Effect of Nitrogen Fertilization Practices on Wheat Protein Content in the San Joaquin Valley 2012-2013 Report

Project Leader
Steve Wright
Farm Advisor –Tulare/Kings
UCCE Tulare County
4437 S. Laspina, Ste. B. Tulare, CA 93274-9539
559-684-3315
sdwright@ucdavis.edu

Cooperators:
Bob Hutmacher
WSRC Field Station Director. UC Cotton State Specialist
17353 West Oakland Avenue Five Points, CA 93624
(559) 884-2411
rbhutmacher@ucdavis.edu

Collaborators
Steve Orloff
Farm Advisor/ County Director
UCCE Siskiyou County
1655 S. Main St. Yreka, CA
(530) 842-2711
sborloff@ucdavis.edu

Gerardo Banuelos SRA III
Sonia Rios SRA II
Kelly Hutmacher
UCCE Tulare/Kings County
4437 S. Laspina, Ste. B. Tulare, CA 93274-9539
559-684-3315

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 2011-2012. The study conducted at Kearney Research was a partial failure due to poor irrigation agronomic practices and some of the plots were accidently sprayed out with Roundup while treating the alley ways. The study conducted at WSREC indicated applying N at planting, tillering, boot, and flowering on newer varieties may increase 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.

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 a previous study 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

Preliminary reports show varieties differed in yield and grain protein content. Research indicated applying N at planting, tillering, boot, and flowering on newer varieties may increase yield and protein, however more research is continuing. The study conducted at Kearney Research was a partial failure due to poor irrigation agronomic practices and some of the plots were accidently sprayed out with Roundup while treating the alley ways. The results shown in the tables are variable and so far inconclusive. 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. Two slow release nitrogen products were also evaluated in Summit 515 at 2 locations. Both products did not match yield or protein of higher rate urea treatments.

Precise timing for protein was not critical (boot vs. protein). In conclusion, 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.

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

	50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
80R					80	10.9	3.70
80R	✶				130	11.4	3.89
80R	✶		✶		180	11.7	4.17
80R	✶			✶	180	13.8	3.88
80R			✶	✶	180	13.5	3.45
80R + 50 lb N	✶		✶		230	13.3	3.99
80R + 50 lb N	✶			✶	230	13.6	4.35
80R		✶	✶	✶	230	13.6	3.94
80R + 200 lb N					280	13.3	4.20
80R + 50 lb N	✶	✶		✶	280	13.7	4.53
80R + 50 lb N	✶		✶	✶	280	13.5	4.21
80R	✶	✶	✶	✶	280	13.3	4.51
80R + 120 lb N	✶	✶			300	13.4	4.22
80R + 120 lb N	✶		✶		300	13.2	4.40
80R + 50 lb N	✶	✶	✶	✶	330	13.6	4.57

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

	50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
80R					80	10.3	3.37
80R	✶				130	11.0	3.96
80R	✶		✶		180	11.4	4.05
80R	✶			✶	180	12.8	4.16
80R			✶	✶	180	12.4	3.77
80R + 50 lb N	✶		✶		230	12.7	4.34
80R + 50 lb N	✶			✶	230	13.5	4.22
80R		✶	✶	✶	230	12.7	4.14
80R + 200 lb N					280	12.8	4.00
80R + 50 lb N	✶	✶		✶	280	13.5	4.25
80R + 50 lb N	✶		✶	✶	280	13.4	4.08
80R	✶	✶	✶	✶	280	13.1	4.33
80R + 120 lb N	✶	✶			300	13.0	4.40
80R + 120 lb N	✶		✶		300	13.0	4.24
80R + 50 lb N	✶	✶	✶	✶	330	13.5	4.51

