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HARD RED WINTER WHEAT

the effects of seeding date and nitrogen fertilization on yield and quality

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The yield and quality of winter wheat produced by southern Idaho dryland farmers are not always what is desired. Even with improved varieties of grain there are wide fluctuations in yield and quality from year to year.

Recognizing that other factors besides varieties affect yield and quality of wheat, the Idaho Agricultural Experiment Station began studies on the effect of seeding dates and rates and the effect of nitrogen fertilization on the yield and quality of hard red winter wheat at the Tetonia Station.

Date and Rate of Seeding Trials at Tetonia

Four dates of seeding were compared: August 15, September 1, September 15 and October 1. Four rates of seeding – 20, 40, 60 and 80 lbs. per acre – were compared on each date of seeding. Two sets of plots were established at each seeding date and rate, with one set receiving 40 lbs. of actual nitrogen per acre as ammonium nitrate in the spring of the crop year and the other set receiving no nitrogen. Several different varieties of hard red winter wheat were compared, but there were no significant differences among varieties so the data for all varieties is composited. Results from six different years are included.

Effect of Seeding Date and Fertilizer on Yield

During the six years the trials were conducted, growing conditions varied from extremely dry to wet. There was a greater difference in yield from dates of seeding during the dry years than during the wet years. (Table 1.)

During the wet years, favorable fall growing weather enabled the late seedings of non-fertilized plots to become well established and nearly equal the yield of the earlier seedings. During the wet years there was only a 4-bushel difference between the highest and lowest yield, while during the dry years there was a 12-bushel difference. During the wet years the Sept. 15 seeding date gave the highest yield, while during the dry years the Sept. 1 seeding date gave the highest yield.

The application of 40 lbs. of available nitrogen caused a 10-bushel increase for the Aug. 15 seeding date during the wet years. The increase for the later seeding dates was not as great, but was still large enough to be significant. During the dry years the application of nitrogen caused a 3-bushel decrease in yield for the Sept. 1 and 15 seeding dates. There were no significant reductions in yield on the other two dates.

Table 1. Average yield in bushels per acre during wet and dry years for various seeding dates and rates of nitrogen fertilizer.

Date of Seeding	Wet Years		Dry Years	
	0-N bushels/a.	40-N bushels/a.	40-N bushels/a.	0-N bushels/a.
August 15	42.0	52.3	34.7	34.2
September 1	41.2	48.5	35.8	32.5
September 15	44.5	46.7	28.9	25.9
October 1	40.3	44.4	23.1	23.0

Effect of Seeding Date and Fertilizer on Percent Protein

The percent protein of wheat is one of the principal factors determining quality in hard red winter wheat. The amount of rainfall received definitely affected the amount of protein produced in the wheat kernel. (Table 2.)

Highest yields and lowest protein were obtained during the wet years. Percent protein increased as the seeding date was delayed after the Sept. 1 seeding date. Wheat seeded Oct. 1 had the highest percent protein but also the lowest yield. During dry years the percent protein of non-fertilized wheat was from 3 to 6 percent higher and increased as the seeding date was delayed. The Oct. 1 seeding date of non-fertilized grain had the highest percent protein, which was probably due to the extremely low yield from that date of seeding.

The application of 40 lbs. nitrogen fertilizer increased the percent protein about 2 to 3 percent during the wet years. The biggest increase occurred in the later dates of seeding. During the dry years, the biggest percent protein increases occurred during the early seeding dates. The Oct. 1 seeding date showed no increase in protein from the use of fertilizer. In dry years with no fertilizer, protein increased.

Table 2. Effect during wet and dry years of seeding date and nitrogen fertilizer on percent protein of winter wheat.

Date of Seeding	Wet Years		Dry Years	
	0-N percent protein	40-N percent protein	0-N percent protein	40-N percent protein
August 15	8.9	10.9	11.2	15.3
September 1	8.8	10.5	13.2	16.1
September 15	9.2	12.2	14.2	16.3
October 1	9.7	12.5	15.9	15.8

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Effect of Seeding Date and Nitrogen Fertilizer on Peak Time

Peak time is a measure of the amount of mixing a flour will require to produce the best loaf of bread; flours with a peak time over 9 minutes are the most desirable. On the non-fertilized wheat the peak time varied from a low of 6.7 minutes for the Aug. 15 seeding date to a high of 14.1 minutes for the Sept. 15 seeding date (Table 3).

