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Farming Systems Used in U.S. Upland Cotton Production, 1997, 1999 and 2000

—Some preliminary findings—

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Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Tulsa, Oklahoma, February 14-18, 2004

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Abstract

Nutrient management and pest management practices employed by upland cotton producers are presented and related to their socio-economic characteristics, farm financial characteristics and regional differences. A preliminary analysis of data from the 1997, 1999 and 2000 cotton Agricultural Resources Management Surveys (ARMS) shows significant increases in the use of genetically modified seed varieties such as Ht, Bt, and stacked. Use of fertilizer and pesticides declined on a per acre basis over the same period although this does not occur uniformly across all forms of operation. Data are presented to demonstrate what is available to the research community for further analysis of cotton production practices using ARMS results.

Introduction

Intensive practices used in the production of upland cotton may have negative impacts on water quality and other environmental indicators. A variety of management practices can help mitigate such negative impacts. Decisions made by cotton farmers in their choice of crop production practices and management systems can have a major impact on input use, farm profitability and on the environment.

Cotton producers, farm advisors and technical service providers may benefit from seeing whether the use of crop production practices and management systems are associated with the socio-economic characteristics of producers and their farms. Upland cotton is one of the most important crops grown in the United States in terms of acreage, value of production and use of agricultural chemicals. In the year 2000, farmers planted upland cotton on over 15.3 million

acres with a harvested value of over $4 billion (USDA-NASS).[1] This represents 5 percent of both the total value of crop production in the U.S. for 2000 and the land in principal crops. Upland cotton is even more important in the major cotton producing states. States included in the ARMS cotton surveys represent 90-95 percent of the total U.S. cotton production. Of the 11 states included in the cotton-specific 2000 Agricultural Resource Management Survey (ARMS) upland cotton was the primary crop in 5 states and second or third in 4 more. Upland cotton is a heavy user of commercial fertilizers and pesticides, with over 90 and 97 percent of upland cotton acres received commercial fertilizers and pesticides annually.

Information on the characteristics of U.S. upland cotton farmers and their farms can inform the provision of educational and technical assistance related to nutrient and pest management and water quality, specifically through the recognition of the production complexities and regional differences in upland cotton production, as well as the impacts of socio-economic factors on selection of management practices. There are numerous nutrient and pest management practices available, but their feasibility and adoption varies by region and by producer characteristics. It is important to understand what is both technically and economically feasible and how this influences farmers' selection of practices.

This paper presents results of a preliminary summary and spatial and temporal comparisons of ARMS data on cotton production practices. Specifically, the analysis 1) characterizes the use of the nutrient and pesticide management practices used in upland cotton production for 1997, 1999 and 2000, 2) suggests how their use may be related to selected socio-economic characteristics of

[1] Historically, cotton acreage reached its highest level in 1925 with almost 46 million acres planted. Cotton acreage was greatest during the period 1924-1933[1]. Cotton acreage reached the lowest point on record in 1983 with less than 8 million acres of Upland cotton planted. Upland cotton acreage planted has averaged 12.8 million acres during the period 1960-2000. The 15.5 million acres of upland cotton planted in 2000 was the largest acreage since 1995 and the 5th largest since 1960 (1960-1962 being the only other years with more cotton planted).

upland cotton producers, their farms, and to major cotton producing regions and 3) shows the types of data that can be used by the research community to conduct a more rigorous analysis. It links nutrient management and pest management practices selected by upland cotton farmers to operator characteristics, farm size, farm financial indicators and to implications for the environment.

Regions for analysis are the Southeast, Delta States, Southern Plains, and Southwest. Management practices summarized by socioeconomic characteristics and the environment include types, application rates, timing and application methods for nutrient and pesticide practices. The analysis also incorporates the interactions of seed type, scouting and pesticide use.

We analyze the extent of use of management systems, along with operator and farm characteristics of those using different nutrient and pest management systems, including the education level of farmers. Farm size is another variable that may impact practice adoption, along with measures of farm diversity such as cropping patterns.

Data

The data sources are the USDA's Agricultural Resource Management Surveys (ARMS).[2] Data from the 1997, 1999 and 2000 upland cotton surveys were combined to create a multi-period national dataset of the nutrient and pesticide management practices used in upland cotton

[2] The ARMS is USDA's primary source of information on agricultural resource use, production costs and farm financial conditions. Each year, producers in the States growing the primary field crops (cotton, soybeans, wheat, potatoes, and upland cotton) are surveyed regarding their cropping practices. For more information got to http://www.ers.usda.gov/Briefing/ARMS.

production. Sampling and data collection for the upland cotton version of the ARMS involved a three-phase process (Kott and Fetter, 1997). Phase 1 involved screening a sample of producers to identify farms that produced upland cotton. For Phase 2, production practice and cost information was collected on a randomly selected upland cotton field from the acreage of each producer in the sample. Respondents to the phase 2 interview were questioned in phase 3 about farm financial conditions. Data in phases 2 and 3 establish the link between agricultural resource use and farm financial conditions, a cornerstone of the ARMS design.

The summary of nutrient management and pest management systems are based upon data from a sample of 1,131 upland cotton producers in 1997, 1,630 in 1999 and 1,839 in 2000. Respondents operated farms in 12 States in 1997, in 10 States in 1999 and in 11 States in 2000. The responses were aggregated into 4 geographic regions: the Southeast, the Southwest, the Delta States, and the Southern Plains.[3] Each sampled farm represents a number of similar farms in the population, as indicated by its expansion factor, or survey weight, determined from the selection probability of each farm.

Practices on cotton acreage were tabulated using several classification variables. These variables include rotations used, operator characteristics, farm organization, farm type, main occupation of the operator, gross value of sales and production regions (tables 1-11). Differences between population means of selected variables were tested for statistical significance using a Kruskal-

[3] Regional designations are: Southeast for 1997, 1999 and 2000 are AL, GA, NC, plus the inclusion of SC in 1997; Southwest States for 1997, 1999 and 2000 are AZ, CA; Delta States for 1997, 1999 and 2000 are AR, LA, MS, TN, plus the inclusion of MO in 1997 and 2000; and Southern Plains for 1997, 1999 and 2000 is TX.

Wallis test. Only a few, which are identified later in the paper, were found to be statistically significant at the .05 level.

Characteristics of Farms Producing Upland Cotton

The National Agricultural Statistics Service (NASS) reported that in 1997 13.2 million acres of upland cotton were planted in the states included in ARMS. This estimate increased to 13.3 million acres in 1999 and to 14.4 million acres in 2000 (USDA-NASS). ARMS results show that farms growing upland cotton planted an average of approximately 750 acres in 1997, 1100 acres in 1999 and just over 1200 acres in 2000 (table 1). In 1997 and 1999, the largest average upland cotton acreage was in the Delta States while in 2000 it was in the Southwest region. Average yields across all farms and years varied from 713 pounds per acre in 1997 to 658 pounds in 2000.

Management Systems in Upland Cotton Production

Upland cotton production involves complex management systems and decisions that are affected by technical, economic, and environmental factors. While producers may make some of these choices in isolation, most choices require consideration of numerous interactions. For example, crop rotation and nutrient and pesticide management choices are likely determined simultaneously rather than sequentially.

Nutrient Management in Cotton Production

The majority of respondents treated their cotton with a commercial fertilizer each year, ranging from 99 percent of planted acres in 1997 to 84 percent of planted acres in 2000 (table 2). This decline in the share of total cotton acreage fertilized is consistent with national NASS estimates

for the same period. Nitrogen is the most commonly used commercial fertilizer, applied to over 90 percent of the cotton acreage in 1997 and 1999 and to 83 percent in 2000. The change in the share of acres receiving nitrogen fertilizer between 1997 and 2000 was significant at the 5 percent level. Phosphorous and potassium fertilizers are applied to 50-60 percent of the cotton acreage. Manure was applied to 3.1 to 4.4 percent of surveyed acres. Between 0.9 and 3.2 percent of cotton acreage received both commercial fertilizer and manure (table 2). The change in acres treated with manure and in acres treated with both commercial fertilizers and manure treatment was significant at the 5 percent level. As would be anticipated, it was more common for farms raising both cotton and livestock to apply manure to their cotton fields.

