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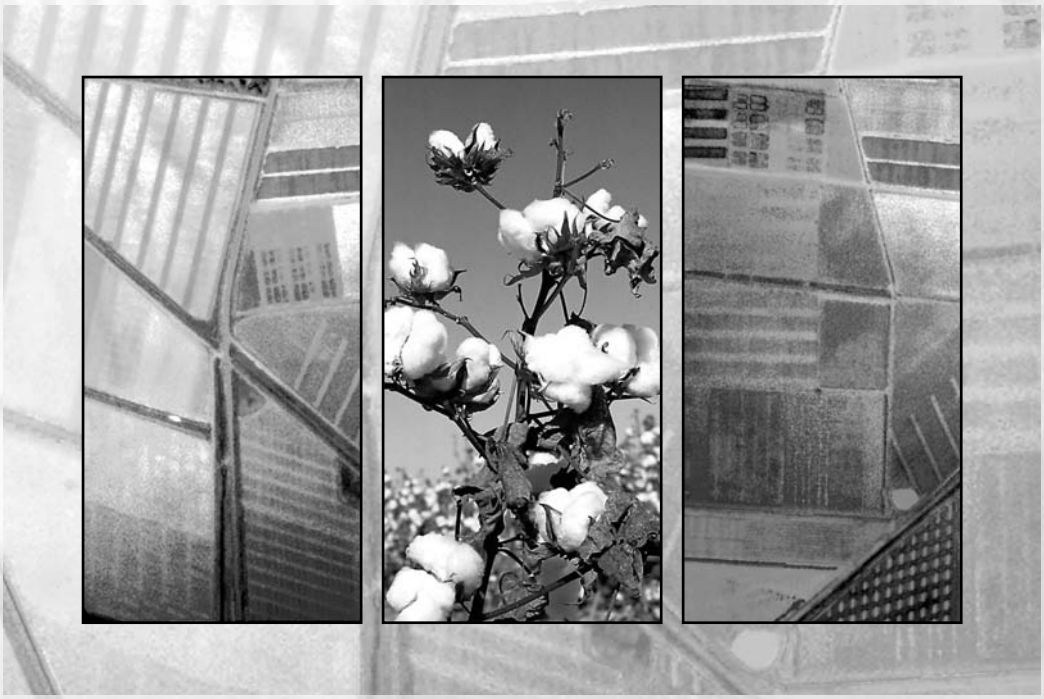
Summary of Precision-Farming Practices and Perceptions of Mississippi Cotton Producers



Results from the 2005 Southern Precision-Farming Survey

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Summary of Precision-Farming Practices and Perceptions of Mississippi Cotton Producers:

Results from the 2005 Southern Precision-Farming Survey

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EXECUTIVE SUMMARY

Precision-farming technologies are used to identify and measure within-field variability and its causes, prescribe site-specific input applications that match varying crop and soil needs, and apply the inputs as prescribed. Reduction of input levels, increased efficiency of inputs, and proper timing of the inputs can reduce costs as well as increase yields and returns.

The use of precision technology for cotton (a high-value crop) is still limited because accurate yield monitors have only recently become commercially available. Because cotton is an important high-value crop in Mississippi, a follow-up to the 2001 survey evaluating the use of precision-farming practices, investigation into the factors that influence adoption and retention of precision-farming technologies, and an evaluation of cotton producers' adoption of newly developed precision-farming equipment and technologies would provide important information for Mississippi cotton producers and agribusinesses alike.

The adoption of precision-farming technologies depends on the characteristics of the decision maker, the farm, the cotton market, and the prices/costs of the new technologies. The 2002 Census of Agriculture revealed 1,596 cotton producers in Mississippi. Planted acres of cotton in Mississippi have ranged from 1.1 million acres to 1.62 million acres over the last 5 years. Statewide cotton yields have averaged 825 pounds for the period 2000-2004. The future of precision farming in cotton production depends on how producers perceive this set of technologies and how willing and financially able they are to incorporate these tools into their current management practices.

A survey conducted in 2001 to determine producers' attitudes toward precision farming received a usable response rate of 20%. According to that survey, responding adopters of precision-farming practices planted more acreage and reported higher yields per acre than nonadopters. Responding producers indicated less willingness to purchase precision-farming equipment (yield monitors) as price increased.

The objectives of the current study were (1) to determine attitudes toward and current use of precision-farming technologies by Mississippi cotton producers, (2) to determine adoption and value of precision guidance systems, and (3) to examine Mississippi cotton producers' retention of precision-farming technologies. A mail survey of cotton producers located in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and Tennessee was conducted in January and February of 2005 to establish the current use of precision-farming technologies in these Southeastern states. This report provides information dealing with the Mississippi portion of the survey and compares the 2005 survey with that of 2001.

The survey was sent to 1,335 cotton producers. The overall usable response rate was 13%. Of the responding farmers, 73% were from the Delta region of Mississippi. In 2002, 75% of Mississippi cotton producers reported farming as their primary source of income. According to the responses received, the top four technologies being used by adopters were soil grid sampling, soil sampling by management zones, soil survey maps, and remote-sensing aerial photography. Seventy-six percent of the responding users of precision-farming technologies indicated profitability was the most important reason that motivated them to adopt precision farming.

INTRODUCTION

The Mississippi State Planning Budgets (MSPB) show the cost of cotton production in Mississippi using conventional practices to be as much as $600 per acre depending on soil type and irrigation practices. MSPB costs do not include land costs, overhead costs, or any return to management. With costs increasing and cotton prices low, producers are continuously looking for ways to improve net returns. Reduction of input levels, increased efficiency of inputs, and proper timing of the inputs may reduce costs as well as increase yields and returns.

A mail survey was sent to 1,335 cotton producers. The overall usable response rate was 13%. Of the responding farmers, 73% were from the Delta region of Mississippi. In 2002, 75% of Mississippi cotton producers reported farming as their primary source of income. Survey respondents reported planting averages of 828 acres of cotton in 2003 (656 acres of dryland cotton and 1,140 acres of irrigated cotton), and 869 acres of cotton in 2004 (703 acres of dryland cotton and 1,170 acres of irrigated cotton). According to the responses received, the top four technologies being used by adopters were soil grid sampling, soil sampling by management zones, soil survey maps, and remote-sensing aerial photography. Seventy-six percent of the responding users of precision-farming technologies indicated profitability was the most important reason that motivated them to adopt precision farming.

Cotton is produced in Mississippi on a wide range of soils with varying yield potentials. Topsoil, rooting depth, water-holding capacity, texture, and other soil characteristics vary within a field and can cause yields to vary across a field. Though accurate cotton-yield monitors have only recently become commercially available, other precision-farming technologies have been available to cotton farmers for some time. These precision-farming services can be custom hired from consultants and vendors for a fee or implemented by the producers.

The adoption of precision-farming technologies depends on the characteristics of the decision maker, the farm, the cotton market, and the prices/costs of the new technologies. The 2002 Census of Agriculture revealed 1,596 cotton producers in Mississippi. Planted acres of cotton in Mississippi have ranged from 1.1 million acres to 1.62 million acres over the last 5 years. Statewide cotton yields averaged 825 pounds for the period 2000-2004.

A survey conducted in 2001 to determine producers' attitudes toward precision farming received a usable response rate of 20%. According to that survey, responding adopters of precision-farming practices planted more acreage and reported higher yields per acre than nonadopters. Responding producers indicated less willingness to purchase precision-farming equipment (yield monitors) as price increased (Martin and Cooke, Jr., 2002).

OBJECTIVES

The objectives of this study were (1) to determine attitudes toward and current use of precision-farming technologies by Mississippi cotton producers, (2) to determine adoption and value of precision guidance systems, and (3) to examine Mississippi cotton producers' retention of precision-farming technologies. A mail survey of cotton producers located in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and Tennessee was conducted in January and February of 2005 to establish the current use of precision-farming technologies in these Southeastern states. This bulletin provides information dealing with the Mississippi portion of the survey.

METHODS

Survey Methods

A mail survey of cotton producers located in Alabama, Arkansas, Florida, Georgia, Louisiana, Missouri, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia was conducted in January and February of 2005 to establish the current use of precision-farming technologies in these Southeastern states. This report provides information dealing with the Mississippi portion of the survey.

A questionnaire was developed to query producers about their attitudes toward and use of precision-farming technologies (Appendix I). 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. The initial mailing of the questionnaire was on January 28, 2005, and a reminder post card was sent one week later on February 4, 2005. A follow-up mailing to producers who did not respond to previous inquiries was conducted 3 weeks later on February 23, 2005. The second mailing included a letter indicating the importance of the survey, the questionnaire, and a postage-paid return envelope. Each producer was instructed to return the questionnaire without filling it out if he was not a cotton producer.

A mailing list of 1,335 potential Mississippi cotton producers for the 2003-2004 season was furnished by the Cotton Board in Memphis, Tennessee (Skourpa, 2004). Of the 1,335 questionnaires mailed, four letters were returned undeliverable, 10 respondents indicated they were not cotton farmers or had retired, and 13 surveys were otherwise unusable, leaving a total of 1,308 cotton producers in Mississippi. Of those who responded, 169 individuals provided data. Assuming the remaining nonrespondents to the survey were active cotton producers, the usable response rate was 13%.

