11-1-1917

Bulletin No. 116 - Winter Grains

University of Wyoming Agricultural Experiment Station

Follow this and additional works at: https://repository.uwyo.edu/ag_exp_sta_bulletins

Part of the Agriculture Commons

Publication Information


This Full Issue is brought to you for free and open access by the Agricultural Experiment Station at Wyoming Scholars Repository. It has been accepted for inclusion in Wyoming Agricultural Experiment Station Bulletins by an authorized administrator of Wyoming Scholars Repository. For more information, please contact scholcom@uwyo.edu.
UNIVERSITY OF WYOMING
AGRICULTURAL
EXPERIMENT STATION
LARAMIE, WYOMING.

WINTER GRAINS
By T. S. Parsons

Bulletins will be sent free upon request.
Address: Director Experiment Station, Laramie, Wyoming.
UNIVERSITY OF WYOMING
Agricultural Experiment Station
LARAMIE

BOARD OF DIRECTORS
Officers
MARY B. DAVID .......................................................... President
ALEXANDER B. HAMILTON, M. D ............................ Vice President
C. D. SPALDING .......................................................... Treasurer
FRANK SUMNER BURRAGE, B. A ................................ Secretary

Executive Committee
A. B. HAMILTON ............................... MARY B. DAVID .......................... W. S. INGHAM

Members
Appointment ............................. Term Expires
1895 ........................................... TIMOTHY F. BURKE, LL. B .......................... 1919
1913 ........................................... MARY B. DAVID ........................................... 1919
1914 ........................................... MARY N. BROOKS ........................................... 1919
1911 ........................................... W. S. INGHAM, B. A ........................................... 1921
1913 ........................................... C. D. SPALDING ........................................... 1921
1915 ........................................... J. M. CAREY, LL. B ........................................... 1921
1911 ........................................... ALEXANDER B. HAMILTON, M. D .......................... 1923
1911 ........................................... LYMAN H. BROOKS ........................................... 1923
1913 ........................................... CHARLES S. BEACH, B. S ........................................... 1923
EDITH K. O. CLARK, State Superintendent of Public Instruction ........................................... Ex Officio
A. NELSON, Ph. D ........................................... Ex Officio

STATION STAFF
A. NELSON, Ph. D ........................................... Acting President, Botanist and Horticulturist
HENRY G. KNIGHT, Ph. D ........................................... Director and Agricultural Chemist
F. S. BURRAGE, B. A .................................................. Secretary
C. D. SPARWASSER .................................................. Clerk
F. E. HEPNER, M. S .................................................. Research Chemist
*J. A. HILL, B. S .................................................. Wool Specialist
J. C. FITTERER, M. S, C. E ........................................... Irrigation Engineer
A. D. FAVILLE, M. S .................................................. Animal Husbandman
*T. S. PARSONS, M. S .................................................. Agronomist
KARL STEIK, M. A .................................................. Engineering Chemist
J. W. SCOTT, Ph. D .................................................. Parasitologist
O. A. BEATH, M. A .................................................. Research Chemist
E. H. LEHNERT, D. V. S .................................................. Veterinarian
EARL O’ROKE .................................................. Assistant Parasitologist
J. I. HARDY, Ph. D .................................................. Assistant Wool Specialist
J. L. ROBINSON, M. S .................................................. Assistant Agronomist
A. F. VASS, Ph. D .................................................. Associate Agronomist
MARION HIGGINS .................................................. Librarian

*On leave.
WINTER GRAINS

INTRODUCTION.

Work with winter grains has been carried on at the Experiment Station with the idea of determining varieties adapted to the state, time of seeding, protection of the crop from winter-killing, etc.

Winter wheat has been the principal fall or winter grain crop in the state for many years, and has been practically the only winter grain crop grown with the exception of winter rye, until within the past five or six years. Winter wheat has been grown extensively on both irrigated and non-irrigated lands in practically all parts of the state with more or less success, depending on the time of seeding, preparation of the soil, moisture supply, etc. In many sections of the state it is considered superior to spring wheat. This is especially true on the non-irrigated farms, as the winter grain does not usually suffer so severely from drought as does the spring grain.