The operator's number of years of school completed does not appear to be a significant factor in the use of commercial fertilizer on cotton. While the 1997 data suggest an inverse relationship between fertilizer use and years of formal education, this pattern is reversed in 1999 and 2000. A comparison of education level and fertilizer use over the three years suggests less variability in fertilizer use among those operators with the highest formal education. For example, acres receiving fertilizer operated by those with graduate education were 93, 88, and 87 percent respectively in 1997, 1999 and 2000 while those with some high school or less the comparable acreage shares receiving commercial fertilizer were 100, 87, and 84. The percentage of upland cotton acres receiving commercial fertilizer tends to increase as the size of the farm, as measured by gross value of sales, increases (table 2).

Most fertilizer (56-62 percent of the acres) was applied in "split" treatments, fertilizer applied both before and after planting. Split applications were used on the largest share of acres in the

Southeast region for all three years (table 3). Indicators of nitrogen application timing suggest a movement away from making all applications before planting to all applications at or after planting in all regions. Such shifts in timing may have a positive effect on the environment as a larger share of nutrients are available when the plant use is greatest, reducing what may contribute to nutrient runoff.

The method of nitrogen fertilizer application and incorporation varies by region. Ground broadcasting methods were used on approximately 60 percent of cotton acreage in 1997 and 50 percent of the acreage in 1999 and 2000 and (table 4). Changes in timing were significant for acres that were treated before planting and those that were treated at/after planting but not those with a split treatment. The most common method of application was ground broadcast with incorporation. Other common methods include chiseled, ground broadcast without incorporation, and banded/sidedressed. These 4 categories account for all applications to approximately 90 percent of cotton acreage in all 3 years ranging from 88.3 percent in 1999 to 92.5 percent in 2000 (table 4).

The use of soil tests for nitrogen increased slightly from 27 percent of the planted upland cotton acres tested in 1997 to over 30 percent in 2000 (table 5). Average fertilizer application rates for 1997, 1999 and 2000 ranged between 80-87 pounds of nitrogen, 32-35 pounds of phosphate, and 48-57 pounds of potash per treated acre. The changes in average application rates from 1997 to 2000 for both nitrogen and phosphate were significant at the 5 percent level.

Pest Management in Cotton Production

Use of genetically modified seed

One of the more dramatic developments in cotton production has been the shift to the use of genetically modified seed, which was the type planted to the largest share of acres planted in 1999 and 2000 (table 6). The use of genetically modified seed (herbicide resistant, Bt, or stacked variety) grew from 27.6 percent of surveyed acres in 1997 to 65.9 percent in 2000. The most common reason reported for planting a genetically modified seed was to increase yield (37 percent of surveyed acres). Decreasing costs and saving time or labor were tied for second place at 15 percent of surveyed acres each.

The adoption of the newer varieties of cotton has occurred across all levels of educational attainment, with a slightly faster increase among those cotton farmers with the most formal education. The share of cotton acreage farmed by operators with some high school or less using the newer varieties increased from 18 percent in 1997 to 60 percent in 2000, while the acreage farmed by those with graduate training using the new varieties increased from 24 to 73 percent. The most rapid shift to genetically modified seeds occurred in the Delta region, increasing from 31 percent in 1997 to 87 percent in 2000 (table 6).

Pesticide use

The use of pesticides is widespread in cotton production. Even with the increases in the share of cotton acres planted with genetically modified seed, farmers treated the majority of their planted acres with a pesticide in each of the three years. Pesticides were applied to 100 percent of cotton acreage in 1997, 98 percent in 1999 and 96 percent in 2000 (table 2). The acreage share receiving herbicides declined from 97 percent in 1997 to 91 percent in 2000 (table 8). Insecticide

use ranged from 76 percent of planted acres in 1997 to 81 percent in 1999. In the case of insecticides, changes may be due to the specific target pest associated with genetically modified seed. Farmers lose the broad-spectrum treatments from the pesticides that target only the tobacco budworm/bollworm.

Respondents treated 81-92 percent of surveyed acres with a pre-emergence herbicide in 1997, 1999 and 2000 (table 9) and 77-78 percent of surveyed acres with a post-emergence herbicide (table 10). Acres receiving a pre-emergence herbicide declined from 92 percent in 1997 to 81 and 77 percent, respectively in 1999 and 2000. The change in pre-emergence herbicide application was significant at the 5 percent level, likely reflecting the increased use of round-up ready cotton. From just over one-third to less than half of surveyed acres had pesticides alternated to control for resistance.

Farmers based their pest management decisions on information gleaned from their experiences and a variety of other sources. For all cotton acreage, between 65 and 70 percent of pre-emergence herbicides were applied as part of routine practices. Recommendations from chemical dealers and crop consultants were reported to have influenced decisions on 10-20 percent of the acreage, with the influence of consultants increasing relative to chemical dealers between 1997 and 2000 (table 9).

Scouting

For all crop rotations and years, the largest share of acreage scouted was for insects, followed by weeds and diseases (table 7). The share of acres scouted for each of the three pests remained statistically unchanged from 1997 to 2000. The crop rotation that consistently had the greatest

share of acreage scouted for all three pests was the cotton-small grain rotation. There are some regional differences in the shares of cotton acres scouted. The Southwest region had the highest percentage of acres scouted for weeds each year, and the largest acreage share scouted for insects in 2000. The Southeast region had the greatest share of acreage scouted for insects in 1997 and 1999. The share of acres scouted for weeds across the 4 regions for 1997, 1999 and 2000 ranged from 73-89 percent, 71-96 percent and 71-95 percent, respectively. The share of acres scouted for insects for the same time periods ranged from 88-99 percent, 80-98 percent, and 81-97 percent, respectively. There was a much wider reported range for scouting for diseases. The share of acres scouted for diseases ranged from 39-66 percent, 74-96 percent and 51-83 percent for 1997, 1999 and 2000, respectively (table 7).

Farmers based their pest management application decisions on a variety of information sources. The most common reason for pre-emergence herbicide treatment was routine practice (table 9). The least likely reason was historic knowledge of weed infestations. The most common deciding factor in post-emergence herbicide treatment was type/density of weeds but roughly a quarter of post-emergence applications were based on routine practice (table 10). The main reasons for applying insecticides were scouting data/infestation level (table 11), which accounted for between 71 percent (1999) of treated acres and 79 percent (1997) of treated acres. Regional differences do not appear to be significant in pesticide pretreatments. However the Southern Plains region had the largest acreage share pretreated as a routine practice. While there is some variation between the three years both within and between years, the Southwest region in general has the greatest share of acreage where decisions are based upon field maps or recommendations from chemical dealers or consultants.

Summary and Conclusions

Cotton is one of the most economically important crops grown in the United States, particularly in the states included in the ARMS cotton surveys. Cotton production practices rely heavily on nutrients and pesticides, although some practices, particularly pesticide management practices, are beginning to change, possibly due to the increased use of seeds genetically modified for herbicide tolerance, Bt, or both. The use of genetically modified seed increased from 28 percent of respondents in 1997 to 66 percent in 2000. Chemical use, among other production practices, was relatively unchanged across the surveyed periods.

Cross-tabulation and a preliminary analysis of ARMS data for 1997, 1999 and 2000 provides some insights into the nutrient and pest management practices used by cotton producers. The surveys provide a wealth of data for descriptive analysis and for in-depth analysis. If posed and tested as hypothesis, apparent relationship of operator characteristics, such as age and education levels to management practices, as well as the regional distribution of these practices, would provide insights that could be used to more finely target educational materials or technical assistance to cotton producers. Additional insights on cotton production practices will be available when the results of the 2003 cotton ARMS are compiled and become available in September 2004.

