UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

High Altitude Substation

Rate, Date and Depth of Seeding Winter Wheat

Including Recommendations on Cultural Practices and on Selection and Treatment of Seed

By
W. A. MOSS

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RATE, DATE AND DEPTH OF SEEDING WINTER WHEAT

W. A. MOSS

INTRODUCTION

Wheat is the most important cereal crop grown in Idaho and the upper Snake River country in eastern Idaho is one of the state's most productive wheat growing sections. This bulletin is written particularly for the farmers of that region, the experiments described having been conducted at the high altitude substation at Felt, 6000 feet above sea level.

The dry farming area of the Upper Snake River district has soil and climatic conditions very favorable to wheat growing. Table I gives the annual and five year average precipitation for each month from 1920 to 1924 inclusive. The average annual rainfall for the five year period is shown to be 11.17 inches. Sufficient snow to protect the wheat from freezing usually falls during the winter and there have been cases where wheat on north slopes was smothered by snow which remained late into the spring.

Rainfall is fairly evenly distributed over the growing season and evaporation is light. Table I shows that May, with 1.52 inches, has the highest average precipitation, and that June, July and August each have more than an inch.

Killing frosts in the fall may be expected about the first of September and occasionally they come during the latter part of August. Winter wheat usually ripens about August 1 to 15 and is seldom affected by frost. Spring wheat must be planted as early as possible in the spring in order to escape the early freezes.

TABLE I—Precipitation at the High Altitude Substation for five years, 1920-1924 inclusive.

	1920	1921	1922	1923	1924	Average
January	.16	1.31	.88	.73	1.09	.83
February	.29	.98	.30	.38	.43	.47
March	.90	.52	.50	.75	.55	.64
April	.81	.73	.28	1.14	.48	.69
May	.79	3.62	.73	2.18	.29	1.52
June	1.04	.50	1.02	2.52	.54	1.12
July	1.19	.45	1.40	1.48	.56	1.01
August	1.09	1.84	1.91	.72	.01	1.11
September	1.93	1.47	0.	.47	.39	.85
October	1.18	.40	.51	.75	2.78	1.12
November	1.16	.40	.73	.47	.08	.57
December	.81	1.25	1.50	.74	1.73	1.20
Average	11.35	13.47	9.76	12.33	8.93	

Five year average, 11.17 inches.

An experiment to determine the best rate, date and depth of seeding winter wheat was begun in the fall of 1920. For experimental purposes one-fortieth acre plots were used. Seedings were made at the rate of *25, 35, 50, 60, 65 and 70 pounds per acre, in each of three depths—surface (broadcast), shallow and deep. The shallow seeding average from one to two inches and the deep seeding from two to four inches. The first seed was sown July 15 and seeding were made at intervals of two weeks up to and including October 15.

Results of Experiment

Rate of Planting—Results of the experiment indicate that the rate of planting winter wheat necessarily varies with the date and with moisture and tilth conditions of the seed bed. Generally speaking, the earlier the seeding the lighter the rate should be. The following table gives the averages of yields from the six rates during four years.

TABLE II—Average of all dates and depths of seeding by rates.

	Rate of seeding in pounds					
	25	35	50	60	65	70
Year	Yield in bushels per acre					
1921	26.7	29.4	30.0	30.3	30.3	30.0
1922	18.3	22.0	25.1	25.6	24.4	24.1
1923	25.5	29.3	36.3	33.3	34.3	34.4
1924	13.9	15.5	14.9	15.4	15.4	15.3
Average	21.1	24.0	26.5	26.5	26.1	25.9

*Seed was treated with formaldehyde on nights before plantings were made.

Seed was treated with formaldehyde on nights before plantings were made.

For late plantings it is seen that 65 pounds of treated seed per acre seemed to give the best results, while 50 pounds proved most efficient on early seeded plots.

July seedings made a heavy growth early in the season, some stools being six to eight inches in diameter and containing as many as 50 stalks. The October 15 seeding seldom came up until the following spring, and therefore had no time to stool. It should be planted thicker than early seedings.