Winter rye is a sure crop under practically all conditions, therefore it receives very little attention in this bulletin. Winter wheat is given prominence as the main winter grain crop of the state and the other winter grains as speltz, emmer, barley, and oats have received some attention, as they are important stock feeding crops and should be more generally grown. The difficulty, however, has been to obtain strains sufficiently hardy to withstand the winter conditions in the higher altitudes of the state.

Winter emmer has been successfully grown in parts of the state for several years past. It has winterkilled badly, however, in some sections. Early sowing will probably give it a start so that it will be able to withstand the winters. At least, this has been the case at the Experiment Station.

Winter speltz has but recently been introduced into the state. It promises to be a good crop for Wyoming conditions
and will perhaps be a valuable addition to the list of winter grains wherever it will withstand the winter. Winter speltz and winter barley did not survive the winter of 1916-1917 at the Experiment Station.

Winter barley has not been wholly successful in the state. It has not stood the winters well at the Station, but the County Agent of Platte County reports fair yields of White Winter Barley in his county in 1916.

Thus far winter oats have not proved at all successful at the Station, nor in any other part of the state.

There are several advantages in growing winter grains: the winter grain crop has an important place in the crop rotation, as it is a good crop to sow on the summer fallow or on ground that is broken up in the spring, grain seeded in the fall gets that much work out of the way in the spring, and the growing of winter crops improves the fertility of the soil.

Where, as in many parts of Wyoming, the growing season is short, it is important that those crops be grown that are the most certain to mature. Bad weather often hinders work in the spring, so that spring grains are sown too late to mature. The weather is usually more favorable for planting in the fall and winter grains are more certain to mature, provided they withstand the winter. The winter wheats grown in Wyoming are also hard wheats and therefore better for flour. Winter wheats also give better yields than spring wheats when they do not winterkill.

THE WORK AT THE STATION.

The work with winter grains has been carried on at the Experiment Station since the fall of 1910. The areas planted have been in most cases one-fourth acre plots. These have been reduced to one-fifth acre areas in figuring yields.

VARIETIES.

Turkey Red is the variety of winter wheat most commonly grown in the state. This has been the principal variety grown
Turkey Red is a Crimean wheat introduced from Southern Russia. It is a bearded red winter wheat, with grain of good milling quality and does not shatter badly. This characteristic makes it a good wheat for the dry farm. The Buffum’s No. 17 is said to be a selection from the Turkey Red. The grain appears about the same in hardness and color, but it is beardless. The Kharkov, another Russian variety, was grown at the Station in 1909 and the Malakoff, also from Russia, was grown in 1911. Several other varieties of winter wheat from various sources were also grown in 1912. Most of them did not do well, therefore the experiments since that time have been confined mainly to the Turkey Red and Buffum’s No. 17. Yield and sources of seed of the different varieties will be found in Table I.

**Record of Work.**

In the fall of 1910, the north half of acre Plot 2 was sown to Turkey Red winter wheat at the rate of one hundred pounds per acre with seed grown on the Experiment Farm in 1909. The plot was plowed in August and worked down thoroughly and sown on September 9. The southwest quarter of the plot was also plowed and sown on the same date to Malakoff winter wheat. This seed was grown in Iowa and was obtained from the Iowa Seed Company of Des Moines. The following plot record may be of interest to wheat growers:

May 27, 1911, wheats came through the winter well. The Turkey Red appears the best. June 14, plot given the second irrigation. July 12, both varieties in full head. Stand of both varieties rather uneven. Turkey Red much the better. August 2, Turkey Red beginning to ripen. August 4, Malakoff beginning to ripen. The Malakoff ripened much more rapidly than the Turkey Red. It was cut on August 15, while the Turkey Red was not cut until August 25. Moisture conditions, however, were probably responsible for the slower ripening of
the Turkey Red. An irrigation ditch ran down one side of the plot in which the water ran continuously during the summer, and there was probably some seepage from this. The grain near the ditch remained green for a longer time and grew taller than that on the other side of the plot. A total of 1,122 pounds of Turkey Red was threshed from the plot. This was a yield of 37.4 bushels per acre and the grain weighed 61 pounds to the bushel. The total yield of Malakoff was 285 pounds, or a yield of 19 bushels per acre, and the grain weighed but 52 pounds per bushel. The Malakoff was evidently not suited to local conditions.

