702	14.0	2550
1921	0.2	283	14.1	2798	0.3	160	4.2	1154
1922	25.4	2133	21.6	6329	12.6	1595	24.6	4425
1923	27.9	3683	65.0	10094	21.1	3335	22.0	6500
1924	3.0	1633	5.8	2889	16.8	1835	35.0	1935
1925	0	0	0	0	0	760	1.7	338
1926	1.8	913	6.7	2954	4.9	1490	6.6	2026
1927	22.6	1793	35.6	7639	23.8	4192	3.3	2920
1928	0.4	908	0.5	2928	2.7	189	0	1025
1929	6.0	1713	1.9	2017	1.0	553	7.3	1835
1930	1.6	833	14.0	7538	0.9	667	3.1	2699
1931	0.8	635	0	3300	3.6	1399	0.6	440
1932	10.1	420	14.0	3511	14.5	2020	8.4	2605
21 yr. Av.	8.2	1614	10.5	2992	8.4	1473	7.2	1634
Kaoliang—1912-23 Da. Amber—1924-32 Av.	10.4	2087	11.9	2505				

* Yields for 1912 and 1913 are substituted from Rotation 6.

Field notes relating to seasonal conditions in several years which doubtless bear directly upon yields of sorghum ,are as follows: 1915, "In this year corn was abandoned, too wet;" 1919, "Corn is reported dried up;" 1925, "Corn made no seed, dried up;" 1926, "Hail, July 26, leaves split;" 1928 "No grain or sorghum (Kaoliang) due to unfavorable weather;" 1932, "Frost nipped corn, May 27."

computed grain value for sorghum was $5.05 per acre. The grain value of the corn for the same period was $4.88.

During the 21-year period from 1912 to 1932 the average yield per acre of forage including the grain from sorghum was 2,992 pounds with a computed farm value of $7.80 per acre. The comparative yield of forage including the grain from corn for the same period was 1,614 pounds with a computed farm value of $4.39.

The sorghum during the 21-year period was: 1912-23 Kaoliang, a grain sorghum and 1924-32 Dakota Amber, an Amber Cane Sorghum. The cane produces a higher yield of forage than the grain sorghums.

A comparison of the forage yields from 1924-32 of Dakota Amber and corn show a decided difference in gavor of Dakota Amber. (See also S. Dak. Expt. Sta. Bu. No. 285). Dakota Amber yielded 8.7 bushels of grain and 3,642 pounds of forage while during the same period corn yielded 5.1 bushels of grain and 983 pounds of forage per acre.

Inspection of the tables comparing sorghum and corn yields at Cottonwood indicate that sorghum is equal to corn for the production of grain. It also becomes evident that sorghum gives a higher yield of field cured forage per acre than corn. From the results obtained and the fact that it is resistant to grasshoppers it is evident that sorghum is a valuable crop for the production of forage in the west-river area, to the extent that it might replace corn in some instances.

Table 6—Farm Values of Corn or Sorghum Forage

Comparative Returns from Corn or Sorghum Forage from Given Cropping Systems												
	S. Dak. Farm Price of Corn		S. Dak. Farm Price of Sorghum		Rotation 6: Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd, green man.)				Rotation 9: Rye, Corn, Winter Wheat, Sorghum			
					Corn		Sorghum		Corn		Sorghum	
Year	Grain	Forage, T	Grain	Forage, T	Grain	Forage	Grain	Forage	Grain	Forage	Grain	Forage
1912	$ .37	$4.07	$ .37	$4.07	$5.85	$4.93	$3.26	$3.90		$3.90	$4.40	$2.94
1913	.56	4.33	.56	4.33	0	1.49	.95	1.88		1.88	1.12	1.49
1914	.50	3.80	.50	3.80	0	1.97	1.85	2.84		.64	1.80	1.35
1915	.49	3.53	.49	3.53	0	5.47	0	3.19		0	0	0
1916	.77	3.60	.77	3.60	6.24	6.89	1.23	1.21	$7.32	3.58	.23	.59
1917	1.20	7.07	1.20	7.07	8.28	4.77	.72	2.15	3.12	2.82	0	0
1918	1.10	6.67	1.10	6.67	24.09	10.51	0	0	13.75	7.48	.99	.95
1919	1.19	9.00	1.19	9.00	0	6.80	0	0	0	8.44	2.50	1.85
1920	.42	5.67	.42	5.67	8.02	8.04	10.84	9.84	6.68	7.66	5.88	7.23
1921	.26	4.27	.26	4.27	.05	.60	3.67	5.97	.08	.34	1.09	2.46
1922	.50	5.00	.50	5.00	12.70	5.53	10.80	15.82	6.30	3.99	12.30	11.06
1923	.52	5.40	.25	5.40	14.51	9.94	34.06	27.25	10.97	9.00	11.44	17.55
1924	.80	5.93	.80	5.93	2.40	4.84	4.64	8.57	13.44	5.44	28.00	5.74
1925	.60	7.33	.60	7.33	0	0	0	0	0	2.78	1.02	1.24
1926	.58	8.66	.58	8.66	1.04	3.95	3.89	12.79	2.84	6.45	3.83	8.77
1927	.57	5.07	.57	5.07	12.88	4.54	20.29	19.36	13.57	10.63	1.88	7.40
1928	.62	5.47	.62	5.47	.25	2.48	.31	8.01	1.67	.52	0	2.80
1929	.62	5.80	.62	5.80	3.72	4.97	1.18	5.85	.62	1.60	4.53	5.32
1930	.47	5.67	.47	5.67	.75	2.36	6.58	21.37	.42	1.89	1.46	7.65
1931	.41	5.33	.41	5.33	.33	1.69	0	8.79	1.48	3.73	.25	1.17
1932	.13	2.83	.13	2.83	1.31	.59	1.82	4.97	1.89	2.86	1.09	3.69
21-yr Av.					$4.88	$4.39	$5.05	$7.80	$4.95	$4.08	$3.99	$4.35
Kaoliang, 1912-23—Av.					$6.65	$5.56	$5.62	$6.17				
Dak. Amber, 1924-32—Av.					$2.52	$2.29	$4.41	$9.97				

Comparitive Yields of Grain Following Corn and Grain Following Sorghum

Comment has been made from time to time regarding the effect, if any, which sorghum may have on succeeding crops produced on the same land. Table 7 gives comparative results of the grain yield following corn, and following sorghum, in the same rotation.

Table 7—Comparative Yields of Grain Following Corn, and Grain Following Sorghum, Rotation 6

Year	Wheat following Corn, (bu)	Wheat following Sorghum, (bu)	Oats following Corn, (bu)	Oats following Sorghum, (bu)	Barley following Corn, (bu)	Barley following Sorghum, (bu)	Rye following Corn, (bu)	Rye following Sorghum, (bu)	W. Wheat following Corn, (bu)	W. Wheat following Sorghum, (bu)
1929	16.3	19.1	41.3	37.8	20.4	19.0	3.3	5.7	21.5	15.5
1930	4.1	3.5	15.9	7.8	15.8	9.6	14.4	8.0	8.3	5.7
1931	2.0	3.9	5.9	2.5	6.9	5.8	1.9	3.3	5.3	4.1
1932	28.6	29.7	57.2	72.8	44.2	41.0	17.9	15.7	4.2	8.7
4-yr. Av.	12.8	14.1	30.1	30.2	21.8	18.9	9.4	8.2	9.8	8.5
	Plot 6 Av. 12.4 bu	Plot6 Av. 14.5 bu.								

Table 8—Comparative Farm Value of Grain Following Corn, and Grain Following Sorghum, Rotation 6

Year	Wheat following Corn	Wheat following Sorghum	Oats following Corn	Oats following Sorghum	Barley following Corn	Barley following Sorghum	Rye following Corn	Rye following Sorghum	W. Wheat following Corn	W. Wheat following Sorghum
1929	$15.16	$17.76	$14.04	$12.85	$9.18	$8.55	$2.51	$4.33	$20.00	$14.42
1930	1.89	1.61	3.34	1.64	4.58	2.78	3.60	2.00	3.82	2.62
1931	.96	1.87	1.30	.55	2.21	1.86	.63	1.09	2.54	1.97
1932	8.58	8.91	2.71	2.72	5.75	5.33	2.69	2.36	1.26	2.61
4 yr. Av.	$6.65	$8.54	$5.35	$4.44	$5.43	$4.63	$2.36	$2.45	$6.91	$5.41

A study of Table 7 indicates that for the four year period of 1929-32, spring wheat and oats yielded slightly more following sorghum than following corn. Barley, rye, and winter wheat yielded slightly more following corn than following sorghum.

It is evident that additional data will be necessary to establish the fact that sorghum has any other or any greater influence upon succeeding crops than corn.

Methods of Seeding Sudan Grass, Millet, and Dakota Amber Sorghum

In Tables 9 and 10 are shown the yields and farm values of forage in pounds per acre of Sudan grass, Millet, and Dakota amber. Tables 11 and 12 give the yields and farm values of the grain from the same plots in the same years.

Table 9.—Comparative Average Yields in Pounds of Forage from Sudan Grass, Millet, and Sorghum—from Cottonwood Experiment Farm

Comparative average yields in pounds of forage from given crop and given method of seeding						
	Sudan		Millet		Dak. Amber Sorghum	
Year	Solid	42 in. Rows	Solid	36 in. Rows	Solid	42 in. Rows
1920	2900	3720	4320	4280	* 6570	6570
1921	1044	856	1992	1128	* 2572	2570
1922	3240	2200	5540	4740	4220	4780
1923	1940	2970	4940	4940	4250	6035
1924	960	1510	1260	1180	1520	3020
1925	410	647	0	0	215	410
1926	1630	2653	1650	1240	2160	1730
1927	3150	2900	2025	2517	3850	3433
1928	800	1100	400	767	900	1133
1929	830	767	600	1533	1500	1273
1930	1950	3047	450	707	3600	3713
1931	160	200	440	320	1050	1533
1932	1800	1467	3800	3667	1800	1750
13 yr. Av.	1601	1849	2109	2078	2631	2919

* Yields from 42 in. rows are here substituted.

Table 10.—Farm Values of Forage from Sudan Grass, Millet and Sorghum

Comparative Returns from Forage from Given Crop and Given Method of Seeding									
	S. Dak. Farm Price			Sudan		Millet		Dakota Amber Sorghum	
Year	Su-dan	Mil-let	Sor-ghum	Solid	42 in. Rows	Solid	36 in. Rows	Solid	42 in. Rows
1920	$ 8.50	$ 7.44	$ 5.67	$12.33	$15.81	$16.07	$15.92	*$18.66	$18.66
1921	6.40	5.60	4.27	3.34	2.74	5.58	3.16	* 5.50	5.50
1922	7.50	6.56	5.00	12.15	8.25	18.17	15.55	10.55	11.95
1923	8.10	7.09	5.40	7.86	12.03	17.54	17.54	11.48	16.29
1924	8.90	7.89	5.93	4.27	6.72	5.03	4.71	4.51	8.97
1925	11.00	9.62	7.33	2.26	3.56	0	0	.79	1.50
1926	13.00	11.37	8.66	10.60	17.24	9.37	7.04	9.35	7.49
1927	7.60	6.65	5.07	11.97	11.02	6.74	8.38	9.78	8.72
1928	8.20	7.18	5.47	3.28	4.51	1.44	2.75	2.47	3.10
1929	8.70	7.61	5.80	3.61	3.34	2.29	5.84	4.35	3.69
1930	8.50	7.44	5.67	8.29	12.95	1.67	2.63	10.22	10.54
1931	8.00	7.00	5.33	.64	.80	1.54	1.12	2.80	4.09
1932	4.25	3.72	2.83	3.82	3.11	7.07	6.82	2.56	2.49
13 yr. Av.				$ 6.49	$ 7.85	$ 7.12	$ 7.04	$ 7.16	$ 7.92

* Returns fro m42 in. rows are here substituted.

Table 11—Comparativve Average Yields in Bushels of Grain From Sudan Grass, Millet, and Sorghum from Cottonwood Experiment Farm

	Comparative average yields in bushels of grain per acre from given crop and given mehtod of seeding					
	Sudan		Millet		Dakota Amber Sorghum	
Year	Solid	42 in. rows	Solid	36 in. rows	Solid	42 in. rows
1920	5.4	8.0	25.0	26.5	31.4	31.4
1921	1.8	3.1	1.4	2.1	4.2	4.2
1922	16.2	10.4	35.2	28.2	* 20.1	20.1
1923	6.9	6.2	*38.2not planted		38.2	18.0	41.9
1924	5.5	11.6	0.8	2.5	1.9	8.0
1925	0	0	0	0	0	0
1926	7.1	5.4	0.9	1.4	1.3	4.5
1927	12.7	10.3	16.1	22.3	16.5	18.7
1928	0	0	0	0	0	0.1
1929	1.2	1.7	1.0	2.6	2.7	1.5
1930	0.1	0.2	2.9	1.9	0.8	2.9
1931	0.2	0.5	0.7	0.3	2.5	3.1
1932	2.4	1.9	7.8	9.7	2.3	7.9
13 yr. Av.	4.6	4.6	10.0	10.4	7.8	11.1

* Yield from row seeding is here substituted

Table 12.—Farm Values of Grain from Sudan Grass, Millett, and Sorghum

Comparative Returns from Grain from Sudan Grass, Millet, and Sorghum from Same Rotation

	S. Dak. Farm Price								
				Sudan		Millet		Dakota Amber Sorghum	
Year	Sudan	Millet	Dak. Amber Sorghum	Solid	42 in. Rows	Solid	36 in. Rows	Solid	42 in. Rows
1920	$ .38	$ .38	$ .42	$ 9.50	$10.07	$ 9.50	$10.07	$13.18	$13.18
1921	.38	.38	.26	.53	.80	.53	.80	1.09	1.09
1922	.50	.50	.50	17.60	14.10	17.60	14.10	10.05	10.05
1923	.75	.75	.52	* 28.65	28.65	* 28.65	28.65	9.36	21.79
1924	.75	.75	.80	.60	1.88	.60	1.88	1.52	6.40
1925	1.00	1.00	.60	0	0	0	0	0	0
1926	.75	.75	.58	.68	1.05	.68	1.05	.75	2.61
1927	.58	.58	.57	9.34	12.93	9.34	12.93	9.41	10.66
1928	.58	.58	.62	0	0	0	0	0	.06
1929	.50	.50	.62	.50	1.30	.50	1.30	1.67	.93
1930	.75	.75	.47	.08	.15	2.18	1.43	.38	1.36
1931	.35	.35	.41	.07	.18	.25	.11	1.03	1.27
1932	.25	.25	.13	.60	.48	1.95	2.43	.30	1.03
13 yr. Av.				$ 5.24	$ 5.51	$ 5.52	$ 5.67	$ 3.75	$ 5.42

* Return from row seeding is here substituted.

Observations from Tables 9, 10, 11, and 12.—1. Sudan Grass: Comparison of yields from seeding Sudan Grass solid or in 42 inch rows for grain production shows no variation, both being 4.6 bushels per acre. Evidently for forage production, the 42 inch rows yielding 1,849 pounds per acre were somewhat above the 1,601 pounds per acre secured from solid seeding.

2. Millet: Seeding millet solid produced 2,109 pounds of forage per acre which is slightly more than the amount produced from 36 inch rows with a forage yield of 2,078 pounds per acre. The forage is finer and more palatable when seeded solid than when seeded in wider rows. Yields of grain in bushels per acre were 10.0 bushels from solid seeding and 10.4 bushels per acre from 36 inch rows.

3. Sorghum: Forage yields from sorghum seeded solid were 2,631 pounds per acre as compared with 2,919 pounds from seeding in 42 inch rows. The computed yields of grain from Dakota Amber seeded solid is 7.8 bushels per acre and when seeded in 42 inch rows it is 11.1 bushels.

Results from the 13-year period indicate that the higher yields of forage and grain were secured from sorghum when seeded in 42 inch cultivated rows. Seeding Sudan grass by this method is preferable to seeding solid (6 inch) drills from the standpoint of yield. Seeding in 42 inch rows requires less seed than solid (6 inch) seeding.

Legumes. (Sweet Clover and Field Peas)

In the following Tables 13 and 14 the crop, (legume) is sweet clover unless otherwise specified. In years when the sweet clover failed to make a growth field peas were planted as a substitute or catch crop.

It becomes evident that legumes yielded more pounds per acre from Rotation 4—Sorghum, Barley, Legumes; and from Rotation 6—Sorghum, small grains, legumes for crop, corn, small grains, legumes (first, hay) (second, green manure), than from other rotations.

Table 13—Comparative Average Yields of Legumes From Different Crop Rotations At Cottonwood Experiment Farm

	Comparative average yields of legumes in pounds per acre from given rotation in given year				
Year	Rotation No. 1 Corn Wheat Legumes, Alfalfa, Potatoes, Flax	Rotation No. 3 Corn, Wheat, Legumes	Rotation No. 4 Sorghum, Barley, Legumes	Rotation No. 5 Sunflowers, Barley, Legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay) (2nd green manure)
1912	4250	Peas 1802	Peas 4220		Peas 4840
1913	130	Peas 0	Peas 155		Peas 0
1914	850	Peas 1011	Peas 954		Peas 872
1915	850	Peas 1730	2699		Peas 0
1916	1356	4212	3590		Peas 950
1917	1600	4480	2422		Peas 100
1918	1250	Peas 1076	4750		Peas 1449
1919	2860	2208	2691		2724
1920	3900	2192	5325	4300	8000
1921	4300	1728	0	0	1783
1922	1620	3692	0	0	4157
1923	5080	2191	3753	2902	3555
1924	4330	1760	3910	2965	2775
1925	1952	2801	4266	2067	4530
1926	0	0	0	0	Peas 4600
1927	3910	1000	917	0	3530
1928	3110	4160	4697	3680	3377
1929	1055	4190	4637	3400	3164
1930	0	0	0	0	0
1931	0	0	0	0	0
1932	0	0	0	0	0
21 yr. Av. Legume	2029	1916	2333		2400
Av. Peas Sw.clover		1124	1776		1601
Av.	2029	2163	2425		2892

Table 14—Farm Values of Legumes

	Comparative Returns From Legumes From Given Cropping Systems						
Year	S. Dak. Farm Price of Legumes	Rotation No. 1. Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax	Rotation No. 3. Corn, Wheat Legumes	Rotatiton No. 4 Sorghum, Barley, Legumes	Rotation No. 5. Sunflowers, Barley, Legumes	Rotation No. 6. Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd gr. manure). Foll. sor.	Rotation No. 6. Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd gr. manure). Foll. corn. Plowed under except Plat 6.
1912	$ 6.10	$19.96	$ 5.50	$12.87		$14.76	$11.13
1913	6.50	.42	0	.50		0	2.17
1914	5.70	2.42	2.88	2.72		2.49	3.14
1915	5.30	2.25	4.58	7.15		0	1.11
1916	5.40	3.66	11.37	9.69		2.57	3.48
1917	10.60	8.48	23.74	12.84		.53	3.50
1918	10.00	6.25	5.38	23.75		7.25	5.75
1919	13.50	19.31	14.90	18.16		18.39	15.12
1920	8.50	16.58	9.32	22.63	$18.28	34.00	33.58
1921	6.40	13.76	5.53	0	0	5.71	19.52
1922	7.50	6.08	13.85	0	0	15.59	32.63
1923	8.10	20.57	8.87	15.20	11.75	14.40	28.96
1924	8.90	19.27	7.83	17.40	13.19	12.35	10.01
1925	11.00	10.74	15.41	23.46	11.37	24.92	14.08
1926	13.00	0	0	0	0	29.90	6.33
1927	7.60	14.86	3.80	3.48	0	13.41	18.16
1928	8.20	12.75	17.06	19.26	15.09	13.85	30.50
1929	8.70	4.59	18.23	20.17	14.79	13.76	35.24
1930	8.20	.85	0	0	0	0	16.24
1931	8.00	0	0	0	0	0	0
1932	4.25	0	0	0	0	0	0
21 yr. Av. Legume		$8.70	$8.01	$9.97		$10.69	$13.84

Sweet Clover Seed.—In connection with the yields of sweet clover in Table 13 it may be stated that the second crop of sweet clover was customarily harvested for seed providing it occurred that there was some yield of seed from second growth sweet clover under the conditions.

In point of fact second growth sweet clover in Rotation 3, (Corn, wheat, sweet clover) produced some seed in three years of a 21-year period. Said years were 1922, 1923, and 1924.

In Rotation 6 a seed crop was harvested from second growth sweet clover in 1923. Very light yields of seed were also produced in the same rotation in 1919, 1921, and 1929, also from second growth, first growth having been utilized for hay, as previously indicated. There is no indication that sweet clover seed production from second growth, after taking off first growth for hay, would be dependable as a regular project.

Sweet clover seed production under conditions represented might be made dependable with some other plan of production. One possibility would be that of attempting to utilize first crop for seed.

Some further experimentation with the problems of sweet clover seed production under conditions represented by Cottonwood Experiment Farm are desirable and necessary. Such will be undertaken.

Alfalfa—Varieties and Methods of Seeding

The following tables 16 and 17 compare the yields of hay and their corresponding farm value from Cossack, Grimm, Common S. D. 12, Semipalatinsk and Turkestan alfalfa, each one seeded solid (in 6 inch drills) and in rows 36 inches apart.

Alfalfa on creek bottom at Cottonwood Experiment Farm, 1926

Table (15) 16—Comparative Average Yields of Alfalfa From Different Varieties And Different Methods of Seeding

Comparative average yields in pounds per acre of alfalfa of given variety and method of seeding in given year

Year	Cossack		Grimm		Common S. D. 12		semipalatinsk		Turkestan					Average all foregoing varieties	
	36″ Rows	Solid	36″ Rows	Solid	36″ Rows	Solid	36″ Rows	Solid	36″ Rows	Solid	12″ Rows	2 R. 44″	44″ Rows	36″ Rows	Solid
1917	1164	956	868	660	520	532	0	1012	850	560	605	920	1120	680	744
1918	1120	1020	1306	1200	854	854	0	488	1430	1080	1070	1385	1660	942	928
1919	1372	856	1872	888	1929	717	674	774	2465	2185	2260	2205	2435	1663	1084
1920	884	1812	1210	2500	1090	1276	832	1568	1435	1930	2115	1425	1440	1090	1799
1921	520	220	720	440	768	312	380	56	900	410	730	780	1330	658	287
1922	2788	4248	4748	4494	2716	3140	4338	3008	4900	5600	5500	4575	4900	3898	5098
1923	2530	2600	3620	3220	3220	2740	4300	2200	3475	3525	3675	2800	2675	3429	2857
1924	660	480	920	640	1150	1150	200	0	1000	1400	1875	1025	1100	1146	734
1925	0	0	0	0	250	250	0	0	0	0	0	0	0	0	50
1926	1158	1054	2140	1348	760	760	1850	362	4540	3075	3075	4540	4540	2090	1320
1927	1900	1035	3610	3616	2166	2166	2780	1960	2430	2430	2430	2430	2430	2577	2241
1928	460	460	730	730	600	600	650	650	190	190	190	190	190	526	526
1929	210	1200	540	1100	1600	680	2180	540	925	2050	1600	1300	950	1091	1114
1930	940	620	1180	1060	1240	700	1940	120	2050	1400	1750	2000	1500	1470	780
14-yr. av.	1122	1183	1676	1564	1347	1134	1560	910	1899	1845	1919	1827	1876	1519	1397

Table 17—Alfalfa—Varieties, in Rows or Close Drills—Money Values

Comparative Returns From Alfalfa From Given Cropping Systems

Year	S.Dak. Farm Price of	Cossack		Grimm		Common S.D.12		Semi-palatinsk		Turkestan					Average for foregoing varieties		Rotation 1 Av. of 5 Plots Vale 2 Plots Orenburg 2 Plots N. Sweden	Average of: 6 Plots Turkestan 2 Plots Orenburg 2 Plots N. Sweden	Rotation 1. Av. of: 3 Plots Turkestan 5 Plots Vale 2 Plots Grimm
	Alfalfa	36″ Rows	Solid	36″ Rows	Solid	36″ Rows	Solid	36″ Rows	Solid	36″ R.	Solid	12″R.	2R.44″	44″	36″ R.	Solid			
1917	$14.40	$8.35	$6.85	$6.23	$4.73	$3.73	$3.81	$0	$7.26	$6.09	$4.02	$4.34	$6.60	$8.03	$4.88	$5.33	$3.76	$ .17	$ .24	7.09
1918	13.34	7.47	6.80	8.71	8.00	5.70	5.70	0	3.25	9.54	7.20	7.14	9.24	11.07	6.28	6.19	6.75	5.25	8.28	13.50
1919	18.00	12.35	7.70	16.85	7.99	17.36	6.45	6.07	6.97	22.19	19.67	20.34	19.85	21.92	14.97	9.76	11.35	10.42	11.58	16.82
1920	11.34	5.01	10.27	6.86	14.18	6.18	7.23	4.72	8.89	8.14	10.94	11.99	8.08	8.16	6.18	10.20	11.42	7.04	12.42	26.86
1921	8.54	2.22	.94	3.07	1.88	3.28	1.33	1.62	.24	3.84	1.75	3.12	3.33	5.68	2.81	1.23	1.80	1.04	2.44	5.64
1922	10.00	13.94	21.24	23.74	22.47	13.58	15.70	21.69	15.04	24.50	28.00	27.50	22.88	24.50	19.49	25.49	24.83	15.19	30.38	66.20
1923	10.80	13.66	14.04	19.55	17.39	17.39	14.80	23.22	11.88	18.77	19.04	19.85	15.12	14.45	18.52	15.43	21.55	13.12	24.30	53.20
1924	11.87	3.92	2.85	5.46	3.80	6.83	6.83	11.87	0	5.94	8.32	11.14	6.09	6.53	6.81	4.36	0	3.27	5.50	0
1925	14.67	0	0	0	0	1.84	1.84	0	0	0	0	0	0	0	0	0	0	.37	1.70	0
1926	17.34	10.04	9.14	18.55	11.69	6.59	6.59	16.04	3.14	39.36	26.66	26.66	39.36	39.36	18.12	11.44	22.09	10.27	11.80	33.99
1927	10.13	9.63	5.25	18.30	18.33	10.98	10.98	14.09	9.94	12.32	12.32	12.32	12.32	12.32	13.03	11.36	11.00	9.73	19.20	28.95
1928	10.94	2.52	2.52	3.99	3.99	3.28	3.28	3.56	3.56	1.04	1.04	1.04	1.04	1.04	2.88	2.88	20.40	2.80	5.10	49.75
1929	11.60	1.07	6.81	2.98	6.28	9.13	3.79	12.49	2.98	5.21	11.73	9.13	7.54	5.51	6.33	6.46	20.53	5.24	9.04	47.20
1930	11.34	5.33	3.52	6.69	6.01	7.03	3.70	11.00	.68	11.62	7.94	9.92	11.34	8.51	8.33	4.42	13.81	2.55	50	52.50
14-yr. Av.		$6.82	$7.00	$10.07	$9.05	$8.06	$6.57	$9.03	$5.27	$12.04	$11.33	$11.75	$11.63	$11.93	$9.19	$8.18	$12.06	$6.20	$10.45	$27.26

Alfalfa

Results of Varieties and Method of Seeding Test.—Comparison of the average yields of the several varieties seeded solid and in 36-inch rows indicates slightly higher yields when seeded in rows.

