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Progress of Grain Investigations

Clifford Willis

Manley Champlin

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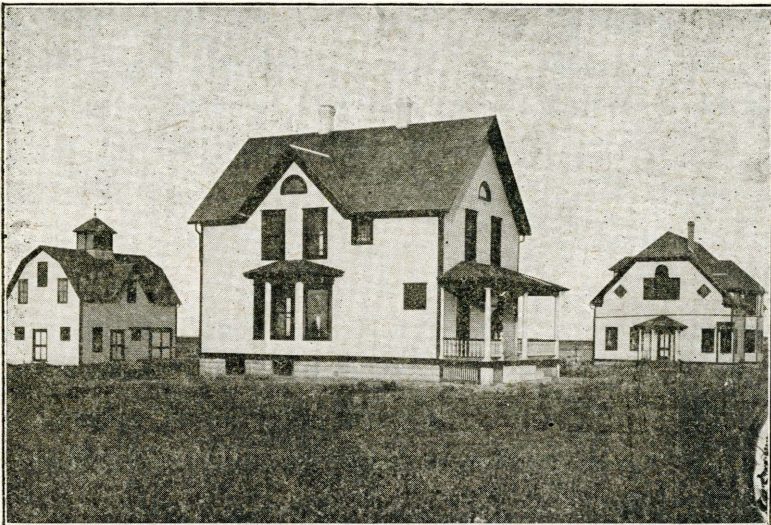
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PROGRESS OF GRAIN INVESTIGATIONS

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

CO-OPERATING WITH
UNITED STATES DEPARTMENT OF AGRICULTURE



BUILDINGS AT HIGHMORE SUBSTATION

BY

CLIFFORD WILLIS,

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AND

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SCIENTIFIC ASSISTANT, GRAIN INVESTIGATIONS.

1903-1910

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INTRODUCTION

As South Dakota has led her sister states in per capita production of new wealth for a number of years it has seemed advisable to devote a comparatively large amount of experimental work to the principal sources of that new wealth, namely, the grain crops, including wheat, barley, oats, millet, grain sorghums, emmer, flax and corn. This work has, of necessity, been basic, consisting mainly in determining which varieties are best adapted to the climatic and soil conditions found in various parts of the state. Now that this has in a large measure been determined, it is the chief purpose of the experimentation to improve these best varieties by a process of rigid selection and by crossing when necessary to obtain the characters desired.

HISTORY.

In 1903 the South Dakota Experiment Station, in co-operation with the United States Department of Agriculture began a series of tests at Highmore. This location is particularly desirable for such an enterprise. The Substation is situated near the divide between the James and the Missouri river valleys, having an altitude of 1890 feet. The soil is a glacial loam, to sandy loam, representative of that found in a large part of the east half of the state. The precipitation, as nearly as can be determined from existing records, is from one to four inches less than on the surrounding valleys and prairies. A change of fifty degrees in temperature in twenty-four hours is not uncommon. Winds of considerable velocity prevail at all seasons of the year. It has been found that results obtained here are conservative and reliable for that part of the state between the Sioux Valley and the Missouri river, and that varieties proving valuable here may be depended upon in the tributary territory.

In 1908 a new Substation was provided at Eureka and work was begun there on the newly broken prairie sod. This work has been continued and increased during 1909 and 1910. In 1909, a third Substation was established at Cottonwood, for the sake of conducting experiments with the "gumbo" soil and to obtain results of direct value to the new settlers in that area. There are now eight years results from Highmore, three from Eureka and two from Cottonwood. This bulletin is a brief resume of the work at these three points, the conclusions being based mainly upon the work of the older, more fully equipped Substation at Highmore.

SEASONAL CONDITIONS.

During the period covered by the tests at Highmore, 1903 to 1910, the average rainfall has been 18.41 inches. During two seasons the rainfall has been little more than half the normal, viz., 10.5 inches in 1904 and up to October 1st, 1910 only 10.07 inches. June has been the month of greatest rainfall with an average of 3.27 inches. February has the opposite record with an average of 0.34 inches. Table No. 1 shows the precipitation by years and months, together with the averages for the entire period. Table No. 2 illustrates the effect of the rainfall upon crop production as recorded by the yield of each of the leading varieties of cereals.

The most severe period in crop production is usually the heated term from July 15th to August 10th. There have been exceptions to this rule as in 1910, when the most severe heat and drouth prevailed from June 15th to 25th.

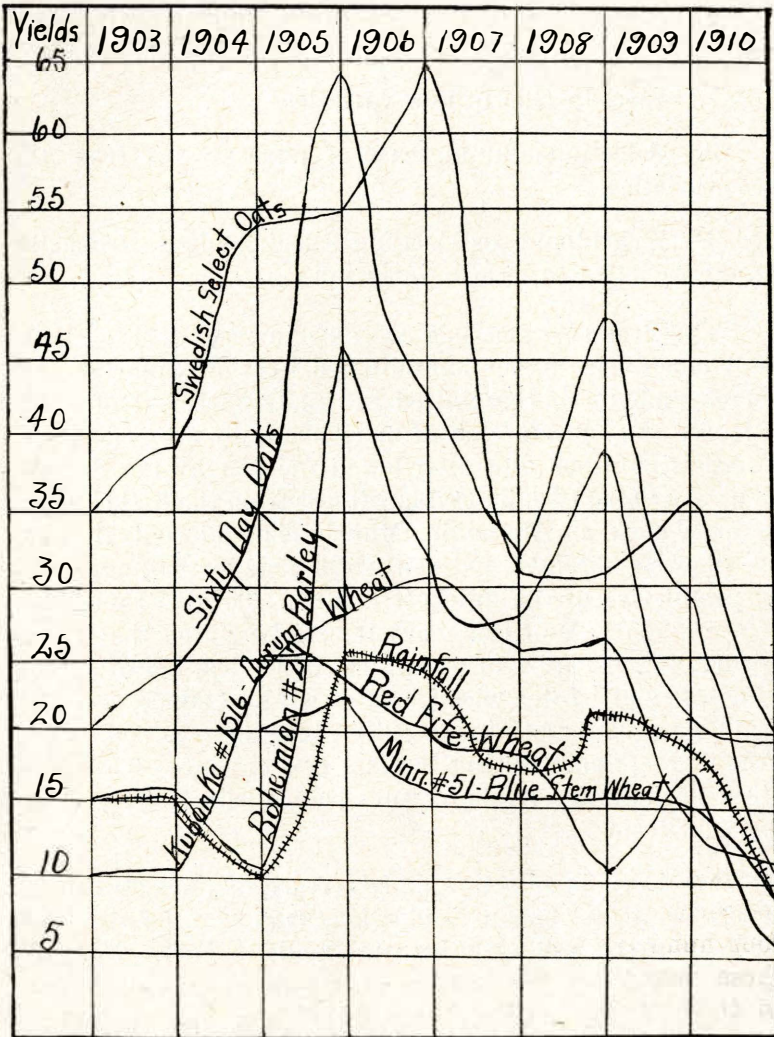
The corn season, without frost, can usually be depended upon from May 20th to September 15th. The general weather conditions at Eureka and Cottonwood will probably approximate very closely those described for Highmore. The rainfall at Eureka was 15.21 inches in 1909 and has been 15.45 inches up to October 1st, 1910. A severe drouth in July did serious damage to the grain

crops. The rainfall at Cottonwood was 8.8 inches up to Oct. 1st, 1910. This is probably about half of the normal precipitation. Since the eight years of test at Highmore have included two seasons of as little precipitation as we need to expect, three of very normal precipitation, and three when the rainfall was above normal, it is believed that the tests are fairly representative and conclusions based upon them will tend to be reliable.

TABLE I.

Precipitation in inches by Years and Months
103-110

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Apr.-Sept	Annual
1903 ..	0.05	0.30	0.87	0.70	0.85	2.93	3.58	2.40	1.46	0.66	0.65	0.63	10.46	15.08
1904 ..	0.15	0.17	0.05	1.43	0.99	2.25	2.40	1.48	0.38	0.60	T	0.60	8.55	10.50
1905 ..	0.60	T	0.60	1.39	5.23	5.64	5.54	3.56	0.56	1.95	1.29	T	21.36	26.36
1906 ..	0.30	0.40	0.80	2.40	5.00	2.50	1.19	6.35	2.80	0.30	2.47	0.40	17.44	24.91
1907 ..	1.00	0.40	1.10	0.68	5.11	1.62	3.64	0.18	1.04	1.96	0.05	0.40	11.33	17.28
1908 ..	0.10	0.93	0.80	1.55	2.68	5.78	2.49	3.53	0.62	2.19	1.39	0.31	16.03	22.37
1909 ..	0.26	0.34	0.13	0.30	4.72	1.69	1.81	3.92	1.70	1.04	0.71	1.41	14.14	18.03
1910 ..	0.82	0.19	0.58	1.40	0.94	3.74	0.85	0.66	0.89				8.48	
Average	0.41	0.34	0.62	1.23	3.19	3.27	2.69	2.76	1.18	1.24	0.94	0.54	14.32	18.41



GRAIN IMPROVEMENT WORK.