A major conclusion from the comparison of the survey data is that although there are changes in some variables, there is a considerable level of stability in many of the variables for 1997, 1999

and 2000 at the national level. The most significant changes are in the seed type and pesticide use. Survey data also indicate a shift in the timing of commercial fertilizer applications from before planting to at or after planting, potentially contributing to reduced nutrient runoff. The use of nutrient testing techniques was relatively constant at the national level, but varied considerably among the four regions.

Opportunities exist for analysis to interpret the wealth of information contained in the ARMS data set, particularly multivariate analysis. These include an investigation of the impacts of off-farm employment and income on the selection of nutrient or pest management systems and more detailed analysis of regional and farm size impacts on the choice of nutrient and pest management practices. In addition, the interaction between management practices and socioeconomic and farm financial characteristics can be evaluated econometrically to determine causal relationships.

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Table 1. Size of cotton farms, lint yield, and size of surveyed cotton field

Item	1997			1999			2000		
	Avg. Cotton Acres	Yield (lbs)	Field Size	Avg. Cotton Acres	Yield (lbs)	Field Size	Avg. Cotton Acres	Yield (lbs)	Field Size
Total	752	713	45.9	1105	598	54.5	1220	658	50.6
Rotation									
Continuous Cotton	863	718.1	53.3	1359	568.8	63.2	1291	597.0	61.2
Cotton-Grain	675	625.6	58.2	773	625.7	82.3	1209	715.0	56.0
Cotton-Small Grain	889	1495.0	63.9	1188	1273.0	65.9	673	1245.0	27.6
Cotton-Oilseed	693	695.1	30.9	673	533.7	36.5	788	678.4	31.0
Other	572	746.1	30.6	985	639.2	35.5	1293	737.6	38.8
Formal education of operator									
Some high school or less	449	580.0	33.4	488	442.0	54.5	736	553.6	36.1
High school graduate	791	701.7	46.3	944	573.9	52.1	967	632.4	49.6
Some college	783	724.0	44.4	1442	603.0	60.1	1253	700.2	51.3
Completed college	779	752.5	50.8	1137	644.1	51.2	1465	669.8	52.0
Graduate school	550	811.4	59.3	675	772.7	57.2	2179	570.0	64.7
Farm organization									
Individual	661	670.7	44.5	1074	556.0	50.3	968	593.5	51.0
Partnership	1057	830.6	49.0	1338	747.8	64.7	1611	775.9	55.5
Family corporation	935	820.5	55.4	886	591.4	68.0	1683	763.0	38.6
Other	1009	1165.0	38.5	853	812.0	63.9	2604	746.2	58.5
Farm type									
Cotton	907	737.1	54.1	1328	610.2	62.0	1361	656.4	56.0
Grains and oilseeds	553	691.5	55.3	570	630.9	67.0	694	613.2	55.6
Other crop	558	685.4	27.3	535	552.3	24.0	791	697.7	26.0
Livestock	512	640.5	35.0	490	486.9	55.2	631	483.7	41.3
Main occupation									
Farming/ranching	730	707.7	46.8	1144	600.9	54.9	1190	657.6	51.3
Hired manager	1108	886.2	45.3	1018	835.7	73.2	2705	837.6	30.8
Other	591	657.6	36.3	372	408.3	50.9	582	508.5	48.2
Retired	1542	699.9	41.8	281	461.0	25.7	1744	620.2	75.7
Gross value of sales									
$0-$9,999	98	579.1	27.2	707	494.2	53.5	165	285.1	40.8
$10,000-$49,999	160	512.0	33.5	649	319.4	56.3	359	426.8	50.7
$50,000-$99,999	389	629.0	51.9	388	480.3	78.0	406	372.4	61.3
$100,000-$499,999	615	650.9	48.4	757	530.7	47.8	1849	780.0	45.7
$500,000 or more	1040	820.5	43.8	1939	786.6	57.2	1840	781.6	44.6
Region									
Southeast	638	681.1	24.8	801	558.5	24.2	1024	683.3	23.5
Southwest	796	1284.0	53.5	911	1365.5	67.4	1930	1415.0	56.9
Delta	931	787.2	52.9	1858	670.6	57.8	1309	686.6	57.4
Southern Plains	866	472.5	100.1	999	422.1	113.6	1310	393.3	93.1

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 2. Commercial fertilizer, manure, pesticide, nitrogen, phosphorus, and potash applicatio