What planted on late summer fallow that is dry and in poor condition as too tilth and moisture should have a little heavier seeding than that indicated in Table III.

The plots with the heavier rate of seeding ripened several days sooner than those with the lighter seeding. There were more weeds on the thin seeded plots. It is somtimes necessary to seed fairly heavy on account of weeds.

Date of Planting—The best time to plant winter wheat on dry farm areas of eastern Idaho apparently is around September 1. Many farmers have considered August 15 the best date. Table III shows that in the four year average 3.9 bushels more per acre has been realized by planting September 1.

From Figure I we find that the yield in bushels per acre increases from the July 15 seeding up to September 1 when the high peak of production is reached. From September 1 the yield gradually decreases up to the last planting on October 15.

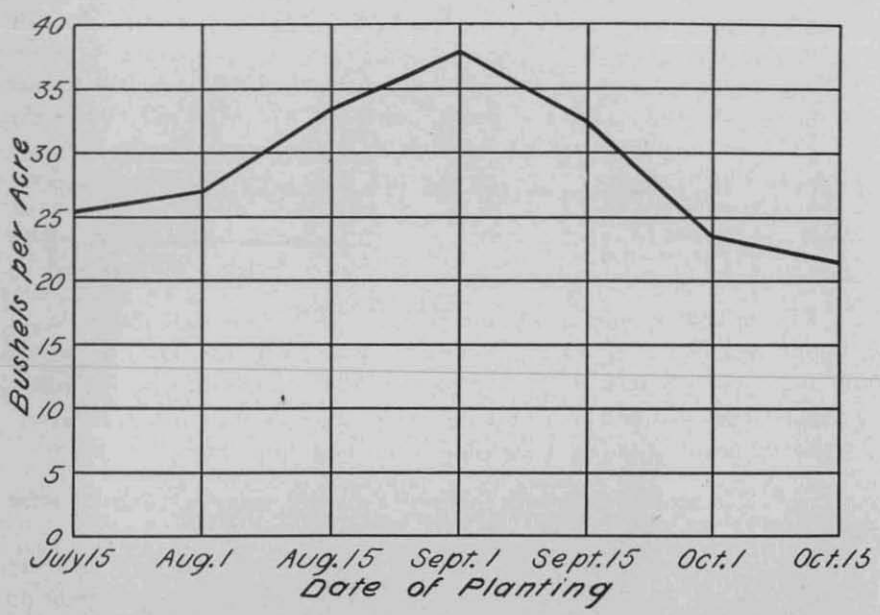

FIGURE I—Yields of wheat in bushels per acre for the different dates of planting, computed from the rate producing the highest average of the shallow and deep plantings, as shown in Table IV.

The July plantings gave a poorer grade of wheat and straw. The grain was bleached and contained more yellow berry. The straw had a dead appearance all thru the growing season and did not appear to have much vitality. Later plantings produced grain with good color which raised its market value.

Some years a fairly good crop is raised from October seedings but the chances are against the grower. If seeding cannot be done before the middle of October it probably pays to wait until spring. Spring wheat will average more than late planted winter wheat.

TABLE III—Showing the highest average yield of wheat from the shallow and deep plantings for each date, and the rates producing the respective yields.

Date of seeding	Yield in Bushels	Drill set for	Amount of treated seed actually planted
July 15	25	4 pecks	50 pounds
August 1	26.5	4 pecks	50 pounds
August 15	33	5 pecks	60 pounds
September 1	36.9	4 pecks	50 pounds
September 15	32.5	6 pecks	65 pounds
October 1	23.2	5 pecks	60 pounds
October 15	21.6	6 pecks	65 pounds

Some fields that are foul with weed seed probably should be planted even before September 1 in order that the wheat may stool well and keep ahead of the weeds.

Depth of Planting—The experiments indicate that winter wheat should be planted from two to three inches deep. Deeper plantings have averaged 0.4 bushels more per acre than shallow plantings. There was little difference in the yield of the deep and shallow plantings for each month or date of planting.

