Precision Farming Technology: Adoption, Data Use, and Training Needs of Ohio Farmers

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Abstract

Results of the "2010 Ohio Farming Practices Survey" are used to (1) determine the level of adoption of precision farming technologies, (2) better understand farmers' use of precision farming information and data, and (3) assess farmers perceptions of the costs and benefits of their precision farming systems. The study updates past observations of farmers precision farming practices and use of precision farming information in the state. Results help to identify barriers for further advancement of precision farming technology and to aid development of best practices for research and extension programs to meet the educational needs of farmers.

Motivation

- Ohio farmers have rapidly adopted precision farming technologies since the first tools were introduced, with adoption continuing to increase every year (Batte 2007).
- Precision farming differs from previous farming technologies in that the impact on farm production and farm profitability is largely based on data and information to assist farmers to make site-specific and other management decisions (Batte and Arnholt 2003).
- Precision farming is intrinsically information and data intensive, substantially increasing the complexity of farmers' information management processes and the need for specific information management skills. In particular, lack of data management skills and precision farming training can limit the effective use of precision farming technologies (Kitchen et al. 2002; Reichardt et al. 2009).
- Adoption of precision farming technologies is influenced by multiple factors, including socioeconomic characteristics (Khanna 2001), farming experience and education (Kitchen et al. 2002; Reichardt et al., 2009), profitability (Lambert, et al., 2004), access to information (Fountas et al., 2005), and attitudes and perceptions towards precision farming technology (Adrian et al. 2005).

Method

- Analysis is based on a mail survey administered to a representative sample of 3,000 Ohio farmers in spring 2010. Survey design and administration followed best survey practices.
- Sample was restricted to farmers generating more than $50,000 in annual gross farm income and was stratified across gross farm income categories to guarantee sufficient representation of larger farms.
- 1,401 surveys were returned, 1,163 had sufficient data to enter the analysis, which yielded an effective response rate of 40.4%.
- A weighting procedure based on gross farm income categories was applied in the calculation of all statistics to return estimates to a sample representative of Ohio farmers.
- Survey collected data on farmers' familiarity with precision farming technologies, information resources, motivation, adoption and use of various technologies, perceptions of costs and benefits of adopted systems, demographics, and personal characteristics.
- Key demographic variables of sample compare favorably to Census of Agriculture figures.

Selected sample descriptive statistics

	All farms	Adopters	Non-Adopters
Full sample	100.0%	38.7%	61.3%
Farm size (acres)	705.01 (732.277)[1]	1,093.71 (916.020)	455.72 (428.542)
Gross farm income			
$50,000-99,000	31.6%	14.7%	42.3%
$500,000+	17.5%	23.6%	7.4%
Livestock enterprise	49.5%	36.5%	57.5%
Age (years)	58.6 (11.49)	55.2 (11.37)	60.8 (11.03)
High school or some college	73.8%	67.1%	77.9%
College degree or more	26.2%	32.7%	22.1%

Note: [1]Mean (Standard deviation).

Key Findings

Familiarity with precision farming

38.7% used precision farming technology on their farm
3.6% planed to adopt precision farming technology within the next 3 years
23.5% knew about precision farming but don't plan to adopt within the next 3 years
34.1% were unfamiliar with precision farming technology

Motivation for adopting precision farming

Item (top 5)	Mean	Std.dev.
Reduction in input costs	4.15	.795
Higher profitability	4.11	.810
Better understanding of field variability	3.95	.759
Increase in crop yields	3.90	.806
More information for better decisions	3.89	.800

Note: Measured on a five-point Likert scale, 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