Item	1997							1999							2000						
	Commercial fertilizer applied	Manure applied	Both applied	Pesticide applied	N applied	P applied	K applied	Commercial fertilizer applied	Manure applied	Both applied	Pesticide applied	N applied	P applied	K applied	Commercial fertilizer applied	Manure applied	Both applied	Pesticide applied	N applied	P applied	K applied
	percent of acres																				
Total	98.7	4.4	0.9	100.0	91.1	65.9	58.3	89.5	4.1	3.2	98.4	89.0	56.7	49.8	83.8	3.1	2.5	96.2	83.1	56.7	48.5
Rotation																					
Continuous Cotton	99.1	1.2	0.9	100.0	90.6	62.2	59.4	87.8	3.0	2.9	98.7	87.4	55.2	50.6	79.7	1.7	1.5	95.8	78.9	51.9	48.1
Cotton-Grain	100.0	5.0	5.0	100.0	94.7	68.0	40.2	89.8	5.7	3.4	97.1	88.9	51.3	45.4	93.8	5.0	3.1	98.6	93.6	77.5	47.3
Cotton-Small Grain	75.0	17.7	17.7	100.0	75.0	45.8	20.1	96.5	14.5	11.0	100.0	96.5	17.9	17.0	100.0	12.5	12.5	100.0	98.4	34.7	3.9
Cotton-Oilseed	100.0	11.4	11.4	100.0	96.5	86.2	89.7	94.9	3.5	1.2	98.0	94.4	76.2	77.7	96.4	11.6	8.1	96.4	94.9	76.1	77.1
Other	96.8	10.5	10.5	100.0	88.3	66.7	60.5	89.8	5.4	4.5	98.5	89.7	56.4	39.5	86.1	3.5	2.8	96.4	85.8	54.3	41.6
Operator characteristics																					
Some high school or less	100.0	8.0	8.0	100.0	89.4	66.6	45.9	86.7	0.8	0.8	98.9	85.7	62.5	49.7	83.6	5.6	5.6	100.0	82.6	56.3	51.2
Completed high school	98.6	2.5	2.5	100.0	90.0	70.1	60.1	90.4	1.7	2.8	98.3	89.6	58.4	54.9	81.4	2.3	1.7	95.0	79.8	59.7	53.7
Some college	99.0	6.5	6.0	100.0	90.9	64.0	58.4	88.8	2.3	1.4	97.6	88.4	56.0	51.5	83.6	3.2	2.6	97.3	83.3	52.7	46.9
Completed college	99.5	2.9	2.9	100.0	95.3	59.8	56.6	90.0	6.9	5.8	99.9	89.9	55.8	42.4	86.6	3.7	2.7	95.5	86.6	60.4	45.5
Graduate school	92.6	7.4	7.4	100.0	85.3	71.0	66.8	87.5	10.8	9.7	96.7	82.5	46.5	33.9	87.4	2.8	2.8	99.6	87.4	40.6	33.6
Farm organization																					
Individual	99.6	3.5	3.5	100.0	90.2	66.0	58.0	87.8	2.7	1.8	98.1	87.3	57.6	52.7	78.4	3.0	2.4	95.0	78.0	54.3	45.8
Partnership	95.2	4.2	3.4	100.0	92.4	66.7	59.0	95.1	4.1	3.8	99.4	94.3	54.1	45.9	96.4	3.0	2.6	99.1	94.6	63.2	55.8
Family corporation	100.0	12.4	12.4	100.0	95.4	67.3	64.8	87.9	16.8	14.9	98.1	87.7	53.7	35.6	94.3	3.9	2.5	98.7	94.0	63.0	53.5
Other	100.0	15.2	15.2	100.0	100.0	34.5	28.5	95.0	1.3	1.3	100.0	95.0	68.8	43.4	92.7	3.0	3.0	100.0	97.7	41.0	40.6
Farm type																					
Cotton	98.7	3.9	3.9	100.0	90.1	65.8	58.3	88.9	3.7	2.9	98.2	88.5	55.5	48.4	82.6	2.5	2.1	96.2	81.8	56.0	46.7
Grains and oilseeds	98.4	2.8	2.0	100.0	94.8	62.3	60.2	91.7	3.3	2.1	99.4	91.1	59.0	53.9	89.0	1.9	1.2	95.6	88.9	61.8	61.2
Other crop	99.1	5.6	5.6	100.0	93.5	75.3	61.8	93.9	5.7	5.2	99.8	92.7	63.9	56.9	92.0	7.5	5.6	97.6	91.8	56.5	51.4
Livestock	100.0	15.7	15.7	100.0	79.9	53.5	38.7	78.3	14.4	9.3	96.5	78.3	52.8	45.9	76.3	13.9	12.6	93.6	76.3	61.4	53.9
Main occupation																					
Farming/ranching	98.7	4.0	3.8	100.0	91.1	66.5	58.4	89.5	3.8	2.9	98.4	88.9	57.1	51.1	83.0	3.1	2.5	96.2	82.4	56.9	49.1
Hired manager	97.2	5.3	5.3	100.0	94.3	43.3	47.3	100.0	12.1	12.1	100.0	100.0	50.6	27.8	94.8	5.5	4.3	97.8	94.4	42.6	27.6
Other	100.0	8.0	8.0	100.0	82.6	65.0	53.1	79.7	4.1	3.3	98.1	79.7	54.5	45.2	90.2	1.5	1.5	96.0	89.1	62.5	48.9
Retired	100.0	13.8	13.8	100.0	100.0	85.0	84.1	85.0	0.0	0.0	97.1	85.0	48.6	18.8	89.3	0.0	0.0	100.0	89.3	52.7	52.7
Gross value of sales																					
$0-$9,999	100.0	2.5	2.5	100.0	42.4	34.3	34.3	79.0	0.0	0.0	98.7	79.0	43.3	49.6	80.0	0.0	0.0	100.0	80.0	55.6	31.4
$10,000-$49,999	100.0	0.0	0.0	100.0	80.3	53.5	46.4	71.4	1.0	0.4	94.9	71.0	38.4	31.5	65.3	2.2	2.2	97.0	64.8	37.8	34.3
$50,000-$99,999	100.0	1.6	1.6	100.0	80.6	58.5	37.7	82.3	1.8	0.9	98.2	81.6	54.1	43.6	61.2	0.8	0.2	91.1	60.7	44.0	31.9
$100,000-$499,999	98.6	4.2	3.8	100.0	90.6	68.3	53.4	88.8	4.4	3.3	98.6	88.6	61.4	54.4	83.1	3.1	2.2	95.1	82.7	62.7	51.3
$500,000 or more	98.3	5.9	5.9	100.0	97.0	67.3	70.9	97.4	5.3	4.7	98.8	96.6	55.7	49.2	97.3	4.1	3.6	99.5	96.0	56.7	53.3
Region																					
Southeast	100.0	6.0	6.0	100.0	97.7	90.9	95.7	98.7	6.3	5.3	97.8	97.6	92.4	96.0	98.2	8.2	7.4	98.2	96.4	89.7	89.6
Southwest	86.8	21.7	20.0	100.0	81.8	26.5	18.8	97.8	10.7	10.1	99.2	96.3	37.3	17.7	95.4	8.2	6.9	97.8	95.2	27.0	13.4
Delta	100.0	0.7	17.0	100.0	97.9	68.9	83.1	99.2	1.2	0.5	99.3	98.9	56.4	65.4	100.0	0.9	0.9	99.7	99.9	64.0	74.3
Southern Plains	100.0	2.3	2.3	100.0	84.0	60.0	26.2	73.2	3.2	2.1	97.5	73.2	53.3	31.6	60.4	1.3	0.4	92.0	59.4	48.7	23.2

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 3. Timing of fertilizer applications (percent of treated acres)

Item	1997			1999			2000		
	All Before Planting	All At/After Planting	Split Application	All Before Planting	All At/After Planting	Split Application	All Before Planting	All At/After Planting	Split Application
	percent of acres								
Total	22.6	15.4	61.9	23.0	20.9	56.1	21.4	21.7	56.9
Rotation									
Continuous Cotton	26.2	11.2	62.6	23.3	20.8	55.9	20.2	21.2	58.5
Cotton-Grain	27.1	15.5	57.4	27.3	18.6	44.1	43.4	14.4	42.2
Cotton-Small Grain	1.4	29.1	69.6	2.4	88.6	9.1	0.0	82.7	17.3
Cotton-Oilseed	19.3	16.1	64.5	14.6	9.5	76.0	13.1	21.9	65.0
Other	9.9	27.5	62.6	19.7	23.2	57.0	16.4	26.2	57.5
Operator characteristics									
Some high school or less	44.2	5.8	50.0	30.9	26.5	42.6	18.0	21.1	61.0
Completed high school	19.4	14.0	66.6	26.2	21.5	52.3	22.3	18.8	58.9
Some college	26.3	23.5	50.3	19.5	20.6	59.9	22.1	24.4	53.5
Completed college	18.1	10.6	71.3	21.7	20.4	57.9	22.3	19.2	58.5
Graduate school	21.7	9.5	68.8	23.3	15.2	61.5	7.0	41.6	51.4
Farm organization									
Individual	23.1	12.9	64.0	26.0	19.4	54.6	22.5	19.7	57.7
Partnership	19.3	21.2	59.5	17.3	25.0	57.7	17.3	26.3	56.4
Family corporation	33.2	14.5	52.3	14.2	22.6	63.2	25.8	22.9	51.3
Other	0.0	57.3	42.7	32.6	18.3	49.1	6.3	29.1	64.6
Farm type									
Cotton	23.4	15.9	60.7	23.3	20.9	55.8	22.0	20.8	57.3
Grains and oilseeds	31.1	8.7	60.1	26.9	21.3	51.8	24.3	26.7	49.0
Other crop	4.6	20.1	75.3	12.3	21.5	66.2	10.3	26.7	62.9
Livestock	39.6	23.1	37.3	65.2	10.5	24.3	34.4	14.9	50.7
Main occupation									
Farming/ranching	22.7	14.6	62.7	23.0	21.1	55.9	21.6	20.5	57.9
Hired manager	15.0	33.6	51.4	14.2	21.4	64.4	11.8	43.3	44.9
Other	33.0	10.1	56.9	28.7	19.8	51.5	23.0	30.8	46.2
Retired	22.3	18.6	59.1	90.3	7.0	2.7	11.3	17.9	70.9
Gross value of sales									
$0-$9,999	7.2	0.0	92.8	23.9	10.6	65.4	22.5	19.7	57.7
$10,000-$49,999	27.3	36.0	36.7	36.5	42.2	21.3	31.6	28.0	40.4
$50,000-$99,999	37.4	13.7	48.9	31.6	23.8	44.6	30.6	22.1	47.3
$100,000-$499,999	30.0	8.6	61.4	24.9	20.7	54.4	23.3	18.7	58.0
$500,000 or more	13.2	20.7	66.1	17.9	18.3	63.8	6.3	29.1	64.6
Region									
Southeast	12.7	16.8	70.5	14.9	11.2	73.9	14.6	13.8	71.6
Southwest	7.9	52.5	39.6	6.5	39.1	54.4	5.6	47.0	47.4
Delta	20.5	12.0	67.6	23.4	18.2	58.4	17.6	20.7	61.7
Southern Plains	37.2	7.5	55.3	39.3	19.6	41.0	43.7	13.4	42.9

