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Characteristics and Production Costs of U.S. Cotton Farms, 2007

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Abstract

Agricultural Resource Management Survey (ARMS) data for 2007 highlight the production practices and costs related to the cotton enterprise, as well as the characteristics of U.S. cotton farm operations. Combining ARMS data with ERS cost-of-cotton production estimates for 2007 provides a 1-year snapshot of cotton producers. For instance, low-cost producers reported higher yields and lower levels of major inputs per planted cotton acre than mid- and high-cost producers in 2007. Southwest producers accounted for a larger share of the smaller U.S. cotton crop in 2007 due to their lower cotton production costs and lack of alternative crops. Most U.S. cotton is produced on very large diversified farm operations, with cotton often constituting a small share of these operations' total acres. In contrast, producers with larger cotton enterprises in 2007 relied more on their cotton crop, making them vulnerable to changes in cotton prices or yields. These producers, however, were also more likely to offset greater risks by purchasing revenue insurance on cotton.

Keywords: cotton, operator characteristics, production costs, production practices, cost variation, Agricultural Resource Management Survey, ARMS

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Summary

What Is the Issue?

This report provides a 1-year snapshot of U.S. cotton farms in 2007, the latest year for which detailed data were collected from a cotton version of USDA's Agricultural Resource Management Survey (ARMS). While aggregate estimates provide some clues about cotton production costs and practices and about the characteristics of cotton farm operations and their operators, aggregate data mask diversity among cotton operations. Our analysis is based on disaggregated data and offers additional perspective to a topic previously discussed in the ERS report, "Characteristics and Production Costs of U.S. Cotton Farms," which examined 1997 data.

What Did the Study Find?

Cotton farms are not homogeneous. Operators have different characteristics and utilize different production practices. Cotton farm operators raise several varieties of cotton in different locations on enterprises that may vary from less than 200 acres of cotton per farm to more than 1,500 acres of cotton per farm. An enterprise refers to the production of one commodity on a farm, such as cotton, but a farm may include one or more enterprises. For our purposes, enterprise size is measured by the acres of the planted commodity, and farm size is measured by the value of annual gross sales from all commodities.

- The number of U.S. cotton farms fell by 41 percent between 1997 and 2007, while the average size of cotton farms rose and the share of U.S. cotton production in the Southwest (primarily Texas) increased.
- The Southwest is the major U.S. cotton production region, accounting for nearly half the cotton acreage and output in 2007. The Southwest also has more cotton farms than any other region. Southwest cotton producers are vulnerable to swings in cotton demand since they generally lack alternative crops and cotton accounts for a higher percentage of their farm production value. These farmers were more likely than cotton farmers in other regions to mitigate their risks by purchasing buy-up or revenue crop insurance.
- Low-cost producers' operating and ownership costs averaged $0.44 per pound of cotton, compared with $0.64 per pound for mid-cost producers and $1.02 per pound for high-cost producers. Cotton producers with the lowest operating and ownership costs per pound of cotton had higher cotton yields and lower costs per planted acre than mid- and high-cost cotton producers. The lower per-acre costs stemmed mainly from lower application or usage rates of seed, gasoline, diesel, fertilizer, and labor per planted acre. Low-cost producers made fewer trips across their fields, reducing machinery use and ownership costs per unit. Most low-cost producers in 2007 farmed in the Southwest, where favorable weather boosted their yields.

- Operating costs per acre did not vary significantly by the size of the cotton enterprise. Operators with larger cotton enterprises generally did not have lower costs per planted acre or per pound, despite economies of scale. Many operators with smaller cotton enterprises minimized their ownership costs by relying on custom work to avoid the purchase cost and maintenance of expensive cotton harvesters. Providers of custom work supply their own machinery as well as labor to accomplish a task.
- Most cotton production takes place on very large farm operations, with half of the cotton production occurring on farms with annual gross sales of $1 million or more. Those farms had the highest average cotton yields per planted acre and the highest average per acre costs. They were more likely to irrigate their cotton acres than smaller cotton farms.
- Cotton farms vary considerably in the degree of reliance on cotton. Operators with the larger cotton enterprises often had less commodity diversification on their farms. They depended more on cotton compared with operators with smaller cotton enterprises. In contrast, operators of the largest U.S. farms who included cotton in their production mix had more commodity diversification and were less dependent on cotton than operators of smaller cotton farms, since many operators of the largest farms growing cotton had small- to mid-size cotton enterprises.

How Was the Study Conducted?

Cotton producers were grouped by cotton production costs, region, cotton acreage, and typology to examine the variation in characteristics and production practices of U.S. cotton farms in 2007. Farms were ranked by the operating and ownership costs per pound of cotton lint to analyze the factors associated with low and high cotton production costs. We analyzed the characteristics of cotton farms by major cotton production areas to gain insights into regional shifts in cotton production. Cotton farms were grouped by the size of the cotton enterprise (planted acres) and size of the farm (gross farm sales) to determine whether size offers advantages or disadvantages.

The data we analyzed came from ERS's farm-level production cost estimates for cotton and the cotton version of the 2007 Agricultural Resource Management Survey (ARMS)—a joint effort conducted annually by USDA's National Agricultural Statistics Service (NASS) and ERS. These two data sources are tightly intertwined since the cotton version of ARMS is one of several data sources used by ERS to compute cotton production cost estimates. Several NASS reports provided secondary data for estimating cotton production costs.

For our purposes, a farm is considered a cotton farm if 1 or more cotton acres were planted with the intention of harvesting the cotton for lint, with cottonseed as a byproduct. Therefore, data from producers who planted cotton with the intention of harvesting the cotton for commercial seed are excluded from our analysis. In addition, yield and cost data per acre are based on planted acres rather than harvested acres.

Background

The cotton plant produces both cotton lint and cottonseed. Cotton lint is a natural fiber that competes with other natural and synthetic fibers in textile production. Cottonseed is fed as whole seed to animals or is separated into three components—hulls, meal, and oil. The hulls and meal are used as feed for livestock, poultry, and fish, or as fertilizer. Cottonseed oil is used as cooking oil and as an ingredient in various food products, especially snack foods.

Cotton lint is more valuable than cottonseed, even though cottonseed accounts for two-thirds of harvested cotton by weight (USDA/ERS, 1992). In 2007, the value of cotton lint accounted for 81 percent of the gross value of cotton production and cottonseed for the remainder, according to ERS production cost accounts. Cotton producers often use their cottonseed as payment to the cotton ginner for transporting their cotton to the gin and for ginning their cotton. In addition, cotton producers may either receive or pay a small additional amount, depending on prices.

U.S. farmers planted 10.8 million acres of cotton in 2007, according to USDA's National Agricultural Statistics Service (USDA/NASS, 2011). Nearly all cotton acres planted in 2007 were harvested, pushing the yield to 879 pounds per harvested acre, a record that has yet to be broken through the 2012 season. According to NASS, cotton prices averaged $0.61 per pound in 2007, up from $0.48 per pound in the previous year. In 2007, net returns after operating costs averaged $183 per planted cotton acre, while the total cost of production exceeded the gross value of production by an average of $32 per planted acre. Net returns per acre for cotton in 2007 were the highest since 2003.[1]

In the United States, cotton is a major field crop that generates significant cash receipts for farm producers. Only corn, soybeans, wheat, and greenhouse products account for more crop cash receipts than cotton. From 2005 to 2007, cotton accounted for 2.4 percent of total cash receipts from agricultural commodities and for nearly 5 percent of annual crop cash receipts (USDA/ERS, 2011a). In 2007, cotton was planted on 1.2 percent of U.S. farmland and on 2.5 percent of farmland in cotton-producing States, according to NASS data.

Understanding the trends that faced cotton producers may help put the data in this report in perspective. According to the 2007 and 1997 Censuses of Agriculture, 18,591 farms grew cotton in 2007, down 41 percent from 1997. Planted U.S. cotton acreage trended downward slightly between 1997 and 2007. Texas accounted for 43 percent of U.S. cotton production in 2007, while Arkansas, Georgia, California, and Mississippi each accounted for 7-10 percent.

As a major cotton producer and the leading cotton exporter, the United States ranks third in production behind China and India. The share of the U.S. cotton crop exported has grown rapidly as domestic mill use has declined. By 2007, U.S. cotton exports had grown to 13.6 million 480-pound bales and accounted for 75 percent of U.S. cotton disappearance. A decade earlier,

[1]Net returns after costs were lower in the 2 years following 2007, while 2010 returns were higher than those for 2007. Estimates of returns to cotton production in 2011 were significantly lower than those for 2007. For current information on returns, see http://www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx.

the United States exported 7.5 million bales of cotton, which accounted for 40 percent of U.S. cotton disappearance. As U.S. cotton exports trended upward, domestic mill use declined to 4.6 million 480-pound bales in 2007 after peaking in 1997 at 11.3 million bales. Domestic mill use fell as apparel imports rose amid lower trade barriers and lower labor costs abroad (Meyer et al., 2007).

As higher shares of the U.S. cotton crop are exported, the economic well-being of U.S. cotton producers becomes linked more closely to changes in foreign demand for cotton. Trade policies, exchange rates, the global economy, and cotton production and prices in foreign countries all influence foreign demand for U.S. cotton. Cotton producers may face increased market risks as a result of greater fluctuations in annual cotton exports than in annual domestic mill use. Since China is a major importer of U.S cotton, changes in China's cotton demand will have significant impacts on U.S. cotton producers.

Data Sources

The data we analyzed came from ERS's farm-level production cost estimates for cotton and the cotton version of the 2007 Agricultural Resource Management Survey (ARMS).[2] These two data sources are tightly intertwined since the cotton version of ARMS is one of two major data sources used by ERS to compute cotton production cost estimates. Several NASS reports provided secondary data for estimating cotton production costs.[3]

The cotton version of the 2007 ARMS collected data related to cotton farms with a focus on cotton production practices, cotton production costs, and farm business characteristics, as well as the characteristics of farm operators. The survey was implemented in three phases:

- Phase I: verified the operating status of a farm and identified whether the operator was a cotton producer. If so, the farm operator received the phase II cotton questionnaire in fall 2007.
- Phase II: collected data on production practices, input usage, and input costs for a randomly selected cotton field. Acres in the selected field were weighted to represent NASS's number of planted cotton acres in the surveyed States.
- Phase III: collected data related to the whole farm operation, including the financial situation of the farm operation and the characteristics of the farm, farm operator, and farm household.

The phase II cotton version of the survey provided 1,502 usable observations on farms planting cotton for lint, and these data served as the basis for estimates found in tables 1 and 2. The phase III cotton version of the survey targeted the same set of producers in spring 2008 that received phase II. As a result, data for the cotton production practices and costs collected in phase II of the survey can be matched with data on farm and operator characteristics from phase III. The phase III cotton version of the survey contained 1,114 usable observations from the pool of phase II respondents. Weights were applied to phase III data to more closely represent the population of cotton farms in the surveyed States. The weighted phase III data were used to produce estimates in the third table "Characteristics of 2007 cotton farm and operators" in each of the major sections in this report with one exception. Data on the type of crop insurance for cotton acreage came from phase II rather than phase III.

Cotton producers from 11 States within the 4 traditional U.S. cotton producing regions—the Southeast, Delta, Southwest, and West—where the majority of cotton production takes place, were surveyed in the 2007 ARMS (fig. 1). The 11 States included North Carolina, South Carolina, Georgia, Alabama, Tennessee, Mississippi, Arkansas, Missouri, Louisiana, Texas, and California. According to the 2007 Census of Agriculture, these States accounted for 92 percent of all cotton farms, 95 percent of the harvested cotton acreage, and 94 percent of the cotton production.

[2]ARMS is a joint effort by the National Agricultural Statistics Service and Economic Research Service. For more information, visit www.ers.usda.gov/Data/ARMS.

[3]For more information on ERS production cost estimates, please see http://www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx.

Table 1
Production costs and returns per planted acre for 2007 cotton, by cost groups

Production item	Low (a)	Mid (b)	High (c)	Total
Cotton farms (percent)	25	50	25	100
Planted cotton acres (percent)	27	52	21	100
Cotton production quantity (percent)	31	56	13	100
Cotton production value (percent)	27	55	17	100
Planted cotton acres per farm	771 c	719 c	567 ab	693
Cotton acres harvested (percent)	100 c	100 c	92 ab	98
Expected lint yield (pounds per planted acre)	1,085 c	1,072 c	949 ab	1,050
Yield (pounds per planted acre):				
Cotton lint	1,057 bc	967 ac	569 ab	908
Cottonseed	1,711 bc	1,564 ac	921 ab	1,469
Break-even price (dollars per pound of lint)	0.32 bc	0.51 ac	0.88 ab	0.50
Operating and ownership costs not covered (percent of farms)	0 bc	30 ac	96 ab	39
Price (dollars per pound):				
Cotton lint	0.55 bc	0.57 ac	0.59 ab	0.57
Cottonseed	0.08 bc	0.08 ac	0.08 ab	0.08
Operating and ownership costs (dollars per pound of lint)	0.44 bc	0.64 ac	1.02 ab	0.63
Costs and returns per planted cotton acre (dollars):				
Gross value of production:	715 bc	677 ac	414 ab	632
Cotton lint	583 bc	551 ac	336 ab	514
Cottonseed	133 bc	126 ac	78 ab	118
Operating costs:	370 bc	486 ac	458 ab	449
Seed	45 bc	64 ac	69 ab	60
Fertilizer	35 bc	67 ac	86 ab	63
Chemicals	40 bc	70 ac	77 ab	63
Custom operations	15 bc	25 a	22 a	22
Fuel, lube, and electricity	35 bc	52 a	54 a	48
Repairs	26 bc	36 ac	32 ab	33
Ginning	158 bc	146 ac	87 ab	137
Purchased irrigation water	#0 bc	3 a	6 a	3
Interest on operating capital	4 bc	7 ac	8 ab	6
Hired labor	10 bc	15 a	16 a	14

--continued

Table 1
Production costs and returns per planted acre for 2007 cotton, by cost groups (continued)

Production item	Low (a)	Mid (b)	High (c)	Total
Ownership costs:	98 bc	131 ac	122 ab	120
Capital recovery of machinery and equipment	92 bc	123 ac	114 ab	113
Taxes and insurance	7	8	8	8
Economic costs:	74 bc	101 a	103 a	94
Opportunity cost of land	38 bc	60 a	63 a	55
Opportunity cost of unpaid labor	24	25	23	24
General farm overhead	12 bc	16 a	17 a	15
Operating and ownership costs	468 bc	617 ac	580 ab	570
Total costs	543 bc	718 ac	683 ab	664
Value of production less…				
Operating costs	345 bc	191 ac	-44 ab	183
Operating and ownership costs	247 bc	59 ac	-166 ab	62
Total costs	172 bc	-41 ac	-269 ab	-32

Coefficient of variation (CV) = (Standard error/estimate) x 100.

