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# Characteristics and Production Costs of U.S. Rice Farms

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The average cost of producing a hundred pounds (cwt) of rice was \$6.00 for U.S. producers surveyed in 2000, ranging from about \$2 per cwt to more than \$10. Producers in the lowest quartile of production costs averaged \$3.99 per cwt compared with \$8.94 for producers in the highest quartile. Regional differences in production practices, farm characteristics, and growing conditions were major influences on production costs among rice producers. More than half of the low-cost farms were located in the Arkansas Non-Delta, the largest rice region. Most high-cost farms were in California and the Gulf Coast regions. Three-quarters of rice production was concentrated on large and very large farms, categories that included nearly two-thirds of all rice farms, but the link between size of enterprise and production costs for rice is weaker than for other commodities. At the marketing-year average price of \$5.61 per hundredweight, 78 percent of rice farms were able to cover operating costs and 43 percent covered both their operating and ownership costs of rice production in 2000. After accounting for Government payments, nearly all rice farms (97 percent) were able to cover operating costs in 2000, and about 84 percent were able to cover both operating and ownership costs.

**Keywords:** Rice, costs of production, cost variation, input use, production practices, farm characteristics, Agricultural Resource Management Survey.

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## Overview

In 2000, the value of rice cash receipts exceeded \$800 million, eighth-highest among field crops and among the top 30 U.S. agricultural commodities (including both crops and livestock). Rice is grown primarily in six States (Arkansas, Louisiana, California, Mississippi, Texas, and Missouri) and is an important commodity in the regions where production is concentrated. In Arkansas and Louisiana, rice consistently ranks in the top five commodities; in 2000, it averaged 8 and 9 percent, respectively, of each State's total value of agricultural production. In Arkansas, Louisiana, and Mississippi, rice ranked in the top five agricultural products for foreign export during fiscal year 2000. In Arkansas, rice was the number one agricultural export, with a value of over \$460 million (Economic Research Service Web site <http://www.ers.usda.gov> — Farm Income and Costs Briefing Room).

Rice production generally increased during the 1990s, reaching record highs in 1999 and 2001. Plantings of rice increased rapidly during the second half of the 1990s, fueled by its planting flexibility and by higher returns than for other crops. Texas was the only State where rice plantings steadily declined, the result of high irrigation costs, lack of a viable rotation crop, and a combination of weather and climatic difficulties (Childs). In 2000, however, U.S. rice plantings were the lowest since 1991 (USDA National Agricultural Statistical Service). Expectation of low prices at harvest and drought, heat, and saltwater intrusion kept rice acreage down from previous years in the southern States, where most of the rice—and nearly all of the long-grain rice—is grown. California, where most U.S. medium-grain rice is grown, was the only State where acreage increased. Near-normal weather and better price expectations for medium- than for long-grain rice were factors influencing California farmers' decisions to grow more rice (Childs).

This report presents the costs of producing U.S. rice and examines how these costs vary among rice farms. Rice farms (for the purposes of this report) are those that planted at least 1 acre of rice in 2000. Farms are ranked by rice production costs per hundredweight (cwt) to analyze factors associated with low and high production costs. In addition, farms in different regions are compared to gain insights into regional cost variations. The ERS farm typology is used to examine the relationship between farm size (both sales and acreage), farm char-

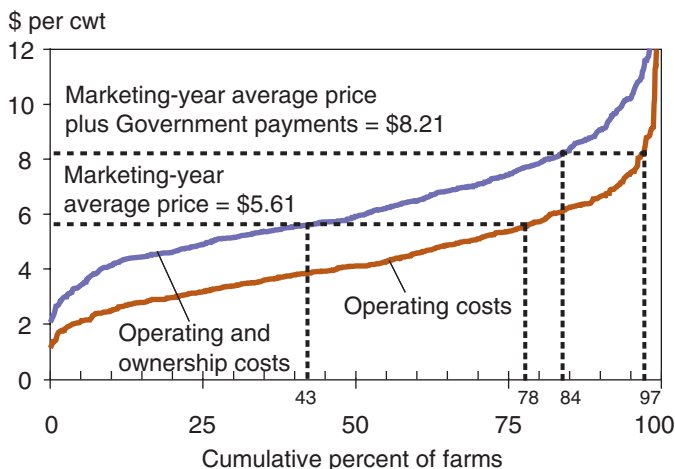
acteristics, and rice production costs. Data in this report are derived from a special rice cost-of-production survey undertaken as part of the 2000 Agricultural Resource Management Survey (ARMS) - <http://www.ers.usda.gov/Briefing/ARMS/> (see glossary). This was the latest survey to collect data on farmers' costs for rice production. Production costs were computed according to standards recommended by the American Agricultural Economic Association Task Force on Commodity Costs and Returns (AAEA).

Production costs used in this analysis are the sum of the operating and asset ownership costs for consumable inputs provided by operators, landlords, and contractors (see [Production costs](#) in the glossary). Production costs exclude marketing and storage. Operating costs include seed, fertilizer, soil conditioners, chemicals, custom operations, fuel, repairs, purchased irrigation water, interest, and hired labor. Ownership costs are those related to capital items consumed during the annual production process, such as farm machinery and equipment. Rice production costs are used in the analysis for this report, since farmers must be able to meet their short-term operating costs and, in the longer run, replace assets consumed during the production process. Since ownership costs are fixed in the short term, most producers can remain in business for several years as long as they can meet their short-term obligations. In the long term, producers must be able to pay their operating costs and replace capital assets consumed during the production process.

This report includes rice costs of production accumulated only until the 2000 harvest; therefore, the harvest-period rice price was used to value the quantity harvested (see [Value of production](#) in the glossary). However, producers often delay sales and store rice with the expectation that future prices will exceed the harvest-period price plus costs of carrying the crop inventory. Even though the costs of marketing and storing the rice crop from harvest to sale are not included in the cost estimates, a comparison of costs with average prices received by rice producers gives a rough indication of how many rice farms covered costs. At the marketing year 2000 average price of \$5.61 per cwt, roughly 78 percent of rice farms were able to cover operating costs of production. Only about 43 percent of farms were able to cover both operating and asset ownership costs (fig. 1).