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 4. Fertilizer application methods used in cotton production

	1997								1999								2000							
	Fertilizer application method[1]																							
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	percent of acres																							
Total	20.1	29.4	1.4	3.0	3.4	25.9	14.6	2.2	13.1	33.0	2.8	2.4	4.8	26.6	15.6	1.6	17.1	29.4	3.1	1.9	5.1	24.3	18.1	0.9
Rotation																								
Continuous Cotton	18	31	2	2	2	31	12	1	13	36	3	2	2	26	16	1	18	31	4	1	4	25	17	1
Cotton-Grain	16	30	1	3	2	24	17	6	14	33	2	4	2	29	15	1	13	33	1	3	3	30	17	<1
Cotton-Small Grain	14	1	<1	<1	37	39	9	<1	<1	8	7	<1	43	25	14	3	4	<1	<1	<1	52	29	16	<1
Cotton-Oilseed	42	22	<1	5	3	11	16	<1	18	34	1	2	6	23	13	2	24	28	4	3	2	13	27	<1
Other	19	28	<1	5	6	20	18	3	10	28	5	1	9	28	16	2	15	24	3	3	10	24	20	1
Operator characteristics																								
Some high school or less	30	35	1	1	3	19	11	1	14	25	<1	1	3	36	18	2	25	25	2	2	6	25	14	2
Completed high school	17	29	1	3	3	31	14	2	17	34	2	3	2	25	16	1	19	34	3	2	4	20	17	1
Some college	21	30	<1	6	3	23	16	1	11	33	2	1	5	27	18	2	16	29	3	1	4	26	19	1
Completed college	21	27	2	<1	3	27	15	4	10	34	5	3	8	28	12	1	15	26	3	3	6	27	19	1
Graduate school	25	33	8	2	13	9	8	1	18	20	7	1	12	22	12	6	10	28	5	2	9	26	20	<1
Farm organization																								
Individual	20	32	1	3	2	26	14	2	14	36	2	2	4	26	14	1	18	30	3	2	4	24	18	1
Partnership	21	22	2	3	6	27	16	2	13	26	5	1	6	28	18	2	15	28	3	2	7	24	21	1
Family corporation	26	27	3	2	4	21	12	5	5	33	3	10	5	26	15	2	16	27	5	1	7	29	15	<1
Other	2	15	<1	<1	28	33	22	<1	15	20	<1	2	13	31	20	<1	6	27	4	5	21	28	7	2
Farm type																								
Cotton	20	28	2	3	4	27	15	2	14	33	3	3	4	27	15	1	17	29	4	1	5	26	18	1
Grains and oilseeds	20	37	1	2	2	24	12	2	14	46	3	1	3	21	16	2	20	36	3	4	<1	19	18	<1
Other crop	21	22	1	2	3	30	18	3	11	29	2	1	13	25	17	2	16	30	1	4	12	15	22	1
Livestock	25	42	<1	5	6	10	12	<1	9	45	<1	<1	2	31	13	<1	20	41	<1	3	2	20	14	<1
Main occupation																								
Farming/ranching	20	30	1	3	3	26	15	2	14	34	2	2	5	26	16	2	17	29	3	2	5	25	18	1
Hired manager	18	14	4	1	10	33	15	5	6	15	18	<1	7	44	10	<1	17	21	6	1	8	29	17	1
Other	23	40	4	2	3	18	11	<1	16	39	2	4	6	26	8	<1	13	36	2	2	9	18	22	1
Retired	43	16	<1	2	9	11	19	<1	8	32	<1	<1	<1	54	6	<1	34	12	<1	<1	6	25	23	<1
Gross value of sales																								
$0-$9,999	<1	54	<1	10	<1	3	33	<1	27	19	13	1	9	20	12	<1	20	39	<1	<1	6	9	26	<1
$10,000-$49,999	23	32	3	2	<1	22	18	<1	19	25	<1	6	1	31	17	<1	24	32	1	1	3	24	15	1
$50,000-$99,999	15	29	1	1	<1	43	10	<1	13	37	1	2	3	24	17	3	26	29	1	2	2	24	15	1
$100,000-$499,999	19	36	1	2	4	23	13	2	14	37	2	2	4	24	14	2	18	31	3	2	5	23	17	1
$500,000 or more	21	23	1	5	4	27	17	3	11	28	4	1	6	31	17	1	13	27	4	2	6	26	20	1
Region																								
Southeast	30	27	<1	7	1	8	25	2	25	38	1	4	<1	9	21	2	27	31	1	4	<1	5	31	1
Southwest	12	9	2	<1	17	37	18	4	3	16	9	1	16	35	19	2	3	17	2	2	21	33	20	2
Delta	21	33	1	3	<1	30	10	1	17	35	3	1	<1	28	14	1	23	30	6	1	<1	27	12	1
Southern Plains	13	33	2	1	5	32	11	3	6	37	1	5	7	31	12	1	8	36	1	2	7	30	16	<1

Source: ARMS cotton surveys; 1997, 1999, and 2000

[1] method

1=Broadcast, Ground, w/o Incorporation
2=Broadcast, Ground, with Incorporation
3=Broadcast, Air
4=In Seed Furrow
5=In Irrigation Water
6=Chisel, Injected, or Knifed
7=Banded or Sidedress
8=Foliar