Questions 1-21 and 25-34

Question 1 asked producers in which county and state their farms were located. Question 2 asked if they grew cotton in 2003 and/or 2004. If they chose "Neither" as their option, they were asked to return the survey blank. If not, they were asked to continue. The following questions asked producers their opinions on the usefulness of precision-farming equipment in the future in general and specifically 5 years into the future. Specific information was gathered on their assessment of a typical purchase price of a cotton-yield-monitoring system with global positioning system (GPS), their source(s) of precision-farming information, who analyzed their soil samples (if anyone), acres planted and average yields for 2003 and 2004, cropped acres (owned and rented), and cotton lint yields (least productive 1/3, average productive 1/3, most productive 1/3) to assess variability within a field.

Users of cotton-yield monitors were asked to skip to question 25, where producers were asked if they used map-based or sensor-based methods to apply inputs. Questions 26 through 34 were on GPS guidance systems — if they used such systems, what value they placed on the additional information obtained through such systems, the reason(s) they used those systems, and for which field operations they used those systems. If they did not use a GPS guidance system, they were asked if they planned on purchasing one in the next 3 years and what value (dollars per acre per year) they would place on using such a system on their farm.

Questions 22-24 and 35-40

Nonusers of cotton-yield monitors were asked to respond to questions 22 through 24. These questions asked which methods the producers used to assess yield variability within a cotton field, as well as what value in terms of acres per year the additional information obtained from yield monitors had to them.

Questions 35 through 37 were on variable-rate-input technologies. Question 35 asked how many years producers had utilized certain inputs using each of four different input technologies, as well as the number of cotton acres on which they used these technologies in 2004. Question 36 asked producers to list the inputs from question 35 they stopped applying after using variable-rate technologies. Users of variable-rate-input technologies were asked in question 37 if they perceived that their yields had increased, remained the same, or decreased because of these technologies.

Users of precision-farming technologies were asked in question 38 if they experienced any improvements in environmental quality from using such technologies. Question 39 asked them to rate reasons to adopt precision farming; the question presented four options for rating degree of importance. Nonusers of precision farming were asked in question 40 (an open-ended question) the most important reason for their not practicing such farming.

Questions 41-52

Demographic information about the primary decision maker on each farm was collected in these questions. These included year of birth, years in farming, years of formal education, whether they owned a computer, whether they owned a computer for farm management, and whether they used a laptop handheld computer in the field. The questions also assessed each producer's farm planning goal (with multiple choices), gross household income in 2004 from farm and nonfarm sources, and percentage of 2004 household income that came from farming. Finally, they were asked to indicate whether the Extension Service needed to provide more educational outreach about precision farming in their area, as well as whether their county agents had the necessary skills in precision farming to meet their needs.

RESULTS

Results of the survey are presented in four sections. The first section compares several characteristics of the respondents and their farming operations with data from the 2002 Census of Agriculture (Mississippi results), the National Agricultural Statistics Service (NASS), and a survey similar to the current one conducted in 2001 (Martin and Cooke, Jr., 2002). The second section presents information on the use of precision-farming practices in Mississippi. Where appropriate, the responses of precision-farming adopters from the current survey and those from the 2001 survey are compared. In the third section, the characteristics of the typical precision-farming adopter and nonadopter are juxtaposed. The fourth section presents the farm and demographic characteristics of responding precision-farming adopters and nonadopters.

Comparisons of Survey Data with Secondary Data Sources

The distribution of cotton farmers across Mississippi counties reported in Table 1 (Appendix II) corresponded closely with the distribution of respondents across counties (question 1). In 2002, more than 70% of the cotton producers were located in the Delta region of Mississippi (U.S. Department of Agriculture – NASS, 2005). Of the responding farmers, 73% were from the Mississippi Delta. In a similar survey in 2001, 72% were from this region (Martin and Cooke, Jr., 2002).

The average age of a typical respondent was younger than the average age of cotton producers reported in the census. The average age of cotton farmers reported in the survey was 52 years. In the 2001 survey, the average age was 51 years (Martin and Cooke, Jr., 2002). In 2002, the average age of Mississippi producers was 57 years (U.S. Department of Agriculture – NASS, 2005). Respondents ranged in age from 25 to 82 years. In the survey conducted in 2001, they ranged from 21 to 89 years (Martin and Cooke, Jr., 2002).

In 2002, 75% of Mississippi cotton producers reported farming as their primary source of income (U.S. Department of Agriculture – NASS, 2005), com-

pared with 71% of our survey respondents. In 2001, 83% of survey respondents reported farming to be their primary source of income (Martin and Cooke, Jr., 2002).

Survey respondents reported planting averages of 828 and 869 acres of cotton in 2003 and 2004, respectively (question 11), compared with 913 and 962 acres in 1999 and 2000, respectively, according to the 2001 survey (Martin and Cooke, Jr., 2002). In 2003 and 2004, Mississippi cotton yields were estimated at 934 and 1,024 pounds per acre, respectively (Mississippi Agricultural Statistics Service, 2005), while survey respondents reported average yields of 1,020 and 1,065 pounds per acre, respectively (question 11), in 2003 and 2004. In the 2001 survey, the average yields reported for 1999 and 2000, respectively, were 750 and 700 pounds per acre (Martin and Cooke, Jr., 2002). Thus, yields reported by survey respondents were higher in 2003 and 2004 than in 1999 and 2000, but they were similar to the state averages, although acreage figures in both 2003 and 2004 were reported lower than in 1999 and 2000.

Adopter Responses about Precision Farming in Mississippi

Unlike the 2001 survey, the 2005 questionnaire was not clearly demarcated for adopters and nonadopters of precision-farming technologies. Instead, both faced the same set of questions initially. The responses provided determined the distinction between adoption and nonadoption.

Information Sources

From a list of seven choices, users of precision-farming technologies were asked where they got their precision-farming information (question 8). The question was posed by having the respondents rank the usefulness of each of the seven given sources (1 = not useful, 5 = very useful) in learning about the precision-farming technologies they had used. Other farmers as a source of information received the highest average scores (3.43). Extension Service and universities received the next highest score (3.33). These were followed by farm dealers (3.2), crop consultants (3.13), trade shows (3.06), news media (2.68), and the Internet (2.38). Table 2 (Appendix II) lists the average scores for sources of information about all precision-farming technologies considered across all responding adopters for both the 2001 and 2005 surveys. In contrast, the 2001 survey ranked crop consultants (3.62), the Extension Service and universities (3.28), and farm dealers (2.58) as the most helpful, while other farmers (1.90), the Internet (1.69), trade shows (1.38), and the news and media (1.13) were the least helpful (Martin and Cooke, Jr., 2002).

Use of Precision-Farming Technologies

Question 14 asked users of precision-farming technologies to indicate which of four information-gathering technologies they used to make each of 10 variable-rate management decisions (Appendix II, Table 3). Aerial or satellite infrared imagery received the maximum number of responses (97 out of a possible total of 1,690, which is approximately equal to 5.7%), followed closely by yield monitoring with GPS (88/1,690 = 5.2%), and handheld GPS units (76/1,690 = 4.5%). COTMAN plant mapping received the fewest responses (24/1,690 = 1.4%). Among the variable-rate decisions, fertility or lime received the maximum number of responses (50 out of a possible total of 676, which approximates to 7.4%), followed closely by zone identification (42/676 = 6.2%), and drainage (39/676 = 5.8%). The other decisions indicated by respondents in descending order of importance were growth regulator and harvest aids (30/676 = 4.4% each), insecticide and irrigation (23/676 = 3.4%), seeding (20/676 = 3.0%), herbicide (16/676 = 2.4%), and fungicide (12/676 = 1.8%).

Adopting producers were asked to indicate the number of years they had used each precision-farming technology for cotton (survey question 15). Table 4 reports information about the number of years Mississippi producers have used some form of precision-farming technology on cotton fields. Based on these responses, the top four technologies being used by adopters were soil grid sampling, soil sampling by management zones, soil survey maps, and remote-sensing aerial photography. The first three of these technologies were also among the top four in the 2001 survey (Martin and Cooke, Jr., 2002). When considering the average years of use, these technologies were also among the most used for cotton production. In response to question 16, between 0.5% and 3% of the respondents listed the technologies mentioned in question 15 that they used in the past and then abandoned.

Variable-Rate-Input-Application Technologies

Question 35 provided respondents with a table containing 11 cotton inputs (nitrogen, phosphorus, potassium, lime, seed, growth regulator, defoliant, fungicide, herbicide, insecticide, and irrigation) and four variable-rate technologies (map-based, sensor-based, row markers, and GPS). For each input application, they were asked to enter how many years they used each of the first three technologies and how many cotton acres they produced using that technology in 2004. Using the map-based method, the majority (61%) of responding variable-rate-technology users applied phosphorus, potassium, and lime on 59% of the acres they grew in 2004. The highest mean number of years for this method was 21 years each for seed and irrigation, and the mean of 3,563 acres was the highest number of acres grown using this method for seed. With the row markers method, 42% of the responding adopters applied seed, growth regulator, and defoliant as inputs, with seed being the input used the longest (mean of about 18 years). The highest mean acres subjected to this method in 2004 were 1,086 acres for nitrogen. Very few adopters used the sensor-based method (Appendix II, Table 5). For the fourth technology (GPS guidance system), producers were only asked if they used that technology. Of those responding, a majority (ranging from 64% in the case of potassium to 98% in the case of irrigation) did not use the GPS guidance system to apply any of the given inputs (Appendix II, Table 5). According to the survey conducted in 2001, the majority of adopters did not use variable-rate-application technologies on cotton. Unlike the current survey, the 2001 survey did not categorize or differentiate variable-rate technologies. Forty percent of responding adopters used variable-rate phosphorus and potassium application, followed by variable-rate lime application (30%), variable-rate nitrogen application (25%), and variable-rate growth regulator and defoliant application (18%). Few responding adopters had used variable-rate technology for manure application, nematicide application, or irrigation (5% or less) (Martin and Cooke, Jr., 2002).

