Extension's Role in Precision Agriculture: A Case Study of Auto-Steer Adoption

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Introduction

According to Mississippi Farm Bureau Federation (2017), there are approximately 35,800 farms in Mississippi. This represents a 6 percent decrease in the number of farms since the 2012 Census of Agriculture. Despite decreasing farm numbers, average productivity per farm increased. In order for farmers to remain competitive, they must employ efficient production practices. One way farmers can increase production efficiency is using precision agriculture. Studies show that precision agriculture technologies consistently increase net returns (Smith, Dhuyvetter, Kastens, Kastens, & Smith, 2013; Shockley, Dillon, Strombaugh, & Shearer, 2012; Shockley, Dillon, & Stombaugh, 2011). However, not all farm operators adopt all precision agriculture technologies. Extension educators are tasked with assisting diffusion of innovations, thus it is important to understand why adoption may not occur.

Auto-steer is a relatively common precision technology that uses GPS to guide the travel pattern of equipment, leaving the farmer free to monitor operation of the implement (D'Antoni, Mishra, & Joo, 2012). It is considered a sound investment as it has been shown to save time and money as well as reduce operator errors (Schimmelpfennig, 2016; Shockley et al., 2011). However, research has failed to investigate farmers' perceptions of auto-steer technology (D'Antoni et al., 2012).

Extension educators could benefit from understanding these perceptions, as this could influence efforts to promote and advance adoption of this and similar precision agriculture technologies. Aligning with AAAE's research priority addressing "new technologies, practices, and products adoption decisions" (Linder, Rodriguez, Strong, Jones, & Layfield, 2016, pg. 19), the purpose of this study was to understand farmers' decisions to adopt auto-steer technology. Our specific research objective was to identify and rank farmers' reasons for adopting auto-steer.

Theoretical framework

The theoretical framework for this study was Rogers's (2003) innovation-decision model. According to Rogers, the innovation adoption decision is realized through knowledge, persuasion, decision, implementation, and confirmation. In addition, Rogers described prior conditions, characteristics of the decision-making unit, and perceived characteristics of the innovation that all influence whether or not an innovation is adopted. Perceived characteristics of an innovation including relative advantage, compatibility, low complexity, trialability, and observability directly impact the decision to adopt or reject. Therefore, it is important to understand which of these characteristics adopters perceive auto-steer as possessing.

Methodology

This was part of a larger, exploratory study that examined Mississippi farmers' adoption of auto-steer. Data were collected utilizing a modified survey instrument from the University of Tennessee Department of Agricultural and Resources Economics. The 17 question instrument was administered through Qualtrics, and a link was emailed to Mississippi row crop farmers with two follow-up reminder emails to increase response rate. For the purpose of this study, question 10 asked producers to rate the importance of specific factors with regard to the farmer's decision to use auto-steer. These factors, intended to correspond to Rogers's characteristics of an innovation, included profitability, integration into existing equipment, difficulty of learning to use, trying it beforehand, positive environmental benefits, being able to see others us auto-steer before purchase, and saving time.

Results

Of 1,154 Mississippi row crop farmers emailed the survey link, 152 survey instruments were completed, a response rate of 13.1%. A majority of respondents indicated they grew corn (80%) and/or soybeans (85.5%), followed by cotton (48.7%), wheat (23%), rice (15.8%), and others. The mean age of respondents was 48 years, ranging from 19 to 82. Mean farm acreage was just over 3,000, ranging from 60 acres to 16,000 acres. The mean number of years farming was 26.5. Of the respondents, 119 (78.8%) indicated they use auto-steer on one or more pieces of farm equipment, and of those who had adopted auto-steer, most adopted in 2010.

Nearly 80% of respondents reported using auto-steer in their farming operation. Those respondents were subsequently asked to rate the importance of several factors in their decision to use auto-steer. Using a five-point Likert scale, where 1 indicated “not important at all” and 5 indicated “absolutely essential”, adopters reported that saving time was the most important reason ($m = 4.44$), followed by profitability ($m = 4.00$), ease of integration ($m = 3.90$), positive environmental benefits ($m = 3.50$), difficulty of learning ($m = 3.14$), seeing others use the innovation ($m = 2.92$), and being able to try the equipment beforehand ($m = 2.91$).

Conclusions

Knowing which factors affect farmers’ adoption decisions is imperative for the Extension Service to better prepare and deliver educational programming that benefits farmers. Rogers (2003) suggested that characteristics including relative advantage, compatibility, low complexity, trialability, and observability impact adoption rate. In our study, adopters reported that saving time and increasing profitability were the most important reasons to adopt auto-steer. These factors speak to the relative advantage of auto-steer. Interestingly, our respondents indicated that seeing others use auto-steer and being able to try auto-steer were less important in their decision to adopt which represent observability and trialability, respectively. Extension education methods frequently rely on field trials and corresponding field days that allow for trialability and observability of innovations. However, our study results suggest that these methods may have had less impact on farmers’ decision to adopt this specific innovation.

Implications/Recommendations

This study was limited in scope, investigating auto-steer adoption by Mississippi row crop farmers. However, useful insights may be gleaned for similar clientele groups. As change agents, Extension educators frequently apply Rogers’ innovation-decision model, designing programming to highlight the attributes of innovations that should positively impact their rate of adoption. In order to be efficient with resources, understanding which attributes are most important to farmers in necessary. Certainly different innovations possess varying degrees of each attribute identified by Rogers, however, our study suggests that farmers place the most importance on relative advantage. Therefore, it may be wise to focus educational efforts regarding precision technology on communicating the benefits those technologies offer over current or outdated technologies in use. Further research on precision technology adoption should extend beyond row crop farmers and additional technologies should be studied to better understand farmers’ adoption decisions.

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