Post leaf fall has been too variable to draw conclusions.

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Summary: In our studies across the six sites years, late-season foliar nitrogen (N) never impacted yield in either a positive or negative manner when compared to the standard fertility treatment. The response to overall measured variables, which included protein, mix tolerance, and loaf volume, was very variable and not consistent. Oklahoma’s post-flag leaf environment may be too variable to say conclusively that late-season foliar application would improve the baking and milling qualities of hard red winter wheat.

In the fall of 2010 the Kansas Board of Trade proposed and passed quality standards on No. 2 Hard Red Winter Wheat, in which any wheat that fell below 10.5 percent would be considered undeliverable. This new standard significantly increased the interest of late-season N application to increase grain protein in the Southern Great Plains. It has been a practice widely used and accepted in the Northwest and Eastern US, relative to spring wheat production. However, in the Southern Great Plains, late-season N application is not as widely used. Average yield levels of the region often do not support additional trips over the field. In a 2002 field study by Woolfolk et al., it was reported that when UAN and ammonium sulfate were applied to winter wheat pre- and post-flowering, grain nitrogen concentration was increased. However, producers in the region are commonly making fungicide applications during flag leaf stage. This presents an opportunity to apply fertilizer N with no additional harvest cost. To this point, many producers are putting one to two gallons of low salt N products with the flag leaf fungicide application in hopes of either improved yield or increased grain protein levels.

Trial specifics

Evaluation. This trial was established to evaluate the use of two N sources applied flag leaf (FL) and post anthesis (PA) to improve Great Plains hard red winter wheat grain yield, protein, and milling and baking characteristics.

Sources. The two sources evaluated were UAN 28-0-0 and CoRoN 25-0-0. CoRoN (which is labeled as being derived from urea, methylene diurea, and methylene urea) was selected due to its low salt level and wide availability within the region.

Rates. Protein levels were maximized at a rate of 34 kg N ha⁻¹ (Woolfolk et al., 2000). However, the greatest majority of the low salt N fertilizers is not being recommended at a rate above 18 kg N ha⁻¹ or as, in the case of CoRoN, 7.6 kg N ha⁻¹. Therefore, it was important to evaluate rates below that which Woolfolk looked at.

Location. The trials were established at two locations: Lahoma and Lake Carl Blackwell (LCB). Figures 1, 2, and 3 document the deviation in plant-available water, average daily temperature, and relative humidity from the long-term average values for each year of the study at the Lahoma site.

Treatments. Our study consisted of 14 treatments, which included a non-fertilized and a fertilized control arranged in a RCBD.

Plot size was measured 3m by 6m.

Harvest. At maturity, the grain was harvested from the center 1.5 m of each plot with a Massey 8XP combine.

Evaluation. All grain from each plot was sent to the USDA ARS Baking and Milling lab in Manhattan KS for evaluation of milling and baking qualities.

Samples. All samples received fertilizer. All treatments received fertilizer at PA. The 2013 harvest was lost when packaging was damaged during the shipping process. Therefore, for the 2013 crop year, only yield data are available.

Baking, milling variables

Recommended Quality Targets (RQT) are set by the HRWW Quality Target Committee. The purpose of RQT for Hard Red Winter Wheat (HRWW) is to provide specific quality goals for the breeding community, winter producers, and marketing programs in order to assist and guide the decisions needed to maintain the consistency and end-use quality of the U.S. HRWW market class. Variables are:• Test Weight > 60 lb/bu• Protein > 12.0• Mixing tolerance: ranked value with a score from 0-6; values above 3 are preferred• Mix time: 3 to 5 minutes• Flour Volume > 850 cc

Flour yield was also measured. The greater the flour percent the better.

2011 crop year

The 2011 crop year was characterized by a late spring warm-up with good winter moisture but a dry spring with below average relative humidity levels during the FL and PA application window.

Yields. At both locations the yield of the check was significantly different from any other treatment due to a non-responsive crop season. Yields at Lahoma, however, were significantly higher than LCB with ranges of 4.0 to 5.4 Mg ha⁻¹ and 1.7 to 2.2 Mg ha⁻¹ respectively.

Protein. While yield was not affected at either location, protein was significantly above the non-fertilized control at LCB. There was no significance in protein at Lahoma across all 14 treatments and no significant differences in protein at LCB for any treatment that received fertilizer N. At Lahoma, the 13.4 kg N ha⁻¹ PA application resulted in the highest protein content. Five of the six treatments with the highest protein content at LCB were PA applications.

Baking/milling. Of the baking and milling qualities measured, only mixing tolerance was impacted by timing when compared to the late-season N applications at Lahoma, with all treatments receiving statistically higher than values than CoRoN at 3.67 and 2.94, respectively.

Loaf volume. At LCB, loaf volume was the only variable significantly impacted. All late-season N treatments resulted in a 55% increase in loaf volume over the fertilizer control.

Samples. All samples fell below the 850cc target.

2012 crop year

The 2012 crop year was characterized by good moisture through winter and the onset of a severe drought in June. Early spring temperatures and relative humidity values were above average; however, May saw relative humidity values drop below the long-term average.

