

## **RESIDUE MANAGEMENT, TILLAGE, AND NITROGEN RATE RESPONSE IN CONTINUOUS CORN 2015 Report on Project 802 NREC 2014-02376, February 2016**

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This research has been underway since 2006 at the Crop Sciences Research & Education Centers at DeKalb, Monmouth, Urbana, and Perry. The objective is to evaluate long-term (10 years or longer) effects of residue removal and tillage, and to see how these affect response to N rate in corn grown continuously. While the future market for corn residue as a biofuel feedstock remains a question, we are able through this project to evaluate effects on both yields and on soil properties.

### **2015 Results**

The project went well at three of the sites in 2015; at DeKalb, where in most recent years there has been little or no response to N rate, there was a response in 2015 but there was also a lot of variability. This site has a mixed record of production, with yields most years lower than those at other sites over the past five years. In the first 5 years of this study, yields at DeKalb were good, and it remains unclear why we are seeing lower yields recently. In 2015 we applied a blanket application of 60 lb N as UAN in order to prevent deficiency before postemergence N application; this might have helped some. Soils were wet and cool early in the season, and this could have affected plant growth.

Compared to the typical pattern we have seen at this site (and other sites), no-till yields at Monmouth were relatively high in 2015, and yield loss from having all the residue present under no-till was minimal (Figure 1). The N response at this site in 2015 was similar to that seen in previous years, but with optimum N rate across treatments less (167 lb N/acre) than we usually see in continuous corn. Averaged across N rates and residue treatments, tilled plots yielded only 8 bushels more than no-till in 2015. Residue removal had no effect by itself, but interacted with tillage and with N rate: the higher the amount of residue present, the larger the yield penalty to no-till.

Responses to treatments were also somewhat unusual at Urbana in 2015, in that residue removal neither had an effect on yield by itself nor did it interact with tillage or N rate (Figure 2). No-till yielded 20 bushels per acre less than tillage, and tillage interacted only slightly with N rate. The N rate response was typical at Urbana in 2015, with an optimum N rate across residue and tillage treatments of 198 lb N/acre, at a yield of 198 bu/acre.

The responses at Perry in 2015 were normal for tilled treatments and for no-till with all residue removed, but yields dropped sharply under no-till as the amount of residue left in the plots increased; compared to tilled plots at the same residue level, leaving some or all of the residue in the plot reduced yield by 23 and 44%, respectively (Figure 3). Without these two treatments, the N response was normal at this site, with an optimum N rate of 186 lb N/acre. For the two NT plots with some residue present, yields were low but N responses were nearly linear up to the highest N rate (240 lb/acre) used. Including these two treatments raised the optimum N rate to 209 lb N/acre, and dropped the yield at the optimum N rate from 167 to 155 bu/acre.

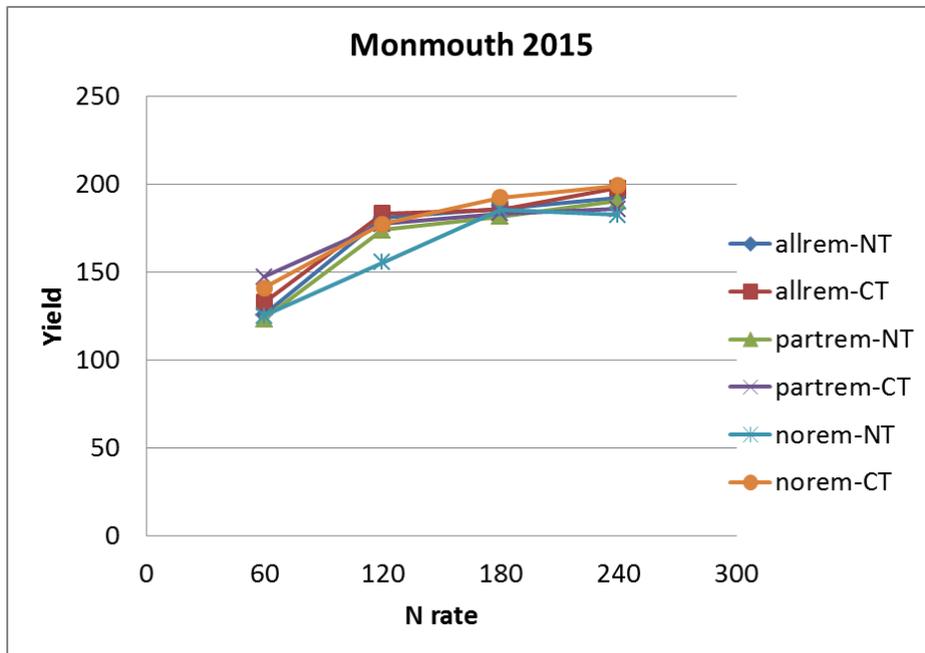


Figure 1. Response of continuous corn (continuous since 2005) to residue removal (all, part, or none) and tillage (CT = tilled; NT = no-till) and N rate at Monmouth in 2015.

