2011-12 California Wheat Commission Research Report

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Title of Research Project: 2011-12 Wheat Fertilization Practices in the Imperial Valley

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Abstract/Summary of Results and Conclusions:
Sufficient amounts of nitrogen are needed to produce high quality wheat and economical yield in the Imperial Valley. Current nitrogen fertilization practices in the Valley may not be sufficient to produce high quality grain and maximum yield potential. Three nitrogen application rates ranging from the current N application practices (350 lb/acre) to a maximum of 550 lb/acre were implemented on small plots at the University of California Desert Research and Extension Center (UCDREC) near Holtville. The same treatments were implemented on a large commercial field in El Centro with Mr. Ron Rubin. The effect of preplant phosphorus rates (0, 50, and 100 lb/acre) on wheat yield and protein levels were also considered.

Yields obtained from research plots at UCDREC varied from 3.49 tons/ac to 4.80 tons/ac (average 4.22 tons/ac with a standard deviation of 0.32 tons/ac with average moisture of 6.7%). Protein levels varied from 13.5% to 14.7% (average 13.9% with standard deviation of 0.6%). Yields obtained from the commercial field plots varied from 3.22 tons/ac to 4.30 tons/ac (average 3.86 tons/ac with a standard deviation of 0.26 tons/ac with average moisture of 6.7%). Protein levels varied from 12.4% to 13.1% (average 12.8% with standard deviation of 0.26%). UCDREC data obtained in 2011-12 season showed similar trend to data obtain in 2010-11 season. In general, the rate of nitrogen fertilization in excess of 350 lb/ac did not have an impact on yield or protein level. However, all fertilization treatments at UCDREC yielded high protein levels (in excess of 13%) but the protein level at the commercial field had an average of 12.8%.

Based on soil fertility results from this season and the previous season, it appears that the soil contained enough amount of P for wheat production at UCDREC. Additional applications of P had little to no impact on yield. Data obtained over the last two seasons will be analyzed for a possible publication in California Agriculture.

Introduction and Objectives:
Wheat was grown on more than 74,000 acres in Imperial County in 2011 (Imperial County , 2011). The optimum planting date for the highest yields in the Imperial Valley is from early December through early to middle January. Desert Durum wheat varieties include Desert King, Orita, and Kronos. General practice for wheat grown in the Imperial Valley is to apply 300-350 pounds of actual nitrogen. Phosphate fertilizer is not commonly applied if sufficient amount of phosphorus was applied to other crops in the rotation. Less nitrogen is needed when wheat follows early winter vegetables or alfalfa.

The current fertilization practices may not be applicable since wheat yields have increased from about 3.06 tons/ac in 1999 to more than 3.57 tons/ac in 2008 (Imperial County, 2009). Some of the newer varieties currently used in the Valley have the potential to yield 5 tons/acre. The objective of this research was to study the impact of different nitrogen and phosphorus application rates on wheat yield and grain protein level.

Material and Methods:

Three nitrogen application rates (350, 450, and 550 lbs/acre) were implemented on small wheat plots (27 plots- each split-plot 25ft*12ft) at UC Desert Research and Extension Center near Holtville (soil type 110). Additional work was conducted on a commercial field in El Centro. Each nitrogen rate was applied according to the standard practices in the Valley (preplant 40% of total N, tillering 30% of total N and boot stage 30% of total N). A split-plot design (table 1 at UCDREC and table 2 at commercial field) were used to study the impact of pre-plant phosphorus application rates on wheat yield and grain protein levels. Three P application rates were implemented (0, 50, and 100 lbs/acre of preplant P_2O_5).

Table 1. Layout of split-plots at UCDREC.

Replicate 1			Replicate 2			Replicate 3		
N1			**N2**			**N3**		
P1	P2	P3	P2	P1	P3	P3	P1	P2
N2			**N3**			**N1**		
P2	P3	P1	P1	P3	P2	P2	P3	P1
N3			**N1**			**N2**		
P3	P1	P2	P3	P2	P1	P1	P2	P3

Nitrogen rates: N1: 350 lb/ac, N2: 450 lb/acre, N3: 550 lb/acre
P_2O_5 Rates: P1: 0 lb/acre, P2: 50 lb/acre, P3: 100 lb/acre

