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Precision Agriculture Usage and Big Agriculture Data

Mike Castle
University of Nebraska-Lincoln

Bradley D. Lubben
University of Nebraska-Lincoln

Joe Luck
University of Nebraska-Lincoln

Cornhusker Economics

University of Nebraska–Lincoln Extension

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Institute of Agriculture & Natural Resources
Department of Agricultural Economics
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Market Report	Year Ago	4 Wks Ago	5/22/15
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	147.00	*	160.00
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	245.80*	288.14	289.49
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	186.84	228.03	227.24
Choice Boxed Beef, 600-750 lb. Carcass.	225.34	259.02	263.19
Western Corn Belt Base Hog Price Carcass, Negotiated.	109.64	62.57	78.16
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	112.15	65.94	84.86
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	136.00	137.18	146.30
National Carcass Lamb Cutout FOB.	369.40	369.07	356.28
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	6.98	4.59	4.93
Corn, No. 2, Yellow Nebraska City, bu.	4.62	3.66	3.45
Soybeans, No. 1, Yellow Nebraska City, bu.	14.65	*9.44	899
Grain Sorghum, No.2, Yellow Dorchester, cwt.	8.02	7.59	6.88
Oats, No. 2, Heavy Minneapolis, Mn, bu.	3.87	2.97	2.77
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	160.00	202.50	190.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	120.00	77.50	*
Grass Hay, Large Rounds, Good Nebraska, ton.	105.00	115.00	120.00
Dried Distillers Grains, 10% Moisture Nebraska Average.	206.00	176.50	170.50
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	67.50	59.50	52.00

*No Market

Agricultural producers have quickly adopted precision agriculture technologies in recent years. With the availability of global positioning system (GPS) signals and other technology, producers can track yields, steer and control equipment, monitor field conditions, and manage inputs at very precise levels across a field, offering the potential to substantially increase productivity and profitability.

Coupled with the adoption of the technology is the rapid accumulation of *big* agricultural data, with more data points than can be comprehended in any standard analysis, leading to the demand not just for technology, but also for analysis and advisory services from numerous precision agriculture industry providers. With the reams of data on individual operations and fields comes questions of how the data is used, for what purpose, and by whom.

A recent study at the University of Nebraska-Lincoln looked at these issues of precision agriculture technology adoption and opinions. The study was conducted with partial support from the University's Undergraduate Creative Activities and Research Experience (UCARE) program which provides small grants to undergraduate students engaged in research and other creative efforts with supervising faculty.

This study was based on a survey distributed to agricultural producers at several different Nebraska Extension sponsored events in early 2015, including the Extension Crop Production Clinics across the state, Extension Precision Ag Data Management Workshops, the 2015 Fremont Corn Expo (sponsored by Extension), and the 2015 NEATA Ag Technology Conference. Thus, the survey population was not completely random, but was composed of Nebraska farmers associated with UNL Extension, which is assumed to be a good representation of the state's farmers.

A total of 135 responses were received at the various meetings, with 126 usable responses based on a reported county of operation in Nebraska. Initial results and analysis from the survey provides a good perspective of the current state of precision technology use and opinions in Nebraska. Producers responding to the survey indicated an average of 1,247 acres of row crops in an average operation of 1,507 acres. Of those acres, 47% were owner-operated, 26% were cash rented, 22% were crop-share leased, and 5% were custom farmed. Most of the responses (79%) were in the eastern three crop districts in Nebraska (Northeast, East, and Southeast), but that is consistent with the largest density of crop production and producers in the state as well.

Precision Agriculture Technology Adoption

Producers were asked several questions relating to technology usage. Figure 1 summarizes the adoption rates of numerous precision agriculture and ag data management tools currently available.

