Effect of Nitrogen Fertilization Practices on Wheat Protein Content in the San Joaquin Valley 2013-2014 Report

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Title of Research Project
"Effect of Nitrogen Fertilization Practices on Spring Wheat Protein Content"

Abstract/Summary of Results and Conclusions

Abstract
Growers seek both high yield and high protein content to improve the profitability of wheat production. This can be difficult to achieve especially with many of the newer higher yielding wheat varieties. University of California studies in the 1980's demonstrated late-season N applications conducted in the San Joaquin Valley increased grain protein content by 0.5 to 2 percent depending on rate and timing. This work was done with Yecora Rojo (already a high nitrogen accumulating wheat variety). Research is needed to evaluate the effectiveness of this practice on a range of newer varieties to quantify the level nitrogen and proper timing needed to achieve both high protein and yields. This study is a follow up to work done in 2011-2013. The study conducted at WSREC indicated applying N at planting, tillering, boot, and flowering on newer varieties increased yield and protein. Highest rates gave the greatest response to yield and protein. The summaries still have to have statistical analysis done to make further conclusions. Results of the research conducted in 2013 were instrumental in 4 presentations given statewide for Certified Crop Advisors in Nutrient Mgmt. training and being used by Bob Hutmacher who is part of the statewide advisory board for N mgmt. guidelines and potential regulations.

The objectives of this research were to:

1. Evaluate nitrogen rates and application timing for improving both grain yield and protein.
2. Compare the protein content of four wheat varieties at two locations.
3. Assess the effectiveness of late-season N applications to increase protein in different wheat varieties.
4. Soil Cores were taken after harvest but will be discussed in another proposal working with Bob Hutmacher.

Materials and Methods

All plots were replicated four times in a factorial randomized complete block design. Factors were the 3 wheat varieties and 15 nitrogen treatment regimens. Main plot was the variety and sub-plot was the treatment Data collected includes plant tissue nitrate levels, grain yield, bushel weight, and grain protein content. Trials were planted and harvested by personnel from the University of California at Davis. An analysis of variance analysis will be performed on all data using SAS statistical software.

Preplant soil nitrogen test was taken. This season the soil nitrogen test showed that there was about 80 lbs. available, in addition to the N treatments listed above. This study is a follow up from previous studies and established at the WSREC and KARE research centers in the southern San Joaquin Valley. Varieties representing a range of yield and protein potential were evaluated for yield, bushel weight and protein content. The varieties for the SJV site included: Volante Durum, Summit 515 and a hard white variety Blanca Grande. Nitrogen was applied as a foliar application for all timings with urea.

Results In general, results were similar to 2013 where varieties differed in yield and grain protein content. Yields in 2014 were approximately half a ton lower than 2013. Research indicated applying N at planting, tillering, boot, and flowering on newer varieties increase yield and protein. Some treatments where the greatest amount of nitrogen applied on at the flowering stage resulted in acceptable yield. The study conducted at WSREC indicated applying N at planting, tillering, boot, and flowering on newer varieties increased yield and protein. Highest rates gave the greatest response to yield and protein.

More research is needed to complete an economic evaluation of the nitrogen strategies using the different yields and protein contents at different price levels and protein penalties (and premiums) to determine the profit potential with different nitrogen management strategies. The summaries still have to have statistical analysis done to make further conclusions. Preplant soil nitrogen tests should be part of the nitrogen management strategies in wheat. These are preliminary results and statistics have not been analyzed.

Table 1. Blanca Grande Protein % and Yield (Tons/A) WSCREC

	N	N	N	N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
40R					40	10.8	1.9
40R	90 lb				130	10.9	3.1
40R	70 lb		70 lb		180	13.3	3.1
40R			70 lb	70 lb	180	15.6	2.7
40R	90 lb			90 lb	180	14.4	3.1
40R		60 lb	60 lb	60 lb	230	14.8	3.5
40R + 60 lb N	60 lb		60 lb		230	13.4	3.1
40R + 60 lb N	60 lb			60 lb	230	11.0	3.1
40R + 240 lb N					280	12.7	3.8
40R	60 lb	60 lb	60 lb	60 lb	280	14.3	3.6
40R + 60 lb N	60 lb	60 lb		60 lb	280	13.3	3.5
40R + 60 lb N	60 lb		60 lb	60 lb	280	14.5	3.4
40R + 160 lb N	50 lb		50 lb		300	13.6	4.0
40R + 160 lb N	50 lb	50 lb			300	13.0	3.6
40R + 60 lb N	60 lb	60 lb	60 lb	60 lb	330	14.0	3.7

Table 2. Summit 515 Protein % and Yield (Tons/A) WSREC.

	N	N	N	N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
40R					40	10.2	2.6
40R	90 lb				130	11.2	3.4
40R	70 lb		70 lb		180	12.7	3.1
40R			70 lb	70 lb	180	14.6	2.9
40R	90 lb			90 lb	230	13.8	3.5
40R		60 lb	60 lb	60 lb	230	13.8	4.0
40R + 60 lb N	60 lb		60 lb		230	12.9	3.8
40R + 60 lb N	60 lb			60 lb	230	10.9	3.6
40R + 240 lb N					280	12.9	3.6
40R	60 lb	60 lb	60 lb	60 lb	280	13.6	3.9
40R + 60 lb N	60 lb	60 lb		60 lb	280	13.3	3.8
40R + 60 lb N	60 lb		60 lb	60 lb	280	13.8	3.9
40R + 160 lb N	50 lb		50 lb		300	12.8	3.6
40R + 160 lb N	50 lb	50 lb			300	12.4	3.7
40R + 60 lb N	60 lb	60 lb	60 lb	60 lb	330	13.4	3.4

Table 3. Volante Protein % and Yield (Tons/A) WSREC.

	N	N	N	N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
40R					40	9.8	2.4
40R	90 lb				130	10.1	3.3
40R	70 lb		70 lb		180	12.0	3.5
40R			70 lb	70 lb	180	13.8	2.6
40R	90 lb			90 lb	180	13.3	3.6
40R		60 lb	60 lb	60 lb	230	13.4	3.6
40R + 60 lb N	60 lb		60 lb		230	11.9	3.5
40R + 60 lb N	60 lb			60 lb	230	9.9	3.2
40R + 240 lb N					280	11.1	3.4
40R	60 lb	60 lb	60 lb	60 lb	280	12.8	3.7
40R + 60 lb N	60 lb	60 lb		60 lb	280	12.4	4.1
40R + 60 lb N	60 lb		60 lb	60 lb	280	12.8	3.8
40R + 160 lb N	50 lb		50 lb		300	11.7	3.8
40R + 160 lb N	50 lb	50 lb			300	11.6	4.0
40R + 60 lb N	60 lb	60 lb	60 lb	60 lb	330	12.5	3.9

Budget The majority was spent on employee labor and benefits. Some was spent on research station charges. Travel was not included.