

THE EFFECT OF RESIDUAL N FROM CORN ON WHEAT PRODUCTION

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Objectives & Relevance:

Corn acreage in Missouri has increased while N fertilizer prices have fluctuated dramatically. Corn production in claypan soils may vary depending on the environmental conditions (Nelson et al, 2009; Nelson and Smoot, 2008). Nitrogen uptake is affected by water management systems and fertilizer source (Nelson et al., 2009). In years with low rainfall or other factors limiting crop growth, residual N from an application to corn may remain in the soil profile (Nelson et al., 2009) and be susceptible to slow lateral transport (Blevins et al., 1996). Rotation to a grass crop such as wheat with limited N inputs could reduce fertilizer costs, continue to maximize N utilization, and minimize N loss when planted after corn. This would shift a typical crop rotation with wheat from soybean-wheat-corn (Jiang et al., 2007) to soybean-corn-wheat which may work better for no-till production systems since establishment of corn following wheat is difficult due to cool, wet soil conditions. Nitrate-N in water samples from suction lysimeters 153 days after N application to corn of non-coated urea were 85 to 92% lower than polymer-coated urea (Nelson et al., 2009). This indicated residual fertilizer may be available for a rotational crop such as wheat. Fertilizer application timing also affects residual N (Nelson and Motavalli, 2008). No research has evaluated a means to utilize residual N in claypan soils from different N fertilizer sources and the impact of this change in rotation on crop performance.

The objective of this research is to evaluate the effect of residual N following corn on wheat grain yield.

Procedures:

- A two-year rotational crop study utilized current commonly used nitrogen management treatments in corn. These plots were then planted to wheat in the fall. This research was conducted over a 2-year cycle.
- The study was arranged as a randomized complete block design with four replications. Corn N fertilizer treatments consisted of application timings (fall, preplant, sidedress), N sources (anhydrous ammonia, urea, urea plus Agrotain, urea ammonium nitrate, and polymer-coated urea) at 150 lbs N/acre, and rates of urea and polymer coated urea (50, 100, and 150 lbs N/acre).
- Residual nitrate- and ammonium-N in the soil profile was determined in the fall following corn harvest for the anhydrous ammonia, urea, and polymer-coated urea treatments when applied at 150 lbs N/acre as well as the non-treated control.
- Wheat was no-till planted into corn stubble.
- Wheat grain yield and test weight was determined to evaluate the consistency in crop response to residual N following corn.
- Wheat production challenges following corn will be assessed.

Current status and importance:

Residual N in a corn-soybean rotation has not been shown to enhance soybean production. Preliminary research in 2008 indicated there was an interaction between N source and application timing on wheat grain yields the following year (Figure 1). Corn grain yield was not a good predictor of wheat response. This may be due to the fertilizer source/placement, application timing, or rate. Wheat grain yield following anhydrous ammonia was similar for the fall of 2006, preplant in 2007, and a sidedress application in 2007. Side-dress N applications had wheat grain yields 4 to 20 bu/acre greater than fall and preplant applications in some instances. This research will help Missouri farmers make informed decisions regarding recommendations for planting wheat after corn to capture residual N for the wheat crop and minimize environmental N loss. This research would also help farmers justify soil testing for residual N for the wheat crop following corn.

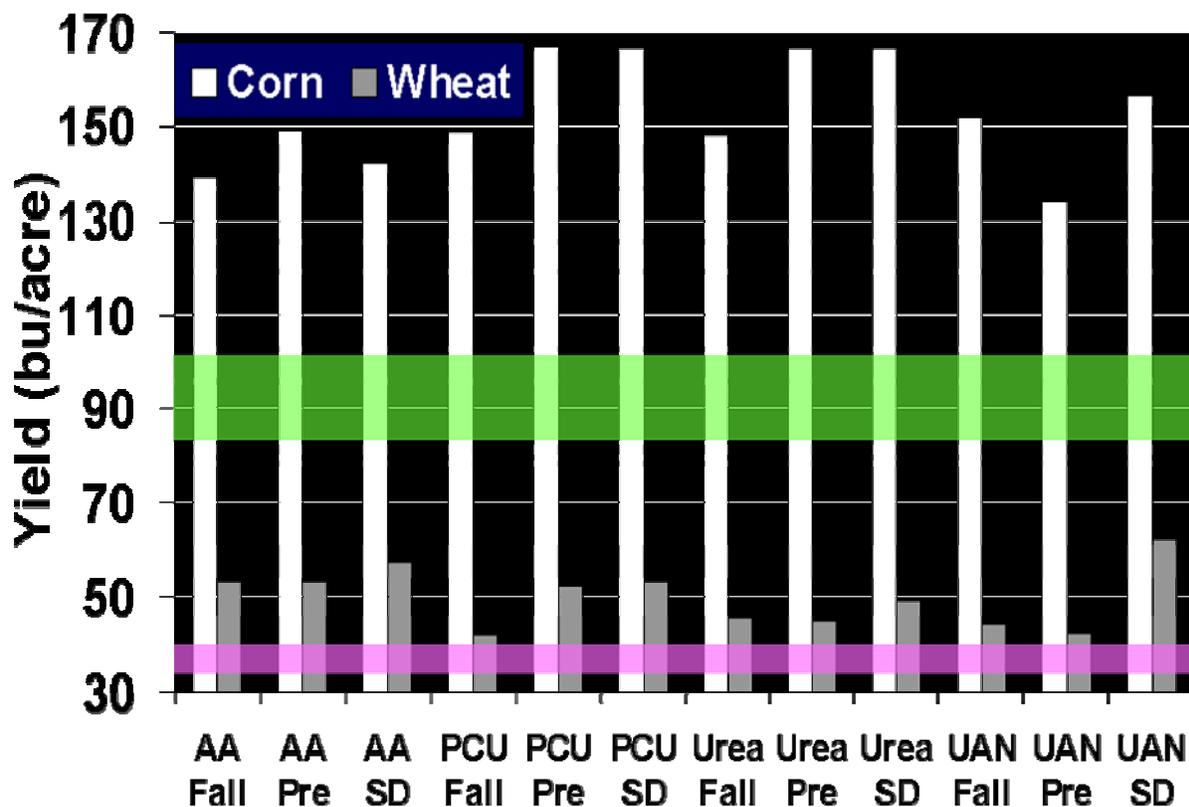


Figure 1. Fertilized corn and subsequent non-fertilized wheat grain yields. Corn was planted in 2007 and followed by non-fertilized wheat planted in the fall, 2007. The shaded portion of the grain yields represents the LSD centered on the non-treated control grain yield. Abbreviations: AA, anhydrous ammonia; Fall, fall 2006 applied; PCU, polymer-coated urea; Pre, preplant applied; SD, side-dressed; and UAN, 32% urea ammonium nitrate (Nelson, unpublished).

Expected economic impact of the project:

Farmers need to maximize N utilization by the corn crop. However, environmental conditions such as drought that limit uptake and use should not hinder the use by a rotational crop such as wheat. This research will directly impact a farmer’s decision to sample for residual N following

corn and the decision to plant wheat after corn. Utilization of residual nitrogen from corn increased wheat returns \$25 to 125/acre in preliminary research.

References:

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