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Rate and Date of Seeding Winter Wheat in Eastern Colorado

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and J. J. CURTIS

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Rate and Date of Seeding Winter Wheat in Eastern Colorado

[1]D. W. ROBERTSON, J. F. BRANDON, H. FELLOWS, O. H. COLEMAN, and J. J. CURTIS

Experiments to determine the best rate and date to seed winter wheat have been conducted in the Great Plains area for varying periods of years since the establishment of experiment stations in that area. The results of experiments of this kind carried out on the U. S. Dry Land Field Station[2], Akron, Colo., are presented in this bulletin.

Experimental Methods

In 1920 an experiment was started to determine the best rate and date of seeding Kanred winter wheat. Between 1920 and 1930 dry-land foot rot was noticed to affect the early planted plots. To determine the effect of this disease on the wheat planted at different dates, an additional experiment was started in 1930.

The studies were conducted under dry-land conditions on the U. S. Dry Land Field Station at Akron, Colo., where the average annual rainfall is approximately 17 inches.

The soil of the Akron Station is classified as Weld Silt loam, which along with other loam soils is commonly known as "hard land" in eastern Colorado. It is a light brown loam underlaid at a depth of 12 to 15 inches by a calcareous layer. The subsoil is slightly heavier in texture than the surface soil.

Plantings were made near the following dates during the period from 1920 to 1937: August 15, September 1, September 15, October 1, and October 15. In 1938 and 1939 plantings were made weekly between August 15 and October 1. The wheat was

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[2] The U. S. Dry Land Field Station, located in northeastern Colorado at an altitude of about 4,600 feet, is operated by the Division of Dry Land Agriculture, U. S. D. A., in full cooperation with the Colo. Agr. Exp. Sta. The cereal experiments at this station were under the care of a representative of the Division of Cereal Crops and Diseases, U. S. D. A., in cooperation with the Colo. Agr. Exp. Sta. The rate and date experiment was carried on at this station by the representative of the Division of Cereal Crops and Diseases from 1920 to 1924, by Brandon and Robertson from 1924 to 1930, and by Curtis from 1930 to August 1940.

seeded at the following rates on each date: 1 peck, 2 pecks, 3 pecks, 4 pecks, and 5 pecks, except in 1926, 1927, and 1928, when a 6-peck rate was sown instead of the 1-peck rate. Four replications of each rate on each date were sown, two on fallow and two on cornland.

From 1920 to 1925 all plantings were made with an 8-inch disk drill. After 1925 a 12-inch furrow drill was used. The plots were 1/45-acre in size from 1920 to 1933. After this date smaller plots, 1/55-acre in size, were used. Kanred, C. I. 5146, was the variety of winter wheat used in all the tests.

An additional study was started in 1930 to determine the relationship of dry-land foot rot of wheat to yield. The method of soil preparation, size of plot, dates of planting, and the variety of wheat used were exactly the same as used in the rate and date studies mentioned previously. However, the rate of planting in the disease work was 3 pecks per acre only.

Symptoms of Dry-land Foot Rot

Dry-land foot rot may be definitely identified by the condition of the crowns in diseased plants. These crowns when cut the long way show a brownish discoloration which varies in extent

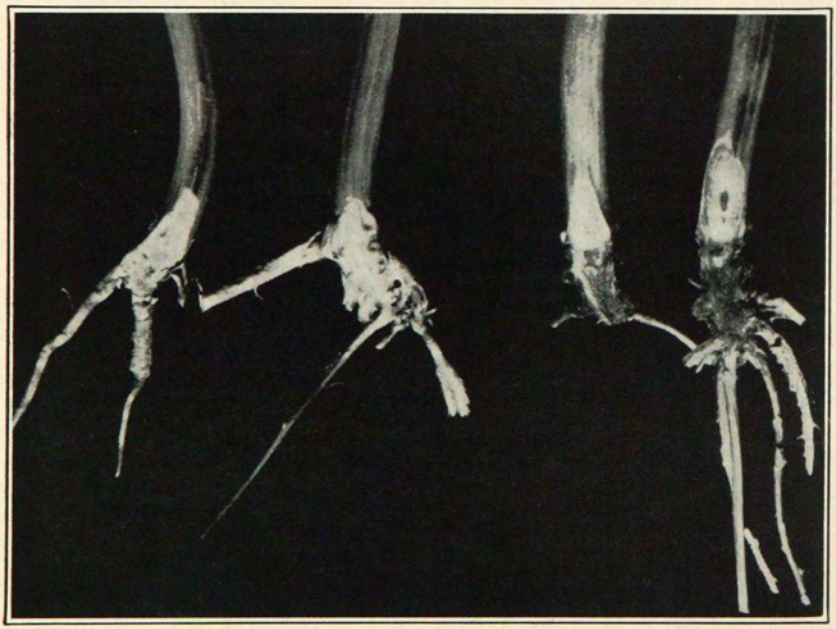


Figure 1.—Kanred winter wheat showing normal plants and plants infected with dry-land footrot. Infected plants on right and normal plants on left.