Question 36 asked respondents to indicate which cotton inputs in question 35 they had applied using variable-rate technologies in the past but no longer used. For each of the 11 inputs mentioned in question 35, no more than 3% of the respondents indicated that they had discontinued the use of variable-rate technologies to apply those inputs.

Question 37 asked adopters to indicate how their cotton yields changed after variable-rate application. Eighty-three percent indicated their average cotton yields increased between 10 and 250 pounds of lint per acre, and 17% indicated their yields did not change. Nobody reported a decrease in average yields. According to the 2001 survey, 39% of the responding adopters experienced an increase in yields, 14% reported a decrease, and 47% indicated no change in cotton yields. The average yield increase was up to 100 pounds (Martin and Cooke, Jr., 2002).

Changes in Profit and Environmental Quality

In response to question 38, approximately 36% of the precision-farming-technology users indicated that they experienced improvements in environmental quality from using precision-farming technologies (Appendix II, Table 6). In the 2001 survey, 33% of adopters thought they had experienced an improvement in environmental quality because of precision farming (Martin and Cooke, Jr., 2002).

Question 39 allowed precision-farming-technology users to rank the importance of four reasons for adopting precision farming: profit, environmental benefits, to be at the forefront of agricultural technology, and to avoid being left behind (scale of 1–5, 1 = Not Important, 5 = Very Important). Table 7 in Appendix II lists the statistics on responses to this question. Seventy-six percent of the responding precision-farming-technology users indicated profitability was the most important reason. On the "environmental benefits" option, 29% of the responding users placed high importance (rank 4). These figures compare well with the 2001 survey, in which 72% of responding adopters thought precision farming was profitable on their fields, and 33% of adopters thought they had experienced an improvement in environmental quality as a result of precision farming (Martin and Cooke, Jr., 2002). In the current survey, the reasons "being at the forefront of agricultural technology" and "not wanting to be left behind" each received medium importance (rank 3) by 35% of the users that responded to those parts of question 39.

Future of Precision Farming

Questions 4 through 6 asked all producers about the future of precision farming. Question 4 asked whether they thought precision farming would be profitable for them to use in the future. Fifty-three percent said "Yes," 9% said "No," and 38% said "Don't know." Question 5 asked whether they would prefer to own or rent their precision-farming equipment. For those responding to the latter question, 35% indicated they preferred to own. Only 6% would rather rent, but a majority (60%) said the decision to rent or own "Depends" (Appendix II Table 8). In the 2001 survey, 88% of adopting producers and 61% of nonadopting producers thought precision farming would be profitable for them to use in the future. For those respondents who believed it would be profitable, 61% of adopters and 53% of nonadopters would prefer to own the precision-farming equipment (Martin and Cooke, Jr., 2002).

Question 6 gave respondents an opportunity to rate the importance of precision farming for cotton and other crops 5 years in the future on a 1–5 scale (1 = not important, 5 = very important). The average scores for cotton and other crops were 3.65 and 3.49, respectively. Ninety-one percent of respondents for cotton and 87% for other crops opted for scores of 3-5, which signifies how producers perceive the importance of precision farming in the near future (Appendix II, Table 9). In the 2001 survey, adopters consistently rated the importance of precision farming 5 years in the future higher than did nonadopters. For cotton production, the average scores for adopters and nonadopters were 4.1 and 3.53, respectively; for corn production, they were 3.87 and 3.33, respectively; for soybean production, they were 3.48 and 2.89, respectively; for rice production they were 3.96 and 3.01, respectively; and for wheat production, they were 3.39 and 2.52, respectively (Martin and Cooke, Jr., 2002).

Analysis of Soil Samples

Two questions asked cotton producers in general about soil samples. Question 9 asked whether they had soil samples analyzed for their cotton fields in the preceding 3 years. An overwhelming 90% responded positively to this question. Question 10 asked respondents who typically collected soil samples for them. Among the five given choices, producers provided the following responses: consultant, 37%; fertilizer or chemical dealer, 34%; self, 19%; family member, 2%; and "Other," 1%. About 8% marked more than one choice (Appendix II, Table 10). In 2001, the majority (60%) of responding adopters also used consultants to collect their soil samples. Twenty-two percent used a fertilizer or chemical dealer to collect samples, while only 17% collected the samples themselves (Martin and Cooke, Jr., 2002).

Perceived Price of a Cotton-Yield-Monitoring System

Question 7 asked producers to report their best estimate of the typical purchase price for a cotton-yield-monitoring system with GPS for their area. The average purchase price indicated was $10,209 (Appendix II, Table 11). At the time the survey was conducted, that amount was more than the actual price ($9,175) for a cotton-yield-monitoring system that included a monitor, a GPS receiver, and sensors on two chutes of a four- to five-row picker (Ag Leader Technology, 2004). According to the 2001 survey, the average purchase price given by adopters was $8,183, while the average price given by nonadopters was $7,441. At the time of the 2001 survey, these estimates were less than the actual price of $9,200 for a cotton-yield-monitoring system that included a monitor, a GPS receiver, and sensors on two chutes of a four- and five-row picker (Ag Leader Technology, 2001).

Willingness to Purchase a Cotton-Yield-Monitoring System

The survey asked current users of cotton-yield monitors to answer questions 17-21, 25 (yield variability questions).

Question 17 asked if the user of a cotton-yield monitor himself or a consultant generated a yield map using data from his monitor. Out of the 40 yield-monitor users that responded to this question, only 30% said "Yes" to that question, while the other 70% said "No." The introduction of a cotton-yield monitor is supposed to facilitate the assessment of within-field variability of yield. Question 18 asked current yield-monitor users how they assessed the yield variability within a typical cotton field before they began using a cotton-yield monitor. Out of the 27 respondents who answered this question, 81% said they used year-to-year field records before they introduced the yield monitor. About 15% used soil maps, while another 15% used consultants' estimates. Only 7% used aerial photography. Four per-

cent used COTMAN, while another 4% used grid sampling. None used satellite imagery. Twenty-two percent used other methods (e.g., own estimates, personal observation, plant mapping, etc.).

Question 19 asked how the yield information obtained from yield monitoring changed the producers' perception of yield variability within their typical cotton field. Forty-one percent of the 17 who responded to this question indicated that yield monitoring somewhat increased their perception; their yields appeared to be 25-50% more variable than they thought. For about 18% of the responding yield-monitor users, the technology substantially increased their perception; their yields appeared to be at least 50% more variable than they thought. About 12% of them stated their perception increased slightly, with yields appearing to be 1-25% more variable than they thought. Another 29% indicated their perception did not change because their yields appeared to be the same as they thought. None of the respondents indicated that yield information obtained from yield monitoring decreased their perception of yield variability (Appendix II, Table 12). Eighty-six percent thought the additional information about within-field variability from their cotton-yield monitor (question 20) was valuable. The average value they placed on the additional information about within-field variability (question 21) was $45.15, and the values ranged from $1.50 to $150 per acre annually.

Site-specific information for variable-rate application of inputs is obtained *via* two methods: the map-based method and the sensor-based method. The map-based method uses a computer to generate a site-specific, input-application map. The map is entered into a data card, which is then placed in a variable-rate controller on the implement or tractor. About 23% of the responding yield-monitor users indicated they used this method (question 25A), 47% of whom used consultants, 38% used fertilizer/chemical dealers, 6% did it themselves, 6% used "Other" help, and 3% checked more than one choice (question 25B). The sensor-based method uses sensors to measure desired properties, and the information is used immediately to control a variable-rate-input applicator on the go. Only about 3% of the responding yield-monitor-using producers indicated they used the sensor-based method to apply inputs (question 25C) (Appendix II, Table 13).

Current nonusers of cotton-yield monitor were asked questions 22-24 (yield variability questions).

Question 22 asked yield-monitor nonusers how they assessed the yield variability within a typical cotton field on their farm. They were asked to check all of the eight choices (including "Other") that applied to them. A majority (69%) of the 121 respondents to this question indicated they used year-to-year field records for this purpose. Soil maps, consultants' estimates (without a yield monitor), and grid sampling were used by 22%, 20%, and 15% of the respondents, respectively. Seven percent of them used aerial photography, 4% used satellite imagery, and 23% used "Other" methods (e.g., personal observation, own estimates, experience).

Question 23 (Yes/No question) asked if the additional information about within-field yield variability that the farmer could obtain from a yield monitor would have some value to him. Seventy-six percent of the 117 respondents to this question answered "Yes." For those who answered "Yes," the survey asked them to place a value on the additional information they could obtain from a cotton-yield monitor in question 24. Of the 64 farmers who responded to this question, the value ranged between $0.40 and $5,000 per acre per year, with the maximum number of farmers (14, which is about 22% of respondents to this question) placing a value of $5 per acre. A cumulative total of about 63% placed a value of $10 or less for the additional information they would obtain from obtaining a yield monitor, and a cumulative total of 75% placed a value of $20 or less for this additional information.

Current users of cotton-yield monitor with GPS guidance system(s) were asked questions 26-31.

Question 26 asked respondents whether they used Lightbar, Autosteer, or "Other" types of GPS guidance systems. They were asked to check all that applied. Sixteen percent used Lightbar, and about 16% used Autosteer. Three respondents (2%) checked "Other"; each one specified a different system — JD Greenstar System, Tremble, and Rowfinder. Sixty-eight percent indicated they used "None" of the GPS guidance systems (Appendix II, Table 14). These latter respondents were asked to skip to question 32. The rest were asked to continue with question 27.