Figure 1

### Cumulative distribution of rice farms by operating and ownership costs per (cwt) for 2000

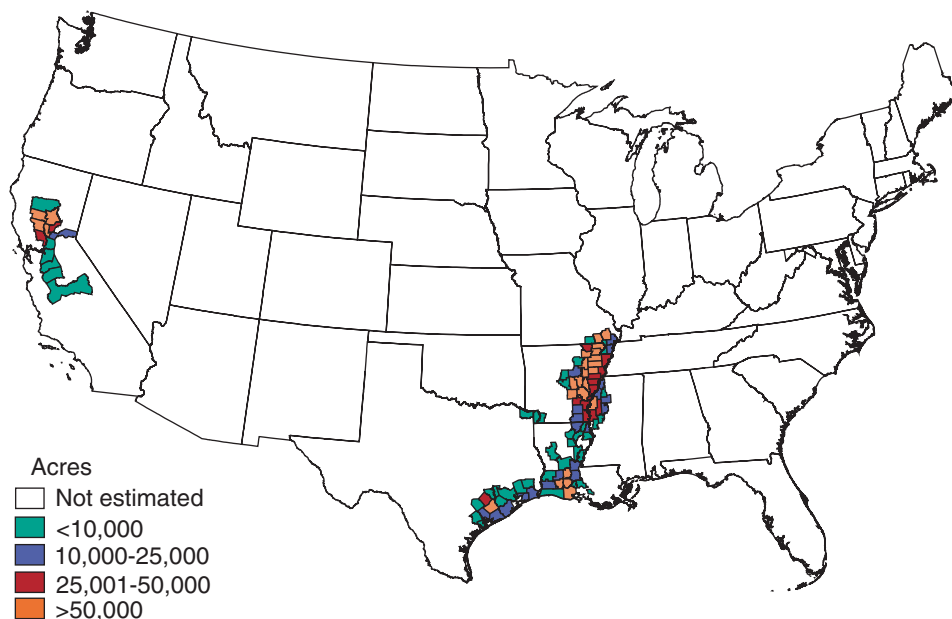


Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

Nearly all rice producers received Government payments in 2000, including flexibility contract payments and emergency assistance. The average flexibility contract payment was \$2.60 per cwt for the 2000 rice crop. Adding this to the marketing-year average rice price of \$5.61, total revenue generated is estimated to be about \$8.21 per cwt. With these returns, nearly all rice farms (97 percent) were able to cover operating costs and about 84 percent of farms covered both their operating and ownership costs of rice production in 2000 (fig. 1).<sup>1</sup> Insufficient data on marketing patterns, marketing and storage costs, and the distribution of Government payments restricts further analysis of their impact on rice costs and returns.

<sup>1</sup>These Government payments are based on a history of rice production on each farm. Farmers did not have to produce rice or any other crop in the current year in order to receive the payments. Therefore, the returns generated with the addition of these payments are not expected to have impacted current year rice production decisions.

### All Rice 2000 Harvested Acres by County



Source: USDA National Agricultural Statistics Service.

### Location of Rice Acreage and Regions

Rice is grown in the United States in two distinct areas: (1) northern California and (2) an area in the southern United States that follows the Mississippi River from the boot heel of Missouri south to northeastern Louisiana and then continues along the Gulf Coast from southwestern Louisiana down through the lower Gulf Coast of Texas (see maps).

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### Rice Production Regions



Source: USDA National Agricultural Statistics Service.

About 80 percent of rice acreage is located in the southern United States and 20 percent in northern California. Rice acreage in the South is chiefly located in Arkansas (57 percent in 2000) and Louisiana (19 percent in 2000), with the remaining acreage (24 percent in 2000) in Texas, Mississippi, and the boot heel of Missouri. Acreage in Arkansas is concentrated in the northeastern and south-central parts of the State; in Louisiana it is concentrated in the southwest and, to a lesser degree, the northeast.

Four regions have been defined by ERS for estimating costs of production, based on similarities in production practices and soil characteristics (Salassi). Three of the regions are in the southern United States. The Arkansas Non-Delta, largest of the four regions, consists of rice acreage in northeastern Arkansas and the Grand Prairie in south-central Arkansas. The Mississippi River Delta (MRD) region is made up of acreage in Mississippi, southeastern Arkansas, and northeastern Louisiana lying near the Mississippi River and in an area in south-central Arkansas bordering the western and southern fringes of the Grand Prairie. The Gulf Coast region combines areas of southwest Louisiana and the upper and lower Gulf Coasts of Texas. California stands alone as one region. The rice area within California is principally located in the Sacramento Valley north of Sacramento.

### Classes of Rice Grown in the United States and Ratoon Crop

In the United States, rice is referred to by length of grain: long, medium, or short. The southern States produce nearly all the long-grain and some medium-grain rice, while California produces most of the medium- and short-grain. California produces a higher quality of medium-grain rice for table use than is generally grown in the South (Setia et al.). Arkansas and Louisiana are the two States most likely to shift acreage between long- and medium-grain because of changes in market or growing conditions. Mississippi, Texas, and Missouri usually grow only long-grain rice.

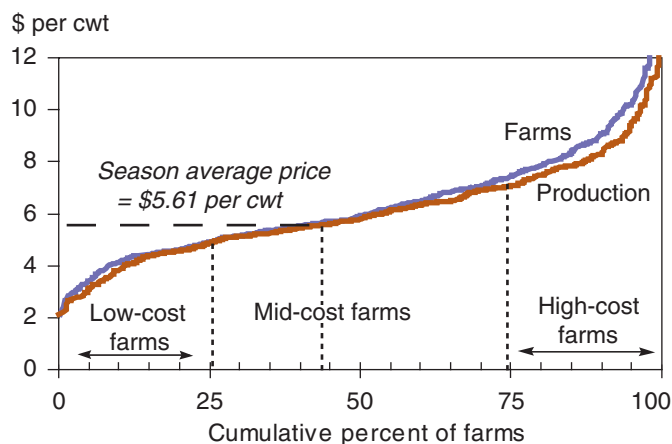
A ratoon crop, grown from the stubble of the first crop by applying fertilizer and water after the crop has been harvested, is often produced in the Gulf Coast region when weather conditions are favorable. In 2000, 30 percent of the rice acres in the Gulf Coast included a ratoon crop. A successful ratoon crop is smaller than the first crop, but can add substantially to the overall yield, thereby reducing costs of production per unit. It takes fewer resources and less time to grow a ratoon crop than to grow the first crop.