One objection to seeding alfalfa in rows is that the soil tends to blow into the rows during times of wind erosion which results in the field becoming ridged. This process of ridging in turn makes an unfavorable surface to work over with a mower and with other implements during the harvesting season.

Alfalfa Varieties.—Later at time of harvesting the examination of the comparative yields secured from the varieties indicates that Turkestan made the highest yield of forage. The second highest yield of forage was from Grim.

Alfalfa, Stages of Cutting.—Tables 18 and 19 give yields and farm value of alfalfa hay cut at different stages of maturity.

The term, "bud stage," indicates that one plot was mowed when the alfalfa was in the bud stage of maturity. "One-tenth bloom," as used in the table-heading means the next plot was harvested at the time when about one-tenth of the alfalfa plants were in bloom. "One-half bloom", indicates that one-half of the plants were in blossom at the time of mowing or harvesting for hay. "Full bloom", indicates that all the alfalfa plants were in bloom at the time of mowing.

The small fields from which the foregoing alfalfa was harvested at successive stages are made up of two acres each, which makes the total acreage of the four plots eight acres. This test was conducted to determine the effect if any which the stage of maturity of alfalfa at the time of cutting would have on the yield of hay, and later survival of the alfalfa itself.

Table 18.—Comparative Average Yields of Alfalfa from Different Stages of Cutting Alfalfa at Cottonwood Experiment Farm

Comparative yield in pounds per acre from given stage in given year					
Year		Bud	1 10 bloom	½ bloom	Full bloom
1926	First cutting	1590	1490	1240	990
	Second cutting	1147	1887	1136	2740
	TOTAL	2737	3377	2376	3730
1927	First cutting	2420	2980	3560	4270
	Second cutting	3850	3360	3370	3220
	TOTAL	6270	6340	6930	7490
1928	First cutting	1950	1840	1500	1215
	Second cutting	0	0	0	0
	TOTAL	1950	1840	1500	1215
1929	First cutting	4145	3060	2560	4290
	Second cutting	2100	1180	270	120
	TOTAL	6245	4240	2830	4410
1930	First cutting	3020	2980	2720	2360
	Second cutting	0	0	0	0
	TOTAL	3020	2980	2720	2360
1931	First cutting	2070	1850	1800	1780
	Second cutting	0	0	0	0
	TOTAL	2070	1850	1800	1780
1932	First cutting	2480	4200	4390	4460
	Second cutting	3041	3500	2650	1850
	TOTAL	5521	7700	7040	6310
7-yr. Av.		3973	4046	3599	3899

Table 19.—Farm Values of Alfalfa

Comparative returns from alfalfa from given stages of cutting					
Year	S. Dak. Farm Price of Alfalfa	Bud	1 10 Bloom	½ Bloom	Full Bloom
1926	$17.34	$23.72	$29.28	$20.60	$32.33
1927	10.13	31.79	32.14	35.14	37.97
1928	10.94	10.67	10.06	8.21	6.65
1929	11.60	36.22	24.59	16.41	25.58
1930	11.34	17.12	16.90	15.42	13.38
1931	10.67	11.05	9.88	9.61	9.51
1932	5.67	15.57	21.71	19.85	17.79
7-yr. Av.		$20.88	$20.65	$17.89	$20.46

Table 20.—Comparative Average Yields of Forage (Alfalfa, Grasses, and Combinations of them)

Comparative average yields in pounds per acre of given crop or combination in given year						
Year	Brome	Grimm + Slender Wheat	Grimm + Brome	Grimm	Grimm + Native Grass	Native Western Wheat Grass
1915						1890
1916						835
1917						954
1918	741	1308	1314	1290	960	920
1919	1214	1130	1078	1000	657	438
1920	649	2780	2240	2481	894	1026
1921	140	604	546	480	404	740
1922	764	4264	3634	3934	2544	680
1923	740	3120	3045	2340	1905	
1924	425	575	835	950	780	
1925	0	0	0	0	0	Discontinued 1923-31
1926	110	986	1100	1320	860	
1927	540	1960	2150	1140	1800	
1928	0	650	510	880	880	
1929	0	0	0	0	730	
1930	0	990	1020	1330	740	
1931	575	400	360	460	350	
1932	706	2150	1785	2230	1240	930
Av.	440	1394	1308	1322	983	(933)

Table 21.—Farm Values of Forage (Alfalfa, Grasses, and Combinations of them)

Comparative Returns from Given Combination, or Crop								
Year	S. Dak. Farm Price of hay							
	Tame	Wild	Brome	Grimm + Slender Wheat	Grimm + Brome	Grimm	Grimm + Native Grass	Native Western Wheat Grass
1915	$ 5.30	$ 5.30						$ 5.01
1916	5.40	5.40						2.25
1917	10.60	10.60						5.06
1918	10.00	10.00	$ 3.71	$ 6.54	$ 6.57	$ 8.60	$4.80	4.60
1919	13.50	13.50	8.19	7.63	7.28	9.00	4.43	2.96
1920	8.50	8.50	2.76	11.82	9.52	14.06	3.80	4.36
1921	6.40	6.40	.45	1.93	1.75	2.05	1.29	2.37
1922	7.50	7.50	2.87	15.99	13.63	19.67	9.54	2.55
1923	8.10	8.10	3.00	12.64	12.33	12.64	7.72	
1924	8.90	8.90	1.89	2.56	3.72	5.64	3.47	
1925	11.00	11.00	0	0	0	0	0	
1926	13.00	13.00	.72	6.41	7.15	11.44	5.59	
1927	7.60	7.60	2.05	7.45	8.17	5.78	6.84	
1928	8.20	8.20	0	2.67	2.09	4.81	3.61	
1929	8.70	8.70	0	0	0	0	3.18	
1930	8.50	8.50	0	4.21	4.34	7.54	5.65	
1931	8.00	8.00	2.30	1.60	1.44	2.46	1.40	
1932	4.25	4.25	1.50	4.56	3.78	6.33	2.63	1.97
Av.			$ 1.96	$ 5.73	$ 5.45	$ 7.33	$ 4.26	($ 3.46)

Alfalfa, Observations from Yields

Harvested at Several Stages.—Inspection of the yields shown in Table 18 will indicate that the variation between stages of cutting is not great. Yields from the one-tenth bloom stage appear highest. This field is on lower land than the others and apparently catches more runoff when it rains. Hence the fact that the yield is somewhat higher in this instance may not be attributed solely to the stage of cutting.

Examination shows that yields of the second cutting are higher when the alfalfa is cut the first time in the bud and one-tenth bloom stage than when cut later. Such an outcome might be expected. This might be significant if and when the second crop is to be depended upon for seed.

Brome Grass, Alfalfa, Native Grass and Combinations.—In Table 20 yields of tame grasses, alfalfa, native grasses and combinations of these are given. Table 21 gives their computed farm values.

"Grimm plus slender wheat," indicates that Grimm alfalfa and slender wheat grass were sown together on plowed ground and at the same time. Likewise, "Grimm plus Brome," means Grimm alfalfa and Brome grass were sown together on plowed ground.

In the combination "Grimm alfalfa plus Native Grass," the alfalfa seed was broadcast on the native unplowed sod. After thus broadcasting the seed the ground was disked with a disk harrow. No other soil preparation or cultivation was made in this instance. Only a very small amount of alfalfa grew when thus seeded into native sod already established.

"Native western wheat" grass is unplowed native sod.
"Brome grass" when seeded alone was on plowed ground.
"Grimm" was alfalfa of that variety seeeded alone on a plowed field.

Alfalfa and Grasses, Alone or in Combinations

Conclusions from Tables 20 and 21.—It may be observed from Table 20 that the highest yields of forage were obtained from alfalfa, in this instance Grimm, or from Grimm alfalfa plus tame grasses. It might be stated that a large per cent of the hay which made up the yields in these combinations was alfalfa, because the stand of tame grass was invariably poor in these tests.

A comparison of yields per a. from Brome Grass and from Native Western Wheat grass in the several years 1918 to 1922, inclusive, indicates that in the instance given there was no apparent advantage in attempting to substitute brome grass, a cultivated grass, for native western wheat grass, already growing on the plains.

A comparison of the average farm values of table 21 shows the highest return for alfalfa. While alfalfa (Grimm) yields were not absolutely highest, the farm value is highest because alfalfa hay, which is a legume hay, returns a higher price per ton than tame or mixed hays.

Forage Crop Summary

In the following forage summary Table 22 the yields and their corresponding farm values for the various forage crops grown at Cottonwood Experiment Farm are given.

Forage crops are of considerable importance in the west river area and Cottonwood station devotes a large amount of time and land to various tests along that line.

Yields for alfalfa, sweet clover, brome, native grass, millet, and oats were taken from solid seedings of these crops. Likewise corn, sorghum, and Sudan grass yields are taken from seedings in 42-inch rows. In each case the crop yields are taken from the recommended method of planting for that particular crop for forage purposes. Some of the conclusions with regard to the best method of planting a certain crop were arrived at from the results shown in Table 4 page 13.

Forage Yields and Value

Conclusions from Summary Table No. 22.—Examination of the following Table 22 indicates that the crops can be arranged in the following order with regard to their relative economic value, using the results of the 13-year average. The yields from the 13-year average are used because it is the only period where all the crops are comparable, with the exception of native grass where only nine years of results are recorded.

	Pounds of Forage per Acre	Farm Value of Forage per Acre
Sorghum	4267	$17.43
Alfalfa	1874	9.46
Sweet Clover	2266	9.23
Oats	1971	7.91
Sudan	1849	7.85
Millet	2109	7.12
Corn	1368	3.80
Native Grass (Western wheat)	933	3.46
Tame Grass (Brome)	358	1.36

In the above arrangement the sorghum for the period from 1923 to 1932 was Dakota Amber. Sorghum with a yield of 4,267 pounds of forage with a farm value of $17.43 per acre is well above any of the other crops in production of forage.

Alfalfa with a yield of 1,874 pounds and a corresponding farm value of $9.46 per acre is second hghest in farm value. While the forage yield of alfalfa is slightly below that of sweet clover, millet, and oats, the farm value is greater because alfalfa hay has a higher money value per ton than the three mentioned crops which out yielded it in pounds per acre, This will be clearly indicated by referring to Table 13, page 69 of the appendix, giving the farm vaule of the the separate crops. Alfalfa ordinarily requires no cultivation after a stand is secured. This fact reduces operating costs since annual seeding and cultivation are not required, as is the case of such crops as sorghum, oats, millet and Sudan grass.

Third in economic importance is sweet clover with a forage yield of 2,266 pounds and a corresponding farm value of $9.23 per acre. Sweet clover is a biennial, requiring reseeding every two years. The first year it can be seeded with the regular small grain crop. The growth the first

Table 22.—Comparative Average Yearly Yields and Value of Forage per Acre of Given Crop

Year	Alfalfa (Grimm) Solid Seeding		Sweet Clover "Rotation 1"		Tame Grass "Brome"		Native Grass		Corn "Rotation 6"		Sorghum 42 in. Rows "Rotation 6"		Millet Solid "Rotation 9"		Sudan Grass 42 in. Rows "Rotation 9"		Oats "Rotation 6"	
	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value	Yield	Est. Value
1912			4250	$19.96					2435	$ 4.93	1916	$ 3.90					720	$ 2.20
1913			130	.42					688	1.49	868	1.88					180	.59
1914			850	2.42					1038	1.97	1494	2.84					570	1.62
1915			850	2.25			1890	$ 5.01	3100	5.47	1807	3.19					1190	3.15
1916			1356	3.66			835	2.25	3830	6.89	670	1.21					870	2.35
1917	660	$ 4.73	1600	8.48			954	5.06	1350	4.77	608	2.15					840	4.45
1918	1200	8.00	1250	6.25	741	$3.71	920	4.60	3153	10.51	0	0					1370	6.85
1919	888	7.99	2860	19.31	1214	8.19	438	2.96	1510	6.80	0	0					2310	15.59
1920	2500	14.18	3900	16.58	649	2.76	1026	4.36	2838	8.04	3472	9.84	4320	$16.07	3720	$15.81	5000	21.25
1921	440	1.88	4300	13.76	140	.45	740	2.37	283	.60	2798	5.97	1992	5.58	856	2.74	300	.96
1922	4494	22.47	1620	6.08	764	2.87	680	2.55	2133	5.33	6329	15.82	5540	18.17	2200	8.25	2510	9.41
1923	3220	17.39	5080	20.57	740	3.00	Discontinued		3683	9.94	10049	27.25	4940	17.54	2970	12.03	3010	12.19
1924	640	3.80	4330	19.27	425	1.89			1633	4.84	2889	8.57	1260	5.03	1510	6.72	1470	6.54
1925	0	0	1952	10.74	0	0			0	0	0	0	0	0	647	3.56	780	4.29
1926	1348	11.69	0	0	110	.72			193	3.95	2954	12.79	1650	9.37	2653	17.24	1140	7.41
1927	3616	18.33	3910	14.86	540	2.05			1793	4.54	7639	19.36	2025	6.74	2900	11.02	2140	8.13
1928	730	3.99	3110	12.75	0	0			908	2.48	2928	8.01	400	1.44	1100	4.51	1530	6.27
1929	1100	6.28	1055	4.59	0	0			1713	4.97	2017	5.85	600	2.29	767	3.34	2010	8.74
1930	1060	6.01	200	.85	0	0			833	2.36	7538	21.37	450	1.67	3047	12.95	1360	5.78
1931	860	4.59	0	0	575	2.30			635	1.69	3300	8.79	440	1.54	200	.80	1280	5.12
1932	4354	12.32	0	0	706	1.50	930	1.97	420	.59	3511	4.97	3800	7.07	1467	3.11	3090	6.58
21-yr. Av.			2029	$ 8.70					1614	$ 4.39	2992	$ 7.80					1556	$ 7.07
13-yr. Av.	1874	$ 9.46	2266	$ 9.23	358	$ 1.35			1368	$ 3.80	4267	$17.43	2109	$ 7.12	1849	$ 7.85	1971	$ 7.91
9-yr. Av.							(933)	($3.46)										

K 12-23
2505 $ 6.17
DA 24-32
3642 $ 9.97

year in the small grain nurse crop and after harvest is not sufficient to produce any crop of importance. Hence only one year's crop is secured from each seeding. Sweet clover has a tendency to spread to other fields by stray seeds carried by birds and winds. Hence care should be aken in its use where such dissemination is undesirable.

Oats with a yield of 1,971 pounds of forage and a farm value of $7.85 ranks fourth in economic value, among these forage crops. For these tests oats was drilled in, in the usual manner. Cut slightly green or when just beginning to turn, oats produces a good grade of forage.

Fifth in order is Sudan grass, with a forage yield of 1,849 pounds, and an acre value of $7.85. Sudan grass is an annual, seeded here in 42-inch rows in late spring. Sudan will produce several crops in one season when moisture conditions are favorable.

Millet holds sixth place with a forage yield of 2,109 pounds and a farm acre value of $7.12. Millet is an annual crop sown in late spring. It is of particular value as a catch crop, that is one which may be sown late in the season where other previous crops have been killed out for various reasons.

Corn for forage produced 1,368 pounds, valued at $3.80 per acre. **Corn, ranking seventh as a forage crop as arranged in this list might be regarded as a supplementary crop rather than the leading one, as it is in many localities outside of the Great Plains.**

Native grass yields show 933 pounds of hay with a corresponding farm value of $3.46 per acre for the years 1915-1922 inclusive. The given yield and consequent estimated value as here put down in these records is obviously not strictly comparable with average returns computed for other forage crops. The main grass is western wheat, together with some buffalo, and grama grasses. These grasses will survive under pasture conditions, but do not produce high yields of hay per acre. No reseeding or cultivation costs are involved since the grasses are native.

Tame grass (Brome) is at the bottom of the list in both yield, 358 pounds and value $1.35 per acre.

Wheat—Comparitive Yields from Ten Different Crop Rotations

Previous sections of this bulletin have presented yields mainly of forage crops. In Tables 23 and 24, yields and values of wheat for grain are discussed.

Wheat produced the highest gross money return from grain of any of the crops at Cottonwood Experiment Farm. Highest yields of spring wheat were produced where land previously in a cultivated crop was utilized for a seed bed.

Yields from winter wheat at Cottonwood are lower than yields from spring wheat in similar rotations. Dry fall condition together with low winter temperatures are apparently not the most favorable conditions for winter wheat.

Wheat, Yields and Returns, Conclusions from Several Crop Rotations.—Tables 23 and 24 indicate the highest yields and consequent gross returns from wheat were obtained from Rotations 6 and 7, which yielded 10.2 and 10.1 bushels per acre respectively with corresponding farm val-

ues of $10.87 and $10.18 per acre. Rotation 6 consists of (1) sorghum, (2) wheat, (3) sweet clover (for hay), (4) corn, (5) wheat, (6) sweet clover (first crop for hay second green manure). Rotation 7 consists of (1) corn and (2) wheat.

Rotation 1 comprised of (1) corn, (2) wheat, (3) legumes, (4) potatoes, (5) flax, and (6) (alfalfa) with a yield of 9.9 bushels per acre is comparable with the yields of Rotations 6 and 7 .

It is evident wheat yields are improved where the wheat crop is preceded by a cultivated crop (corn) the year before as compared with yields from land in wheat continuously.

The area devoted to continuous wheat has been divided into three separate plots in regard to soil preparation. One plot is fall plowed every year, followed by double disking in the spring. Such arrangement produced a yield of 6.8 bushels per acre. A second is double disked and planted; no other soil preparation. The yield there is 7.8 bushels. A third plot is plowed in the spring followed by double disking and seeding. This soil preparation produced a yield of 7.9 bushels per acre. These plots are permanently staked out and so the land which is double disked has that

Table 23.—Comparative Average Yields of Wheat from Different Rotations at Cottonwood Experiment Farm

Year	Rotation No. 1 Corn, Wheat, Legumes, (Alfalfa), Potatoes, Flax	Rotation No. 2 Corn, Wheat, Oats	Rotation No. 3 Corn, Wheat, Legumes	Rotation No. 6 Sorghum, small grs. Legumes for Crop, Corn, small grains, Legumes (1st hay, 2nd gr. manure)		Rotation No. 7 Corn, Wheat	Rotation No. 8 Continuous Wheat				Rotation No. 9 Corn, Winter Wheat Sorghum, Rye
				Comparative average yields of wheat in bushels per acre from given rotation ingiven year							
				Spg.	W'ter		Fall Plow	Double Disc	Spg. Plow	Av.	
1912	4.9	5.0	8.3	0.5	0.8	2.0	0.8	0.8	1.2	0.9	*0.8
1913	1.3	0	0.5	1.2	0.4	0	0	0	0	0	*0.4
1914	2.5	1.5	4.0	2.6	0	4.0	2.1	2.3	2.0	2.1	*0
1915	0	0	0	0	3.1	0	0	0	0	0	3.1
1916	8.6	10.6	7.8	13.2	0	13.1	6.6	12.0	12.7	10.4	7.2
1917.	2.6	2.6	4.5	2.4	0	1.3	0	0	0	0	0 .
1918	7.5	7.5	3.7	6.4	0	0	0	0	0	0	13.3
1919	10.1	6.2	5.5	12.8	23.2	12.1	3.1	6.4	5.2	4.9	11.3
1920	23.7	23.3	24.6	29.7	16.1	30.8	28.4	30.2	30.2	29.6	15.1
1921	0.7	0.1	0.9	0	0	0.6	0	0	0	0	4.8
1922	11.5	10.3	12.1	10.4	0	9.8	6.3	6.5	5.5	6.1	7.1
1923	15.3	7.0	17.6	19.1	3.9	26.6	11.9	10.3	17.0	13.1	16.1
1924	10.6	8.7	10.1	8.9	10.4	11.4	5.8	5.2	3.0	4.7	30.7
1925	10.6	8.1	4.5	9.7	2.9	6.0	2.5	3.2	5.0	3.6	4.3
1926	4.2	5.6	8.5	3.7	2.5	4.0	1.9	0.8	4.2	2.3	6.2
1927	28.7	22.2	29.4	32.9	0	24.4	24.5	28.3	26.8	26.5	0
1928	17.9	11.9	13.1	10.4	12.7	10.7	3.1	17.3	7.5	9.3	11.8
1929	18.6	16.3	18.9	15.5	21.5	17.3	9.0	11.0	13.0	11.0	16.1
1930	5.2	2.7	2.4	4.2	8.3	7.4	5.7	5.7	6.2	5.9	8.0
1931	2.6	4.1	1.2	1.9	5.3	2.9	5.3	4.7	4.0	4.7	0.7
1932	24.4	30.2	25.2	28.5	4.2	27.7	24.8	19.3	21.3	21.8	20.0
Av.	9.9	8.8	9.7	10.2	5.5	10.1	6.8	7.8	7.9	7.3	8.4

* Yield from Rotation 6.

Table 24.—Farm Values of Wheat

Year	Rotation No. 1 Corn, Wheat, Legumes, (Alfalfa), Potatoes, Flax	Rotation No. 2 Corn, Wheat, Oats	Rotation No. 3 Corn, Wheat Legumes	Rotation No. 6 Sorghum, small grs. Legumes for Crop, Corn, small grains, Legumes (1st hay, 2nd gr. manure)		Rotation No. 7 Corn, Wheat	Rotation No. 8 Continuous Wheat				Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum	S. Dak. Farm Price of Wheat
				Spg.	W'ter		Fall Plow	D'ble Disc	Spg. Plow	Av.		
1912	$3.38	$3.45	$5.73	$ .35	$ .55	$1.38	$ .55	$ .55	$ .83	$ .62	*$.55	$ .69
1913	.92	0	.36	.85	.28	0	0	0	0	0	* .28	.71
1914	2.35	1.41	3.76	2.44	0	3.76	1.97	2.16	1.88	1.97	*0	.94
1915	0	0	0	0	2.66	0	0	0	0	0	*2.66	.86
1916	12.90	15.90	11.70	19.80	0	19.65	9.90	18.00	19.05	15.60	10.80	1.50
1917	5.10	5.10	8.82	4.70	0	2.55	0	0	0	0	0	1.96
1918	14.53	14.93	7.36	12.74	0	0	0	0	0	0	26.47	1.99
1919	24.24	14.88	13.20	30.72	55.68	29.04	7.44	15.36	12.48	11.76	27.12	2.40
1920	27.26	26.80	28.29	34.16	18.52	35.42	32.66	34.73	34.73	34.04	17.37	1.15
1921	.61	.09	.78	0	0	.52	0	0	0	0	4.18	.87
1922	10.58	9.48	11.13	9.57	0	9.02	5.80	5.98	5.06	5.61	6.53	.92
1923	12.39	5.67	14.26	15.47	3.16	21.55	9.64	8.34	13.77	10.61	13.04	.81
1924	13.25	10.88	12.63	11.13	13.00	14.25	7.25	6.50	3.75	5.88	35.37	1.25
1925	13.57	10.37	5.76	12.42	3.71	7.68	3.20	4.10	6.40	4.61	5.50	1.28
1926	4.96	6.61	10.03	4.37	2.95	4.72	2.24	.94	4.96	2.71	7.32	1.18
1927	30.42	23.53	31.16	34.87	0	25.86	25.97	30.00	28.41	28.09	0	1.06
1928	15.22	10.12	11.14	8.84	10.80	9.10	2.64	14.71	6.38	7.91	10.03	.85
1929	17.30	15.16	17.58	14.42	20.00	16.09	8.37	10.23	12.09	10.23	14.97	.93
1930	2.39	1.24	1.10	1.93	3.81	3.40	2.62	2.62	2.85	2.71	3.68	.46
1931	1.25	1.97	.58	.91	2.54	1.39	2.54	2.26	1.92	2.26	.34	.48
1932	7.32	9.06	7.56	8.55	1.26	8.31	7.44	5.79	6.39	6.54	6.00	.30
Av.	$10.47	9.89	$9.66	$10.87	$6.62	$10.18	$6.20	$7.73	$7.66	7.20	$9.29	

Comparative returns from wheat from given cropping systems

* Computed from yields of Rotation 6.

soil preparation each and every year and no other. The other plots are also located with permanent metal stakes and are accorded the same preparation continuously

It is significant that yields of spring wheat from all land seeded to that crop continuously year after year, are lower than yields from several other crop rotations. This was true whether the preparation for continuous wheat was accomplished by annual double disking with no plowing whatever or with plowing as a means of seed-bed preparation.