The increase in peak time did not correspond to the protein levels. Peak time increased 4 minutes for the Sept. 1 seeding date, while there was a reduction in percent protein. Peak time was reduced 2.4 minutes for the Oct. 1 seeding date as compared to the Sept. 15 seeding date, but the Oct. 1 seeding date had the highest percent protein. The application of 40 lbs. of nitrogen fertilizer increased the peak time for all seeding dates as compared to no nitrogen, but the same general relationship held true for the various dates of seeding.

Effect of Seeding Date and Nitrogen Fertilizer on Water Absorption

Flour absorption is the amount of water (expressed as percent of flour weight) required to produce the optimum loaf of bread. The baker desires a flour having a high absorption (62% or more) because a flour with high water-absorbing capacity yields more bread per sack of flour.

On the non-fertilized wheat, the amount of water absorbed increased from a low of 55.2 percent for the Aug. 15 seeding date to 61.6 percent for the Oct. 1 seeding date (Table 4).

The application of 40 lbs. of nitrogen caused water absorption above the 62 percent level. The application of nitrogen narrowed the range of water absorption differences caused by the seeding date but did not entirely eliminate them.

Effect of Seeding Date on Maturity Date

The maturity date of winter wheat depends upon the time of seeding the previous year. The actual date may vary somewhat, depending upon whether or not it is a dry or wet growing season. Delaying seeding 15 days causes a harvest delay of about 10 days (Table 5).

Effect of Seeding Rates on Yield, Percent Protein, Absorption and Peak Time

There were no significant differences in yield from the different rates of seeding. There was a slight decrease in percent protein and absorption as the rates of seeding increased. Rate of seeding had no effect on peak time.

Disease Problems

During the last few years of the experiment the wheat plants from the Aug. 15 seeding date were seriously infected with root, crown and foot rots. Yields were reduced as much as 30 percent some years. The wheat plants from the Sept. 1 seeding date showed some infection, but not enough to cause any yield reduction. During the years when stripe rust was prevalent, the Aug. 15 seedings of Itana and Tendoy lost their leaves from rust infection. Wheat seeded Sept. 1 showed some infection, but the Sept. 15 and Oct. 1 seedings showed no infection.

Summary

Results from 6 years of trials at the Tetonia Station on rates of seeding and nitrogen fertilization of winter wheat showed some striking effects on yield and quality. During wet years there was only a 4-bushel difference between the various dates of seeding, during dry years there was a 12-bushel difference favoring the Sept. 1 over the Oct. 1 seeding date.

The yield response to nitrogen fertilizer depended upon whether the growing season was wet or dry. During wet years there was a 10-bushel increase for the Aug. 15 seeding date compared to the later seeding dates. During dry years there was a decrease in yield as seeding date was delayed, except for the last date of seeding.

The percent protein was low (9-10 percent) during the wet years. During dry years protein percent was higher (11 to 16 percent). The percent protein increased as the seeding date was delayed.

The peak time nearly doubled from the Aug. 15 seeding date to the Sept. 15 seeding date, then decreased for the October seeding date. The application of 40 lbs. nitrogen fertilizer increased the peak time to 13 minutes.

Water absorption of flour increased from 55 percent for the Aug. 15 seeding date to 62 percent for the October seeding date. The application of 40 lbs. nitrogen fertilizer also increased water absorption to over 62 percent.

For areas similar to the Tetonia Station, the Sept. 1 seeding date and 40 lb. seeding rate give the highest yield, with quality improved by application of 40 lbs. of actual nitrogen fertilizer.

Table 3. Effect of seeding date and nitrogen fertilizer on peak time of winter wheat flour.

Date of Seeding	0-N Peak Time (minutes)	40-N Peak Time (minutes)
August 15	6.7	13.0
September 1	10.8	17.0
September 15	14.1	17.9
October 1	11.7	14.8

Table 4. Effect of seeding date and nitrogen fertilizer on water absorption of wheat flour.

Date of Seeding	Percent Water Absorbed 0-N	40-N
August 15	55.2	62.3
September 1	58.8	62.3
September 15	59.6	63.9
October 1	61.6	64.1

Table 5. Average harvest dates for winter wheat seeded at 15-day intervals.

Seeding Date	Harvest Date
August 15	August 1
September 1	August 10
September 15	August 20
October 1	September 1

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