Question 27 asked producers if their GPS guidance system met their expectations. Eighty-five percent of the respondents stated that it did (Appendix II, Table 14). A majority (72%) of the farmers indicated they used their GPS guidance system for improved efficiency (question 28). Sixty percent said they used it to elimi-

nate the need for row markers. For 51% of the responding farmers, it served to improve spraying capacity. Improved planting was the reason 38% used the GPS guidance system. About 23% indicated "Other" reasons ("fertilizers and lime spreading," "just purchased this year," "mark rice levees," "spreader truck," "saved on chemicals," "run 24 hours," "working at night," "all rows equal width," "don't have GPS guidance," "labor," "straight rows," and "labor use better [more drivers able to row up, etc.]"). The respondents were asked to indicate all the reasons that were pertinent to them in question 28 (Appendix II, Table 15).

The GPS guidance system was of value to 92% of the 50 respondents (question 29). Thirty-five of those respondents placed the average value per acre per year at $521.83 (question 30). These values ranged from $1 (two respondents) to $18,000 (one respondent) (Appendix II, Table 16). Seventy-seven percent of them valued the GPS guidance system at $10 or less.

Question 31 asked GPS-guidance-system users which operations (primary tillage, planting, spraying, cultivating, harvesting) they used the system for and asked them to indicate all that applied. Seventy-six percent of the 49 responding to this question said they used the system for spraying, 49% for primary tillage, 41% for planting, 16% for harvesting, and 14% for cultivating (Appendix II, Table 17).

Current nonusers of cotton-yield monitors with GPS guidance systems were asked questions 32-34, 40.

Question 32 asked nonusers of GPS guidance systems whether they thought the use of such systems would have some value to them. About 78% of the 107 producers responding to this question thought it would. Forty-seven of those respondents placed the average value per acre per year at $666.35 (question 33), with the values ranging from $0.50 (two respondents) to $30,000 (one respondent) (Appendix II, Table 18). Seventy-four percent of them valued the GPS guidance system at $10 or less. Out of the 109 nonusers of GPS guidance systems responding to question 34, about 24% indicated they planned to purchase such a system in the next 3 years. Another 34% indicated they had no such plans, and the rest (42%) checked "Don't know" (Appendix II, Table 19).

Question 40 asked cotton producers who were nonusers of the GPS guidance system to list the most important reason for their not practicing precision farming. It was an open-ended question. From the responses received, the predominant reason seemed to revolve around funds; high cost/lack of money/high expenses constituted 71% of the responses to this question. Evidently, given the cost of buying precision-farming equipment and adopting it, a majority of the nonadopting farmers were not sure of the profitability of precision farming. The next big reason cited by respondents was lack of knowledge or information about precision farming, which constituted only 9% of the responses to question 40. Some of the respondents mentioned more than one reason. Table 20 in Appendix II summarizes the response statistics to this question.

Farm and Respondent Characteristics for Both Adopters and Nonadopters

Farm Characteristics

Producers were asked where the majority of their farms were located (survey question 1). The most responses from precision-farming adopters came from these counties: Tallahatchie and Coahoma (14 producers each); Yazoo (12 producers); Washington, Leflore, and Bolivar (11 producers each); and Sunflower and Humphreys (10 producers each) (Appendix II, Table 1). In the 2001 survey, the majority of responses came from these counties: Washington (10 precision-farming adopters); Leflore (7 adopters); and Bolivar, Coahoma, and Humphreys (5 adopters). Responses to the 2005 survey also correlate well with the number of producers reported in the 2002 Census of Agriculture (U.S. Department of Agriculture – NASS, 2005).

Table 21 (Appendix II) presents producers' responses to survey question 3 concerning livestock. Sixteen percent of the respondents reported having owned livestock, but only 3% stated they applied manure to their fields. According to the 2001 survey, 11% of adopters and 17% of nonadopters reported that they owned livestock; 8% of both adopters and nonadopters applied manure to their fields (Martin and Cooke, Jr., 2002).

Producers reported acres planted and estimated yields for the crops they produced in 2003 and 2004 (survey question 11). Survey respondents reported planting averages of 828 acres of cotton in 2003 (656 acres of dryland cotton and 1,140 acres of irrigated cotton). They reported planting 869 acres of cotton in 2004 (703 acres of dryland cotton and 1,170 acres of irrigated cotton) (Appendix II, Table 22). Compare these

amounts with the average planted acreage of 559 acres in 1997 (U.S. Department of Agriculture, 1999). According to the 2001 survey, cotton producers planted an average of 913 acres in 1999 and 962 acres in 2000 (Martin and Cooke, Jr., 2002). On average, adopters planted 1,183 acres of cotton in 1999 with yields averaging 803 pounds per acre. Nonadopters planted an average of 821 acres per farm in 1999, with cotton yields averaging 732 pounds per acre. In 2000, adopters planted 1,175 acres yielding 772 pounds per acre, while nonadopters planted 889 acres yielding 677 pounds per acre. In 1999 and 2000, yields and acreage planted to corn, soybeans, and wheat were, in general, higher for adopters than nonadopters (Martin and Cooke, Jr., 2002).

As part of question 11, producers were asked to indicate the average yields per acre in 2003 and 2004. Survey respondents reported average yields of 1,020 pounds per acre in 2003 and 1,065 pounds per acre in 2004. Mississippi cotton yields were estimated at 934 and 1,024 pounds per acre, respectively, in those years (Mississippi Agricultural Statistics Service, 2005). In the 2001 survey, the average reported yields were 750 pounds per acre in 1999 and 700 pounds per acre in 2000 (Martin and Cooke, Jr., 2002). Thus, yields reported by 2005 respondents were higher than those reported in the 2001 survey, as well as the state averages, but they were closer to the state averages. However, it is interesting to note that survey respondents reported lower acreage in 2003 and 2004 (828 and 869 acres, respectively) than they did in 1999 and 2000 (913 and 962, respectively).

Within-field variability was tested by asking producers to provide annual average cotton lint yields for the most productive one-third, the average one-third, and the least productive one-third of typical cotton fields they farmed (question 13) (Appendix II, Table 23). The most productive one-third averaged 1,266 pounds per acre (standard deviation of 289), the average one-third was 957 pounds per acre (standard deviation of 242), and the least productive one-third averaged 709 pounds per acre (standard deviation of 219). In the 2001 survey, adopters reported similar or higher yields with lower standard deviations than nonadopters for cotton in all three yield categories (Martin and Cooke, Jr., 2002).

Respondents were asked to describe their farms in 2004 (question 12). On average, respondents owned 818 acres and rented 1,581 acres (Appendix II, Table 24). According to the 2001 survey, the average precision-farming adopters owned 1,434 acres, share rented 1,150 acres under a 2-year or longer rental agreement, and cash rented 1,224 acres under a 3-year rental agreement. The average nonadopter owned 1,045 acres, share rented 828 acres, and cash rented 1,053 acres for 3 years.

Respondent Characteristics

Producers were queried about their age, years of farming experience, education, computer usage, and educational achievement (survey questions 41 through 52). The average cotton farmer was 52 years old (question 41), and ages ranged from 25 to 82 (Appendix II, Table 25). According to the 2001 survey, the average age of a precision-farming adopter was 51, and ages ranged from 25 to 78; nonadopters averaged 50 years, and their ages ranged from 21 to 89 (Martin and Cooke, Jr., 2002). Cotton producers had been in farming an average of 28 years (survey question 42) (Appendix II, Table 25). According to the 2001 survey, precision-farming adopters had farmed an average of 26 years, while nonadopters had farmed an average of 28 years. Years of farming ranged from 4 to 57 years for adopters and from 3 to 70 years for nonadopters in the 2001 survey.

Survey question 43 asked for the producers' years of formal education (excluding kindergarten). They reported an average of 15 years of formal education, indicating 3 years of college. Ninety-three percent of the respondents had at least a high school diploma, 14% had associate degrees, 46% indicated they had a bachelor's degree, and 10% had graduate degrees (Appendix II, Table 26). In the 2001 survey, the majority of adopters (90%) and nonadopters (95%) completed high school. Adopters averaged more than 3 years of college, while nonadopters averaged more than 2 years. The majority of cotton farmers (82%) owned computers (question 45). Fifty-one of the respondents used their computers for farm management (question 46), but 83% of the respondents said they did not use a laptop or handheld computer (question 47) (Appendix II, Table 27). According to the 2001 survey, the majorities of adopters (83%) and nonadopters (81%) owned computers. Eighty percent of adopters used their computers for farm management, compared with 58% of nonadopters. The 2001 survey did not ask the question on laptop or handheld computers.

Question 48 asked producers to indicate the one statement that best described their farm-planning goal. The majority (50%) of farmers stated their farm-planning goal was to acquire enough farm assets to generate sufficient income for family living. Twenty-two percent wanted to expand their size of operation through acquiring additional resources, another 22% indicated they were thinking about retirement and transferring the farm to the next generation, and only 2% stated they were considering selling the farm and moving on to a different career (Appendix II, Table 28). The ranking of respondents' farm-planning goals was the same in the 2001 survey. According to that survey, 57% of adopters and 56% of nonadopters stated their farm-planning goal was to acquire enough farm assets to generate sufficient income for family living. Twenty-three percent of adopters wanted to expand the size of their operation by acquiring additional resources, and only 5% of the responding adopters were considering selling the farm and moving to a different career. Fifteen percent of nonadopters wanted to expand the size of their operation, and 24% were thinking about retirement and transferring the farm to the next generation (Martin and Cooke, Jr., 2002).