VARIETIES OF WINTER WHEAT IN 1912.

In the fall of 1911, Plots 11 and 14 were selected for further experiments with winter grains. These plots were given a coat of approximately 10 tons of barnyard manure each, the preceding winter, and were plowed on September 7 and 8, no crop, however, having been produced on them in 1911. The ground was quite dry and plowed up in bumps, which were difficult to break down. Rolling, disking, and harrowing, however, put the ground in fairly good shape for seeding. The plots were divided into six equal areas approximately one-sixth acre each in size, and the seeding was done on September 11. The following varieties were sown at the rate of 100 pounds per acre, beginning at the south side of Plot 11 and continuing across Plot 14: Black Winter Emmer, Defiance Winter Wheat, Bulgarian Winter Wheat, Winter Rye with Vetch, Speltz, Turkey Red Winter Wheat, Kharkov Winter Wheat, Malakoff Winter Wheat, Red Cross Winter Wheat, Defiance Winter Wheat, and Buffum's No. 17 Winter Wheat.

There was not sufficient moisture in the ground to germinate the grains, therefore the plots were irrigated on September 15. This brought the grains up and kept them in excellent shape for winter. It would probably have been better, however, to irrigate before sowing under these conditions, as the seed bed could then have been put in better shape for seed-
On March 26, the plots were harrowed with a spike-tooth harrow. All the wheats and the rye came through the winter well, but the Emmer and Speltz winterkilled completely. On June 19-20 the plots were given their first and on July 22-24 their second irrigation.

