Using Corn and Soybean Yield History to Predict Subfield Yield Response

Corn and soybean producers desire maximum yield with minimal input costs. This continues to be researched as many production practices such as tillage, rotation, and crop inputs interact to influence yield. Today’s production practices have evolved to include precision technology that uses Global Positioning Systems (GPS) to collect site-specific data throughout the growing season. The most common application is having harvested grain yield data. Other examples include an exact reference point in a field where varieties changed in planting data or where a nitrogen application ended. Growers try to use this spatial information to make subfield rather than whole-field management decisions.

Site-specific management often uses past grain yield data to delineate management zones in a field, but questions remain about the type and amount of data required to classify subfields into management zones. In addition, spatial and temporal variability make the type and amount of spatial data needed for “effective” management zone delineation challenging. In the March–April 2015 issue of Agronomy Journal, researchers set out to test the hypothesis that grain yield history could predict grain yield patterns of subfields. This research utilized past field grain yield data and management histories of two long-term rotation study experiments to describe spatial and temporal variability of subfields. Past grain yield data were collected from two experiments that were conducted on a Plano silt loam near Arlington, WI. Experiment 1 included 26 years, and Experiment 2 included 10 years of grain yield data for three rotations: continuous corn, continuous soybean, and rotated corn–soybean in two tillage systems: conventional-till and no-till. Since the positioning of these plots has not varied over time, the plots simulate grain yield monitor data over time for common crop rotation–tillage systems.

Measuring the yield variation across both experiments, the spatial yield standard deviation of corn was 0.68 to 1.69 Mg ha⁻¹, and the temporal yield standard deviation was 1.87 to 2.73 Mg ha⁻¹. Also, across both experiments, the spatial yield standard deviation of soybean was 0.24 to 0.37 Mg ha⁻¹, and the temporal yield standard deviation was 0.56 to 0.85 Mg ha⁻¹. Temporal variability was 1.1 to 3.9 times greater than spatial variability. Since the temporal variability includes items such as precipitation, sunlight, and temperature, this demonstrates the challenges in lessening that variability due in large to weather factors. In addition to the variability, the length of time for grain yield patterns to emerge in fields was evaluated among subfields. The research demonstrated that grain yield patterns did develop within subfields, but it takes a long time. Yields differed after 4 to 20 years for subfields within each crop by rotation by tillage treatment, although it took 4 to 24 years to estimate consistent patterns between subfields. Further comparisons between the corn–soybean rotated subfields indicate that the corn yield was not predictive of soybean yield in 16% of the total subfields.

A major conclusion from this article is that temporal yield variation was greater than spatial yield variation. Classifying subfields into management zones for input prescriptions remains challenging. This research suggests that many years of data are required to predict subfield performance. Furthermore, the article describes the process and challenges involved in developing management zones and utilizing precision agriculture to predict site-specific management decisions.


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