# indicates that CV is greater than 50.

Notes: Letters a, b, and c indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic. The total category in column 4 is excluded from testing due to a lack of sample independence.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Table 2
Production practices on 2007 cotton acreage, by cost groups

Production practice	Low (a)	Mid (b)	High (c)	Total
Cotton planted acres (percent):				
Dryland	65 b	48 ac	71 b	57
Irrigated	35 b	52 ac	29 b	43
Upland	100 bc	97 ac	96 ab	98
Pima	0 bc	3 ac	4 ab	2
Farms irrigating cotton (percent)	31 b	51 ac	28 b	40
Crop rotation (percent of acreage):				
Cotton	70	62	64	65
Legumes	*3	6	*6	5
Grass	19	25	23	23
Idle or Conservation Reserve Program	*6 c	*5	*2 a	4
Seed (pounds per acre)	9.8 bc	10.8 a	10.9 a	10.5
Seed variety (percent of acres):				
Herbicide resistant	33 c	26	22 a	27
Bt	*7 c	11	13 a	10
Stacked gene	52	57	57	55
Other	*8	7	*9	7
Energy use:				
Gasoline (gallons per acre)	0.7 bc	1.0 ac	1.1 ab	0.9
Diesel (gallons per acre)	7.4 bc	13.1 a	14.2 a	11.8
Liquefied petroleum gas (gallons per acre)	#0.1 b	*0.7 a	#1.4	*0.7
Natural gas (1,000 cubic feet per acre)	#0.2	*0.5	#0.2	*0.4
Electricity (kilowatt hour per acre)	58.9 b	119.6 a	*78.3	94.7
Fertilizer and manure use:				
Nitrogen (pounds per acre)	55 bc	88 a	88	79
Phosphorous (pounds per acre)	20 bc	30 ac	37 ab	29
Potassium (pounds per acre)	15 bc	39 ac	59 ab	37
Lime (tons per acre)	0.0 bc	0.2 ac	0.3 ab	0.2
Nitrogen (percent of farms)	79 bc	94 a	94 a	90
Phosphorous (percent of farms)	59 bc	71 ac	79 ab	70
Potassium (percent of farms)	34 bc	56 ac	77 ab	56
Lime (percent of farms)	19 bc	38 ac	60 ab	39
Chemical use:				
Herbicides (percent of acreage)	98	97	95	96

--continued

Table 2
Production practices on 2007 cotton acreage, by cost groups (continued)

Production practice	Low (a)	Mid (b)	High (c)	Total
Insecticides (percent of acreage)	43 bc	72 a	78 a	65
Herbicides (treatments per acre)	3.0 bc	3.8 a	3.9 a	3.6
Insecticides (treatments per acre)	1.0 bc	2.9 ac	2.3 ab	2.2
Trips over field (number)	8.9 bc	11.0 a	10.3 a	10.3
Farms custom harvesting (percent)	19.2	17.2	15.3	17.2
Labor (hours per acre):	2.2 bc	2.6 a	2.6 a	2.5
Paid	1.0 bc	1.5 a	1.5 a	1.4
Unpaid	1.1	1.1	1.0	1.1
Farms with paid labor (percent)	60 b	75 a	72	71
Machinery maximum width (feet):				
Planter	27.0 c	26.5 c	24.8 ab	26.2
Harvester	19.3 bc	17.1 ac	15.4 ab	17.2

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

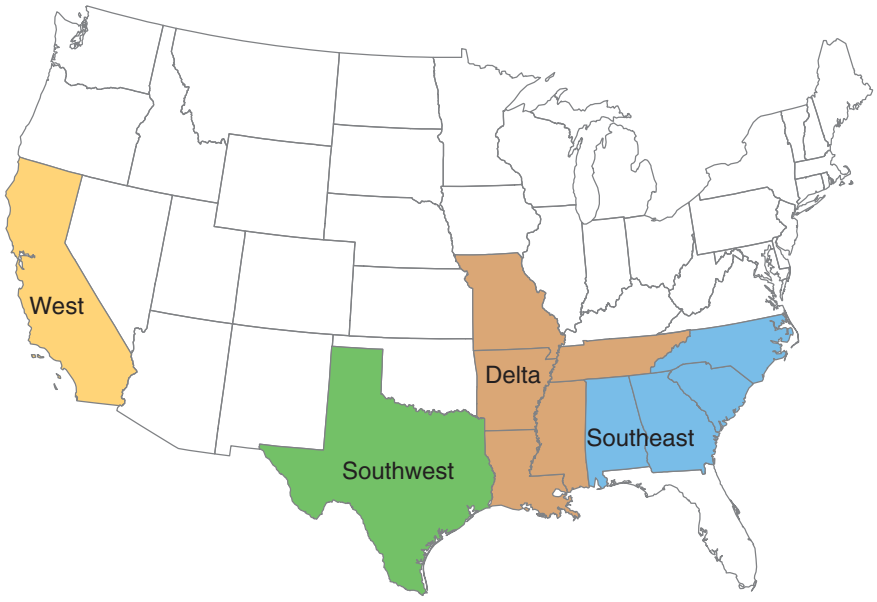
# indicates that CV is above 50.

Notes: Letters a, b, and c indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic. The total category in column 4 is excluded from testing due to a lack of sample independence.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Figure 1
States and regions covered in the cotton version of the 2007 Agricultural Resources Management Survey

Cotton producers in 11 surveyed States produced 94 percent of U.S. cotton in 2007.



Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Prices Covered Costs for Most U.S. Cotton Production

In 2007, low- and mid-cost producers, on average, covered their cotton operating and ownership costs, while high-cost cotton producers did not, primarily because of low average yields caused by a widespread drought in the Southeast. Compared with mid- and high-cost producers, low-cost cotton producers, on average, used lower levels of inputs on their cotton fields and made fewer trips across their fields. Fewer trips resulted in lower ownership costs per unit. In addition, low-cost producers planted more cotton acres per farm than high-cost producers.

Cotton production costs per acre and per pound varied widely in 2007 among farms due to differences in production and management practices, weather conditions, natural resources, efficiencies, and varieties of cotton. Cotton farms were ranked from lowest to highest based on the operating and ownership costs per pound of cotton lint in 2007 and grouped into quartiles to evaluate the factors associated with various cost levels.[4] We chose to rank farms by operating and ownership costs per pound of cotton lint since these costs, over a period of several years, must be covered for sustainable cotton production. Low- and high-cost farms were in the extreme quartiles, while mid-cost farms consisted of farms in the mid-quartiles.[5]

Producers in the lowest cost quartile produced 31 percent of the cotton lint, while producers in the middle two quartiles produced 56 percent of the cotton lint and high-cost producers produced 13 percent of the cotton lint (see table 1). In 2007, low-cost cotton producers received $0.55 per pound for cotton lint, far exceeding the price they needed to break even on cotton lint (see glossary, break-even price for cotton lint). As a result, all low-cost producers were able to cover their operating and ownership costs of cotton production from gross value of cotton production. At the opposite end, high-cost producers needed $0.88 per pound, on average, to break even (fig. 2). However, they received $0.59 per pound, on average, for their cotton. Nearly all the high-cost cotton producers, 96 percent, were not able to cover their operating and ownership costs of cotton production from cotton production in 2007. The average price of $0.57 per pound for cotton lint received by producers in the mid-cost group exceeded their average break-even price of $0.51 per pound for operating and ownership costs. Nearly 70 percent of mid-cost producers were able to cover their operating and ownership costs of cotton production from cotton sales.

Although differences in both yield and costs per acre contributed to the $0.56 per pound gap in the average break-even price of cotton lint between low- and high-cost producers, yield differences contributed more. Low-cost producers averaged 1,057 pounds per acre of cotton lint in 2007, compared with 967 pounds per acre for mid-cost producers and 569 pounds per acre for high-cost producers. Part of the large yield difference between low- and high-cost producers was due to weather conditions in 2007. Southwest cotton producers saw record cotton yields in 2007 resulting from favorable weather conditions, while the drought in southeastern Tennessee, Alabama, northwestern Georgia, and southwestern South Carolina reduced cotton yields in

[4]See box, "ERS Cotton Production Costs and Returns," for more information on cost measures or refer to Appendix I: Determining the Break-Even Price per Pound of Cotton Lint. Less than 2 percent of cotton farms changed cost groups when cotton ginning and custom hauling costs were subtracted from the operating and ownership costs before ranking the farms into quartiles based on the remaining operating and ownership costs per pound of cotton lint.

[5]Quartiles represent a quarter of the total. The low-cost group represents the 25 percent of farms with the lowest total operating and ownership costs per pound of cotton lint, while the high-cost group represents the 25 percent of the farms with the highest operating and ownership costs per pound. Mid-cost producers were ranked from the 26th to the 74th percentile of farms.

ERS Cotton Production Costs and Returns

USDA's Economic Research Service (ERS) production cost estimates include costs and returns for all participants in commodity production. Thus, the costs and returns of farmers, landlords, and contractors are included. Costs and returns for commodities are calculated on a per planted acre basis rather than per harvested acre. By computing the costs and returns per planted acre, varying degrees of crop failure are taken into consideration. ERS production cost estimates are computed based on the recommendations of the American Agricultural Economics Association Task Force on commodity costs and returns.

ERS calculates gross returns per acre from the harvested quantity of the crop times the harvest month price from NASS divided by the number of planted acres. All expenses incurred up to the point of "first rest" are included. The first rest point for cotton is the selling point or, if it is not immediately sold, the storage point. Since cotton must be ginned, ginning costs are included in cotton production cost estimates.

There are several measures of commodity costs, and each measure has a different purpose. Generally, a producer will not plant a commodity unless the expected revenue from commodity production exceeds expected operating costs. Operating costs include inputs that vary with the amount of the commodity planted. Often, these inputs are purchased and paid for annually. For our purposes, cotton operating costs include seed, fertilizer, chemicals, custom operations, fuel, repairs, purchased irrigation water, interest, hired labor, and cotton ginning costs.

Over several growing seasons, producers need to recover their operating and ownership costs to continue producing a commodity profitably over the longer term, including replacement of farm machinery, equipment, and facilities needed to efficiently produce the commodity. Annual ownership costs include those for capital recovery in farm machinery, equipment, and facilities used in the production of the commodity, as well as the annual nonreal estate property taxes and insurance.

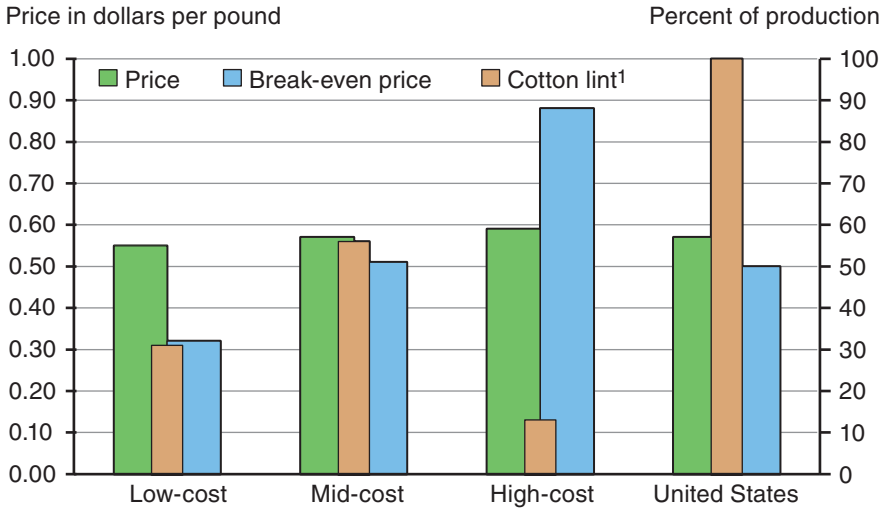
Producers may examine expected and actual returns over total production costs for their farm operations and for individual commodities over a period of years to assist in planning their long-term goals. Producers who feel that their net returns are not sufficient may reassess the commodity mix on their farming operation; allocation of time among farm work, nonfarm work, and other activities; and returns from alternate investment sources. Total production costs include the opportunity costs for land and unpaid labor and general farm overhead, in addition to operating and ownership costs.

Often, the gross value of production does not cover total production costs in ERS's production cost estimates. This does not necessarily mean that producers are losing money by producing the commodity. Producers often store crops for later sale when prices are typically higher than the harvest month price or use forward contracting to lock in higher prices for their commodities. Many crop producers also receive Government payments, loans, or subsidies that, although not directly tied to the crop being produced, supplements income from commodity production.

Producers may be willing to accept different rates of return than the ones used by ERS to estimate opportunity costs for owned land and unpaid labor. In ERS's production cost estimates, the cash rental rate for farmland is used to measure the opportunity cost of land used in cotton production. The off-farm wage rates earned by workers with comparable age, education, and location serves as a measure of the opportunity costs of unpaid labor. Producers may accept lower returns due to personal preferences, costs of switching occupations, Federal and State income and estate tax laws, or other factors.

Figure 2
U.S. cotton lint prices and share of lint produced, by cost groups, 2007

Prices received for cotton lint exceeded break-even prices after operating and ownership costs for most cotton production.



[1]Share of production.
Source: USDA, Economic Research Service calculations based on USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

these areas. High yields likely pushed a higher-than-normal percentage of Texas cotton producers into the low-cost group in 2007. In the Southeast and Delta regions, National Agricultural Statistics Service (NASS) data show that the average 2007 cotton lint yield was lower than the average annual yields for 2005-09 by 23 percent in Alabama, 6 percent in Georgia, 41 percent in South Carolina, and 31 percent in Tennessee. Many producers in these States were classified with the high-cost group due to a temporary reduction in their cotton lint yields that boosted their average production costs per pound of cotton lint.

The operating and ownership costs, which include ginning costs, averaged $468 per planted acre for low-cost producers in 2007, compared with $617 per acre for mid-cost producers and $580 per acre for high-cost producers. The cost per planted acre was lower for high-cost producers compared with mid-cost producers because high-cost producers had lower ginning costs per acre as a result of lower yields. Low-cost producers had statistically significant lower costs per planted cotton acre compared with mid- and high-cost producers for all operating and ownership cost items except for taxes, insurance, and ginning. Ginning costs were higher based on higher yields.

Low-cost cotton producers planted an average of 771 acres of cotton per farm compared with high-cost producers who averaged 567 acres of planted cotton per farm. Since more cotton acreage may allow low-cost producers to make efficient use of larger machines, low-cost cotton producers used larger planters and harvesters. On average, low-cost producers used planters that were 2 feet wider and harvesters that were 4 feet wider than those of high-cost producers.

On average, low-cost producers used lower levels of major inputs per planted acre of cotton in 2007, consuming less seed, gasoline, diesel, fertilizer, insecticides, and labor per planted acre than mid- and high-cost producers (see table 2). Low-cost producers were the least likely to apply fertilizers, and they made fewer applications of herbicides and insecticides. These actions resulted in fewer trips over their cotton fields and fewer labor hours used per acre. Low-cost producers' use of larger planters and harvesters also reduced their labor hours per acre.

Mid-cost cotton producers were the most likely to irrigate their cotton fields. Irrigating typically raises fuel costs and capital recovery costs (i.e., machinery and equipment) that result from the use of irrigation pumps, wells, and various irrigation systems. Since electricity is a major energy source for irrigation pumps, electricity use per acre was highest for mid-cost producers.

