Science Societies

Know your community: Sensor-based nutrient management

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Dr. Curtis Ransom using a RapidSCAN (Holland Scientific, Lincoln, NE) to collect corn canopy reflectance measurements in hopes of determining corn N fertilizer need. This particular sensor uses three different wavebands of light (visual, red edge, and near infrared) to measure corn N stress. Photo courtesy of Dr. Mac Bean.

Top: SmartFirmer sensors (Precision Planting, Tremont, IL) installed on each row of a four-row corn planter. Bottom: The iSCAN (Veris Technologies, Salina, KS) getting ready to be pulled through a field. These sensors collect soil information such as soil moisture and temperature intended to better inform planting and other management decisions. Photos

courtesy of Kaylin Bean and Dr. Curtis Ransom.

Traditionally, nutrient management has been based on soil and plant tissue testing, yield goal estimates, and known plant response functions. The Sensor-Based Nutrient Management Community (SBNMC) of ASA aims to fuse sensor technology with these practices to improve yield and profitability while minimizing environmental concerns.

There are several types of sensors—optical, chemical, capacitance, and force sensors—commonly used in agriculture production systems. Optical sensors emit and utilize different wavebands of light on crop and soil surfaces to estimate plant stress (usually nitrogen deficiencies), plant biomass, soil moisture, and/or soil organic matter. Chemical sensors measure soil nutrient and pH levels through the detection of soil ions. Capacitance sensors record soil moisture through measuring the dielectric constant, and force sensors determine soil compaction by estimating resistance. These sensor measurements, combined with crop growth models, agricultural software programs, and other precision agricultural tools, can help researchers and farmers make better-informed management decisions.

Dr. Ken Sudduth (USDA-ARS) working with a soil apparent electrical conductivity meter (Veris

Technologies, Salina, KS). This is commonly used to estimate soil texture and the depth to restrictive soil layers. Photo courtesy of Dr. Curtis Ransom.

Currently, members of the SBNMC are researching the applicability of sensors throughout the entire growing season. Before planting, apparent soil electrical conductivity is being used to estimate soil texture across the field in hopes of determining the depth to restrictive soil layers or areas of the field that are most susceptible to nutrient loss. Others are researching sensors mounted on corn planters at the bottom of the seed firmers to estimate real-time soil moisture, temperature, and organic matter to determine the ideal corn planting depth. Researchers are utilizing canopy sensors mounted on tractors, high-clearance sprayers, drones, or pivot-irrigation systems to estimate in-season plant nutrient deficiencies and, therefore, variable-rate fertilizer recommendations. Some are exploring the ability of sensors to alert, signal, and trigger soil irrigation events. These sensor technologies provide researchers and farmers with additional tools to improve agricultural practices.

Grad Student Oral Competition Winners

We would like to congratulate Michael Swoish, Brian Bohman, and Samantha Teten—our first-, second-, and third-place winners from the 2019 graduate student oral competition. At this year's Annual Meeting, we will have three session topics: (i) translating sensor-based research into farmer-supported management decisions; (ii) fusing sensor-based technology with soil, weather, and other tools for improved performance in estimating nutrient demand (including separate M.S. and Ph.D. student competitions); and (iii) the latest and greatest in sensor-based nutrient management. Please plan to join us at this year's conference. We “sense”

you will have a great time.

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