Table 5. Nitrogen management practices and fertilizer application rates

Item	1997					1999					2000				
	Nitrogen soil test	Nitrogen inhibitor	Nitrogen	Phosphorus	Potash	Nitrogen soil test	Nitrogen inhibitor	Nitrogen	Phosphorus	Potash	Nitrogen soil test	Nitrogen inhibitor	Nitrogen	Phosphorus	Potash
	percent of acres		(lbs)			percent of acres		(lbs)			percent of acres		(lbs)		
Total	27.0	3.6	80.3	34.8	57.1	27.5	1.3	87.2	32.6	48.1	30.2	2.3	83.0	32.2	48.2
Rotation															
Continuous Cotton	31.9	3.6	80.8	33.1	55.2	26.0	0.9	86.2	30.9	49.6	27.4	7.8	82.0	29.5	46.6
Cotton-Grain	17.2	0.0	75.3	33.2	40.8	21.6	0.4	78.1	28.5	36.7	30.4	0.6	80.2	37.7	36.2
Cotton-Small Grain	17.7	13.2	71.5	14.3	14.0	11.9	5.5	163.1	13.9	9.6	7.9	0.0	121.0	18.8	0.1
Cotton-Oilseed	22.2	3.6	82.2	48.4	83.3	34.5	1.0	88.3	45.9	68.9	30.8	1.5	80.7	40.7	70.0
Other	23.8	6.7	84.0	32.7	63.7	34.6	2.8	89.6	33.7	43.2	37.8	1.9	86.5	32.7	47.9
Operator characteristics															
Some high school or less	23.3	0.6	71.6	31.5	57.3	35.3	1.9	86.9	39.8	44.3	22.7	2.2	86.8	33.7	51.7
Completed high school	29.3	2.5	81.2	36.6	58.6	20.7	1.2	83.8	35.8	54.4	26.4	3.1	75.6	33.0	53.0
Some college	21.9	1.4	79.0	35.6	55.6	27.6	1.6	87.3	31.9	49.5	28.4	2.0	86.0	31.6	46.9
Completed college	26.1	6.7	82.6	32.6	57.2	34.7	0.8	90.6	26.2	38.7	39.6	1.8	88.4	32.3	43.5
Graduate school	51.2	15.5	86.6	30.5	55.8	33.4	1.3	101.3	32.7	34.5	24.8	0.0	87.2	27.4	38.8
Farm organization															
Individual	26.5	3.0	76.7	36.1	57.3	25.1	1.1	80.6	34.0	50.8	26.4	1.9	77.1	32.5	48.2
Partnership	20.6	4.6	86.7	31.3	55.9	30.5	2.1	106.6	29.8	44.2	36.8	2.7	97.6	32.1	48.9
Family corporation	51.9	6.8	89.7	32.9	62.2	38.0	0.6	91.5	27.2	33.7	44.9	4.3	90.7	30.7	45.8
Other	32.1	1.9	131.4	26.8	42.0	36.8	2.6	121.2	28.5	31.6	29.1	0.0	116.1	29.1	49.5
Farm type															
Cotton	24.6	3.7	81.3	35.0	54.8	27.5	1.1	85.8	31.3	46.1	27.8	1.9	83.5	32.4	47.1
Grains and oilseeds	25.6	1.8	78.9	32.8	50.0	25.8	0.8	78.5	30.8	43.1	40.2	4.6	77.2	27.9	42.4
Other crop	40.5	6.9	82.6	39.0	75.4	27.4	1.6	100.3	40.5	62.9	42.3	3.8	86.9	33.6	59.4
Livestock	24.4	0.0	68.9	26.1	47.3	31.2	3.5	70.1	26.5	28.9	41.7	2.4	68.7	32.9	40.2
Main occupation															
Farming/ranching	26.5	3.4	79.5	34.9	55.9	26.2	1.3	85.7	32.7	48.9	29.6	2.4	82.6	32.0	48.8
Hired manager	46.5	11.1	100.5	21.7	64.5	68.0	1.1	136.7	32.6	27.2	48.2	0.0	95.9	25.6	44.1
Other	18.9	0.0	69.8	36.6	62.0	14.6	1.0	85.9	30.6	48.8	29.2	1.0	82.1	39.2	44.1
Retired	23.4	0.0	91.7	48.9	71.9	25.9	0.0	74.7	38.2	34.5	34.1	0.0	89.1	22.9	30.7
Gross value of sales															
$0-$9,999	0.0	0.0	34.0	16.8	27.2	4.6	2.6	75.7	28.2	49.2	7.4	0.0	72.0	23.3	27.8
$10,000-$49,999	24.9	9.2	71.3	36.3	47.9	22.0	1.1	69.6	26.9	33.1	19.3	1.8	71.2	27.6	36.7
$50,000-$99,999	32.7	1.4	65.4	28.3	39.9	17.2	2.1	66.8	34.2	36.0	18.9	1.1	60.1	30.0	40.6
$100,000-$499,999	24.2	1.3	76.0	36.4	52.3	26.1	0.4	81.2	33.6	54.8	29.1	3.1	78.9	34.8	49.6
$500,000 or more	29.8	6.0	91.4	35.1	68.7	35.9	1.9	113.3	32.2	43.3	38.1	1.7	99.1	31.2	53.3
Region															
Southeast	25.3	0.9	81.4	46.5	91.6	13.6	0.4	83.0	50.7	89.2	37.7	1.6	80.8	45.0	84.0
Southwest	37.4	13.8	106.7	16.9	16.6	39.7	5.6	131.4	23.1	11.1	40.8	3.2	117.7	17.7	7.9
Delta	28.6	4.4	90.7	36.7	65.4	32.4	0.4	93.9	31.2	60.9	38.8	3.2	94.6	33.4	60.3
Southern Plains	23.8	1.6	51.1	20.1	4.6	22.6	0.6	49.6	21.2	6.6	16.2	1.3	43.9	22.5	6.0

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 6. Seed type

Item	1997			1999				2000			
	Herbicide resistant	Bt variety	Other	Herbicide resistant	Bt variety	Stacked[1]	Other	Herbicide resistant	Bt variety	Stacked	Other
	percent of acres										
Total	9.7	17.9	72.4	27.4	22.3	10.1	40.2	32.2	15.1	18.6	34.1
Rotation											
Continuous Cotton	9.4	16.1	74.5	29.0	21.5	10.4	39.1	31.7	17.2	16.7	34.4
Cotton-Grain	10.2	13.2	79.6	30.1	25.9	7.7	36.3	36.5	11.9	15.2	36.5
Cotton-Small Grain	0.0	62.2	37.8	6.3	41.5	0.0	52.2	0.0	28.7	20.1	51.3
Cotton-Oilseed	9.2	22.1	68.7	28.7	20.6	14.9	35.8	35.2	9.0	41.7	14.1
Other	11.5	23.4	65.2	20.7	19.3	9.9	50.1	31.8	12.0	17.8	38.5
Operator characteristics											
Some high school or less	4.2	13.7	82.1	30.8	19.6	7.8	41.8	29.7	18.5	11.4	40.4
Completed high school	8.4	15.5	76.1	30.3	18.5	10.7	40.5	37.2	16.7	17.1	29.1
Some college	11.5	23.8	64.7	26.0	20.1	10.2	43.7	28.4	14.6	19.4	37.7
Completed college	12.8	13.6	73.6	26.0	30.8	10.0	33.2	31.1	13.5	19.0	36.5
Graduate school	2.6	21.4	76.0	18.5	20.4	9.5	51.6	29.8	12.8	29.9	27.4
Farm organization											
Individual	10.4	15.5	74.1	29.0	20.1	9.7	41.2	33.4	14.3	17.4	34.9
Partnership	9.3	28.5	62.2	28.4	29.0	12.6	30.1	30.4	16.2	23.9	29.5
Family corporation	6.1	7.3	86.7	14.4	21.5	6.9	57.2	25.3	19.1	14.9	40.7
Other	0.0	28.6	71.4	10.6	29.1	11.5	48.8	47.5	14.2	18.4	19.9
Farm type											
Cotton	10.6	17.7	71.6	25.4	22.8	9.9	42.0	31.3	16.6	17.6	34.5
Grains and oilseeds	11.0	15.4	73.6	45.8	17.2	5.4	31.6	42.4	10.1	22.7	24.9
Other crop	3.6	22.6	73.8	25.1	21.6	15.4	38.0	28.1	6.2	21.9	43.8
Livestock	10.9	16.3	72.8	29.5	28.6	16.0	26.0	46.8	12.2	25.7	15.4
Main occupation											
Farming/ranching	10.0	18.2	71.9	27.8	22.2	10.3	39.7	32.6	14.1	18.7	34.6
Hired manager	3.2	17.8	79.0	11.1	32.0	9.6	47.4	9.3	30.2	12.4	48.1
Other	18.4	2.2	79.4	35.2	18.0	9.0	37.9	40.0	23.8	17.7	18.5
Retired	0.0	28.1	71.9	19.3	0.0	3.0	77.9	23.7	16.5	43.2	16.7
Gross value of sales											
$0-$9,999	5.7	6.2	88.1	40.1	19.7	0.5	39.7	31.5	29.4	17.6	21.5
$10,000-$49,999	3.5	7.4	89.1	29.1	20.2	8.0	42.7	28.8	12.7	15.6	42.9
$50,000-$99,999	8.5	10.7	80.7	22.0	19.7	10.3	47.9	38.5	11.2	11.0	39.4
$100,000-$499,999	6.4	13.8	79.9	30.6	21.0	9.4	39.1	33.9	16.0	17.0	33.0
$500,000 or more	14.6	25.7	59.7	23.9	26.8	11.6	37.7	27.9	15.6	24.2	32.3
Region											
Southeast	12.9	41.9	45.3	35.8	20.3	24.6	19.3	27.1	13.0	44.7	15.3
Southwest	3.0	30.6	66.5	10.2	24.4	6.2	59.1	14.6	14.1	6.6	64.7
Delta	14.8	16.8	68.5	32.7	38.3	12.1	16.9	29.0	30.7	27.9	12.5
Southern Plains	5.3	2.6	92.1	26.7	6.8	4.6	61.9	43.1	2.7	5.2	49.0