Cotton accounted for a larger share of the farm value of production for low-cost producers compared with high-cost producers. Approximately 57 percent of the gross value of agricultural production for low-cost producers is derived from cotton, compared with 40 percent for mid-cost producers and 31 percent for high-cost producers (table 3). If high-cost producers had achieved more normal cotton yields, their value of production attributable to cotton would have been closer to those for mid- and low-cost producers.

The number of commodities produced per farm averaged 3.1 for low-cost producers, 3.8 for mid-cost producers, and 4.2 for high-cost producers. Greater commodity diversification protects producers against large swings in net income if a commodity price or yield changes dramatically from the expected. Differences in commodity diversification are due partly to the location of producers in the low-, mid-, and high-cost groups. Texas—a low-cost cotton production region—tends to be hot and dry, thus limiting the alternative crops that can be economically grown there. Mid- and high-cost producers were more likely to grow soybeans, corn, peanuts, fruits, or vegetables.

High-cost cotton producers had significantly lower household incomes in 2007 compared with mid- and low-cost producers. Farm incomes for high-cost producers were lower than those for low- and mid-cost producers, while the differences in off-farm income received by the producers' families in the different cost groups were not statistically significant.

Table 3
Characteristics of cotton farms and operators, by cost groups, 2007

Characteristic	Low (a)	Mid (b)	High (c)	Total
Cotton as percent of value of production	57 bc	40 ac	31 ab	41
Commodities per farm	3.1 bc	3.8 ac	4.2 ab	3.7
Farms producing (percent):				
Cotton under contract	39 b	50 a	43	46
Corn	24 bc	46 ac	55 ab	43
Sorghum	25	22 c	14 b	20
Soybeans	16 bc	27 ac	45 ab	29
Cattle	27	25	21	25
Wheat	37	31	31	32
Hay	16	14	11	14
Peanuts	*12 bc	22 a	26 a	21
Fruits or vegetables	*0 bc	10 a	11 a	8
Farms in Southwest (percent)	74	42	23	45
Cotton acreage with crop insurance (percent):	96	95	95	95
Federal insurance:	94	91	92	92
Basic catastrophic	29	35	39	34
Buy-up	41	32	34	35
Revenue	19	18 c	12 b	17
Private crop insurance	48 bc	26 ac	17 ab	30
Total operated acres per farm:	2,091	1,862	1,677	1,868
Owned and operated	*763	450	450	523
Rented:	1,329	1,401 c	1,225 b	1,339
Cash-rented	517 bc	743 a	836 a	714
Share-rented	811 bc	657 ac	389 ab	624
Cropland	1,551	1,596 c	1,417 b	1,540
Principal operator occupation (percent):				
Farming	89	95	94	93
Nonfarm	*11	4	#5	6
Principal operator age (mean):	57 b	54 a	55	55
Younger than 50 years (percent)	29	34	28	31
65 years or more (percent)	29 bc	19 a	17 a	21
Principal operator education (percent):				
High school	93	97	93	95
Completed college	37	32	26	32

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Table 3
Characteristics of cotton farms and operators, by cost groups, 2007 (continued)

Characteristic	Low (a)	Mid (b)	High (c)	Total
Farm organization (percent):				
Sole/family proprietor	82 b	72 ac	78 b	76
Partnership	*12 b	20 ac	14 b	17
Family corporation	*5	*6	*5	5
Gross cash income per farm (1,000 dollars):	614.8 bc	971.0 a	832.6 a	852.7
Crop cash receipts	446.7 bc	748.5 a	629.7 a	647.9
Government payments:	71.1	80.7	78.6	77.9
Direct	32.7 b	39.9 a	37.6	37.6
Counter-cyclical	28.6	32.1	29.2	30.6
Loan deficiency	*0.6 bc	1.7 a	*2.6 a	1.7
Other	9.2	7.0	9.1	8.1
Federal crop and livestock insurance	5.2 c	7.7 c	18.7 ab	10.0
Cash production expenses	407.6 bc	697.2 a	676.9 a	624.6
Net cash income	207.2	273.8 c	155.6 b	228.1
Household income per family (1,000 dollars):	214.2 c	198.3 c	118.1 ab	182.0
Farm income	150.6 c	164.2 c	*71.2 ab	137.5
Off-farm income:	*63.6 b	34.1 ac	46.9 b	44.5
Earned income from business or job	36.4 b	20.4 a	25.2	25.5
Percent with off-farm business or job	57	55	55	56
Average value per farm (1,000 dollars):				
Farm assets	1,791.1	2,194.6	2,115.5	2,080.5
Farm debt	164.0 b	238.2 a	220.4	216.4
Farm equity	1,627.1	1,956.4	1,895.2	1,864.1
Debt-to-asset percentage	9	11	10	10

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

# indicates that CV is above 50.

Notes: Letters a, b, and c indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.The total category in column 4 is excluded from testing due to a lack of sample independence.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Southwest Producers Dominate U.S. Cotton Production

In 2007, Southwest cotton farms produced more cotton than cotton farms in other regions, and their share of U.S. cotton production grew because they had the lowest average cotton production costs and lacked viable alternative crops.

Like most crops, cotton is grown in several U.S. regions (see fig. 1). Some of the diversity in cotton farms' production practices and characteristics is driven by location. Regional climatic and soil conditions influence the type of cotton grown, whether the cotton is irrigated, and the mix of agricultural commodities grown. Other factors, such as farmland availability and land costs, impact farm size in these regions.

The Southwest is the major cotton production region, accounting for 42 percent of U.S. cotton farms and 48 percent of the planted cotton acres in 2007 (table 4 and fig. 3). Southwest cotton growing conditions can fluctuate widely based on weather. Because of good regional growing conditions during 2007, Southwest cotton producers achieved record-high cotton yields per harvested acre. Calculations based on NASS data indicate that Southwest cotton producers experienced the most volatile cotton yields from 1997 to 2012. Volatile yields raise production and financial risks.

The Southwest accounts for a larger proportion of the U.S. cotton crop. According to ARMS data, Southwest producers accounted for 47 percent of U.S. cotton production in 2007, up from 25 percent in 2003. Southeast producers accounted for 17 percent in 2007, down from 25 percent in 2003, and Delta producers share fell to 28 percent in 2007 from 35 percent in 2003 (Meyer et al., 2007 and table 4).[6] The West's share of U.S. cotton production slipped to 7 percent in 2007, down from 16 percent in 2003.

The Southwest's rising share of the U.S. cotton crop comes more as a result of the region's slower rate of decline in cotton acreage, compared with declines in other regions, rather than from increases in the region's cotton acreage or cotton production. U.S. cotton acreage fell 20 percent between 2003 and 2007 because of a decline in cotton demand and an increase in ethanol demand that boosted corn acreage as the returns to corn production rose. In contrast, cotton acreage fell 12 percent between 2003 and 2007 in the Southwest.

The percentage drop in cotton acres was less in the Southwest for several reasons. First, Southwest cotton producers had the highest average returns to upland cotton production per acre and the lowest average cotton production costs per acre, which encouraged cotton production in the region in 2007 (see box, "Cotton Types" and fig. 3).[7] Because Southwest cotton yields per planted acre were similar to the U.S. average, their low per acre cotton production costs were largely responsible for high average returns. Their average per acre costs for seeds, fertilizer, chemicals, land, and general farm overhead matched or were significantly lower than those for other regional producers. Southwest producer seed costs per acre were low because the region used more herbicide-resistant seeds than seeds with stacked genes.

[6]This trend is continuing. Calculations using National Agricultural Statistics Service's Quick Stats data show that Southwest cotton producers planted just over 50 percent of the U.S. annual average cotton acreage during 2008-12, compared with 43 percent during 2005-07.

[7]Differences in the average returns to cotton production in the Southeast, Delta, and Southwest would have been smaller if producers achieved their expected yields.

Table 4
Production costs and returns per planted acre for 2007 cotton, by region

Production item	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Farms (percent)	31	22	42	6
Planted cotton acres (percent)	21	26	48	4
Cotton production quantity (percent)	17	28	47	7
Cotton production value (percent)	16	26	47	11
Planted cotton (acres per farm)	479 bc	916 acd	746 abd	445 bc
Cotton acres harvested (percent)	98 b	100 ac	97 b	99
Expected lint yield (pounds per planted acre)	1,005 bd	1,126 acd	980 bd	1,566 abc
Yield (pounds per planted acre):				
Cotton lint	743 bcd	972 acd	888 abd	1,512 abc
Cottonseed	1,203 bcd	1,573 acd	1,437 abd	2,446 abc
Break-even price (dollars per pound of lint)	0.63 bcd	0.55 ac	0.41 abd	0.53 ac
Operating and ownership costs not covered (percent of farms)	62.3 bcd	53.8 acd	21.4 ab	18.6 ab
Price (dollars per pound):				
Cotton lint	0.55 bcd	0.55 ad	0.55 ad	0.75 abc
Cottonseed	0.07 bcd	0.08 acd	0.08 abd	0.12 abc
Operating and ownership costs (dollars per pound of lint)	0.75 bc	0.68 acd	0.54 abd	0.73 bc
Costs and returns (dollars per planted cotton acre):				
Gross production value:	498 bcd	659 acd	602 abd	1,438 abc
Cotton lint	409 bcd	538 acd	490 abd	1,134 abc
Cottonseed	89 bcd	121 acd	111 abd	304 abc
Operating costs:	437 bcd	520 acd	370 abd	945 abc
Seeds	64 bcd	84 acd	47 ab	47 ab
Fertilizer	96 bc	80 acd	36 abd	92 bc
Chemicals	75 bcd	90 ac	40 abd	102 ac
Custom operations	20 bd	25 acd	16 bd	75 abc
Fuel, lube, and electricity	38 cd	38 cd	49 abd	152 abc
Repairs	32 bd	37 acd	30 bd	41 abc
Ginning	94 bcd	143 ad	135 ad	319 abc
Purchased irrigation water	0 cd	0 cd	*0 abd	68 abc
Interest on operating capital	7 bcd	8 acd	5 abd	13 abc
Hired labor	13 bd	16 acd	11 bd	37 abc
Ownership costs:	118 bcd	140 acd	108 abd	155 abc
Capital recovery of machinery and equipment	110 bd	131 ac	102 bd	141 ac
Taxes and insurance	8 d	9 cd	6 bd	14 abc

--continued

Table 4
Production costs and returns per planted acre for 2007 cotton, by region (continued)

Production item	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Economic costs:	98 bcd	114 acd	71 abd	208 abc
Opportunity cost of land	62 bcd	78 acd	31 abd	141 abc
Opportunity cost of unpaid labor	19 cd	20 cd	28 ab	27 ab
General farm overhead	17 cd	17 cd	12 abd	40 abc
Operating and ownership costs	555 bcd	660 acd	478 abd	1,100 abc
Total costs	653 bcd	774 acd	549 abd	1,309 abc
Production value less…				
Operating costs	61 bcd	139 acd	231 abd	493 abc
Operating and ownership costs	-57 bcd	#-1 acd	124 abd	338 abc
Total costs	-155 bcd	-115 acd	53 ab	*129 ab

Coefficient of variation = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

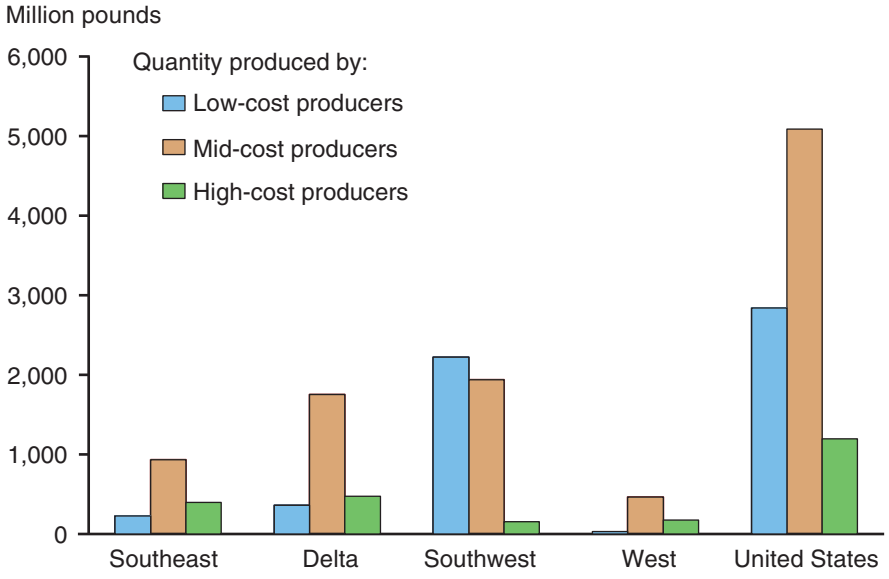
# indicates that CV is above 50.

Note: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Figure 3
Cotton lint produced, by region and cost groups, 2007

Southwest cotton farms produced more cotton than farms in any other region, and they produced most of the low-cost cotton.



Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Cotton Types

Two major types of cotton are grown in the United States, with American Upland cotton accounting for 97 percent of the cotton acres planted and American Pima, or extra-long staple (ELS), accounting for the remainder of the acreage. Fiber from American Upland cotton is usually shorter than the fiber from American Pima cotton. American Pima cotton is primarily grown in California, where it accounted for 57 percent of the State's planted cotton acreage in 2007 (USDA/NASS, 2012). Small quantities of American Pima cotton are also grown in southwest Texas, southern Arizona, and New Mexico. In the United States, Pima cotton yields are, on average, significantly higher than upland cotton yields. In California, however, where special varieties of upland cotton are grown, upland cotton yields exceed Pima yields. Producers receive higher prices for American Pima cotton compared with American Upland, partly reflecting Pima's higher quality cotton lint and its higher production costs based on different ginning techniques and extra management needs. Pima cotton is more expensive to gin since it is roller-ginned to preserve the fiber's length and quality, while upland cotton is saw-ginned or cut from the seed in the ginning process. Pima cotton is used mainly in higher value products, such as finer apparel, sewing thread, and finer home furnishings (Calcot, 2012).

Southwest cotton producers used lower levels of fertilizer, gasoline, diesel, and insecticides per acre (table 5).

The rate of decline in Southwest cotton acres was also slower due to climatic conditions. The Southwest climate is not as conducive to the production of other commodities, such as corn and soybeans, compared with the Southeast and Delta regions. Therefore, many Southwest cotton producers did not have the option of switching into corn or soybean production when demand for corn rose, pushing up corn prices and net returns for corn and soybeans.

Cotton's importance to Southwest producers is reflected in the average number of commodities produced per farm and in the percentage of cotton's production value to the farm's production value (table 6). The number of commodities produced is an indicator of the producers' flexibility to shift commodity production should demand, prices, or local growing conditions change. Increased flexibility may reduce long-term risks and lessen producers' dependence on a particular commodity. Cotton's production value as a share of agricultural production value indicates a producer's reliance on cotton. Higher percentages may indicate less diversification and, therefore, higher risk for farm income variability should conditions for cotton change.

Southwest cotton producers were the least agriculturally diversified with an average of 2.9 commodities per farm, typically including sorghum and wheat. Cotton producers in the Southeast, Delta, and West averaged 3.6 or more commodities per farm. Soybeans and corn were grown on at least 45 percent of the Southeast and Delta farms, while peanuts were grown on more than half of Southeast cotton farms. Southeast cotton producers averaged 4.8 commodities per farm, the highest of all the regions. Cotton producers in the West often grew fruits, vegetables, or hay rather than corn, soybeans, or peanuts.