## National and Regional Distribution of Rice Farms by Production Costs

*Production costs for rice in 2000 varied widely among farms. Regional factors were instrumental in explaining the variations in costs.*

To identify factors affecting costs, rice farms were grouped into low-, mid-, and high-cost groups according to their level of operating and ownership costs. Using the 2000 ARMS data, rice farms were ranked from lowest to highest based on production costs per cwt (fig. 2). The analysis showed that production costs for U.S. rice farms in 2000 averaged \$6.00 per cwt, ranging from \$2 to more than \$10. Low-cost farms were defined as the 25 percent with the lowest costs and high-cost farms as the 25 percent with the highest costs. Production costs averaged \$8.94 per cwt for the high-cost farms compared with \$3.99 per cwt for the low-cost farms.

Figure 2  
**Cumulative distribution of rice farms by production costs for 2000**



Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

Based on production costs estimated from the ARMS data, rice farms in 2000 produced 54 percent of the Nation's rice for less than the average production cost of \$6.00 per cwt and 43 percent for less than the season-average price of \$5.61 per cwt. Record-high yields in 2000 helped to keep production costs per cwt down; however, low rice prices dampened returns. The 2000-01 season-average price of \$5.61 per cwt was the lowest since 1986-87.

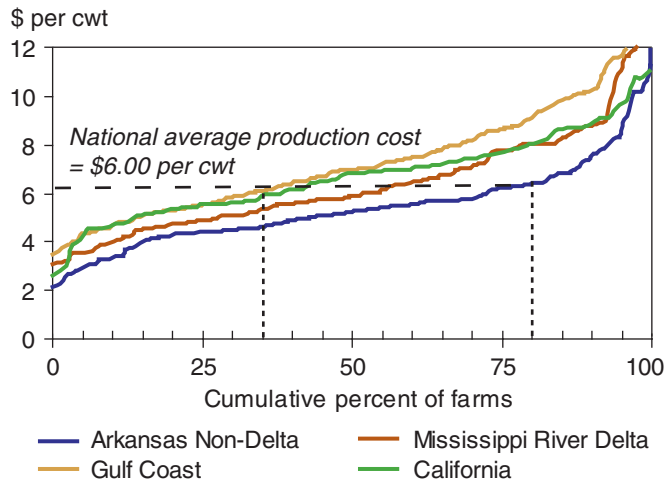
Regional differences in production practices, farm and producer characteristics, and growing conditions were instrumental in explaining the variation in production costs across cost groups in 2000. The Arkansas Non-Delta region had the lowest costs per cwt (fig. 3), producing 80 percent of the region's rice for less than the national average production cost of \$6.00 per cwt, compared with 40 percent of California's rice farms. Sixty percent of the lowest cost farms and less than 20 percent of the highest cost farms were located in the Arkansas Non-Delta (fig. 4).

While regional differences among rice farms were paramount in explaining differences in cost of production (table 1), a few farm and producer characteristics are worth noting. Low-cost farms had more diverse operations than high-cost farms and more often rotated rice with other crops (table 2), particularly soybeans. More low-cost producers reported farming as their primary occupation. More high-cost producers were over 65 years of age. Size of operation, associated with declining production costs for most crop and livestock commodities, did not create a distinction between low- and high-cost U.S. rice farms in 2000 (table 3).



Figure 3

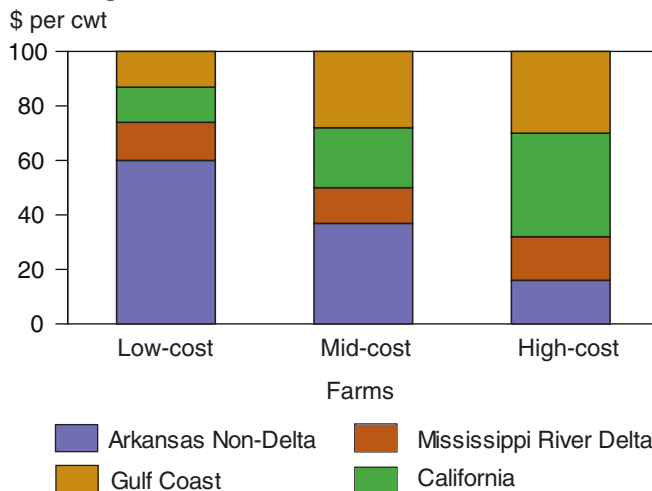
**Cumulative distribution of rice farms by production costs in each region for 2000**



Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

Figure 4

**Percent of rice cost groups represented by each region, 2000**



Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

**Table 1—Rice production costs and returns on rice farms, by cost group, 2000**

Item	Low-cost (a)	Mid-cost (b)	High-cost (c)
Percent of rice farms	25	49	26
Percent of rice acres	26	53	*21
Percent of rice production	27	54	*19
Location ( <i>percent of farms</i> ):			
Arkansas Non-Delta	40	50	10
Mississippi River Delta	25	47	28
Gulf Coast	14	46	40
California	13	56	31
Type of rice grown ( <i>percent of rice acres</i> ):			
Long grain	84	70	#64
Medium and short grain	*16	*30	#36
Yield in cwt per acre:			
Actual	70	69	62
Expected	70	72	71
Ratoon crop produced ( <i>percent of farms</i> ) <sup>1</sup>	#5.8	#6.1	#9.5
<i>Dollars</i>			
Operating and ownership costs/cwt:			
Costs/actual yield	3.99 <i>bc</i>	5.99 <i>ac</i>	8.94 <i>ab</i>
Costs/expected yield	4.01 <i>bc</i>	5.74 <i>ac</i>	7.74 <i>ab</i>
Costs and returns per planted acre:			
Gross value of production	385.45	374.32	332.78
Operating costs	204.17 <i>c</i>	314.52	434.30 <i>a</i>
Seed	20.68 <i>b</i>	23.77 <i>a</i>	*25.50
Fertilizer and soil conditioners	34.70 <i>c</i>	45.16	65.82 <i>a</i>
Chemicals	32.73 <i>bc</i>	51.45 <i>a</i>	64.75 <i>a</i>
Custom operations	34.26 <i>c</i>	*70.64	*107.75 <i>a</i>
Fuel, lube, and electricity	43.53	*57.14	*77.93 <i>a</i>
Repairs	14.59 <i>bc</i>	19.58 <i>a</i>	23.92 <i>a</i>
Purchased irrigation water	*3.68	#11.37	#20.01
Interest on operating capital	5.16 <i>c</i>	7.87	10.92 <i>a</i>
Hired labor	14.86	*27.53	#37.69
Ownership costs	74.64 <i>bc</i>	96.15 <i>ac</i>	118.64 <i>ab</i>
Capital recovery of machinery and equipment	62.62 <i>bc</i>	79.54 <i>ac</i>	100.61 <i>ab</i>
Taxes and insurance	12.02 <i>bc</i>	16.61 <i>a</i>	18.04 <i>a</i>
Total operating and ownership costs	278.81 <i>bc</i>	410.66 <i>ac</i>	552.94 <i>ab</i>
Value of production less operating costs	181.28 <i>bc</i>	*59.71 <i>ac</i>	*-101.52 <i>ab</i>
Value of production less operating and ownership costs	106.64 <i>bc</i>	#-36.44 <i>ac</i>	-220.16 <i>ab</i>

<sup>1</sup>Ratoon crop is a second crop grown from the stubble of the first crop.

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.

a, b, and c indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.



**Table 2—Production practices and input use on rice farms, by cost group, 2000**

Item	Low-cost (a)		Mid-cost (b)		High-cost (c)	
Previous crop ( <i>percent of farms</i> ):						
Soybeans	53	c	40	c	*19	ab
Rice	35		44		*49	
No crop (fallow)	#7		#10		#24	
Seed quantity ( <i>lbs per acre</i> )	119		124		134	
Method of planting seed ( <i>percent of acres</i> ):						
Aerial	23		*34		*52	
Drilled-dry	74		60		#44	
Tillage systems ( <i>percent of acres</i> ):						
Conventional	95		93		97	
Reduced	*11		#6		#10	
Conservation	*5		#7		#3	
Fertilizer use ( <i>percent of farms reporting use</i> ):						
Nitrogen	98		99		99	
Phosphorus	38	bc	66	a	73	a
Potassium	35	b	55	a	*51	
Fertilizer quantity ( <i>lbs/acre</i> ):						
Nitrogen	127		144		*152	
Phosphorous	19	b	31	a	*43	
Potassium	24		29		*24	
Chemical use ( <i>percent of acres treated</i> ):						
Herbicides	94		98		96	
Insecticides	*6	b	25	a	#40	
Fungicides	*14		#22		*33	
Chemical use ( <i>number of acre-treatments</i> ):						
Herbicides	2.1		*2.9		*3.0	
Insecticides	#0.1		#0.4		#0.7	
Fungicides	*0.2		#0.3		*0.4	
Custom chemical application ( <i>percent of farms</i> )	53	bc	75	a	83	a
Custom-operations cost ( <i>dollars per acre</i> ):						
Drying	*9	c	#23		*29	a
Fertilizer	10	c	*14		16	a
Chemical	5	b	10	a	*15	
Harvest	*2		*5		#10	
Fuel usage:						
Gasoline ( <i>gal/acre</i> )	1.6		*4.1		2.1	
Diesel ( <i>gal/acre</i> )	22.7	c	*32.1		*52.2	a
LP gas ( <i>gal/acre</i> )	*4.1	bc	*1.6	a	#0.9	a
Natural gas ( <i>cubic ft/acre</i> )	#170.0		#697.0		#625.0	
Electricity ( <i>kilowatt hour/acre</i> )	168.0		*123.7		#106.4	
Inches of irrigation water per acre	40		44		44	
Percentage of water purchased	*11		#27		#40	
Drying rice ( <i>percent of production</i> ):						
Custom dried	35		*57		*66	
Dried on-farm	36		#33		#30	
Dried by coop or buyer	30	bc	#10	a	#4	a
Percentage moisture removed drying rice	6.4		5.4		6.3	
Paid labor hours per acre	1.5		2.0		2.1	
Unpaid labor hours per acre	1.7	b	2.5	a	*2.8	

Coefficient of Variation (CV) = (standard error/estimate) x 100.

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

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a, b, and c indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: USDA Agricultural Resource Management Survey, USDA, ERS.