The wheat varieties showed considerable variation in growth and time of ripening, Defiance Winter Wheat and Bulgarian Winter Wheat being so late that they were beaten down by a heavy snow storm on September 12. Alkali showed on the lower half of one of the plots, reducing the yields at least fifty per cent, hence, in estimating yields per acre, returns were based on figures obtained from the non-alkalied areas. Tables I and II summarize results obtained with various types of winter grains.
<table>
<thead>
<tr>
<th>Year</th>
<th>VARIETY</th>
<th>Date Sown</th>
<th>No. Irrigations</th>
<th>Date Harvested</th>
<th>Yield per Acre</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>Turkey Red Wheat</td>
<td>Sept. 9</td>
<td>2</td>
<td>Aug. 25</td>
<td>37.4</td>
<td>Slow ripening</td>
</tr>
<tr>
<td>1911</td>
<td>Malakoff Wheat</td>
<td>Sept. 9</td>
<td>2</td>
<td>Aug. 15</td>
<td>19</td>
<td>Poor stand</td>
</tr>
<tr>
<td>1912</td>
<td>Imported Winter Emmer</td>
<td>Sept. 12</td>
<td>1 fall</td>
<td></td>
<td></td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1912</td>
<td>Winter Emmer</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1912</td>
<td>Iowa Defiance Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Snowed down Sept.12</td>
</tr>
<tr>
<td>1912</td>
<td>Bulgarian Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td>July 24</td>
<td>2 tons</td>
<td>Snowed down Sept.12</td>
</tr>
<tr>
<td>1912</td>
<td>Winter Rye and Vetch</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Cut for hay</td>
</tr>
<tr>
<td>1912</td>
<td>Speltz</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1912</td>
<td>Turkey Red Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Fair stand</td>
</tr>
<tr>
<td>1912</td>
<td>Kharkov Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Fair stand</td>
</tr>
<tr>
<td>1912</td>
<td>Malakoff Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Poor stand</td>
</tr>
<tr>
<td>1912</td>
<td>Red Cross Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Good stand</td>
</tr>
<tr>
<td>1912</td>
<td>North Dakota Defiance Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Good stand</td>
</tr>
<tr>
<td>1912</td>
<td>Buffum 17 Wheat</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Fair stand</td>
</tr>
<tr>
<td>1912</td>
<td>Winter Rye</td>
<td>Sept. 11</td>
<td>1 fall, 2 summer</td>
<td></td>
<td></td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1913</td>
<td>All winter grains winter killed this year</td>
<td>Sept. 5</td>
<td>2</td>
<td>Aug. 15</td>
<td>51</td>
<td>Very heavy</td>
</tr>
<tr>
<td>1914</td>
<td>Buffum 17 Wheat (early)</td>
<td>Sept. 19</td>
<td>2</td>
<td>Aug. 22</td>
<td>45.46</td>
<td>Very heavy</td>
</tr>
<tr>
<td>1914</td>
<td>Buffum 17 Wheat (late)</td>
<td>Sept. 19</td>
<td>2</td>
<td>Aug. 22</td>
<td>45.46</td>
<td>Very heavy</td>
</tr>
<tr>
<td>1914</td>
<td>Turkey Red Wheat</td>
<td>Aug. 31</td>
<td>2</td>
<td>Aug. 30</td>
<td>47.4</td>
<td>Good stand</td>
</tr>
<tr>
<td>1914</td>
<td>Defiance Wheat</td>
<td>Aug. 31</td>
<td>2</td>
<td>Aug. 30</td>
<td>40.8</td>
<td>Good stand</td>
</tr>
<tr>
<td>1914</td>
<td>Buffum 17 Wheat</td>
<td>Sept. 15</td>
<td>2</td>
<td>Sept. 9</td>
<td>41.6</td>
<td>Good stand</td>
</tr>
<tr>
<td>1915</td>
<td>Defiance Wheat</td>
<td>Sept. 15</td>
<td>2</td>
<td>Aug. 30</td>
<td>29.34</td>
<td>Good stand</td>
</tr>
<tr>
<td>1915</td>
<td>Buffum 17 Wheat</td>
<td>Sept. 15</td>
<td>2</td>
<td>Sept. 9</td>
<td>32</td>
<td>Good stand</td>
</tr>
<tr>
<td>1916</td>
<td>Buffum 17 Wheat</td>
<td>July 15</td>
<td>1</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1916</td>
<td>Winter Emmer</td>
<td>July 15</td>
<td>1</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Half winterkilled</td>
</tr>
<tr>
<td>1914</td>
<td>Utah Winter Wheat</td>
<td>Aug. 30</td>
<td>1</td>
<td>Aug. 30</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1914</td>
<td>Tennessee Winter Barley</td>
<td>Sept. 15</td>
<td>1</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1914</td>
<td>Turf Oats</td>
<td>Sept. 15</td>
<td>1</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1915</td>
<td>Utah Winter Barley</td>
<td>Sept. 5</td>
<td>2</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
<tr>
<td>1915</td>
<td>Idaho Winter Barley</td>
<td>Sept. 5</td>
<td>2</td>
<td>Aug. 13</td>
<td>40.5</td>
<td>Winterkilled</td>
</tr>
</tbody>
</table>
The yields in the above table are taken from carefully measured areas and the acre yields figured from data thus obtained.

The Tennessee Winter Barley contained a great deal of volunteer grain. The yield given is the total of mixed seed.

The plots were given the same treatment as regards plowing, cultivation, irrigation, etc., and a comparative study of the habits of growth, size of heads, height of grain, etc., was made in the different years. Plots 11 and 14 were badly alkaliised on the lower side and much of the grain was killed out, so yields were made up from the upper half of the plots, where conditions were more normal.