Total estimated pretax household income in 2004 (question 49) ranged from $50,000 to $149,999 for 66% of the respondents and was less than $50,000 for 13% of the respondents. Thirteen percent of the respondents reported income of $500,000 or more. Question 50 asked cotton farmers what percentage of their 2004 household income came from farming. The average percentage reported in the survey was 77% (Appendix II, Table 29). According to the 2001 survey, total household income in 2000 ranged from $50,000 to $149,999 for 53% of adopters and less than $50,000 for 15% of adopters. Eight percent of adopters had household incomes greater than $500,000 in 2000. Farming was also the primary income source for most nonadopters, according to the 2001 survey. Total household income in 2000 ranged from $50,000 to $149,999 for 51% of nonadopters and less than $50,000 for 27% of nonadopters. Six percent of nonadopters had household incomes greater than $500,000 in 2000 (Martin and Cooke, Jr., 2002). Unlike in 2001, the 2005 survey did not separate adopters from nonadopters in collecting demographic data.

Question 51 asked if the Extension Service needed to provide more educational outreach about precision farming in the each respondent's area. Sixty-eight percent of those who responded to this question said "Yes" and 32% said "No." The final question of the survey (question 52) asked if the respondent's county agent had precision farming skills adequate to meet their needs. Fifty-three percent said "Yes" while 47% said "No" (Appendix II, Table 30). These last two questions were not asked in the 2001 survey.

CONCLUSIONS

The objectives of this study were (1) to determine attitudes toward and current use of precision-farming technologies by Mississippi cotton producers, (2) to determine adoption and value of precision guidance systems, and (3) to examine Mississippi cotton producers' retention of precision-farming technologies. Cotton producers are confronted every day with information concerning the rapidly growing precision-farming industry. Most responding cotton producers use computers for farm-management decisions and believe precision farming will be profitable in the future. Producers who adopt these technologies do so to increase profit.

Cotton producers are listening to crop consultants, extension and research personnel at universities, and farm dealers in making decisions about precision farming. According to this survey, the top four precision-farming technologies being used by adopters were soil grid sampling, soil sampling by management zones, soil survey maps, and remote-sensing aerial photography. Responding producers indicated less willingness to purchase precision-farming equipment (yield monitors) as price increased.

As more information becomes available, cotton producers will have greater opportunities to make more informed decisions about the use of these technologies on their farms. Findings from this and other studies that investigate the current use and future prospects of precision-farming technologies are important to cotton producers because they provide the needed information for making better decisions.

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2005 Southern Precision Farming Survey

Researchers at several Southern Land Grant Universities and Cotton Incorporated request your help in evaluating the use of new and emerging methods or technologies in precision farming. As agricultural economists, we want to use the results of this survey to help each cotton farmer determine whether precision farming is right for him or her. Even if you do not use precision farming technologies, your response to this survey will provide useful information about whether precision farming will improve the bottom line for you and other cotton farmers. Regardless of whether or not you use precision farming technologies, please take a few minutes to fill out this survey.

Jeanne Reeves, a production economist in the Agricultural Research Division of Cotton Incorporated states, "*I encourage you to participate in this survey. Cotton Incorporated is sponsoring this important effort to obtain information about cotton practices. Our goal is to share this information with producers through Extension programs, and ultimately increase profitability as you evaluate new technologies and production practices*."

The survey may appear long at first glance, but should take only about 20 minutes or less to complete. Several questions that seem long really require only a minute or two to answer. We realize that some of the questions may be difficult but we ask that you answer each question that applies to your farming situation by providing your best estimate. Please return the completed survey in the enclosed self-addressed envelope.

We want to assure you that your responses will be anonymous. Answering this survey is voluntary and your response serves as an informed consent to participate in the study. Your responses will not be published or communicated in any way that could possibly identify you with them. Also, we assure you that after the survey is completed we will not be able to associate your name with your response.

Thanks in advance for your participation in this important survey. If you have questions about this survey, please call (865) 974-7231 and speak with Roland Roberts, Burt English, or Jim Larson at The University of Tennessee.

Roland K. Roberts
Professor of Agricultural Economics

2005 Southern Precision Farming Survey

"Precision farming" involves collecting site-specific information about within-field variability in yields and crop needs, linking that information to specific locations within a field, and acting on that information to determine and apply appropriate input levels. This may result in varying input levels within a field.

1. Where is most of your farm located? County _____ State _____

2. Please circle the years during which you grew cotton: 2003 2004 Neither

If you circled "Neither," please return this blank survey now.

3. Do you own livestock? Yes ___ No ___ Do you apply manure on your fields? Yes ___ No ___

4. Do you think it would be profitable for you to use precision farming technologies in the future? Yes ___ No ___ Don't know ___

5. Would you prefer to own or rent precision farming equipment? Own ___ Rent ___ Depends ___

6. Please circle in the table below how *important* you believe precision farming will be five years from now for cotton and other crops in your state.

	Not Important		Somewhat Important		Very Important
Cotton	1	2	3	4	5
Other Crops	1	2	3	4	5

7. What is your best guess for the typical purchase price of a GPS cotton yield monitoring system that can be used to generate a yield map? $_____

8. Where do you get your precision farming information?

Circle each source you have used to get information. ⟶	Farm Dealers	Crop Consultants	Extension/ Universities	Other Farmers	Trade Shows	Internet	News Media
Rank the *usefulness* of each source you have used in assisting you to make decisions about precision farming, where: (circle number➔)							
1 is not useful	1	1	1	1	1	1	1
3 is somewhat useful	2	2	2	2	2	2	2
5 is very useful.	3	3	3	3	3	3	3
	4	4	4	4	4	4	4
	5	5	5	5	5	5	5

9. In the last three years, have you had soil samples analyzed for your cotton fields? Yes ___ No ___

10. Who typically collects your soil samples? (Please check the best item)
Self ___ Consultant ___ Fertilizer or Chemical Dealer ___ Family Member ___ Other ___

11. Please give the acres planted and estimated *average* yields for 2003 and 2004.

	2003		2004	
Crop	Acres Planted	Yield/acre	Acres Planted	Yield/acre
Dryland Cotton		lb		lb
Irrigated Cotton		lb		lb
Other Crops				

12. How many of your 2004 total cropped acres were owned or rented?
Owned? _____acres Rented? _____acres

13. Since yields are likely to vary within a field, please estimate your *cotton lint yields* (lb/acre) for the following portions of your typical cotton field:
Least productive 1/3 _____ Average productive 1/3 _____ Most productive 1/3 _____

14. For each variable rate management decision, indicate with an X which of the 4 information gathering technologies you use to make the decision. Leave blanks for technologies you do not use.

Variable Rate Decision	1. Yield Monitoring with GPS	2. Aerial or Satellite Infrared Imagery	3. Handheld GPS Units	4. COTMAN Plant Mapping
Identify Zones				
Drainage				
Fertility or Lime				
Seeding				
Growth Regulator				
Harvest Aids				
Fungicide				
Herbicide				
Insecticide				
Irrigation				

15. For each technology listed below, please complete the table. Leave blanks for technologies you do not use.

Use of Information Gathering Technology for *Cotton* Production	Number of years used	Number of acres used in 2004	If you received technical advice in 2003 or 2004		If you hired custom services in 2003 or 2004	
			What was the per-acre cost?	Will you purchase this advice again?	What was the per-acre cost?	Will you purchase this service again?
a. Yield monitor – with GPS				**Y N**		**Y N**
b. Yield monitor – no GPS				**Y N**		**Y N**
c. Soil sampling – grid				**Y N**		**Y N**
d. Soil sampling – zone				**Y N**		**Y N**
e. Aerial photos				**Y N**		**Y N**
f. Satellite images				**Y N**		**Y N**
g. Soil survey maps				**Y N**		**Y N**
h. Handheld GPS/PDA				**Y N**		**Y N**
i. COTMAN plant mapping				**Y N**		
j. Digitized mapping				**Y N**		**Y N**

16. List the letters of the technologies in Question 15 that you used in the past and then abandoned: _____

If you currently use a cotton yield monitor, please answer the next 5 questions, otherwise skip to Question 22.

17. Did you or a consultant generate a yield map using data from your cotton yield monitor? Yes ___ No ___

18. How did you assess the yield variability *within* a typical cotton field on your farm before you began using a cotton yield monitor? (Check all that apply)
Grid sampling ___ Year-to-year field records___ Soil maps___ Consultants' estimates___ Satellite imagery ___ COTMAN___ Aerial photography___ Other (specify) _____

19. How did the yield information you obtained from yield monitoring change your perception of the yield variability within your typical cotton field? Circle the statement that best matches your findings.
A. Substantially increased my perception; my yields appear to be at least 50% more variable than I thought.
B. Somewhat increased my perception; my yields appear to be from 25-50% more variable than I thought.
C. Slightly increased my perception; my yields appear to be from 1-25% more variable than I thought.
D. Did not change my perception; my yields appear to be the same as I originally thought.
E. Slightly decreased my perception; my yields appear to be from 1-25% less variable than I thought.
F. Somewhat decreased my perception; my yields appear to be from 25-50% less variable than I thought.
G. Substantially decreased my perception; my yields appear to be at least 50% less variable than I thought.

20. Do you think the additional information about within-field yield variability you obtain from your cotton yield monitor is valuable to you? Yes ___ No ___

21. If yes, what value do you place on the additional information you obtain from your cotton yield monitor?
$_____ acre/year

If you currently use a cotton yield monitor, skip to Question 25, otherwise continue with Question 22.