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

	50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
80R					80	9.5	3.84
80R	✶				130	10.9	4.20
80R	✶		✶		180	9.9	4.07
80R	✶			✶	180	12.2	4.77
80R			✶	✶	180	11.9	4.12
80R + 50 lb N	✶		✶		230	12.1	4.04
80R + 50 lb N	✶			✶	230	12.8	4.31
80R		✶	✶	✶	230	12.2	4.44
80R + 200 lb N					280	12.4	4.32
80R + 50 lb N	✶	✶		✶	280	12.7	4.35
80R + 50 lb N	✶		✶	✶	280	12.8	4.36
80R	✶	✶	✶	✶	280	12.8	4.33
80R + 120 lb N	✶	✶			300	12.4	4.10
80R + 120 lb N	✶		✶		300	12.5	4.29
80R + 50 lb N	✶	✶	✶	✶	330	13.0	4.37

Table 4. Volante Protein % and Yield (Tons/A) KARE

		50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
	Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
1	80R					80	12.2	2.35
2	80R + 50 lb N	✶	✶		✶	280	13.7	3.72
3	80R	✶			✶	180	11.2	2.61
4	80R	✶	✶	✶	✶	280	13.6	3.89
5	80R + 200 lb N					280	12.1	3.29
6	80R	✶				130	11.5	2.91
7	80R		✶	✶	✶	230	13.5	3.46
8	80R			✶	✶	180	13.5	3.51
9	80R	✶		✶		180	12.4	3.80
10	80R + 50 lb N	✶		✶		230	13.1	3.87
11	80R + 50 lb N	✶			✶	230	12.5	3.91
12	80R + 50 lb N	✶	✶	✶	✶	330	13.2	4.04
13	80R + 120 lb N	✶		✶		300	12.9	4.03
14	80R + 120 lb N	✶	✶			300	12.8	3.40
15	80R + 50 lb N	✶		✶	✶	280	13.0	3.47

Table 5. Summit 515 Protein % and Yield (Tons/A) KARE.

		50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
	Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
1	80R					80	10.3	3.37
2	80R + 50 lb N	✶	✶		✶	280	13.5	4.25
3	80R	✶			✶	180	12.8	4.16
4	80R	✶	✶	✶	✶	280	13.1	4.33
5	80R + 200 lb N					280	12.8	4.00
6	80R	✶				130	11.0	3.96
7	80R		✶	✶	✶	230	12.7	4.14
8	80R			✶	✶	180	12.4	3.77
9	80R	✶		✶		180	11.4	4.05
10	80R + 50 lb N	✶		✶		230	12.7	4.34
11	80R + 50 lb N	✶			✶	230	13.5	4.22
12	80R + 50 lb N	✶	✶	✶	✶	330	13.5	4.51
13	80R + 120 lb N	✶		✶		300	13.0	4.24
14	80R + 120 lb N	✶	✶			300	13.0	4.40
15	80R + 50 lb N	✶		✶	✶	280	13.4	4.08

Table 5. Blanca Grande Protein % and Yield (Tons/A) KARE.

		50 lbs N	50 lbs N	50 lbs N	50 lbs N	Total lb	Protein	Yield
	Pre-Plant	Tillering	Joint	Boot	Flowering	N/Acre	%	Tons/A
1	80R					80	10.9	3.70
2	80R + 50 lb N	✶	✶		✶	280	13.7	4.53
3	80R	✶			✶	180	13.8	3.88
4	80R	✶	✶	✶	✶	280	13.3	4.51
5	80R + 200 lb N					280	13.3	4.20
6	80R	✶				130	11.4	3.89
7	80R		✶	✶	✶	230	13.6	3.94
8	80R			✶	✶	180	13.5	3.45
9	80R	✶		✶		180	11.7	4.17
10	80R + 50 lb N	✶		✶		230	13.3	3.99
11	80R + 50 lb N	✶			✶	230	13.6	4.35
12	80R + 50 lb N	✶	✶	✶	✶	330	13.6	4.57
13	80R + 120 lb N	✶		✶		300	13.2	4.40
14	80R + 120 lb N	✶	✶			300	13.4	4.22
15	80R + 50 lb N	✶		✶	✶	280	13.5	4.21

Budget

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