<table>
<thead>
<tr>
<th>Year</th>
<th>VARIETY</th>
<th>Height of Grain</th>
<th>Length of Head</th>
<th>Character of Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1911</td>
<td>Turkey Red</td>
<td>30 inches</td>
<td>2.5 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1911</td>
<td>Malakoff</td>
<td>24 inches</td>
<td>2 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Iowa Defiance</td>
<td>20 inches</td>
<td>2.5 inches</td>
<td>Medium bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Bulgarian</td>
<td>24 inches</td>
<td>3 inches</td>
<td>Medium bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Turkey Red</td>
<td>32 inches</td>
<td>2 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Kharkov</td>
<td>32 inches</td>
<td>3 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Malakoff</td>
<td>32 inches</td>
<td>3 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Red Cross</td>
<td>40 inches</td>
<td>2.75 inches</td>
<td>Medium bearded</td>
</tr>
<tr>
<td>1912</td>
<td>North Dakota Defiance</td>
<td>36 inches</td>
<td>2.75 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1912</td>
<td>Buffum 17</td>
<td>24 inches</td>
<td>2.5 inches</td>
<td>Hard beardless</td>
</tr>
<tr>
<td>1914</td>
<td>Buffum 17</td>
<td>44 inches</td>
<td>3.5 inches</td>
<td>Hard beardless</td>
</tr>
<tr>
<td>1914</td>
<td>Buffum 17</td>
<td>34 inches</td>
<td>3 inches</td>
<td>Hard beardless</td>
</tr>
<tr>
<td>1914</td>
<td>North Dakota Defiance</td>
<td>36 inches</td>
<td>3.5 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1915</td>
<td>Turkey Red</td>
<td>30 inches</td>
<td>2.75 inches</td>
<td>Hard beardless</td>
</tr>
<tr>
<td>1915</td>
<td>North Dakota Defiance</td>
<td>40 inches</td>
<td>3 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1915</td>
<td>Buffum 17</td>
<td>40 inches</td>
<td>3 inches</td>
<td>Hard bearded</td>
</tr>
<tr>
<td>1915</td>
<td>Buffum 17</td>
<td>41 inches</td>
<td>3.25 inches</td>
<td>Hard beardless</td>
</tr>
<tr>
<td>1916</td>
<td>Buffum 17</td>
<td>30 inches</td>
<td>2.75 inches</td>
<td>Hard beardless</td>
</tr>
</tbody>
</table>

*Early sowing.
Late sowing.

The Buffum No. 17 wheat in 1916 was grown in a large field where there had been no barnyard manure or other fertilizer used and received but one irrigation. This was sown on July 15, 1915, and is the only time that winter grain has withstood the winter in the large field. Black Winter Emmer sown in this field on the same date also withstood the winter well. Early sowing seems necessary for the most successful growing of winter grains.
In the fall of 1912 a portion of the field on the east side of the county road was prepared for winter wheat. This field is more exposed and has not had any barnyard manure or other fertilizer. The purpose was to try out the grain under more severe conditions than those found in the experimental plots.

Ten plots of one-tenth acre each were selected and prepared in the following manner:

Plot 1—Check plot. Disked once and harrowed down.
Plot 2—Plowed ordinary depth (4 inches) and thoroughly harrowed down.
Plot 3—Double disked and thoroughly worked down.
Plot 4—Disked twice and thoroughly harrowed down.
Plot 5—Listed and worked down, leaving ridges for irrigation.
Plot 6—Listed and two weeks later the ridges split and worked down.
Plot 8—Plowed as deep as possible (8 inches) and thoroughly worked down.
Plot 9—Plowed shallow (3 inches) and thoroughly worked down.
Plot 10—Disked four times and thoroughly worked down.

Turkey Red Winter Wheat grown on the Experiment Farm in 1911 was sown on September 1, at the rate of 100 pounds per acre. September rains gave good moisture conditions and the wheat made satisfactory growth in the fall, and went into the winter in apparently good shape. It was found in the spring, however, that the wheat on all of the plots was dead. Winter emmer, sown in the same field at the same time, also winterkilled.

Unfortunately no winter wheat was sown on any of the more highly fertilized plots, so no comparison along this line could be made. The winter of 1912 and 1913, however, was very hard on winter grains and alfalfa. Many of the alfalfa varieties growing on the Experiment Farm winterkilled badly and many reports of winterkilling of alfalfa and winter wheat
Winter Grains.

came from all parts of the state. Earlier sowing might have prevented winterkilling, as winter wheat sown in the same field on July 15, 1915, came through the winter in good shape.

The method of soil preparation seemed to make no difference in this case, as there was complete winterkilling on every plot.

**WORK IN 1913-1914 AND 1914-1915.**

In the fall of 1913 it was decided to make a comparison of the time of seeding winter wheat. Buffum's No. 17 was selected as the variety and acre Plot 5 was prepared for sowing, and one-half the plot sown at the rate of 100 pounds per acre on September 5, and the other half sown at the same rate on September 15. Both plots were given the same treatment as to plowing, cultivation, irrigation, etc. Both plots apparently came through the winter equally well, a very slight degree of winterkilling showing in the later sowing. Two irrigations were given the crop during the season. The wheat showed considerable rust, probably due to heavy rains following the second irrigation. Wheat should not be irrigated just before ripening begins if it can be avoided, as rust is apt to be induced.