**Table 3—Characteristics of rice farms and rice producers, by cost group, 2000**

Item	Low-cost (a)	Mid-cost (b)	High-cost (c)
Production value:			
All commodities ( <i>dollars per farm</i> )	282,503	322,206 <i>c</i>	244,282 <i>b</i>
Rice ( <i>dollars per farm</i> )	138,260	167,621 <i>c</i>	122,127 <i>b</i>
Percentage of rice to total production value	49	52	50
Typology ( <i>percent of farms</i> ):			
Very large	25	60	15
Large	27	48	25
Small, high sales	25	46	29
Size:			
Total operated acres per farm	1,226	1,300	1,371
Acres of cropland per farm	1,122	1,235	1,086
Harvested rice acreage per farm	346	425 <i>c</i>	330 <i>b</i>
Diversification:			
Percentage of farms with only rice	*13 <i>bc</i>	29 <i>ac</i>	45 <i>ab</i>
Average number of commodities/farm	2.6 <i>c</i>	2.3	2.1 <i>a</i>
Percent of rice farms with:			
Soybeans	81 <i>bc</i>	58 <i>ac</i>	33 <i>ab</i>
Wheat	42 <i>bc</i>	30 <i>ac</i>	16 <i>ab</i>
Cotton	*10	7	9
Cattle	*6 <i>c</i>	8 <i>c</i>	*20 <i>ab</i>
Corn	*5 <i>b</i>	11 <i>a</i>	*6
Fruit, vegetable, nursery	D	*6	#9
Land tenure:			
Acres owned per farm	267	262	*618
Acres cash-rented per farm	370	455	*451
Acres share-rented per farm	575 <i>c</i>	632 <i>c</i>	383 <i>ab</i>
Farm organization ( <i>percent of farms</i> ):			
Sole/family proprietor	73 <i>b</i>	60 <i>a</i>	70
Partnership	21	32 <i>c</i>	23
Family corporation	#5	*8	#6
Percentage acreage insured	68 <i>c</i>	76	92 <i>a</i>
Percentage with operator working off-farm	*10	15	*22 <i>a</i>
Percentage with spouse working off-farm	29 <i>c</i>	38	45 <i>a</i>
Operator occupation ( <i>percentage</i> ) <sup>1</sup> :			
Farming	91 <i>c</i>	91 <i>c</i>	79 <i>b</i>
Nonfarm	#6 <i>c</i>	*8	*13
Operator age ( <i>percentage</i> ):			
Less than 50 years	41	52	49
50 to 64 years	54 <i>c</i>	41	36 <i>a</i>
65 years or more	*5 <i>c</i>	*7 <i>c</i>	*15 <i>a</i>
Operator education ( <i>percentage</i> ):			
High school or less	40	29	35
Some college	*22 <i>b</i>	35 <i>a</i>	27
Completed college	26	31	30

See notes at end of table.

Continued—

**Table 3—Characteristics of rice farms and rice producers, by cost group, 2000—Continued**

Item	Low-cost (a)	Mid-cost (b)	High-cost (c)
Financial characteristics per farm:			
Farm equity ( <i>dollars</i> )	653,145 <i>c</i>	800,587	1,131,547 <i>a</i>
Assets ( <i>dollars</i> )	724,882 <i>c</i>	896,464 <i>c</i>	1,298,316 <i>ab</i>
Debt ( <i>dollars</i> )	71,737 <i>c</i>	95,877 <i>c</i>	166,769 <i>ab</i>
Debt-to-asset ratio ( <i>percent</i> )	10	11	*13
Financial characteristics per farm household:			
Total household income ( <i>dollars</i> )	110,921	90,668	79,716
Farm income ( <i>dollars</i> )	*85,354	63,156	*38,478
Off-farm income ( <i>dollars</i> )	25,567 <i>c</i>	27,511 <i>c</i>	41,237 <i>ab</i>
Government payments per farm ( <i>dollars</i> )			
Loan deficiency (LDP)	86,574 <i>b</i>	125,031 <i>a</i>	108,514
Transition AMTA/FAIR	42,792	55,881 <i>c</i>	35,164 <i>b</i>
Agricultural disaster	30,228 <i>bc</i>	48,790 <i>a</i>	48,929 <i>a</i>
Other Federal and State programs	*10,237	12,222	14,598
Conservation Reserve Program	*5,476	*5,714	*5,891
Environmental Quality Incentive Program	*251	#202	D
	D	*406 <i>c</i>	#52 <i>b</i>
Percent of operators receiving govt. payments			
Loan deficiency (LDP)	100 <i>b</i>	98 <i>a</i>	99
Transition AMTA/FAIR	90 <i>c</i>	91 <i>c</i>	73 <i>ab</i>
Agricultural disaster	63 <i>c</i>	69 <i>c</i>	79 <i>ab</i>
Other Federal and State programs	28 <i>b</i>	42 <i>a</i>	36
Conservation Reserve Program	23 <i>bc</i>	39 <i>a</i>	40 <i>a</i>
Environmental Quality Incentive Program	*8	*3	#8
	*4	*5 <i>c</i>	#2 <i>b</i>

<sup>1</sup>May not add to 100, since percentages for hired managers are not shown.

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.

a, b, and c indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

D = Data insufficient for disclosure.

Source: USDA Agricultural Resource Management Survey, USDA, ERS.

## Costs of Production Varied Significantly by Region in 2000

*Gross sales per farm, costs for custom operations and purchased water, and level of diversity showed major differences among farms in each region.*

The **Arkansas Non-Delta** is the largest rice-growing region in the United States. Based on ARMS data, this region accounted for 39 percent of all rice farms and rice acres and 38 percent of production in 2000.

The Arkansas Non-Delta was also the lowest cost region for growing rice in 2000; average production costs there were markedly lower than in California and the Gulf Coast. Average production costs in the Arkansas Non-Delta were also much lower than in the Mississippi River Delta (MRD), a neighboring region (table 4).

Compared with higher cost regions, farms in the Arkansas Non-Delta had much lower operating and ownership costs per acre. Specifically, producers in the region had lower custom-operations costs for fertilizer and chemicals, were not likely to custom-dry their rice, and did not purchase irrigation water like producers in other regions. Their seed, fertilizer, and chemical costs per acre were also lower than in most other regions. The majority of rice farmers in the Arkansas Non-Delta planted rice by drilling the seed into the soil. This procedure is cheaper and requires less seed per acre than seeding from an airplane, which is common in the Gulf Coast and California (tables 4 and 5).

Farm size based on sales (see Typology in the glossary) varied markedly between farms in the Arkansas Non-Delta and those in higher cost regions. Although farms in the Arkansas Non-Delta did not have the largest rice acreage per farm (table 6), they had the most farms identified as large or very large when measured by typology; half of large farms and 42 percent of very large rice farms were located there. With the MRD accounting for an additional 31 percent of very large farms, these two low-cost regions together had 73 percent of the very large rice farms.

Crop diversity was another key factor explaining differences among regions. Rice farms in the Arkansas Non-Delta were more diversified than those in the Gulf Coast and California, growing other crops such as soybeans and wheat. Farmers in the Arkansas Non-Delta were also more likely to rotate their rice crop with other crops such as soybeans (tables 5 and 6).

