

## ALLEVIATING THE CONTINUOUS CORN YIELD PENALTY WITH CROP MANAGEMENT

While many factors contribute to a farmer's decision to alter corn or soybean acres in Illinois, continuous corn still constitutes over 20% of corn acres despite the wide acknowledgment of a yield penalty. Previous research conducted by the Crop Physiology Laboratory indicated that the primary agents of yield reduction in continuous corn were nitrogen availability, residue accumulation, and the weather (Gentry et al. 2013). Our current research was designed to determine how to reduce or eliminate these causative factors, and we focused on the effects of enhanced fertility and agronomic management, planting population, and hybrid selection for increased corn yields.

The yield penalty associated with 11th-year continuous corn vs. long-term corn following soybean was assessed using either a standard or an intensive management system, with contrasting plant populations (Figures 24 and 25). The standard management system, designed to emulate the typical grower's management practices, consisted of a base rate of nitrogen fertilizer (180 lb N acre<sup>-1</sup>), no additional fertility, and no fungicide application. The intensive management system consisted of additional sidedressed nitrogen fertilizer (60 lb of extra N acre<sup>-1</sup> stabilized with a urease inhibitor); P, S, and Zn fertility banded 4 to 6 inches directly beneath the crop row preplant to provide 100 lb P2O5 acre-



**Alison Vogel**  
M.S. Research Assistant  
Department of Crop Sciences  
[amvogel2@illinois.edu](mailto:amvogel2@illinois.edu)



**Laura Gentry**  
Research Assistant Professor  
Department of Natural Resources  
and Environmental Sciences  
[lauragen@illinois.edu](mailto:lauragen@illinois.edu)



**Fred Below**  
Professor of Plant Physiology  
Department of Crop Sciences  
[fbelow@illinois.edu](mailto:fbelow@illinois.edu)

1, 25 lb S acre<sup>-1</sup>, and 2.5 lb Zn acre<sup>-1</sup> (supplied as Mosaic's MicroEssentials SZ: 12-40-0-10S-1Zn); K and B fertility broadcast just prior to planting to provide 75 lb K2O acre<sup>-1</sup> and 0.4 lb B acre<sup>-1</sup> (supplied as Mosaic's Aspire: 0-0-58-0.5B); and leaf protection from a foliar fungicide application at VT/R1. Two plant populations (32,000 and 45,000 plants acre<sup>-1</sup>) and eight commercially available hybrids that had distinctly different genetic makeups were also evaluated.



**Figure 24.** Early-season differences between standard (left) and intensive management systems (right).



**Figure 25.** Late-season differences between 11th year continuously grown corn (left) and rotated corn (right).

Agronomic management plays a critical role in any producer's final grain yield; however, it becomes vital in continuously grown corn. There was a 60% greater yield response to intensive management in continuous corn vs. the corn-soybean rotation (50 bu acre<sup>-1</sup> increase with intensive management in continuous corn vs. a 32 bu acre<sup>-1</sup> increase with the corn-soybean rotation; see Figure 3), suggesting intensified management as a method to mitigate the CCYP. Select hybrids grown with intensive management were able to reduce the continuous corn yield penalty by 60% to 80% (data not shown). Without enhanced fertility (i.e., standard management), continuous corn yielded 38 bu acre<sup>-1</sup> less than corn following soybean (Figure 26).

Further improvements in corn yields will likely come from an increase in plant populations, and our previous work has shown that higher populations are an important component in high corn yields. Increased plant population, however, can result in more plant-to-plant competition, potentially exacerbating the yield-reducing effects of continuously grown corn. It was our belief that better plant nutrition might help to mitigate any negative effects of increased population, and in the current study providing intensive management to the increased plant density treatment only resulted in a modest reduction in yield (average of -3.6 bu acre<sup>-1</sup> across cropping systems).

The results of this ongoing work suggest that a multifaceted approach to crop management, especially hybrid selection in combination with intensive management practices, will continue to

	Rotation		<b>D Rotation</b>
	Continuous Corn	Corn-Soybean	
	<b>bu acre<sup>-1</sup></b>		
<b>Standard</b>	<b>167</b>	<b>205</b>	<b>+38</b>
<b>High Tech</b>	<b>217</b>	<b>237</b>	<b>+20</b>
<b>△ Management</b>	<b>+50</b>	<b>+32</b>	

**Figure 26.** Effect of management level and rotation on final grain yield in continuous corn (11th-year) and corn following soybean at Urbana, IL, in 2014. Values are the average of 2 plant populations and 8 hybrids.

play an important role in managing the continuous corn yield penalty and increasing corn yields.

## REFERENCES

- Gentry, L.F.; M.L. Ruffo, F.E. Below. 2013. Identifying factors controlling the continuous corn yield penalty. *Agron. J.* 105: 1-9.