The early sowing began to mature a little earlier than the late sowing, beginning to turn on July 28, and was ready to cut on August 15. It also exceeded the late sowing in height, being 44 inches high when cut. The later sowing began turning on August 4, was ready to cut on August 22, just one week later than the early sowing, and was 40 inches high when cut.

There was a difference in yield of 5.54 bushels per acre in favor of the earlier sowing and the grain was also of better quality, weighing 63 pounds to the bushel as against 61 pounds for the later sowing.

During the years 1914 and 1915 comparisons were made of Defiance, Buffum’s No. 17, and Turkey Red winter wheats on Plot 20. Sowing dates, yields, etc., are shown in Tables I and II. It is advisable to use summer fallow for winter wheat, as the sowing can then be done earlier.

The source of the seed also is important. The Defiance
has proved a good variety for local conditions when seed from North Dakota was used, but the same variety of Iowa seed has not done well at all. The Turkey Red and Buffum's No. 17 are dependable, yielding about the same, but the Buffum's No. 17, being a beardless wheat, is preferable.

In 1915, an area of about three acres in the south field was sown to Buffum No. 17. This made excellent growth in the fall and came through with no winterkilling, as also did the Winter Emmer sown on the same date. It is probable that sowing as early as the middle of July could not be practiced in the lower altitudes of the state unless the crop was pastured off in the fall. This is not too early to sow winter grains at the higher altitudes, however, and numerous reports of sowing as early as this date have come from dry-farmers who consider early sowing necessary to successful winter wheat growing.

Further experimentation is necessary in order to determine whether early sowing will prevent winterkilling of other fall grains, such as Winter Barley, Winter Emmer, Winter Speltz, and Winter Oats. Winter Emmer has come through the winter and given a good crop when sown as early as July 15, but sown at later dates it has winterkilled. Tests of early seeding of winter varieties of oats, barley, and speltz are now under way and it is hoped that some hardy varieties will be found that will withstand winter conditions in this state.

WINTER BARLEYS AND OATS.

Winter Barleys are successfully grown in Idaho and Utah, as well as in other neighboring states, therefore it should be possible to grow them in Wyoming, provided proper strains are secured. The winter varieties yield as well as the spring varieties and are as valuable for stock feeding.

Winter Barleys from Colorado, Utah, and Idaho have been tried out at the Experiment Station for several years with but little success. B. S. Tedmon, County Agent of Platte County, however, reported some fair yields of Winter Barley from his county in 1916. This is the first report received of any Winter
Barley growing in the state. All the varieties of Fall Barleys and Oats make excellent growth in the fall until the ground freezes up. They do not seem, however, to be able to live through the winter, as they seldom make any start whatever in the spring.

It is doubtful if any varieties of winter oats will be found hardy enough to withstand Wyoming conditions.

WINTER EMMER AND SPELTZ.

Winter Emmer has been quite successfully grown in many sections of the state and as a stock food approaches barley in feeding value. Experiments would indicate that early sowing will insure a good crop, therefore one more winter grain is added to the list for the state.

Winter Speltz is a new grain in the state. It was brought from Switzerland four or five years ago, and has been grown since that time near Spearfish, South Dakota. In 1915 a small acreage was sown in Crook County, Wyo., and the County Agent, W. S. Reeves, reported a yield of more than 100 bushels per acre. Mr. Reeves sent a small quantity to this Station in the fall of 1915. The sample was received about November 1st. A row was planted in the garden, but so late that the seed did not germinate until spring. The plants came up and made a good growth through the season, but the grain was not quite mature when killing frosts came. The seed, living in the ground through the winter, would indicate that it is a hardy grain and a little earlier sowing in the fall would permit it to mature. Mr. Reeves reports some winterkilling of the grain in Crook County this year (1916), but the grain still made a good yield.

The Speltz is a tall growing, long headed, beardless grain which does not shatter as freely as the Winter Emmer and promises to be a valuable addition to the winter grain list of Wyoming. Trials of earlier sowing are at present being made at the Experiment Station. (None of these grains survived the winter of 1916-1917.)
SPRING GRAINS SOWN IN FALL.