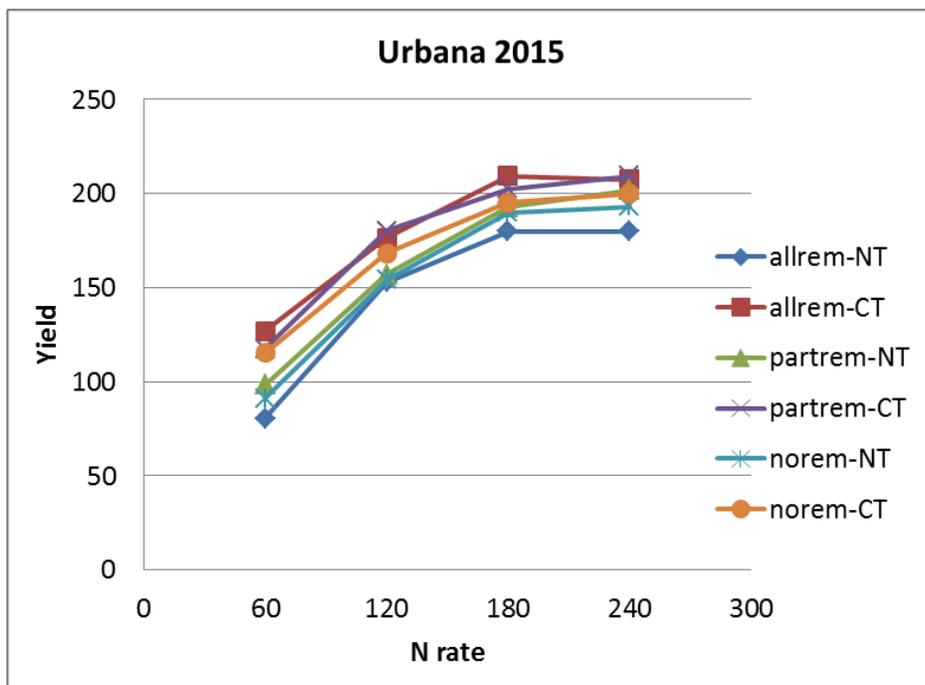


Figure 2. Response of continuous corn (continuous since 2005) to residue removal (all, part, or none) and tillage (CT = tilled; NT = no-till) and N rate at Urbana in 2015.

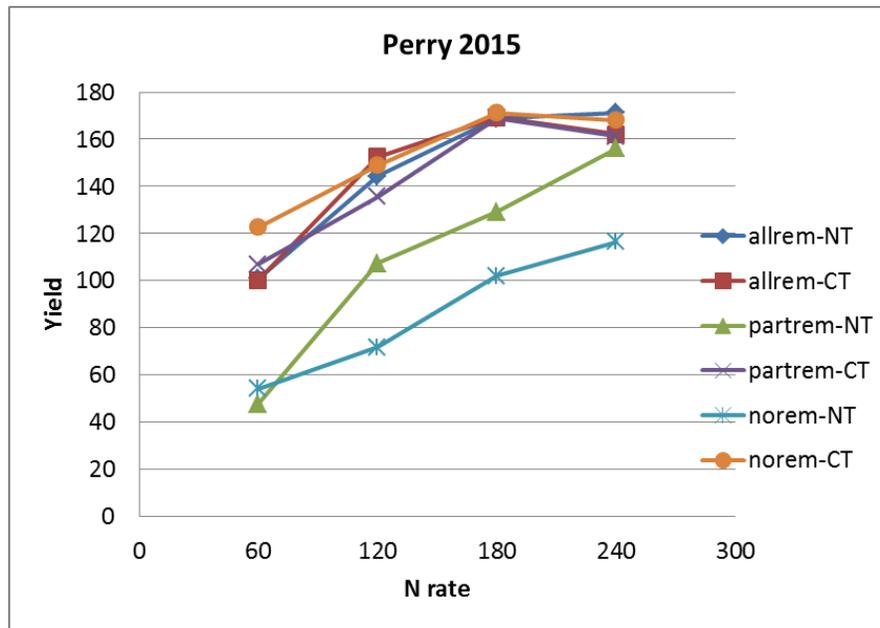


Figure 3. Response of continuous corn (continuous since 2005) to residue removal (all, part, or none) and tillage (CT = tilled; NT = no-till) and N rate at Orr Center (Perry) in 2015.

**Budget:** Funds for this project have been spent well, with a balance of \$2,896 available as of December 31, 2015.

### Outreach

Data from this trial have proven to be valuable, though with the decrease in interest in harvesting corn stover the interest in this topic has waned somewhat. This project became part of the DOE regional biomass project, and a manuscript was published from that project (Karlen et al., 2014) that included yield data from this project through 2013. Another paper from this project with results of soil analyses was published in 2015 (citation below) The data continue to be used in Extension programs.

Villamil, María B., Joseph Little, and Emerson D. Nafziger. 2015. Corn residue, tillage, and nitrogen rate effects on soil properties. *Soil Till. Res.* 151: 61–66. doi:10.1016/j.still.2015.03.005

### Project in 2016 – third and final year of NREC funding

In accordance with the proposal and plan, all plots at all of the sites in this trial were sampled in the fall of 2015, following 10 years with treatments in place. A range of soil analyses is underway on these samples, and will include extractable N, P, K, pH, and other nutrients and physical properties. The project will terminate at the end of 2016, with Year 3 funding used to complete analyses and to prepare and submit at least two additional manuscripts, including one on soil effects and one on yield effects.

Part of the funding in 2016 will also support keeping the trial in place at the Urbana site, mostly so that the nitrous oxide measurements initiated in this study in 2015 by Dr. Cameron Pittelkow can continue in 2016.