It is possible to improve the grain crops by three methods,—

1. Introduction of new varieties.
2. Selection and increase of pure strains from the best varieties.
3. Hybridizing or crossing selected plants from different varieties to induce variation.

The first two methods are now in use. The earth is kept constantly under surveillance by the explorers and correspondents of the United States Department of Agriculture. Any production of merit made by a breeder anywhere is obtained and distributed for test by the Substations. Any seed of supposed hardiness from the little known regions, such as Abyssinia, Manchuria and central Asia, are likewise obtained and disturbed. This method has proved productive of the quickest results. To give some idea of the magnitude of this work it may be stated that twenty-four new varieties of oats, forty of barley, ten of spring wheat, five of winter wheat, one of winter emmer, seven of grain sorghums and nine of millet have been added to the tests at Highmore during the last two seasons. These are given preliminary trials in rows before being carried into the field tests.

The work in selection and increase of pure strains of merit is but just begun. Selections toward a definite type for each of the best varieties were made in 1909. In 1910, four hundred head-rows were grown to test the ability of these parent heads to perpetuate their superior characters in their progeny. The behavior of these head-rows has been recorded and the best ones will be saved and increased for further test.

The work of crossing to combine desirable characters will be taken up later.

SUCCESSFUL CROPPING SYSTEMS.

While it is not the purpose of this bulletin to report the results of crop rotation experiments, a few general suggestions along this line may not be out of place.

A rotation should contain a cultivated crop such as corn, potatoes, sorghum or alfalfa seed rows; a legume crop, such as alfalfa, clover or Canadian peas, and the desired market crops of small grain. If it is possible to manure the land the legume crop may be omitted. In this case the manure should be spread at the rate of five to seven spreader loads to the acre on the land which is to be used for corn or sorghum.

The legumes adapted to our conditions are alfalfa and Canadian field peas. Clover is successful in the eastern portion as well as in favored valleys scattered throughout the state, but on the open prairies of the west and central portions clover is still in the experimental stage. Alfalfa lives for years and is adapted to long schemes of rotation. Canadian peas are annuals and adapted to short rotations. The cultivated crop cleans the land, conserves moisture and acts like summer fallow by releasing elements of fertility.

With these general principles in mind each farmer can figure out the system best adapted to his needs. Here are a few suggestions:

THREE YEAR ROTATION.

Corn on land plowed six to ten inches deep, oats on disked corn ground, wheat on disked oat ground. Manure and plow deep again for corn.

TWO YEAR ROTATION.

Corn as above, wheat on disked corn ground. Plow again for corn. Manure the second round, preceding corn.

INDIFINITE, LONG TIME, ROTATION.

Corn as above, alfalfa on spring plowed corn ground,

allowed to stand five years or more, corn on fall plowed alfalfa, wheat on disked corn ground, oats or barley on fall plowed wheat land.

FIVE YEAR ROTATION.

Corn as above, wheat on disked corn ground, oats, barley or millet on fall plowing two years; Canadian peas on spring plowing, pastured or turned under for green manure. In this rotation clover might be substituted for peas.

METHODS PURSUED.

The tests are conducted upon plots two rods in width by eight in length, comprising one-tenth acre each. These plots are arranged in series, separated by alleys four feet wide. The series are separated by roads one rod wide. All varieties of the same cereal are grown in the same series.

The rotation now in use consists of four crops of small grain, and one crop of corn. Up to date no fertilizer of any kind has been used to enrich the soil. The cultivation and tillage methods were the same for all varieties. The land was plowed to a depth of six inches in the fall and thoroughly harrowed with a disk and drag before seeding in the spring. The seeding was done with a disk drill, the drills being six inches apart. After the crop came up and was well-rooted, a spring tooth weeder was used after each shower, to preserve a dust mulch. This method provides for an annual crop of small grain and gives the varieties a very severe test. Whenever more than one plot was grown, the yields given are averages.

The seed is carefully cleaned and graded each year. Before seeding it is treated for smut by the regulation formalin method, using a solution of one pint of 40 per cent formalin to 40 gallons of water.

The rates of seeding used are as follows:—wheat, 5 pecks; oats, 8 pecks; barley, 6 pecks; foxtail millet, 1 peck for seed production, 2 pecks for forage production; proso millet 9 quarts; grain sorghums, 7 pounds; emmer, 6 pecks; corn, 3 kernels to the hill; flax, 2 pecks.

The weights per bushel in pounds used as standard are as follows:—wheat, 60; oats, 32; barley, 48; millet, 50; grain sorghums, 50; emmer, 45; corn 80; flax, 60.

In the tables G. I. stands for Grain Investigations, H. for Highmore, and F. for failure. The dates are expressed by number of month and day as 7-30, meaning July 30th. Rust and smut resistance is marked on a scale of 100 per cent. Yields are expressed in bushels. In the tables for 1910, wheat and oats, the heading, Ordinary Methods sig-

nifies those above described. The heading, Improved Methods, refers to work done as follows:—Certain varieties were grown from especially graded, pure seed in rows in 1909. The seed obtained was again carefully graded and the best sown in 1-100 acre plots in 1910 on land which had been devoted to cultivated alfalfa in rows during 1908 and 1909.

PLANT DISEASES.

A very small per cent of each of the common plant diseases, including rusts, smuts, blights, wheat scab, flax wilt and spikelet sterility in oats, has been present each season but none of these has ever developed seriously, owing to the dry weather, which is unfavorable to their propagation.

EUREKA SUBSTATION.

This Substation is situated near the town of Eureka in McPherson county near the north line of the state, a little west of the center of the great wheat belt of the state. In this area, wheat is king and has been for many years. One of the purposes of this Substation is to stimulate more diversified methods of farming than the present single cropping system.

The farm consists of 640 acres of rolling prairie. The soil is a glacial loam varying from a silt to a sandy loam. A new seed house of approved design is the only equipment in the way of buildings.

A line of diversified crops were grown in acre lots in 1908 on the newly broken sod. In 1909, the forty acres under cultivation were divided into 0.1 acre plots according to the method previously described and a line of experimental work, partially duplicating that at Highmore was begun. The yields obtained may be found in the accompanying tables under the head Eureka.

COTTONWOOD SUBSTATION.

The distinct purpose of the Substation at Cottonwood is to help the new settlers in the central district west of the Missouri river in their effort to make a diversified farming country out of the old range.

The farm consists of a section of land near Cottonwood in Stanley county, chosen because several types of soil are represented within its boundaries. The soil is for the most part a heavy shale known as gumbo. Experiments will eventually determine the best varieties to grow and the best methods of farm practice for each soil type. The land was first broken in the fall of 1908. The first crops were grown in 1909.

The experiments, in part, duplicate the work at Highmore.

The climatic conditions have been unfavorable both in 1909 and 1910. This type of soil is especially untractable and difficult to bring into a condition of good tilth. A line of experiments is being conducted to learn what the soil lacks in fertility and to determine the best method to be pursued to keep the soil in good physical condition. From the results and observations of the past two seasons we believe it advisable for the homesteader to diversify his farming as much as possible, to keep a requisite amount of stock and poultry, and to grow a comparatively large amount of cultivated crops, such as corn, sorghum, alfalfa seed rows, potatoes, etc. It seems reasonably certain that profitable crops of small grain cannot be grown in succession, but by alternating with cultivated crops, the soil may be kept in condition, the moisture conserved and success made certain.

The yields in the variety tests are given under the head of Cottonwood in the accompanying tables.

WHEAT.

The tests of wheat varieties have been divided about equally between the durum or macaroni and the common or bread wheat types. The common wheats include several strains of each; bluestem, bearded fife, beardless fife and miscellaneous introductions from Russia and Asia. The durum wheats belong for the most part within the three groups Kubanka, Arnautka and Wild Goose. Complete data regarding each variety will be found in the following tables.