TABLE 1.—*Average yields in bushels per acre for Kanred winter wheat sown on summer fallow at different rates on different dates for* 13 *years between* 1920 *and* 1937.

Rates	Date of sowing					
	Aug. 15	Sept. 1	Sept. 15	Oct. 1	Oct. 15	Average
	Yields in bushels per acre					
1 peck	10.2	14.5	15.3	10.6	9.9	12.1
2 pecks	12.0	16.2	15.5	11.5	11.1	13.3
3 pecks	13.0	16.1	15.4	12.2	11.3	13.6
4 pecks	13.8	16.1	14.9	12.4	11.8	13.8
5 pecks	14.5	16.4	14.5	12.4	12.3	14.0
Average	12.7	15.9	15.1	11.8	11.3	13.4

TABLE 2.—*Average yields in bushels per acre of Kanred winter wheat planted on cornland at various rates on different dates at the Akron Field Station for* 12 *years between* 1920 *and* 1937.

Rates	Date of seeding					
	Aug. 15	Sept. 1	Sept. 15	Oct. 1	Oct. 15	Average
	Yields in bushels per acre					
1 peck	7.3	11.2	11.4	6.7	5.9	8.5
2 pecks	9.1	11.6	11.3	6.7	6.7	9.1
3 pecks	10.4	12.1	10.6	6.9	6.9	9.4
4 pecks	11.0	12.3	10.7	6.8	7.1	9.5
5 pecks	11.6	12.3	10.2	7.6	7.7	9.9
Average	9.9	11.9	10.8	7.0	6.9	9.3

and depth of shade depending upon the severity of the disease (see fig. 1). The roots where they enter the crown may or may not be discolored.

The symptoms of dry-land foot rot vary with its severity. The appearance of a moderately diseased field is that of extreme drought. This condition is more or less spotted over the entire field. The seed is shriveled, and occasionally there may be a white head although there are many other causes of white heads. The wheat in a diseased portion of a field when viewed from a distance is more or less ashy gray in color. In a badly diseased field the plants may die before heading occurs.

Experimental Results

In a study of this kind several factors may influence the final results. Some of these, such as extremely low temperature and moisture, may destroy part or all of the experiment. In analyzing the data an effort was made to determine some of the causes affecting the yield of winter wheat planted at different rates and dates. In order to do this and eliminate the effect of as many different factors as possible, yields which were definitely

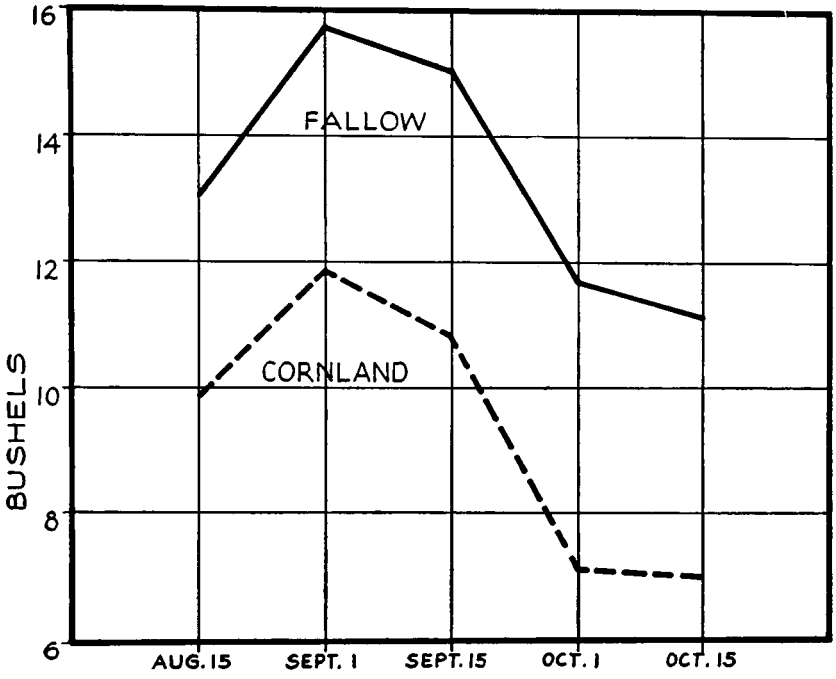
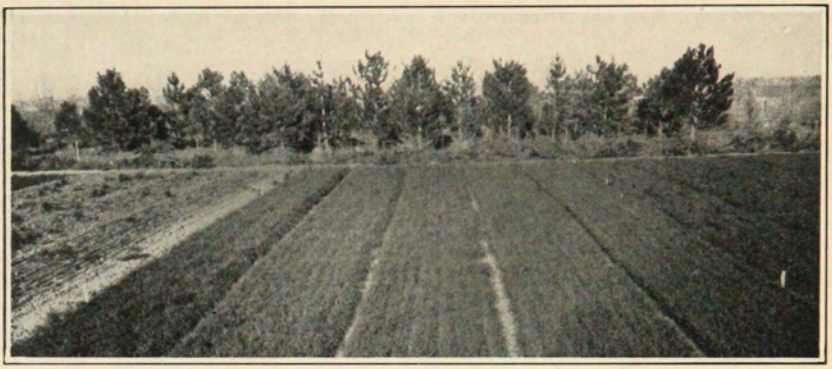