Arkansas rice farmers had significantly less off-farm income than farmers in the other three regions. The Arkansas farmers were mostly full-time farmers and high school graduates. Half of them were in the 50- to 64-year age range, compared with 32 percent of those in the MRD. Arkansas producers carried a higher debt-to-asset level than producers in the MRD and Gulf Coast regions. They also held less insurance (table 6).

The Arkansas Non-Delta also plants a larger proportion of rice acreage in medium-grain varieties than the other southern regions. In 2000, 18 percent of Arkansas rice acres were planted to medium- or short-grain, compared with less than 5 percent in the other southern regions. Medium-grain yields on average are higher than long-grain yields. Yields, however, were not a major factor explaining cost variation in 2000.

The Mississippi River Delta region had the fewest farms, fewest rice acres, and lowest rice production of all the regions. It was the second-to-lowest cost region. Due to drought and heat in 2000, producers in the MRD had the lowest average rice yield among the regions. Their actual yield was 6 cwt per acre lower than expected (table 4).

The cost structure of MRD rice farms was similar to that of Non-Delta farms, but the MRD farms had higher seed, fertilizer, and chemical costs. MRD rice farmers also planted rice by drilling the seed into the soil. Producers in this region used their own drying facilities more than farmers in other regions. Compared with the Gulf Coast region, where producers also dried their own rice, MRD producers removed less moisture during the drying process. MRD had the highest frequency of chemical applications per acre and the highest percentage of rice acreage cultivated using reduced tillage (table 5).

The MRD region had the largest farms, the largest rice acreage per farm, and the most cash-rented acres. MRD farmers had the lowest level of rice to total production value and the lowest percentage of farms with only rice. Like the Arkansas Non-Delta, the MRD had diverse farms growing other commodities like soybeans, wheat, cotton, and corn. However, MRD producers were less

likely to rotate rice with other crops than producers in the Non-Delta (tables 5 and 6).

The MRD had different farm and producer characteristics than other regions. It had the highest share of young farmers and partnerships, the highest farm equity, household income, and in 2000, the highest Government payments per farm (table 6).

Only producers in the Gulf Coast region planted a ratoon crop. Since the Gulf Coast region is the southernmost rice-growing region in the United States, it typically has a long enough growing season to harvest two crops (see box and the section on ratoon crop). The ratoon crop increased yields in the Gulf Coast and helped to reduce costs per cwt.

Other factors, however, increased costs in the Gulf Coast region compared with the Arkansas Non-Delta and the MRD. Costs for seed there were high relative to other regions (table 4). Aerial seeding, used in the Gulf Coast to control red rice, often results in infestations of water weevils (Louisiana State University Agricultural Center). Seed treatment to control for the weevils likely raised the costs of the seed. Gulf Coast producers also purchased more of their water than producers in the other southern regions.

Rice farms in the Gulf Coast region also used the most fungicides and were more likely to apply phosphorus and potassium. As in the Arkansas Non-Delta, producers were likely to rotate their rice acreage to control for red rice (a weed commonly found in southern rice fields) (table 5); half of the 2000 rice acreage in the Gulf Coast was planted on land that was fallow in 1999.

When drying their rice, Gulf Coast producers lowered the moisture content more than producers in other regions because of a higher starting level.

Over 50 percent of rice farms in the Gulf Coast region had rice as their only crop, and compared with the other regions, Gulf Coast rice farms overall had the highest percentage of rice to total farm production value. Crop diversification in the Gulf Coast was low compared with

other regions. Soybeans and cattle were the most likely choice to add diversity to the commodity mix (tables 5 and 6).

Rice producers in the Gulf Coast region received the highest loan deficiency and transition payments and the second-highest Government payments in 2000, particularly disaster payments for drought that led to salt water intrusion of the water table (table 6). This region had a larger share of sole proprietor/family farms than the Arkansas Non-Delta and the MRD. As in the Arkansas Non-Delta, 96 percent of Gulf Coast producers reported farming as their major occupation. Compared with Arkansas, farms in this region had low debts relative to their assets.

California was the highest cost region in 2000 (table 4). Costs were especially high for chemicals, custom operations, and purchased irrigation water. Costs were the lowest relative to other regions for fuel, lube, and electricity, most likely because all California's irrigation water is surface water requiring no pumps and because custom operations were used for many farm functions. California producers also had the highest yields and the highest gross value of production.

Compared with production practices in the other regions, California made the greatest use of aerial seeding and used the most seed per acre and the most insecticides, purchased the most water, and applied the most inches of water per acre. California rice farmers were also more likely to custom-dry their rice. They used less nitrogen per acre than producers in the Arkansas Non-Delta and the MRD (table 5).

California had the highest percentage of farms producing only rice. California farms also had fewer acres of cropland and were less diversified than farms in other regions. California operators were more likely to work off-farm and were least likely to have farming as their major occupation. Relative to other regions, California farmers had the highest off-farm income and were more likely to have completed college. They received smaller Government payments per farm than farmers in the other regions (table 6).