1 Use of stacked variety not asked in 1997

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 7. Scouting targets, alternating pesticides for resistance, and pest management practices

Item	1997					1999					2000				
	Scout for			Alternate Pesticides	Other PM Practices	Scout for			Alternate Pesticides	Other PM Practices	Scout for			Alternate Pesticides	Other PM Practices
	Weeds	Insects	Diseases			Weeds	Insects	Diseases			Weeds	Insects	Diseases		
	percent of acres														
Total	74	94	54	42	95	81	91	74	42	96	82	91	66	34	93
Rotation															
Continuous Cotton	68	92	51	39	96	78	90	70	36	96	80	88	63	29	93
Cotton-Grain	81	95	51	52	97	83	90	72	42	96	81	96	70	48	96
Cotton-Small Grain	100	100	69	41	87	98	100	98	55	95	80	94	33	57	94
Cotton-Oilseed	68	98	40	49	97	84	95	84	53	98	87	91	69	31	87
Other	84	97	71	38	91	86	93	81	58	96	88	94	72	42	92
Operator characteristics															
Some high school or less	68	83	37	35	97	73	92	65	45	97	78	88	60	33	93
Completed high school	69	93	52	39	96	80	89	70	36	94	81	88	64	30	93
Some college	77	94	53	42	93	79	91	73	42	96	83	94	68	33	93
Completed college	76	98	57	46	95	86	95	80	53	99	83	91	67	40	91
Graduate school	80	100	74	60	95	86	96	88	43	98	84	90	68	37	98
Farm organization															
Individual	76	92	52	44	95	81	90	72	40	97	80	88	63	31	93
Partnership	73	99	59	31	95	84	97	79	51	94	87	95	77	38	93
Family corporation	58	100	54	54	96	75	86	72	40	98	87	98	67	47	93
Other	55	100	43	55	85	76	96	77	53	100	89	100	75	58	100
Farm type															
Cotton	70	92	50	41	94	79	91	72	40	97	81	90	65	33	94
Grains and oilseeds	73	98	55	36	96	81	91	69	44	94	92	95	77	25	85
Other crop	86	99	64	58	96	94	97	93	56	94	88	93	70	52	94
Livestock	87	91	63	42	100	79	86	66	44	89	83	85	53	29	88
Main occupation															
Farming/ranching	74	94	53	41	95	81	91	73	42	96	82	91	67	34	93
Hired manager	75	99	69	58	89	93	100	94	66	96	95	100	85	67	95
Other	373	98	51	50	87	76	84	71	36	97	72	86	45	24	89
Retired	54	95	40	47	97	81	85	80	21	97	88	89	57	37	82
Gross value of sales															
$0-$9,999	41	94	31	10	98	74	83	53	37	100	88	93	62	9	89
$10,000-$49,999	79	92	51	35	93	63	82	47	16	98	66	76	42	21	92
$50,000-$99,999	71	92	45	51	99	73	86	63	23	96	80	87	56	23	95
$100,000-$499,999	70	91	47	40	95	81	91	74	43	96	81	90	66	34	93
$500,000 or more	79	98	64	42	94	90	98	86	56	97	90	97	76	42	92
Region															
Southeast	66	99	56	50	95	87	99	81	49	93	89	94	71	36	78
Southwest	89	95	63	60	91	96	98	96	63	97	95	99	83	57	98
Delta	73	98	66	30	91	83	98	74	42	96	87	97	75	34	94
Southern Plains	74	88	39	44	100	71	80	61	32	98	71	81	51	25	95

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 8. Herbicide and insecticide applications in cotton production

Item	1997		1999		2000	
	Insecticide	Herbicide	Insecticide	Herbicide	Insecticide	Herbicide
	percent of acres					
Total	76	97	81	95	77	91
Rotation						
Continuous Cotton	75	96	79	97	76	91
Cotton-Grain	71	100	85	94	82	91
Cotton-Small Grain	100	88	51	90	83	82
Cotton-Oilseed	94	100	84	97	74	94
Other	79	98	84	92	78	91
Formal education of						
Some high school or less	60	98	79	97	69	97
High school graduate	75	97	80	96	72	90
Some college	73	99	81	94	81	93
Completed college	83	96	84	96	79	90
Graduate school	96	95	83	91	87	92
Farm organization						
Individual	74	98	79	95	72	90
Partnership	77	97	86	96	89	94
Family corporation	97	95	91	96	90	95
Other	100	100	88	100	83	100
Farm type						
Cotton	72	96	83	95	77	91
Grains and oilseeds	80	99	82	95	77	90
Other crop	90	98	73	94	80	95
Livestock	82	100	74	96	61	86
Main occupation						
Farming/ranching	75	98	81	95	77	92
Hired manager	99	89	92	97	93	95
Other	71	100	84	95	69	79
Retired	95	96	95	82	76	94
Gross value of sales						
$0-$9,999	42	100	92	95	86	76
$10,000-$49,999	46	98	67	92	63	91
$50,000-$99,999	76	99	73	95	62	87
$100,000-$499,999	72	96	79	96	75	92
$500,000 or more	86	98	90	95	90	94
Region						
Southeast	86	100	81	95	76	96
Southwest	90	90	83	89	82	87
Delta	84	98	96	97	91	95
Southern Plains	60	98	67	96	64	88

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 9. Pre-emergence herbicide treatment and decision influences

	1997					1999					2000				
Item	Pretreated	Routine	Field Map	Chemical Dealer	Consultant	Pretreated	Routine	Field Map	Chemical Dealer	Consultant	Pretreated	Routine	Field Map	Chemical Dealer	Consultant
	percent of acres														
Total	92	70	5	14	11	86	67	2	11	20	81	65	4	10	21
Rotation															
Continuous Cotton	93	75	3	14	9	87	69	2	12	17	76	73	3	8	16
Cotton-Grain	97	84	2	3	11	81	75	3	14	8	79	74	5	9	11
Cotton-Small Grain	88	80	0	20	0	64	45	16	10	28	61	49	14	22	15
Cotton-Oilseed	96	76	3	14	6	89	79	3	6	13	76	78	4	3	15
Other	85	75	4	12	10	81	71	6	9	14	73	66	3	11	19
Operator characteristics															
Some high school or less	98	87	1	7	5	86	85	<1	7	8	84	87	2	5	6
Completed high school	94	79	3	13	5	84	78	3	10	10	73	76	3	8	14
Some college	92	75	1	11	12	87	66	3	12	19	77	70	3	12	15
Completed college	90	75	5	9	12	85	65	5	13	17	75	72	4	7	16
Graduate school	95	60	7	20	13	85	74	10	4	11	83	45	8	4	43
Farm organization															
Individual	94	79	2	9	10	85	72	3	11	14	75	75	3	8	14
Partnership	90	71	3	19	7	83	69	4	8	18	76	67	3	8	22
Family corporation	89	67	12	11	11	89	76	7	12	5	76	65	5	15	15
Other	100	73	0	12	15	92	48	7	16	30	78	81	10	0	10
Farm type															
Cotton	92	79	3	11	7	84	74	3	9	14	77	72	3	8	17
Grains and oilseeds	93	70	2	13	15	90	61	2	17	19	67	73	5	9	13
Other crop	95	70	3	16	10	87	64	5	13	18	77	74	2	11	13
Livestock	100	93	0	4	3	88	68	5	22	5	72	83	1	14	2
Main occupation															
Farming/ranching	93	78	3	11	9	85	71	3	12	14	76	72	3	9	16
Hired manager	88	58	14	7	21	93	55	12	5	28	82	50	4	15	31
Other	100	73	1	13	13	90	79	3	4	13	65	83	3	4	9
Retired	96	73	0	24	4	80	100	0	0	0	80	67	6	28	0
Gross value of sales															
$0-$9,999	100	100	0	0	0	75	74	0	26	0	49	71	8	0	20
$10,000-$49,999	98	87	3	8	2	81	78	2	10	10	79	84	3	7	6
$50,000-$99,999	98	80	<1	7	12	90	80	2	14	4	74	78	5	12	5
$100,000-$499,999	93	80	2	12	5	85	74	3	12	12	76	76	3	7	13
$500,000 or more	91	70	4	12	14	85	61	4	9	25	76	61	3	10	26
Region															
Southeast	94	72	5	14	9	78	79	6	4	11	76	87	2	5	7
Southwest	79	52	7	27	14	80	52	7	18	23	71	43	4	19	33
Delta	91	63	3	17	17	84	61	2	13	23	74	61	3	8	28
Southern Plains	98	95	1	3	1	91	85	2	8	5	78	86	3	8	3