Yields. The favorable spring weather led to slightly higher maximum yields at Lahoma and significantly high maximum yields at LCB, with ranges of 9 to 5.9 Mg ha⁻¹ and 1.8 to 3.9 Mg ha⁻¹, respectively.

Proteins. At both locations, the majority of the treatments increased protein levels above that of the fertilizer controls. At Lahoma the 13.4 kg N ha⁻¹ rate of CoRoN applied PA was the only treatment that was statistically higher than the fertilizer control, while 13.4 and 26.8 kg N ha⁻¹ UAN applied at FL, as well as the 26.8 kg N ha⁻¹ UAN applied PA treatments, all had statistically higher protein content. A comparison of N source at LCB showed that UAN had a significantly higher protein level at 11.5 percent than CoRoN had at 11.18 percent.

Mix time. The same trend was seen in mix time as the average mix time of treatment receiving UAN was longer than that for those receiving CoRoN. Flour yield was significantly impacted by timing of treatment. Treatments receiving N at PA had flour yields of 79.3 percent while those receiving N at FL had an average yield of 72.2 percent.

2013 crop year

As was previously mentioned, all samples were damaged in transport to the lab in Manhattan KS. Therefore, the only variables that can be reported are yield and test weight. The 2013 crop year was characterized by an extremely dry winter with the month of March bringing below normal temperatures, timely rains, and average relative humidity.

Yields. The poor winter with a following favorable spring led to average yields at Lahoma and LCB, with ranges of 4.0 to 4.9 Mg ha⁻¹ and 3.2 to 3.8 Mg ha⁻¹, respectively. It is hypothesized that...
Nitrogen, Irrigation Timing Key To Higher Corn Yields

Performance of remote sensors is essential in achieving high yields.

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Summary: Nitrogen use efficiency (NUE) in high-yield irrigated corn production systems has many economic and environmental implications. Many producers in the region rely on single pre-plant applications of granular urea or anhydrous ammonia as the primary N source in irrigated production systems. This practice increases the likelihood of N loss, environmental impact, and reductions in profit per acre. The increasing conversion of irrigated land in Kansas to center pivot irrigation systems presents the opportunity to develop automated systems for advanced N management through fertigation that can potentially increase NUE, reduce environmental impact and increase profit per acre. The purpose of this study was to measure the impact of the relationship between irrigation timing, N rate, and timing of N application on corn grain yield and determine the potential for developing algorithms for fertigation systems. Results indicate that overall performance of the sensors and algorithms used was effective at achieving high yields but has the tendency to overestimate N requirements. In order to optimize sensor based N recommendations for fertigation systems, algorithms must be specifically designed for these systems in order to take advantage of their full capabilities, thus allowing advanced N management systems to be implemented.

Nitrogen use efficiency (NUE) in high-yield irrigated corn production systems has many economic and environmental implications. In the sub-humid region of North Central and North East Kansas, risk of in-season N loss is higher than in drier irrigated corn production regions of the Central Plains. Many producers in the region rely on single pre-plant applications of granular urea or anhydrous ammonia fertilizer as the primary N source in irrigated corn production systems. These practices increase the likelihood of N loss, environmental impact, and reductions in profit per acre. The continued conversion of flood irrigated land in Kansas to center pivot irrigation systems presents the opportunity to develop automated systems for advanced N management through fertigation, which can potentially reduce environmental impact and increase profit per acre.

The greatest take-home may be that the field is properly fertilized to reach maximum yield potential, an economical return on late-season N applications is unlikely. Currently, work is being performed to estimate the impact of these late-season N applications in situations where N is limiting.

The objectives of this study were to:

• Measure the impact of the relationship between irrigation timing, N rate, and timing of N application on corn grain yield
• Evaluate the potential for developing algorithms designed for fertigation systems

Methodology

The study was initiated in 2012 and conducted through the 2014 crop year in cooperation with Kansas producers and Kansas State University Agronomy Experiment Fields. The Scandia and Rossville Experiment Fields were irrigated with a lateral sprinkler irrigation system while the cooperative farmer’s field, located outside Scandia (Scandia Site 2), was flood irrigated. Crop rotations, tillage, cultural practices, and corn hybrids used were representative of each area.

Plots. Each field study used small research plots, 10 feet in width by 40 feet in length.

Irrigation events were scheduled using the KanSched2 evapotranspiration-based irrigation scheduling tool (http://mobileirrigationlab.com/kansched2).

Applications. Sidedress N applications were made prior to scheduled irrigation events to stimulate an N fertigation system. Application timing methods implemented at each site consisted of single pre-plant application, split application between pre-plant and corn growth stage V-4, and split application between pre-plant and variable treatments based on plant reflectance. Fertilizer needs other than N were applied near planting.

Design. Treatments were placed in a randomized complete block design with four replications.

Canopy reflectance of corn was measured prior to each irrigation event with focus being on V-10 and R-1 growth stages, respectively. Canopy plant growth was stimulated by artificial lighting.