The broadcast method of planting is not considered practical, although some fairly good results were obtained from early broadcast seedings. Usually there is enough moisture in the soil to bring the wheat up soon after planting broadcast in July so there is not as much difference in the yield of the broadcast and drilled plots as there is in the mid-season seedings. The October 15 seedings seldom came up until the following spring, consequently the broadcast seedings came the same time as the drilled plots and in some cases yielded almost as much. However, weeds gave much more trouble than on the drilled plots as the wheat was not as evently distributed. The greatest difference in the yield of the broadcast plots in comparison with the drilled plots was in the September 15 and October 1 seedings. This was due to the dry condition of the surface soil. Plants came up in the drilled plots soon after planting while in some cases plants did not appear in the broadcast plots until the following spring.

If the season is dry the wheat grower should be careful not to plant too deep in trying to get the seed down to moist soil, especially late in the season, as it may be too deep for many of the sprouts to get to the surface. The plant is so long in getting to the surface that it is in a weakened conditioned and sometimes curls up under the crust, unable to push thru. In such a case a light harrowing or rolling may be beneficial. Care should be taken not to drag out the young growing wheat.

TABLE IV—Yields obtained in rate, date and depth of seeding experiments with winter wheat on dry land on the High Altitude Substation, 1921 to 1924 inclusive.

Date of seeding	Method of seeding	Drill set for 2 Pks.	3 Pks.	4 Pks.	5 Pks.	6 Pks.	7 Pks.	Average
		Rate in pounds actually planted						
		25	35	50	60	65	70	
		Yield in bushels per acre						
July 15	Broadcast	17.1	22.3	25.	22.1	20.4	20.5	21.2
July 15	Shallow	21.4	21.3	28.4	22.5	20.4	20.9	22.4
July 15	Deep	21.3	23.	21.7	20.8	22.3	22.1	21.8
August 1	Broadcast	20.3	20.8	22.6	23.	22.5	22.3	21.9
August 1	Shallow	17.6	23.8	24.	26.1	24.8	25.4	23.6
August 1	Deep	20.2	26.5	29.	28.3	27.6	23.1	25.8
August 15	Broadcast	24.	27.	28.4	30.1	31.9	29.5	28.5
August 15	Shallow	29.5	30.7	30.5	33.4	32.4	32.1	31.4
August 15	Deep	27.1	30.6	33.	32.6	31.7	30.1	30.8
September 1	Broadcast	22.3	24.8	29.9	27.7	29.8	30.4	27.5
September 1	Shallow	30.	36.	36.2	36.5	35.8	35.6	35.
September 1	Deep	35.5	34.6	37.6	37.8	38.8	34.8	36.5
September 15	Broadcast	13.2	18.9	22.3	21.1	20.6	22.2	19.7
September 15	Shallow	26.5	32.2	33.2	31.3	32.3	33.	31.4
September 15	Deep	27.7	31.1	29.9	32.8	32.8	32.5	31.1
October 1	Broadcast	9.8	12.4	16.7	15.3	16.7	18.4	14.9
October 1	Shallow	18.6	19.	23.4	23.	20.9	23.4	21.3
October 1	Deep	18.1	23.5	22.6	23.4	23.5	21.4	22.
October 15	Broadcast	14.	14.9	17.2	16.3	18.7	19.9	16.8
October 15	Shallow	14.7	15.9	19.1	20.9	21.2	22.1	18.9
October 15	Deep	12.	18.9	21.4	20.2	22.	21.	19.2

Average of all rates, dates and depths for four years.....24.7
Average of all broadcast seeding 21.5
Average of all shallow seeding 26.3
Average of all deep seeding 26.7

The Summer Fallow

The purpose of summer fallow is to store moisture in the soil, to kill weeds and volunteer grain, to increase the amount of available plant food. Moisture seems to be the chief limiting factor in raising a crop of wheat under dry farming conditions. The summer fallow should be started early in the spring while there is plenty of moisture in the soil and before the weeds and volunteer wheat gets much of a start, as there is considerable loss of moisture from the soil through transpiration.