Table 5
Production practices on 2007 cotton acreage, by region

Production practice	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Cotton acres (percent):				
Dryland	73 bcd	54 ad	57 ad	0 abc
Irrigated	27 bcd	46 ad	43 ad	100 abc
Upland	100 d	100 d	100 d	53 abc
Pima	0 d	0 d	0 d	47 abc
Farms irrigating cotton (percent)	15 bcd	40 ad	46 ad	100 abc
Crop rotation (percent of acreage):				
Cotton	40 bcd	79 acd	68 ab	61 ab
Legumes	17 bcd	*4 acd	*1 abd	0 abc
Grass	38 bcd	14 ac	23 abd	*9 ac
Idle or Conservation Reserve Program	#1 cd	#0 cd	8 ab	*10 ab
Seed (pounds per acre)	8.4 bcd	9.9 acd	11.2 abd	16.5 abc
Seed variety (percent of acres):				
Herbicide resistant	9 cd	12 cd	42 ab	39 ab
Bt	16 cd	11 d	*8 a	#3 ab
Stacked gene	73 cd	77 cd	40 abd	*10 abc
Other	#2 cd	#0 cd	10 abd	49 abc
Energy use:				
Gasoline (gallons per acre)	1.2 cd	1.2 cd	0.7 ab	0.6 a
Diesel (gallons per acre)	13.5 cd	12.6 cd	8.4 abd	36.5 abc
Liquefied petroleum gas (gallons per acre)	0.0 b	*0.4 a	#0.6	#6.8
Natural gas (1,000 cubic feet per acre)	0.0 c	na	*0.7 ab	#0.2
Electricity (kilowatt hour per acre)	*36.9 cd	19.2 cd	124.9 abd	491.3 abc
Fertilizer and manure use:				
Nitrogen (pounds per acre)	82 bcd	104 acd	60 abd	118 abc
Phosphorous (pounds per acre)	44 bcd	31 ac	21 ab	30 a
Potassium (pounds per acre)	78 bcd	68 acd	4 abd	*14 abc
Lime (tons per acre)	0.4 bd	0.3 ad	na	#0.1 ab
Nitrogen (percent of farms)	97 bc	99 ac	81 abd	94 c
Phosphorous (percent of farms)	88 bcd	73 acd	61 abd	50 abc
Potassium (percent of farms)	96 bcd	79 acd	25 ab	32 ab
Lime (percent of farms)	95 bcd	59 ad	na	*5 ab

--continued

Table 5
Production practices on 2007 cotton acreage, by region (continued)

Production practice	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Chemical use:				
Herbicides (percent of acreage)	99 d	99 d	96 d	76 abc
Insecticides (percent of acreage)	78 bc	93 acd	42 abd	82 bc
Herbicides (treatments per acre)	4.1 cd	4.4 cd	3.0 abd	1.9 abc
Insecticides (treatments per acre)	1.9 bc	4.5 acd	1.2 abd	1.8 bc
Trips over field (number)	8.9 bcd	12.2 ac	9.9 abd	11.9 ac
Farms custom harvesting (percent)	21.7 b	6.7 acd	18.4 b	26.2 b
Labor (hours per acre):	2.1 bcd	2.5 ad	2.5 ad	4.4 abc
Paid	1.2 bd	1.6 acd	1.1 bd	3.4 abc
Unpaid	0.9 c	0.9 c	1.3 abd	1.0 c
Farms with paid labor (percent)	57 bcd	86 ac	68 abd	89 ac
Machinery maximum width (feet):				
Planter	20.3 bc	29.7 acd	28.1 abd	20.8 bc
Harvester	14.7 bc	16.6 acd	19.4 abd	14.3 bc

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

# indicates that CV is above 50.

na indicates value is not available due to no observations, an undefined statistic, or reliability concerns.

Note: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Southwest cotton producers' reliance on cotton is reflected in the proportion of agricultural production value attributed to cotton. In 2007, cotton accounted for 58 percent of their agricultural production value, the highest percentage for all regions. These producers faced risks if cotton prices declined or if climatic events or disease significantly reduced cotton yields. Cotton accounted for 45 percent of agricultural production value on Delta farms, 29 percent on Southeast farms, and 22 percent on West farms in 2007.

Southwest producers were the most likely to purchase private insurance and Federal insurance on their cotton crop to mitigate risks imposed by the lack of crop diversity and reliance on cotton (table 6). Southwest cotton producers also were more likely to purchase Federal revenue insurance, 28 percent compared with 11 percent or less for cotton producers in other regions. Federal revenue insurance offers more financial protection than insurance based on yields, since revenue insurance protects producers against both price and yield declines.

Cotton production varies by region since they grow different cotton varieties. In 2007, about half of the West's cotton acres were planted with Pima cotton, with the balance of the region's cotton acres planted with upland cotton varieties not typically planted in other regions (see box, "Cotton Types"). While

Table 6
Characteristics of 2007 cotton farms and operators, by region

Characteristic	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Cotton's production value (percent)	29 bcd	46 acd	58 abd	23 abc
Commodities per farm	4.8 bcd	3.9 ac	2.9 abd	3.6 ac
Farms producing (percent):				
Cotton under contract	51 bd	40 ad	42 d	67 abc
Corn	61 cd	64 cd	23 abd	*12 abc
Sorghum	#1 bcd	14 acd	41 abd	0 abc
Soybeans	45 bd	70 ad	na	0 ab
Cattle	34 bd	11 acd	28 bd	na
Wheat	28	30	38	28
Hay	*7 bcd	*3 acd	18 abd	61 abc
Peanuts	55 bcd	*1 acd	*8 abd	0 abc
Fruits and vegetables	11 bcd	*1 ad	*2 ad	62 abc
Cotton acreage with crop insurance (percent):	91 cd	94 cd	99 abd	73 abc
Federal insurance:	87 cd	89 cd	98 abd	71 abc
Basic catastrophic	22 bd	66 ac	20 bd	63 ac
Buy-up	45 bd	15 acd	44 bd	*7 abc
Revenue	11 bcd	*5 acd	28 abd	0 abc
Private crop insurance	23 cd	23 cd	39 abd	*7 abc
Total operated acres per farm:	1,415 bcd	2,075 a	2,099 a	1,820 a
Owned and operated	471 bd	322 acd	611 b	928 ab
Rented:	942 bc	1,749 acd	1,477 abd	889 bc
Cash-rented	881 c	942 c	454 abd	871 c
Share-rented	60 bcd	807 acd	1,023 abd	#18 abc
Cropland	1,071 bcd	1,962 ac	1,634 ab	1,767 a
Principal operator occupation (percent):				
Farming	91	91	94	95
Nonfarm	*5	9	*5	#5
Principal operator age (mean):	55	54	55	55
Younger than 50 years (percent)	31	34	30	28
65 years or older (percent)	17	16 c	26 ab	20
Principal operator education (percent):				
High school	97	93	94	96
Completed college	17 bcd	32 ac	41 ab	40 a

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Table 6
Characteristics of 2007 cotton farms and operators, by region (continued)

Characteristic	Southeast (a)	Delta (b)	Southwest (c)	West (d)
Farm organization (percent):				
Sole/family proprietor	82 bd	68 acd	79 bd	51 abc
Partnership	11 bd	27 ac	13 bd	31 ac
Family corporation	6	5 d	*5 d	*12 bc
Gross cash income per farm (1,000 dollars):	690.6 bd	1,058.8 acd	620.7 bd	2,693.2 abc
Crop cash receipts	509.7 bd	839.4 acd	436.3 bd	2,258.5 abc
Government payments:	74.3 b	103.7 acd	66.4 bd	83.9 bc
Direct	32.2 bd	57.7 acd	30.0 bd	46.3 abc
Counter-cyclical	28.1 b	37.7 ac	28.2 b	34.4
Loan deficiency	2.9 c	2.1 c	*0.5 ab	#1.9
Other	11.1 bcd	6.3 ad	7.7 ad	#1.3 abc
Federal crop and livestock insurance	19.6 bcd	4.7 ad	6.9 ad	#0.4 abc
Cash production expenses	550.6 bcd	792.5 acd	398.9 abd	2,080.3 abc
Net cash income	140.0 bcd	266.3 a	221.8 ad	*612.9 ac
Household income per farm family (1,000 dollars):	120.6 bcd	189.9 a	207.7 a	*351.9 a
Farm income	81.0 bcd	153.5 a	155.9 a	*305.7 a
Off-farm income	39.6	36.4	51.9	*46.2
Earned income from business or job	25.0	25.8	25.0	*32.7
Percent with off-farm business or job	50 bd	61 a	54 d	73 ac
Average value per farm (1,000 dollars):				
Farm assets	2,166.5 bcd	1,661.9 ad	1,549.9 ad	7,245.4 abc
Farm debt	172.7 bd	232.4 acd	172.3 bd	*727.6 abc
Farm equity	1,993.7 bcd	1,429.6 ad	1,377.6 ad	*6,517.8 abc
Debt-to-asset percentage	9 bc	14 ac	11 ab	*10

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

# indicates that CV is above 50.

Notes: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.Sums may not total to exactly 100 due to rounding.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

cotton varieties grown in the West produce higher yields and garner higher prices for their lint, their irrigation needs and longer growing seasons tend to boost production costs per acre. In 2007, cotton yields in the West averaged 1,512 pounds per planted acre, more than 50 percent greater than the highest average yield for other cotton-producing regions. In 2007, all cotton acreage in the West was irrigated, while less than half the cotton acreage in other regions was irrigated (see table 5). The West's dependence on irrigation water for the cotton crop creates greater risk for producers should the supply or demand for irrigation water change significantly in this region. Thus, significant droughts, changes in irrigation water policies, and population growth in California, which would increase pressure to divert water supplies to California residents, may have significant impacts on cotton producers in the West.

In addition, irrigating usually raises per acre production costs for fuel, machinery and equipment, and land. The per acre costs for these items were highest in the West, pushing their operating, ownership, and economic cost of cotton production per acre above those for cotton producers in other regions (see table 4). Despite the high cotton production costs, producers in the West earned the highest average returns per acre after costs as a result of their above-average prices and yields.

Cotton producers in the West owned more acres per farm and had the highest ratio of owned-to-operated farmland. Cotton farms in this region also were the most likely to have multiple operators (see table 6). Multiple partners in the farm operation may have boosted the percentage of farmland owned by the farm operation through the combined use of partner-owned assets.

Cotton farms in the West generated the highest net cash income per farm in 2007, more than twice the average amount generated by cotton farms in other regions, even though cotton producers in the West operated fewer acres per farm than those in the Delta and Southwest. The above average net returns per acre from cotton production in the West, as well as their per acre returns from their fruit and vegetable production likely contributed to their high average net cash income per farm. Compared with cotton farms in other regions, Southeast cotton farms produced the lowest net cash income in 2007, partly as a result of the smaller number of acres operated and a widespread drought in the region.

Cotton Production, by Size of the Cotton Enterprise

The cost of production per acre and per pound of cotton did not vary significantly by the size of the enterprise. Cotton played a larger role on farms with larger cotton enterprises. Producers on these farms were at a greater financial risk if cotton yields or prices declined, but they also were more likely to take steps to mitigate their risks.

The sizes and characteristics of cotton enterprises vary widely. Cotton farms were divided into five classes based on the size of their cotton enterprise, where enterprise size was measured by the number of planted cotton acres per farm.

At the extreme ends, cotton producers with more than 1,500 acres of planted cotton accounted for 11 percent of U.S. cotton farms and 36 percent of U.S. cotton production, while producers with fewer than 200 acres of planted cotton accounted for 25 percent of cotton farms and 4 percent of cotton production in 2007 (see box, "Relationship Between Cotton Enterprise Size and Farm Typology"). Most U.S. cotton production occurs on farms with 500 or more acres of planted cotton. In 2007, they accounted for 80 percent of planted cotton acreage and 46 percent of all cotton farms (table 7).

In 2007, producers needed an average price of $0.49-$0.52 per pound, depending on enterprise size, to break even with the operating and ownership costs of cotton lint. These differences, however, were not statistically significant (i.e., due to chance). Cotton lint prices ranged from $0.56 to $0.58 per pound, well above the break-even price in each enterprise size category.

In 2007, the average operating and ownership costs ranged from $540 to $582 per acre of cotton for the enterprise classes, but these differences were statistically insignificant. With economies of size, operators with larger cotton enterprises often have lower costs per unit because they can spread their fixed costs over more units, and their larger size may allow them to negotiate better prices or receive discounts from bulk purchases. Average operating costs per acre ranged from $431 to $466 per acre and did not vary significantly by the number of planted cotton acres per farm. Average ownership costs per acre were higher for farms with more cotton acreage (see table 6), contrary to what might be expected from economies of size. Capital recovery of machinery and equipment contributes most to ownership costs. In 2007, producers with 1,500 acres of cotton averaged $119 per acre in capital recovery costs compared with $93 per acre for those with fewer than 200 acres of cotton.

ARMS data suggest that some producers with smaller cotton enterprises avoided purchasing large, specialized cotton machinery by relying on custom work,[8] which allowed small cotton enterprises to avoid capital recovery and repair costs for farm machinery. Custom costs per acre were higher for producers with smaller cotton enterprises, averaging $36 per acre for those with fewer than 200 acres of cotton compared with $16 per acre for those with 1,500 or more acres of cotton (table 7). Producers with smaller cotton enterprises made fewer trips over their fields, lending support to the fact that

[8]Custom workers supply their own farm machinery. Custom work is not considered a component of the farming sector; rather, it is a component of the service sector. Therefore, the capital recovery costs for farm machinery supplied for custom operations are not included in ERS's production cost accounts and the number of trips over a field does not include those for custom work.

Relationship Between Cotton Enterprise Size and Farm Typology

Commodity enterprise size and farm typology are related. The size of a crop enterprise is measured by the number of acres planted to the commodity, while farm typology is based on the annual gross sales of all commodities and the primary occupation of the operator. In many cases, farms with larger enterprises have higher sales unless there was a significant crop failure. Because the ratio of unharvested cotton acres to planted cotton acres was low in 2007, producers with larger cotton enterprises generally had higher farm sales. For example, in 2007, 69 percent of the producers planting 1,500 or more cotton acres had annual sales of $1 million or more.

Producers with higher farm sales may not always plant a large number of acres of the specific commodity. A significant percentage of these producers had small- to mid-size cotton enterprises. In 2007, 29 percent of cotton producers with annual agricultural sales of $1 million or more planted 1,500 or more acres of cotton, while 26 percent of them planted fewer than 500 acres of cotton (see box table). There is a stronger relationship between small cotton farms and small cotton enterprises than there is between large cotton farms and large cotton enterprises. Only 1 percent of small family farms planted 1,500 or more acres of cotton, while 89 percent of small cotton farms planted fewer than 500 acres of cotton.