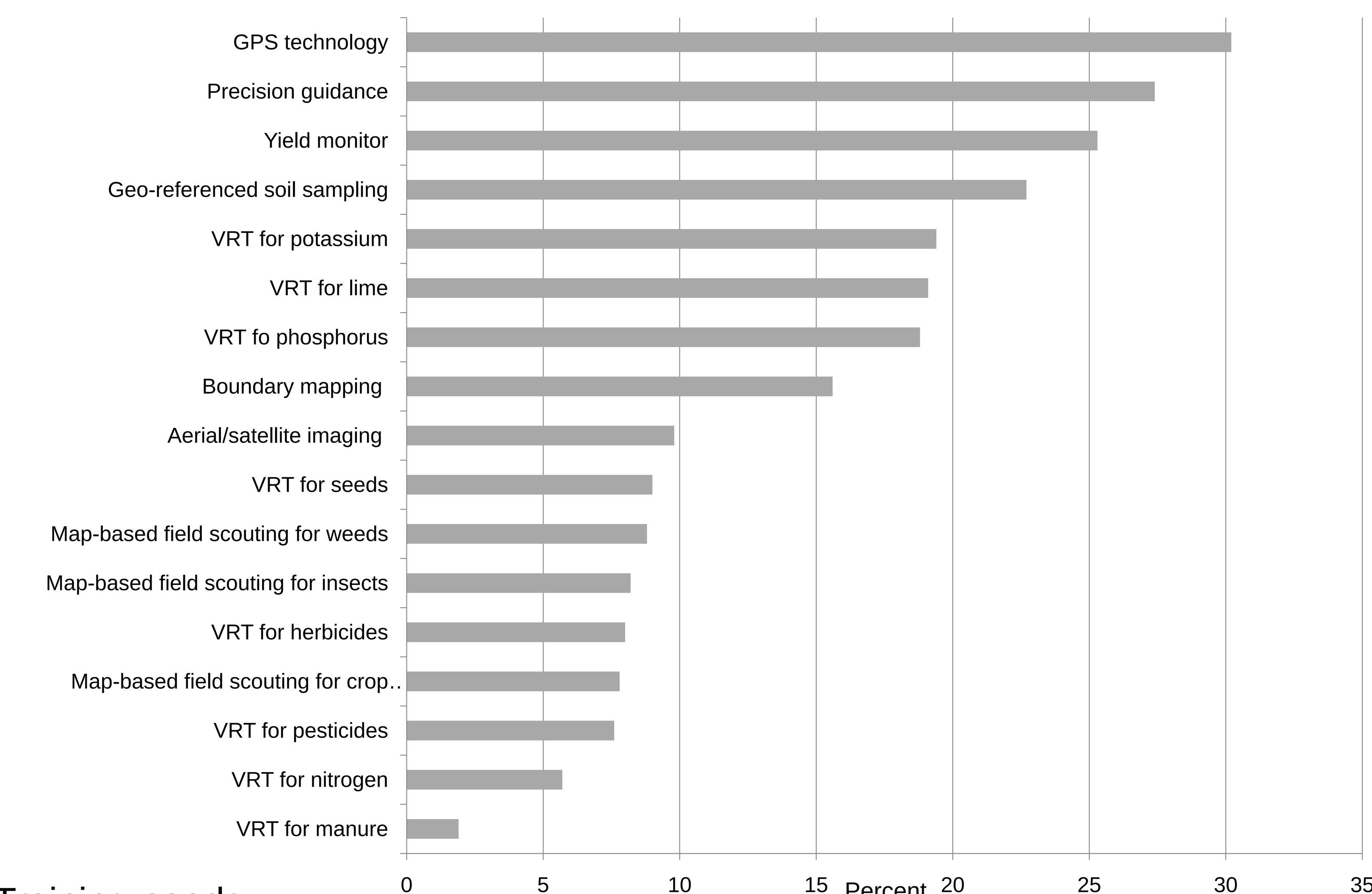
Resources for precision farming information

Item (top 5)	Mean	Std.dev.
Own experience	3.53	.666
Demonstration site, field days etc.	3.34	.066
Machinery companies	3.31	.682
Discussion with other farmers	3.29	.703
Internet (e.g., websites)	3.26	.778

Note: Farmers were asked to "Rate the importance of the following precision farming information resources". Items were measured on a five-point Likert scale, 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

Adoption of precision farming technologies

- Farmers adopted on average 5.5 individual precision farming components.
- Growth in adoption rates varied greatly by technology, farm size, and other farm characteristics.
- 84.7% of large farms ($1,000,000 and higher annual gross income) adopted one or more components but only 18.0% of smaller farms (less than $100,000 gross income).
- Precision guidance is the most rapidly growing component with light-bar guidance, assisted steering and auto-steering adopted by 17.8%, 12.3%, and 2.0%, respectively.



Training needs

- 66.2% of all farmers agreed or strongly agreed that "there is a great need for training/education in precision farming technology."
- Farmers expressed confidence in agronomical and technical skills for using precision farming technology but are less confident about their information management skills.
- More than one-third of farmers reported lacking the necessary computer skills for using precision farming technology on their farm. Almost a quarter of respondents indicated a limited support for precision farming by local consultants and service providers.
- Access to and use of precision farming data varied greatly by technology, farm size, and other farm characteristics.
- About a third of adopters owned software to process their precision farming data.

Benefits and costs of precision farming

- 75.7% of all adopters indicated that the total benefits of their precision farming systems were exceeding total costs.
- Evaluation of performance varied by technology, farm size, and other farm characteristics.

Item	Mean	Std.dev.
VRT for fertilizer	1.63	.856
Geo-referenced soil sampling	1.72	.958
Precision guidance	1.87	.926
Entire precision farming system	2.09	.988
Yield monitor	2.12	1.052
Map-based field scouting for weeds	3.20	.822
Map-based field scouting for insects	3.16	.841
Map-based field scouting for crop diseases	3.09	.828
VRT for seeds	3.28	.873
VRT for herbicides	3.17	.862
VRT for pesticides	3.07	.790
Boundary mapping	3.35	.846
Aerial/satellite field imaging	3.26	.885

Note: Measured on a five-point Likert scale, 1=Benefits significantly greater than costs, 3=about equal, 5=costs significantly greater than benefits.

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