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water spouts

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The last stop will be at Oberg Farms near Hoople starting at 5 p.m. The final stop will include research poster presentations and an evening meal.

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Oakes Irrigation Research Site Field Day on Aug. 14

A field day will be held at the NDSU Oakes Irrigation Research Site – Robert Titus Research Farm on Tuesday, Aug. 14, with refreshments at 8:30 a.m. and a tour from 9 a.m. to noon.

The approximately 40-acre site 4.5 miles south of Oakes on North Dakota Highway 1 is a substation of the NDSU Carrington Research Extension Center (CREC).

Research into white mold, potatoes and drones, along with an update from the North Dakota Department of Agriculture’s pesticide enforcement program, are this year’s main topics.

Michael Wunsch, plant pathologist at the CREC, has been doing extensive research on ways to control white mold more effectively in soybeans, dry beans and sunflowers. Much of his work has been done at the Oakes research site.

At this year’s field day, Wunsch will provide producers, consultants and the agriculture industry with insights on effectively managing and preventing white mold from robbing yields and profits.

Dicamba drift, in spite of the new regulations, is still a major issue in 2018. Kevin Coufal, North Dakota Department of Agriculture pesticide inspector,

Upcoming 2018 NDSU Field Days and Tours

Oakes Irrigation Research Site	Aug. 14	701-742-2744
Potato Field Day (NPPGA)	Aug. 23	701-231-8732

Potato Field Day Set for Aug. 23

North Dakota State University and University of Minnesota potato research will be highlighted during the Northern Plains Potato Grower Association (NPPGA) field day Thursday, Aug. 23.

The field day tour will travel to three locations. The day will begin at 7 a.m. with breakfast at Hoverson Farms near Larimore. Research presentations will begin at 8:15.

Lunch and research presentations will be at the Forest River Colony near Inkster at noon. Also scheduled is a field tour of the irrigated research trials.

will share information on how North Dakota is handling complaints.

Greg Endres, NDSU Extension cropping systems specialist at the CREC, will talk about the work done at Carrington utilizing rye as a cover crop to maximize soybean production. Variety selection, weed suppression, seeding rates, and planting and termination dates, all play roles in successful implementation.

The research site has a large number of potato trials, including variety trials from the NDSU potato breeding program headed by Asunta (Suzie) Thompson. Team Potato representatives will talk about their work at the Oakes site and across the state.

Drone technology continues to be enhanced and has reached critical levels of accuracy for stand counts, disease detection and fertility monitoring. Paulo Flores, NDSU Extension precision agriculture specialist at the CREC, will talk about the latest technology in unmanned aerial vehicles (UAVs) and how he has been able to do stand counts with 99 percent accuracy. Weather permitting, a drone photography demonstration will be held.

Here is the schedule of presentations:

- 9 a.m. Welcome from Blaine Schatz, CREC director
- 9:15 a.m. Overview of the Oakes site's projects – Kelly Cooper, Oakes research scientist
- 9:30 a.m. White mold studies – Wunsch
- 10 a.m. Team Potato
- 10:30 a.m. Rye as a cover crop preceding soy and dry beans – Endres
- 11 a.m. Dicamba enforcement – Coufal
- 11:30 a.m. UAV technology update and demonstration – Flores

Tour participants also will have the opportunity to review the site's irrigated corn hybrid and soybean performance tests.

For more information, contact the CREC at 701-652-2951 or visit its website at www.ag.ndsu.edu/CarringtonREC.

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Components of Irrigation Management

(These are excerpts from a paper presented by Paul Colaizzi and Susan O'Shaughnessy of the U.S. Department of Agriculture-Agricultural Research Service's Conservation and Production Laboratory, Bushland, Texas, at the 2018 Central Plains Irrigation Conference held Feb. 20-21 in Colby, Kan. The complete paper is available at www.ksre.k-state.edu/irrigate/ooow/cpiadocs.html.)

Numerous tools and components have been developed for irrigation management. These can be built as a custom system and changed or expanded according to management needs. Most components are commercially available and are being adopted, and a few are nearing commercialization. We have organized these components into four broad categories, which roughly correspond to their function and chronological development.

Control Panels

The traditional control panel site is usually at the pivot point or one end of a lateral move. Its primary function is to control, monitor (i.e., feedback and alerts) and record all variables of interest of the irrigation system. The control panel has evolved from a box containing analog switches and gauges (which may control and monitor but not record) to digital touch screens.

The complete system of hardware and software used to control, monitor and record any process or system, including irrigation, is termed Supervisory Control and Data Acquisition (SCADA). One such system was developed and patented for variable-rate irrigation (VRI) by Evett et al. (2014), termed the Irrigation Scheduling Supervisory Control and Data Acquisition (ISSCADA). Most SCADA systems, including ISSCADA, also include at least one component of remote control, soil-plant-water feedback and analytics.