Cotton farms, by cotton enterprise and farm typology, 2007

	Small family farms	Large family farms	Very large family farms	
Cotton acres	(less than $250,000)	($250,000-$499,999)	$500,000-$999,999	$1 million or more
		Percent of farms		
Fewer than 200	53	20	11	8
200-499	36	42	27	18
500-999	9	26	29	28
1,000-1,499	1	9	20	16
1,500 or more	1	2	12	29

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Since very large cotton farms do not necessarily have large cotton enterprises, the characteristics of very large cotton farms can differ from the characteristics of cotton farms with large cotton enterprises. The most striking difference between these two groups is their commodity diversity and dependence on cotton production. Very large cotton farms have more commodity diversification and are less dependent on cotton compared with farms with large cotton enterprises.

Table 7
Production costs and returns per planted acre for 2007 cotton, by enterprise size

Production item	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Cotton farms (percent)	25	30	23	11	11
Planted cotton acres (percent)	4	16	24	21	35
Cotton production quantity (percent)	4	15	24	21	36
Cotton producton value (percent)	4	15	26	20	36
Planted cotton acres per farm	105 bcde	342 acde	728 abde	1,231 abce	2,423 abcd
Cotton acres harvested (percent)	97 e	96 e	97	98	100 ab
Expected lint yield (pounds per planted acre)	1,047	1,021	1,081	1,035	1,051
Yield (pounds per planted acre):					
Cotton lint	872	834 cde	914 b	916 b	937 b
Cottonseed	1,411	1,1349 cde	1,478 b	1,482 b	1,515 b
Break-even price (dollars per pound of lint)	0.51	0.52	0.50	0.49	0.49
Operating and ownership costs not covered (percent of farms)	43.0	41.6	36.6	34.7	33.8
Price (dollars per pound):					
Cotton lint	0.58 de	0.57 c	0.58 bde	0.56 ac	0.56 ac
Cottonseed	0.09 bcde	0.08 ae	0.08 ade	0.08 ac	0.08 abc
Operating and ownership costs (dollars per pound of lint)	0.65	0.65	0.64	0.62	0.62
Costs and returns (dollars per planted cotton acre):					
Gross production value:	629	581 ce	654 b	631	642 b
Cotton lint	504	472 ce	532 b	513	524 b
Cottonseed	125 b	109 ace	121 b	118	118 b
Operating costs:	466	431	462	444	450
Seed	61	57	62	59	62
Fertilizer	67	64	65	62	60
Chemicals	64	60	66	61	64
Custom operations	36 cde	28 de	25 ae	21 ab	16 abc
Fuel, lube, and electricity	45	45	46	48	52
Repairs	26 cde	29 cde	32 abe	34 ab	35 abc
Ginning	138	125 ce	139 b	136	141 b
Purchased irrigation water	*11 de	*3 e	*6 de	#2 ac	*1 abc
Interest on operating capital	7	6	7	6	6
Hired labor	10 cde	11 cde	14 ab	15 ab	15 ab

--continued

Table 7
Production costs and returns per planted acre for 2007 cotton, by enterprise size (continued)

Production item	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Ownership costs:	101 cde	109 cde	120 ab	124 ab	126 ab
Capital recovery of machinery and equipment	93 cde	101 cde	112 abe	117 ab	119 abc
Taxes and insurance	8	8	8	7	7
Economic costs:	131 bcde	109 ade	100 ae	94 abe	79 abc
Opportunity cost of land	68 bde	57 ae	60 e	53 a	49 abc
Opportunity cost of unpaid labor	40 bcde	32 ace	25 abe	27 ae	17 abcd
General farm overhead	24 cde	20 cde	15 ab	14 ab	13 ab
Operating and ownership costs	567	540	582	568	577
Total costs	698	649	682	662	656
Production value less…					
Operating costs	163	150 ce	192 b	187	192 b
Operating and ownership costs	*62	*41 c	72 b	*63	65
Total costs	*-69 e	*-68 ce	*-28 b	#-31	#-13 ab

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

# indicates that CV is greater than 50.

Note: Letters a, b, c, d, and e indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

they had more custom work done in their cotton fields (table 8). In addition, 34 percent of the operators with the smallest cotton enterprises had their cotton custom harvested in 2007 compared with just 2 percent of the operators with the largest cotton enterprises. Higher repair costs per acre for producers with larger cotton enterprises indicate that they were more likely to use their own or leased machinery in field operations.

Cotton equipment often cannot be adapted for use on other crops. Hence, operators must have sufficient cotton acreage to justify the purchase of machinery that can only be used on cotton. Cotton harvesters tend to be more expensive than other farm equipment designed for crop use. A four-row cotton picker with spindle cost $272,000 in 2007, second only to combines as the most expensive machinery based on the *Agriculture Prices 2007 Summary* (USDA/NASS, 2008a). In 2007, harvesting cotton also required module builders, which were expensive, although less so than cotton pickers.

Only one of the return measures—the value of production less total costs—shows a statistically significant and positive correlation with the number of cotton acres per farm (see table 7). Including economic costs in total costs contributed to making these returns per acre statistically significant since the economic cost per acre was lower on farms with more cotton acres in 2007.

Table 8
Production practices on 2007 cotton acreage, by enterprise size

Production practice	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Cotton planted acres (percent):					
Dryland	59	65 e	61 e	55	52 bc
Irrigated	41	35 e	39 e	45	48 bc
Upland	96 de	98 c	95 bde	99 ac	99 ac
Pima	*4 de	*2 c	*5 bde	#1 ac	*1 ac
Farms irrigating cotton (percent)	38	37	41	46	45
Crop rotation (percent of acres):					
Cotton	37 bcde	58 ace	66 ab	65 a	70 ab
Legumes	*11 de	9 de	6 e	*3 ab	*3 ab
Grass	41 bcde	28 ac	21 ab	23 a	21 a
Idle or Conservation Reserve Program	*9 bc	*3 a	#3 a	*6	#5
Seed used (pounds per acre)	11.4 bde	10.4 a	10.8	10.3 a	10.5 a
Seed variety (percent of acres):					
Herbicide resistant	32	24	25	26	31
Bt	9 b	16 ace	*8 b	10	*9 b
Stacked gene	49	50	56	58	56
Other	*10	10 e	11 e	*7	*4 bc
Energy use:					
Gasoline (gallons per acre)	1.0	0.9	1.0	0.9	1.0
Diesel (gallons per acre)	13.5	9.9 d	11.5	14.2 b	11.3
Liquefied petroleum gas (gallons per acre)	#0.7	*0.3	#1.3	na	#0.6
Natural gas (1,000 cubic feet per acre)	#0.2	#0.7	#0.3	#0.1	#0.4
Electricity (kilowatt hour per acre)	*75.1	85.2	*89.5	*65.2	*122.3
Fertilizer and manure use:					
Nitrogen (pounds per acre)	81	75	80	75	83
Phosphorous (pounds per acre)	30	30	29	32	26
Potassium (pounds per acre)	40	41 e	39	37	32 b
Lime (tons per acre)	0.2	0.2 e	0.2	0.2	0.1 b
Nitrogen (percent of farms)	89	89	91	90	93
Phosphorous (percent of farms)	71	73 e	67	75 e	63 bd
Potassium (percent of farms)	62 de	58 d	53	48 ab	51 a
Lime (percent of farms)	46 de	41 de	34	33 ab	33 ab

--continued

Table 8
Production practices on 2007 cotton acreage, by enterprise size (continued)

Production practice	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Chemical use:					
Herbicides (percent of acreage)	95 de	94 de	93 de	99 abc	99 abc
Insecticides (percent of acreage)	67	67	69	63	63
Herbicides (treatments per acre)	2.7 bcde	3.4 a	3.5 a	3.8 a	3.7 a
Insecticides (treatments per acre)	2.0	2.2	2.5	2.1	2.2
Trips over field (number)	8.8 bcde	10.0 acde	11.2 abe	11.0 abe	11.9 abcd
Farms custom harvesting (percent)	34.2 bcde	16.1 ae	*10.1 ae	*11.6 ae	*2.2 abcd
Labor (hours per acre):	2.8 e	2.5 e	2.5 e	2.8 e	2.3 abcd
Paid	1.0 cde	1.1 cde	1.4 ab	1.5 ab	1.5 ab
Unpaid	1.8 bcde	1.4 ace	1.1 abe	1.3 ae	0.8 abcd
Farms with paid labor (percent)	50 bcde	64 acde	80 abde	91 abc	94 abc
Machinery maximum width (feet):					
Planter	21.5 bcde	25.6 acde	27.6 abe	28.6 abe	32.3 abcd
Harvester	14.8 cde	16.2 ae	18.3 ae	18.6 a	19.8 ab

Coefficient of variation (CV) = (Standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50.

# indicates that CV is above 50.

na indicates value is not available due to no observations, an undefined statistic, or reliability concerns.

Note: Letters a, b, c, d, and e indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.

Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Economic costs are the sum of the opportunity costs for land and unpaid labor and general farm overhead. All three of these economic costs were significantly lower on a per acre basis for farms with more cotton acreage. Their opportunity cost of land was lower since cotton acres in the Southwest account for a larger share of their total cotton acres. The opportunity cost of cotton land is low in the Southwest, or $31 per acre compared with an average $62-$141 per acre for other regions (see table 4).

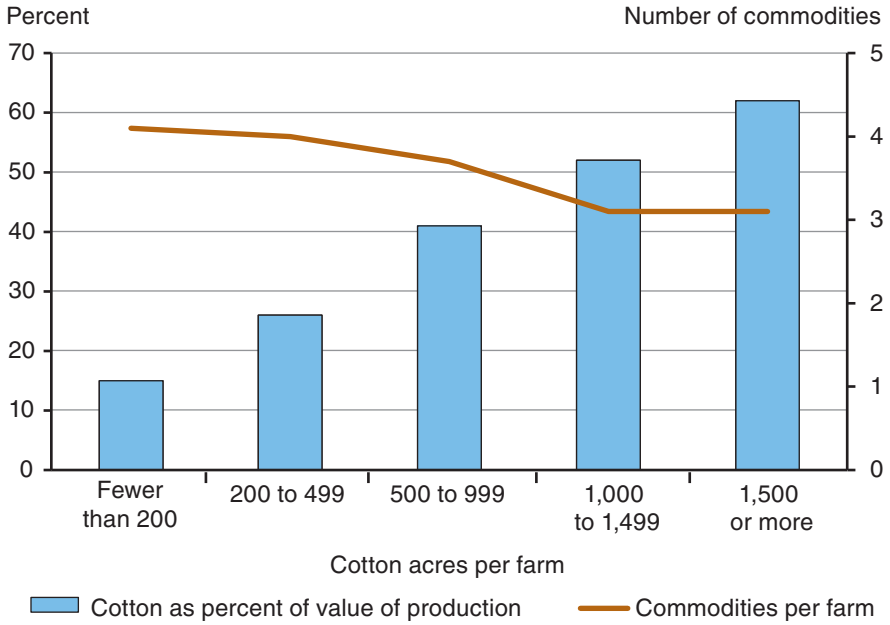
Production practices and inputs do not vary greatly by enterprise size, with a few notable exceptions. Farms with larger cotton enterprises had a higher proportion of labor hours per acre supplied by paid laborers. The unpaid labor hours that can be provided by operators and their family members are often insufficient to meet the labor needs of larger enterprises. Nearly all farms with 1,500 or more acres of cotton (94 percent) used hired labor compared with half of farms with fewer than 200 acres of cotton (see table 8).

In 2007, producers with more cotton acres per farm were less likely to rotate crops in their cotton fields, partly as a result of their lower levels of crop diversification and cotton's dominance on their farm operations (fig. 4).[9] Seventy percent of producers with 1,500 or more acres of cotton did not plant their 2007 cotton field with other crops in 2006 compared with 37 percent

[9]Note the definitional differences between farms with the largest cotton enterprises and the largest cotton farms. See box, "Relationship Between Cotton Enterprise Size and Farm Typology." Many of the farms with the largest cotton enterprises will also be large cotton farms, but many large cotton farms will not have large cotton enterprises.

Figure 4
Cotton's role on farms, by cotton enterprise size, 2007

Farms with larger cotton enterprises tend to specialize in cotton. They grow fewer commodities per farm, and cotton accounts for a higher percentage of their value of production.



Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

of producers who grew fewer than 200 acres of cotton in 2007 (see table 8). More than half of the acreage on farms with 1,500 or more acres of cotton was planted to cotton in 2007 compared with 13 percent of the acreage on farms planting fewer than 200 acres of cotton.

Cotton's production value to total production value averaged 15 percent on farms with fewer than 200 cotton acres compared with 62 percent for farms with 1,500 acres or more of cotton in 2007. As stated in the previous section, these higher percentages indicate increased risk for variations in farm income if conditions outside of a producer's control change the demand, yields, or prices for U.S. cotton.

Farms with greater commodity diversity face less financial risks since they often have greater flexibility to shift production between commodities when supply and demand change, and they often rely less on income from any one commodity. Farms with 1,500 or more acres of cotton in 2007 averaged 3.1 commodities per farm, compared with 4.1 or more commodities per farm for farms with fewer than 200 acres of cotton.

Producers with more cotton acreage also tend to have higher percentages of debt to assets. These producers are at greater risk of defaulting on their loans should their income levels drop. In 2007, producers with fewer than 1,000 acres of cotton had debt-to-asset levels averaging 9 percent compared with 16 percent for producers with 1,500 or more acres of cotton. Higher average debt-to-asset percentages are usually found on farms with large enterprises

devoted to one crop.[10] These farms were the least likely to have operators who were 65 years or older. Older operators tend to have lower debt-to-asset percentages since they have had more time to repay their debt obligations.

Cotton producers facing greater risk from farm income variability and loan repayment problems as a result of high percentages of cotton to total acres, cotton production value to total production value, and debt to assets were more likely to mitigate these risks. In 2007, 98 percent of operators with 1,500 or more cotton acres insured their cotton crop through Federal or private crop insurance compared with 77 percent of cotton producers with fewer than 200 acres of cotton (table 9). Producers with more cotton acreage also were more likely to purchase higher levels of insurance coverage for their cotton crop. According to Shields (2010), basic catastrophic and buy-up policies provided payments based on yield losses, with buy-up policies providing greater benefit levels than basic policies. Federal revenue policies are based on both prices and yields, so they provide income protection to producers. In 2007, 22 percent of producers with the largest cotton enterprises obtained Federal revenue insurance policies on their cotton crop compared with 8 percent of producers with the smallest cotton enterprises (table 9).

Producers can mitigate their financial risks by share-renting farmland. In share-renting, the landlord often receives a percentage of the crop and, therefore, shares in the risks for price and yield changes. In 2007, producers with fewer than 200 acres of cotton per farm share-rented 23 percent of their total farm acres, while producers with 1,500 or more cotton acres per farm shared-rented 44 percent of their farm acres.

Producers with the largest cotton enterprises are slightly younger, on average, and they are more likely to have a partnership arrangement on their farms compared with producers with the smallest cotton enterprises. Cotton producers with different sizes of cotton enterprises showed no distinguishable difference in their level of education. In 2007, the off-farm income received by cotton producers' families did not vary significantly by the size of the cotton enterprise, even though considerable variation did exist in the average farm income received per farm family among these groups.