In general it may be said that the bearded fife types of common wheat are well adapted to this state and ripen earlier than the bluestems, producing wheat of higher weight per bushel and better quality. Their worst fault in the field is shattering. The millers classify this type of wheat as velvet chaff and usually pay a slightly lower price. Recent analyses, however, show that northwestern velvet chaff has improved as regards quality of gluten and per cent of patent flour so that the discrepancy in milling value may not affect the market price much in the future.

The beardless fife types ripen two or three days earlier than the blue stem and grade equally well. The blue stems are most widely grown and their milling value is well known. They ripen about a week later than velvet chaff as will be seen by referring to the tables. The average yields of the different types varies but little through a series of years, though for single seasons, the difference is marked. A new wheat, Manchuria No. 2492, has proved earliest of all and a remarkable yielder. Its milling qualities will be tested before any is distributed. The Kubanka types of durum wheat have proved best adapted to central South Dakota conditions. These were obtained from the "Black Earth" region of Russia where climatic and soil conditions are very similar to those prevailing here. They ripen at about the same time as the bearded fifes. No. 1516 has proven the best yielder. The Arnautka and Wild Goose types have their place in the more humid portions of the state.

TABLE III.
COMMON WHEAT—Seasonal Data and Yields for 1909

Variety	G. I. No.	H. No.	Seeded	Headed	Ripened	Days to mature	Stem Rust	Loose Smut	Cwt. of Straw	Wt. per bu.	Yield	Rank
Bluestems												
Pedigreed		81	5-3	7-6	8-6	95	98	100	14.3	55.5	16.2	9
Okanagan		78	5-3	7-6	8-6	95	98	99	13.	54.5	15.8	10
Minn. No. 51		74	5-4	7-6	8-4	92	98	99	16.5	55.	15.8	10
Minn. No. 169		73	5-4	7-6	8-5	93	98	98	14.	56.2	17.2	5
Bearded		70	5-4	7-12	8-6	95	85	99	13.8	57.0	14.5	11
Velvet Chaffs												
Red Fife		79	5-3	7-1	7-30	88	98	100	20.5	59.5	17.5	3
S. D. Climax		80	5-3	7-1	7-31	89	98	100	19.3	59.8	17.8	2
Beardless Fifes....												
Minn. No. 66		75	5-4	7-6	8-4	92	90	97	13.6	55.5	16.5	8
Minn. No. 163		76	5-4	7-8	8-3	91	97	99	18.	54.4	15.3	10
Minn. No. 171		77	5-4	7-6	8-3	91	90	99	14.9	55.	16.8	7
Miscellaneous												
Ghirka	1517	69	5-4	7-3	7-31	88	60	98	14.4	56.5	17.7	4
Manchuria	2492	68	5-4	6-27	7-29	86	100	100	16.8	59.	21.2	1
Minn. No. 188		71	5-4	7-3	7-31	88	60	88	16.1	54.5	16.5	8
Minn. No. 185		72	5-4	7-3	7-31	88	85	100	14.8	56.2	17.0	6

TABLE IV.

COMMON WHEAT

Seasonal Data Comparing Improved and Ordinary Methods—1910

Variety	G. I. No.	H. No.	Ordinary Methods					Improved Methods				
			Ripened	Days to mature	Cwt. of Straw	Wt. per bu.	Yield	Ripened	Days to mature	Cwt. of Straw	Wt. per bu.	Yield
Bluestems			-					-				
Pedigreed	81	8-1	102	6.6	53	7.7	8-5	95	19.5	58	10.8	3.1
Okanogan	78	8-1	102	7.8	53	8.3	8-5	95	20.0	58	10.0	1.7
Marvel	195	8-1	102	11.8	54	13.7	-	-	-	-	-	-
Select	194	8-1	102	10.1	54	12.3	-	-	-	-	-	-
Minn. No. 51	74	8-1	102	7.9	54	9.5	8-5	95	19.0	58	11.7	2.2
Minn. No. 169	73	8-1	102	8.0	55	10.0	8-5	95	16.5	59	14.2	4.2
Bearded	70	8-1	102	9.3	54	11.2	-	-	-	-	-	-
Velvet Chaffs			-				-					
Red Fife	79	7-25	96	6.4	59	6.8	8-3	93	20.5	60	10.8	4.0
S. D. Climax	80	7-25	96	5.0	60	6.2	8-3	93	24.5	60	12.5	6.3
Beardless Fife			-				-					
Minn. No. 66	75	8-1	102	8.6	55	10.3	8-5	95	17.5	58	14.2	3.9
Minn. No. 163	76	8-1	102	9.7	54	12.2	8-5	95	17.5	56	15.8	3.6
Minn. No. 171	77	7-25	96	5.1	54	9.8	-	-	-	-	-	-
Powers'	3025	172	-	-	-	-	8-2	92	16.5	59	17.5	-
Rystings'	3022	173	-	-	-	-	8-2	92	12.0	59	13.3	-
Miscellaneous			-				-					
Minn. 188	184	7-25	90	14.8	55	16.0	-	-	-	-	-	-
Ghirka	1517	69	7-25	96	4.0	58	6.2	8-2	92	19.5	58	17.5
Manchuria	2492	68	7-25	96	3.9	54	5.5	8-2	92	22.0	57	18.3
S. P. I. 24485	82	-	-	-	-	-	8-2	92	17.5	58	14.2	-
S. P. I. 24819	83	-	-	-	-	-	8-2	92	17.5	58	15.8	-
S. P. I. 24483	84	-	-	-	-	-	7-30	89	16.5	58	12.5	-
Erivan	2397	120	7-22	93	4.9	61	6.5	-	-	-	-	-
Java	181	7-25	90	13.7	59	8.3	-	-	-	-	-	-

TABLE V.
COMMON WHEAT
Yield Per Acre for Each Year Grown, with Averages
and Comparative Rank—1903-1910

Variety	G. I No.	H. No.	1903	1904	1905	1906	1907	1908	1909	1910	No. yrs. Grown	Av.	Av.5 Yrs.	Rank
Bluestems														
Pedigreed		81	11.8	24.8	16.2	16.7	13.6	16.2	7.7	7	15.3	14.1	3	
Okanogan		78	23.3	15.0	18.5	16.2	15.8	8.3	6	16.2	14.8	2		
Marvel		195							13.7	1				
Select		196							12.3	1				
Minn. No. 51.		74	22.8	17.0	16.0	16.3	15.8	9.5	6	16.2	14.9	1		
Minn. No. 169.		73	13.1	23.1	17.3	14.7	17.2	10.0	6	15.9				
Bearded		70				11.3	9.8	14.5	11.2	4	11.7			
Velvet Chaffs														
Red Fife		79	25.5	20.3	18.7	11.0	17.5	6.8	6	16.6	14.9	1		
S. D. Climax		80		19.7	18.5	10.0	17.8	6.2	5	14.9	14.9	1		
Beardless Fifes														
Minn. No. 66		75	20.5	14.8	12.5	16.1	16.5	10.3	6	15.1	14.0	4		
Minn. No. 163		76				13.9	15.8	12.2	3	14.0				
Minn. No. 171		77	15.8	18.2	13.2	11.0	16.8	9.8	6	14.1	13.8	6		
Miscellaneous														
Ghirka	1517	69	14.0	8.0	9.7	22.0	15.0	4.8	17.7	6.2	8	12.2	13.1	7
Manchuria	2492	68				19.2	13.1	21.2	5.5	4	14.8			
Minn. No. 188		71				11.0	9.1	16.5	3	12.2				
Minn. No. 185		72	10.8	19.5	9.3	10.3	17.0	5	13.4	13.4	4			
Java	181								8.3	1				
Erivan	2397	120							6.5	1				

TABLE VI.
COMMON WHEAT
Eureka and Cottonwood Substations
Variety Yields for Each Year Grown

Variety	G. I. No.	Eureka			Cotton-wood	
		1908	1909	1910	1909	1910
Pedigreed Blue Stem	6.9	10.5	1.3	1.6	1.7	
Okanogan Blue Stem		16.5	0.8	1.4		
Minn. No. 51 Blue Stem		11.2	0.8	1.5	3.2	
Minn. No. 169 Blue Stem		10.1	2.3	2.1	1.8	
Bearded Blue Stem		8.8	2.0	2.6	3.2	
Minn. No. 66 Fife		10.8	2.1	1.6	2.5	
Minn. No. 163 Fife		9.5	2.6	2.3	2.3	
Minn. No. 171 Fife		9.8	2.1	2.6	2.0	
Minn. No. 185		9.8	5.3		2.2	
Minn. No. 188		10.3	5.8			
Bearded Red Fife		12.5	3.8	3.8	2.3	
S. D. Climax		11.7	1.8	4.8		
Ghirka	1517	5.3				