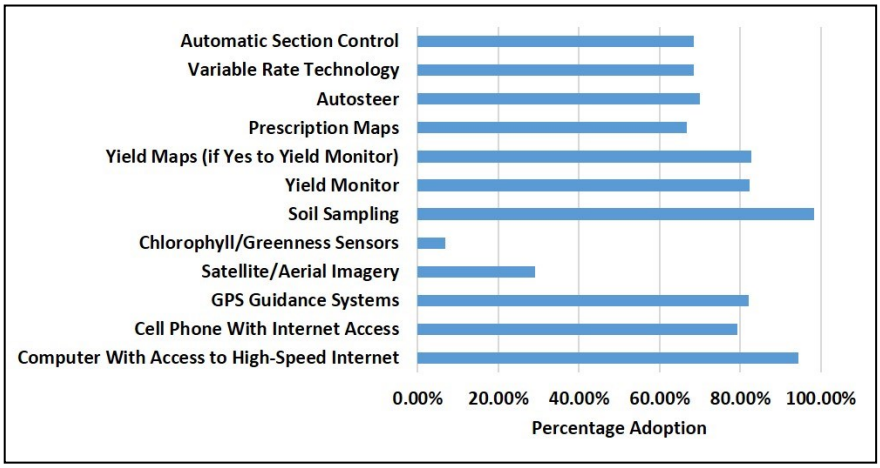

Figure 1. Precision Agriculture Technology Usage

Producers responding to the survey have widely adopted many commonly-available technologies, including soil sampling (98%) and computer high-speed internet access (94%). Whether these are specifically used to manage precision agriculture practices merits further analysis. Soil sampling, for example, could include a number of methods although 75% of those reporting the use of soil sampling did indicate the usage of grid sampling procedures. Yield monitors and maps and GPS guidance systems were the next most common practices with more than 80% adoption rates. Yield monitors and maps may be a prerequisite for any additional precision agriculture practices and are a common first step to develop historical data for further analysis and management. Guidance systems are popular not just to facilitate precision application but to improve field efficiency and reduce driver fatigue. Guidance systems facilitate the use of autosteer and automatic section controls, which are also widely adopted among survey respondents. Variable rate (VR) technology is also widely adopted at 68% among survey respondents although uses vary and include planting (population or hybrid), fertilizer and lime (rate and product), or irrigation. Satellite imagery and plant sensing are less widely adopted although new developments in the use of unmanned aerial vehicles (drones) could increase the interest in using imagery for scouting, analysis, and management decisions.

Which precision agriculture technologies producers use and how they use them will be the topic of further analysis and potential research. As suggested, adopting yield monitors first may be a necessary step to build a history of production data to layer with other variables such as soil types, weather, hybrids and varieties, and other production practices. With these data layers in hand, adopting guidance systems and variable rate applications may be very attractive and would be expected to be highly correlated. On the other hand, autosteer and section controls could improve operator performance and reduce excess input usage regardless of whether yield monitors and variable rate applications are adopted. Further analysis can provide insight on what producers adopt and what technologies drive the adoption of other technologies.

Big Agriculture Data Management

Coupled with the adoption of precision agriculture technology is the accumulation of large amounts of agricultural data on individual operations and fields. The survey also asked producers several questions about agriculture data management and policy issues.

Nearly 80% of survey respondents indicated that they managed their farm data although that does not necessarily suggest they do so exclusively. Numerous firms from input and machinery suppliers to independent consulting companies offer services to producers. Of those survey respondents who indicated they did not manage their data, more than 40% said their local cooperative or a consultant managed their data, while more than 5% said their equipment dealer or their seed dealer managed their data.

Producers use their data and a range of farm software packages to analyze numerous production and management decisions for their operations. Figure 2 provides insight on the uses of the data for those reporting usage of farm software.

Using the data and software for yield mapping is the most common practice, followed by developing plans or prescriptions for VR nutrient and fertilizer application as well as VR seeding.

Producers appear confident in the usage and the opportunity with precision agriculture and data management. A strong majority (70%) of survey respondents indicated profits had increased due to the use of precision

agriculture equipment, with 42% of those respondents saying the profits had come from increased efficiency and decreased input costs and, 58% saying the profits had come from increased production. Nearly 95% of respondents indicated the investment in precision agriculture was worth it.

