



California Wheat Commission

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September 24, 2012

WHEAT RESEARCH REPORTS

We look forward to receiving your reports on the wheat research project you conducted with support from the California Wheat Commission. Please use the format below. Suggested maximum length of the report is 5 pages (not counting figures and tables of results). **All reports are due by September 30, 2012.**

Title of Research Project

“Effect of Nitrogen Fertilization Practices on Spring Wheat Protein Content”

Project Leader and Cooperators:

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Abstract/Summary of Results and Conclusions (about ½ page summarizing key findings and conclusions/recommendations of the research that was conducted):

Previous research indicated that wheat cultivar grown and the nitrogen (N) fertilizer program had significant impact on both wheat yield and grain protein content. Topdress N applications increased protein contents markedly; It is now understood that the optimum fertilizer rate varies by site depending on the initial preplant soil nitrate level as well as yield potential of the site. There is a great deal to be learned about the effect of nitrogen fertilizer practices in wheat. Additional studies are needed to more precisely quantify the nitrogen rate and timing required for different wheat cultivars in the San Joaquin Valley. A field trial was conducted in the San Joaquin Valley at the WSREC to determine the effect of nitrogen fertilization practices on the yield and protein content of different wheat cultivars. Because of a lack of rainfall the study had to be irrigated up. This resulted in a non uniform stand. Varying rates of N fertilizer applications were made at different timings and stem nitrate along with Flag leaf N was taken and analyzed. A sizable portion of the trial was accidentally chopped by a custom silage chopper thus no yield data was measured on approximately 1.5 replications. The remainder of the trial was harvested, taken to yield and statistically analyzed. The decision was made to not release the results that were collected due to extreme variability in the field along with final results.

Introduction and Objectives

Protein content is a significant issue for wheat producers throughout California—nearly as important as yield. The price that a producer receives for hard spring wheat is determined by the grain protein content with a discount for wheat with less than 13% grain protein in the Central Valley of California and usually 14% for grain marketed in

the Pacific Northwest. This has significant economic consequences for wheat producers. The primary production factors that affect protein content are cultivar selection and nitrogen fertility management. Unfortunately, yield and protein content are often inversely related and is difficult to achieve both.

Nitrogen fertilization practices have a profound effect on both yield and grain protein. A general guideline is to apply at least one-half to two-thirds of the total nitrogen fertilizer preplant to establish a vigorous crop with maximum yield potential. Late-season N applications, between boot and flowering, increase grain protein with little effect on yield. It is possible for growers to over-apply N to achieve both yield and protein goals in fewer applications but this can lead to inefficient fertilizer use, reduced profitability and have the potential of unwanted environmental consequences such as excessive nitrate leaching. With the high cost of fertilizers and their application, growers need to maximize N use-efficiency while at the same time minimize the number of fertilizer applications. The purpose of this study was to evaluate the effect of different cultivars and nitrogen regime on yield, protein and bushel weight.

Materials and Methods (describe the experimental design, data collected, and methods used for data analysis):

A trial was conducted in the San Joaquin Valley at the West Side Research and Extension Center (WSREC) in Fresno County. Preplant soil nitrate nitrogen levels were sampled prior to the study; results determined that soil contained 40-60 lbs of nitrogen. Wheat was planted on November 11, 2011, plots were 6 by 20 feet, with 4 replications, and planted at 125 lbs/A. Weeds were controlled with MCPA plus Express and were also by hand weeded throughout the trial. After irrigating up, the wheat had 4 additional in-crop irrigations.

A factorial experimental design was used to evaluate the effect of wheat cultivar and nitrogen treatment on grain yield, protein and bushel weight. The wheat cultivars evaluated at WSREC were Redwing (HR), Blanca Grande 515 (HW), Summit 515 (HR) and Volante (Durum). There were seven nitrogen treatments (Table 1). Seven nitrogen treatments/strategies were evaluated, plus an untreated control and a treatment where nitrogen was applied preplant, at tillering and again at flowering. Urea was the nitrogen fertilizer source used for all applications. The fertilizer was broadcast using a hand spreader and irrigated within one or two days after application.

Table 1. Nitrogen treatments evaluated in WSREC study (Fresno County).

1. UTC
2. 120 N Pre
3. 120 N Pre + 50 lbs Tillering + 30 lbs Boot
4. 120 N Pre + 50 lbs Tillering
5. 120 N Pre + 50 lbs Tillering + 30 lbs Flowering
6. 120 N Pre + 30 lbs Flowering
7. 120 Nitrogen Pre + 50 lbs Tillering + 30 lbs Boot + 30 lbs Flowering

Wheat heights were taken prior to harvest. In addition, flag leaf and stem samples were hand harvested at the flag-leaf emergence stage and sent to UC Davis for analysis. The total amount of N in the leaf was compared to the amount of N in the stem. Once analyzed, results were extremely variable. The wheat study was taken to yield, mechanically harvested with a small combine and samples were sent to UC Davis for protein and yield analysis.

Budget (describe how the Commission funding was spent): About 50 percent of the budget was spent on leaf/soil analysis and research station land/labor charges. The remainder was spent on employee labor and benefits. Travel was not included.

Results

As stated earlier: a large portion of the trial was accidentally harvested leaving only 2 ½ replications. In addition, due to having to irrigate up, wheat stand counts were low. Even though the rest of the trial was harvested, taken to yield and analyzed, a decision was made to not release the results that were collected due to extreme variability in the field and final results.

Discussion, Conclusions and Recommendations

Despite the successes of our previous study in 2010-2011, this year demonstrated that sprinklers will be used if necessary to bring up the wheat if timely rain does not occur. In addition, the samples taken at the flag leaf stage compared the total amount of N in the leaf to the amount of N in the stem. Once analyzed, results were extremely variable. Further research needs to be done to determine the amount of N that is in wheat at different stages. 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. We hope to have more than one site in the San Joaquin Valley if funded to not have all of our results based on one site.

Send the report to: California Wheat Commission
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(or email to Janice Cooper, Executive Director: cooper@californiawheat.org)

*For researchers who received funding from the CWC during FY 2011/12, please note that we must receive your completed report by the deadline of **September 30, 2012** in order to consider additional funding requests.*