The yields of continuous spring wheat were almost the same whether the land was plowed or whether it was prepared entirely with a disc absolutely without plowing.

Barley from Several Rotations

Barley yields are discussed in the following Table 25 with corresponding farm value in Table 26.

Barley was included in six rotations. It yielded, as an average for 13 years, from 11.7 bushels to 20.3 bushels per acre with a corresponding farm value of $4.71 to $8.97 per acre.

Examination of comparative yields of barley over the 13 year period from 1920 to 1922 inclusive indicate the yield of 20.3 bushels per acre

from rotation 4 are highest. This was produced in a three year rotation of (1) sorghum, (2) barley, (3) legumes. The corresponding farm value put down in Table No. 26 is $8.97 per acre.

Second highest yield from Rotation 6 consisting of (1) sorghum, (2) barley, (3) legume for hay, corn, barley, legumes (first hay, second green manure) with an average yield of 18 bushels and a corresponding farm value of $7.43 per acre.

Rotation 5 consisting of (1) sunflowers, (2) barley, (3) legumes with a yield of 16.6 bushels per acre ranks third.

Lower comparative yields are secured where barley is grown continuously on the same ground year after year. Such was the case with wheat. Contrary to the case with wheat however where barley was produced continuously year after year on the same land was somewhat higher where the land was plowed either fall or spring, than where preparation was made by discing only. The significance of the difference is not determined.

Table 25—Comparative Average Yields of Barley from Different Rotations at Cottonwood Experiment Farm

Comparative Average Yields of Barley Per Acre from Given Rotation in Given Year							
Year	Rotation No. 4 Sorghum, Barley Legumes	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd gr. manure)	Rotation No. 8 Continuous Barley				Rotation No. 5 Sunflowers, Barley, Legumes
			Fall Plow	Double disc	Spring Plow	Av.	
1912	1.8	2.7					
1913	.1	.6					
1914	6.9	7.7					
1915	6.7	0					
1916	21.9	26.6					
1917	10.9	14.9					
1918	21.5	13.1					
1919	14.2	19.0					
1920	49.7	42.8	31.5	35.8	33.5	33.6	48.3
1921	0	0.5	0	0	0	0	0
1922	18.5	13.6	8.4	3.1	3.5	5.0	13.8
1923	16.4	43.8	27.5	12.5	21.9	20.6	18.2
1924	26.5	7.1	13.5	12.9	7.1	11.2	4.0
1925	18.6	9.3	3.3	3.5	5.8	4.2	24.1
1926	11.2	0.5	0.2	0.3	1.9	0.8	9.8
1927	27.5	37.3	21.0	14.8	14.4	16.7	22.4
1928	24.8	3.5	6.7	6.4	5.6	6.2	16.1
1929	20.3	19.0	5.6	11.7	12.7	10.0	12.2
1930	3.8	9.6	9.0	11.9	13.1	11.3	3.5
1931	4.0	5.8	11.4	4.0	7.5	7.6	1.3
1932	42.8	41.0	26.9	35.8	36.5	33.1	41.8
21-yr.Av.	16.6	15.2					
13-yr.Av.	20.3	18.0	12.7	11.7	12.6	12.3	16.6

Table 26—Farm Values Of Barley

Year	S. Dak. Farm Price of Barley	Rotation No. 4 Sorghum, Barley, Legumes	Rotation No. 6. Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd gr. manure)	Rotation No. 8 Continuous Barley				Rotation No. 5 Sunflowers, Barley, Legumes
				Fall Plow	Double disc	Spring Plow	Av.	
	Comparative Returns From Barley From Given Cropping Systems							
1912	$ .42	$ 0.76	$ 1.13					
1913	.46	.05	.28					
1914	.50	3.45	3.85					
1915	.46	3.08	0					
1916	.83	18.18	22.08					
1917	1.10	11.99	16.39					
1918	.78	16.77	10.22					
1919	1.15	16.33	21.85					
1920	.52	25.84	22.26	16.38	18.62	17.42	17.47	25.11
1921	.29	0	.15	0	0	0	0	0
1922	.42	7.77	5.71	3.53	1.30	1.47	2.10	5.80
1923	.40	6.56	17.52	11.00	5.00	8.76	8.24	7.28
1924	.64	16.96	4.54	8.64	8.26	4.54	7.17	2.56
1925	.47	8.74	4.37	1.55	1.65	2.72	1.97	11.33
1926	.52	5.82	.26	.10	.15	.99	.41	5.10
1927	.58	15.95	21.63	12.18	8.58	8.35	9.69	12.99
1928	.48	11.90	1.68	3.22	3.07	2.69	2.98	7.73
1929	.45	9.14	8.55	2.52	5.27	5.72	4.50	5.49
1930	.29	1.10	2.78	2.61	3.45	3.80	3.28	1.02
1931	.32	1.28	1.86	3.65	1.28	2.40	2.43	.42
1932	.13	5.56	5.33	3.50	4.65	4.75	4.30	5.44
21-yr. Av.		$ 8.92	$ 8.21					
13-yr. Av.		$ 8.97	$ 7.43	$ 5.30	$ 4.71	$ 4.89	$ 4.96	$ 6.94

Oats for Grain from Several Rotations at Cottonwood

In a previous section of this bulletin is a discussion of oats as a forage producing crop. Tables 27 and 28 show the grain yields and farm values of oats in eight crop systems.

When cut green and stacked for hay oats makes a valuable forage. In years when forage is plentiful they can be allowed to mature for a grain crop, with retaining straw as a valuable by-product.

Harvested as a grain crop the farm value is low in comparison with other grain crops. Average farm returns from oats range from $3.27 to $8.32 per acre. As indicated in the lowest horizontal line of Table 28, yields are highest where the oat crop is preceded by a cultivated crop such as corn or sorghum.

Oats for Grain,—Yields and Value, Observations from Tables 27 and 28.—A comparison of the 13-year average from 1920 to 1932 indicates that the yield of oats from Rotation 6 of (1) sorghum, (2) Oats, (3) legumes (for crop), (4) corn, (5) Oats, (6) legumes (first crop for hay, second for green manure), with a yield of 27.9 bushels of oats per acre is higher than yields from other rotations. It is to note that the oats crop in this Rotation comes on land where it is invariably preceded

by a cultivated crop either sorghum or corn. The computed gross return per acre from the foregoing maximum yield as put down in Table 28, was $7.82 per acre.

Yields of oats grown as a continuous crop are lower than those in Rotations 2 and 6 where oats comes systematically in combination with other crops. Oats on land prepared by double discing yielded 22 bushels per acre as an average of 13 years. Continuous oats on plowed land yielded roundly two bushels per acre, lower than the foregoing, whether the land was plowed in fall or spring.

Yields of oats in Rotation 10 in combination with Dakota Amber (sorghum), Sudan grass, and with millet, cover an eight year period from 1925 to 1932. Compared with yields of oats in the other rotations made in the same eight-year period they are somewhat lower.

Table 27.—Comparative Average Yield of Oats From Different Crop Rotations at Cottonwood Experiment Farm

	Comparative Average Yield of Oats Per Acre From Given Rotation in Given Year								
Year	Rotation No. 2 Corn, Wheat, Oats	Rotation No. 6 Sorghum, small grains, legumes, for crop, corn, small grains, legumes (1st hay, 2nd gr. manure)	Rotation No. 8 Continuous Oats				Rotation 10		
			Fall Plow	Double Disc	Spring Plow	Av.	Amber Dakota Oats	Sudan Oats	Millet Oats
1912	16.9	11.6							
1913	2.9	2.4							
1914	11.6	16.6							
1915	0	0							
1916	32.4	34.8							
1917	17.0	22.1							
1918	20.3	25.9							
1919	25.9	30.9							
1920	71.3	70.8	73.1	71.9	74.7	73.2			
1921	0.2	0.2	0	0	0	0			
1922	17.1	21.1	2.1	10.9	8.8	7.3			
1923	54.9	44.9	37.5	40.3	35.9	37.9			
1924	14.5	18.0	20.3	12.5	7.2	13.3			
1925	10.5	14.3	7.2	7.8	6.6	7.2	11.1	10.3	11.1
1926	7.9	9.7	0.6	0.8	2.2	1.2	3.4	3.2	3.4
1927	25.0	41.4	25.0	28.1	23.4	25.5	19.8	17.8	19.8
1928	0	20.8	8.6	20.5	14.2	43.3	20.7	18.0	20.7
1929	24.6	37.8	14.4	18.4	20.3	17.7	19.9	15.9	19.9
1930	15.6	7.8	10.3	16.6	16.3	14.4	5.2	3.9	5.3
1931	3.2	2.5	2.8	2.5	2.5	2.6	.3	2.3	.2
1932	41.7	72.8	52.8	55.9	46.6	51.8	40.3	34.1	40.3
21-yr. Av.	19.7	24.1							
13-yr. Av.	22.0	27.9	19.6	19.6	22.0	19.9	20.5		
8-yr. Av.	16.1	25.9	15.2	18.8	16.5	20.5	15.1	13.2	15.1

Table 28—Farm Values of Oats

Year	S. Dak. Farm Price of Oats	Comparative Returns From Oats From Given Cropping Systems								
		Rotation No. 2 Corn, Wheat, Oats	Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd gr. manure)	Continuous		Rotation No. 9 Oats		Rotation 10		
				Fall Plow	Double Disc	Spring Plow	Av.	Oats Dakota Amber	Oats Sudan	Oats Millet
1912	.25	$ 4.23	$ 2.90							
1913	.34	.99	.82							
1914	.38	4.41	6.31							
1915	.28	0	0							
1916	.46	14.90	16.00							
1917	.61	10.37	13.48							
1918	.59	11.98	15.28							
1919	.63	16.32	19.47							
1920	.33	23.53	23.36	24.12	23.73	24.65	24.16			
1921	.20	.04	.04	0	0	0	0			
1922	.32	5.47	6.75	.67	3.49	2.82	2.34			
1923	.31	17.02	13.92	11.63	12.49	11.13	11.75			
1924	.40	5.80	7.20	8.12	5.00	2.88	5.32			
1925	.28	2.94	4.00	2.02	2.18	1.85	2.02	$3.11	$2.88	$3.11
1926	.36	2.84	3.49	.22	.29	.79	.43	1.22	1.15	1.22
1927	.36	9.00	14.90	9.00	10.12	8.42	9.18	7.13	6.41	7.13
1928	.33	0	6.86	2.84	6.77	4.69	4.29	6.83	5.94	6.83
1929	.34	8.36	12.85	4.90	6.26	6.90	6.02	6.77	5.41	6.77
1930	.21	3.28	1.64	2.16	3.49	3.42	3.02	1.09	.82	1.09
1931	.22	.70	.55	.62	.55	.55	.57	..07	.51	.07
1932	.084	3.50	6.12	4.44	4.70	3.91	4.35	3.63	3.07	3.63
21-yr. Av.		$6.94	$8.32							
13-yr. Av.		$6.34	$7.82	$5.44	$6.08	$5.54	$5.65			
8-yr. Av.								$3.73	$3.27	$3.73

Flax at Cottonwood

Dates of Seeding—Tables 29 and 30 following give yields and farm values for flax from Rotation 1, consisting of (1) corn, (2) wheat, (3) legumes, (4) Potatoes, (5) Flax, and (6) Alfalfa. The flax was seeded in five consecutive dates two weeks apart; to determine the best date to seed flax in the area.

Inspection of the yields indicates that over a long period flax seeded April 15 made the highest yield of 4.1 bushels with a corresponding farm value of $8.32 per acre. Flax seeded May 1 yielded 3.9 bushels per acre over the same period of years. The lowest average yield in the test was from flax seeded May 15; 3.11 bushels per acre.

Flax—Yields and Returns

Observations from foregoing Tables.—It is evident from Table 30 that a gross average return of 4.1 bushels per acre from flax, worth $8.32 per acre has been secured.

Results favorable to seasonably early seeding (April 15) are in accord with similar tests elsewhere including, Highmore and Eureka Experiment farms.

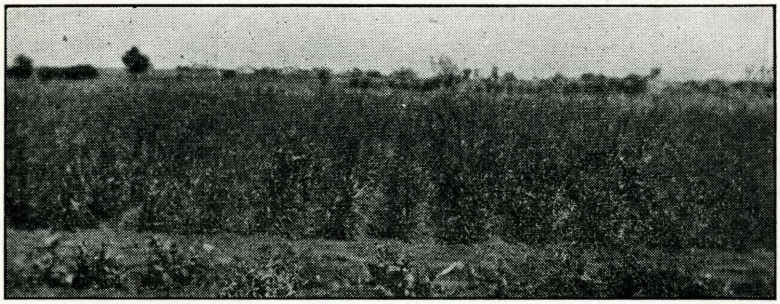
Obviously the "spread" of yields from seeding at successive dates is not wide, and it is not necessary here to attempt to make a more exact calculation than the foregoing to say that results are favorable to seasonably early seeding of flax.

Table 29.—Comparative Average Yields of Flax from Different Dates of Seeding at Cottonwood Experiment Farm

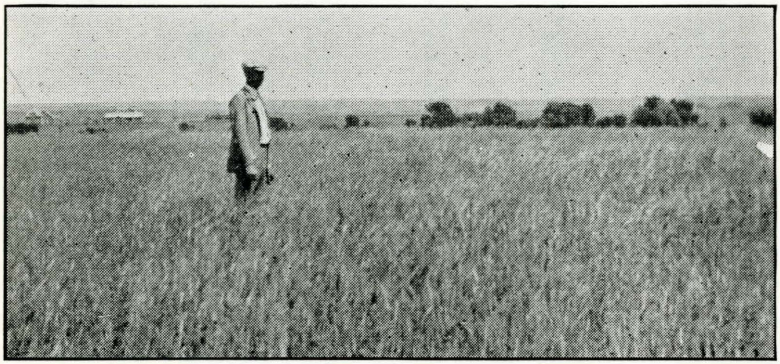
Rotation No. 1.—Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax					
	Date of Seeding				
Year	April 15	May 1	May 15	June 1	June 15
1912	9.0	14.7	11.0	9.5	8.8
1913	0	1.7	0.8	0	0
1914	1.5	1.6	1.4	0	0
1915	9.3	7.1	5.9	8.9	10.9
1916	2.4	1.4	2.1	2.4	2.4
1917	3.1	2.9	1.3	0.3	3.7
1918	5.8	4.3	3.9	4.1	6.3
1919	3.1	1.3	0.5	0	0
1920	6.1	2.0	0.4	0	0
1921	0	0	0	0.1	0.2
1922	2.1	0.8	1.4	1.2	0.7
1923	8.8	8.8	6.8	14.3	15.4
1924	0.7	3.1	0.3	0.7	0.9
1925	2.6	2.3	1.3	3.6	4.3
1926	1.7	0.6	1.3	1.5	1.8
1927	12.8	11.6	13.9	14.3	15.0
1928	6.4	8.3	5.5	3.0	2.3
1929	4.9	4.5	2.1	3.8	0.9
1930	2.5	2.0	1.4	3.0	3.8
1931	0	0	0	0	0
1932	3.8	3.2	2.9	1.4	0.3
21-yr. Av.	4.1	3.9	3.1	3.4	3.7

Table 30.—Farm Values of Flax

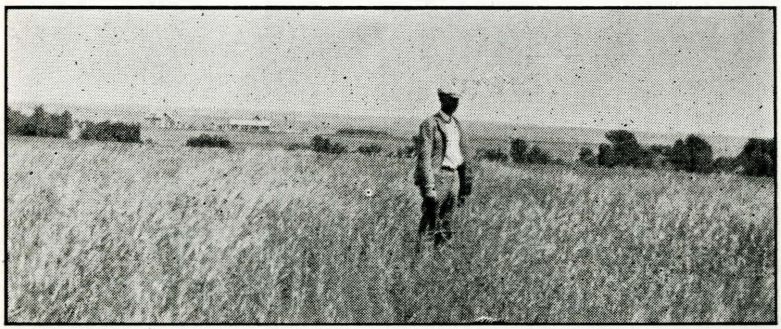
Comparative Returns from Flax from Given Cropping Systems						
		Rotation No. 1. Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax				
		Date of Seeding				
Year	S. Dak. Farm Price of Flax	April 15	May 1	May 15	June 1	June 15
1912	$1.13	$10.17	$16.61	$12.43	$10.74	$ 9.94
1913	1.20	0	2.04	.96	0	0
1914	1.23	1.85	1.97	1.72	0	0
1915	1.67	15.53	11.86	9.85	14.86	18.20
1916	2.47	5.93	3.46	5.19	5.93	5.93
1917	2.99	9.27	8.67	3.89	.90	11.06
1918	3.25	18.85	13.98	12.68	13.33	20.48
1919	4.25	13.18	5.53	2.13	0	0
1920	1.65	10.07	3.30	.66	0	0
1921	1.39	0	0	0	.14	.28
1922	2.01	4.22	1.61	2.81	2.41	1.41
1923	2.08	18.30	18.30	14.14	29.74	32.03
1924	2.23	1.56	6.91	.67	1.56	2.00
1925	2.25	5.85	5.18	2.93	8.10	9.68
1926	1.90	3.23	1.14	2.47	2.85	3.42
1927	1.85	23.68	21.46	25.72	26.46	27.75
1928	2.01	12.86	16.68	11.06	6.03	4.62
1929	2.80	13.72	12.60	5.88	10.64	2.52
1930	1.33	3.33	2.66	1.86	3.99	5.05
1931	1.17	0	0	0	0	0
1932	.82	3.12	2.62	2.38	1.15	.25
21-yr. Av.		$ 8.32	$ 7.46	$ 5.69	$ 6.61	$ 7.36



Barley seeded in rows to compare with solid drilled seedings, Cottonwood Experiment Farm, 1928



Wheat Rotation 7 (corn, wheat) Cottonwood Station, 1926



Wheat in Rotation 8 (continuous wheat) Cottonwood Station, 1926

Table 31—Comparative Average Yields Of Rye From Different Crop Rotations At Cottonwood Experiment Station

Year	Comparative Average Yield of Rye Per Acre From Given Rotation in Given Year: Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd green manure)	Rotation No. 9 Rye, Corn, Winter Wheat, Sorghum
1912		
1913	0.4	
1914	8.1	
1915	9.4	4.0
1916	31.3	11.8
1917	0	0
1918	13.6	16.5
1919	10.6	9.3
1920	17.8	14.8
1921	0	0
1922	0	3.8
1923	0	16.3
1924	13.4	6.8
1925	6.1	3.8
1926	0.9	4.5
1927	19.7	8.0
1928	8.0	5.3
1929	3.3	10.2
1930	14.5	12.4
1931	1.9	2.6
1932	17.9	18.6
18-yr. Av.	9.4	8.3

Table 32—Farm Values of Rye

Year	S. Dak. Farm Price of Rye	Comparative Returns Rrom Rye From Given Cropping Systems: Rotation No. 6 Sorghum, small grains, legumes for crop, corn, small grains, legumes (1st hay, 2nd green manure)	Rotation No. 9 Corn, Winter Wheat, Sorghum, Rye
1912	.52		
1913	.50	.20	
1914	.78	6.32	
1915	.76	7.14	3.04
1916	1.18	36.93	13.92
1917	1.55	0	0
1918	1.41	19.18	23.27
1919	1.25	13.25	11.63
1920	1.09	19.40	16.13
1921	.58	0	0
1922	.58	0	2.20
1923	.49	0	7.99
1924	1.02	13.67	6.94
1925	.67	4.09	2.55
1926	.73	.65	3.29
1927	.79	15.56	6.32
1928	.79	6.32	4.19
1929	.76	2.50	7.75
1930	.25	3.63	3.10
1931	.33	.63	.86
1932	.15	2.69	2.79
18-yr. Av.		$8.45	$6.44

Rye Yields from Two Cropping Systems

Comparative yields of rye from Rotation 6 and 9 are compared in Table 31, and their corresponding farm values in Table 32.

The yields from the two rotations are indicative of what rye will do in Cottonwood area.

Winter Rye— Yields and Returns

Observations from Tables 31 and 32.—Maximum average return from winter rye in the two foregoing rotations was 9.4 bushels per acre, valued at $8.45 per acre in Rotation 6.

The soil of Rotation 6 (page 5) representative of the greatest extent in Cottonwood area, is possibly more favorable to winter rye than the soil in Rotation 9 (page 5). Thus without attempting to stress comparisons too closely, the yield from Rotation 6, containing a fairly wide distribution of crops (including legumes) is higher than that in Rotation 9 (on heavier clay soil without legumes).

Potatoes

The yield and computed value of potatoes at Cottonwood station are put down in the following Table 33.

Early Ohio potatoes in Rotation 1 (1) Corn, (2) Wheat, (3) Legumes, (4) Potatoes, (5) Flax, and (6) Alfalfa indicate an average yield of 36.1 bushels per acre.

The average farm value was $29.92 per acre. This gross value is somewhat higher than that for other crops at Cottonwood in these experiments. The expense of producing the crop is also considerably higher per acre than for other crops.

Table 33.—Potatoes—Yields and Computed Farm Values Cottonwood Experiment Farm

Rotation No. 1—Corn, Wheat, Legumes, Alfalfa, Potatoes, Flax			
Year	Early Ohio (Yields)	South Dakota Farm Price of Potatoes	Rotation No. 1 Corn, Wheat, Legumes, Alfalfa Potatoes, Flax
1912	29.4	.36	$10.58
1913	6.5	.63	4.10
1914	15.8	.47	7.43
1915	17.1	.35	5.99
1916	53.6	1.37	73.43
1917	10.0	1.11	11.10
1918	99.5	.93	92.54
1919	3.7	1.90	7.03
1920	16.5	.97	16.00
1921	0	1.07	0
1922	84.6	.44	37.22
1923	71.8	.44	31.59
1924	50.1	.48	24.05
1925	19.6	1.80	35.28
1926	23.2	1.59	36.89
1927	58.6	.55	32.23
1928	68.2	.40	27.28
1929	44.8	1.15	51.52
1930	49.3	.95	46.84
1931	16.2	.57	9.23
1932	19.7	.25	4.93
21-yr. Av.	36.1		$26.92

Root Crops

Results of the root crop test at Cottonwood are given in following Table 35.

The common root crops include sugar beets, mangel wurzels, carrots, rutabagas and turnips.

The yields harvested from root crops are abstracted from South Dakota Experiment Station Bulletin 180, Agronomy Department, "Root Crop Culture," by Manley Champlin and George Winright. The limited number of yields, covering only two seasons obviously serve as an indication only of possible returns which may be secured from five different kinds of roots.

It is easy to observe that the highest return in pounds, was produced from Mangels. The same kind of roots in a single instance produced as many pounds of sugar per acre as any kind included in the test.

In case further trials are made with various root crops for forage, as will doubtless be the case, mangels will evidently be included in view of this indicated yield and quality.

Table (34) 35.—Annual and Average Results of Root Crops at Cottonwood for 1914 and 1915

Varieties	1914 (1)			1915					Averages	
	Per cent Sugar	Pounds roots per Acre	Pounds sugar per Acre	Per cent Sugar	Per cent Dry Matter	Pounds Roots per Acre	Pounds Dry Matter per Acre	Pounds Sugar per Acre	Pounds Roots per Acre	Pounds sugar per Acre
SUGAR BEETS										
Shepards	5.3	1440	76.3	16.0	21.6	2140	463.3	342.4	1790	209.3
White Klein	6.1	1710	104.3	-----	-----	------	------	------	------	------
MANGELS										
Golden Tankard	.9	1320	11.9	9.5	16.4	3060	501.7	290.7	2190	151.3
Mammoth Long Red	.2	990	2.0	10.1	14.4	3500	504.4	353.5	2245	177.7
Red Globe	1.9	1380	26.2	8.9	15.6	4470	697.3	397.8	2925	212.0
TURNIPS										
Purple Top W Globe	1.3	330	4.3	2.5	13.3	2500	333.0	62.5	1415	33.4
White Globe	.9	360	3.2	3.0	11.9	5750	685.0	172.5	3055	87.9
CARROTS										
Danvers	---	------	-----	2.3	12.9	5850	759.0	134.5	------	------
Rubicon	.2	180	36.0	2.5	12.2	4625	567.0	115.6	2405	58.0
Guerande	1.7	480	8.2	2.5	11.2	9650	1084.0	241.2	5065	124.7
RUTABAGAS										
Sweet German	1.5	1020	15.3	3.8	17.9	5800	1039.0	220.0	3410	117.8
Purple Top Yellow	.9	630	5.7	2.5	15.2	5450	831.6	136.2	3040	70.9

(1) Roots were not ripe enough to figure the dry matter.