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 10. Post-emergence herbicide treatment and decision influences

Item	1997					1999					2000				
	Post-treated	Weed type or density	Field Map	Chemical Dealer	Consultant	Post-treated	Weed type or density	Field Map	Chemical Dealer	Consultant	Post-treated	Weed type or density	Field Map	Chemical Dealer	Consultant
	percent of acres														
Total	78	27	43	15	14	77	22	43	12	24	77	25	38	10	26
Rotation															
Continuous Cotton	74	28	42	17	14	73	24	40	11	25	73	30	37	9	25
Cotton-Grain	73	27	58	4	10	73	29	40	13	18	62	22	48	8	21
Cotton-Small Grain	45	0	35	39	26	42	10	58	16	16	52	38	39	15	7
Cotton-Oilseed	83	29	54	5	12	87	26	56	7	10	85	37	40	3	20
Other	74	32	44	13	11	60	20	42	11	27	72	23	37	12	28
Operator characteristics															
Some high school or less	49	28	45	17	10	67	26	41	5	28	72	17	64	6	13
Completed high school	67	26	48	15	11	74	26	46	7	21	72	32	39	7	22
Some college	79	31	41	13	15	71	22	41	12	26	73	29	33	12	26
Completed college	83	28	51	9	12	71	24	39	16	21	70	26	40	9	25
Graduate school	83	27	43	22	8	60	27	46	12	15	84	14	37	4	45
Farm organization															
Individual	72	28	48	11	12	72	25	42	11	21	71	1	40	8	21
Partnership	84	23	44	20	13	74	22	42	6	30	76	21	33	12	34
Family corporation	74	37	34	10	18	60	21	44	22	13	70	27	39	7	26
Other	55	71	11	0	18	70	10	47	7	36	87	34	31	0	35
Farm type															
Cotton	74	26	51	12	11	71	26	42	9	22	72	27	39	9	25
Grains and oilseeds	81	28	43	13	16	81	20	39	17	24	77	28	33	9	31
Other crop	63	35	28	20	17	70	17	49	11	23	75	29	37	12	22
Livestock	75	41	36	13	10	67	5	48	23	24	62	43	35	14	9
Main occupation															
Farming/ranching	75	28	46	14	13	72	24	43	11	22	73	28	38	8	25
Hired manager	69	37	42	6	15	63	10	39	6	44	68	8	38	29	26
Other	61	33	42	7	18	75	38	37	7	19	67	32	42	7	19
Retired	80	14	63	19	4	50	18	78	0	4	94	23	53	24	0
Gross value of sales															
$0-$9,999	87	5	88	7	0	61	14	55	31	0	73	23	40	19	18
$10,000-$49,999	57	39	59	3	0	68	30	34	16	20	61	29	52	12	7
$50,000-$99,999	58	33	33	14	20	61	27	52	8	13	66	37	45	8	10
$100,000-$499,999	72	26	50	13	10	74	27	45	10	18	71	30	40	7	23
$500,000 or more	82	29	42	14	15	74	19	37	10	34	81	22	32	11	36
Region															
Southeast	82	32	39	9	20	92	21	57	4	18	85	38	41	5	16
Southwest	57	18	30	35	17	47	13	28	19	40	61	6	25	28	40
Delta	93	23	43	18	16	94	25	35	12	27	92	26	29	8	37
Southern Plains	57	36	59	4	<1	52	29	51	10	11	54	33	56	6	5

Source: ARMS cotton surveys; 1997, 1999, and 2000

Table 11. Reasons for insecticide application

Item	1997					1999					2000				
	Preventative schedule	Scouting data	Standard practice	Local information	Infestation level	Preventative schedule	Scouting data	Standard practice	Local information	Infestation level	Preventative schedule	Scouting data	Standard practice	Local information	Infestation level
	percent of acres														
Total	10	31	8	3	48	18	33	10	2	38	14	35	12	1	38
Rotation															
Continuous Cotton	12	28	8	4	47	22	32	10	1	33	16	38	13	1	32
Cotton-Grain	7	30	10	<1	52	15	31	8	4	42	10	37	10	<1	44
Cotton-Small Grain	0	41	11	0	47	0	36	11	0	53	5	38	0	0	57
Cotton-Oilseed	9	44	3	0	44	12	43	12	0	34	13	30	17	2	38
Other	5	35	9	3	49	12	31	8	3	47	12	24	10	2	52
Operator characteristics															
Some high school or less	11	25	16	7	41	22	13	19	1	46	10	22	22	2	44
Completed high school	8	32	10	<1	50	22	31	8	2	37	15	36	11	<1	38
Some college	8	28	7	4	52	16	31	13	3	36	14	36	11	1	37
Completed college	12	33	5	4	45	12	42	6	1	40	14	33	15	<1	38
Graduate school	15	39	2	7	36	29	22	4	5	41	20	43	4	0	34
Farm organization															
Individual	11	30	8	2	49	19	31	10	2	38	16	33	13	1	37
Partnership	4	31	12	5	48	9	43	9	3	36	11	35	10	<1	44
Family corporation	8	46	1	4	41	34	21	8	1	36	15	41	14	<1	29
Other	0	27	10	0	64	8	38	1	3	50	4	41	3	1	52
Farm type															
Cotton	9	34	8	2	47	19	33	9	2	37	15	35	11	1	38
Grains and oilseeds	11	30	8	5	46	11	39	10	3	36	15	42	8	0	35
Other crop	8	27	9	5	52	12	26	12	2	48	11	25	21	2	41
Livestock	13	27	6	0	54	28	37	3	0	32	7	21	36	0	36
Main occupation															
Farming/ranching	10	32	8	3	47	18	32	10	2	38	14	35	12	1	38
Hired manager	2	29	5	0	64	6	43	3	3	45	8	33	18	4	37
Other	16	21	14	0	50	27	46	5	0	21	21	22	8	2	47
Retired	9	33	11	0	47	33	19	12	6	30	15	31	14	0	40
Gross value of sales															
$0-$9,999	20	47	13	0	20	36	42	0	0	22	44	1	3	0	53
$10,000-$49,999	21	20	8	0	51	35	8	16	1	39	20	28	14	2	36
$50,000-$99,999	16	9	9	0	66	39	21	9	2	29	15	39	17	1	27
$100,000-$499,999	8	36	8	2	47	17	35	8	3	38	14	36	12	<1	37
$500,000 or more	9	33	8	5	46	8	40	10	1	41	13	33	11	1	42
Region															
Southeast	9	42	5	3	42	18	19	15	1	47	18	29	16	<1	37
Southwest	0	31	7	0	62	6	27	10	4	54	5	16	18	3	58
Delta	11	26	12	6	44	10	43	11	3	34	14	41	8	1	36
Southern Plains	11	30	6	0	52	35	28	5	<1	31	17	38	13	<1	32

Source: ARMS cotton surveys; 1997, 1999, and 2000