Since spring grains volunteer so freely under Wyoming conditions, it was determined to try sowing spring grains in the fall, as this would result in a considerable saving of time if this could be done.

Plot 5 was prepared for sowing in the fall of 1912 and sown to spring varieties of Barley, Oats, and Rye. The plot had been in potatoes in 1912, so only needed disk ing and harrowing to put it in good shape for seeding. The seeding was done about September 1st, at the rate of 100 pounds per acre. The grains all made good growth until freezing weather came. In the spring of 1913 a little of the rye and barley showed up, but none of the oats. There was not a sufficient stand of either of the grains to make a crop, so the land was prepared for the seeding of Winter Wheat.

from it to cause germination and the germinated seeds are winterkilled.

It was thought that seeds sown so late that there would be no germination in the fall, would live over; but experiments along this line gave no better results than when the seed was sown early enough so that there was considerable growth in the fall. Putting the seeds below the surface probably causes them to gather moisture from the soil and swell, so that they are winterkilled even though they do not germinate.

The question is often asked, "Why cannot spring grains be sown in the fall, since shattered grains lie on the ground all winter and volunteer so freely in the spring?" The reason probably is that the shattered grains on the surface do not gather moisture enough to cause them to germinate, therefore they do not winterkill, while the seed planted in the ground is in more intimate contact with the soil and gathers sufficient moisture
CONCLUSIONS AND SUGGESTIONS.

From experiments carried on, from observations over the state, and reports received, the following conclusions have been reached and are here offered by way of suggestions in growing winter grains:

The best Winter Wheats for Wyoming conditions are Buffum's No. 17 and Turkey Red.

The ideal seed bed for Winter Wheat is a summer fallow. Wheat also does well after a cultivated crop. In this case plowing is not necessary if the ground is free from weeds; thorough diskng is sufficient.

Early seeding should be practiced. July 15 is not too early to sow on the dry-farm or at high altitudes. The time of sowing should be early enough so that a good root system can be developed and the plants become well established before the ground freezes up.

In irrigated sections if the soil is very dry it can be irrigated before the seed is sown. Irrigation can be done after sowing, but it is preferable to irrigate before sowing, as the seed bed can then be put in better shape for the reception of the seed.

Irrigation should be given when the crop needs it during the summer. It should not be given, however, too near the ripening time of the grain, as rust may be induced. Late fall irrigation should also be avoided, as ice is apt to form over the surface and an ice crust will often cause grain to winterkill by shutting off the air supply. This has also been found to be the case when a hard crust forms over the snow.

Other winter grains are not as sure crops as wheat. Emmer and Speltz can be relied on, however, in most sections of the state, and probably Barley when sown early and under good conditions.
Spring grains cannot be successfully sown in the fall.

The farmer should have an experimental plot on which he can try out various grains and discover in this way those best suited to his conditions. The Experiment Station will send out varieties for trial.

Ground should always be plowed for winter grains unless the preceding crop has been a cultivated one. Disking winter grain in stubble land should not be practiced.

Winter rye and winter vetch (grown together) make a good forage crop. The rye also affords considerable pasture in the fall, if sown early. The winter vetch is not a heavy yielder in Wyoming, but improves the quality of the hay when the rye is cut and used for forage.

A corn crop prepares the soil for winter wheat if proper cultivation has been done through the season. The wheat can be sown between the rows at the time of the last cultivation or soon after. This practice has been followed successfully by a number of dry-farmers in the state. The wheat gets a good start before winter in this way and does not hinder the harvesting of the corn. Winter wheat after a cultivated crop is considered practically as good as after a summer fallow.

One hundred pounds per acre is the amount of winter wheat generally sown under irrigation. Thirty to forty pounds is sown under dry-farm conditions. It is probable that this amount could be lessened on the dry-farm to advantage. Successful yields where but twenty pounds per acre was sown have been reported, and Mr. H. W. Campbell reports high yields when but twelve and one-half pounds per acre was used. Light sowing induces stooling and moisture conditions are often more favorable for the light than for the heavier sowing on the dry-farm.