Sunflowers

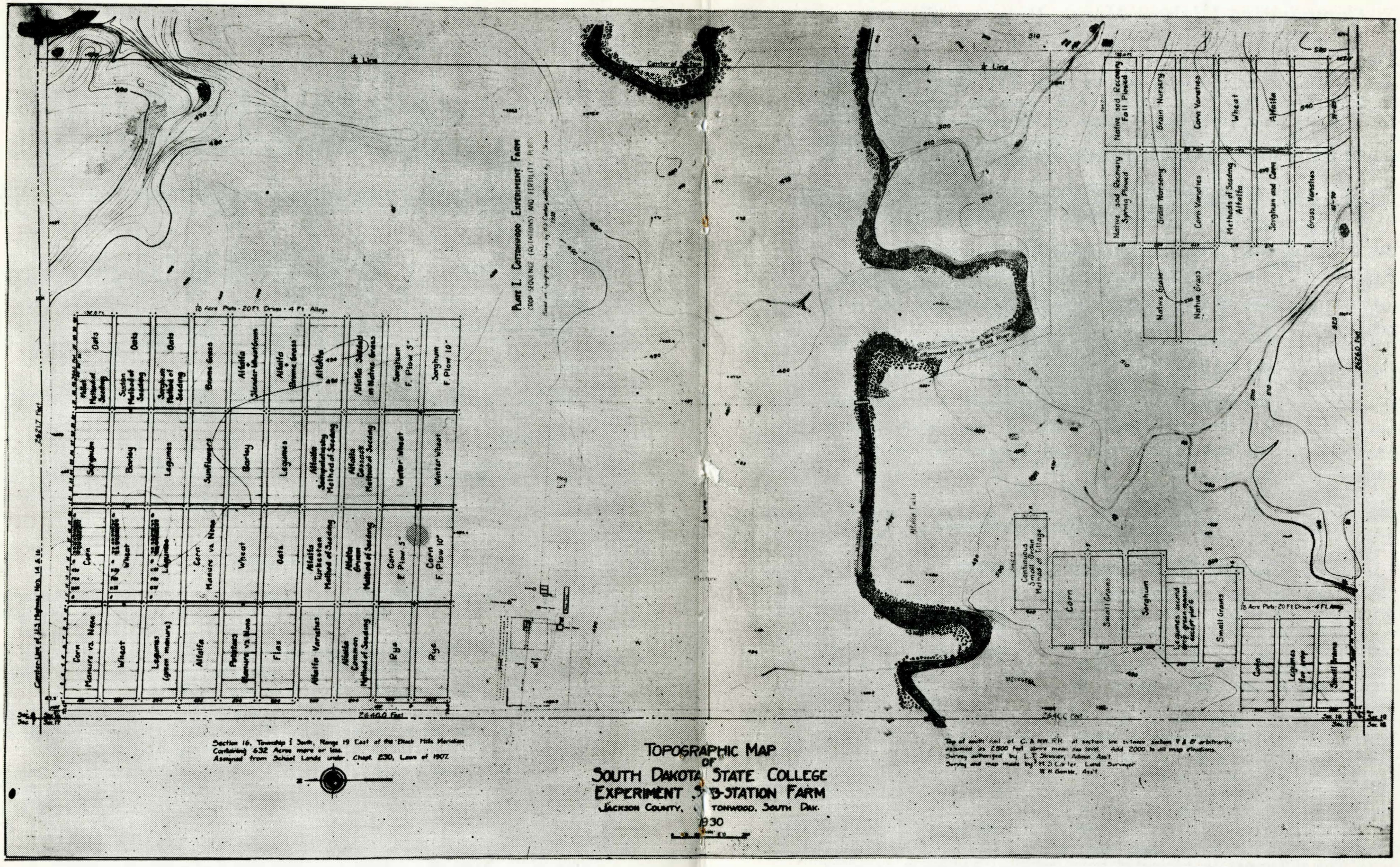
Produced Low Yields of Forage and Seed.—Sunflowers were included in Rotation 5: (1) sunflowers, (2) barley, (3) legumes, for 13 years from 1920 to 1932.

Records are available in this department giving annual yields of forage and grain for all years 1920-1932. Said yields are not tabulated here in detail because they give only indecisive results.

Forage from sunflowers made no yield higher than 700 pounds of field dry weight per acre—grading downward in the several seasons to only 53 pounds, where any positive yield is recorded at all.

Sunflowers failed to produce any yield of seed whatever in seven separate seasons 1920-1932 inclusive. In the years when there was some yield of seed the highest was 61.4 pounds per acre and the lowest 14.8 pounds per acre.

There seems to be no present indication that sunflowers, will supercede other crops, in Cottonwood Area, either for forage or seed.


TOPOGRAPHIC MAP
OF
SOUTH DAKOTA STATE COLLEGE
EXPERIMENT SUB-STATION FARM
JACKSON COUNTY, COTTONWOOD, SOUTH DAK.
1930

Comparitive Highest Money Returns (Gross) From Staple Crops

The amounts in Table 37 show the highest average gross money returns from an acre of land at Cottonwood for 21 years, 1912-1932 from 11 separate crops. These results place the crops in a somewhat different order from that of Table 22. This difference is due to a difference in the number of years in the tests, the number of years in Table 22 being 11 and the number in Table 37 being usually 21.

Table (36) 37.—Money Returns (Gross) from Staple Crops, 21-year Average

	21-year average	
Crop	Highest Return for Given Crop From any Crop Rotation	Rotation in Which Foregoing Return Was Made
Potatoes	$26.92	No. 1—Corn, wheat, legumes (green manure), alfalfa, potatoes, flax.
Sweet Clover	13.84	No. 6—Sorghum, small grains, legumes, corn, small grain, legumes (for green manure).
Alfalfa	12.04	Turkestan 36-inch rows.
Wheat	10.87	No. 6—Sorghum, small grains, (wheat) legumes, corn, small grains, legumes (for green manure).
Barley	8.97	No. 4—Sorghum, barley, legumes.
Rye	8.45	No. 6—Sorghum, small grains, legumes, corn, small grain, legumes (for green manure).
Oats	8.38	No. 6—Sorghum, small grains, legumes, corn, small grain, legumes (for green manure).
Flax	8.32	No. 1—Corn, wheat, legumes (gr. man.), alfalfa, potatoes, flax.
Sorghum forage	7.80	No. 6—Sorghum, small grains, legumes, corn, small grain, legumes (for green manure).
Sorghum grain	7.52	No. 6—Sorghum, small grains, legumes, corn, small grain, legumes (for green manure).
Corn	6.64	No. 2—Corn, wheat, oats.
Winter Wheat	6.62	No. 6—Sorghum, small grains, winter-wheat, legumes, corn, small grain, legumes (for green manure).

Crops that Make Returns

The reason for producing crops from land is to get returns measured either directly in money or otherwise. In the foregoing Table 37, relative returns from twelve separate crops are put down in order, in computed money value for the reason that such values form a convenient basis for comparison. It is not intended to imply here by this use of computed money values for crops, that they must necessarily be sold off the farm—such is another question. The asumption is that the crops are worth approximately the amounts computed, on the farms where produced whether used there for feed or for direct sale, or otherwise.

Certain observations are of interest from Table 37, using the foregoing money values as a basis:

1. The highest money return per acre came from potatoes which may be considered a special crop, for production on limited areas.

2. Barring potatoes the highest computed returns from staple crops came from sweet clover (forage) and alfalfa (forage) in the order named. The difference in computed value of the two foregoing crops ($13.84-$12.04-$1.80), though seemingly appreciable is not sufficient to keep the two important legume forage crops from being in the same group from the standpoint of returns.

For present purposes alfalfa and sweet clover may be put down

together, assuming that growers will decide which one or both may seem most practical to produce.

3. It is to be seen that next below forage crops under conditions at Cottonwood, the highest computed returns came from spring Wheat. (grain) It is well to recall here that farm price is used as one of the factors, and that some other cereal crops might be substituted for wheat if and when such crop were to be utilized for feed on the farm or in the immediate vicinity, rather than sold for cash.

It is more than a possibility that wheat could be utilized in farming systems as a forage crop, either pasture or hay, much more commonly than has been thought of in this area. That possibility is not forgotten, though the comparison in Table 37, is made on a basis of wheat for grain.

Referring again to Tables 23, 25, 27, it may be observed again that maximum yield of wheat is 9.9 bushels, barley 16.6, oats 24.1. Growers may therefore prefer to raise barley or oats for feed rather than wheat for any purpose.

The computed return from winter rye is nearly the same as that from other cereals, excepting wheat. Rye has additional advantages as a temporary pasture.

4. Next in money return lower than 1—Legumes (sweet clover or alfalfa), and (2) cereals (wheat, barley, rye, oats) comes sorghum. Sorghum makes a higher return than corn, which is also a cultivated crop. One reason is that it produces a higher yield of field cured forage than corn, or of seed as the case may be. Ref. South Dakota Bul. 285. Sorghums for Forage and Grain.)

From: "Feed and Feeding," Henry and Morrison. p.—203.

"308. Sorghum fodder and stover.—Throuought regions of scanty rainfall the sorghums are most commonly grown in drilled rows of sufficient width to allow horse cultivation, by which the moisture is conserved and larger yields obtained. When grown in drills, not too thickly, much seed is produced and the stalks are somewhat coarse. Sorghum forage is more palatable when cut before fully matured but the seed should be allowed to reach the early dough stage, for if cut earlier the plants are watery and contain little nutriment. The crop is cured in shocks, the same as Indian corn, but in case of the juicy-stemmed sorghos, which cure with difficulty, the shocks should be small."

On page 204.

"309.—The sorghums formerly had the reputation of producing much sourer silage than corn. Numerous experiments have now shown, however, that when sufficiently matured, both the sorghos and the grain sorghums make excellent silage."

A Hypothetical Cropping System

For Cottonwood Area.—In view of the returns put down in Table 37, and observations thereon, it is possible to construct a hypothetical crop system which may be suited to conditions in Cottonwood area. Such a system may be made up of a succession of (1) cultivated crop, (2) small grain crop, (3) legume crop.

In somewhat greater detail such a crop system will arrange itself as follows:

1. Cultivated Crop—Sorghum	7.80
2. Cereal Crop—Wheat, or Barley	10.87
or Winter Rye or Oats	8.97
3. Legume Crop—Sweet Clover, or Alfalfa	13.84
3)	32.51
Average, (Maximum) return from hypothetical cropping system, per acre per year	10.83

Crop Rotations at Cottonwood

Money Returns.—The foregoing sections of this bulletin have shown that the highest yields and returns from staple crops were made in short rotations including wheat.

It is possible to compute and tabulate the returns from land in money value from all crops produced in the various rotations. These returns are arrived at in all cases by multiplying the actual average yields of crop 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. (See Appendix, page 69.)

Crop Rotations Computed Returns

One may examine the averages put down in the lowest horizontal lines of Table 38 to find the computed returns from all crops in several rotations, produced on land at Cottonwood Experiment Farm. Certain facts are of interest and importance.

1. The crop rotation that produced highest average gross returns (Rotation 1) was that in which one member was potatoes. It has been previously mentioned that the latter constitute a special crop (see pages 37-39). In that respect Rotation 1 may be considered a special rotation, not exactly comparable with those made up of staple crops.

2. The highest money return produced over a 21-year average by any rotation in these trials, made up of staple crops, was Rotation 7: (1) corn, (2) wheat. It is fairly obvious that said money return was highest for the practical reason that it is a simple two-year sequence, in which wheat occurs every alternate year—wheat being also the crop which produces the highest gross money return, based on yield and South Dakota farm price.

3. Further careful examination of computed money return per acre, reveals the fact that the next highest comes from a three-year Rotation 3, (1) corn, (2) wheat, (3) legume. It is safe to state that the return from this latter rotation was practically equal to that from the former two-year sequence. A crop rotation which offers a great number of advantages (not all of which are enumerated here) is this Rotation 3—(1) corn, (2) wheat, (3) legume (sweet clover for hay.)

4. The deduction in the foregoing paragraph is in accord with the hypothesis put down on pages 39, 40, 41 to the effect that the most productive hypothetical cropping system (crop rotation) might be constructed of a succession of the several crops yielding highest from: (1) Cultivated Crop, (2) Small Grain Crop, (3) Legume Crop.

Thus the principles involved in the use of a crop-system, constructed on the foregoing basis to include a cultivated crop, a small grain crop, and a legume crop are fairly well supported both in theory and in 21-years of field practice.

Table 38—Average Yearly Grain Value Per Acre of Separate Rotations Plus Sweet Clover Forage Value

Comparative Yearly Grain Values per Acre (Av. of all Crops in Each Rotation) in Given Rotation

Year	Rotation 1. Corn, Wheat, Legumes (gr. man.) Alfalfa (5-10 yr.), Potatoes, Flax	Rotation 2. Corn, Wheat, Oats	Rotation 3. Corn, Wheat, Legumes (for hay)	Rotation 4. Sorghum, Barley, Legumes	Rotation 5. Sunflowers, Barley, Legumes	Rotation 6						Rotation 7 Corn, Wheat	Rotation 8 Continuous Grain Double Disc Rotation 10			Rotation 9. Rye, Corn, Winter Wheat, Sorghum	Rotation 10		
						Corn, Wheat, Legumes Sorghum, Wheat, Legumes for gr. manure	Corn, Wheat Legumes, Sorghum, Wheat, Legumes for hay	Corn. W. Wheat, Legumes, Sorghum, W. Wheat Legumes for gr. man.	Corn, Oats, Legumes, Sorghum, Oats, Legumes for gr. manure	Corn, Barley, Legumes, Sorghum, Barley, Legumes for gr. manure	Corn, Rye, Legumes, Sorghum rye, Legumes for green manure		Wheat	Oats	Barley		Millet in 36 in. Rows, Oats	Sudan in 42 in. Rows, Oats	Dakota Amber in 42 in. Rows, Oats
1912	$6.29	$6.19	$7.06	$7.51		$1.65	$3.51	$1.72	$2.50	$1.91	$1.53	$4.89	$0.55						
1913	1.33	.33	.12	.18		.34	.69	.15	.33	.15	.12	0	0						
1914	2.48	1.94	2.21	2.92		1.06	1.58	.24	2.36	1.53	2.35	1.88	2.16						
1915	5.64	0	1.53	3.97		0	019	0	0	0	2.38	0	0						
1916	17.12	13.22	9.62	9.42		7.82	8.40	1.22	6.55	8.58	13.53	12.41	.18.00			$8.07			
1917	6.87	7.12	13.01	8.27		2.13	2.71	.56	5.06	6.03	.56	1.76	0			.78			
1918	25.69	15.94	10.77	16.33		5.90	6.86	1.65	6.74	5.06	8.04	11.66	0			16.32			
1919	9.46	10.40	9.37	12.45		11.26	13.78	19.58	7.51	8.31	5.44	14.52	15.36			10.31			
1920	11.74	19.28	14.54	16.16	$14.46	14.33	19.92	9.11	10.73	10.36	9.41	21.77	34.73	$18.62	$23.73	11.52			
1921	.60	.08	2.11	.23	0	.52	3.78	.52	.54	.57	.52	.33	0	0	0	1.36			
1922	14.37	7.82	11.32	4.79	1.93	5.19	10.63	2.00	4.25	3.90	2.00	8.51	5.98	1.30	3.49	6.83			
1923	18.34	13.51	18.02	15.63	6.34	8.61	13.44	4.42	8.09	9.29	3.45	21.44	8.34	5.00	12.49	10.86			
1924	6.85	7.16	7.41	12.76	5.25	4.78	6.44	5.40	3.66	2.58	5.62	10.81	6.50	8.26	5.00	21.69			
1925	9.49	4.79	7.56	10.73	7.57	5.53	7.87	2.62	2.72	2.84	2.75	3.84	4.10	1.65	2.18	2.27	$1.56	$3.22	$2.31
1926	11.84	4.77	4.48	2.15	1.70	3.48	4.53	3.01	3.18	2.11	2.24	3.32	.94	.15	.29	4.32	5.30	9.20	4.36
1927	17.77	21.29	15.76	12.44	4.33	14.35	17.37	2.72	7.69	9.93	7.91	19.86	30.00	8.58	10.12	5.44	6.94	8.72	7.93
1928	12.63	3.60	9.79	10.39	7.61	3.74	8.82	4.39	3.08	1.35	2.90	5.20	14.71	3.07	6.77	3.97	4.14	5.23	4.97
1929	17.97	10.77	13.51	10.68	6.76	5.83	11.70	7.69	5.30	3.87	1.85	11.74	10.23	5.27	6.26	6.97	4.53	4.38	5.23
1930	11.15	2.73	.46	0.74	.34	1.07	3.78	1.70	.98	1.36	1.64	4.52	2.62	3.45	3.49	2.07	1.38	6.89	5.82
1931	2.15	1.20	.58	.43	.14	.33	.33	.87	.21	.64	.23	1.05	2.26	1.28	.55	.73	.81	.66	2.98
21-yr. Av.	$10.18	$7.47	$7.73	$7.68	$4.48	$4.81	$7.11	$3.34	$3.99	1.94 $3.92	1.06 $3.60	5.05 $7.84	5.79 $7.73	4.65	4.70	2.94 $6.85	5.35	3.09	2.78
13-yr. Av.	$10.69	$7.83	$8.35	$7.72	$4.48	$5.44	$8.59	$3.46	$4.05	$3.90	$3.20	$9.03	$9.70	$4.71	$6.08	$6.23			
8-yr. Av.	$10.87	$7.83	$8.35	$7.72	$4.48	$5.44	$8.59	$3.46	$4.05	$3.01	$2.57	$6.82	$8.83	$3.51	$4.30	$3.59	$3.75	$5.18	$4.44

Manure Versus No Manure

In Table 39, following, comparative yields of various crops in rotations 1 and 2 from plots treated with manure and from plots where no manure was added are shown.

This test covers a period of the first 21 years the land has been under cultivation.

Table 39—Comparative Crop Yields, Manure Versus No Manure

Rotation 1. Corn, Wheat, legumes (green manure, alfalfa, potatoes, flax.												
Year	Corn		Wheat		Legumes		Alfalfa		Potatoes		Flax	
	No man.	Manure	No man.	Manure	No man.	Manure	No man.	Manure	No man.	Manure	No man.	Manure
1912-32 21-yr. Av.	10.8	11.3	9.7	10.1	1790*	1442*	2311*	2597*	34.6	31.7	4.1	4.2

Rotation 2. Corn, wheat, oats						
	Corn		Wheat		Oats	
	No Manure	Manure	No Manure	Manure	No Manure	Manure
1912-32 21-yr Av.	11.4	17.5	8.8	9.0	17.8	20.9

Stall Manure Influenced Yields.—Comparison of yields put down in foregoing brief table of averages from two separate rotations at Cottonwood will show that applications of stall manure made some increase in yield of the following: Corn, Wheat, Oats, Flax, Alfalfa.

Yields of the following were lower where manure was applied: Legumes (usually sweet clover), Potatoes.

It is not necessary here to make extended deductions from the foregoing facts. The application of stall manure to staple crops at Cottonwood was generally beneficial from the standpoint of increasing crop yields. Such fact would indicate that the process of removing crops without soil replacements under conditions at Cottonwood even for the first 21-year period, has generally resulted in soil depletion, presumably with the disastrous results of such a process.

The constructive observation to make and one which could not go wrong would be that farming in this area should be carried out with due regard for soil conservation.

Table 40 summarizes average crop yields from land in Rotation 6 where: (1) the legumes (usually sweet clover) occurring in two separate seasons of the rotation are regularly harvested for hay and seed, consequently removed always from the land where grown and (2) where the corresponding legumes are plowed under for green manure in one of the six years of the rotation when such legumes occur.

The comparative yields follow:

Table 40—Comparative Yields From Rotation 6

(1) Legumes are invariably removed (in the same six years) for hay or seed.
(2) Legumes are plowed under for green manure (once in the 6 year rotation)

	Legumes in sixth year of rotation removed for hay or seed (From Plot 6)	Legumes plowed under for green manure every 6th year. (Av. yields from remaining plots) other than 6
Corn	9.4 bu.	8.4 bu.
Sorghum	11.8 bu.	10.8 bu.
Oats	22.8 bu.	22.6 bu.
Wheat	10.4 bu.	10.4 bu.
Sw. Cl.	2500 lbs.	2389 lbs.

Observations from Table 40.—It is possible to observe from comparative average yields that five staple crops involved in Rotation 6 produced higher yields where legumes (usually sweet clover) were removed for hay or seed, than where they were plowed under (once in six-year rotation) for green manure.

It is a generally recognized fact that in field practice in the area represented that turning under large amounts of crop residues, whether straw after combining, native sod, stalks or other material, may apparently reduce crop yields in succeeding seasons. These reductions are generally attributed to a "blanketing effect" of the material turned under, with cutting off moisture that might otherwise be available to crops from the lower soil. A green manure crop left growing late in the fall may likewise exhaust the supply of soil moisture.

Whatever the exact cause technically, the present results are corroberative of such a theory. The yields of four of the five kinds of crops under trial are somewhat higher where legumes are invariably removed for hay or seed, and in the case of the remaining crop (wheat), the yields are equal.

Comparative Crop Yields from Fall Plowing Ten Inches Deep Versus Five Inches Deep

A comparison of the effect upon the yield of sorghum, rye, corn and wheat of plowing 10 inches deep in comparison with plowing five inches deep is shown in Table 41.

Table 41 indicates that plowing 10 inches deep resulted in lower crop yields of all crops in the test than plowing five inches deep.

Conclusions that may be drawn from Table 41 are that deep plowing at Cottonwood not only increases the power requirements, but also reduces the yield of crops per acre.

Table 41—Comparative Crop Yields From Fall Plowing 10 inches deep versus 5 inches deep

Rotation No. 9. Rye, Corn, Winter Wheat, Sorghum								
	Sorghum		Rye		Corn		Wheat	
	F. Plow 5 in.	F. Plow 10 in.	F. Plow 5 in.	F. Plow 10 in.	F. Plow 5 in.	F. Plow 10 in.	F. Plow 5 in.	F. Plow 10 in.
Av.	7.9	6.8	8.9	7.6	7.6	6.9	10.5	9.8

Comparative Yields From North Farm (Orman Clay) With Yields From South Farm (Pierre Clay)

In Table 42 a comparison of the yields of various crops from the north farm which is Orman Clay with the south farm which is Pierre Clay is made.

Orman clay as can be noted by reference to the fore part of the present bulletin (page 5) is a heavier phase than the Pierre clays. Both belong to the Pierre Series of soils.

The comparisons of the crops of both farms are made from the yields of all rotations on each farm. The rotations and land treatments are not exactly the same, and so the comparisons are only indicative rather than too definte, as to how the two soils compare for crop production in the Cottonwod area.

Soil Types May Influence Crop Yields.—Examination of comparative yields from two separate soil types within the same soil series (Pierre), as put down in foregoing Table 42, leads to tentative observations rather than proof of a difference in productive capacity of one of these soil types over another.

Throughout the period of 21 years during which these yields have been accumulated and assembled has been the question whether the two fairly distinct types of soil viz. (1) the Orman clay and (2) the Pierre clay would have decisive differences in crop production. It has been possible to observe differences in crop growth in several seasons, which might apparently be decisive in choosing one type of land over another for given purposes of crop production.

Observation of average yields in the lower horizontal lines of the following Table 42 leads to the following:

1. Yields of legumes, (both alfalfa and sweet clover) as well as yields of sorghum whether for grain or total forage, are higher from Pierre Clay (South Farm) than from Orman Clay (North Farm). It seems possible that the crops in question would be promoted at and immediately after seeding, by favorable tilth and temperature such as might be found in the early part of the season on south farm (Pierre Clay) (Ref. page 5).

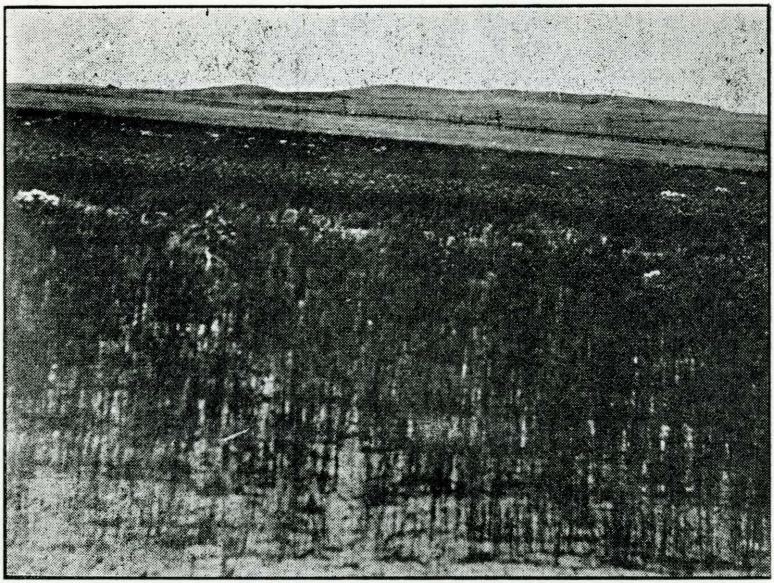
2. The foregoing may be less strongly indicated by yields of the several cereal crops.