TABLE VII.
DURUM WHEAT AND EMMER
Seasonal Data and Yields for 1909

Variety	G. I. No.	H. No.	Seeded	Headed	Ripened	Days to Mature	Cwt. of Straw	Wt. per Bu.	Yield	Rank
Kubanka Types										
Kubanka	1541	65	5-1	6-29	7-29	89	8.1	58.2	10.7	10
"	1516	63	5-1	6-29	7-29	89	11.1	59.2	14.8	5
"	1440	62	5-1	6-29	7-30	90	14.3	60.5	17.0	3
"	1354	64	5-1	6-29	7-30	90	16.3	60.0	19.5	1
Pererodka	1350	61	5-3	7-1	7-30	87	16.2	60.0	17.2	2
Arnautka Types										
Arnautka		60a	5-3	7-3	8-2	90	14.0	61.0	14.2	6
"	1537	60	5-3	7-3	7-30	87	15.5	59.0	15.8	4
" No. 28.8c....		59	5-3	7-6	8-2	90	15.5	60.8	15.8	4
Wild Goose Types....										
Wild Goose	1547	58	5-3	7-3	8-2	90	10.1	58.5	10.7	10
"	1493	57	5-3	7-1	7-30	87	9.9	58.5	12.7	7
Miscellaneous										
Iumillo	1736	67	5-1	6-28	7-29	89	8.3	58.5	11.2	9
Beloturka	1513	66	5-1	6-29	7-29	89	9.5	59.8	12.5	8
Emmer	1524	16	5-5	7-6	7-30	86	8.4	29.9	14.7	

TABLE VIII.
DURUM WHEAT AND EMMER
Seasonal Data Comparing Improved and Ordinary
Methods, 1910

Variety	C. I No.	H. No.	Ordinary Methods					Improved Methods					Bu. Increase
			Ripened	Days to Mature	Cwt. of Straw	Wt. Per Bu.	Yield	Ripened	Days to Mature	Cwt. of Straw	Wt. Per Bu.	Yield	
Kubanka Types													
Kubanka	1541	65	7-26	95	11.6	57	8.3	8-5	97	25.0	61	15.0	2.0
"	1516	63	7-26	95	12.7	60	13.0	8-5	97	24.0	61	16.7	3.7
"	1440	62	7-26	95	17.2	61	8.0	8-5	97	24.0	61	16.7	8.7
"	1354	64	7-26	95	13.7	59	12.2	8-5	97	29.0	61	20.0	7.8
Pererodka	1350	61	7-26	95	16.8	59	6.2	8-5	97	30.0	61	20.0	13.8
Arnautka Types													
Arnautka .....	.....	60a	7-26	95	12.2	58	5.0	8-5	97	24.0	60	16.7	14.7
" No 28.93	1537	60	7-25	96	8.3	58	2.0	8-5	97	29.0	61	15.0	13.5
" No 28.93 .....	.....	59	7-25	96	8.6	55	1.5	8-5	97	29.0	61	15.0	13.5
Wild Goose Types													
Wild Goose	1547	58	7-25	96	9.3	54	2.0	8-5	97	26.0	60	16.7	14.7
" " " " " "	1493	57	7-26	95	6.0	52	1.7	8-5	97	26.0	60	16.7	14.7
Miscellaneous													
Iumillo	1736	67	7-25	96	9.1	59	3.2	8-5	97	28.5	60	19.2	16.0
Beloturka	1513	66	7-25	96	7.8	52	2.0	8-5	97	23.0	60	20.0	18.0
Yellow Gharnovka	1444	121	7-26	95	4.9	61	1.8	8-5	97	23.0	60	20.0	18.0
Emmer	1524	161	7-27	94	9.0	32	18.7	8-2	95	20.0	36	22.2	3.5

TABLE IX.
DURUM WHEAT AND EMMER
Yield per Acre for Each Year Grown, with Averages and
Comparative Rank, 1903-1910

Variety	G. I. No.	H. No.	1903	1904	1905	1906	1907	1908	1909	1910	No. Years	Av.	Av. 5 Yrs.	Rank
Kubankas														
Kubanka	1541	65	10.0	23.2	26.7	25.5	21.7	22.5	10.7	8.3	8	18.6	17.7	9
"	1516	63	10.7	23.3	28.5	31.2	26.8	27.5	14.8	13.0	8	22.0	22.7	1
"	1440	62	15.2	23.8	23.2	26.7	28.7	22.7	17.0	8.0	8	20.7	20.6	3
"	1354	64	12.8	20.3	27.0	27.2	29.7	23.8	19.5	12.2	8	21.6	22.5	2
Pererodka	1350	61	15.9	21.2	28.3	28.5	27.3	22.0	17.2	6.2	8	20.8	20.2	4
Arnautkas		60a	.....	.....	36.7	23.8	23.8	26.0	14.2	5.0	6	21.6	18.6	6
Arnautka	1537	60	16.2	18.0	36.0	22.0	22.7	25.0	15.8	2.0	8	19.7	17.5	10
" No. 28.8c		59	.....	.....	.....	24.3	23.5	28.7	15.8	1.5	5	18.8	18.8	5
Wild Goose Types														
Wild Goose	1547	58	.....	.....	.....	25.7	27.0	25.3	10.7	2.0	5	18.1	18.1	7
"	1493	57	.....	.....	.....	20.0	22.5	25.0	12.7	1.7	5	16.4	16.4	11
Miscellaneous														
Iumillo	1736	67	.....	.....	.....	26.2	22.2	25.8	11.2	3.2	5	17.7	17.7	9
Beloturka	1513	66	14.0	12.3	35.8	22.8	24.2	27.8	12.5	2.0	8	18.9	17.9	3
Yellow Gar.	1444	121	.....	.....	.....	.....	.....	.....	.....	1.8	1	.....	.....	.....
Emmer	1524	16	23.4	.....	53.6	34.7	31.8	30.0	14.7	18.7	7	29.3	26.0	.....

TABLE X.
DURUM WHEAT
Eureka and Cottonwood Substations
Variety Yields for Each Year Grown

Variety	G. I. No.	Eureka			Cottonwood	
		1908	1909	1910	1909	1910
Iumillo	1736	12.2	5.3	5.5	1.2	
Beloturka	1513	12.3	16.5	5.5	1.2	
Kubanka	1541	14.1	11.2	6.7	1.2	
"	1516	10.0	12.0	5.3	1.3	
"	1440	22.5	10.7	4.0	.....
"	1354	13.8	10.1	7.3	1.2	
Pererodka	1350	13.0	9.4	6.8	.....
Arnautka .....	.....	14.2	7.7	4.6	2.7	
"	1537	12.6	8.4	6.8	2.5	
" No. 28.8c .....	.....	17.5	6.3	.....	.....
Wild Goose	1547	22.2	6.0	6.2	2.5	
"	1493	18.8	9.7	.....	2.8	

TABLE XI.
COMMON AND DURUM WHEAT
Comparative Value of Varieties Based on Five-year Test,
1906-1910

Variety	No. Years in Test	Bu. per Acre	Graphic Comparison
Durum			
Kubanka No. 1516	5	22.7	.....
" No. 1354	5	22.5	.....
" No. 1440	5	20.6	.....
Pererodka No. 1350	5	20.2	.....
Arnautka No. 28.8c	5	18.8	.....
Arnautka	5	18.6	.....
Wild Goose No. 1547 ..	5	18.1	.....
Common			
Bearded Red Fife	5	14.9	.....
Minn. No. 51 Bluestem.	5	14.9	.....
Okanogan Bluestem ...	5	14.8	.....
Pedigreed Bluestem ..	5	14.1	.....
Minn. 66 Bearless Fife.	5	14.0	.....
Ghirka No. 1517	5	13.1	.....

OATS.

The tests of oat varieties include four strains of the early varieties, Sixty Day and Kherson, which mature in about eighty days and twenty later varieties which require from ninety to one hundred days. Complete data is contained in the following tables. Swedish Select, a medium late variety of oats obtained from St. Petersburg, Russia, in 1899 has proven the best. At Brookings the Sixty Day has proven the best. At Highmore, there have been no severe storms nor rust epidemics to reduce the yields of late varieties, such as have occurred at Brookings. In view of the changing seasons, it is recommended that South Dakota farmers grow both an early and a late variety and the varieties recommended are Sixty Day or Kherson and Swedish Select. If care is taken to avoid mixing, this practice will be found advantageous. The early variety will often be saved before an injurious storm occurs, while the late variety will make maximum yields when not interfered with by adverse weather conditions. The seasons of 1908 at Highmore was decidedly favorable to early varieties and the season of 1910 was favorable to late varieties. This is illustrative of what may occur in the future.