**Table 4—Rice production costs and returns per acre from rice farms, by region, 2000**

Item	Ark. Non-Delta (a)	Miss. River Delta <sup>1</sup> (b)	Gulf Coast <sup>2</sup> (c)	California (d)	All regions <sup>3</sup>
Percent of rice farms	39	16	20	24	100
Percent of rice acres	39	18	#21	19	100
Percent of rice production	38	16	#21	23	100
Cost group ( <i>percent of farms</i> ):					
Low-cost	60	14	D	D	100
Mid-cost	37	13	*22	28	100
High-cost	D	15	*37	D	100
Type of rice grown ( <i>percent of rice acres</i> ):					
Long grain	82	100	96	D	73
Medium and short grain	18	D	#4	100	27
Yield in cwt per acre:					
Actual	66 <i>bd</i>	61 <i>ad</i>	*65	81 <i>ab</i>	68
Expected	68 <i>d</i>	67 <i>d</i>	*70	84 <i>ab</i>	71
Ratoon crop produced ( <i>percent of acres</i> ) <sup>4</sup>	0	0	#30	0	#7
<i>Dollars</i>					
Operating and ownership costs/cwt:					
Costs/actual yield	5.21 <i>bd</i>	6.11 <i>a</i>	6.68	6.69 <i>a</i>	6.00
Costs/expected yield	5.01 <i>d</i>	5.56 <i>d</i>	6.20	6.52 <i>ab</i>	5.71
Costs and returns per planted acre:					
Gross value of production	367.07 <i>bd</i>	332.55 <i>ad</i>	357.69	422.32 <i>ab</i>	368.63
Operating costs	248.93 <i>d</i>	274.57 <i>d</i>	#332.45	447.98 <i>ab</i>	310.10
Seed	18.62 <i>bcd</i>	22.20 <i>acd</i>	27.85 <i>ab</i>	27.72 <i>ab</i>	23.31
Fertilizer and soil conditioners	38.07 <i>d</i>	47.26	#54.02	57.37 <i>a</i>	*46.66
Chemicals	36.49 <i>bd</i>	48.36 <i>ad</i>	*47.15 <i>d</i>	79.50 <i>abc</i>	49.25
Custom operations	40.68 <i>d</i>	47.71 <i>d</i>	#66.66	153.72 <i>ab</i>	*68.69
Fuel, lube, and electricity	65.91 <i>d</i>	56.57 <i>d</i>	65.89 <i>d</i>	29.05 <i>abc</i>	57.84
Repairs	20.30 <i>d</i>	19.38 <i>d</i>	20.68	16.35 <i>ab</i>	19.16
Purchased irrigation water	0.00 <i>d</i>	0.00 <i>d</i>	#15.60	40.84 <i>ab</i>	#11.12
Interest on operating capital	6.11 <i>d</i>	6.75 <i>d</i>	*8.39	11.64 <i>ab</i>	7.78
Hired labor	22.75	26.36	#26.21	31.79	#26.78
Ownership costs	93.51	98.47	99.45	96.49	95.11
Capital recovery of machinery and equipment	78.86	81.83	86.10	76.85	79.42
Taxes and insurance	14.85 <i>d</i>	16.63	13.35 <i>d</i>	19.64 <i>ac</i>	15.69
Total operating and ownership costs	342.44 <i>d</i>	373.04 <i>d</i>	*431.91	544.46 <i>ab</i>	405.21
Value of production less operating costs	118.13 <i>bd</i>	*57.97 <i>ad</i>	#25.23	*-25.65 <i>ab</i>	#58.54
Value of production less operating and ownership costs	*24.62 <i>bd</i>	#-40.50 <i>ad</i>	#-74.22	-122.14 <i>ab</i>	#-36.57

<sup>1</sup> Mississippi River Delta includes parts of Arkansas, Mississippi, and northeast Louisiana.

<sup>2</sup> Gulf Coast includes southwest Louisiana and Texas.

<sup>3</sup> All regions includes observations not located in the four main regions.

<sup>4</sup> Ratoon crop is a second crop grown from the stubble of the first crop.

D=Data insufficient for disclosure.

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.

a, b, c, and d indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.



**Table 5—Production practices and input use on rice farms, by region, 2000**

Item	Ark. Non-Delta (a)		Miss. River Delta <sup>1</sup> (b)		Gulf Coast <sup>2</sup> (c)		California (d)		All regions <sup>3</sup>
Previous crop ( <i>percent of farms</i> ):									
Soybeans	77	<i>bcd</i>	48	<i>acd</i>	#11	<i>ab</i>	0	<i>ab</i>	38
Rice	19	<i>bd</i>	43	<i>ad</i>	*33	<i>d</i>	93	<i>abc</i>	43
No crop (fallow)	D		*4	<i>c</i>	*50	<i>b</i>	D		#13
Wheat, fall 1998	10	<i>b</i>	#2	<i>a</i>	D		D		*4
Seed quantity ( <i>lbs per acre</i> ):	115	<i>d</i>	111	<i>d</i>	*123		167	<i>ab</i>	125
Method of planting seed ( <i>percent of acres</i> ):									
Aerial	#3	<i>d</i>	#4	<i>d</i>	#69		95	<i>ab</i>	35
Drilled (dry)	85	<i>bd</i>	95	<i>ad</i>	#30		#5	<i>ab</i>	60
Tillage systems ( <i>percent of acres</i> ):									
Conventional	95	<i>cd</i>	91	<i>cd</i>	99	<i>ab</i>	100	<i>ab</i>	94
Reduced	*3	<i>b</i>	*29	<i>ad</i>	#8		D		#8
Conservation	*5	<i>d</i>	#9	<i>d</i>	D		0	<i>ab</i>	#6
Fertilizer use ( <i>percent of farms reporting use</i> ):									
Nitrogen	99		98		99		98		99
Phosphorous	48	<i>bcd</i>	18	<i>acd</i>	92	<i>abd</i>	77	<i>abc</i>	61
Potassium	45	<i>bc</i>	*16	<i>acd</i>	88	<i>abd</i>	39	<i>bc</i>	49
Fertilizer quantity ( <i>lbs/acre</i> ):									
Nitrogen	148	<i>d</i>	167	<i>d</i>	#156		95	<i>ab</i>	*141
Phosphorous	23	<i>d</i>	#19	<i>d</i>	*45		44	<i>ab</i>	30
Potassium	29	<i>bd</i>	*9	<i>ac</i>	*48	<i>b</i>	16	<i>a</i>	26
Chemical use ( <i>percent of acres treated</i> ):									
Herbicides	99	<i>d</i>	99	<i>d</i>	94		92	<i>ab</i>	97
Insecticides	*3	<i>bd</i>	31	<i>a</i>	#38		43	<i>a</i>	#23
Fungicides	*5	<i>bcd</i>	28	<i>ac</i>	47	<i>abd</i>	*27	<i>ac</i>	*22
Chemical use ( <i>number of acre-treatments</i> ):									
Herbicides	2.7	<i>b</i>	3.3	<i>a</i>	#2.7		2.5	<i>b</i>	*2.7
Insecticides	#0.0	<i>bd</i>	0.5	<i>a</i>	#0.8		0.4	<i>a</i>	#0.4
Fungicides	#0.1	<i>bcd</i>	*0.4	<i>a</i>	0.5	<i>a</i>	*0.3	<i>a</i>	*0.3
Custom chemical application ( <i>percent of farms</i> ):	59	<i>cd</i>	68		84	<i>a</i>	78	<i>a</i>	71
Custom-operations cost ( <i>dollars per acre</i> ):									
Drying	15	<i>d</i>	14	<i>d</i>	#27		33	<i>ab</i>	#20
Fertilizer	12		13		#13		14		*13
Chemical	6	<i>bcd</i>	10	<i>ad</i>	10	<i>ad</i>	19	<i>abc</i>	10
Harvest	*1	<i>d</i>	*2	<i>d</i>	#2	<i>d</i>	22	<i>abc</i>	*5
Fuel usage:									
Gasoline ( <i>gal/acre</i> )	#4.6		*2.6		#1.9	<i>a</i>	1.7		*3.0
Diesel ( <i>gal/acre</i> )	40.6	<i>d</i>	35.8	<i>d</i>	43.0	<i>d</i>	9.9	<i>abc</i>	33.8
LP gas ( <i>gal/acre</i> )	*2.0	<i>d</i>	2.7	<i>d</i>	#3.9		D		*2.1
Natural gas ( <i>cubic foot/acre</i> )	*207.0	<i>b</i>	#36.0	<i>a</i>	#984.0		D		#543.0
Electricity ( <i>kilowatt hour/acre</i> )	172.3		*152.0		#49.3		*135.4		*131.8
Inches of irrigation water per acre	43	<i>d</i>	39	<i>d</i>	*31	<i>d</i>	56	<i>abc</i>	43
Percentage of water purchased	0	<i>d</i>	0	<i>d</i>	#24		89	<i>ab</i>	#26
Drying rice ( <i>percent of production</i> ):									
Custom dried	42	<i>d</i>	42	<i>d</i>	#49		84	<i>ab</i>	*52
Dried other than custom	32	<i>b</i>	54	<i>ad</i>	#40		#16	<i>b</i>	*33
Dried by coop or buyer	26	<i>bd</i>	#4	<i>ad</i>	#10		0	<i>ab</i>	*14
Percentage moisture removed drying rice	5.2	<i>c</i>	4.7	<i>c</i>	7.9	<i>ab</i>	D		5.9
Paid labor hours per acre	1.8		2.3		#1.5		2.0		1.9
Unpaid labor hours per acre	2.5	<i>b</i>	0.8	<i>ad</i>	#3.1		2.7	<i>b</i>	2.3