3. Having this in mind the evident importance of legumes and sorghums in farm returns in this area, (Ref. pages 25,-39), it is put down here tentatively that Pierre Clay is more favorable to the production of important crops in the area than the heavier Orman Clay.

Pierre clays and loams (Upland) constitute by far the greater area of the two types under discussion.

Table 42—Comparative Yields From North Farm Versus South Farm (Orman Clay Versus Pierre Clay)

Corn Yield from given farm & given rotation				Wheat Yield from given farm & given rotation				Oats Yield from given farm & given rotation				Barley Yield from given farm & given rotation				Legumes Yield from given farm & given rotation				Sorghum Yield from given farm & given rotation				Alfalfa Yield from given farm & given rotatio			
North farm Orman		South farm Pierre		North farm Orman		South farm Pierre		North farm Orman		South farm Pierre		North farm Orman		South farm Pierre		North farm Orman		South farm Pierre		North farm Orman		South farm Pierre		North farm Orman		South farm Pierre	
Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield	Rot. No.	Yield
1	11.1	6	8.6	1	9.9	6	10.2	2	19.7	6	24.1	4	16.6	6	15.2	1	2029	6	2400	4	8.7	6	10.5		1397		1706
2	11.7	7	9.8	2	8.8	7	10.1	10	15.1	8	18.8	5	16.6	8	12.3	3	1916			9	7.2	6	2992				
3	9.8	6	1614	3	9.7	8	7.8									4	2333			9	1634						
9	8.4			9	10.1											5	1486										
9	1473																										
Grain Av.	10.3		9.2		9.6		9.4		17.4		21.5		16.6		13.8						8.0		10.5				
Forage Av.	1473		1614														1941		2400		1634		2992		1397		1706



Flax plots at Cottonwood, 1914, showing variation in stand and growth for different dates of seeding

Appendix

Six Thousand Five Hundred Ninety Eight Separate Crop Yields

The many yields of the various crops secured in 21 successive years 1912-21 at Cottonwood are put down in detail in Appendix, Tables 1 to 12 inclusive.

The number of crop yields thus recorded is 6,598. Each yield represents the labor of carrying out usual operations of soil preparation, seeding, harvesting, threshing, weighing and recording weights of both straw and grain for each individual yield. These separate yields are in turn secured from plots, usually one-tenth acre each. These weights are 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 in detail 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.

At the present time the 6,598 yields here recorded and covering a 21-year period are all that are available for tabulation in the area represented by Cottonwood Experiment Farm. Agronomists and others

acquainted with statistical methods will of course understand that limited conclusion can be drawn from results covering 21 years and that at least twice that number of yields would equalize seasonal variations more accurately.

South Dakota Farm Prices.—Likewise in this appendix, Farm Prices (Dec. 1) are put down in Appendix Table 13 for South Dakota for the years 1912-1932. These prices were used in computing the farm value of the crop, the table of which follows the table of yields in each case. These farm prices were likewise used in computing Table 27, "Highest Money Returns from Staple Crops," and similarily in computing Table 38, "Average Yearly Value per Acre of Separate Rotations."

Soil and Climate.—The two principal types upon which these experiments at Cottonwood were carried out are described in the Appendix, page 74. They are Orman Clay Loam and Pierre Clay. Rainfall at Highmore for the years 1912 to 1936 is put down by months, page 79. Soil and climate constitute two important conditions of crop growth.

APPENDIX TABLE 1.—CROP SEQUENCE NO. 1. —CORN, WHEAT, LEGUMES (GREEN MANURE), ALFALFA VARIETIES (5-10 yrs.), POTATO VARIETIES, FLAX(DATE OF SEEDING.—(MANURE VS. NONE).

	Yield in bushels per acre of given crop																			
	CORN										WHEAT									
Years	O	M	M	M	O	O	M	M	M	O	A	A	A	A	A	A	A	A	A	A
1912	21.1	37.9	36.3	45.3	38.0	36.5	43.9	39.4	37.6	30.8	8.7	7.3	2.7	3.2	4.3	4.5	3.3	3.3	7.3	4.7
											A	A	A	A	A	A	A	A	A	A
1913	0	0	0	0	0	0	0	0	0	0	1.3	0.8	0.7	2.2	1.8	2.0	1.6	0.2	0.8	1.3
											A	A	A	A	A	A	A	A	A	A
1914	0	0	0	0	0	0	0	0	0	0	2.3	1.0	1.3	3.8	3.3	3.7	4.0	2.0	2.0	1.7
											B	B	B	B	B	B	B	B	B	B
1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											B	B	B	B	B	B	B	B	B	B
1916	8.5	9.0	8.8	10.3	8.4	9.2	8.7	12.9	12.4	8.6	6.3	7.5	9.4	8.0	9.1	10.1	9.3	8.8	9.2	8.3
											B	B	B	B	B	B	B	B	B	B
1917	9.5	8.8	9.9	8.9	9.6	12.6	10.8	10.8	9.5	9.8	6.7	4.7	0.2	0.2	0.3	0.8	0.5	2.1	7.2	2.8
											B	B	B	B	B	B	B	B	B	B
1918	21.7	17.4	19.1	22.7	21.6	19.6	24.6	19.2	13.2	15.6	12.7	5.3	3.8	2.9	7.6	8.7	8.4	7.3	7.7	8.5
1919	0	0.3	0.4	0.8	2.2	1.4	1.3	0.9	0.4	0.2	10.1	12.7	13.2	10.0	9.6	9.5	9.6	10.3	10.8	5.4
1920	14.3	3.3	2.4	13.8	14.9	17.8	16.8	18.0	18.8	14.9	24.5	21.7	20.8	23.5	19.0	25.2	25.7	26.8	24.0	25.3
1921	0	0	0	0	0	0	0	0	0	0	0.5	1.0	1.8	0.3	1.7	1.3	0.2	0.1	0.1	0.1
1922	21.4	21.4	18.6	18.6	15.7	15.7	22.9	17.1	17.1	18.6	9.0	13.3	13.2	15.0	16.7	8.8	11.2	9.3	10.7	7.5
1923	52.1	55.3	55.7	53.6	55.9	53.6	49.3	51.4	47.1	29.8	9.7	14.7	18.3	19.5	15.7	16.2	14.8	16.2	14.5	13.2
1924	2.1	1.8	3.0	2.9	3.9	2.0	2.3	6.4	1.8	1.4	5.3	12.2	13.8	11.0	8.2	9.0	12.3	12.8	13.7	7.2
1925	3.7	0.1	0.9	3.1	9.3	10.0	4.6	5.6	1.6	0.9	5.3	5.3	9.2	13.2	21.2	13.7	10.0	12.3	7.7	7.8
1926	7.4	3.3	2.6	12.1	8.1	8.6	4.6	3.9	6.4	9.9	1.3	1.1	0.7	3.4	7.0	12.2	5.7	4.8	3.0	2.3
1927	20.6	30.4	33.4	28.6	30.0	35.0	37.9	47.3	40.7	33.3	20.7	23.0	28.5	34.3	35.0	32.7	33.3	32.7	29.0	17.5
1928	0	0	0	0	0	0	0	0	0	0	12.5	15.6	13.8	18.6	16.4	18.2	21.2	22.8	23.3	16.3
1929	7.9	3.1	8.0	8.0	14.0	10.4	7.3	9.3	6.7	2.4	18.7	19.5	19.3	18.3	16.8	16.8	19.8	19.2	17.2	20.7
1930	0.9	0	0.1	0.3	3.3	3.0	0.6	1.9	0.6	0.7	1.5	0.9	0.9	3.5	10.3	5.7	2.7	4.0	1.5	1.3
1931	0.3	0.4	0.5	0.4	0.5	0.7	1.4	1.1	1.1	0.3	2.5	0.7	0.3	0.6	3.8	5.7	4.2	4.8	2.3	1.5
1932	10.7	8.7	12.1	11.3	12.3	22.0	20.9	22.1	26.9	22.4	29.2	28.3	24.5	26.7	23.5	23.2	21.8	24.5	20.8	21.3
Av	9.6	9.6	10.1	11.5	11.8	12.3	12.3	12.6	11.5	9.5	9.0	9.4	9.4	10.4	10.6	10.9	10.5	10.7	10.1	8.3

A Preston
B Kubanka

Appendix Table 1.—Crop Sequence No. 1—Corn, Wheat, Legumes (Green Manure), Alfalfa Varities (5-10 yrs.), Potato Varieties, Flax (Date of Seeding),—(Manure vs. None)

	Yield in pounds per acre of given crop																			
	LEGUME										ALFALFA									
											Vale	Turk-estan	Grimm	Vale	Turk-estan	Vale	Vale	Grimm	Turk-estan	Vale
											SEEDED									
1912						4250														
1913						130					900	1000	1000	1100	†850	650	1000	1000	950	750
1914						850					1100	1200	1300	1150	†1000	1050	1400	1100	1300	800
1915						850					3880	5860	4640	4900	†4050	4660	4640	4520	5020	4400
1916						1356					1100	1000	1350	1000	†1200	1650	1350	1100	1000	1000
1917						1600					760	800	620	590	†680	870	970	580	690	540
1918						1250					1690	1600	1590	1530	†1460	1300	1630	1070	1100	530
1919						2860					1330	1790	1440	1720	†1600	1370	2010	1660	1850	1050
1920						3900					2320	2890	2595	2380	†2495	2750	3290	2880	3010	2250
1921						4300					360	640	620	420	640	800	600	600	560	400
1922						1620					6500	7900	7400	6570	5830	6200	7400	5900	7000	5500
1923						5080					4600	6450	6350	5000	4750	6050	6600	4550	5850	3000
1924	5800	5000	3350	3300	3850	3800	3750	5050	4600	4800	0	0	0	0	0	0	0	0	0	0
1925	2540	1850	1890	1730	1980	1900	1900	2260	2200	1270	0	0	0	0	0	0	0	0	0	0
1926	hail 0	0	0	0	0	0	0	0	0	0	1700	2500	4640	2660	3440	4260	3620	4300	3950	2920
1927	3760	3760	3760	3760	3760	5260	3760	3760	3760	3760	2460	*2980	2330	2950	2570	3000	3520	3230	2930	2980
1928	4600	3650	1350	4000	1000	7200	1600	2000	2800	2900	6400	*4700	3600	3800	3750	4150	5850	7800	4600	5100
1929	300	700	600	800	500	6700	300	300	200	150	5300	*5800	4100	3600	2500	4300	5000	5800	5800	5000
1930	0	0	0	0	0	2000	0	0	0	0	4000	*4400	2100	2100	2000	3400	2800	3500	4200	4000
1931	0	0	0	0	0	0	0	0	0	0	500	*700	500	600	300	300	600	200	‡800	700
1932	0	0	0	0	0	0	0	0	0	0	3800	3600	2500	2400	1200	2280	2100	2700	4300	3900
Ave.	1888	1662	1220	1514	1232	2610	1257	1489	1507	1431	2432	2789	2433	2223	2013	2452	2719	2675	2745	2348

† Vale * Ladak ‡ Ont. Varigated

Appendix Table 1.—Crop Sequence No. 1—Corn, Wheat, Legumes (Green Manure), Alfalfa Varieties (5-10 yrs.), Potato Varieties, Flax (Date of Seeding).—(Manure vs. None)

Yield in bushels per acre of given crop

	POTATOES										FLAX									
Year	O Early Ohios	M Varieties	M Early Ohios	M Early Ohios	O Early Ohios	O Early Ohios	M Early Ohios	M Early Ohios	M Varieties	O Early Ohios	4-15	5-1	5-15	4-15	4-15	4-15	4-15	6-1	6-15	4-15
		*		†			†		*		*	*	*	*	*	*	*	*	*	
1912	51.2	39.2	19.7	5.8	33.3	26.7	12.0	53.3	45.8	33.7	9.0	14.7	11.0	10.2	9.2	9.3	10.7	9.5	8.8	5.8
		†	‡					‡	†											
1913	12.3	1.3	2.8	5.8	4.5	9.3	10.7	1.0	1.5	5.5	0	1.7	0.8	0	0	0	0	0	0	0
		†	‡					‡	†											
1914	18.0	6.5	10.0	17.5	15.3	18.0	18.5	13.3	11.0	16.1	1.6	1.6	1.4	1.1	1.4	1.9	1.8	0	0	1.3
		§	§						§											
1915	21.5	45.9	19.2	11.3	9.2	12.0	10.8	30.9	27.7	21.6	9.2	7.1	5.9	6.7	8.9	13.5	10.1	8.9	10.9	7.5
		§	§					§	§											
1916	48.7	65.5	65.7	56.3	53.8	54.3	58.3	52.5	51.9	30.3	2.1	1.4	2.1	2.3	2.9	2.4	2.9	2.4	2.4	1.7
		§	§					§	§											
1917	23.3	8.4	6.7	9.3	8.2	6.3	8.4	12.5	11.3	5.3	3.5	2.9	1.3	3.4	3.8	3.4	2.9	0.3	3.7	1.8
		§	§					§	§											
1918	123.7	71.3	71.5	78.2	122.6	123.3	122.5	78.8	64.4	75.5	7.0	4.3	3.9	4.3	4.8	6.7	4.7	4.1	6.3	6.0
		§	§					§	§											
1919	8.3	0.8	0.3	2.3	2.3	4.7	5.5	1.6	1.1	4.8	1.3	1.3	0.5	3.0	3.8	4.0	4.0	0	0	2.3
		§	§						§											
1920	26.6	26.2	12.5	5.7	4.2	11.3	8.3	27.2	15.9	35.8	5.0	2.0	0.4	6.1	6.1	7.8	6.7	0	0	4.8
		§	drought																	
1921	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.2	0
		§							§											
1922	66.7	34.7	60.1	56.7	52.8	54.7	107.0	110.7	65.5	67.5	1.9	0.8	1.4	2.3	2.0	1.9	2.6	1.2	0.7	2.0
		§							§											
1923	74.0	28.5	62.3	3.7	30.5	83.3	92.5	45.3	73.8	80.3	6.6	8.8	6.8	8.9	6.8	8.0	12.7	14.3	15.4	9.8
		§							§		*	*	*	*	*	*	*	*	*	*
1924	37.5	35.3	37.3	48.1	52.9	35.0	44.5	34.2	49.0	27.3	0.1	3.1	0.3	0.3	0.5	1.3	0.7	0.7	0.9	1.5
		§							§		*	*	*	*	*	*	*	*	*	*
1925	27.7	16.3	16.8	9.8	13.5	19.2	10.0	15.0	9.7	19.0	2.7	2.3	1.3	1.6	2.5	2.9	3.2	3.6	4.3	2.7
		§							§		*	*	*	*	*	*	*	*	*	*
1926	12.8	9.0	16.7	18.0	19.7	25.3	22.5	26.8	16.8	18.2	0.5	0.6	1.3	1.2	1.6	2.1	2.9	1.5	1.8	1.7
		§							§					6-1	6-15		5-15	5-15	6-1	6-15
1927	102.0	47.9	19.3	29.2	37.0	23.5	26.0	48.2	70.9	64.8	8.0	11.6	13.9	16.1	17.5	13.4	13.0	14.3	15.0	9.1
		§							§											
1928	84.3	49.9	76.0	54.4	76.2	85.3	71.9	81.0	43.9	66.5	12.7	8.3	5.5	2.9	0.4	10.9	10.4	3.0	2.3	0.9
		§							§											
1929	41.3	30.6	39.3	44.8	41.2	46.3	46.1	48.8	48.8	44.3	3.0	4.5	2.1	5.0	6.4	6.4	4.6	3.8	0.9	4.1
		§							§		*									
1930	19.3	28.1	28.2	25.7	31.7	47.2	55.5	55.2	50.3	53.0	3.4	2.0	1.4	1.6	1.4	2.0	2.9	3.0	3.8	3.8
		§							§											
1931	13.8	9.8	20.3	16.7	15.9	14.0	13.6	13.0	5.3	7.3	T	O	O	T	T	T	T	O	O	T
		§							§											
1932	24.5	7.7	14.8	13.3	15.8	19.5	24.8	27.7	9.7	17.2	2.1	3.2	2.9	2.5	6.1	5.9	3.2	1.4	0.3	2.9
Av.	39.9	26.8	28.6	24.4	30.5	34.3	36.7	37.0	31.9	33.5	3.9	3.9	3.1	3.8	4.1	4.9	4.8	3.4	3.7	3.3

* Early Ohio
† Late Rose
‡ Carmen No. 3
§ Variety
* No. date of seeding

Appendix Table 2—Crop Sequence No. 2—Corn, Wheat Oats (Rate of Seeding). Manure vs. None)

Yield in bushels per acre of given crop

	CORN										WHEAT									
Year	O	M	M	M	O	O	M	M	M	0	*	†	†	*	*	*	*	‡	‡	*
1912	28.0	26.9	21.5	23.5	35.1	34.6	39.6	36.6	29.5	18.6	4.7	1.8	1.0	4.5	4.2	11.0	9.5	4.2	3.8	5.0
											*	†	†	*	*	*	*	‡	‡	*
1913	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											*	†	†	*	*	*	*	‡	‡	*
1914	0	0	0	0	0	0	0	0	0	0	1.2	0.8	0.2	1.0	1.7	1.5	2.5	2.8	2.0	1.3
1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
											†	†	†	†	†	†	†	†	‡	‡
1916	12.6	6.1	5.7	2.9	10.1	14.2	15.4	16.3	15.6	11.6	5.9	11.0	12.3	13.1	8.0	9.3	10.8	12.6	14.4	8.9
											†5pk	†3pk	†7pk	†5pk	†5pk	†5pk	†5pk	‡3pk	‡7pk	‡5pk
1917	1.4	2.6	4.3	3.6	4.4	4.9	4.9	5.3	5.1	4.4	2.8	4.4	3.4	4.5	4.7	2.4	1.3	0.8	1.2	0.8
											†5pk	†3pk	†7pk	†5pk	†5pk	†5pk	†5pk	‡3pk	‡7pk	‡5pk
1918	18.5	17.3	16.1	15.3	18.3	24.8	22.5	22.3	19.8	15.2	5.8	3.6	1.8	1.6	6.8	18.7	14.2	11.2	5.8	5.9
	hail										†5pk	†3pk	†7pk	†5pk	†5pk	†5pk	†5pk	‡3pk	‡7pk	‡5pk
1919	0	0	0	0	0	0	0	0	0	0	5.4	6.3	6.8	6.3	4.4	5.8	6.3	6.3	7.6	7.0
										dest	†5pk	†3pk	†7pk	†5pk	†5pk	†5pk	†5pk	‡3pk	‡7pk	‡5pk
1920	13.3	16.8	17.9	19.4	16.4	20.9	22.8	18.1	24.3	royed	21.3	24.0	26.2	26.7	20.5	22.8	22.7	22.2	26.5	20.5
1921	0	0.1	0	0.3	0.4	0.9	1.3	0.5	0.3	0.1	0	0	0	0	0.2	1.1	0.3	0	0	0
											†5pk	†3pk	†7pk	†5pk	†5pk	†5pk	†5pk	‡3pk	‡7pk	‡5pk
1922	15.7	13.1	24.3	12.9	18.6	15.7	15.7	15.7	17.1	20.9	13.0	10.3	10.3	9.5	9.0	7.3	9.0	10.0	12.8	12.2
1923	30.0	30.7	30.0	39.6	28.4	33.1	43.7	41.6	40.6	25.1	4.5	11.7	13.0	13.5	2.8	1.2	3.8	5.2	6.3	7.8
1924	2.5	1.8	1.8	3.6	5.7	14.3	7.1	9.1	6.8	6.3	5.6	9.7	8.5	9.0	8.0	7.5	9.3	10.2	9.7	9.5
1925	1.0	1.0	1.1	1.0	5.4	5.3	1.1	0.9	0.4	0.6	6.7	8.0	7.7	7.7	7.5	13.7	11.7	7.0	5.5	5.7
1926	1.9	1.9	6.6	6.0	6.7	10.9	12.5	11.6	13.1	12.9	7.8	7.3	4.0	4.2	6.0	5.3	1.0	1.7	4.5	14.0
1927	44.4	41.4	44.4	31.4	57.1	60.0	77.1	71.4	65.7	57.1	26.0	27.0	22.8	20.5	20.5	17.8	21.0	20.7	26.3	19.7
1928	0.2	0	0	0.1	3.2	5.7	1.2	0.4	0	0	8.3	10.1	9.0	8.2	8.3	15.0	18.0	16.6	13.8	11.2
1929	9.4	10.6	13.7	16.0	19.1	19.3	16.7	15.3	21.6	16.1	11.0	18.0	16.7	16.7	17.8	15.7	17.7	18.7	19.8	10.8
1930	1.0	1.1	1.3	0.6	8.3	19.9	12.7	12.6	8.7	11.9	3.2	2.0	2.8	2.8	2.3	2.2	2.5	3.8	2.7	2.8
1931	1.9	2.9	1.9	0.8	5.4	6.7	1.1	0.6	1.6	0.4	0.7	1.3	0.6	0.1	3.8	8.2	9.7	7.7	4.3	4.3
1932	7.1	12.1	12.9	12.1	12.1	12.9	17.9	17.1	12.9	12.1	31.7	32.3	33.8	34.0	27.7	27.0	27.7	28.3	30.7	28.7
Av.	9.0	8.9	9.7	9.0	12.1	14.5	14.9	14.1	13.5	10.1	7.9	9.0	8.6	8.7	7.8	9.2	9.5	9.0	9.4	8.4

* Preston
† Kubanka
‡ Bluestem

‡ The sequence 1916-1923 was 1-Corn, 2-Oats, 3-Wheat

Appendix Table 2.—Crop Sequence No. 2.—Corn, Wheat, Oats (Rate of Seeding) (Manure Versus None)

	Yield in Bushels per Acre of Given Crop									
	Oats—60 Day									
Year	7 pk.	9 pk.	5 pk.	7 pk.	7 pk.	7 pk.	7 pk.	5 pk.	9 pk.	7 pk.
	*			*	*	*	*			*
1912	14.7	15.3	17.5	12.2	10.3	9.1	16.6	25.9	28.1	19.1
	*			*	*	*	*			*
1913	0.6	7.8	7.8	0.3	1.5	0.9	0.6	6.2	2.9	0.3
		*	*					*	*	
	3R30 in	2R36 in.	3R30 in.	3R30 in.	3R30 in.		3R30 in.	2R36 in.	3R30 in.	3R30 in.
1914	11.0	6.7	8.0	11.2	12.5	14.0	18.4	10.7	8.7	15.0
		*	*					*	*	
	3R30 in.	2R36 in.	3R30 in.	3R30 in.	3R36 in.		3R30 in.	2R36 in.	3R36 in.	3R30 in.
1915	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		*	*					*	*	
						3R30 in.				
1916	27.0	21.1	21.9	35.3	36.6	55.6	46.3	28.6	26.6	24.5
						3R30 in.				
1917	13.1	14.0	17.1	18.6	18.0	24.4	23.1	16.7	13.6	11.9
						3R30 in.				
1918	18.4	20.6	20.0	20.0	16.9	19.1	20.3	25.0	19.7	23.1
						3R30 in.				
1919	17.3	26.6	35.5	38.4	31.4	16.1	22.5	24.7	27.2	18.9
						3R30 in.				
1920	76.9	79.7	78.1	73.4	74.7	55.0	75.6	68.8	70.6	59.7
						3R30 in.				
1921	0.	0.	0.	0.	0.	0.6	0.5	0.8	0.5	0.
						3R30 in.				
1922	15.6	20.6	20.0	22.2	17.8	10.0	10.9	12.5	19.1	22.5
1923	43.1	55.0	60.9	55.9	50.3	52.8	65.3	63.1	60.3	42.5
1924	9.0	14.4	14.4	18.8	18.1	14.4	17.5	11.3	16.9	9.7
1925	6.6	10.9	9.4	10.6	10.0	7.2	10.6	13.1	15.6	11.3
1926	3.1	7.8	6.3	8.4	7.9	11.3	7.2	7.8	9.4	9.4
1927	19.7	26.3	23.8	24.7	11.6	19.7	33.1	31.3	42.5	17.2
1928	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1929	23.4	30.6	29.1	21.9	19.7	27.5	29.7	27.2	23.1	13.4
1930	15.0	22.2	20.0	16.6	12.5	15.3	15.9	13.1	15.3	10.3
1931	1.2	2.9	1.2	2.2	3.6	4.7	4.1	2.9	6.6	22.2
1932	47.8	50.6	46.6	42.5	36.3	36.6	39.4	40.6	41.3	35.0
Av.	17.3	20.6	20.8	20.6	18.6	18.8	21.8	20.5	21.4	16.5
	3R30 in.	2R36 in.	3R30 in.	3R30 in.	3R30 in.		3R30 in.	2R36 in.	3R30 in.	3R30 in.