TBALÉ XII.

OATS

Seasonal Data and Yields for 1909

Variety	G. I. No.	H. No.	Seeded	Headed	Ripened	Days to Mature	Stem Rust	Smut	Cwt. of Straw	Wt. per Bu.	Yield	Rank
Sixty Day	165	54	5-6	6-27	7-22	77	100	98	7.8	30.4	28.8	3
Kherson	539	56	5-6	6-27	7-22	77	100	98	5.5	31.0	21.9	7
Belyak	336	50	5-6	7-10	8-2	88	100	99	12.7	31.0	22.8	5
American Triumph	162	37	5-7	7-6	8-2	87	99	99	7.8	28.5	22.5	6
" Beauty	163	39	5-7	7-8	8-2	87	98	97	8.5	29.0	20.3	8
Minn. No. 6	38	5-7	7-6	7-31	8-5	98	96	96	7.6	31.0	20.0	9
" No. 26	40	5-7	7-11	8-2	87	98	98	98	8.6	28.5	20.0	9
Garton	55	5-6	7-6	7-30	8-5	95	95	95	7.6	31.0	20.0	9
Swedish Select	134	53	5-6	7-6	8-2	88	100	99	13.8	35.6	36.6	1
Lincoln	151	46	5-6	7-10	8-2	88	99	88	11.5	27.5	15.6	14
Banner	160	36	5-7	7-6	8-2	87	99	99	7.6	28.5	16.9	12
Holstein Prolific...	158	42	5-7	7-6	8-2	87	99	98	9.3	29.0	17.8	10
Abyssinian	155	44	5-7	7-6	8-2	87	99	90	9.4	24.8	12.8	16
Danish	441	49	5-6	7-6	8-2	88	100	97	10.2	29.6	15.0	15
Canadian	444	48	5-6	7-10	7-29	84	100	95	10.5	35.0	12.5	17
North Finnish	174	52	5-6	7-1	7-30	85	100	99	10.2	30.0	30.6	2
Red Algerian	286	51	5-6	7-2	8-10	96	95	100	11.0	29.6	23.4	4
Columbus	156	43	5-7	7-6	7-31	85	99	99	9.8	27.5	16.3	13
Golden Beauty	159	41	5-7	7-6	7-31	85	98	98	9.5	28.0	17.2	11
White Tartar	445	47	5-6	7-13	8-10	96	100	98	8.5	26.0	4.7	19
Wide Awake	154	45	5-6	7-11	8-2	88	99	80	10.6	28.5	10.6	18

TABLE XIII.

OATS

Seasonal Data Comparing Improved and Ordinary
Methods, 1910

Variety	G. I. No.	H. No.	Ordinary Methods					Improved Methods					Bu. Increase
			Ripened	Days to Mature	Cwt. of Straw	Wt. per Bu.	Yield	Ripened	Days to Mature	Cwt. of Straw	Wt. per Bu.	Yield	
Sixty Day	165	54	7-18	86	5.7	25.0	9.4	7-27	88	25.0	32.0	21.9	12.5
" "	625	158	7-16	84	6.7	30.0	7.8	7-27	88	25.0	32.0	21.9	11.9
Kherson	539	56	7-16	84	6.8	30.0	10.0	7-28	89	17.0	36.0	21.9	11.9
Belyak	336	50	8-1	100	13.2	32.0	36.9	8-3	95	25.0	38.0	37.5	0.6
American Triumph	162	37	7-27	95	6.3	29.0	13.1	8-2	94	19.0	34.0	37.5	24.4
" Beauty	163	39	7-27	95	6.5	30.0	15.6	8-2	94	25.5	34.0	35.9	20.3
Minn. No. 6 .....	....	38	7-27	95	7.5	29.0	14.1	8-2	94	20.5	35.0	29.7	15.6
" No. 26 .....	....	40	7-27	95	8.4	29.0	14.4	8-2	94	21.0	33.0	31.3	16.9
Garton .....	....	55	7-26	94	6.8	30.0	11.6	8-2	94	14.0	35.0	18.8	7.2
Swedish Select	134	53	8-1	100	10.2	27.0	25.0	8-3	95	29.5	39.0	35.9	10.9
Lincoln	151	46	7-26	94	7.1	32.0	16.3	8-3	95	21.5	36.0	29.7	13.4
Banner	160	36	7-27	95	6.8	31.0	14.7	8-3	95	23.5	35.0	35.9	21.2
Holstein Prolific...	158	42	7-27	95	7.2	29.0	16.6	8-3	95	23.5	35.0	35.9	21.2
Abyssinian	155	44	7-26	94	7.8	31.0	15.6	8-3	95	23.5	35.0	35.9	21.2
Danish	441	49	7-26	94	9.4	33.0	23.8	8-3	95	23.5	35.0	35.9	21.2
Canadian	444	48	7-25	93	9.0	36.0	14.1	8-3	95	23.5	35.0	35.9	21.2
North Finnish	174	52	7-26	94	9.8	29.0	19.4	8-2	94	22.5	35.0	23.4	4.0
Red Algerian	286	51	8-1	100	11.4	30.0	35.0	8-3	95	23.0	35.0	25.0	-10
Columbus	156	43	7-27	95	8.5	33.0	20.9	8-3	95	24.0	35.0	28.1	7.2
Golden Beauty	159	41	7-27	95	7.8	32.0	16.3	8-3	95	27.0	36.0	40.6	14.1
Great Dane	613	155	7-27	95	8.5	33.0	20.9	8-3	95	20.0	33.0	21.9	....
Minn. No. 295	632	156	7-27	95	8.5	33.0	20.9	8-3	95	17.5	35.0	32.8	....
Abundance .....	....	185	7-27	91	10.3	32.0	14.1	8-3	95	17.5	35.0	32.8	....

TABLE XIV.

OATS

Yield per Acre for Each Year Grown, with Averages and
Comparative Rank, 1903-1910

Variety	G. I. No.	H. No.	1903	1904	1905	1906	1907	1908	1909	1910	No. Yrs. Grown	Av.	Av. 5 Yrs.	Rank
Sixty Day	165	54	24.1	41.2	64.0	43.3	31.6	47.5	28.8	9.4	8	36.2	32.1	5
"	625	158	.....	.....	.....	.....	.....	.....	.....	7.8	1	.....	.....	.....
"	626	157	.....	.....	.....	.....	.....	.....	.....	6.9	1	.....	.....	.....
Kherson	539	56	.....	.....	.....	69.7	28.8	39.0	21.9	10.0	5	33.9	33.9	2
Belyak	336	50	.....	.....	52.5	55.6	26.6	21.3	22.8	36.9	6	36.0	32.6	3
American Triumph	162	37	.....	.....	.....	49.4	35.3	26.3	20.3	13.1	5	28.9	28.9	8
" Beauty	163	39	.....	.....	.....	47.8	35.3	25.3	20.3	15.6	5	28.9	28.9	8
Minn. No. 6	38	.....	.....	.....	.....	.....	33.8	25.0	20.0	14.1	4	23.2	.....	.....
" No. 26	40	.....	.....	.....	.....	.....	34.7	26.9	20.0	14.4	4	24.0	.....	.....
Garton	55	.....	.....	.....	.....	.....	.....	27.0	20.0	11.6	3	19.5	.....	.....
Swedish Select	134	53	38.1	54.4	55.0	65.0	30.3	30.3	36.6	25.0	8	41.8	35.4	1
Lincoln	151	46	.....	.....	.....	45.6	30.6	29.7	15.6	16.3	5	27.6	27.6	11
Banner	160	36	.....	.....	.....	62.5	31.6	.....	16.8	14.7	4	31.4	.....	.....
Holstein Prolific ..	153	42	.....	.....	.....	48.8	26.3	22.5	17.8	16.6	5	26.4	26.4	12
Abyssinian	155	44	.....	.....	.....	50.9	25.3	25.0	12.8	15.6	5	25.9	25.9	14
Danish	441	49	.....	.....	.....	46.3	26.9	30.3	15.0	23.8	5	28.5	28.5	10
Canadian	444	48	.....	.....	.....	52.2	23.4	30.3	12.5	14.1	5	26.3	26.3	13
North Finnish	174	52	35.3	.....	53.4	58.8	25.0	26.3	30.6	19.4	7	35.5	32.0	6
Red Algerian	286	51	.....	.....	.....	49.6	21.9	32.8	23.4	35.0	5	32.5	32.5	4
Columbus	156	43	.....	.....	.....	52.5	25.0	28.1	16.3	20.9	5	28.6	28.6	9
Golden Beauty	159	41	.....	.....	.....	60.3	26.6	27.5	17.2	16.3	5	29.6	29.6	7
White Tartar	445	47	.....	.....	.....	44.7	26.3	25.0	.....	4.7	.....	25.2	.....	.....
Wide Awake	154	45	.....	.....	.....	42.5	24.7	28.9	10.6	.....	4	25.2	.....	.....