Table 2. Layout of split plots in a commercial field in the Imperial Valley

Replicate 1			Replicate 2			Replicate 3		
Land 1	Land 2	Land 3	Land 4	Land 5	Land 6	Land 7	Land 8	Land 9
N1 P1	**N2** P2	**N3** P3	**N2** P2	**N3** P1	**N1** P3	**N3** P3	**N1** P2	**N2** P1
N1 P2	**N2** P3	**N3** P1	**N2** P1	**N3** P3	**N1** P2	**N3** P1	**N1** P3	**N2** P2
N1 P3	**N2** P1	**N3** P2	**N2** P3	**N3** P2	**N1** P1	**N3** P2	**N1** P1	**N2** P3

Nitrogen rates: N1: 350 lb/ac, N2: 450 lb/acre, N3: 550 lb/acre
P_2O_5 Rates: P1: 0 lb/acre, P2: 50 lb/acre, P3: 100 lb/acre

Prior to planting, composite soil samples from the top 12 inches of the soil profile at UCDREC were collected from each plot to determine soil salinity (electrical conductivity), P, and N levels. Pre-plant N and P fertilizers were applied to each plot according to the rates discussed earlier (40% of total N rate applied at preplanting stage). Durum wheat Variety (Desert King) was planted in December according to the standard seeding practices in the Valley (at rate of approximately 150 lb/acre). Wheat at UCDREC was harvested on May 17, 2012. Wheat was harvested in the commercial field between June 5 and 9, 2012. All plots were irrigated according to the standard irrigation practices in the Imperial Valley. Composite soil samples from the UCDREC location were collected from each plot prior to the 2nd and 3rd N application events. The remaining N were applied during the growing season (with the remainder in 15% increments in the 2nd-5th irrigations.) Wheat was harvested according to the standard harvesting practices in the region. Wheat biomass, yield, and grain protein were determined in each plot at harvest. Additional statistical analysis will be conducted to study the impact of N and P application rates on wheat yield and grain protein levels.

Results

Average wheat yield and quality for various treatments are shown in Tables 3-8. In general, the rate of nitrogen fertilization in excess of 350 lb/ac did not have a significant impact on yield.

Table 3. UCDREC average wheat yield and quality for the 350 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	4.15	13.90
P2	4.43	13.87
P3	4.32	13.80
Average P treatments	4.30	13.86

Table 4. UCDREC average wheat yield and quality for the 450 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	4.42	13.93
P2	4.10	14.00
P3	3.83	13.97
Average P treatments	4.12	13.97

Table 5. UCDREC average wheat yield and quality for the 550 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	4.15	13.83
P2	4.44	13.73
P3	4.26	13.87
Average P treatments	4.28	13.81

Table 6. Commercial field average wheat yield and quality for the 350 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	3.72	12.60
P2	4.08	12.63
P3	3.94	12.47
Average P treatments	3.91	12.57

Table 7. Commercial field average wheat yield and quality for the 450 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	4.08	12.93
P2	3.94	13.03
P3	3.51	12.93
Average P treatments	3.84	12.97

Table 8. Commercial field average wheat yield and quality for the 550 lb/ac nitrogen rate

P treatment	Wheat yield (ton/ac)	Protein content (%)
P1	3.87	12.97
P2	3.73	12.87
P3	3.87	12.83
Average P treatments	3.82	12.89

Budget:
The California Wheat Commission funding was spent mostly on salaries for the research assistants who assisted in conducted the work, soil analysis conducted by the ANR laboratory in Davis, labor charges related to growing the crop, and material and field supplies needed to grow the crop.

Discussion, Conclusions and Recommendations
It appears that the increase in nitrogen rate above the current practices of 350 lbs/ac did not have a significant impact on yield or protein level. However, complete statistical analysis has not been performed and additional time is needed to complete the soil analysis and to consult with other farm advisors to provide a comprehensive conclusion.

In general yields were higher in the 2011-12 season as compared to the previous season due mostly to soil type. In 2010-11 season, wheat was grown on Imperial-Glenbar silty clay loams (soil type 115) and in 2011-12 season, the experiment was conducted on other common soil type (soil type 110;Holtville silty clay) which is in general lighter soil and yields of most crops are typically higher than those grown on soil type 115.

References:
Imperial County Agricultural Crop and Livestock Report. 2009-11. Agricultural commissioner's report. http://imperialcounty.net/ag/Departments/clreports.htm