* Swedish Select

Appendix Table 3.—Crop Sequence 3.—Corn, Wheat, Legumes (Fertility Test)

Yield in bushels per acre of given crop

	CORN—ALTA										WHEAT—ACME									
	0	N35	P20	K20	N35 P20	N35 K20	P20 K20	N35 P20 K20	0		O	N35	P20	K20	O	N35 P20	N35 K20	P20 K20	N35 P20 K20	0
1912	25.5	23.1 drought	22.8	29.0	27.8	24.8	29.1	28.6	27.1	27.5	7.2 *	9.3 *	8.7 *	8.3 *	7.8 *	6.5 *	5.8 *	7.8 *	8.2 *	13.3 *
1913	0	0 drought	0	0	0	0	0	0	0	0	0 *	1.4 *	1.0 *	0.7 *	0.7 *	0 *	0 *	0.7 *	0 *	0.7 *
1914	0	0 frost	0	0	0	0	0	0	0	0	2.3 *	2.7 *	3.3 *	4.0 *	4.8 *	3.3 *	5.0 *	4.8 *	4.7 *	4.8 *
1915	0	0	0	0	0	0	0	0	0	0	0 ‡	0 †	0 †	0 †	0 †	0 †	0 †	0 ‡	0 †	0 ‡
1916	9.8	6.6	3.3	2.8	5.5	4.4	2.6	10.0	5.8	6.8	8.3 ‡	5.0 †	7.8 †	10.0 †	8.0 †	7.6 †	8.6 †	9.5 ‡	5.8 †	7.8 ‡
1917	6.4	7.4	5.8	6.8	5.9	3.5	4.3	3.4	3.1	3.8	5.8 ‡	2.5 †	3.9 †	6.8 †	5.9 †	2.2 †	2.3 †	4.7 ‡	4.2 †	6.3 ‡
1918	16.7	17.1 drought	15.0	19.9	18.9	18.0	20.3	17.0	16.9	17.9	4.6 ‡	6.0 †	4.7 †	5.9 †	6.3 †	1.8 †	1.8 †	1.5 ‡	1.3 †	2.8 ‡
1919	0	0	0	0	0	0	0	0	0	0	3.6	5.1	5.5	5.7	5.6	5.7	6.5	7.8	3.9	5.2
1920	13.4	14.3	12.8	13.5	15.3	10.0	17.4	12.8	12.3	14.1	19.8	24.2	28.8	30.8	26.8	22.5	21.2	25.8	21.7	24.2
1921	0	0	0	0	0.4	0.6	0	0.3	0.1	0	1.4	1.5	1.4	1.5	1.0	.3	.7	0.2	0.3	0.5
1922	19.4	20.9	17.1	21.4	18.9	15.7	20.0	18.0	15.7	15.7	12.0	7.7	14.1	13.3	11.8	10.2	11.0	15.7	12.2	12.5
1923	57.0	61.2	65.3	63.7	63.7	63.4	60.7	60.7	54.4	57.7	14.5	14.8	19.0	19.3	17.8	15.8	18.2	21.0	18.5	16.8
1924	2.7	2.1	0.9	0.9	0.8	1.6	1.8	0.9	1.8	3.0	8.7	9.2	11.3	10.5	10.5	11.3	10.0	11.2	10.8	7.7
1925	1.4	0.7	0.7	1.9	3.1	1.6	1.6	2.1	3.0	2.9	3.3	3.7	3.8	4.5	4.7	5.3	6.0	4.5	4.2	5.0
1926	7.5	4.3	5.8	4.0	4.2	3.6	4.1	7.1	4.1	5.9	5.8	4.2	6.0	11.3	14.0	6.6	7.2	8.5	7.9	13.0
1927	22.0	22.0	19.6	25.0	24.9	26.9	30.1	24.7	22.0	17.9	27.7	29.5	27.2	23.5	25.8	31.3	31.8	32.5	27.5	36.7
1928	2.6	0.7	0.1	0.1	1.7	0.5	1.3	1.1	1.1	1.5	10.8	10.6	10.8	12.3	12.8	16.8	17.8	13.8	14.5	10.5
1929	9.2	10.9	8.7	10.1	9.4	2.7	5.0	1.6	1.1	4.3	17.3	16.7	19.8	23.0	20.3	13.2	16.0	22.5	18.3	22.0
1930	0.1	0.1	0.1	0.7	0.1	1.1	2.4	0.7	0.4	1.7	2.7	3.0	3.5	5.2	4.2	1.0	1.7	0.8	0.3	1.3
1931	3.9	3.1	1.9	1.7	2.6	2.6	4.1	3.0	2.5	2.0	0.2	0.7	0	0.4	0.3	1.7	3.7	0.7	1.5	3.0
1932	12.1	12.9	17.1	12.1	14.3	8.6	17.1	12.9	11.4	10.0	24.2	22.7	25.7	27.3	26.2	20.3	24.2	30.2	24.8	26.3
21 yr. Av.	10.0	9.9	9.4	10.2	10.3	9.0	10.6	9.8	8.8	9.2	8.6	8.6	9.8	10.7	10.2	8.7	9.5	10.7	9.1	10.5

* Preston
† Kubanka

Appendix Table 3.—Corn Sequence No. 3—Corn, Wheat, Legumes (Fertility Test)

		Yield in hay (pounds); seed (bushels) per acre LEGUME										
		4.0	3.7	4.0	5.7	7.7	3.3	4.0	6.0	5.3	10.3	
Peas	1912	2170	1720	920	2160	2340	860	2930	1440	1560	1920	Peas
		drought										
Peas	1913	0	0	0	0	0	0	0	0	0	0	Peas
		0.7	1.0	0.8	1.2	0.7	1.7	1.3	0.8	1.0	1.2	
Peas	1914	720	700	1100	1140	770	980	1300	1030	1270	1100	Peas
Peas	1915	2000	1850	1850	1500	1200	2150	1850	1600	1850	1450	Peas
	1916	3700	4000	5020	4220	4490	4600	4170	3740	3980	4200	Sw. Clover
	1917	740	740	200	600	600	140	620	220	300	320	Sw. Clover
Peas	1918	1060	1260	780	960	1000	1240	1380	700	1660	720	Peas
	1919	2100	2680	2580	2100	2080	2120	2220	1940	2380	1880	Sw. Clover
	1920	2090	2180	1580	1460	1670	3110	2175	1675	3330	2650	Sw. Clover
	1921	1960	1700	2320	2800	2420	1260	1000	1060	1300	1460	Sw. Clover
		2.5	3.5	5.2	7.3	7.3	5.5	4.7	3.3	3.7	3.3	
	1922	2650	3990	4290	4360	4260	3970	3820	3000	3580	3000	Sw. Clover
		7.0	5.3	8.5	9.8	6.8	6.7	7.5	10.2	7.0	8.5	
	1923	1980	2030	1690	2810	1190	2800	2600	2990	2130	1690	Sw. Clover
		0.3	0.2	0.2	0.2	0.3	0.3	0.6	0.5	0.6	0.7	
	1924	1680	1090	2090	1490	1585	1585	1775	1573	2275	2460	Sw. Clover
	1925	2820	2560	4570	3020	2700	2840	2140	2540	2460	2360	Sw. Clover
	1926	0	hail 0	0	0	0	0	0	0	0	0	Sw. Clover
	1927	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	Sw. Clover
	1928	4200	4000	5000	4500	3900	4500	3900	3600	4600	3400	Sw.Clover
	1929	3400	3700	3900	4300	3900	5400	3900	4500	3900	5000	Sw. Clover
		drought										
	1930	0	0	0	0	0	0	0	0	0	0	Sw. Clover
		drought										
	1931	0	0	0	0	0	0	0	0	0	0	Sw. Clover
		drought										
	1932	0	0	0	0	0	0	0	0	0	0	Sw Clover
21-yr. Av. Legumes		1632	1676	1852	1829	1671	1835	1751	1552	1789	1649	
5-yr. Av. Peas		1190	1106	930	1152	1062	1046	1492	954	1268	1038	
16-yr. Av. Sw. Cl.		1770	1854	2140	2041	1862	2083	1833	1740	1952	1839	

Appendix Table 4.—Crop Sequence No. 4—Sorghum, Barley and Legumes (Method of Planting

Yield in bushels per acre of given crop

	SORGHUM										BARLEY									
	3 rows 30″	3 rows 30″	3 rows 30″	3 rows 30″	3 rows 30″	Solid 30″	3 rows 30″	3 rows 30″	3 rows 30″	3 rows 30″	Solid	Solid	Solid	Solid	Solid	3 rows 30″	Solid	Solid	Solid	Solid
	* Solid †			*	*	*	* Solid †		*	*	*	*	†	†	*	*	†	*	*	*
1912	16.0	11.0	17.2	14.6	28.4	24.0	34.0	47.2	28.6	20.4	0.	0.	5.1	5.3	0.	0.	7.6	0.	0.	0.
	* Solid †			*	*	*	* Solid †		*	*	*	*	†	†	*	*	†	*	*	*
1913	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.	0.
	* Solid †			*	*	*	* Solid †		*	*	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1914	7.0	1.6	1.4	9.0	10.0	9.0	7.0	3.4	1.4	2.4	9.6	8.3	8.0	7.5	5.4	4.6	5.8	6.5	7.1	5.8
	* Solid †			*	*	*	* Solid †		*	*	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1915	0.	5.8	5.4	0.	0.	0.	0.	5.8	6.0	0.	0.	0.	17.8	20.8	0.	0.	16.0	12.5	0.	0.
	* Solid †			*	*	*	* Solid †		*	*	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1916	0.4	1.3	1.8	0.1	0.	0.	0.	0.7	0.7	0.2	22.4	22.4	22.4	22.4	22.4	17.6	22.4	22.4	22.4	22.4
	*drought†		†	*	*	*	*	†	†	*	‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1917	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	11.3	11.3	11.3	11.3	11.3	7.0	11.3	11.3	11.3	11.3
					x3R30″						‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1918	x 8.5	8.5	8.5	8.5	8.5	8.5	0.	8.5	8.5	8.5	19.2	18.3	19.2	21.9	26.6	25.6	23.0	26.4	20.8	14.4
					x3R30″						‡	‡	‡	‡	‡	‡	‡	‡	‡	‡
1919	x 2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
					x3R30″															
1920	x 0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7
					x3R30″															
1921	x 2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1922	19.2	16.2	18.4	13.4	12.4	12.2	3.8	9.4	10.6	16.4	17.7	19.2	19.8	21.7	22.9	21.0	17.3	17.9	12.1	10.6
1923	44.2	44.2	44.2	44.2	44.2	40.9	44.2	44.2	44.2	44.2	22.7	22.7	14.4	16.9	17.1	9.4	12.7	16.3	17.7	14.0
1924	4.5	4.5	4.5	4.5	4.5	8.3	4.5	4.5	4.5	4.5	26.8	26.8	26.8	26.8	26.8	24.1	26.8	26.8	26.8	26.8
1925	0.	.0	0.	0.	0.	0.	0.	0.	0.	0.	9.4	10.4	10.4	14.2	15.0	19.0	32.7	38.6	26.3	10.4
1926	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	15.6	15.1	14.9	9.0	10.4	10.6	15.9	10.2	8.3	2.3
1927	6.8	32.6	39.6	34.8	37.8	34.8	36.2	21.0	36.6	34.2	38.8	32.5	32.3	27.7	27.7	24.6	21.5	9.6	21.9	27.7
1928	T	T	T	T	T	O	T	T	T	T	16.3	21.9	20.6	21.0	33.3	26.0	23.8	30.2	27.7	21.7
1929	4.0	2.4	3.4	4.0	3.6	2.2	6.4	8.8	6.2	3.0	23.1	22.9	27.5	20.6	17.1	15.0	21.7	19.4	19.2	16.3
1930	.9	2.5	2.2	2.2	1.6	3.1	1.2	2.6	5.3	2.0	4.0	3.7	1.7	3.8	3.5	9.0	3.3	5.4	2.7	1.0
1931	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	.5	1.7	2.5	.5	5.4	6.3	6.5	8.1	4.4	3.8
1932	34.0	29.8	35.6	41.0	36.4	39.8	32.8	24.8	23.2	24.4	32.1	35.0	50.2	49.2	42.9	34.8	45.8	49.0	45.6	43.3
Av.	7.2	7.9	8.9	8.7	9.2	8.6	8.8	8.9	8.6	7.9	15.9	16.0	17.6	17.9	16.7	15.2	18.2	17.8	16.3	14.1
Av. Sorghum																				
Av. Millet																				

x Entire acre seeded 3R30″
* Sorghum 4′4″ rows
† Black variety

* Manchuria
† Emmer
Emmer on plots 3, 4, 7 in 1912 & 1913.
‡ Gatami

Appendix Table 4.—Crop Sequence No. 4.—Sorghum, Barley, and Legumes (Method of Planting)

	Yield in pounds per acre of given crop										
	LEGUME										
Year	Solid	Solid	Solid	Solid	Solid	3 rows 30"	Solid	Solid	Solid	Solid	
	*	*	*	*	*	*	*	*	*	*	
1912	4220	4220	4220	4220	4220	4220	4220	4220	4220		
4220	Peas										
	*	*	*	*	*	*	*	*	*	*	
1913	155	155	155	155	155	155	155	155	155	155	Peas
	*	*	*	*	*	*	*	*	*	*	
1914	800	690	1090	1080	810	800	620	980	1090	1580	Peas
1915	2880	2800	2800	2800	2800	1791	2800	2800	2800	2800	Sw. Clover
1916	3700	3700	3700	3700	3700	2598	3700	3700	3700	3700	Sw. Clover
1917	2500	2500	2500	2500	2500	1718	2500	2500	2500	2500	Sw. Clover
1918	5000	5000	4500	4500	4500	4500	4750	4750	5000	5000	Sw. Clover
1919	2590	2770	2550	2640	3140	2480	2490	2790	2820	2640	
1920	5325	5325	5325	5325	5325	5325	5325	5325	5325	5325	
1921	0	0	0	0	0	0	0	0	0	0	
1922	0	0	0	0	0	0	0	0	0	0	
1923	2680	3450	2150	3070	4840	3800	3690	3980	4120	3750	
1924	5450	4750	5150	4550	3250	3800	3100	3650	2800	2600	
1925	3550	3620	4410	4500	5580	5600	4520	4540	3360	2780	
1926	0	0	0	0	0	0	0	0	0	0	
1927	917	917	917	917	917	917	917	917	917	917	
1928	4800	4000	4050	6500	5000	4520	5000	4900	4900	3300	
1929	1970	3800	4400	4600	5400	5400	6500	5900	4600	3800	
1930	0	0	0	0	0	0	0	0	0	0	
1931	0	0	0	0	0	0	0	0	0	0	
1932	0	0	0	0	0	0	0	0	0	0	
21-yr. Av. Legumes	2212	2271	2282	2431	2483	2268	2490	2434	2300	2156	
3-yr. Av. Peas	1725	1688	1822	1822	1728	1725	1665	1785	1825	1985	
18-yr. Av. Sw. Cl.	2293	2368	2358	2533	2608	2358	2627	2542	2380	2184	

* Peas

Appendix Table 5.—Crop Sequence No. 5.—Sunflowers, Barley Legumes (Years 1912 to 1919 Incl.)

	Yield in pounds per acre of given crop									
	LEGUME									
Year										
1912										
1913										
1914										
1915										
1916										
1917										
1918										
1919										
1920	4300	4300	4300	4300	4300	4300	4300	4300	4300	4300
1921	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0
1923	2080	4050	2630	3590	2850	3360	1310	3410	2370	3370
1924	3950	3400	3000	2650	2800	2700	2250	4350	2150	2400
1925	2960	2300	1920	1130	1700	1460	1520	2480	2040	3160
1926	0	0	0	0	0	0	0	0	0	0
1927	0	0	0	0	0	0	0	0	0	0
1928	3800	4400	4900	3100	3300	2700	2400	3600	4800	3800
1929	2700	3400	4300	3600	4300	3400	2700	3600	3400	2600
1930	0	0	0	0	0	0	0	0	0	0
1931	0	0	0	0	0	0	0	0	0	0
1932	0	0	0	0	0	0	0	0	0	0
13-yr Av.	1523	1681	1619	1413	1481	1378	1114	1672	1466	1510

Appendix Table 5.—Crop Sequence No. 5, (Sunflowers,, Barley, Legumes (Years 1920-1934 Inclu.).

	Yield in bushels per acre of given crop																			
	SUNFLOWERS										BARLEY									
	M	M	M	M	M	M	M	M	M	M										
1912																				
1913																				
1914																				
1915																				
1916																				
1917																				
1918																				
1919																				
1920	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3
1921	22.	22.	22.	22.	22.	22.	22.	22.	22.	.22.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1922	12.	16.	13.	10.	8.	9.	16.	42.	12.	10.	18.1	15.4	14.8	12.9	17.3	9.2	11.9	13.1	13.8	11.3
1923	71.	56.	55.	50.	52.	60.	54.	67.	76.	73.	35.	30.2	17.9	15.	11.5	6.0	17.7	27.7	6.0	14.6
1924	7.	21.	40.	35.	30.	10.	7.	6.	6.	4.	9.2	6.0	3.8	2.3	1.4	.4	.8	4.0	5.0	6.9
1925	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	30.8	35.2	41.7	26.5	26.7	16.5	16.0	16.3	15.6	16.0
1926	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.8	8.3	18.3	16.3	8.4	6.0	9.6	19.0	6.7	1.5
1927	10.	11.	15.	11.	21.	14.	23.	19.	17.	17.	22.5	19.4	21.0	28.8	34.0	24.4	22.7	28.8	14.6	7.9
1928	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	20.1	19.4	19.2	13.8	10.0	15.8	18.3	16.5	15.0	12.7
1929	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	19.2	18.3	13.3	12.7	7.5	4.8	6.7	15.0	8.5	16.0
1930	2.0	4.0	3.0	3.5	3.0	3.5	4.0	4.0	4.0	2.0	6.0	6.9	6.0	1.0	0.6	3.1	0.6	1.6	3.3	6.0
1931	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.2	3.8	4.2	1.0	1.0	1.5	0.3	0.4	0.5	0.1
1932	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	46.9	48.1	41.9	41.7	42.3	43.3	39.0	32.1	37.3	45.4
13-yr. Av.	9.5	10.0	11.4	10.1	10.5	9.1	9.7	12.3	10.6	9.8	20.0	19.9	19.3	16.9	16.1	13.8	14.8	17.1	13.4	14.4

M Manure applied

Appendix Table 6.—Crop Sequence No. 6—Sorghum, Small Grains, Leggumes for Crop(Corn, Small Grains, Legumes (1st Hay, 2nd Green Manure)

	Yield in pounds or bushels per acre of given crop																			
	LEGUMES (lbs.)										CORN									
											Alta	Gehu	Rain bow	Blue Flint Sorghum	Alta	Alta	N. W. Dent	Minn. 13	Dako-ta Sorghum	Alta
1912	4840 *	4840 *	4840 *	4840 *	4840 *	4840 *	4840 *	4840 *	4840 *	4840 *	37.4 *	18.1 †	11.6		22.5 *	26.5 *	11.4 *	12.5 *	*	17.6 *
1913	0 *	0 *	0 *	0 *	0 *	0 *	0 *	0 *	0 *	0 *	0. *	0. †	0.	0.	0. *	0. *	0. *	0. *	0. *	0. *
1914	940 *	870 *	830 *	760 *	820 *	820 *	920 *	980 *	880 *	900 *	0.	0.	0.	0.	0.	0.	0.	0. ‡	0. §	0.
1915		Hailed Oout									0.	0.	0.	0.	0.	0.	0.	0. ‡	0. §	0.
1916	500 *	1600 *	1200 *	1300 *	1100 *	940 *	600 *	600 *	600 *	1060 *	5.0	5.8	70.	10.0	15.4	14.5	7.6	4.1 ‡	3.9 §	7.5
1917	0 *	260 *	140 *	60 *	0 *	0 *	165 *	175 *	200 *	0 *	7.0	5.5	8.3	6.6	9.0	8.3	8.3	3.4 ‡	7.1 §	5.4
1918	1700	1420	860	640	1420	2550	1940	800	960	2200	15.5	23.3	31.3	26.3	26.4	22.1	20.9	19.4 ‡	16.3 §	17.4
1919	1900	2800	2460	2320	2500	2800	3320	2740	3160	3240	0.	0.	0.	0.	0.	0.	0.	0. ‡	0. §	0.
1920	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	18.6	23.0	16.6	21.5	19.4	20.9	20.7	11.7 ‡	20.5 §	17.8
1921	1600	1580	1840	2020	1600	1420	1940	2200	1930	1700	.2	0.	.4	.1	.1	.1	.1	.2 ‡	.1 §	.3
1922	3580	4540	3060	3520	5020	4570	4800	4210	3870	4400	15.7	23.2	40.0	35.9	23.6	22.1	24.4	30.5 ‡	22.8 §	15.3
1923	4800	2800	3950	3200	2700	3700	2700	4700	3600	3400	25.7	17.1	42.9	14.3	22.9	28.6	32.9	30.0	34.3	30.0
1924	2700	2900	2500	2800	3250	3150	2750	3050	2450	2200	3.0	5.1	2.7	4.3	2.9	2.3	2.7	2.4	1.8	2.7
1925	3910 *	2900 *	3060 *	3340 *	3440 *	3640 *	3980 *	2900 *	3010 *	3590 *	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1926	4600	4600	4600	4600	4600	4600	4600	4600	4600	4600	3.9	0.	0.	0.	5.3	5.4	0.	0.	0.	3.4
1927	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	23.6	16.4	21.4	10.6	30.4	29.9	25.0	20.7	25.0	22.9
1928	4200	4700	5000	5400	4500	4600	4600	4100	4000	4200	0.	0.2	0.5	2.1	0.2	0.3	0.2	0.	0.	0.2
1929	2860	3015	2033	2380	2970	3325	3340	4220	3625	3865	7.4	11.1	6.1	13.4	5.9	3.7	2.4	1.4	3.1	5.1
1930	0	0	0	0	0	0	0	0	0	0	4.9	2.4	1.1	0.1	1.3	1.9	0.6	1.4	0.7	1.6
1931	0	0	0	0	0	0	0	0	0	0	1.0	0.6	0.6	0.6	1.5	1.0	0.9	0.9	0.3	0.4
1932	0	0	0	0	0	0	0	0	0	0	4.3	7.1	12.9	16.4	10.7	10.7	5.0	12.9	10.7	10.7
21-yr. Av.	2365	2398	2281	2320	2395	2500	2477	2459	2345	2463	8.2	7.6	9.7	7.7	9.4	9.4	7.8	7.2	7.0	7.5
Legumes 8-yr. Av. Peas	1560	1699	1559	1525	1598	1719	1633	1499	1510	1700										
13-yr. Av. Sw. Cl.	2852	2828	2726	2808	2885	2980	2997	3050	2860	2933										

* Peas

† Flint
* Minn. No. 13
‡ Silver King
§ Minn. No. 23 or White Cap.