Remote Control

The consolidation of irrigated areas under a single management entity has increased the need for remote control where the complete SCADA system can be accessed off-site. Many irrigation systems are at remote, often difficult-to-access locations (especially following precipitation), and lack telephone landlines. Therefore, remote control often requires wireless

communication (e.g., cellular, satellite, RT, WI-FI), which can be linked to a mobile device directly or via the internet. Remote control software (i.e., “apps”) can reside and execute virtually anywhere in the system, such as in the component hardware, on the web and in a mobile device.

Soil, Plant and Weather (SPW) Feedback

Soil, plant and weather (SPW) feedback is by sensors deployed in the field, which is distinct from feedback related to the irrigation system itself. Many SPW sensors were developed before the 1960s and have been used in research and commercial production since, although their use has been limited by cost, accuracy, harsh field environments and the need for wireless data transmission.

Automated data acquisition was developed and increasingly adopted in the 1970s and 1980s. The first automated agricultural weather stations used telephone lines to transmit data. This was followed by cellular and then internet service. Wireless interfaces were developed for existing and new field sensors with the advent of several wireless protocols, such as the Zigbee standard.

Numerous wireless sensors are available and can be accessed directly in the field by a mobile device via Bluetooth or WI-FI, or accessed through commercially available SCADA systems offered by center-pivot or third-party manufacturers. These have greatly enhanced sensor ease of use and adoption.

Analytics

Analytics are concerned with reports, forecasts and decision support tools for irrigation management. Analytics can be a major component of a SCADA system, and similar to remote control apps, can reside and execute anywhere in the system (e.g., firmware, web or mobile device).

However, analytics are a step beyond merely acquiring data, and they include additional calculations to synthesize data into meaningful reports, and forecast future conditions using crop and weather modeling. These feed into decision support tools (e.g., variable-rate irrigation prescriptions, or VRI Rx) and irrigation system automation. For instance, weather data and canopy temperature measurements can be used to map crop water stress, which can be used to trigger irrigation events.

The role of analytics will become more crucial as SCADA systems acquire increasing amounts of data and we find ourselves “drowning in information but starved for knowledge.” At the same time, practical field experience is still relevant and will guide successful adoption of analytical approaches.

Commercially Available Components

The five major U.S. center pivot/lateral move and several third-party manufacturers offer hardware and software products that span several component categories and are web- and smartphone-ready. The products are built around a SCADA system that includes a control panel, remote control, interfaces to SPW sensors (usually third-party sensors) and some analytics.

Many products are modular and expandable in terms of the number of irrigation systems that can be handled and the number of components or features that can be added. Some products are interchangeable across center pivot manufacturers. Many require an annual subscription or license fee for firmware and software updates, technical support and maintenance, although some products offer a one-time fee.

Presently, most of the analytics are limited to irrigation history reports, irrigation prescriptions (i.e., VRI Rx), and evapotranspiration history and forecasts to approximately one week.

Ongoing and Future Developments

Control panel and remote-control components are well-established as core components of SCADA systems. Numerous products that embody SCADA, linked to each other by the internet and mobile devices, are commercially available and gaining acceptance. However, they are constantly evolving in concert with industry-standard communication protocols and the expanding capabilities of SPW feedback and analytics. Rapid advances and market demands in these areas are introducing many new hardware and software products, some still under development.

Sensors that measure soil temperature and electrical conductivity, and report volumetric soil water content are available as a single encapsulated unit. Also available are wireless infrared thermometers that measure crop canopy temperature, and are accessible by smartphone and the internet. Mapping crop light



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County commissions, North Dakota State University and U.S. Department of Agriculture cooperating.

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reflectance characteristics and temperature by drones is becoming more common. In addition, sensors are being developed to more efficiently distinguish between soil and vegetated ground cover.

Analytic components are under development where sensor measurements are combined with weather data and irrigation events recorded by a SCADA system to produce maps of crop water stress, crop evapotranspiration, soil water depletion, crop growth, and development and final crop yield. When available on mobile devices in real time, these sensors and analytics will help producers make better irrigation management decisions with the overarching goal of increasing net returns.

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Evelt, S.R., S.A. O'Shaughnessy, R.T. Peters. 2014. Irrigation Scheduling and Supervisory Control and Data Acquisition System for Moving and Static Irrigation Systems. U.S. Patent No. 8,924,031.

North Dakota Water Education Foundation – Summer Water Tours

Missouri River Development Tour – Aug. 17

Registration is \$20 per person and includes tour transportation, meals, refreshments, informational materials and a one-year subscription to *North Dakota Water* magazine.

For more information and to register, go to www.ndwater.com/programs and click on "Summer Water Tours" in the left-hand menu or send a check to NDWEF, PO Box 2254, Bismarck, ND 58502. Please indicate which tour or tours you want to attend and include the number of people who will be attending. For more information, give us a call or send an email.

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