PDA AND HANDHELD GPS ADOPTION IN PRECISION COTTON PRODUCTION

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Abstract

Factors affecting the adoption of computers in agriculture have received significant attention in previous research. Previous studies of computer use in agriculture indicate that computers were used primarily as financial management tools rather than as production decision aids. Precision agriculture has taken computer use beyond these established roles of financial accounting and record keeping. Information technologies used in precision agriculture gather agronomic data in a number of ways, producing large volumes of data. The integration of information gathering technologies with Global Positioning Systems (GPS) has allowed spatial referencing of data. The need for an ability to process spatially referenced crop, soil, and input application data has given rise to the use of portable computers for guiding scouting and ground-truthing as well as a means for controlling variable-rate application. However, little is known about the uses of small computing devices such as PDAs in farm management and production. The objective of this analysis is to identify the farm and farmer characteristics that affect the adoption of Personal Digital Assistants (PDA) and handheld computers with GPS capabilities in precision cotton production. Results from this study have the potential to stimulate discussion about the potential impacts of PDAs on cotton farm management and the potential adoption of complementary precision farming technologies.

Data used for this analysis come from a 2005 survey where cotton producers responded providing information about the extent to which precision agricultural technologies were used on their farms as well as information on the general structure and characteristics of their farming operations. Producers answered questions concerning their opinions on the costs and profitability of precision agriculture as well as perceptions about the future viability of precision agriculture.

Univariate analysis of sample means of farm and farmer characteristics were used to examine differences between farmers who adopted PDA/handheld devices and those who did not. Farmer characteristics included age, education, and computer use. Also included were farmer perceptions about the usefulness of the Extension Service in making precision farming decisions. Farm characteristics included cotton acreage, percentage of total cropped acres devoted to crops other than cotton, livestock ownership, land tenure, spatial yield variability of cotton, and income. Additionally, variables capturing the adoption of variable-rate applications of fertilizer, defoliant, insecticide, and growth regulator were included. The adoption of remotely sensed images and yield monitors were included to highlight complementary relationships between PDA/handheld GPS devices and other technologies.

Results indicate that adopters of PDA/handheld GPS devices had larger cotton farm size. They planted an average of 49 percent more cotton acres than those who did not adopt. Adopters also reported 17 percent higher spatial yield variability than non-adopters. Results also indicate that adopters were younger, more educated, had greater income, and perceived extension services to be more helpful. Adopters also utilized computers in farm management applications to a greater extent than non-adopters. Average use of plant mapping was 78 percent higher among adopters. Analysis of variable-rate input application practices found that adopters of PDA/handheld GPS devices reported 71 percent higher use of variable-rate fertilizer and lime than non-adopters. The analysis also showed that variable-rate application of defoliant, insecticide, and growth regulator was 85 percent higher among adopters. Analysis of precision farming technologies which may have complementary relationships to PDA/handheld GPS devices indicated that adopters used remote sensing 71 percent more than non-adopters. Adopters also reported 76 percent higher use of yield monitors.

Findings from this research have implications for agronomists and agribusiness firms involved in developing methods to assist in the implementation of precision farming practices. An understanding of the factors motivating adoption of a PDA/handheld GPS device in precision cotton production can provide insight into areas of potential improvement in the promotion of precision agriculture. Understanding complementarity among precision agricultural tools and practices that motivate adoption also has the potential to illuminate areas in which further product development could increase the efficiency of complementary products used in a package of precision farming technologies. The use of portable computer technology is likely to become increasingly important as development forces strive to induce greater efficiency and profitability in precision agriculture.