Appendix Table 6.—Crop Sequence No. 6.—Sorghum, Small Grains, Legumes for Crop, Corn, Small Grains, Legumes (1st Hay, 2nd Green Manure)

Yield in bushels per acre of given crop

	KAOLIANG										60 da Oats	60 da Oats	60 da Oats	60 da Oats	60 da Oats	60 da Oats		Gatami Barley		60 da Oats
				†			‡	‡	†		*				*	*	†	†	†	*
1912	12.4	14.0	15.0	21.5	12.8	15.6	0.8	1.2	24.6	5.4	12.2	9.7	8.1	11.2	11.6	10.9	2.3	2.7	2.9	17.2
			†	†				†	†		*				*	*	†	†	†	*
1913	2.0	1.0	0.	0.	3.0	1.9	1.8	0.	0.	2.4	0.3	4.6	5.0	4.4	0.5	0.6	1.3	0.6	0.2	1.1
			†	†				†	†											
1914	2.2	4.8	0.	0.	5.6	4.8	2.4	0.	0.	3.4	17.5	17.2	19.5	22.2	17.2	12.8	7.5	7.7	7.7	10.0
			†	†			†													
1915	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
			†	†			†													
1916	1.4	4.0	10.3	2.4	1.3	1.1	7.6	1.1	.4	.4	35.5	35.0	36.1	33.6	36.7	41.3	26.5	26.4	27.1	25.6
			†	†			†													
1917	0.1	0.6	0.5	0.5	0.2	0.3	0.9	0.7	1.7	0.1	21.9	20.3	8.3	27.3	23.5	28.5	5.5	18.8	20.3	24.7
1918	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	29.2	18.1	16.4	22.3	33.1	34.8	12.4	16.7	10.1	27.2
1919	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	29.7	27.8	33.6	36.9	36.6	33.9	21.0	20.5	15.4	17.5
1920	32.8	33.4	35.4	33.2	34.2	31.0	18.2	9.8	14.2	21.0	60.1	72.8	74.1	73.4	68.1	67.5	45.0	42.9	40.6	79.7
1921	19.8	24.0	18.4	10.8	8.9	12.1	13.7	12.8	9.6	9.0	0.	0.2	0.2	0.7	0.	0.	0.8	0.2	0.5	0.
1922	15.0	20.1	24.0	23.0	22.2	24.0	21.6	24.8	23.4	20.0	30.0	21.6	23.1	20.6	21.3	19.1	15.3	13.8	11.6	11.9
1923	65.0	68.8	63.6	67.2	69.2	71.0	55.8	67.4	59.2	58.6	30.3	40.9	50.6	56.6	48.7	48.4	47.3	46.9	37.3	39.1
	Dak.	Amber																		
1924	5.2	6.2	5.8	5.8	7.4	9.4	6.0	4.0	5.0	6.4	12.8	20.0	19.1	23.1	24.4	16.9	6.7	7.7	6.7	10.0
1925	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	17.2	11.3	10.9	17.2	18.1	14.4	11.3	10.8	5.8	11.3
1926	3.8	3.6	6.0	11.1	4.0	6.4	6.0	5.2	9.6	11.2	7.2	10.0	22.4	20.0	3.9	1.1	0.4	0.7	0.3	3.3
1927	25.2	27.8	33.4	35.4	41.2	37.8	34.2	42.2	38.4	42.4	38.1	40.6	42.8	40.3	43.4	35.3	38.3	35.2	38.5	49.4
1928	0.5	0.4	0.5	0.4	0.5	0.5	0.6	0.4	0.6	0.4	23.1	20.3	21.4	25.9	23.0	21.9	4.8	3.3	2.6	10.1
											Acme	Khark-of	60 day	Gata-mi	Kota	Acme	Swe-dish	Swe-dish	Swe-dish	Acme
1929	1.6	2.4	2.1	2.4	1.6	2.1	1.4	2.0	1.2	2.2	20.2	15.5	37.8	19.0	16.8	19.7	4.1	6.1	6.8	17.3
1930	13.4	16.6	13.6	10.4	10.6	13.4	13.0	15.2	16.0	17.2	3.5	5.7	7.8	9.6	2.5	3.2	8.0	8.0	8.0	3.8
1931	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.3	4.1	2.5	5.8	3.1	3.5	2.5	3.6	3.8	4.8
1932	15.0	8.6	19.8	17.4	14.8	17.4	12.4	11.8	10.8	154.	30	8.7	72.8	41.0	26.2	31.7	16.6	15.4	15.2	27.5
21-yr. Av.	10.2	11.3	11.8	11.5	11.3	11.8	9.4	9.5	10.2	10.3	21.5	21.8	23.0	25.6	24.1	22.8	14.5	15.0	17-yr Av. 13.4	19.9
12-yr. Ave. Kaoliang 9-yr. Av.	12.6	14.2			13.1	13.5				10.0										
Dak. Ambeer	7.2	7.3	9.0	9.2	8.9	9.7	8.2	9.0	9.1	10.6	4-yr. Av. 14.3	8.5	30.2	18.9	12.2	14.5	7.8	8.3	8.5	13.4

† Corn
‡ Kaffir

* Swedish Select
† Manchuria

Appendix Table 6.—Crop Sequence No. 6.—Sorghum, Small Grains, Legumes for Crop, Corn, Small Grains, Legumes (1st hay, 2nd Green Manure)

Yield in bushels per acre of given crop

WHEAT AND RYE (rate of seeding)

Year	Acme	Kharkof 3 pk.	Kharkof 4 pk.	Kharkof 5 pk.	Kota	Acme	Swedish 3 pk.	Swedish 4 pk.	Swedish 4 pk.	Acme
	*	*	*	*	*	*	†	†	†	‡
1912	0.3	0.5	0.8	1.2	0.5	1.0				0.2
	*	‡	‡	‡	*	*				‡
1913	3.5	1.0	0.2	0.1	0.7	0.5	0.2	0.3	0.8	0.3
	*	‡	‡	‡	*	*				‡
1914	4.7	0.	0.	0.	2.0	1.3	8.9	7.8	7.7	2.3
	†	‡	‡	‡	†	†				†
1915	0.	3.0	4.7	4.7	0.	0.	10.7	8.7	9.3	0.
	†	‡	‡	‡	†	†				†
1916	11.3	0.	0.	0.	15.1	15.7	32.3	24.5	37.1	10.6
	†	‡	‡	‡	†	†				†
1917	2.5	0.	0.	0.	2.7	2.2	0.	0.	0.	2.0
	†	‡	‡	‡	†	†				†
1918	7.3	0.	0.	0.	6.3	6.7	13.5	11.3	16.1	5.4
	†		£	£	†	†				†
1919	14.0	20.0	22.7	27.0	11.7	14.0	9.0	9.5	13.2	11.5
			£	£	✠					
1920	30.2	13.8	17.3	17.2	29.3	27.5	16.3	18.4	18.6	31.7
			£	£						
1921	T	T	T	T	T	T	T	T	T	T
			£	£						
1922	8.2	0.	0.	0.	11.5	12.7				9.2
			£	£						
1923	17.7	3.7	2.7	5.2	20.2	22.2	0.	0.	0.	16.3
			£	£						
1924	6.8	12.0	8.5	10.7	12.3	7.7	13.5	14.3	12.3	8.7
			£	£						
1925	20.8	5.2	1.5	2.0	8.7	6.2	6.1	6.3	5.9	3.0
			£	£						
1926	6.8	2.0	1.7	3.7	2.0	2.2	0.5	1.3	0.9	3.9
			£	£						
1927	36.7	0.	0.	0.	19.7	37.3	21.3	21.8	16.1	37.8
			£	£						
1928	10.7	11.7	11.0	15.5	9.8	14.0	9.0	8.1	7.0	7.0
			60 day	Gatmi						
1929	19.7	21.5	41.3	20.4	13.3	16.3	3.8	3.0	3.2	12.8
1930	5.3	8.3	15.9	15.8	4.5	3.3	14.4	13.8	15.3	3.7
1931	1.7	5.3	5.9	6.9	1.5	1.9	2.3	2.2	1.3	2.3
1932	29.0	4.2	57.2	44.2	28.0	28.0	16.1	17.9	19.8	28.8
4-yr. Av.	13.9	9.8	30.1	21.8	11.8	12.4	9.2	9.2	9.9	11.9
	21-yr. Av. 11.3	20-yr. Av. of Winter Wheat 5.6				21 yr. Av. 10.5	20 yr. Av. 8.9	20 yr Av. 8.5	20 yr. Av. 9.2	21 yr. Av. 9.4

* Preston
† Kubanka
‡ Turkey
£ Kharkof
✠ Acme

Appendix Table 7.—Crop Sequence No. 7.—Corn, Wheat

Yield in bushels per acre of given crop

	CORN										WHEAT									
1912	13.5	21.4	30.3	30.0	21.9	21.	21.9	19.0	21.8	25.8	0.3	1.3	2.2	1.7	0.5	0.5	3.2	2.3	2.0	5.8
1913	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1914	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.8	4.2	5.2	3.5	4.5	1.7	4.0	4.8	4.2	3.8
1915	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1916	3.5	7.4	9.4	8.8	10.3	8.8	3.8	4.3	4.5	2.8	9.9	13.0	9.4	14.1	13.7	15.5	13.8	13.6	15.3	12.4
1917	0.4	0.8	1.6	1.3	1.0	0.6	0.6	0.9	0.5	0.3	.3	0.8	1.2	0.8	1.8	2.5	2.8	0.5	0.8	1.8
1918	15.5	20.2	21.3	21.8	21.1	23.0	21.8	22.9	22.9	21.3	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1919	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.3	11.5	12.8	12.6	10.1	12.6	10.6	12.7	15.0	14.1
1920	16.0	20.9	21.3	15.1	21.0	20.8	21.3	18.8	20.4	17.4	30.5	31.0	30.3	30.8	30.2	31.7	29.2	32.2	33.2	29.0
1921	0.	0.3	0.3	0.7	0.4	0.5	1.3	0.4	0.6	0.4	0.1	0.7	0.8	0.8	0.6	0.5	0.4	0.5	0.5	0.6
1922	14.3	14.3	15.7	17.1	14.3	17.1	17.1	11.4	20.0	18.6	10.7	9.5	9.4	12.2	9.5	9.7	9.2	9.4	8.5	9.7
1923	37.5	40.7	40.7	41.4	42.3	45.5	40.0	41.1	39.6	41.6	24.7	28.3	26.3	26.8	31.2	24.3	27.3	29.5	28.3	19.3
1924	5.9	7.1	10.4	13.4	9.1	10.7	9.8	9.8	9.3	6.4	9.3	11.7	12.0	12.8	12.8	10.8	12.3	9.5	12.2	10.2
1925	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.8	5.5	6.3	5.3	6.7	7.7	7.8	7.3	7.7	3.3
1926	0.	0.4	0.9	2.3	4.0	7.1	6.3	6.0	4.3	1.2	3.9	2.2	3.7	3.5	5.2	2.7	4.1	5.2	5.5	4.1
											Acme	**Kota**	**Cer-es**	**Khar-kof**	**Swe-dish**	**Sixty Day**	**Cole**	**Rich-land**	**Gat-ami**	**Odes-sa**
1927	18.6	21.0	26.1	30.4	28.3	26.3	25.0	25.7	25.0	16.4	19.2	29.0	25.7	0.	12.3 A	44.4 a	49.7 b	60.9 c	25.0 d	31.9 e
1928	0.4	0.9	2.6	2.1	2.6	3.0	1.4	3.1	2.7	1.9	9.7	12.3	10.2	6.7	8.8 A	32.8 a	30.9 b	28.4 c	4.4 d	7.5 e
1929	6.0	8.1	14.9	16.1	17.4	11.0	12.1	10.9	13.3	9.1	15.5	17.7	18.7	15.5	3.4 A	30.0 a	34.7 b	29.4 c	16.0 d	9.6 e
1930	8.6	12.9	12.9	14.3	18.6	10.0	12.9	8.6	12.9	8.6	4.5	6.5	11.2	6.5	17.5 A	9.7 a	20.3 b	15.3 c	12.9 d	9.8 e
1931	1.0	1.7	1.6	2.7	1.9	1.3	1.4	1.4	1.7	1.9	2.1	3.5	3.1	1.8	3.2 A	4.4 a	5.9 b	5.9 c	8.8 d	1.5 e
1932	11.4	12.0	12.3	13.1	15.4	10.6	12.3	17.4	19.1	13.7	26.7	28.7	27.7	3.0	24.3 A	75.0 a	52.5 b	74.4 c	51.7 d	49.2 e
Av.	7.3	9.1	10.6	11.0	10.9	10.4	10.0	9.6	10.4	8.9	8.7	10.4	10.3	7.5	8.5	8.0	8.3	8.5	8.9	7.6

A Swedish Rye
a Sixty Day
b Cole
c Richland
d Gatami
e Odessa

Appendix Table 6.—Crop Sequence No. 6.—Sorghum, Small Grains, Legumes for Crop, Corn, Small Grains, Legumes (1st Hay, 2nd Green Manure)

	Yield in pounds per acre of given crop									
	LEGUMES (for green manure) Cut and Weigh Plot No. 6									
	Sw. Cl.	Sw. Cl.	Sw. Cl.	Sw. Cl	Sw. Cl.	Sw. Cl.	Sw. Cl.	Sw. Cl,	Sw. Cl.	Sw. Cl.
						*				
1912						5650				
1913						670				
1914						1100				
						*				
1915						420				
1916						1288				
1917						660				
1918						1150				
1919						2240				
1920						7900				
1921						6100				
1922						8700				
1923						7150				
1924						2250				
1925						2560				
						†				
1926						974				
1927	4670	3960	4350	4730	4330	4780	4580	4820	5350	4860
1928	1200	1500	1700	2200	1900	7440	2300	2700	2500	1900
1929	100	200	300	500	600	8100	600	300	200	100
1930						3820				
1931						0				
1932						0				
21-yr. Av.Legumes						3474				
3-yr. Av. Peas						2348				
17-yr. Av. Sw. Cl.						3877				
1-yr. Soybean						974				

Appendix Table 8.—Crop Sequence No. 8.—Continuous Small Grains (Method of Tillage)

	Yield in bushels per acre of given crop									
Year	Acme Wheat FP6″HH	Sixty Day Oats FP6″HH	Gatami Barley FP6″HH	Acme Wheat FP6″HH	Acme Wheat DDHH	Sixty Day Oats DDHH	Odessa Barley DDHH	Acme Wheat SpP5″HH	Sixty Day Oats SpP″5HH	Odessa Barley SpP5″HH
	*	*	*	*	*	*	*	*	*	*
1912	0.6	0.5	0.5	1.0	.8	1.3	1.5	1.2	1.3	0.8
	*	*	*	*	*	*	*	*	*	*
1913	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	*	*	*	*	*	*	*	*	*	*
1914	2.3			1.8	2.3			2.0		
	†	†		†	†			†		
1915	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	†		†	†	†			†		
1916	6.3	11.6	12.4	6.8	12.0	29.1	17.5	12.7	38.9	21.5
	†		†	†	†			†		
1917	0.	0.3	1.5	0.	0.	0.	2.3	0.	0.5	1.7
	†			†	†			†		
1918	0.	0.	2.9	2.0	0.	0.	2.6	0.	0.	2.2
	†			†	†			†		
1919	2.8	13.3	5.4	3.3	6.4	16.4	8.5	5.2	16.7	4.6
1920	27.7	73.1	31.5	29.0	30.2	71.9	35.8	30.2	74.7	33.5
1921	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1922	6.3	2.1	8.4	6.2	6.5	10.9	3.1	5.5	8.8	3.5
1923	13.3	37.5	27.5	10.5	10.3	40.3	12.5	17.0	35.9	21.9
1924	6.0	20.3	13.5	5.5	5.2	12.5	12.9	3.0	7.2	7.1
1925	1.8	7.2	3.3	3.2	3.2	7.8	3.5	5.0	6.6	5.8
1926	0.9	0.6	0.2	2.9	0.8	0.8	0.3	4.2	2.2	1.9
1927	24.7	25.0	21.0	24.2	28.3	28.1	14.8	26.8	23.4	14.4
1928	1.8	8.6	6.7	4.4	17.3	20.5	6.4	7.5	14.2	5.6
1929	8.0	14.4	5.6	10.0	11.0	18.4	11.7	13.0	20.3	12.7
1930	5.7	10.3	9.0	5.7	5.7	16.6	11.9	6.2	16.3	13.1
1931	4.8	2.8	11.4	5.8	4.7	2.5	4.0	4.0	2.5	7.5
1932	23.2	52.8	26.9	26.3	19.3	55.9	35.8	21.3	46.6	36.5
Av. 21-yr.	6.5			7.1	7.8			7.9		
13-yr.	9.6	19.6	12.7	10.4	11.1	22.0	11.7	11.2	19.9	12.6

* Preston
† Kubanka

Appendix Table 9—Crop Sequence No. 9.—Rye, Corn, Winter Wheat, Sorghum (Tillage Test)

	Yield In Bushels Per Acre of Given Crop							
Year	Sorghum FP5 in.	Rye FP5 in.	Corn FP5 in.	Wheat FP5 in.	Sorghum FP10 in.	Rye FP10 in	Corn FP10 in. DDHH	Wheat FP10 in. DDHH
1912								
1913								
1914	4.6	Not in	0.	Not in	2.6	Not in	0.	Not in
1915	0.	5.6	0.	Not in	0.	2.3	0.	Not in
1916	0.1	15.7	12.	8.6	0.4	7.9	.7	5.8
1917	0.	0.	2.7	0.	0.	0.	2.5	0.
1918	.8	18.9	11.0	15.2	.8	14.1	13.0	11.4
1919	2.0	8.2	0.	11.2	1.8	10.4	0.	11.4
1920	9.5	13.6	20.1	17.6	16.0	15.9	11.6	12.5
1921	6.8	0.	0.5	6.6	.8	0.	0.	2.9
1922	24.8	3.0	11.7	5.2	24.4	4.6	13.4	8.9
1923	23.9	19.7	15.5	12.9	20.1	12.8	26.7	19.3
1924	37.2	6.8	9.0	31.2	32.8	6.8	24.6	30.1
1925	2.2	2.1	.0	4.3	1.2	5.5	0.	4.2
1926	8.1	7.0	3.6	6.7	5.1	2.0	6.2	5.7
1927	4.0	9.0	21.1	0.	2.5	7.0	26.4	0.
1928	0.	6.7	4.8	12.8	0.	3.9	0.5	10.7
1929	5.6	9.3	1.5	15.7	8.9	11.0	0.5	16.4
1930	2.5	12.6	0.7	9.6	3.6	12.2	1.1	6.3
1931	0.8	3.1	3.8	0.5	0.3	2.0	3.3	0.8
1932	9.7	18.9	18.1	20.0	7.5	18.2	10.0	19.9
17-yr. Av.	7.9	8.9	7.6	10.5	6.8	7.6	6.9	9.8

Appendix Table 10—Crop Sequence No. 10—Forage Method of Planting (Millet, Sudan and Sorghum) Oats

	Yield in bushels per acre of given crop					Oats following sorghum				
Year	Dak. Amber Sorghum 42 in rows	Dak. Amber Sorghum Solid	Dak. Amber Sorghum 42 in rows	Dak. Amber Sorghum Solid	Dak. Amber Sorghum 42 in rows	Oats 60 day	Oats 60 day	Oats 60 day	Oats 60 day	Oats 60 day
	4843*									
1920	31.4									
	1056*									
1921	4.2									
	3773*									
1922	20.1									
	4887*	3754*								
1923	41.9	18.0								
	1310*	712*	1310*	712*	1310*					
1924	8.0	1.9	8.0	1.9	8.0					
	400*	190*	500*	240*	330*					
1925	0.	0.	0.	0.	0.	9.7	8.8	11.9	13.1	11.9
	815*	2575*	1990*	1615*	1665*					
1926	7.7	1.7	1.8	0.9	3.9	5.0	2.8	4.4	1.9	2.8
	3220*	2740*	1320*	3310*	2950*					
1927	15.6	19.2	19.6	13.8	21.0	15.4	13.8	26.6	18.4	24.8
	1000*	600*	1100*	1200*	1300*					
1928	0.2	0.	0.1	0.	0.1	21.6	21.4	24.5	16.1	19.7
	1110*	1465*	900*	1270*	550*					
1929	1.8	4.7	0.4	0.6	2.3	21.3	18.8	22.8	18.4	18.1
	3410*	3525*	3625*	3600*	3720*					
1930	2.6	0.7	2.7	0.8	2.4	8.8	5.3	5.0	4.4	2.6
	1050*	850*	1450*	1000*	1180*					
1931	5.0	3.0	9.0	2.0	4.4	0.7	0.4	0.3	0.1	0.
	2030*	1870*	1290*	1500*	740*					
1932	5.4	2.6	8.2	2.0	10.2	50.3	39.1	46.6	27.2	38.4
No. Yrs. Av.	13 yr. 11.1	10 yr. 5.2	9 yr. 5.5	9 yr. 2.4	9 yr. 5.8	8 yr. 16.6	8 yr. 13.8	8 yr. 17.8	8 yr. 12.5	8 yr. 14.8
8-yr. Av. Seed	4.8	4.0	5.2	2.5	5.5	16.6	13.8	17.8	12.5	14.8
8-yr. Av. Straw	1629*	1727*	1522*	1717*	1554*					

* Straw Wgt.

Appendix Table 10—Crop Sequence No. 10—Forage Method of Planting (Millet, Sudan and Sorghum) Oats

	Yield in bushels per acre of given crop					Oats following millet				
Year	Millet 3 row 36" Shelley	Millet Solid Shelley	Millet 3 row 36" Shelley	Millet Solid Shelley	Millet 3 row 36" Shelley	60 day Oats	60 day Oats	60 day Oats	60day Oats	60day Oats
	1412*	1472*								
1920	26.5	25.0								
	506*	959*								
1921	2.1	1.4								
	1665*	1892*								
1922	28.2	35.2								
	2838*	Not								
1923	38.2	planted								
	532*	610*	532*	610*	532*					
1924	2.5	0.8	2.5	0.8	2.5					
	0*	0*	0*	0*	0*					
1925	0.	0.	0.	0.	0.	11.9	11.9	10.0	10.3	10.9
	1245*	1290*	970*	1955*	1365*					
1926	1.1	0.3	0.9	1.4	2.3	5.0	4.8	6.3	7.5	9.4
	2580*	2260*	970*	160*	660*					
1927	15.4	13.8	26.6	18.4	24.8	8.2	12.0	11.2	13.4	11.4
	900*	300*	1000*	500*	400*					
1928	T	O	T	O	O	22.3	23.0	22.0	14.4	13.4
	1060*	270*	1570*	830*	1580*					
1929	2.8	0.6	2.6	1.4	2.4	16.6	14.4	19.4	15.3	10.9
	535*	670*	645*	835*	650*					
1930	1.3	2.6	2.3	3.3	2.2	8.8	2.2	5.6	1.5	1.9
	250*	445*	295*	365*	365*					
1931	0.2	1.1	0.5	0.3	0.3	1.6	0.9	2.2	0.9	1.2
	3070*	3420*	3490*	3400*	2990*					
1932	8.6	5.6	10.2	10.0	10.2	50.9	51.6	48.4	35.3	40.6
No. Yrs.	13 yr.	12 yr.	9 yr.	9 yr.	9 yr.	8 yr.	8 yr.	8 yr.	8 yr.	8 yr.
Av.	9.8	7.2	5.1	4.0	5.0	15.7	15.1	15.6	12.3	12.5
8-yr. Av. Seed	3.7	3.0	5.4	4.5	5.3	15.7	15.1	15.6	12.3	12.5
8-yr. Av. Straw	1205*	1082*	118*	1006*	1001*					

* Straw Wgt.

Appendix Table 10—Crop Sequence No. 10—Forage Method of Planting (Millet, Sudan and Sorghum) Oats

	Yield in bushels per acre of given crop									
Year	Sudan 42" rows	Sudan Solid	Sudan 42" rows	Sudan Solid	Sudan 42" rows	Oats 60 day	Oats 60 day	Oats 60 day	Oats 60 day	Oats 60 da
	1642*	1302*								
1920	8.0	5.4								
	344*	433*								
1921	3.1	1.8								
	849*	1232*								
1922	10.4	16.2								
	2843*	1751*								
1923	6.2	6.9								
	460*	342	460*	342*	460*					
1924	11.6	5.5	11.6	5.5	11.6					
	650*	600*	670*	220*	620*					
1925	0.	0.	0.	0.	0.	11.9	11.9	10.0	8.1	[illegible]
	1170*	1050*	1535*	1500*	725*					
1926	6.6	5.0	7.3	9.2	2.3	1.1	1.3	2.2	4.1	.5
	2290*	2600*	2430*	2430*	2530*					
1927	8.2	12.0	11.2	13.4	11.4	15.6	19.2	19.6	13.[illegible]	[illegible].0
	800*	900*	1200*	700*	1300*					
1928	T	O	T	O	T	20.8	15.2	17.2	14.[illegible]	12.5
	715*	825*	795*	720*	595*					
1929	2.1	1.5	1.7	0.8	1.3	18.4	15.3	18.1	1[illegible].2	15.3
	2085*	1990*	2395*	1897	3085*					
1930	0.3	0.1	0.1	0.1	0.3	5.0	2.8	5.9	[illegible].1	2.8
	185*	150*	217*	152*	150*					
1931	0.7	0.2	0.5	0.2	0.2	4.1	3.7	3.9	[illegible].5	0.1
	1640*	1590*	1430*	1770*	1050*					
1932	1.2	2.2	1.4	2.6	3.0	38.4	26.6	33.8	3[illegible].4	37.2
No. Yrs.	13 yr.	13 yr.	9 yr.	9 yr.	9 yr.	8 yr.	8 yr.	8 yr.	[illegible] yr.	8 yr.
Av.	4.5	4.4	3.8	3.5	3.3	14.4	12.0	13.8	11.3	14.5
8-yr.Av Seed	2.4	2.6	2.8	3.3	2.3	14.4	12.0	13.[illegible]	11.3	14.5
8-yr. Av. Straw	1192*	1213*	1402*	1174*	1257*					

* Straw Wgt.

