ADOPTION AND PERCEIVED USEFULNESS OF PRECISION SOIL SAMPLING TECHNIQUES IN COTTON PRODUCTION

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Abstract

Precision soil sampling helps farmers identify nutrient variability to optimize input placement and timing. Anecdotal evidence suggests that soil test information has a useful life of 3–4 years before it needs to be updated. However, the time period of perceived usefulness may depend on a variety of factors, including field variability, farmer experience and education, farm size, Extension and other information providers. In 2009, a survey of cotton farmers in 12 southern states collected information about the use of precision soil sampling technologies. A regression model incorporating farm operator and business characteristics, use of precision agriculture technologies, and information sources analyzed (1) the adoption of soil testing technologies and (2) the number of years farmers perceived soil test information to be useful. We find that a number of farm operator and business characteristics are associated with the length of time producers perceive the information they obtain from soil tests to be useful, including farmer experience, information from trade shows, news media sources and university Extension services, and the use of private consultants.

Introduction

Precision soil sampling technologies have progressed in recent years with the implementation of global positioning satellites (GPS), soil maps, and other management tools. These technology improvements have increased the demand for more accurate, real-time, site-specific information. Site-specific information assists farmers in determining the optimal amounts of fertilizer to apply over a field, potentially lowering input costs or increasing output productivity. But how long soil test information is useful before updates are needed depends on many factors. This preliminary analysis of the 2009 southern cotton precision farming survey identifies the farm business, operator, off-farm attributes, and information sources influencing the adoption decision and the period of time soil test information is useful (e.g., time before tests are performed again) as understood by cotton farmers.

Input management is a dynamic and complex problem involving trade-offs between soil nutrient carrying capacity, soil nutrient uptake, soil variability, plant genetics, prices, yield response, and many other factors. The potential economic value of managing soil nutrient carry-over and yield variability includes increased soil fertility, decreases in input costs, and optimal input placement. Farmers often adopt precision agriculture (PA) technologies based upon economic incentives and increased returns (Roberts, English, and Mahajanashetti 1999) as well as perceived ease-of-use and usefulness. While the perception of profitability and usefulness may drive producers to adopt PA technologies like soil testing, producer perception about soil test information may change as increasing familiarity with the technology and new information about within-field soil variability is realized.

Survey

The 2009 Cotton Incorporated Precision Agriculture survey was mailed to 13,579 farms in Alabama, Arkansas, Georgia, Florida, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, and Virginia. 1,692 of the surveys were returned and available for analysis. Mooney et al. (2010) provide details of the survey. About 14% of the cotton farmers surveyed had adopted soil testing. Of the cotton farmers that reported using soil tests, the average time between tests was about 3 years (Figure 1).

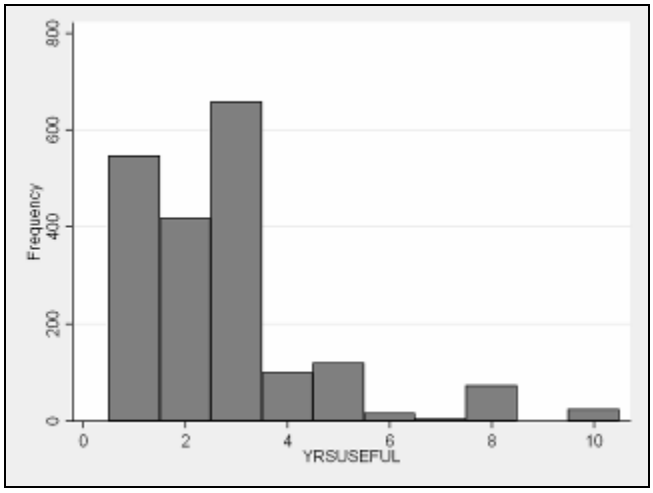

Figure1. Distribution of years between soil testing reported by cotton farmers who adopted the technology.

Farm Operator, Information, Technology Characteristics, Soil Test Adoption, and Period Usefulness

The variables hypothesized to be correlated with the soil test adoption decision and the length of time soil test information was perceived as being useful are represented by four categories: 1) Farm operator characteristics, 2) Information sources, 3) Information gathering/processing technologies, and 4) off-farm/regional attributes.

The characteristics associated with the likelihood of precision soil sampling adoption and the perceived usefulness of precision soil sampling information following an initial soil test (in years) are summarized in Table 1. Larger farms, farmers who owned more land than they operated, the use of the internet as an information source, and the use of a custom input application or a variable rate technology plan were associated with producers being more likely to adopt PA technologies. Alternatively, farmer experience (as measured by years farming over farmer age) and the use of consultants or trade-shows as information outlets suggested a negative correlation to adoption. The perceived usefulness over time of precision soil sampling technologies increased with land tenure (acres owned /acres operated), farmer experience, engaging Extension services, and the use of electrical conductivity (EC) devices and Greenseeker technology. Farm size, the use of trade-shows as an information source, and the use of a computer for farm management were associated with the perception that a shorter period was required before soil test information needed to be updated.

Summary

Understanding the factors contributing to the perceived usefulness of soil test information may provide guidance to industry with respect to product and service marketing, and help Extension tailor informational efforts regarding the benefits and costs of soil sampling. This report provided a preliminary analysis of the factors influencing adoption of soil testing by cotton farmers in the southern U.S., as well as the perceived usefulness of soil test information over time. Farm, information, and technology characteristics affect the decision to adopt soil testing, and the length of time between soil tests. More experienced farmers, larger farms, internet information sources, custom input application, and the use of a variable rate technology plan all increase the likelihood that precision soil sampling technology may be adopted. Land ownership, farmer experience, use of Extension for information about PA, and the use of EC devices and Greenseeker technology increase the time period between tests.

Table 1. Factors influencing the adoption and perceived usefulness of precision soil sampling technologies

Factor	Outcome	
	Likelihood of adopting precision soil sampling	**Length of time between soil tests**
----------Effect of farm operator characteristics----------		
Increase in farm size (acres operated)	Increased	Decreased
Increase in tenure (acres owned/acres operated)	Increased	Increased
Increase in experience (years farming/age)	Decreased	Increased
----------Effect of information sources----------		
Relied on consultant (1=yes)	Decreased	---
Relied on extension (1=yes)	---	Increased
Relied on internet (1=yes)	Decreased	---
Relied on trade shows (1=yes)	Decreased	Decreased
----------Effect of information gathering/processing technologies----------		
Custom hired input application (1=yes)	Increased	---
Used a computer for farm management (1=yes)	---	Decreased
Formulated a VRT management plan (1=yes)	Increased	---
Used EC (1=yes)	---	Increased
Used Greenseeker® (1=yes)	---	Increased

References

Mooney, Daniel F., Roland K. Roberts, Burton C. English, James A. Larson, Dayton M. Lambert, Margarita Velandia, Sherry L. Larkin, Michele C. Marra, Roderick Rejesus, Steven W. Martin, Kenneth W. Paxton, Ashok Mishra, Eduardo Segarra, Chenggang Wang, and Jeanne M. Reeves. 2010. Status of Cotton Precision Farming in Twelve Southern States. Proceedings of the 2010 Beltwide Conference, New Orleans, LA, January 5 – 8.

Roberts, R.K., B. English, and S. Mahajanashetti. 1999. Paper presented at the American Agricultural Economics Association Annual Meeting, Nashville, TN, 8-11 August.

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