Figure 2.—Graph showing yield of Kanred winter wheat sown at different dates on fallow and on cornland at the U. S. Dry Land Field Station, Akron, Colo., for varying periods of years from 1920 to 1937.

affected by winter-killing, date of emergence, and lack of moisture have not been included in the analyses.

In appendix table 1 the rainfall for the 20-year period between 1920 and 1939 is given. The fall rainfall before and during seeding time was sufficient for germination of the crop in all years except for the 1934 crop on cornland and the 1935 crop on both cornland and fallow. In spite of the adequate moisture in the fall, several failures were reported in the 20-year period of the test. While fall moisture is necessary for germination, subsoil moisture at seeding time, supplemented by rainfall later in the fall season and again in the spring and early summer is essential to produce a crop.

Experimental data only from years in which the crops survived the winter and in which moisture was sufficient to produce a crop have been used. The data for several years were not used for the following reasons. In 1925 part of the plots were destroyed by army cutworms and no yields were taken. In 1926, 1927, and 1928 the 1-peck rate was not included in the test. In



2 pecks 3 pecks 4 pecks 5 pecks 6 pecks

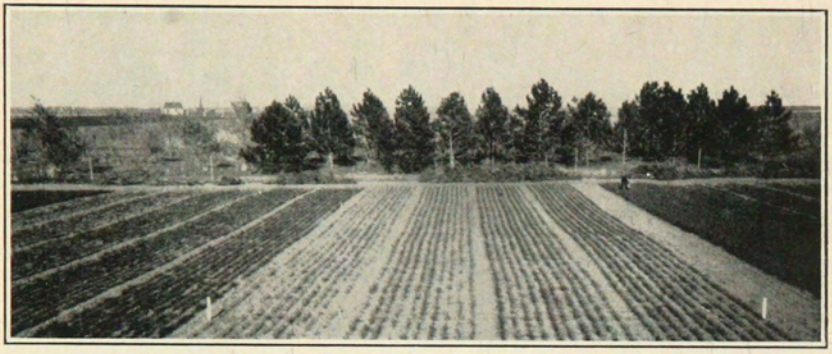
Figure 3.—Early seeding at U. S. Dry Land Field Station at Akron showing excess growth in the fall. Such a condition is favorable to attack of dry-land foot rot.

1935 poor stands were obtained. The wheat on all planting dates emerged at the same time in the spring. In 1934 the crop on cornland was a failure, and in 1938 and 1939 different dates of planting were used.

The results were analyzed separately for fallow and cornland. Data for 13 years (table 1) were used in the analysis of the plots grown on summer fallow and for 12 years (table 2) for the plots grown on cornland. The details of the statistical analysis[3] will not be discussed in this paper. The statistical analysis indicated a significant difference in the rates of planting in summer fallow and also showed that Kanred winter wheat gave a greater response to date of planting than to the rate of seeding. From these analyses it may be concluded that (a) 1 peck is too light a seeding on summer fallow, and (b) 2 pecks is sufficient when planted at the proper date, between September 1 and September 15. Slight increases were obtained when more than 2 pecks were used at the other dates. This is particularly true for the August 15 planting.

On cornland little increase was obtained by an additional amount of seed over the 1-peck rate. In the late planting there are indications that heavier rates give a slight increase but it is doubtful if the use of the additional amount of seed is justified by the slight increase in yield.

[3] Robertson, D. W., Coleman, O. H., Brandon, J. F., Fellows, H., and Curtis, J. J., "Rate and Date of Seeding Kanred Winter Wheat and the Relation of Seeding Date to Dry-Land Foot Rot at Akron, Colo." **Jour. Agr. Res.**, Vol. 64:339-356. 1942.



2 pecks 3 pecks 4 pecks 5 pecks

Figure 4.—A late planting on the U. S. Dry Land Field Station at Akron showing the lack of cover typical of late plantings.

These results indicate that 1 peck of seed is sufficient when plantings on cornland are made at the proper time. More than 2 pecks of seed did not increase yields enough to justify the use of additional amounts of seed, with the exception of the August 15 planting.