[10]See http://www.ers.usda.gov/data-products/commodity-costs-and-returns/readings.aspx for a series of bulletins on the "Characteristics and Production Costs" for crops and livestock.

Table 9
Characteristics of 2007 cotton farms and operators, by enterprise size

Characteristic	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Cotton as percent of value of production	15 bcde	26 acde	41 abde	52 abc	62 abc
Commodities per farm	4.1 de	4.0 cde	3.7 bde	3.1 abc	3.1 abc
Farms producing (percent):					
Cotton under a contract	35 bde	50 a	42 d	55 ac	52 a
Corn	47 de	50 de	43 a	32 ab	29 abc
Sorghum	17	24	20	*18	23
Soybeans	31 d	30 d	30 d	20 abce	29 d
Cattle	31 de	27 e	24 e	18 a	13 abc
Wheat	28	35	35	33	32
Hay	*16	13	17 e	*9	*7 c
Peanuts	27 cde	25 cde	15 ab	16 ab	16 ab
Fruits or vegetables	*6	9	*10	*7	*6
Farms in Southwest (percent)	35	44	49	56	51
Cotton acreage with crop insurance (percent):	77 bcde	92 ace	96 ab	95 a	98 ab
Federal insurance:	71 bcde	87 ace	93 ab	92 ae	96 abd
Basic catastrophic	32	28 c	39 b	33	35
Buy-up	26 b	36 a	36	36	34
Revenue	*8 de	14 e	13 e	17 a	22 abc
Private crop insurance	21 e	25 e	27	30	36 ab
Total acres per farm:	839 bcde	1,433 acde	2,134 abe	2,465 abe	4,069 abcd
Owned and operated	289 bcde	447 ae	*695 a	581 a	814 ab
Rented:	547 bcde	984 acde	1,421 abde	1,878 abce	3,251 abcd
Cash-rented	350 bcde	606 ade	781 ae	907 abe	1,447 abcd
Share-rented	197 bcde	379 acde	640 abde	971 abce	1,804 abcd
Cropland	655 bcde	1,127 acde	1,676 abde	2,160 abce	3,611 abcd
Principal operator occupation (percent):					
Farming	87 cde	92 de	96 ade	99 abc	99 abc
Nonfarm	*12 cde	*7 cde	*2 abe	#1 ab	*1 abc
Principal operator age (mean):	56 ce	56 e	54 a	54	52 ab
Younger than 50 years (percent)	26 e	30	34	35	37 a
65 years or more (percent)	*24	23 e	20 e	17	13 bc

--continued

Table 9
Characteristics of 2007 cotton farms and operators, by enterprise size (continued)

Characteristic	Fewer than 200 acres (a)	200-499 acres (b)	500-999 acres (c)	1,000-1,499 acres (d)	1,500 or more acres (e)
Principal operator education (percent):					
High school	95	96	94	93	96
Completed college	31	29	38	31	29
Farm organization (percent):					
Sole or family proprietor	89 bcde	76 ae	73 ae	72 ae	58 abcd
Partnership	*8 cde	12 cde	19 abe	22 abe	38 abcd
Family corporation	*2 bc	*8 a	*6 a	#6	*4
Gross cash income per farm (1,000 dollars):	335.7 bcde	651.1 acde	978.5 abe	1,160.9 abe	1,920.1 abcd
Crop cash receipts	250.0 bcde	469.5 acde	767.2 abe	903.8 abe	1,464.5 abcd
Government payments:	30.7 bcde	60.5 acde	89.3 abde	104.2 abce	175.0 abcd
Direct	16.2 bcde	28.9 acde	42.1 abde	50.9 abce	83.8 abcd
Counter-cyclical	10.4 bcde	22.5 acde	36.0 abe	41.6 abe	72.8 abcd
Loan deficiency	#0.7 be	*2.1 a	*1.6	*1.3	*3.1 a
Other	*3.4 bcde	7.0 ae	9.6 ae	10.5 a	15.3 abc
Federal crop and livestock insurance	6.7 e	9.4 e	10.1 e	*7.8 e	20.4 abcd
Cash production expenses	258.7 bcde	499.8 acde	711.9 abe	827.1 abe	1,352.1 abcd
Net cash income	77.0 bcde	151.3 acde	266.6 abe	333.8 abe	568.1 abcd
Household income per farm family (1,000 dollars):	84.1 bcde	134.1 acde	229.9 abe	261.5 abe	355.4 abcd
Farm income	*43.1 bcde	86.1 acde	182.9 abe	225.6 ab	308.7 abc
Off-farm income:	41.0	48.0	*47.0	35.9	46.7
Earned income from business or job	24.9	32.0 cd	19.9 b	18.8 b	27.3
Percent with off-farm business or job	61	52	55	55	54
Average value per farm (1,000 dollars):					
Farm assets	1,128 bcde	1,999 ae	2,433 a	2,489 ae	3,189 abd
Farm debt	97 bcde	173 ade	214 ae	300 abe	504 abcd
Farm equity	1,031 bcde	1,826 ae	2,220 a	2,189 a	2,684 ab
Debt-to-asset percentage	9 e	9 e	9 e	12	16 abc

Coefficient of variation (CV) = (Standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is above 50.
na indicates value is not available due to no observations, an undefined statistic, or reliability concerns.
Notes: Letters a, b, c, d, and e indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic. Total may not sum to 100 due to rounding.
Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Cotton Production, by Farm Typology

The largest farms dominate cotton production. These farms were the most likely to irrigate their cotton acres and used more inputs per acre of cotton. On average, the largest cotton farms were more diversified in their commodity production and less dependent on cotton production. Operators of these farms were slightly younger and were more likely to be in a farm partnership arrangement.

While the number of cotton farms is spread somewhat evenly among the four ERS typology groups (table 10), 2007 ARMS data show that most cotton production takes place on the largest cotton farms.[11] Farms with $1 million or more of annual agricultural sales accounted for 26 percent of all U.S. cotton farms, but they produced just over 50 percent of the cotton lint. In contrast, small family farms accounted for 28 percent of all U.S. cotton farms and produced 8 percent of the cotton lint.

[11]See Glossary for a definition of farm typology classes. Also, see Appendix II for a comparison of Census of Agriculture and ARMS data on the distribution of cotton farms by typology classes.

Since the share of cotton farms in each farm typology class was roughly the same, differences in the number of planted cotton acres per farm and the proportion of planted cotton acres harvested contributed to the concentration of cotton production on very large farm operations. Small family farms averaged 254 acres of planted cotton per farm, while the largest family farms averaged 1,241 acres of planted cotton per farm (see box, "Relationship Between Cotton Enterprise Size and Farm Typology"). In 2007, small family farm operators abandoned a larger share of their cotton acres (5 percent) than operators of the largest cotton farms (less than 1 percent).

Southwest cotton producers planted more cotton acres in 2007 than producers in any other region, and they dominated the cotton acres planted in each of the farm typology groups except for producers with $1 million or more in annual agricultural sales (fig. 5). In that group, Delta cotton producers planted the most cotton acres. Most cotton production in the Delta region occurred on farms with gross annual sales of $1 million or more.

For 2007, the average price received for cotton lint exceeded the average break-even price for three of the four farm typology groups. Producers with the largest farms—those with the highest annual sales—were the most likely to recover operating and ownership costs of cotton production from cotton revenue in 2007. For the fourth typology group—large family farms—the average price for cotton lint matched the break-even price. Half of the producers in this group recovered their operating and ownership costs for cotton production.

In 2007, the average operating and ownership costs attributed to cotton lint ranged from $0.48 to $0.55 per pound among the typology classes, but the costs did not follow a straightforward pattern. Producers with very large cotton farms—gross annual sales between $500,000 and $999,999—had the lowest average cotton lint cost ($0.48 per pound), while producers of large farms—gross annual sales between $250,000 and $499,999—had the highest lint cost ($0.55 per pound). Since cotton lint costs per pound consist of two components—the cost per planted acre and the yield per planted acre—each will be examined in more detail.

Table 10
Production costs and returns per planted acre for 2007 cotton, by farm typology

Production item	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Cotton farms (percent)	28	21	25	26
Planted cotton acres (percent)	10	15	29	45
Cotton production quantity (percent)	8	12	28	52
Cotton production value (percent)	8	12	28	53
Planted cotton acres per farm	254 bcd	510 acd	826 abd	1,231 abc
Cotton acres harvested (percent)	95 d	97 d	99	100 ab
Expected lint yield (pounds per planted acre)	851 cd	891 cd	972 abd	1,125 abc
Yield (pounds per planted acre):				
Cotton lint	689 cd	703 cd	847 abd	1,005 abc
Cottonseed	1,114 cd	1,137 cd	1,371 ab	1,626 abc
Break-even price (dollars per pound of lint)	0.49	0.55 c	0.48 b	0.52
Operating and ownership costs not covered (percent)	43.1	50.3 d	40.8	36.2 b
Price (dollars per pound):				
Cotton lint	0.55 d	0.55 d	0.56 d	0.59 abc
Cottonseed	0.08 d	0.08 cd	0.08 bd	0.08 abc
Operating and ownership costs (dollars per pound of lint)	0.62	0.68 c	0.61 bd	0.65 c
Costs and returns (dollars per planted cotton acre):				
Gross value of production:	468 cd	475 cd	579 abd	726 abc
Cotton lint	381 cd	388 cd	471 abd	592 abc
Cottonseed	86 cd	87 cd	108 abd	134 abc
Operating costs:	337 cd	372 d	397 ad	518 abc
Seed	51 d	57 d	55 d	66 abc
Fertilizer	44 bd	58 ad	51 d	73 abc
Chemicals	50 bd	59 ad	55 d	75 abc
Custom operations	23 c	19 d	15 d	26 bc
Fuel, lube, and electricity	33 d	36 d	42 d	55 abc
Repairs	24 cd	27 acd	31 abd	37 abc
Ginning	101 cd	101 cd	127 abd	154 abc
Purchased irrigation water	*1 d	#0 d	*1 d	4 abc
Interest on operating capital	5 bd	6 ad	6 d	7 abc
Hired labor	6 bcd	9 acd	13 abd	18 abc

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Table 10
Production costs and returns per planted acre for 2007 cotton, by farm typology (continued)

Production item	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Ownership costs:	89 bcd	105 acd	119 abd	135 abc
Capital recovery of machinery and equipment	83 bcd	98 acd	111 abd	127 abc
Taxes and insurance	7 d	6 d	7	9 ab
Economic costs:	94	95 c	82 bd	101 c
Opportunity cost of land	42 d	50 d	42 d	65 abc
Opportunity cost of unpaid labor	37 cd	32 cd	26 abd	20 abc
General farm overhead	15	14 d	15	17 b
Operating and ownership costs	426 bcd	477 acd	515 abd	653 abc
Total costs	520 cd	572 d	598 ad	755 abc
Production value less…				
Operating costs	131 cd	103 cd	182 ab	208 ab
Operating and ownership costs	*41	#-2 cd	63 b	73 b
Total costs	#-53	-97 cd	#-19 b	*-28 b

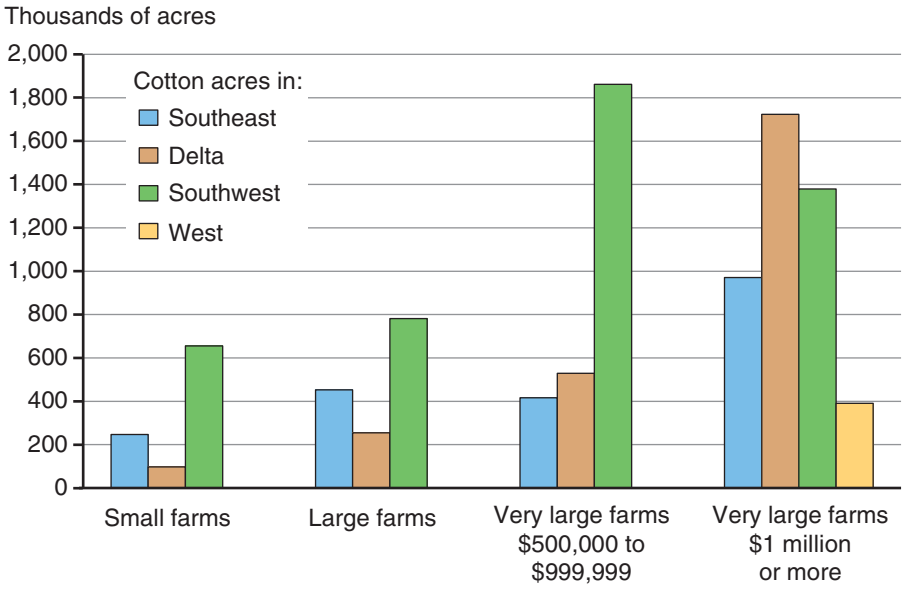
Coefficient of variation (CV) = (Standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is above 50.
Note: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.
Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

The average operating and ownership costs per planted acre of cotton were higher on farms with greater annual gross sales, even though more cotton acres were planted per farm. Differences in the average cost per acre among the typology classes were statistically significant. In 2007, producers with gross annual sales of $1 million or more averaged $653 per acre in operating and ownership costs compared with $426 per acre for small family farms with gross annual sales of less than $250,000 (see table 10). This contradicts what one normally expects, since farms with more acreage devoted to a particular commodity often will have lower costs per unit due to economies of size. With economies of size, fixed costs can be spread over more output units and operators are more likely to receive discounts for bulk purchases of inputs, which would lower the operating cost per unit.

Farms with sales of $1 million or more had higher-than-average costs per planted acre for two reasons. First, they had higher average cotton yields per planted acre, so their ginning costs per acre were higher. In 2007, cotton lint yields averaged 689 pounds for small family farms compared with 1,005 pounds for the largest family farms. Second, operators of the largest farms were more likely to plant Pima cotton or specialized varieties of upland cotton that are more expensive to produce because of their longer growing season, irrigation needs, and, in the case of Pima cotton, more expensive ginning techniques.

Figure 5
Cotton acres, by region and typology, 2007

Most of the cotton acres in 2007 were planted by very large cotton farms in the Delta and Southwest.



Note: The number of cotton acres in the West on small, large, and very large farms with sales of $500,000-$999,999 is not available due to statistical quality or confidentiality concerns.

Source: USDA's 2007 cotton version of the Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Operators of larger farms achieved higher cotton yields per planted acre based on a variety of factors. Larger cotton farms were more likely to irrigate their cotton, which reduces yield losses. In 2007, 48 percent of the cotton acres on cotton farms with sales of $1 million or more were irrigated compared with 23 percent on small family farms (table 11). Most Pima cotton, with its higher yields, was grown on farm operations with sales of $1 million or more. From 2003 to 2007, the weighted annual yield averaged 812 pounds of cotton lint per harvested acre for upland cotton compared with 1,260 pounds per acre for Pima cotton (USDA/NASS, 2011). Finally, operators of larger farms harvested 97 percent or more of their planted cotton acres compared with 95 percent for operators of small family farms.

Cotton farms with sales of $1 million or more used more inputs per acre of cotton production in 2007 than farms in any other typology class. Diesel fuel and electricity consumption per planted cotton acre was significantly higher on very large farms; these were the two most commonly used energy sources to operate irrigation pumps. Operators of the largest cotton farms were most likely to apply nitrogen, and just over 75 percent applied insecticide to their cotton acres compared with 50-61 percent of the producers of smaller cotton farms.