22. How do you assess the yield variability *within* a typical cotton field on your farm? (Check all that apply)
Grid sampling ___ Year-to-year field records ___ Soil maps ___
Consultants' estimates (without a yield monitor) ___ Satellite imagery ___ Aerial photography ___
COTMAN ___ Other (specify) _____

23. Do you think the additional information about within-field yield variability that you could obtain from a cotton yield monitor would have some value to you? Yes ___ No ___

24. If yes, what value would you place on the additional information you could obtain from a cotton yield monitor? $_____ acre/year

25. Two basic methods of implementing site-specific information for variable rate application of inputs include map-based and sensor-based methods. The map-based method uses a computer to generate a site-specific input application map. The map is entered into a data card, which is then placed in a variable rate controller on the implement or tractor. The sensor-based method uses sensors to measure desired properties and the information is used immediately to control a variable rate input applicator on-the-go.

A. Have you used a map-based method to apply inputs? Yes ___ No ___ **(If "No", skip to Question 25.C.)**

B. If yes, who typically generates the maps and information required to apply the inputs? (Check one)
Yourself ___ Consultant ___ Fertilizer or Chemical Dealer ___ Family member ___ Other ___

C. Have you used a sensor-based method to apply inputs? Yes ___ No ___

26. Have you used any of the following GPS guidance systems? (Check all that apply)
Lightbar ___ Autosteer ___ Other (specify) _____ None ___
If you checked "None", skip to Question 32, otherwise continue with Question 27.

27. Has your GPS guidance system met your expectations? Yes ___ No ___

28. For what reasons did you use your GPS guidance system? (Circle all that apply)
a. Improved planting b. Improved spraying capacity c. Improved overall efficiency
d. Eliminate need for row markers e. Other (list) _____

29. Do you think your GPS guidance system is of value to you? Yes ___ No ___

30. If yes, what value do you place on using a GPS guidance system on your farm? $_____ acre/year

31. For which field operations do you use a GPS guidance system? (Circle all that apply)
a. Primary tillage b. Planting c. Spraying d. Cultivating e. Harvesting

If you currently use a GPS guidance system, skip to Question 35, otherwise continue with Question 32.

32. Do you think the use of a GPS guidance system would have some value to you? Yes ___ No ___

33. If yes, what value would you place on using a GPS guidance system on your farm?
$_____ acre/year

34. Do you plan to purchase a GPS guidance system in the next 3 years? Yes ___ No____ Don't know ___

35. Please fill in this table for each cotton *input* you have *applied* using each of the 4 *variable rate technologies*. Leave blanks for technologies you have not used.

Input	Enter number of years used and 2004 **cotton acres** for each input						4. Did you use a GPS guidance system?
	1. Map-based		2. Sensor-based		3. Row Markers		
	Years Used	2004 Acres	Years Used	2004 Acres	Years Used	2004 Acres	
a. Nitrogen							Y N
b. Phosphorous							Y N
c. Potassium							Y N
d. Lime							Y N
e. Seed							Y N
f. Growth regulator							Y N
g. Defoliant							Y N
h. Fungicide							Y N
i. Herbicide							Y N
j. Insecticide							Y N
k. Irrigation							Y N

36. Please indicate which cotton inputs in Question 35 you have applied using variable rate technologies, but no longer apply using variable rate technologies.
List the letters: _____

37. If you use variable rate input technologies, circle the letter of the sentence that *best* reflects your perception of the yield effects on your farm from variable rate input application. Fill in the blank with your *best guess*.
A. My average cotton lint yields increased approximately _____ lb. lint/acre.
B. My average cotton lint yields did not change.
C. My average cotton lint yields decreased approximately _____ lb. lint/acre.

38. If you use precision farming technologies, have you experienced any *improvements* in environmental quality from using precision farming technologies? Yes ___ No ___

39. If you use precision farming methods, how *important* were each of the following reasons in your decision to practice precision farming? Circle the appropriate number.

Reason	Not Important		Somewhat Important		Very Important
Profit	1	2	3	4	5
Environmental benefits	1	2	3	4	5
Be at the forefront of agricultural technology	1	2	3	4	5
Not wanting to be left behind	1	2	3	4	5

40. If you do not use precision farming methods, please list your most important reason for not practicing precision farming. _____

Please answer the following questions about the primary decision maker on the farm. Answers to all questions will remain strictly confidential.

41. In what year were you born? _____

42. Number of years farming? ____

43. Number of years of formal education excluding kindergarten? ___ (Example, 13 is one year of college)

44. Check all degrees received.
High school ___ Associate ___ BS or BA ___ Graduate degree ___

45. Do you own a computer? Yes ___ No ___

46. Do you use a computer for farm management? Yes ___ No ___

47. Do you use a laptop or handheld computer in the field? Yes ___ No ___

48. Please check the one statement that *best* describes your farm planning goal.
___ I want to acquire enough farm assets to generate sufficient income for family living.
___ I want to expand the size of operation through acquiring additional resources.
___ I am thinking about retirement and transfer of farm to the next generation.
___ I am considering selling the farm and moving on to a different career.

49. Please check the category that best reflects your total estimated pre-tax household income from both farm and non-farm sources in 2004.
Less than $50,000 ___ $50,000 to $99,999 ___ $100,000 to $149,999 ___
$150,000 to $199,999 ___ $200,000 to $499,999 ___ $500,000 or greater ___

50. About what percentage of your 2004 household income was from farming? ___%

51. Does the Extension Service need to provide more educational outreach about precision farming in your area?
Yes ___ No ___

52. Does your county agent have the necessary skills in precision farming to meet your needs?
Yes ___ No ___

Appendix II: Tables of Results

Table 1. Primary county of cotton farm business reported by primary decision maker for Mississippi cotton farms – 2001 and 2005 Southern Precision-Farming Surveys.[1]

County	2002 Census of Agriculture[2]	2001 number of usable surveys	2005 number of usable surveys
Alcorn	7 (.5%)[3]	0	1 (.6%)[4]
Benton	14 (.9%)	1 (.4%)[5]	1 (.6%)
Bolivar	108 (7%)	18 (7%)	11 (7%)
Calhoun	60 (4%)	2 (.8%)	1 (.6%)
Carroll	24 (2%)	4 (2%)	3 (2%)
Chickasaw	10 (.7%)	3 (1%)	2 (1%)
Choctaw	3 (.2%)	0	1 (.6%)
Claiborne	4 (.3%)	2 (.8%)	1 (.6%)
Coahoma	90 (6%)	16 (7%)	14 (8%)
Copiah	2 (.1%)	1 (.4%)	1 (.6%)
DeSoto	8 (.5%)	2 (.8%)	2 (1%)
Forrest	4 (.3%)	1 (.4%)	0
George	8 (.5%)	3 (1%)	3 (2%)
Greene	1 (.1%)	1 (.4%)	1 (.6%)
Grenada	19 (1%)	0	1 (.6%)
Hinds	26 (2%)	3 (1%)	3 (2%)
Holmes	72 (5%)	10 (4%)	7 (4%)
Humphreys	95 (6%)	17 (7%)	10 (6%)
Issaquena	23 (2%)	4 (2%)	4 (2%)
Itawamba	10 (.7%)	2 (.8%)	0
Jefferson	8 (.5%)	0	1 (.6%)
Lafayette	18 (1%)	1 (.4%)	2 (1%)
Leake	10 (.7%)	1 (.4%)	1 (.6%)
Leflore	93 (6%)	26 (11%)	11 (7%)
Lowndes	17 (1%)	5 (2%)	2 (1%)
Madison	23 (2%)	7 (3%)	5 (3%)
Marshall	11 (.7%)	0	1 (.6%)
Monroe	27 (2%)	4 (2%)	3 (2%)
Montgomery	29 (2%)	3 (2%)	2 (1%)
Noxubee	21 (1%)	4 (2%)	3 (2%)
Oktibbeha	2 (.l%)	0	1 (.6%)
Panola	48 (3%)	4 (2%)	1 (.6%)
Pontotoc	11 (.7%)	4 (2%)	2 (1%)
Prentiss	10 (.7%)	1 (.4%)	1 (.6%)
Quitman	58 (4%)	7 (3%)	1 (.6%)
Rankin	14 (1%)	2 (.8%)	1 (.6%)
Sharkey	43 (3%)	10 (4%)	8 (5%)
Sunflower	67 (5%)	10 (4%)	10 (6%)
Tallahatchie	75 (5%)	5 (2%)	14 (8%)
Tate	21 (1%)	2 (.8%)	0
Tippah	3 (.2%)	1 (.4%)	0
Tunica	39 (3%)	8 (3%)	3 (2%)
Union	15 (1%)	1 (.4%)	2 (1%)
Warren	13 (1%)	1 (.4%)	1 (.6%)
Washington	94 (6%)	30 (12%)	11 (7%)
Webster	38 (3%)	3 (1%)	3 (2%)
Yazoo	87 (6%)	13 (5%)	12 (7%)
Total	1483 (+/- 100%)	244 (+/-100%)	169 (+/-100%)

[1]Survey question 1 in 2005 survey.
[2]Reported in the 2002 Census of Agriculture, USDA.
[3]Numbers in parentheses in this column indicate the approximate percentage of farms per county.
[4]Numbers in parentheses in this column indicate the approximate percentage of respondents who gave the associated answer in the 2005 survey.
[5]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer in the 2001 survey.

