The Wisconsin Integrated Cropping Systems Trial: Twenty-six Years of Research in Agricultural Sustainability in Wisconsin

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Abstract

The Wisconsin Integrated Cropping Systems Trial (WICST) was established in 1989 by the late Dr. Josh Posner to compare productivity, profitability, and environmental impact of six alternative cropping systems. For 26 years this 25-ha randomized and replicated experiment has been managed by a coalition of farmers, extension agents, and scientists. Originally designed with six cropping systems (three cash-grain, three dairy-forage) the study was expanded for forage and bioenergy to include low- and high-diversity native grass mixes (1999) and switchgrass (2007). The statistically robust experimental design sought to evaluate long-term trends while accounting for inter-annual climate and market variability.

In 2008, over a decade and a half of production data demonstrated that the organic systems at WICST were capable of producing equivalent forage yields, and grain yields that were 90% of conventional grain systems (Posner *et al.*, 2008). Moreover, in two-thirds of the years studied, organic grain yields were 99% of conventional. A follow-up study on long-term yield trends highlighted the production benefits of crop rotation in high stress years, the lack of acceleration in annual yield gains with GMOs, and the rapid improvement in organic yields with improved technologies (Baldock *et al.*, 2014). These results were bolstered by an economic analysis of net returns and associated risk exposure showing that organic- and pasture-based farming systems have been the most profitable at WICST (Chavas *et al.*, 2009).

Analysis of historic and current soils from WICST showed that every cropping system in the experiment except for the grazed pasture and native grasslands had lost significant amounts of soil organic carbon, after 20 years of best management practices, contrary to expectation (Sanford *et al.*, 2012). Recently published data incorporating native perennial grasses reinforced the idea that carbon sequestration on Midwestern prairie soils is dubious under prevailing management practices dominated by annual crops (Sanford, 2014). Fluxes of other greenhouse gases such as N_2O appear to be lower in low input and diverse systems on a per hectare basis but equivalent per tonne of dry matter (Osterholz *et al.*, 2014).

Sustainable cropping system management is key to addressing food security and climate change challenges. Complex and highly integrated questions related to agroecosystem function and cropping system resilience can only be answered with long term cropping system trials. It is critical therefore that experiments like WICST remain an investment priority for research in the 21st century.

References

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