Appendix Table 11—Crop Sequence No. 14—Forage (Alfalfa, Grasses, & Combinations of Them)

Yield in bushels per acre of given crop						
Year	Brome	Grimm plus Slender Wheat	Grimm plus Brome	Grimm	Grimm plus Native	Native Grass
1915						1890
1916						835
1917						954
1918	741	1308	1314	1290	960	920
1919	1214	1130	1078	1000	657	438
1920	649	2780	2240	2481	894	1026
1921	140	604	546	480	404	740
1922	764	4264	3634	3934	2544	680
1923	740	3120	3045	2340	1905	
1924	425	575	835	950	780	
1925	0	0	0	0	0	
1926	110	986	1100	1320	860	
1927	540	1960	2150	1140	1800	
1928	0	650	510	880	880	
1929	Seeded	Seeded	Seeded	Seeded	730	
1930	0	990	1020	1330	740	
1931	706	2150	1785	2230	1240	
						Discontinued 1923-31
1932	706	2150	1785	2230	1240	930
						9-yr. Av. 1915-22
15-yr. Ave.	440	1394	1308	1322	983	933

Appendix Table 11.—Stages of Cutting Alfalfa (Cossack)

Yield in pounds				
Year	Bud	1-10th bloom	½ bloom	Full Bloom
1926	2737	3377	2376	3730
1927	6270	6340	6930	7490
1928	1950	1840	1500	1215
1929	6245	4240	2830	4410
1930	3020	2980	2720	2360
1931	3020	2980	2720	2360
1931	2070	1850	1800	1780
1932	5521	7700	7040	6310
7-yr. Av.	3973	4046	3599	3899

Appendix Table 12—Alfalfa Varieties

Average yields in pounds per acre of all varieties										
Year	Turkestan SD240	Turkestan SD240	Oren-burg SD55	N. Sweden SD54	Turkestan	Turkestan	N. Sweden	Oren burg	Turkestan	Turkestan
1917	24	24	24	24	24	24	24	24	24	24
1918	828	828	828	828	828	828	828	828	828	828
1919	1158	1158	1158	1158	1158	1158	1158	1158	1158	1158
1920	1242	1242	1242	1242	1242	1242	1242	1242	1242	1242
1921	244	244	244	244	244	244	244	244	244	244
1922	3038	3038	3038	3038	3038	3038	3038	3038	3038	3038
1923	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430
1924	550	550	550	550	550	550	550	550	550	550
1925	170	170	170	170	170	170	170	170	170	170
1926	1184	1184	1184	1184	1184	1184	1184	1184	1184	1184
1927	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920
1928	510	510	510	510	510	510	510	510	510	510
1929	904	904	904	904	904	904	904	904	904	904
1930	450	450	450	450	450	450	450	450	450	450
14-yr. Av.	1047	1047	1047	1047	1047	1047	1047	1047	1047	1047

Appendix Table 12—Methods of Seeding Alfalfa Varieties

Average yields in pounds per acre from given method of seeding

S. D. COMMON NO. 12

Year	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Solid 6″	Solid 6″	Solid 6″	Solid 6″	Solid 6″
1917	520	520	520	520	520	532	532	532	532	532
1918	854	854	854	854	854	854	854	854	854	854
1919	1929	1929	1929	1929	1929	717	717	717	717	717
1920	1090	1090	1090	1090	1090	1276	1276	1276	1276	1276
1921	768	768	768	768	768	312	312	312	312	312
1922	2716	2716	2716	2716	2716	3140	3140	3140	3140	3140
1923	3220	3220	3220	3220	3220	2740	2740	2740	2740	2740
1924	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
1925	250	250	250	250	250	250	250	250	250	250
1926	760	760	760	760	760	760	760	760	760	760
1927	2166	2166	2166	2166	2166	2166	2166	2166	2166	2166
1928	600	600	600	600	600	600	600	600	600	600
1929	1600	1600	1600	1600	1600	680	680	680	680	680
1930	1240	1240	1240	1240	1240	700	700	700	700	700
14-yr. Av.	1347	1347	1347	1347	1347	1134	1134	1134	1134	1134

Appendix Table 12—Methods of Seeeding Alfalfa Varieties

Average yields in pounds per acre from given method of seeding

SEMIPALATINSK

Year	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Solid 6″	Solid 6″	Solid 6″	Solid 6″	Solid 6″
1917	0	0	0	0	0	1012	1012	1012	1012	1012
1918	0	0	0	0	0	488	488	488	488	488
1919	674	674	674	674	674	774	774	774	774	774
1920	832	832	832	832	832	1568	1568	1568	1568	1568
1921	380	380	380	380	380	56	56	56	56	56
1922	4338	4338	4338	4338	4338	3008	3008	3008	3008	3008
1923	4300	4300	4300	4300	4300	2200	2200	2200	2200	2200
1924	2000	2000	2000	2000	2000	0	0	0	0	0
1925	0	0	0	0	0	0	0	0	0	0
1926	1850	1850	1850	1850	1850	362	362	362	362	362
1927	2780	2780	2780	2780	2780	1960	1960	1960	1960	1960
1928	650	650	650	650	650	650	650	650	650	650
1929	2180	2180	2180	2180	2180	540	540	540	540	540
1930	1940	1940	1940	1940	1940	120	120	120	120	120
14-yr. Av.	1566	1566	1566	1566	1566	910	910	910	910	910

Appendix Table 12—Methods of Seeding Alfalfa Varieties

Average yields in pounds per acre from given method of seeding

COSSACK

Year	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Rows 36″	Solid 6″	Solid 6″	Solid 6″	Solid 6″	Solid 6″
1917	1164	1164	1164	1164	1164	956	956	956	956	956
1918	1120	1120	1120	1120	1120	1020	1020	1020	1020	1020
1919	1372	1372	1372	1372	1372	856	856	856	856	856
1920	884	884	884	884	884	1812	1812	1812	1812	1812
1921	520	520	520	520	520	220	220	220	220	220
1922	2788	2788	2788	2788	2788	4248	4248	4248	4248	4248
1923	2530	2530	2530	2530	2530	2600	2600	2600	2600	2600
1924	660	660	660	660	660	480	480	480	480	480
1925	0	0	0	0	0	0	0	0	0	0
1926	1158	1158	1158	1158	1158	1054	1054	1054	1054	1054
1927	1900	1900	1900	1900	1900	1035	1035	1035	1035	1035
1928	460	460	460	460	460	460	460	460	460	460
1929	210	210	210	210	210	1200	1200	1200	1200	1200
1930	940	940	940	940	940	620	620	620	620	620
14-yr. Av.	1122	1122	1122	1122	1122	1183	1183	1183	1183	1183

Appendix Table 12—Methods of Seeding Alfalfa Varieties

Average yields in pounds per acre from given method of seeding

GRIMM

Year	Rows 36"	Rows 36"	Rows 36"	Rows 36"	Rows 36"	Solid 6"	Solid 6"	Solid 6"	Solid 6"	Solid 6"
1916	0.9	0.9	0.9	0.9	0.9	0.47	0.47	0.47	0.47	0.47
1917	868	868	868	868	868	660	660	660	660	660
1918	1306	1306	1306	1306	1306	1200	1200	1200	1200	1200
1919	1872	1872	1872	1872	1810	2500	2500	2500	2500	2500
1920	1210	1210	1210	1210	1272	888	888	888	888	888
1921	720	720	720	720	720	440	440	440	440	440
1922	4748	4748	4748	4748	4748	4494	4494	4494	4494	4494
1923	3620	3620	3620	3620	3620	3220	3220	3220	3220	3220
1924	920	920	920	920	920	640	640	640	640	640
1925	0	0	0	0	0	0	0	0	0	0
1926	2140	2140	2140	2140	2148	1348	1348	1348	1348	1348
1927	3616	3616	3616	3616	3616	3616	3616	3616	3616	3616
1928	730	730	730	730	730	730	730	730	730	730
1929	540	540	540	540	540	1100	1100	1100	1100	1100
1930	1180	1180	1180	1180	1180	1060	1060	1060	1060	1060
14-yr. Av.	1676	1676	1676	1676	1676	1564	1564	1564	1564	1564

Appendix Table 12—Methods of Seeding Alfalfa Varieties

Average yields in pounds per acre from given method of seeding

TURKESTAN

Year	Solid 6"	Rows 12"	Rows 36"	Rows 44"	Rows 44"	Solid 6"	Rows 12"	Rows 36"	Rows 44"	Rows 44"
1917	460	360	740	1040	850	660	850	960	1200	890
1918	1009	1460	1520	1830	1830	1160	680	1350	1480	940
1919	2280	1400	1910	2040	2520	2090	3120	3020	2830	1890
1920	1780	1490	1090	1270	1500	2080	2740	1780	1610	1350
1921	280	520	880	760	940	540	940	920	900	620
1922	5100	3900	4000	4900	4400	6100	7100	5800	4900	4750
1923	3400	2450	2300	2850	2800	3650	4900	4650	2500	2800
1924	1400	1100	500	1100	900	1400	2650	1500	1100	1150
1925	0	0	0	0	0	0	0	0	0	0
1926	2820	2820	3780	3780	3780	3330	3330	5300	5300	5300
1927	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430
1928	190	190	190	190	190	190	190	190	190	190
1929	1600	1300	500	650	1500	2500	2500	1350	1250	1100
1930	1400	1200	1400	1600	2200	1400	2300	2700	1400	1800
14-yr. Av.	1724	1473	1517	1746	1853	1966	2409	2282	1936	1801

Appendix Table 13.—South Dakota Farm Price Per Unit For Given Crops For Given Years (Dec. 1)
(Mainly from Yearbooks, U. S. Department of Agriculture)

Year	Corn per bushel	Wheat per bushel	Barley per bushel	Oats per bushel	Flax per bushel	Rye per bushel	Winter Wheat per bushel	Potatoes per bushel	Sweet Clover Seed per bushel	Millet per bushel	Sweet clover, sudan, tame, or western wheat-grass hay. Per T	Sorghum or corn forage per ton	Alfalfa hay per ton	Millet hay per ton
1912	$0.37	$0.69	$0.42	$0.25	$1.13	$0.52	$	$0.36	$9.00	$0.68	$6.10	$4.07	$8.13	$5.24
1913	.56	.71	.46	.34	1.20	.50	.71	.63	7.70	.68	6.50	4.33	8.67	5.69
1914	.50	.94	.50	.38	1.23	.78	.94	.47	8.12	.68	5.70	3.80	7.60	4.99
1915	.49	.86	.46	.28	1.67	.76	.86	.35	10.01	.68	5.30	3.53	7.07	4.64
1916	.77	1.50	.83	.46	2.47	1.18	1.50	1.37	9.40	.68	5.40	3.60	7.20	4.73
1917	1.20	1.96	1.10	.61	2.99	1.55	1.96	1.11	13.53	.88	10.60	7.07	14.14	9.28
1918	1.10	1.99	.78	.59	3.25	1.41	1.99	.93	20.67	1.00	10.00	6.67	13.34	8.75
1919	1.19	2.40	1.15	.63	4.25	1.25	2.40	1.90	27.63	1.00	13.50	9.00	18.00	11.81
1920	.42	1.15	.52	.33	1.65	1.09	1.15	.97	5.70	.38	8.50	5.67	11.34	7.44
1921	.26	.87	.29	.20	1.39	.58	.87	1.07	3.00	.38	6.40	4.27	8.54	5.60
1922	.50	.92	.42	.32	2.01	.58	.92	.44	4.29	.50	7.50	5.00	10.00	6.56
1923	.52	.81	.40	.31	2.08	.49	.81	.44	5.82	.75	8.10	5.40	10.80	7.09
1924	.80	1.25	.64	.40	2.23	1.02	1.25	.48	4.83	.75	8.90	5.93	11.87	7.89
1925	.60	1.28	.47	.28	2.25	.67	1.28	1.80	4.50	1.00	11.00	7.33	14.67	9.62
1926	.58	1.18	.52	.36	1.90	.73	1.18	1.59	7.30	.75	13.00	8.66	17.34	11.37
1927	.57	1.06	.58	.36	1.85	.79	1.06	.55	4.20	.58	7.60	5.07	10.13	6.65
1928	.62	.85	.48	.33	2.01	.79	.85	.40	3.00	.58	8.20	5.47	10.94	7.18
1929	.62	.93	.45	.34	2.80	.76	.93	1.15	3.30	.50	8.70	5.80	11.60	7.61
1930	.47	.46	.29	.21	1.33	.25	.46	.95			8.50	5.67	11.34	7.44
1931	.41	.48	.32	.22	1.17	.33	.48	.57			8.00	5.33	10.67	7.00
1932	.13	.30	.13	.09	.82	.15	.30	.25			4.25	2.83	5.67	3.72

Millet prices, based (1917-1930) on price per cwt. paid by a local firm in Brookings, S. D. Prices supplied by courtesy from their records. Sweetclover seed: 1912-1919, inclusive, U. S. farm price for Dec. on all clover; 1920-1929 include hay whatever kind, the prices for the other years being classified as clover hay. In the present bulletin, Sudan hay, tame hay, and western wheat or native grass hay are considered as having the same value as sweet clover hay; sorghum and corn forage are considered as having one-half the value of alfalfa hay; millet hay is considered as having a value of nearly two-thirds that of alfalfa hay.

Pierre Clays

The soil varies considerably in texture as well as in color, but the sticky nature is a constant feature. In texture the material ranges from a silty clay loam through a silty clay to a heavy clay.

The color is usually a yellowish dark brown, but varies from a decided yellow on the one extreme to a black on the other. Frequently a thin surface covering of ashy gray to white is found.

The subsoil which is encountered at a depth of six to ten inches, is a silty clay to heavy clay of a gray to yellowish-brown color. In some areas it is almost black. It is often mottled with white spots of lime, making these areas quite calcareous. Soft shale is usually encountred at three to six feet below the surface and on some of the badly eroded areas comes to the surface.

A very characteristic feature throughout the area of the Pierre clays is the cracking of the soils upon drying. In general, the heavier the texture the larger the cracks which will be formed. In some instances these extend to a depth of several feet. This tendency to crack or granulate causes the surface soil to become very loose and is a valuable property, as it enables the farmer to secure a proper seed been much more readily than could be done otherwise. It also permits the rains to enter much more easily.

The Pierre clays are derived by weathering and the addition of organic matter from the Pierre shales.—U.S.D.A. Bureau of Soils. Reconnoissance Soil Survey of Western South Dakota 1909.

Orman Clay

The Orman clay consists of six to ten inches of grayish-brown to dark-brown silty clay to clay, underlain by a grayish brown to drab clay, which usually extends to a depth of several feet but may occasionally change into heavy sandy loam and gravel. The surface of the clay has a whitish appearance, owing to a thin surface crust of very light-colored material.

The soil is closely associated with the Pierre clay and possesses many of its characteristics. In part it represents a reworking of the same material. Like the Pierre clay it is sticky when wet and is often classed with this type as "gumbo." When dry the surface cracks; and if it has been stirred while wet hard clods will be formed.

The Orman clay represents Pierre shale or Pierre clay material which has been reworked and redeposited by water. In some cases the material has not been moved very far and occurs as colluvial wash from the adjacent hills; in others it has been carried farther and laid down as alluvium along the streams; in still others it has been washed into depressions or lakes and might here be considered as lacustrine. The essential characteristics are very much the same.

Level flats or gently inclined foothill slopes are the characteristic topographic features. In the broad flats, the surface is so uniform and the fall so slight that water stands for several days after heavy rains.—U.S. D.A. Bureau of Soils. Reconnissance Soil Survey of Western South Dakota 1909.

Wheat

Ceres, S. Dak. Acc. No. 1281, C. I. No. 6900.— Ceres is a bearded variety with white glabrous* glume, strong straw, is relatively non shattering and resistant to black stem rust but susceptible to both covered or stinking and loose smut.

Ceres was developed in 1918 by the North Dakota Agricultural Experiment station from a cross between Marquis and Kota. It has been grown commercially since 1926. Seed used in the tests was obtained from the North Daokta station in 1925.

It has great yielding capacity and produces a grain of good quality. In comparative milling and baking tests Ceres surpassed Marquis in test weight per bushel flour yield and in color and texture of crumb, while the volume of loaf produced was practically equal to that produced from Marquis.— S. D. Exp. Sta. Bu. No. 268, Page 34.

Marquis, S. Dak. Acc. No. 515, C. I. No. 3641.—Marquis is awnless, has white glaubrous glumes, is of medium maturity, has a strong straw of medium height and is susceptibile to stem rust.

Marquis resulted from a cross between a hard red wheat from Calcutta, India and Red Fife made by Charles E. Saunders. It was first grown as a pure line in 1904 and in commercial quantities in 1909. Seed was obtained by the station from Canada in 1913.

Before the development of Ceres, Marquis was the outstanding variety of spring wheat grown in the hard red spring wheat region of the United States.—S. D. Exp. Sta. Bu. No. 268, Page 36.

Reward, S. Dak. Acc. No. 1291, C. I. No. 8182.—Reward is awnless, has slightly pubescent white glumes, midstrong straw, is early maturing but suscepitible to stem rust. It produces a high quality of flour.

Reward was produced from a cross of Marquis and Prelude made in 1911 at the Dominion Experimental farm, Ottawa. It was distributed for commercial growing in 1927.

Reward is not so well adapted as Ceres in the eastern part of the state. It may be grown in the north central portion of South Dakota as an early maturing variety.—S. D. Exp. Sta. Bu. No. 268, Page 38.

"The Kubanka 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 Kanzaii 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. 37) (C.I. 1516).

"Two other similar strains are S.D. 356 and S. D. 152."—S.D. Exp. Sta. Bu. No. 146, page 290.

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* Glabrous means free from hairs, differing from pubescent or hairy, which causes the chaff or glumes to appear velvety.

Mindum, S. Dak. Acc. No. 1160, C. I. No. 5296.—Mindum is very similar in appearance to Arnautka.

Mindum was selected from a mixture of durum found in a field of common wheat at the Minnesota Agricultural Experiment station in 1896. It was first distributed in 1917.

Mindum has produced outstanding yields, especially in the eastern portion of South Dakota. In the central part of the state it yielded no more than Kubanka or Arnautka. It is a desirable durum wheat for macaroni manufacture.— S. D. Exp. Sta. Mu. No. 268, page 40.

Odessa, S. Dak. Acc. No. 182, C. I. No. 182.—Odessa belongs to the same general group as Manchuria. Imported by the United States Department of Agriculture from southern Russia. Obtained from the Bureau of Plant Industry in 1912. This is the best general purpose variety for South Dakota. It does especially well in the eastern portion of the state, as indicated by its uniformly high yields at Brookings. Odessa has also given good yields in the central part of the state.—S. D. Exp. Bu. No. 256, page 30.

Black Gatami, S. Dak. Acc. No. 122, C. I. No. 575.—Probably introduced from Manchuria. Obtained from the Wyoming station in 1912. Gatami is an early maturing, black grained, easily shattering, weak strawed variety. It is a good yielder, especially in dry season. Not recommended for the eastern half of the state. It has given good returns at Cottonwood in the far western portion of the state and is recommended for that section.—S. D. Exp. Sta. Bu. No. 256, page 31.

White Gatami, S. Dak. Acc. No. C. I. No. 920.—Obtained from the Dickinson, N. Dak., iFeld station in 1924. Black Gatami except that the kernels are white and that the straw is stronger. White Gatami yielded slightly better than the Black Gatami.—S. D. Exp. Sta. Bu. No. 256, page 31.

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 whech 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 Agricultural Experiment Station."—S. D. Exp. Sta. Bu. No. 146, page 290.

Corn

Rainbow Flint is a vari-colored variety with long ears and usually produces several stalks to a kernel. It is apparently the best producing flint variety for hog pasture, silage or fodder, but it is not as early maturing as some of the other flint varieties. This corn may be distinguished by its beautiful striped kernels.—S. D. Exp. Sta. Bu. 181, page 869.

Blue Flint is an early variety of flint corn. Typical ears are about ten inches long, with a very small circumference and slightly tapering from butt to tip. The kernels are blue and rather short and round. There are ten rows of kernels which are set close together. The cob is white and the tip is slightly exposed. Blue Flint makes a suitable corn for hogging off or fodder purposes and is adapted to all parts of the state.—S. D. Exp. Sta. Bu. No. 181, page 867.

Northwestern Dent is a very early corn and is probably the product of a cross between the dent and flint corn. The ears are long and tapering and have from twelve to fourteen rows per ear. The kernels are dark red with brownish crowns, and the cobs are white. This corn is very well adapted to the northern and western portions of South Dakota, and it is suitable for hogging off or pasturing purposes in the central and southern counties.—S. D. Exp. Sta. Bu. No. 181, page 867.

Alta is a variety of yellow dent corn adapted to the central and northern and western counties. It is a contribution from Highmore substation, selected mainly from Minnesota No. 13 (S. D. No. 86). It has also produced good yields at Cottonwood substation.—S. D. Exp. Sta. Bu. No. 204, page 600.

Sorghum

Western Blackhull.—Listed as grain sorghum. (Oklahoma Bulletin 210.) This apparently is a selection from Blackhull kafir. Standard Blackhull, has short black glumes and ovate shaped white seed. Heads are cylindrical, semi-compact. Plants are four to six feet in height, with juicy, somewhat sweet stalks.—S. D. Exp. Sta. Bu. No. 285, page 52.

Sooner Milo.—Very nearly the same may be said of Sooner Milo as about Early White Milo, one exception being that the seed of Sooner Milo is not so white—yellowish in color. Neither one is recommended for very high quality of fodder.—S. D. Exp. Sta. Bu. No. 285, page 52.

Early White Milo, FCI 5886.—Listed as grain sorghum, U. S. Department Bulletin 260.

The foregoing states also Early White Milo, the highest grain yielder is unfortunately almost worthless as forage.—S. D. Exp. Sta. Bp. No. 285, page 52.

Kaoliang.—"The kaoliangs comprise a group of grain producing sorghums from eastern Asia, introduced into the United States from China and Manchuria, at various times previous to 1913.

"There is diversity of habit and color among various varieties. All have dry, pithy stalks, 1 to 3 centimeters in butt diameter, relatively few (8-13) leaves which are comparitively small, 1 to 2.5 feet long and 1 to 2.5 inches wide; glumes never exceeding the seed; almost wholly glabrous or smooth, and lemmas (seed coverings) always bearing an awn or

beard. Panicles or heads vary from small oval, compact to long, umbelliform (umbrella shaped) and lax or spreading. Glumes or outside seed covering vary from two-thirds as long as the seeds to equaling them.

"Seeds vary from 3 to 6 millimeters long; in color from chalky white through buff and orange-buff to various shades of reddish-brown and brown." (The Kaoliangs, U. S. Department of Agriculture Bureau of Plant Industry Bulletin No. 253. Also South Daokta Bulletin 156.)— S. D. Exp. Sta. Bu. No. 285, page 54.

Dakota amber.—The most common variety of sweet or sacchrine sorghum. Generally produced because of its comparative early maturity. Early productions were named Minnesota amber and apparently selections made therefrom and developed by this Experiment Station and others in cooperation with the United States Department of Agriculture are called Dakota amber.—S. D. Exp. Sta. Bul. No. 285, page 52.

Annual Rainfall by Months at Cottonwood Experiment Farm

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1910	0.66	0.97	0.76	1.06	2.54	1.30	1.11	0.48	0.82	0.32	0.53	3.00	12.65
1911	T	0.15	T	0.85	1.10	0.64	0.59	2.41	3.59	1.15	0.20	0.42	11.10
1912	0.17	0.05	3.00	3.32	1.18	0.95	2.42	5.33	1.30	0.11	T	0.12	17.95
1913	0.16	0.10	0.43	1.15	2.95	0.59	0.81	1.84	1.15	0.76	0.14	0.38	10.46
1914	0.03	1.18	0.35	2.26	2.35	1.64	1.04	1.88	1.19	2.23	0.02	0.84	15.28
1915	0.39	1.57	0.46	2.80	6.61	4.79	4.58	2.51	2.42	0.90	T	0.10	27.31
1916	0.04	0.02	0.04	0.81	3.87	1.83	1.80	2.22	0.18	0.57	0.15	0.14	11.67
1917	0.45	1.50	0.31	0.80	3.30	0.62	0.90	2.00	1.17	0.14	0.39	0.50	12.08
1918	0.32	1.50	0.34	2.27	2.78	1.37	2.29	3.43	1.43	0.28	0.11	0.25	16.37
1919	0.04	0.29	0.71	3.57	1.29	4.97	2.05	0.20	0.25	2.03	0.71	0.20	1631
1920	0.27	0.54	0.58	2.80	5.83	4.02	0.67	1.87	1.63	0.93	0.36	0.18	19.68
1921	0.17	0.10	0.17	0.40	2.91	0.78	3.58	1.10	0.41	3.43	0.29	0.21	13.55
1922	0.94	0.32	0.00	1.25	2.37	5.43	6.48	0.72	0.16	0.92	2.32	0.00	21.41
1923	0.00	T	0.00	0.66	2.41	4.87	5.28	3.08	3.05	1.89	0.18	4.00	25.42
1924	0.00	0.00	0.32	0.06	0.29	3.03	1.78	1.48	3.05	0.85	0.31	0.17	11.34
1925	4.00	0.20	1.07	1.17	0.72	4.80	3.52	1.56	0.37	1.12	1.06	0.00	16.10
1926	0.00	0.50	0.00	0.75	2.77	1.97	0.60	0.39	0.49	0.48	0.08	2.10	13.41
1927	2.00	0.00	0.03	2.74	5.16	3.26	2.38	2.21	0.63	T	0.00	0.00	16.61
1928	0.00	0.03	0.86	0.35	1.14	3.83	3.11	0.94	1.65	1.19	0.77	T	13.87
1929	0.46	0.03	4.34	2.51	2.20	3.56	1.74	0.89	1.44	1.43	0.10	0.03	18.73
1930	0.35	0.49	3.59	1.85	0.94	0.97	0.99	7.82	1.20	3.98	0.05	0.05	21.77
1931	0.00	0.05	1.23	0.17	1.27	0.62	0.84	0.82	1.65	0.71	T	0.00	7.36
1932	0.00	0.00	T	3.67	3.60	4.34	2.35	0.74	0.26	0.51	T	0.00	15.47
1933	0.04	T	0.58	2.72	4.65	0.56	0.43	3.14	0.32	0.03	0.27	0.02	12.76
1934	0.13	T	1.15	0.39	0.45	4.69	1.01	1.35	0.26	1.41	0.50	2.00	13.34
1935	0.25	1.80	0.85	3.65	3.60	1.68	2.76	1.08	0.06	0.11	0.24	0.92	17.00
1936	1.40	0.90	0.45	1.17	0.70	0.08	0.08	0.60	0.79	0.32	0.80	0.22	7.51