Table 2. Degree of helpfulness assigned to information sources in learning about precision-farming technologies reported by Mississippi cotton farms – 2001 and 2005 Southern Precision-Farming Surveys.[1]

Source	Average level of helpfulness[2]	
	2001	2005
Crop consultants	3.62	3.13
Extension/universities	3.28	3.33
Farm dealers	2.58	3.20
Other farmers	1.90	3.43
Trade shows	1.38	3.06
Internet	1.69	2.39
News and media	1.13	2.68

[1]Survey question 8 in 2005 survey.
[2]Level of importance ranges from not helpful (1) to very helpful (5).

Table 3. Use of information-gathering technologies for variable-rate management decisions on cotton fields reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Variable-rate decision	Number of responses			
	1. Yield monitoring with GPS	2. Aerial or satellite infrared imagery	3. Handheld GPS units	4. COTMAN plant mapping
Identify zones	15 (8.9%)[2]	12 (7.1%)	11 (6.5%)	4 (2.4%)
Drainage	13 (7.7%)	15 (8.9%)	9 (5.3%)	2 (1.2%)
Fertility or lime	19 (11.2%)	10 (5.9%)	20 (11.8%)	1 (.6%)
Seeding	9 (5.3%)	4 (2.4%)	4 (2.4%)	3 (1.8%)
Growth regulator	6 (3.6%)	12 (7.1%)	7 (4.1%)	5 (3.0%)
Harvest aids	4 (2.4%)	14 (8.3%)	8 (4.7%)	4 (2.4%)
Fungicide	4 (2.4%)	5 (3.0%)	2 (1.2%)	1 (.6%)
Herbicide	6 (3.6%)	5 (3.0%)	4 (2.4%)	1 (.6%)
Insecticide	6 (3.6%)	10 (5.9%)	6 (3.6%)	1 (0.6%)
Irrigation	6 (3.6%)	10 (5.9%)	5 (3.0%)	2 (1.2%)

[1]Survey question 14.
[2]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.

Table 4. Years of experience with alternative precision-farming technologies for cotton reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Technology	Number of responses	Average	Standard deviation	Minimum	Maximum
		years	*years*	*years*	*years*
Yield monitoring – with GPS[2]	15	3.60	2.13	1	7
Yield monitoring – without GPS	5	2.80	2.95	1	8
Yield monitoring – handheld GPS/PDA	14	2.50	1.87	1	7
Soil sampling – grid	50	6.62	8.03	1	42
Soil sampling – management zone	30	15.43	12.60	1	50
Remote sensing – aerial photos	16	10.94	11.07	1	35
Remote sensing – satellite images	9	2.89	2.98	1	10
Soil survey maps	21	11.95	12.13	2	40
COTMAN plant mapping	2	7.00	1.41	6	8
Digitized mapping	2	5.50	3.54	3	8

[1]Survey question 15.
[2]Global Positioning System.

Table 5. Use of variable-rate-application technologies with inputs on cotton fields reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Input GPS	Average number of years used and average 2004 cotton acres												4. Did they use a guidance system? [Y=Yes, N=No]
	1. Map-based				2. Sensor-based				3. Row markers				
	N/Y[2]	Years used	N/A[3]	2004 acres	N/Y	Years used	N/A	2004 acres	N/Y	Years used	N/A	2004 acres	
a. Nitrogen	18 (11%)[4]	7.1	17 (10%)	1,771	2 (1%)	1.5	2 (1%)	780	11 (7%)	20.0	14 (8%)	1,086	Y = 11 (18%) N = 49 (82%)
b. Phosphorous	36 (21%)	6.1	34 (20%)	1,583	1 (.6%)	3.0	1 (.6%)	4,000	8 (5%)	7.4	10 (6%)	933	Y = 23 (33%) N = 47 (67%)
c. Potassium	40 (24%)	6.0	39 (23%)	1,571	1 (.6%)	3.0	1 (.6%)	4,000	7 (4%)	8.6	10 (6%)	933	Y = 26 (36%) N = 47 (64%)
d. Lime	36 (21%)	6.2	32 (19%)	1,382	1 (.6%)	3.0	1 (.6%)	4,000	5 (3%)	8.4	6 (4%)	771	Y = 20 (30%) N = 47 (70%)
e. Seed	4 (2%)	20.5	4 (2%)	3,563	2 (1%)	1.5	2 (1%)	780	11 (7%)	17.9	16 (9%)	1,152	Y = 7 (13%) N = 46 (87%)
f. Growth regulator	13 (8%)	6.7	13 (8%)	1,537	3 (2%)	1.3	3 (2%)	520	10 (6%)	13.9	13 (8%)	1,131	Y =13 (23%) N = 44 (77%)
g. Defoliant	13 (8%)	9.4	13 (8%)	1,817	3 (2%)	1.3	3 (2%)	520	9 (5%)	11.3	12 (7%)	934	Y = 13 (23%) N = 43 (77%)
h. Fungicide	4 (2%)	17.5	5 (3%)	1,332	2 (1%)	1.5	2 (1%)	780	7 (4%)	12.4	9 (5%)	686	Y = 5 (11%) N = 42 (89%)
i. Herbicide	6 (4%)	12.0	7 (4%)	1,089	2 (1%)	1.5	2 (1%)	780	6 (4%)	12.2	9 (5%)	917	Y = 7 (14%) N = 44 (86%)
j. Insecticide	10 (6%)	8.4	11 (7%)	1,770	3 (2%)	1.3	3 (2%)	520	7 (4%)	10.6	10 (6%)	725	Y = 11 (21%) N = 41 (79%)
k. Irrigation	3 (2%)	20.7	3 (2%)	1,020	0	0	0	0	1 (.6%)	3.0	1 (.6%)	600	Y = 1 (2%) N = 41 (98%)

[1]Survey question 35.
[2]Number of responses for the "years used" question.
[3]Number of responses for the "2004 cotton acres" question.
[4]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 6. Improvements in environmental quality from using precision-farming technologies reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Survey question	Number of responses	Yes	No
If you use precision-farming technologies, have you experienced any improvements in environmental quality from using precision-farming technologies?	55	35 (64%)[2]	20 (36%)

[1]Survey question 38.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 7. Factors that influenced the adoption of precision-farming practices reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Item	Number of responses	Level of importance[2]				
		Not important				Very important
		1	2	3	4	5
Profit	59	2 (3%)[3]	1 (2%)	4 (7%)	7 (12%)	45 (76%)
Environmental benefits	55	3 (5%)	9 (16%)	15 (27%)	16 (29%)	12 (22%)
Be at the forefront of agricultural technology	54	15 (28%)	8 (15%)	19 (35%)	10 (19%)	2 (4%)
Not wanting to be left behind	54	17 (31%)	10 (19%)	19 (35%)	3 (6%)	5 (9%)

[1]Survey question 39.
[2]Level of importance ranges from not important (1) to very important (5).
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 8. Opinions regarding precision farming reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Total number of responses	Number of responses for each answer choice
Do you think it would be profitable for you to use precision-farming technologies in the future?[1]	167	Yes = 88 (53%)[2] No = 15 (9%) Don't know = 64 (38%)
Would you prefer to own or rent your equipment?[3]	159	Own = 55 (35%) Rent = 10 (6%) Depends = 94 (59%)

[1]Survey question 4.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[3]Survey question 5.

Table 9. Importance of precision farming 5 years from now as reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Item	Number of responses	Level of importance[2]				
		Not important				Very important
		1	2	3	4	5
Cotton	163	3 (2%)[3]	13 (8%)	58 (36%)	53 (33%)	36 (22%)
Other crops	140	3 (2%)	16 (11%)	56 (40%)	40 (29%)	25 (18%)

[1]Survey question 6.
[2]Level of importance ranges from not important (1) to very important (5).
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 10. Soil Sampling in Mississippi reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses	Yes	No
In the last 3 years, have you had soil samples analyzed for your cotton fields?[1]	166	150 (90%)[2]	20 (10%)
Who typically collects your soil samples?[3]	161	Approximate percentage	
Self	31	19	
Consultant	59	37	
Fertilizer or chemical dealer	54	34	
Family member	3	2	
Other	2	1	
More than one choice indicated	12	7	

[1]Survey question 9.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[3]Survey question 10.

Table 11. Estimates of the typical purchase price for a cotton-yield monitoring system with GPS[1] reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses	Average	Standard deviation	Minimum	Maximum
What is your best guess for the typical purchase price of a GPS cotton-yield -monitoring system that can be used to generate a yield map?[2]	131	$10,209	$9,289	$500	$50,000

[1]Global Positioning System.
[2]Survey question 7.

Table 12. Change in perception of yield variability due to yield information obtained from yield monitoring reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Answer choice	Number of responses
A. Substantially increased my perception; my yields appear to be at least 50% more variable than I thought.	3 (18%)[2]
B. Somewhat increased my perception; my yields appear to be from 25-50% more variable than I thought.	7 (41%)
C. Slightly increased my perception; my yields appear to be from 1-25% more variable than I thought.	2 (12%)
D. Did not change my perception; my yields appear to be the same as I originally thought.	5 (29%)
E. Slightly decreased my perception; my yields appear to be from 1-25% less variable than I thought.	0
F. Somewhat decreased my perception; my yields appear to be from 25-50% less variable than I thought.	0
G. Substantially decreased my perception; my yields appear to be at least 50% less variable than I thought.	0
More than one choice indicated.	0
Total	17

[1]Survey question 19.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 13. Method of implementing site-specific information for variable-rate application of inputs reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses
A. **Have you used a map-based method to apply inputs?**[1]	Yes = 33 (23%)[2] No = 112 (77%)
B. **If yes, who typically generates the maps and information required to apply the inputs?**[3]	
Yourself	2 (6%)
Consultant	16 (47%)
Fertilizer or chemical dealer	13 (38%)
Family member	0
Other	2 (6%)
More than one choice indicated	1 (3%)
C. **Have you used a sensor-based method to apply inputs?**[4]	Yes = 4 (3%) No = 136 (97%)

[1]Survey question 25 A.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[3]Survey question 25 B.
[4]Survey question 25 C.