The physical condition of the soil on the early plowed fallow is much better than that of the late dry plowed fallow which is rather difficult to work into proper seed bed condition. Plowing should be from six to seven inches deep and should be followed by harrowing before the soil begins to dry out. Experiments at Felt indicate that the summer fallow plots receiving frequent tillage to conserve the moisture yielded the most grain. The plots getting no cultivation after plowing until time to plant produced the lowest yield.

Early plowing of fallow followed by frequent tillage causes the accumulation of available soil nitrogen which in turn helps to produce

a higher yield and a better grade of wheat than can be produced from the late plowed weedy field.

TABLE V—Effect of early and late plowing of summer fallow; also effect of different methods of cultivating summer fallow on the yield of winter wheat. (Acre yield in bushels)

Date of Plowing	Method of cultivating fallow		
	No Cultivation	Medium Cultivation	Good Fallow
May 15	27	28	30.9
June 15	27.6	30.4	30.7
July 15	28	29.2	29.9

If plowing cannot be done before the ground begins to dry out it is sometimes advisable to disk the land a few weeks in advance of the plowing. The tandem or double disk is a good tool for this work as it leaves the ground level, kills the volunteer growth of wheat and weeds, works the stubble into the soil and makes a mulch that holds the moisture for later plowing. Ground that has been disked is more easily plowed.

TABLE VI—Effect on yield of winter wheat of disking before plowing the summer fallow.

Time of Disking	Time of Plowing	Two Year Average Yield in Bushels
Early Spring	Early Spring	22.6
Early Spring	Late Spring	26
No Disking	Early Spring	22.4
No Disking	Late Spring	24.8

Seed Selection and Treatment

Selection—Only good seed of the highest yielding varieties should be used. All wheat that is to be used for seed should be fanned to remove shriveled and broken kernels and weed seed. Shriveled kernels produce a weak plant that will not stool well and that will not stand the winters as well as a plant from a plump kernel. Many noxious weeds are scattered over the farm because of failure to fan the grain. Mixed wheat should not be used for seed as the miller prefers to mix the wheat that he uses in making flour. Mixed wheat furthermore, does not bring as much on the market as pure wheat of one variety.

Treatment—The following methods of treating wheat, oats, and barley for prevention of smut are recommended by the Plant Pathology Department of the Idaho Agricultural Experiment Station.

It is very important that all grain should be treated, whether sown in the spring or fall. It is not always possible to tell whether grain is smutty by the appearance of the seed. Seed from a crop free from smut

may become infected in threshing, or by other means. The safest method is to treat all seed before planting.

Careful attention to certain details is necessary in order to secure the best results from any of the wet seed treatments. *First*—Clean seed thoroughly to remove smut balls. If the seed is practically free from smut balls, it can safely be treated in the sack. If there are a noticeable number of smut balls present, it should be poured loose into the solution and the smut balls skimmed off. *Second*—Sow as soon after treatment as possible, as grain which stands after treatment is liable to be injured unless thoroughly dried. *Third*—Increase the rate of seeding at least one-fourth after treatment to allow for swelling of the seed. *Fourth*—After treatment do not allow grain to come in contact with floors, machinery or sacks which have not been disinfected with the disinfecting solution. *Fifth*—Measure solution carefully. Do not guess at the amounts. A little variation in the strength of the solution may mean the difference between success and failure.

Ordinary Formaldehyde Method
(For all grains)

Add one pint of formaldehyde (37 per cent to 40 per cent) to 40 gallons of water. This equals one ounce to two and a half gallons or four ounces to ten gallons. Use about one gallon of the solution for each bushel of wheat and a little over a gallon for each bushel of oats or barley. Wet all grain thoroughly, either by sprinkling or by pouring loose into the solution, or by soaking ten minutes in gunny sacks filled one-third full. If treated loose, cover with disinfected sacks or canvas for two hours. Sacked grain should be drained and left spread out in the sack until sown. Sow as soon as possible.

Concentrated Formaldehyde Method
(For oats only)

A new and promising method for treating oats with concentrated formaldehyde has been used successfully for the last three years at the Idaho Agricultural Experiment Station.