Producers with the largest cotton farms made more trips over their cotton fields, 11.4 trips on average compared with 8.8 trips for producers with small family farms. In addition to being the least likely to use nitrogen and insecticides in 2007, small farms producers were more likely to abandon their

Table 11
Production practices on 2007 cotton acreage, by farm typology

Production practice	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Cotton planted acres (percent):				
Dryland	77 cd	81 cd	63 abd	52 abc
Irrigated	*23 cd	19 cd	37 abd	48 abc
Upland	100 d	100 d	99	94 ab
Pima	*0 d	#0 d	#1	6 ab
Farms irrigating cotton (percent)	*23 cd	24 cd	41 abd	54 abc
Crop rotation (percent of acres):				
Cotton	64	70	74 d	64 c
Legumes	*6	*4	4	5
Grass	22	23	18	23
Idle or Conservation Reserve Program	#3	*2	#3	*4
Seed used (pounds per acre)	10.7	10.1	10.9	10.7
Seed variety (percent of acres):				
Herbicide resistant	26 c	30	40 ad	20 c
Bt	*11	*12	7	9
Stacked gene	50	51	48 d	62 c
Other	*13 c	*7	*5 a	9
Energy use:				
Gasoline (gallons per acre)	0.8 bcd	1.0 a	1.0 a	1.0 a
Diesel (gallons per acre)	7.4 cd	8.8 d	10.4 ad	13.7 abc
Liquefied petroleum gas (gallons per ace)	0.0	na	na	#1.0
Natural gas (1,000 cubic feet per acre)	na	#0.1 c	*0.5 b	#0.3
Electricity (kilowatt hour per acre)	*52.2 d	#72.7	45.2 d	114.7 ac
Fertilizer and manure use:				
Nitrogen (pounds per acre)	55 d	64 d	70 d	90 abc
Phosphorous (pounds per acre)	19 bd	28 a	25	30 a
Potassium (pounds per acre)	24 bd	34 ad	29 d	44 abc
Lime (tons per acre)	0.1 bd	0.2 ac	0.1 bd	0.2 ac
Nitrogen (percent of farms)	81 cd	90 d	94 a	96 ab
Phosphorous (percent of farms)	67	76	70	71
Potassium (percent of farms)	56	62	60	59
Lime (percent of farms)	42	48 c	35 bd	44 c

--continued

Table 11
Production practices on 2007 cotton acreage, by farm typology (continued)

Production practice	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Chemical use:				
Herbicides (percent of acres)	97	97	98	96
Insecticides (percent of acres)	52 d	61 cd	50 bd	77 abc
Herbicides (treatments per acre)	3.0 bd	3.6 ac	3.3 bd	3.7 ac
Insecticides (treatments per acre)	1.2 bd	2.4 a	1.6 d	2.9 ac
Trips over field	8.8 bcd	10.5 ad	10.8 a	11.4 ab
Farms custom harvesting (percent)	31.2 bcd	13.0 a	*7.7 a	10.8 a
Labor (hours per acre):	2.4	2.5	2.5	2.7
Paid	0.6 bcd	1.0 acd	1.3 abd	1.8 abc
Unpaid	1.7 bcd	1.4 ad	1.2 ad	0.9 abc
Farms with paid labor (percent)	40 bcd	63 acd	85 ab	91 ab
Machinery maximum width (feet):				
Planter	22.5 bcd	25.9 ad	26.8 ad	29.4 abc
Harvester	16.2	15.7 cd	17.9 b	18.2 b

Coefficient of variation (CV) = (Standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is above 50.
na indicates that a value is not available due to no observations, an undefined statistic, or reliability concerns.
Note: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic.
Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

cotton acres and were nearly three times as likely to custom harvest their cotton acreage compared with the largest cotton farm producers.

Total labor hours per acre for cotton production in 2007 did not vary significantly among the farm size classes. The ratio of paid labor hours to total labor hours per cotton acre, however, did vary significantly over the same period. Paid labor hours per acre ranged from 25 percent to 67 percent of total labor hours per acre in 2007, with a higher share for those with larger farms. Operators with the smallest farms were the least likely to hire labor for cotton production (40 percent), while operators with the largest farms were the most likely to hire labor (91 percent). Because operators with the largest farms planted an average of 1,231 acres of cotton in 2007, these operators often hired workers to assist with planting, maintaining, and harvesting the cotton. In contrast, operators with the smallest farms planted an average of 254 acres of cotton per farm, and these acres could frequently be attended to by the operators and unpaid family members.

Although more trips were made across cotton fields on the largest cotton farms in 2007, the labor hours expended per cotton acre were not significantly different based on the size of the cotton farm, partly as a result of the maximum width of machinery used in the cotton operation. On average, in

2007, operators with the largest farms used larger planters (29 feet wide), while operators with the smallest farms used smaller planters (23 feet wide).

Operators with the largest farms are the least dependent on cotton production and rely on the greatest commodity diversity.[12] Cotton accounted for 33 percent of all agricultural production value on the largest farms compared with 53-61 percent on smaller cotton farms (table 12). Operators of the largest cotton farms produced an average of 4.4 agricultural commodities per farm compared with 3.7 or less commodities for operators in other farm typology groups. Operators of the largest farms were more likely to grow corn, soybeans, wheat, fruits, and vegetables and less likely to raise cattle.

Operators with the largest farms were less likely to purchase Federal revenue insurance but more likely to purchase buy-up insurance on their cotton crop.[13] Crop revenue insurance provides income coverage for low prices or low yields, while catastrophic (CAT) and buy-up insurance provides coverage for low yields (Shields, 2010). The operators of the largest cotton farms may have been the least likely to purchase cotton revenue insurance because they were at the least risk from income fluctuations caused by deviations in cotton prices or cotton yields.

The characteristics of the largest cotton farms and their operators differed from those in the other typology classes. Principal operators of the largest farms tended to be younger and were more likely to list farming as their primary occupation than operators of smaller farms. In 2007, operators with the largest farms were more efficient at generating gross cash income per dollar of cash expenses from the farm operation than operators of smaller farms. On average, the largest family farms generated an average of $142 in gross cash income for every $100 in cash production expenses, compared with an average of $109 in gross cash income by small family farms. The average annual net cash income earned per farm varied widely among the farm typology classes. Operators of small cotton farms earned an average of $11,600 per farm, while operators of large cotton farms earned an average of $637,700 per farm. Differences in farm size and financial efficiency contributed to differences in average income per farm.

The annual household income of cotton operators varied considerably by farm size in 2007. Large and small family farm operators' household incomes averaged less than $60,000 in 2007, with most of their household income coming from off-farm sources. In contrast, household income for operators of very large farms averaged $175,000 or more, with farm income the major source of income.

The average annual value of farm equity per farm was higher for larger farms. The equity in small farms averaged $864,000 per farm, compared with $3,618,000 per farm for the largest cotton farms in 2007. The largest cotton farms were more likely to have multiple farm owners and to be organized in a partnership arrangement. Partnership arrangements allow owners to pool resources (see the Glossary for a definition of farm organization). Although farm equity per farm was highest on very large farms, operators of these farms had higher average ratios of debt-to-farm assets, indicating that these operators are at a greater risk to default on loans should farm income drop for several years.

[12]The largest cotton farms are not the same as farms with the largest cotton enterprises. The largest cotton farms are those farms whose operators planted at least 1 acre of cotton with the intention of harvesting the cotton for lint and whose operators had gross annual sales of $1 million or more from all commodities. See box, "Relationship Between Cotton Enterprise Size and Farm Typology." Some of the largest cotton farms have small cotton enterprises.

[13]In 2007, crop revenue insurance was unavailable for Pima cotton. The influence on the statistics presented here would be minimal because Pima cotton was grown on only 2 percent of the cotton acreage, according to 2007 ARMS data.

Table 12
Characteristics of 2007 cotton farms and operators, by farm typology

Characteristic	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Cotton as percent of production value	61 d	53 d	55 d	33 abc
Commodities per farm	3.2 bcd	3.7 ad	3.7 ad	4.4 abc
Farms producing (percent):				
Cotton under contract	38	46	48	48
Corn	28 bcd	49 a	43 ad	54 ac
Sorghum	20	19	26	19
Soybeans	19 bcd	31 a	29 ad	37 ac
Cattle	31 cd	29 d	20 a	18 ab
Wheat	*22 cd	26 cd	38 ab	42 ab
Hay	*11	*16	11 d	16 c
Peanuts	21	23	17	22
Fruits or vegetables	*3 d	*4 d	*7 d	20 abc
Farms in Southwest (percent)	49	43	51	26
Cotton acreage with crop insurance (percent):	92	95	97 d	93 c
Federal insurance:	90	93	96 d	91 c
Basic catastrophic	*25 d	30 d	28 d	43 abc
Buy-up	43 d	37 d	45 d	24 abc
Revenue	*18	22	19	19
Private crop insurance	*22	*23	36	28
Total acres per farm:	680 bcd	1,312 acd	1,899 abd	3,558 abc
Owned and operated	257 bcd	380 acd	515 ad	927 abc
Rented:	408 bcd	930 acd	1,380 abd	2,629 abc
Cash-rented	189 bcd	586 ad	520 ad	1,583 abc
Share-rented	219 bcd	344 acd	860 abd	1,046 abc
Cropland	529 bcd	1,063 acd	1,623 abd	2,935 abc
Principal operator occupation (percent):				
Farming	87 cd	92 d	96 a	98 ab
Nonfarming	12 bcd	*5 a	*4 a	*2 a
Principal operator age (mean):	58 bcd	54 a	54 ad	52 abc
Younger than 50 years (percent)	26 d	32	29	38 a
65 years or more (percent)	32 bcd	19 a	15 a	14 a

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Table 12
Characteristics of 2007 cotton farms and operators, by farm typology (continued)

Characteristic	Small family farms (a)	Large family farms (b)	Very large family farms	
			$500,000-$999,999 (c)	$1 million or more (d)
Principal operator education (percent):				
High school	93 bd	97 ac	92 bd	98 ac
Completed college	25	35	33	34
Farm organization (percent):				
Sole or family proprietor	95 bcd	83 acd	70 abd	56 abc
Partnership	#2 bcd	*13 ad	18 ad	33 abc
Family corporation	na	#4 c	8 b	7
Gross cash income per farm (1,000 dollars):	140.4 bcd	385.5 acd	715.3 abd	2,143.4 abc
Crop cash receipts	86.8 bcd	260.0 acd	511.7 abd	1,698.1 abc
Government payments:	26.6 bcd	55.4 acd	80.0 abd	151.3 abc
Direct	12.3 bcd	23.3 acd	37.9 abd	78.6 abc
Counter-cyclical	10.4 bcd	23.5 acd	30.6 abd	57.5 abc
Loan deficiency	*1.1	*1.7	*1.5	2.4
Other	*2.7 bcd	7.0 ad	10.1 a	12.8 ab
Federal crop and livestock insurance	6.4 cd	9.1 d	11.0 a	14.5 abc
Cash production expenses	128.7 bcd	334.3 acd	526.4 abd	1,505.7 abc
Net cash income	*11.6 bcd	*51.2 acd	188.9 abd	637.7 abc
Household income per family (1,000 dollars):	44.9 cd	*58.6 cd	175.6 abd	457.4 abc
Farm income	#3.3 cd	#17.5 cd	139.5 abd	400.0 abc
Off-farm income:	41.6	41.1	36.1	57.2
Earned income from business or job	27.5	22.9	21.6	27.9
Percent with off-farm business or job	57	53	54	56
Average value per farm (1,000 dollars):				
Farm assets	912 bcd	1,521 ad	1,779 ad	4,096 abc
Farm debt	48 bcd	127 acd	209 abd	478 abc
Farm equity	864 bcd	1,394 ad	1,570 ad	3,618 abc
Debt-to-asset percentage	5 bcd	8 acd	12 ab	12 ab

Coefficient of variation (CV) = (Standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is above 50.
na indicates that a value is not available due to no observations, an undefined statistic, or reliability concerns.
Notes: Letters a, b, c, and d indicate that the estimates are significantly different from the indicated group at the 90-percent level or higher using the *t*-statistic. Sums may not total to 100 due to rounding.
Source: USDA's 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Conclusions

Cotton farms vary considerably in how much they rely on cotton. Cash receipts from the sale of cotton constitute a high percentage of total farm receipts for some cotton farms and a low percentage for others. The production practices and characteristics of cotton farms growing Pima cotton differ significantly from farms growing upland cotton. Most cotton production takes place on large farm operations. In contrast, most food and feed grain production tends to be more evenly distributed among different size farms.

Among all cotton farms, high-cost producers were the least likely to recover production costs due to low yields caused by poor growing conditions. The large gap in expected and actual yields suggests that these low yields resulted from temporary conditions. Less than 15 percent of 2007 cotton was produced by high-cost producers. In contrast, all producers with low operating and ownership costs per pound of cotton lint were able to cover their costs from the gross value of cotton production. These producers had higher cotton yields as well as lower production costs per acre than mid-and high-cost producers. Low-cost producers, on average, applied less inputs per cotton acre than mid- or high-cost producers, typically because low-cost producers were not as likely to apply such inputs as fertilizer or insecticides.

Southwest cotton producers dominated U.S. cotton production in 2007 because they lacked alternative crops and because they had relatively low cotton production costs. Southwest cotton producers had higher net returns from American Upland cotton production than producers in other regions in 2007. Southwest cotton producers are vulnerable to changes in cotton demand because they have less crop diversity and cotton accounts for more than half of their farm production value.

Cotton farms in the West grew varieties of cotton that have different requirements than varieties grown in other regions. And because all cotton acres in the West were irrigated, farms in this region were vulnerable to factors that could affect their ability to obtain irrigation water, including droughts, changes in water policies, and rising demand for water from urban areas.

Economies of size suggest that operators with more cotton acreage would have lower costs per pound of cotton lint or cotton acre. Cotton costs per unit, however, did not vary significantly by the size of the cotton enterprises. Many operators with small cotton enterprises used custom work to avoid ownership and repair costs associated with expensive cotton harvesting equipment.

Operators of farms with larger cotton enterprises were more dependant on cotton than operators of farms with smaller cotton enterprises. This put operators with larger enterprises at increased financial risk should cotton prices or yields drop. Many of these operators recognized the risks, however, as they were more likely to purchase buy-up or crop revenue insurance on their cotton acreage. Not only did these operators face increased risk based on the size of their cotton enterprise, but they also faced relatively high debt-to-asset ratios for their whole farm operation. They offset some of this financial risk by share-renting a high percentage of their operated land. Also,

farm operators with larger cotton enterprises were younger, on average, which allows them more time to recover from financial setbacks.

One might expect there to be a significant correlation of characteristics among farms with a large number of cotton acres and farms with a high level of gross annual sales because farms with more acreage tend to have higher sales. However, findings show no evidence of a straightforward relationship between the number of cotton acres per farm and the annual value of agricultural sales from a farm operation. As such, the characteristics of farms with large cotton enterprises differ from those of large cotton farms (see box, "Relationship Between Cotton Enterprise Size and Farm Typology"). Our results also show that, on average, operators planting a greater number of cotton acres had less agriculturally diverse farming operations and were more reliant on cotton compared with farm operators with annual sales of $1 million or more in 2007.