TABLE XV.

OATS

Eureka and Cottonwood Substations
Variety Yie'ds for Each Year Grown

Variety	G. I. No.	Eureka			Cotton-wood	
		1908	1909	1910	1909	1910
Sixty Day	165	37.2	20.2	12.5	4.4	
Kherson	539	31.4	9.4	12.6	5.6	
Belyak	336	38.5	6.3	12.7	7.8	
American Triumph	162	44.3	12.7	8.4		
" Beauty	163	53.5	15.6			
Minn. No. 6		31.9	12.5	7.0	7.2	
" No. 26		45.4	9.7	6.1	12.8	
Garton		34.2	11.3	8.3	11.3	
Swedish Select	134	43.7	25.0	7.2	6.3	
Lincoln	151	31.9	7.2	7.3	8.4	
Banner	160	35.9	6.7			
Danish	441	34.8	19.8	8.9		
Canadian	444	34.4	6.6	7.0		
North Finnish Black	174	29.1	11.3	8.9	10.0	
Red Algerian	286	43.0	11.4	3.9	8.4	
Columbus	156	38.9	11.3	7.0		
Golden Beauty	159	34.9	14.0			
White Tartar	445			8.1		

TABLE XVI.

OATS

Comparative Value of Varieties Based on Five-year Test,
1906-1910

Variety	No. Yrs. in Test	Bu. per Acre	Graphic Comparison
Swedish Select No. 134.....	5	35.4	
Kherson No. 539	5	33.9	
Belyak No. 336	5	32.6	
Red Algerian No. 286	5	32.5	
Sixty Day No. 165	5	32.1	
North Finnish No. 174	5	32.0	
Golden Beauty No. 159	5	29.6	
American Beauty No. 163	5	28.9	
Columbus No. 156	5	28.6	
Danish No. 441	5	28.5	
Lincoln No. 151	5	27.6	
Holstein Prolific 158.....	5	26.4	
Canadian No. 444	5	26.3	
Abyssinian No. 155	5	25.9	

BARLEY.

Several types are represented among the barleys tested, including white two-rowed, white six-rowed, black six-rowed and hulless six-rowed. Complete data regarding each variety is contained in the following tables.

The six-rowed types are favored by American brewers but the two-rowed are a little higher in feeding value and have proven the best yielders in the field tests for this area. In Germany the brewers prefer the Hanna barleys, which are of the two-rowed type.

The best six-rowed barley is believed to be Minnesota No. 105. This barley has been grown for the last four years and has made the best average yield of this type. A new variety, Odessa No. 182 has given good results during this same period but did not show as good drouth resistance as Minnesota No. 105 in 1910.

Among the two-rowed barleys Hanna No. 24 has been widely distributed and has given good results, but a new variety obtained from Svalof, Sweden, viz., Hannchen, No. 531, has now been tested for five years and excels Hanna No. 24 by an average of 3.8 bushels for each year of that period. This barley will be increased for distribution as rapidly as possible.

The tests of hulless barleys are only begun. The season of 1910 was decidedly severe on them. There is some reason to believe, however, that they may prove of value and tests will be continued. Barley is a crop which should be more widely grown in South Dakota.

TABLE XVII.

BARLEY

Seasonal Data and Yields for 1909

Variety	G. I. No.	H. No.	Seeded	Headed	Ripened	Days to Mature	Stem Rust	Smut	Cwt. of Straw	Wt. Per Bu.	Yield	Rank
Six Rowed White ...			"	"	"							
Minnesota No. 6....		34	5-4	6-26	7-22	79	100	95	9.1	46.0	14.6	10
" No. 105		33	5-4	6-27	7-22	79	100	95	10.9	45.5	15.8	6
Oderbrucker		32	5-4	6-28	7-23	80	90	95	10.8	45.0	15.6	7
Odessa	182	18	5-5	6-27	7-19	79	100	96	9.2	...	15.8	6
Two Rowed White..			"	"	"							
Hanna	24	29	5-5	7-1	7-23	79	100	93	13.0	45.2	15.6	7
"	203	31	5-5	6-30	7-23	79	100	95	14.9	46.4	19.8	2
"	34	30	5-5	7-1	7-23	79	100	98	16.3	47.2	18.8	4
Bohemian	27	28	5-5	7-1	7-23	79	100	94	15.5	45.5	20.8	1
"	32	27	5-5	7-1	7-23	79	97	95	13.5	46.0	17.3	5
Horn	31	26	5-5	7-1	7-23	79	95	98	11.6	47.0	15.4	8
Strlegum	47	25	5-5	6-29	7-23	79	95	98	10.7	48.8	14.2	11
Golden Melon	48	24	5-5	7-2	7-26	82	97	95	12.5	44.8	11.5	12
White Smyrna	195	23	5-5	6-27	7-19	75	100	96	10.1	48.5	19.6	3
Princess	529	22	5-5	7-8	7-30	86	100	97	16.7	41.0	11.0	13
Chevalier	530	21	5-5	7-6	7-26	82	100	98	16.9	42.3	14.8	9
Hannchen	531	20	5-5	7-1	7-22	78	100	97	11.9	42.5	15.8	6
Primus	532	19	5-5	7-2	7-23	79	100	80	12.8	41.3	9.8	14

TABLE XVIII.

BARLEY

Seasonal Data Comparing Corn and Alfalfa
as Previous Crops, 1910

Variety	G. I. No.	H. No.	Corn Ground					Alfalfa Ground				
			Ripened	Days to Mature	Cwt. of Straw	Wt. Per Bu	Yield	Ripened	Days to Mature	Cwt. of Straw	Wt. Per Bu.	Yield
Six Rowed White			-	-	-	-	-	-	-	-	-	-
Minnesota No. 6.....	34	34	7-25	91	10.1	41.	8.1	7-26	88	16.5	46	14.9
" No. 105.....	33	33	7-25	91	13.0	42.	14.6	7-26	88	22.0	46	20.8
Oderbrucker	32	32	7-25	91	12.8	43.	10.8	7-26	88	17.0	45.	16.7
Wisconsin No. 6.....	178	178	7-24	89	12.7	44.	10.0	.....	.....	.....	.....	.....
Odessa	182	18	7-20	86	11.9	43.	7.5	7-25	87	22.0	47.	14.6
Manchuria	617	127	7-25	91	11.3	42.	14.0	.....	.....	.....	.....	.....
Marlout	261	123	7-16	82	6.5	45.	15.6	.....	.....	.....	.....	.....
Common Cal.	626	126	7-18	84	9.5	43.	8.3	.....	.....	.....	.....	.....
Beldi	190	124	7-14	80	5.0	40.	12.5	.....	.....	.....	.....	.....
Two Rowed White			-	-	-	-	-	-	-	-	-	-
Hanna	24	29	7-27	93	12.1	42.	13.3	7-27	89	21.0	48.	14.6
"	203	31	7-25	91	13.3	40.	14.0	7-25	87	22.0	48.	10.4
"	34	30	7-25	91	13.5	42.	16.7	7-25	87	20.0	49.	10.4
Bohemian	27	28	7-27	93	12.3	43.	19.2	7-27	89	21.0	47.	14.6
"	32	27	7-25	91	14.5	42.	11.5	7-27	89	20.5	48.	14.9
White Smyrna	195	23	7-18	84	5.8	50.	14.0	7-20	82	18.0	50.	10.4
Princess	529	22	8-1	98	13.8	46.	10.8	8-2	95	24.0	47.	10.4
"	603	125	7-25	91	15.5	45.	9.4	.....	.....	.....	.....	.....
Chevalier	530	21	7-27	93	12.1	45.	15.4	8-2	95	20.0	45.5	12.5
"	35	197	.....	.....	.....	.....	.....	8-2	95	17.0	47.0	8.3
Hannchen	531	20	7-22	88	10.0	46.	14.6	7-27	89	22.0	49.0	10.4
Swan Neck	187	199	.....	.....	.....	.....	.....	8-2	95	25.0	49.5	16.7
Kitzing	189	198	.....	.....	.....	.....	.....	8-2	95	26.0	48.0	10.4
Six Rowed Black			-	-	-	-	-	-	-	-	-	-
Galtami	575	122	7-16	82	3.5	50.	8.0	.....	.....	.....	.....	.....
Six Rowed Hulless			-	-	-	-	-	-	-	-	-	-
Hulless	262	2	7-26	92	11.2	50.	3.3	.....	.....	.....	.....	.....
White Hulless	262	2	7-26	92	11.2	50.	3.3	.....	.....	.....	.....	.....