For both fallow and cornland the best date to plant was found to be from September 1 to 15. Planting earlier than this gave low yields. After September 15 the yield of wheat planted at later dates dropped off rapidly (see fig. 2).

In the disease studies it was shown that severe attacks of dryland foot rot reduced the yields of the earlier plantings. As the season advanced the amount of infection and the severity of infection decreased. In the later plantings temperature seemed to be the main factor in reducing yields. In the early plantings with normal emergence an abundance of growth is obtained in the fall (fig. 3). This growth requires an abundance of moisture and in seasons when the winter and spring are dry, loss of stand may result from lack of moisture.

Both disease and lack of moisture may reduce stands and yield in the early plantings. Later plantings produce less growth, show less disease, and give higher yields. Too-late plantings, October 1 and 15, produce very little growth in the fall and give low yields the following year.

Summary

From the studies made at the U. S. Dry Land Field Station, Akron, Colo., the following recommendations are made:

1. The date of planting is more important than the rate of planting.

2. Winter wheat should be planted between September 1 and 15 on either summer fallow or cornland to obtain the best yields.

3. Two pecks is sufficient seed to plant on summer fallow when plantings are made at the best dates, that is, between September 1 and September 15. Slight increases were obtained when more than 2 pecks were seeded at earlier or later dates.

4. One peck of seed is sufficient to plant on cornland if seeded at the proper time, that is, between September 1 and September 15. When seeding is done at earlier or later dates, a slight increase in yield is obtained by increasing the amounts.

5. Low temperature is the main factor in reducing yields in dates of planting after September 15.

6. The effect of high temperature on the incidence of dryland foot rot and the resulting effect of the disease on the plant is one of the main factors in reducing yields in the early plantings, August 15.

7. Other factors, such as moisture and winter-killing, may act independently of rates and dates in reducing yields.

APPENDIX TABLE 1.—*Annual and monthly rainfall for the* 20-*year period* 1920-1939, *inclusive, at the U. S. Dry Land Field Station, Akron, Colo.*

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1920	0.35	0.17	0.90	3.28	2.90	3.97	4.72	1.45	1.80	0.44	0.47	0.90	21.35
1921	1.22	T	1.25	2.77	0.47	1.32	2.88	0.92	0.79	0.97	0.20	0.65	13.44
1922	0.65	0.25	0.15	3.96	3.63	1.43	3.24	1.24	0.06	0.05	1.90	0.10	16.66
1923	T	0.18	0.95	1.65	4.94	2.17	3.62	0.75	0.82	1.91	0.47	0.70	18.16
1924	0.50	0.59	1.25	0.31	3.26	0.35	1.71	0.77	4.04	0.40	0.13	0.77	14.08
1925	0.05	T	0.39	2.24	1.19	2.90	1.08	1.01	0.50	1.46	0.47	0.53	11.82
1926	0.41	0.05	0.36	0.18	3.77	1.42	6.46	5.07	0.72	1.03	0.41	0.28	20.16
1927	0.17	0.29	2.41	2.27	1.46	5.16	3.00	3.74	0.90	0.14	0.64	0.22	20.40
1928	0.13	0.17	0.32	0.17	3.52	5.39	3.14	0.25	0.04	1.75	0.49	T	15.37
1929	0.07	0.34	0.32	3.43	1.19	1.15	4.44	2.66	2.67	2.76	0.49	0.09	19.61
1930	0.07	T	0.17	2.28	5.52	1.61	3.54	3.48	0.39	0.83	1.05	0.09	19.03
1931	0.01	0.71	0.95	0.84	1.38	2.20	1.49	1.04	0.50	0.61	0.11	0.90	10.74
1932	0.27	0.25	0.60	1.93	2.91	2.80	4.17	1.27	0.05	0.49	0.19	0.21	15.14
1933	T	0.04	0.74	4.58	4.15	0.92	2.01	4.54	1.13	T	0.04	0.75	18.90
1934	0.02	0.91	0.36	0.64	1.42	4.14	0.31	3.56	0.75	0.04	0.37	0.09	12.61
1935	0.01	0.23	1.22	3.25	7.35	3.08	0.37	0.83	2.24	0.21	0.26	0.04	19.09
1936	0.29	0.15	0.64	2.08	3.51	3.04	1.85	2.17	3.03	0.94	0.07	0.44	18.21
1937	0.16	0.19	0.82	0.33	1.26	2.40	2.38	1.13	1.65	0.08	0.32	0.63	11.35
1938	0.18	0.09	1.34	2.10	5.75	1.15	1.77	1.21	0.73	0.03	0.68	0.47	15.50
1939	1.00	0.31	1.03	0.80	2.11	1.41	1.28	1.00	0.23	0.36	T	0.40	9.93
Aver.	0.26	0.24	0.81	1.95	3.08	2.40	2.67	1.90	1.15	0.72	0.44	0.41	

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