Operators with total farm sales of $1 million or more had the highest cotton cost of production per acre, even though these operators planted the most cotton acres per farm. These operators were more likely to use higher levels of inputs per cotton acre since they were more likely to irrigate their cotton and were more likely to raise Pima cotton. These latter two factors also contributed to higher cotton yields, which boosted ginning costs per acre. Although their cotton yields per acre were higher, higher production costs left these larger farms with net returns per acre from cotton production not significantly different from those obtained by cotton producers with small family farms.

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Glossary

Break-even price for cotton lint: the price that allows producers to cover their operating and ownership production costs for cotton lint after subtracting the value of cottonseed production. See Appendix I: Determining the Break-Even Price Per Pound of Cotton Lint.

Cost categories: based on the ranking of operating and ownership costs per pound of cotton lint for 2007 U.S. cotton farms.[15] The high-cost category included farms that planted cotton but did not harvest it. For these farms, the operating and ownership costs per pound of cotton lint were set to the costs per planted acre.

- Low-cost farms: 25 percent of the farms with the lowest costs per pound.
- Mid-cost farms: ranked in the 26 to 74 percentile.
- High-cost farms: 25 percent of farms with the highest costs per pound.

Cotton enterprise: the activities related to the farm production of cotton, including cotton lint and cottonseed. In contrast, the farm operation usually refers to all farm-related activities on the farm. Often farms grow more than one commodity and, therefore, most farms have more than one enterprise.

Cotton farms: those farms that planted at least 1 acre of cotton with the intention of harvesting it for lint with cottonseed as the byproduct. Farms that raised cotton primarily for commercial seed rather than fiber were excluded from this report.

Cotton production regions: defined by four geographical clusters of cotton production. For our purposes, California cotton producers are located in the West region, while Texas cotton producers make up the Southwest region. Cotton producers in Missouri, Arkansas, Louisiana, Tennessee, and Mississippi are located in the Delta region, while North Carolina, South Carolina, Georgia, and Alabama cotton producers are located in the Southeast region.

Crop rotation; planting different types of crops in a field during sequential growing seasons. The practice increases soil fertility and reduces problems with weeds, pests, and pathogens.

Cotton is often planted in the same field for two consecutive growing seasons.

Legumes are plants with nodules on their roots formed by bacteria. These bacteria convert atmospheric nitrogen to organic nitrogen that can be utilized by plants. Soybeans and peanuts are two examples of legumes that are frequently rotated with cotton. Often, producers can reduce the amount of nitrogen they apply to crops planted after legumes. For our purposes, cotton was considered to be rotated with legumes if legumes were planted in summer 2006 and a second crop was not planted in the fall, or if legumes were planted in fall 2006 regardless of how the land was used during summer 2006.

[15]The cotton crop consists of two joint products--cotton lint and cottonseed. Since it is difficult to allocate production costs to these joint products, all operating and ownership costs were allocated to cotton lint (including ginning and hauling costs) in computing the costs per pound of cotton lint used to rank the farms and form the cost groups. Many cotton producers associate ginning and hauling costs with cottonseed production rather than cotton lint production, since commercial ginners provide ginning and hauling service in exchange for the cottonseed. Less than 2 percent of farms changed cost groups when ginning and custom hauling costs were deleted from operating and ownership costs before ranking.

Grasses are plants that require nitrogen for growth but cannot convert atmospheric nitrogen into a form usable by the plants. Therefore, producers usually apply nitrogen to their grass crops. For our purposes, cotton was considered to be rotated with grasses if grasses are planted in summer 2006 and a second crop was not planted in the fall, or if grasses were planted in fall 2006 regardless of how the land was used during summer 2006. Winter wheat and rye are examples of two grasses frequently rotated with cotton. Oats are a grass that is sometimes rotated with cotton.

Idled land was fallowed or in the Conservation Reserve Program during summer and fall 2006.

Economic costs: the sum of opportunity costs for land and unpaid labor and general farm overhead. The opportunity costs for land are based on cash rental rates per acre, and unpaid labor is valued at off-farm wage rates.

Expected yields: the yields farm operators reported that they expected to achieve when planting their cotton field.

Farm household income: computed based on ARMS data and equals the sum of farm income and off-farm income for farm households but excludes farm income earned by landlords and contractors. It also excludes farm income generated by farms organized as nonfamily corporations or cooperatives or by those operated by hired managers. For farms with multiple operators or partners, the farm income, off-farm income, and household income figures used in this report represent those for the household of the principal farm operator. Farm income of farm households is defined as net cash farm business income plus net income from farmland rental and earnings of the operator household from farming activities, minus the sum of depreciation, gross farmland rental income, and farm business income received by other households. Off-farm income consists of wages, salaries, net income from nonfarm businesses, interest, dividends, transfer payments, Social Security retirement, pensions, other retirement plans, gifts, net cash income from another farm operation, net income from farmland rental, and other off-farm sources.

Farm organization: the legal status of the farm business. Sole or family proprietors have no legal partners or shareholders (USDA/NASS, 2008b). Under the sole or family proprietor arrangement, the operator(s), usually husband and wife, are regarded as self-employed and personally liable for all the farm's obligations. In legal partnership arrangements, the farm is owned by two or more people. Not all partners need to be operators. The partnership agreement defines who is responsible for daily decisions and designates how farm profits are shared. A corporation, created under Federal or State laws, is a separate legal entity distinct from its owners. The owners are share or stock holders in the corporation. Family corporations are corporations where family members are the owners.

Farm typology: the grouping of farms into homogeneous classes to facilitate the analysis of a diverse farm sector. ERS has defined farm typology classes based on the gross annual value of farm sales of all agricultural products, the farm operator's main occupation, and the ownership of farm assets. The

primary occupation of farmers was reported by the farmers in a response to an ARMS question. Under the farm typology classification system, a farm is considered a family farm if half or more of the farm assets are owned by the farm operator or other individuals related by blood, marriage, or adoption. Farms not meeting the family farm definition are classified as nonfamily farms. All farms in the 2007 cotton version of the ARMS met ERS's definition of a family farm. Hence, no cotton farms in this report were classified as nonfamily farms.

Since cotton farms tend to be large farm operations, ERS farm typology classifications have been modified for our purposes. Under the ERS farm typology classification system, small farms—gross annual sales under $250,000—are divided into subgroups based on the farmer's primary occupation. There were not a sufficient number of ARMS observations from small cotton farms to allow an analysis among the small farm subgroups. Hence, data on small farms were combined.

ERS defines very large farms as those with annual sales of $500,000 or more. With 51 percent of the 2007 cotton farms falling into this group, the very large farms category was subdivided into two groups—farms with annual sales of $500,000-$999,999 and farms with annual sales of $1 million or more. For our purposes, farm typology definitions are as follows.

- **Small family farms:** family farms with gross annual sales of less than $250,000 in 2007, regardless of the operator's primary occupation.
- **Large family farms:** family farms with gross annual sales of $250,000-$499,999 in 2007.
- **Very large family farms:** family farms with gross annual sales of $500,000 or more in 2007. This category of farms was subdivided into:
  - Family farms with sales of $500,000-$999,999; and
  - Family farms with sales of $1 million or more.

Labor hours per acre: exclude the hours spent by workers performing custom field operations.

Lime: a soil additive normally applied once every few years to a field to improve agricultural production. Amounts per acre shown in the tables here are the average prorated annual amount of lime applied to all planted cotton acres. The annual prorated amount applied on farms using lime is computed by taking the amount of lime applied and dividing it by the number of years between lime applications for each farm reported in ARMS. The annual prorated amount of the lime is then summed across all farms and divided by the sum of planted cotton acres to calculate the prorated amount of lime per acre on all cotton acres.

Principal operator: the person who makes most of the daily decisions for the farm operation.

Trips over field: counts the number of trips made across the selected cotton field. The number of trips excludes trips made by custom operators since the costs for labor, fuel, and machinery used in custom operations are included

in the costs for custom operations for cotton. Tandem operations count as one trip over the field. Partial trips over a field are included in this calculation. For example, if a producer sprays pesticide over the entire field and later sprays pesticide over half of the field, then the number of trips over the field would be recorded as 1.5 trips for pesticide applications.

Width of farm machinery: the maximum width of farm machinery used on the cotton enterprise. The machinery used in custom operations is excluded from this calculation.

Appendix I: Determining the Break-Even Price Per Pound of Cotton Lint

Calculating the cost for a unit of output is a useful economic and accounting tool to measure profitability and to compare profitability among products. Typically, ERS analysts measure the crop production costs per unit of output by assuming that all production costs are attributed to the main crop product. For example, in the case of corn, ERS analysts measure the cost for all activities on acres planted to corn with the intention of harvesting the corn for grain. However, a few acres planted for grain are not harvested for grain. Instead, silage is produced from the field. The cost of producing silage is included in the cost of grain production and in the calculation of costs per bushel of corn.

Normally, the secondary crop product has very little value, so no attempt is made to attribute some costs to the secondary product (silage) rather than the primary product (corn). This procedure has been followed by ERS analysts in the past for the calculation of costs per pound of cotton lint—where all production costs are attributed to the primary product (cotton lint). However, seed cotton produces two joint products—cotton lint and cottonseed.[16]

Since the value of cottonseed is a significant proportion of the gross cotton production value, some cotton production costs should be allocated to cottonseed. Because cotton producers give up their cottonseed for ginning and hauling, the value of cottonseed per acre was subtracted from operating and ownership costs per acre. The resulting costs were divided by the pounds of cotton lint produced per acre to compute the break-even price per pound of cotton lint. The break-even price, when multiplied by the pounds of cotton lint produced, covers the costs per acre remaining after exchanging the cottonseed for ginning and hauling. The tables in this report show the break-even price. If the cotton lint price exceeds the break-even price, producers covered their operating and ownership costs. If the cotton lint price is lower than the break-even price, producers did not recover their operating and ownership costs.

[16]Seed cotton must be ginned to separate the joint products. Seed cotton is the mix of cotton lint, cottonseed, and plant parts before ginning separates the components. Many cotton producers do not gin their own cotton. Rather, the seed cotton is transported to the gin by the ginner. Often, producers pay for just the ginning or both the ginning and hauling by giving the cottonseed to the ginner in exchange for service. In some years, the value of cottonseed does not cover the costs of ginning and hauling and the producer makes a small additional payment to the ginner. In other years, prices are higher and cotton producers receive a small payment from their cottonseed.

Appendix II: Comparison of ARMS and Census of Agriculture Data

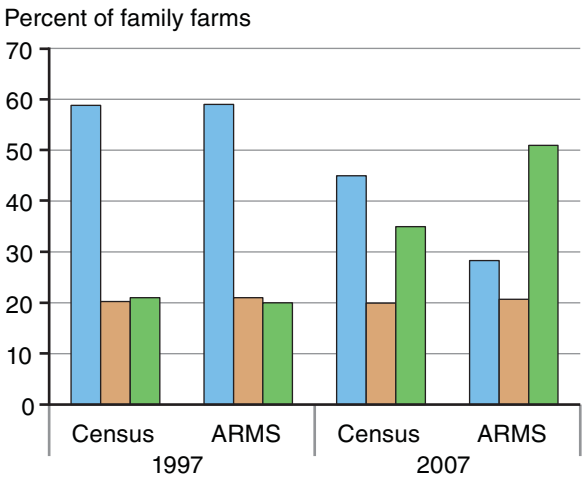
A comparison of Census of Agriculture and ARMS phase III data on cotton farms for 1997 and 2007 reveals differences in the percentage of cotton farms classified as very large family farms in 2007 (app. fig.). Data from the 2007 cotton version of ARMS indicate that very large family cotton farms constitute a higher percentage of total cotton farms compared with data from the Census of Agriculture (see Glossary for farm typology definition). As a corollary effect, ARMS data indicate that a smaller share of the 2007 cotton farms is classified as small family operations compared with census data from the same period.

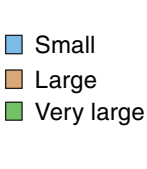
Differences in the number of cotton farms reported based on typology may be explained by the differences in coverage between the Census of Agriculture and ARMS. The census included all U.S. farms with cotton, while the commodity specific version of ARMS targeted producers in States growing the majority of U.S. cotton (94 percent). Cotton farms in States not covered in the cotton version of the ARMS tended to have less than the average number of planted cotton acres per farm, implying that the omitted cotton farms were smaller than average. However, this was also true in 1997, when the distribution of cotton farms among the typology groups in ARMS and the census were more closely matched in 1997 than in 2007.

Appendix II figure

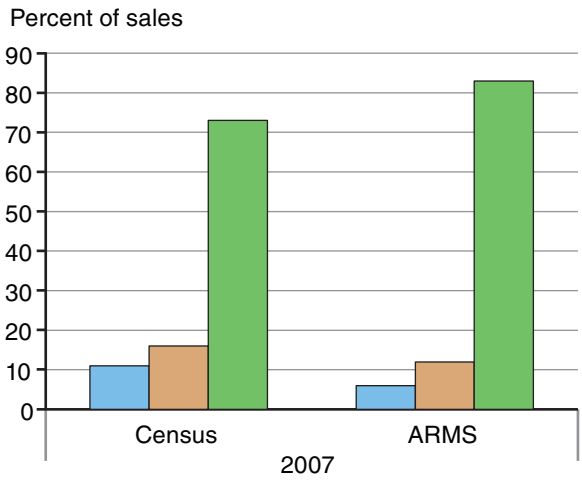
Comparison of cotton farms, by typology, from the Census of Agriculture and ARMS[1]

The data on the share of cotton farms in each typology class match well in 1997 but, in 2007, ARMS data show a higher percentage of very large farms.





Small family farms accounted for a lower share of cotton and cottonseed sales, while very large family farms accounted for a higher percentage of sales in the 2007 ARMS.



Note: Differences between the 2007 Agricultural Resource Management Survey (ARMS) and Census of Agricultural estimates are a result of survey sampling and nonsampling errors, definitional differences, as well as differences caused by the inclusion of fewer States in ARMS.

[1]Since nonfamily cotton farms were not found in the 2007 cotton version of ARMS, our use of 2007 Census of Agriculture data exclude nonfamily farms. The census reported that 8 percent of cotton farms were nonfamily operations in 2007 and 6 percent in 1997.

Source: USDA, Economic Research Service calculations based on data from the 2007 Census of Agriculture, and USDA's 1997 and 2007 Agricultural Resource Management Survey, jointly conducted by Economic Research Service and National Agricultural Statistics Service.

Because small cotton farms are under-represented and large farms are over-represented in the phase III cotton version of the 2007 ARMS, the percentages across the farm typology classes for total cotton farms, planted acres, cotton production quantity, and cotton production value (see table 10), as well as the U.S. aggregate estimates derived from phase III (see table 3) may be skewed. Per farm estimates taken from phase III and data derived from phase II of ARMS are the least likely to be influenced by the under-representation of small cotton farms and the over-representation of large cotton farms.