TABLE XIX.

BARLEY

Yield per Acre for Each Year Grown, with Averages
and Comparative Rank, 1903-1910

Variety	G. I. No.	H. No.	1903	1904	1905	1906	1907	1908	1909	1910	No. Yrs. Grown	Av	Av. 5 Years	Rank
Six Rowed White . . .														
Minn. No. 6		34	27.5	16.8	37.0	42.3	22.7	24.4	14.6	8.1	8	24.2	22.4	3
Minnesota No. 105 . .		33	20.6				22.7	27.7	15.8	14.6	5	20.3		
Oderbrucker		32	20.6					28.3	15.6	10.8	3	18.2		
Wis. No. 6		178								10.0	1			
Odessa	182	18					23.8	32.4	15.8	7.5	4	19.9		
Manchuria	617	127								14.0	1			
Mariout	261	123								15.6	1			
Common Cal.	626	126								8.3	1			
Beldi	190	124								12.5	1			
Two Rowed White . .														
Hanna	24	29	19.4	17.5	50.6	36.8	22.9	34.6	15.6	13.3	8	26.6	24.6	5
Hanna	203	31				30.4	21.5	35.2	19.6	14.0	5	24.1	24.1	6
Hanna	34	30	15.6	11.0	51.6	32.5	21.5	35.2	18.8	16.7	8	25.4	24.9	4
Bohemian	27	28	16.5	12.3	46.8	31.3	27.7	38.4	20.8	19.2	8	26.6	27.5	2
Bohemian	32	27	18.3	10.4	54.1	32.7	21.7	30.0	17.3	11.5	8	24.5	22.6	7
Horn	31	26	14.4	12.7	54.4	25.4	21.5	28.1	15.4		7	24.6		
Striegum	47	25	15.6	13.1	47.9	25.4	18.6	32.1	14.2		7	23.8		
Golden Melon	48	24	10.6	10.4	51.0	28.5	20.8	26.4	11.5		7	22.7		
White Smyrna	195	23	16.5	16.6	45.4	30.4	19.6	27.9	19.6	14.0	8	23.8	22.3	9
Princess	529	22			40.8	47.9	22.7	18.8	11.0	10.8	6	25.4	22.2	10
Princess	603	125								9.4	1			
Chevallier	530	21			48.5	50.6	25.2	22.9	14.8	15.4	6	29.6	25.8	3
Hannchen	531	20			41.8	56.8	26.0	29.0	15.8	14.6	6	30.7	28.4	1
Primus	532	19			40.0	36.4	27.3	22.0	9.8		5	27.1		
Six Rowed Black . .														
Galtami	575	122								8.0	1			
Six Rowed Hulless . .	262	2								3.3	1			
White Hulless		1								2.3	1			

TABLE XX.

BARLEY

Eureka and Cottonwood Substations
Variety Yields per Acre for Each Year Grown

Variety	G. L. No.	Eureka			Cotton-wood	
		1908	1909	1910	1909	1910
Minnesota No. 6	182	31.9	5.1	1.0	2.0	
" No. 105	203	32.6	6.0	2.0	3.1	
Oderbrucker	24	34.4	2.7	2.2	3.1	
Odessa	34	29.4	5.2	2.4	3.5	
Hanna	203	11.4	19.7	3.1	1.7	
"	34	9.1	19.7	3.1	1.7	
"	34	25.4	1.4	2.8		
Bohemian	27	33.1	7.3		1.6	
"	32	28.3	8.0	4.0	2.2	
Horn	31	28.1	12.2	4.9	2.2	
Striegum	47	28.5	3.9			
Golden Melon	48	27.6	1.3		1.2	
White Smyrna	195	19.0	7.2			
Princess	529	30.1	0.0			
Chevallier	530	34.5	0.3	3.4	2.9	
Hannchen	531	19.9	31.5	3.8	6.1	3.6
Primus	532		19.9	1.7		

TABLE XXI.

BARLEY

Comparative Value of Varieties Based on Five-year Test
1906-1910

Variety	No. Years of Test	Bu. per Acre	Graphic Comparison
Hannchen No. 531	5	28.4	
Bohemian No. 27	5	27.5	
Chevallier No. 530	5	25.8	
Hanna No. 34	5	24.9	
Hanna No. 24	5	24.6	
Hanna No. 203	5	24.1	
Bohemian No. 32	5	22.6	
Minnesota No. 6	5	22.4	
White Smyrna No. 195	5	22.3	
Princess No. 529	5	22.2	

MILLET.

The varieties of millet tested are divided equally between the foxtail or forage types and the proso or grain types. The principal value of foxtail millet is its rapid production of forage. For testing seed production, the drill rows were sown 12 inches apart. For testing forage yield the drill rows were sown 6 inches apart and the crop mowed for hay. This latter test was begun in the season of 1910. Kursk No. 78, a variety introduced from Russia, has proved the most valuable as a producer of forage, though it has not seeded quite as heavily as the Common variety.

The proso millets are all introductions from Russia, where their seed is highly prized as food for both man and beast. The seed, when ground, is excellent feed for growing stock, such as calves and pigs. It is best used as a thickener for the soft ration. The seed makes very desirable feed for poultry. The variety which has yielded best is Black Voronezh No. 16. The principal objection to the prosos is their tendency to shatter out in the field.

Millets of both classes have their chief value at catch crops, to be sown where something else has failed.

Complete data regarding each variety will be found in the following tables.

TABLE XXII.

MILLET

Seasonal Data and Yields for 1909

Variety.	G. I. No.	H. No.	Seeded	Headed	Ripened	Days mature	Cwt. straw	Wt. per Bu.	Yield	Rank
Proso Types.....			-	-	-					
White Ural.....	4	4	6-9	7-21	8-21	73	3.8	46.5	14.4	6
Early Fortune.....	23	3	6-9	7-22	8-27	73	7.0	55.0	22.0	1
Red Turgai.....	31	5	6-9	7-19	8-21	73	15.0	57.5	18.0	2
Black Veronezh.....	16	6	6-9	7-19	8-23	75	9.8	56.5	20.4	4
Red Orenburg.....	15	7	6-9	7-21	8-21	73	14.0	56.5	20.0	3
Red Russian.....	11	8	6-9	7-18	8-23	75	15.6	56.0	16.8	5
Tambov.....	13	9	6-9	7-19	8-23	75	13.6	48.0	12.8	7
Foxtail Types.....			-	-	-					
Kursk No. 78.....	11	6-9	7-30	8-30	82	17.4	49.0	15.2		2
" No. 79.....	11a	6-9	7-30	8-30	82	12.9	50.0	14.2		4
" No. 80.....	10	6-8	7-31	8-30	83	11.0	49.5	18.0		1
Common.....	12	6-8	8-8	8-30	83	8.4	48.5	11.2		7
German.....	13	6-8	8-10	8-31	82	14.2	43.0	11.6		6
Hungarian.....	14	6-8	8-10	8-31	82	15.7	43.5	13.6		5
Siberian.....	15	6-8	8-11	8-31	82	16.8	35.0	14.4		3

TABLE XXIII.