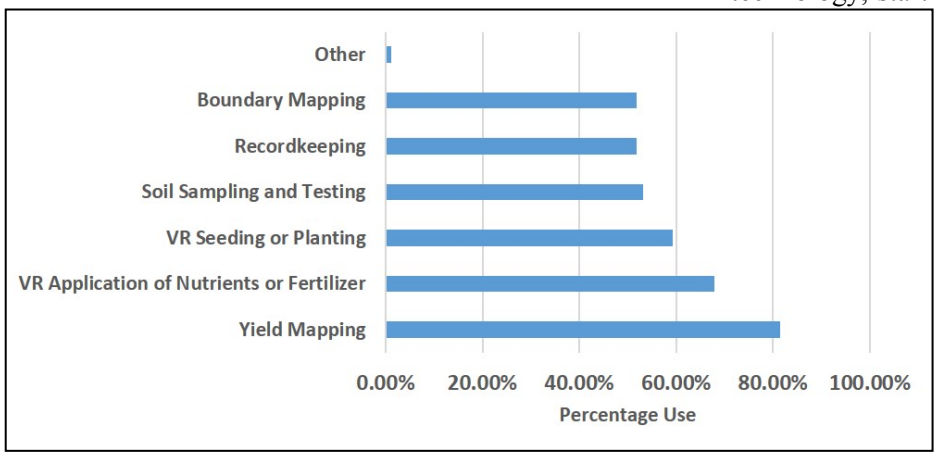

Figure 2. Uses of Farm Management Software

While the investment was deemed valuable, there are still numerous questions about managing the data. Many survey respondents were comfortable sharing their data with trusted partners, such as University researchers or educators (45%), relatives (39%), and local cooperatives (39%). But more respondents trusted their data with "no one" (23%) than with equipment dealers (18%), equipment manufacturers (17%), or neighbors (13%).

Knowing how the data may be used and who owns or has access to it appear to be important questions for producers. In fact, 100% of respondents to the survey said they think the data belongs to the farmer (with one response each also including either the equipment dealer or the equipment manufacturer). Yet, precision agriculture equipment or services may generally come with a producer agreement that gives access or ownership of the data to other parties. Managing the opportunities in precision agriculture and big agriculture data will demand comfort with technology adoption, data management, and likely relationships with suppliers or other precision agriculture service providers.

Producers clearly see opportunities — reduced input costs, increased accuracy and quality of operations, better data and information, increased productivity, and reduced operator fatigue and stress were all frequently mentioned as the number one benefit of using precision agriculture by survey respondents. Producers also see challenges and issues. Cost, keeping up with advancing technology, and return on investment were most frequently identified as the biggest issues regarding advancements in agricultural production technology. Interpreting the data, privacy, ownership, and accuracy of the data were most frequently identified as the biggest issues regarding farm-level data generated by precision agriculture technology.

Summary

The producer survey provides new insight on precision agriculture technology adoption and big agriculture data usage and issues in Nebraska. The preliminary data and analysis shows wide-scale adoption of precision agriculture technology, starting with yield mapping and guidance control systems. Further analysis can address the relationship between the adoption of these technologies and the adoption of additional technologies such as variable rate application systems and imagery and sensing systems for plant or field monitoring and diagnostics.

Along with the adoption of precision agriculture technologies is the rapid accumulation of big agriculture data. Producers are using the data to make improved management decisions and plan variable rate applications, but are concerned about the ownership, control, and interpretation of the data from their operations as well as access to their data.

There appear to be great opportunities to use precision agriculture technology and big agriculture data management to increase production and productivity, to improve management or operator performance, and even to consider on-the-farm experimentation for assessing inputs and production practices. But, there are also concerns to address regarding big agriculture data. Depending on who owns it and who has access to it, how might it be used not just to optimize production and management decisions on the farm, but also marketing decisions at a regional or corporate level and policy or regulatory decisions at the federal, state, or local level?

There is certainly more work to be done to better understand these survey results and the broader management decisions and policy issues ahead. As if to reinforce that conclusion, the final question at the end of the survey asked for any additional comments and the most common response was the need for better education and training.

Mike Castle
Undergraduate Research Assistant
Ag Economics Department, UNL

Bradley D. Lubben
Extension Assistant Professor, Policy Specialist, and Director, NCERMEC
Ag Economics Department, UNL

Joe Luck
Extension Precision Agriculture Engineer
Biological Systems Engineering, UNL