Use one part of formaldehyde in ten parts of water. Spread the grain out on a clean floor, canvas or wagon box. As the grain is shoveled from one pile to another, each shovelful is sprayed with a small quart hand sprayer held close to the grain. Three movements of the handle for each shovelful gives about the right amount. Use in the proportion of one quart of the solution to five bushels of oats. Cover grain with sacks or canvas which have been sprayed with the solution. Leave covered four hours.

Precautions—Formaldehyde vapor acts as an irritant upon the nose and eyes, therefore:

1—Hold the sprayer close to the grain.
2—Shovel the seed onto the vapor.
3—Work from one side of the pile.
4—Have a circulation of air where grain is being treated.

Advantages of the new method—It does not wet the seed and therefore the seed does not swell. Oats may be treatd any time before planting.

Bluestone Treatment
(For wheat only)

Add one pound of bluestone (copper sulphate) (blue vitrol) and one pound of salt to each five gallons of water. Suspend the bluestone in a small cheesecloth bag in the water until it is dissolved. Immerse wheat in the solution until every kernel is thoroughly wet. Then dip seed at once in a lime bath made by slaking one pound of lime and making up to ten gallons by adding water. Dry, and sow as soon as possible.

The lime bath helps to prevent seed injury.

Copper Carbonate Dust Treatment
(For wheat)

The copper carbonate dust method of seed treatment has been thoroughly tested by the Idaho Agricultural Experiment Station both in experimental plots and in cooperation with a large number of farmers in various parts of the state. As a result of those tests, it has been found that when properly applied the treatment is practically as effective in stinking smut control as either the bluestone or formaldehyde methods of treatment.

The treatment is applied by thoroughly mixing two or three ounces of the copper carbonate dust with each bushel of wheat. Several machines are on the market for applying the treatment, but many growers are using a home-made treating machine, a cement mixer or barrel churn, with satisfactory results. Every kernel should be thoroly coated with the powder. Tests have shown that slightly better control is usually secured when the treatment is applied with a power-driven, continuous treating machine than when it is applied with a barrel churn.

Two ounces of the copper carbonate to the bushel is usually sufficient for spring wheat and for winter wheat in regions where the soil does not become infested with smut spores. For winter wheat, where soil is infested and for all seed wheat which is badly smutted, three ounces to the bushel are recommended. These recommendations are for

copper carbonate containing at least 50 per cent copper and of sufficient fineness to pass through a 200 mesh sieve. If the distended brands of copper carbonate are used, which contain less than 50 per cent copper, three or four ounces per bushel should be applied.

This new dust method of seed treatment has certain distinct advantages over the dip method. Among these are the following:

1—It causes no injury to germination, and less seed is necessary.

2—Wheat treated with copper carbonate will start quicker and grow more vigorously in its early stages than that treated with bluestone or formaldehyde.

3—The treatment is easier to apply than wet dips.

4—Grain treated with copper carbonate may be treated and stored indefinitely without injury.

The following precautions should be observed when using copper carbonate:

1—Avoid inhaling copper carbonate (treat where there is a free circulation of air.)

2—Avoid feeding treated grain to livestock.

3—Use as clean seed as can be obtained.

CONCLUSION

At the present time Kharkof, Kanred, Triplet and Turkey Red are the best yielding winter wheats, ranking in the order named. Winter wheat has outyielded spring wheat on the High Altitude Substation, the four highest yielding winter wheats having averaged 13.1 bushels more per acre than the four highest yielding spring wheats.

The average yield from shallow and deep seedings made at the best rate on August 15, September 15, was 34.1 bushels per acre, annual rainfall being 11.17 inches. Therefore, farmers in the upper Snake River country of eastern Idaho can expect their dry farms to produce a good yield of winter wheat if they plant beteen August 15 and September 15 on summer fallowed ground.

SUMMARY

The best time to plant winter wheat is around September 1.

Earlier seedings gave a poorer grade of wheat.

The best date of planting by the broadcast method is July 15.

The greatest range in yield in the broadcast and shallow plantings occurred in the September 15 seeding, a difference of 12 bushels per acre.

The October plantings were weedy, especially the thin plantings. July and August plantings were freer from weeds than those of any other date.

Winter wheat yielded 13.1 bushels per acre more than spring wheat.