MILLET

Seasonal Data and Yields for 1910

	G. I.	H. No.	Seeded	Headed	Ripened	Days to Mature	Cwt. straw	Wt. per Bu.	Yield
Proso Types.....			-	-	-				
White Ural.....	4	4	5-3	7-20	8-23	91	9.5	58.	2.0
Early Fortune.....	23	3	5-3	7-11	8-23	91	8.3	60.	3.4
Red Turgai.....	31	5	5-3	7-11	8-23	91	7.5	59.	5.0
Black Veronezh.....	16	6	5-3	7-20	8-23	97	13.5	58.	5.0
Red Orenburg.....	15	7	5-3	7-11	8-23	91	12.2	60.	1.6
Red Russian.....	11	8	5-3	7-11	8-23	91	14.1	60.0	1.8
Tambov.....	13	9	5-3	7-11	8-23	91	12.0	59.	7.0
Red Voronezh.....	60	103	5-14	7-14	8-23	80	12.5	59.	5.0
Red Lump.....	65	104	5-14	7-14	8-23	80	12.5	58.	5.0
Foxtail Types.....			-	-	-				
Kursk No. 78.....	11	5-19	8-15	8-22	95	42.5	48		1.4
" No. 79.....	11a	5-19	F	F	F	35.0	F		F
" No. 80.....	10	5-19	8-15	8-22	95	30.0	48		1.4
German.....	12	5-19	F	F	F	15.5	F		F
Siberian.....	13	5-19	F	F	F	18.0	F		F
Hungarian.....	14	5-19	F	F	F	15.0	F		F
Common.....	15	5-19	8-7	8-20	93	14.5	46		5.6

TABLE XXIV.

MILLET

Eureka and Cottonwood Substations

Variety Yields for Each Year Grown

Variety	G. I. No.	Eureka			Cotton wood	
		1908	1909	1910	1909	1910
Proso Types						
White Ural	4					
Early Fortune	23					
Red Turgai	31				6.1	
Black Voronezh	16	13.0	N	N	11.0	8.0
Red Orenburg	15		O	O	9.8	8.0
Red Russian	11				12.0	
Tambov	13		R	R	7.3	8.0
.....			e	e		
Foxtail Type			c	c		
Kursk No. 78		17.9	o	o	6.9	
Kursk No. 79			r	r		
Kursk No. 80			d	d		
German					3.1	
Hungarian					3.1	
Siberian					4.8	

TABLE XXV.

MILLET

Yield per Acre for Each Year Grown, with Averages
and Comparative Rank, 1903-1910

	G. I.	H. No.	1903	1904	1905	1906	1907	1908	1909	1910	No. Yrs. Grown	Av.	Av. 5 years	Rank
Proso Types														
White Ural	4	4					24.2		14.4	2.0	3	13.5	13.5	5
Early Fortune . . .	23	3					20.4		22.0	3.4	3	15.3	15.3	3
Red Turgal	31	5				38.7	20.8		18.0	5.0	4	20.6	14.6	4
Black Veronezh . .	16	6			33.7	35.4	22.5		20.4	5.0	5	23.4	16.0	1
Red Orenburg . . .	11	8	22.2		42.3	40.4	19.6		16.8	1.8	6	23.8	12.7	6
Red Russian	11	8	22.2		42.3	40.4	19.6		16.8	1.8	6	23.8	12.7	6
Tambov	13	9				43.3	27.1		12.8	7.0	4	22.6	15.6	2
Foxtail Types . . .														
Kursk No. 78 . . .		11			54.2	37.9	30.7		15.2	1.4	5	27.9	15.8	3
Kursk No. 79 . . .		11a				32.9	32.0		14.2	F	4	19.8	15.4	4
Kursk No. 80 . . .		10				42.6	28.3		18.0	1.4	4	22.6	15.9	2
Common		12			52.7	27.3	35.9		11.2	5.6	5	26.5	17.6	1
German		13				36.7	22.9		11.6	F	4	17.8	11.5	7
Hungarian		14				38.7	24.0		13.6	F	4	19.1	12.5	5
Siberian		15			53.0	31.2	22.1		14.4	F	5	24.1	12.2	6

CORN

Comparatively little work has been done with corn. The tests which have been conducted for the purpose of determining the best variety for this section indicate Minn. No. 13 as the best dent. Among the flints, N. D. White seems to be the best. The seed for these tests was imported pure each year from widely separated sources. These tests covered a period of three years, being discontinued in 1910. During this season Minn. No. 13 and Brown County Yellow Dent were the only varieties grown. The following table contains the data obtained.

TABLE XXVI.

CORN

Results of Variety Tests, 1907-1909

Variety	1907				1908				1909				Average Yield
	Planted	Ripened	Days to Mature	Yield	Planted	Ripened	Days to mature	Yield	Planted	Ripened	Days to mature	Yield	
Early Tuscarora	5-27	9-20	116	33.7	5-19	9-16	120	27.7	5-18	9-11	116	22.5	28.0
Gehu Yellow Flint	5-27	9-14	110	37.0	5-19	9-12	116	22.9	5-18	9-8	113	20.0	26.6
N. D. White Flint	5-27	9-14	110	37.8	5-19	9-12	116	25.6	5-18	9-10	115	21.3	28.2
Northwestern Dent	5-27	9-19	115	28.9	5-19	9-14	118	29.0	5-18	9-10	115	18.5	25.5
Dakota Sunshine	5-27	9-19	115	25.0	5-20	9-14	117	24.8	5-18	9-10	115	19.6	23.1
Triumph Yellow Flint ..	5-28	9-19	114	30.2	5-20	9-16	119	29.7	5-18	9-10	115	18.5	26.1
Minn. No. 13 Highmore	-	-	-	-	-	-	-	-	5-19	9-10	115	13.8	-
N. D. Golden Dent	5-28	9-19	114	30.5	5-20	9-18	121	32.3	5-19	9-10	115	20.0	27.6
Selection No. 133	5-28	9-20	115	23.3	5-20	9-18	121	30.9	5-19	9-10	115	20.3	24.8
Rustler's White Dent ..	5-28	9-25	120	24.8	5-20	9-24	127	30.5	5-19	9-15	120	21.3	25.5
90-Day Yellow Flint ..	5-28	9-14	109	20.9	5-20	9-16	119	27.4	5-19	9-10	115	21.0	23.1
Moore's Premium	5-28	9-20	115	25.7	5-20	9-16	119	27.9	5-19	9-18	123	17.5	23.7
R. . White Flint	5-28	9-20	115	23.8	5-20	9-16	119	25.5	5-19	9-16	121	12.5	20.5
Golden Ideal	5-28	9-19	114	15.2	5-20	-	-	27.9	5-19	9-16	121	13.8	19.0
Square Deal	5-28	9-19	114	28.3	5-20	9-20	123	23.0	5-19	9-14	119	11.9	21.1

GRAIN SORGHUMS.

The grain sorghums, including kaffir, milo, durra, kowliangs, etc., have become the main dependence of the farmers in the Texas Pan-handle and similar regions of the southwest. These crops are valuable, principally for their seed which has a feeding value a little lower than corn. Some of these will prove of great value to farmers in that portion of the state west of the James river, since they are very drouth-resistant, having the ability to stop growing during the periods of drouth without injury, and to grow very rapidly under favorable conditions.

The milos, kaffirs and durras will not mature seed with any certainty under our conditions. These are being subjected to selection in the hope of securing a strain which will mature during our short seasons.

The kowliangs matured in 114-15 days and produced seed of excellent quality in 1909 and 1910. Pedigreed strains will be increased as fast as possible for distribution.

All the sorghums were sown in drills 42 inches apart, a perfect stand being considered a plant to each six or eight inches. Complete data will be found in the following table.

TABLE XXVII.

GRAIN SORGHUMS

Seasonal Data and Yields, 1909-1910

Variety	G. I. No.	H. No.	1909					1910					Aver. Yield
			Planted	Headed	Ripened	Days to Mature	Yield	Planted	Headed	Ripened	Days to Mature	Yield	
Brown Kowliang	171-8	92	5-19	8-7	9-12	117	14.8	5-18	7-30	9-12	116	19.2	17.0
" "	261-4	91	5-19	8-4	9-10	114	14.0	5-18	8-2	9-9	114	20.0	17.0
" "	328	90	5-19	8-1	9-10	114	14.8	5-18	8-2	9-7	110	16.4	15.6
B'k Hull Kowliang	310		5-19	8-14	10-12	146	2.4	"	"	"	"	"	"
Kaffir Durra	198-153	89	5-19	8-14	10-2	146	10.8	5-18	8-6	F	F	F	
"	198-7-3		5-19	8-24	F	F	F	"	"	"	"	"	
Milo Maize	235-3-4		5-19	8-20	F	F	F	"	"	"	"	"	
"	234	88	5-19	8-19	10-11	145	10.0	5-18	8-26	F	F	F	

FLAX.

No variety tests of flax have been made. One variety, Minn. No. 25, has been grown successfully at all stations. At Highmore four preparations have been used, viz, new breaking, brome grass sod, corn ground and fall plowed wheat, in all cases thoroughly disked and harrowed in the spring. The first three preparations were successful; the last was a failure, owing to flax wilt.