Table 14. Specific GPS[1] guidance systems and if they met growers' expectations reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses
Have you used any of the following GPS guidance systems?[2]	
Lightbar	Yes = 25 (16%)[3] No = 128 (84%)
Autosteer	Yes = 24 (16%) No = 129 (84%)
Other (specify)	Yes = 3 (2%) No = 150 (98%)
JD Greenstar System	1 (33%)
Tremble	1 (33%)
Rowfinder	1 (33%)
None	Yes = 104 (68%) No = 49 (32%)
Has your GPS guidance system met your expectations?[4]	Yes = 41 (85%) No = 7 (15%)

[1]Global Positioning System.
[2]Survey question 26.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[4]Survey question 27.

Table 15. Reasons for using GPS[1] guidance systems reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses
For what reasons did you use your GPS guidance system?[2] (Circle all that apply)	
a. Improved planting	Yes = 20 (38%)[3] No = 33 (62%)
b. Improved spraying capacity	Yes = 27 (51%) No = 26 (49%)
c. Improved overall efficiency	Yes = 38 (72%) No = 15 (28%)
d. Eliminate need for row markers	Yes = 33 (62%) No = 20 (38%)
e. Other (list)	Yes = 12 (23%) No = 41 (77%)
All rows equal width	1 (8%)
Don't have GPS guidance	1 (8%)
Fertilizer & lime spreading	1 (8%)
Just purchased this year	1 (8%)
Labor	1 (8%)
Labor use better (more drivers able to row up, etc.)	1 (8%)
Mark rice levees	1 (8%)
Run 24 hours	1 (8%)
Saved on chemicals	1 (8%)
Spreader truck	1 (8%)
Straight rows	1 (8%)
Working at night	1 (8%)

[1]Global Positioning System.
[2]Survey question 28.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 16. Value of a GPS[1] guidance system reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses	Average	Standard deviation	Minimum	Maximum
Do you think your GPS guidance system is of value to you?[2]	Yes = 46 (92%)[3] No = 4 (8%)	—	—	—	—
If yes, what value (per acre per year) do you place on using a GPS guidance system on your farm?[4]	35	$521.83	$3,041.25	$1.00	$18,000.00

[1]Global Positioning System.
[2]Survey question 29.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[4]Survey question 30.

Table 17. Field operations for use of GPS[1] guidance systems reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Total number of responses	Yes	No
For which field operations do you use a GPS guidance system on your farm?[2] (Circle all that apply)			
a. Primary tillage	49	24 (49%)[3]	25 (51%)
b. Planting	49	20 (41%)	29 (59%)
c. Spraying	49	37 (76%)	12 (24%)
d. Cultivating	49	7 (14%)	42 (86%)
e. Harvesting	49	8 (16%)	41 (84%)

[1]Global Positioning System.
[2]Survey question 31.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 18. Perceived value of a GPS[1] guidance system reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question to nonusers	Number of responses	Average	Standard deviation	Minimum	Maximum
Do you think the use of a GPS guidance system would have some value to you?[2]	Yes = 83 (78%)[3] No = 24 (22%)	—	—	—	—
If yes, what value (per acre per year) would you place on using a GPS guidance system on your farm?[4]	47	$666.35	$4,372.42	$0.50	$30,000.00

[1]Global Positioning System.
[2]Survey question 32.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.
[4]Survey question 33.

Table 19. Purchase plans of GPS[1] guidance systems reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Total number of responses	Yes	No	Don't know
Do you plan to purchase a GPS guidance system in the next 3 years?[2] (Circle all that apply)	109	26 (24%)	37 (34%)	46 (42%)

[1]Global Positioning System.
[2]Survey question 34.
[3]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 20. Nonusers' reasons for not using precision-farming methods reported by Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

If you do not use precision-farming methods, please list your most important reason for not practicing precision farming.[1]	Number of responses
$ / Lack of funds / high costs / high expenses / not cost effective / not profitable / unsure of profitability	63 (71%)[2]
Lack of knowledge or proper information about precision farming	8 (9%)
Too close to retirement to change / Retiring	3 (3%)
Other reasons, e.g., small fields / not enough acres, not equipped, no need / don't need it, etc.	15 (17%)

[1]Survey question 40.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 21. Number of Mississippi cotton farmers who own livestock or apply manure to their fields – 2005 Southern Precision-Farming Survey.[1]

Question	Number of responses	Yes	No
Do you own livestock?	168	27 (16%)[2]	141 (84%)
Do you apply manure to your fields?	133	4 (3%)	129 (97%)

[1]Survey question 3.
[2]Numbers in parentheses indicate the approximate percentage of respondents who gave the associated answer.

Table 22. Planted acres and estimated yields for 2003 and 2004 reported for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Crop	2003		2004	
	Planted acres	Yield	Planted acres	Yield
		lb/A		*lb/A*
Dryland Cotton				
Average	656	968	703	993
Standard deviation	664	202	696	251
Minimum	20	392	20	311
Maximum	3,500	1,500	3,200	1,500
Number of responses	142	140	144	142
Irrigated Cotton				
Average	1,140	1,114	1,170	1,193
Standard deviation	1,304	194	1,324	276
Minimum	59	700	40	475
Maximum	8,800	1,750	8,800	2,200
Number of responses	78	77	79	79
Other Crops				
Average	1,113		1,131	
Standard deviation	1,181		1,219	
Minimum	0		35	
Maximum	6,000		6,000	
Number of responses	74		71	

[1]Survey question 11.

Table 23. Annual average spatial yield variability of a typical cotton field reported for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Cotton	Least productive third	Average yield	Most productive third
	lb/A	*lb/A*	*lb/A*
Average	709	957	1,266
Standard deviation	219	242	289
Minimum	150	300	350
Maximum	1,300	1,650	2,060
Number of responses	131	131	129

[1]Survey question 13.

Table 24. Year 2004 farm size and tenure characteristics reported for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Item	Number of responses	Average	Standard deviation	Minimum	Maximum
Acres owned[1]	110	818	1,107	0	6,000
Acres rented[1]	136	1,581	2,015	5	13,100

[1]Survey question 12.

Table 25. Average age and number of years farming reported by the primary decision maker for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Item	Number of responses	Average	Standard deviation	Minimum	Maximum
		years	*years*	*years*	*years*
Age[1]	161	52	11.45	25	82
Years of farming[2]	159	28	12.37	3	65

[1]Survey question 41.
[2]Survey question 42.

Table 26. Education level reported by the primary decision maker for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Number of responses	Average	Standard deviation	Minimum	Maximum
Number of years of formal education excluding kindergarten?[1]	152	15	2.01	7	20
Degrees received[2]	**Number of responses**		**Yes**		**No**
High school	168		156 (93%)[3]		12 (7%)
Associate degree	168		23 (14%)		145 (86%)
BS or BA	168		77 (46%)		91 (54%)
Graduate degree	168		16 (10%)		152 (90%)

[1]Survey question 43.
[2]Survey question 44.
[3]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.

Table 27. Computer ownership and usage as reported by the primary decision maker for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Item	Yes	No
Do you own a computer?[1]	133 (82%)[2]	29 (18%)
Do you use it for farm management?[3]	78 (51%)	76 (49%)
Do you use a laptop or handheld computer in the field?[4]	27 (17%)	135 (83%)

[1]Survey question 45.
[2]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.
[3]Survey question 46.
[4]Survey question 47.

Table 28. Farm planning goals reported by the primary decision maker for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.[1]

Item	Number of responses
I want to acquire enough farm assets to generate sufficient income for family living.	79 (50%)[2]
I want to expand the size of operation through acquiring additional resources.	35 (22%)
I am thinking about retirement and transfer of farm to the next generation.	35 (22%)
I am considering selling the farm and moving on to a different career.	2 (1%)
More than one answer choice indicated.	8 (5%)

[1]Survey question 48.
[2]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.

Table 29. Estimated total household income in 2004 for all respondents from farm and nonfarm sources reported for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Total estimated pretax household income from both farm and nonfarm sources[1]	Number of responses	Cumulative frequency[2]	Cumulative percentage[3]
Less than $50,000	19 (12.5%)[4]	19	12.5
$50,000 to $99,999	53 (34.9%)	72	47.4
$100,000 to $149,999	29 (19.1%)	101	66.5
$150,000 to $199,999	11 (7.2%)	112	73.7
$200,000 to $499,999	21 (13.8%)	133	87.5
$500,000 or greater	19 (12.5%)	152	100

Percentage of household income from farming[5]	Number of responses	Average	Standard Deviation	Minimum	Maximum
	150	77	26.54	0	100

[1]Survey question 49.
[2]Total number of responses with the specified level of income or below.
[3]Total percentage of responses with the specified level of income or below.
[4]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.
[5]Survey question 50.

Table 30. Need for more educational outreach on precision farming and county agents' skills in precision farming reported for Mississippi cotton farms – 2005 Southern Precision-Farming Survey.

Survey question	Total number of responses	Yes	No
Does the Extension Service need to provide more educational outreach about precision farming in your area?[1]	145	99 (68%)[2]	46 (32%)
Does your county agent have necessary skills in precision farming to meet your needs?[3]	119	63 (53%)	56 (47%)

[1]Survey question 51.
[2]Numbers in parentheses indicate the percentage of respondents who gave the associated answer.
[3]Survey question 52.

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