## ADOPTION OF COTTON PRECISION FARMING TECHNOLOGIES IN TENNESSEE

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### <u>Abstract</u>

This paper summarizes Tennessee cotton farmers' responses to the 2013 Southern Cotton Precision Farming Survey. A mail survey of 13,162 cotton producers across 14 southern U.S. states was conducted in January and February of 2013. Of the 568 cotton farmers surveyed from Tennessee, 117 responded for a response rate of 21%. Initial analyses suggest that 96 respondents (82%) adopted at least one component of precision farming. The majority of respondents, who used precision farming technologies, combined the use of one or more information gathering, variable rate management, GPS guidance, and automatic section control technologies. About half of the respondents using variable rate management technology indicated that this technology increased yield. About 18% of respondents, who used at least one component of precision farming, indicated an increase in environmental quality from using precision farming technologies. Profit was considered a very-to-extremely important reason for adopting precision farming technologies (i.e., non-adopters). They also are more likely to use computers for farm management, and farm dealers and University/Extension services as sources of precision farming information than do non-adopters. Approximately 20% of those using precision farming technologies have received cost-share payments for implementing nutrient management plans.

## **Introduction**

A cotton precision farming survey was conducted in January and February of 2013 to assess the present status and future prospects for adoption of precision farming technologies by cotton producers across the southern United States (Boyer et al., 2013). This is the forth in a series of southern cotton precision farming surveys. Surveys were previously conducted in 2001, 2005, and 2009 (Mooney et al. 2010). Results from the 2009 survey for Tennessee producers were summarized by Larson et al. (2010). With the 2013 data now available, a need exists to reevaluate producers' experiences with precision farming technologies. The objective of this study is to present initial findings from this survey for respondents from the state of Tennessee.

#### **Materials and Methods**

A mail survey of cotton producers located in Alabama, Arkansas, Florida, Georgia, Kansas, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, South Carolina, Tennessee, Texas, and Virginia was conducted in 2013 to establish the current use of cotton precision farming technologies in these states. A mailing list of 13,162 cotton producers was furnished by the Cotton Board, 568 of whom lived in Tennessee.

A questionnaire was developed to elicit cotton farmers' attitudes toward and use of precision farming technologies. Following Dillman's (1978) general mail survey procedures, the questionnaire, a postage-paid return envelope, and a cover letter explaining the purpose of the survey were sent to each producer. A reminder post card was sent two weeks after the initial mailing. A second mailing of the questionnaire to producers not responding to previous inquiries was then conducted three weeks later. The second mailing included a letter indicating the importance of the survey, the questionnaire, and a postage-paid return envelope. In total, 117 Tennessee cotton producers responded for a statewide response rate of 21%.

For the purpose of this study, a precision farming adopter is defined as a cotton producer who reported using at least one of the following precision farming technologies: GPS guidance, information gathering, variable rate management or automatic section control. Thus, we are categorizing respondents as adopters if they reported using at least one precision farming component.

# **Results and Discussion**

Results are presented in four sections. The first section summarizes preliminary precision farming technology adoption percentages. The numbers of Tennessee cotton farmers adopting various precision farming technologies and the acreages covered by these technologies are discussed in the second section. In the third section, adopters' perceptions of precision farming technologies are discussed. Selected characteristics of adopters and non-adopters are compared in the fourth section.

#### **Overall Precision Farming Adoption**

Initial finding: A large percentage of adopters (46%) combined the use of all technologies from among information gathering (IG), variable rate management (VRT), GPS guidance (GPSg), and automatic section control (ASC) (Figure 1).



Figure 1. Adopter Use of Precision Farming Technologies

## Adoption of Specific Precision Farming Technologies and Acreages Managed

Initial findings: The most used precision farming technology is GPS guidance. About 76% of the total respondents have used this technology on approximately 92,085 acres. The second most used technology is automatic section control for sprayers with about 50% of total respondents indicating the use of this technology on a total of 109,956 acres (Table 1).

Table 1. Adoption Rates and Numbers of Acres Managed with PF	Technologies
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Variable	Ν	% of Total Respondents	Total Acres
Yield Monitor with GPS	36	30.77%	55,520
Soil Sampling – Grid	50	42.74%	48,437
Soil Sampling – Zone	28	23.93%	26,205
GPS Guidance	89	76.07%	92,085
Variable Rate Nitrogen	20	17.09%	24,020
Variable Rate Phosphorous	37	31.62%	46,464
Variable Rate Potassium	39	33.33%	49,164
Automatic Section Control for Planters	40	34.19%	61,790
Automatic Section Control for Sprayers	58	49.57%	109,956

# Adopter Responses

Initial findings: About half of precision farming adopters, who used variable rate management, reported this technology increased yield. About 18% of precision farming adopters indicated an increase in environmental quality due to the use of these technologies. Profit was considered a very-to-extremely important reason for adopting precision farming technologies (Table 2).

Table 2. Adopter	Responses	about 1	Precision	Farming	Technologies
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Variable	Ν	Value
Found variable rate management:		
Increased yield (%)	51	49%
Did not affect yield (%)	51	51%
Decreased yield (%)	51	0%
Found precision farming:		
Increased cotton quality (%)	19	20%
Improved environmental quality (%)	17	18%
Adopted precision farming:		
To increase profits (Rank 1-5)	54	4.3
For environmental benefits (Rank 1-5)	45	3.3
To be at technological forefront (Rank 1-5)	44	2.9

### **Characteristics of Adopters and Non-Adopters**

Initial findings: On average, cotton farmers using precision farming technologies (i.e., adopters) in Tennessee grow more cotton acres, rely more on farm income, are younger and have attained a higher level of education than non-adopters. They also are more likely to use computers for farm management, and farm dealers and University/Extension services as sources of precision farming information than non-adopters. About 20% of precision farming adopters have received cost-share payments for implementing nutrient management plans (Table 3).

Table 3. Characteristics of Precision Farming Adopters and Non-Adopters

Variable		Non-Adopters	
	Adopters (n=96)	(n=21)	
Cotton area planted 2012 (acres)	898	514	
Farming Experience (years)	28	31	
Age (years)	53	58	
% with bachelor's or graduate degrees	34%	26%	
Use computer for farm management (1=yes)	65%	35%	
Household income from farming (%)	74%	66%	
% using farm dealers as a source of PF information	70%	30%	
% using University Extension as a source of PF information	33%	12%	
Have received cost-share payments for nutrient management	20%	0%	

## **Summary**

This article presents initial findings from the 2013 Southern Cotton Precision Farming Survey for the state of Tennessee. A mail survey of 13,162 cotton producers across 14 southern U.S. states was conducted in January and February of 2013; 568 of whom were located in Tennessee. In total, 117 producers responded for a response rate of 21%.

To summarize, 82% of the Tennessee respondents had used at least one component of precision farming. A large percentage of these adopters (46%) combined the use of all technologies from among information gathering, variable rate management, GPS guidance, and automatic section control. About half of the adopters of variable rate management technology indicated that this technology increased yield and about 18% of adopters indicated an improvement in environmental quality. Profit was the most important reason for adopting precision farming. These

results may be used to focus precision farming research and extension resources on producers who are most likely to use these technologies and to develop decision aids to assist with purchase or custom hiring decisions.

These results represent only a small selection of survey results for the state of Tennessee. Adopter and non-adopters also indicated their primary information sources, indicated their perceptions about the future profitability of precision farming technologies, and provided additional farm and farm operator characteristics. Future analyses using the survey data will further investigate these topics.

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