United States Department of Agriculture

Precision Agriculture Impacts in Organic Research

Dr. Joel Gruver and Andy Clayton
Allison Organic Research and Demonstration Farm
Western Illinois University, Macomb, Illinois

Natural Resources Conservation Service Case Study
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Capital and Management Issues in Transitions

Time sensitivity, additional labor and specialized equipment are standard features of agricultural research, (regardless of production methodology) but add cost. With a limited budget, Joel Gruver, director of Western Illinois University's Organic Research program and Farm Co-Manager Andy Clayton implemented readily available precision agriculture technologies in their organic research program to achieve greater efficiency, effectiveness and timeliness.

Resource Setting

The Allison Farm is a 77 acre organic research and demonstration farm located in SW Warren County, 18 miles northwest of the main campus of Western Illinois University. The entire farm consists of flat black poorly drained soils (mapped as Sable silty clay loam and Muscatine silt loam). One unusual characteristic of the farm is that Mr. Allison (who farmed the land from the 50's to 80's) never adopted conventional farm chemical inputs.

The University began renting the farm as a "Chemical Free" research site in 1989 and early research focused on the mapping of chemical, physical, and biological properties. In 1997, the farm began transitioning to certified organic production and the entire farm has been certified organic since 2009. Cover crop research has been a major focus since 2007.

Changing Directions

For many years, all plots at the Allison Farm were planted sequentially (e.g., from east to west with no skipped swaths) guided by planter marker arms, to minimize excessively wide or narrow row spacing that would compromise cultivation. Experiments that involved multiple planter treatments (e.g., comparisons of seed treatments or genetics) required the filling and emptying of planter boxes many times. This slow process was tedious and sometimes incurred production penalties; especially in years when weather was adverse. So Joel and Andy began looking at and evaluating alternatives. A neighboring farmer and longstanding collaborator had RTK-autosteer on a tractor he was willing to rent when he was not using it. Equally important, the neighboring farmer was willing to provide technical support.

Improving Returns

"RTK has been a game changer!" proclaims Joel. Real time kinematics is a form of GPS guidance with sub-inch accuracy over extended time frames. RTK-autosteer (tractor steering is precisely guided by triangulation with satellites and a ground station after establishment of an A-B line) allows the planting

of very straight rows and the skipping of swaths (tractors passes across a field) while planting experiments. Straight rows make subsequent field operations including mechanical weed control more efficient and effective.

RTK-autosteer also facilitates no-till planting into standing cover crops – a field condition that is largely incompatible with the use of flags or marker arms.

Andy notes with RTK, they have the ability to plant all of the plots of one treatment at a time. Planter cleanout and filling becomes a minor process rather than the dominant process when establishing an experiment.

The capacity to accurately skip swaths also improves field efficiency by allowing wider turns at the end of a field. This is especially important when working with small fields (that involve frequent turning) and narrow field borders with limited area for turning.

Overall, precision guidance has increased the consistency and timeliness of field operations – resulting in improved execution of traditional types of studies and capacity for new types of studies (e.g., bio-strip till).

Bio-strip-till studies have investigated the planting of cover crops on 30" rows in the fall followed by spring planting of crops directly over winter-killed cover crop rows. To date, bio-strip-till has resulted in elevated in-row soil test P and K levels (observed multiple years) but inconsistent effects on crop yield. Joel describes the enhanced in-row soil test levels as both a nutrient *accumulation* and *liberation* effect because the observed increases in soil test levels are larger than can be explained solely by nutrient accumulation in cover crop biomass. Additional research is needed to identify the temporal dynamics of soil test levels following winter-killed cover crops and to translate these effects into consistent crop yield enhancement.

An additional benefit of the application of precision ag technologies has been a growth in the outreach portion of the WIU Organic program. Experience with precision ag technologies has allowed Joel and Andy to help individual producers implement these technologies for production and on-farm research (research that may not have had the time or inclination to do without the application of precision ag technologies)

Summary

Precision ag technologies have improved the capacity to conduct valuable organic and cover crop research on the WIU Organic Research Farm; extend those methodologies to conventional and organic producers as the skills are highly transferrable; provide individuals the ability to conduct valid and unbiased research on their own operations; and expand conservation efforts in ways previously unconsidered. Improvements in efficiency and effectiveness of field activities have been achieved which has resulted in improved productivity and quality of research results. Through their efforts, Joel and Andy have been able to demonstrate that new approaches can yield positive results, and that conservation pays.

Precision planted radish (in middle) with twin rows of lentils (picture taken from NRCS interview with Dr. Gruver)

Precision planted radish, from Dr. Gruver lecture