<sup>1</sup> Mississippi River Delta includes parts of Arkansas, Mississippi, and northeast Louisiana. <sup>2</sup> Gulf Coast includes southwest Louisiana and Texas. <sup>3</sup> All regions includes observations not located in the four main regions. D=Data insufficient for disclosure. 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. a, b, c, and d indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 USDA Agricultural Resource Management Survey, USDA, ERS.



**Table 6—Characteristics of rice farms and rice producers, by region, 2000**

Item	Ark. Non-Delta (a)		Miss. River Delta <sup>1</sup> (b)		Gulf Coast <sup>2</sup> (c)		California (d)		All regions <sup>3</sup>
Production value:									
All commodities ( <i>dollars per farm</i> )	295,118	<i>bcd</i>	506,269	<i>acd</i>	186,182	<i>ab</i>	206,739	<i>ab</i>	292,073
Rice ( <i>dollars per farm</i> )	146,390		170,757		142,357		138,360		148,445
Percentage of rice to total production value	50	<i>bcd</i>	34	<i>acd</i>	76	<i>ab</i>	67	<i>ab</i>	51
Typology ( <i>percent of farms</i> ):									
Very large	42		31		D		D		100
Large	50		12		20		D		100
Small, high sales	36		D		26		D		100
Size:									
Total operated acres per farm	1,266	<i>bd</i>	2,463	<i>acd</i>	1,135	<i>bd</i>	500	<i>abc</i>	1,299
Acres of cropland per farms	1,207	<i>bcd</i>	2,243	<i>acd</i>	971	<i>abd</i>	436	<i>abc</i>	1,168
Harvested rice acreage per farm	367	<i>b</i>	478	<i>ad</i>	404		303	<i>b</i>	380
Diversification:									
Percentage of farms with rice only	D		*7	<i>cd</i>	52	<i>bd</i>	72	<i>bc</i>	29
Average number of commodities per farm	2.9	<i>cd</i>	2.9	<i>cd</i>	1.7	<i>abd</i>	1.4	<i>abc</i>	2.3
Percent of rice farms with:									
Soybeans	100	<i>bcd</i>	80	<i>acd</i>	26	<i>abd</i>	0	<i>abc</i>	57
Wheat	56	<i>bcd</i>	36	<i>acd</i>	*3	<i>ab</i>	#3	<i>ab</i>	29
Cotton	*6	<i>bd</i>	35	<i>acd</i>	*3	<i>bd</i>	0	<i>abc</i>	8
Cattle	#3	<i>c</i>	D		28	<i>ad</i>	#8	<i>c</i>	10
Fruit, vegetables, nursery	D		D		D		*21		6
Corn	*10		*13	<i>cd</i>	*5	<i>b</i>	#5	<i>b</i>	8
Land tenure:									
Acres owned per farm	297	<i>bcd</i>	*869	<i>acd</i>	184	<i>abd</i>	105	<i>abc</i>	355
Acres cash-rented per farm	260	<i>b</i>	936	<i>acd</i>	*352	<i>b</i>	*276	<i>b</i>	432
Acres share-rented per farm	711	<i>d</i>	746	<i>d</i>	633	<i>d</i>	*136	<i>abc</i>	554
Farm organization ( <i>percent of farms</i> ):									
Sole/family proprietor	66	<i>c</i>	56	<i>c</i>	81	<i>ab</i>	67		67
Partnership	25	<i>b</i>	37	<i>ac</i>	*15	<i>b</i>	27		26
Family corporation	*9	<i>c</i>	*7		#3	<i>a</i>	#6		7
Percentage acreage insured	62	<i>bd</i>	92	<i>ad</i>	89		77	<i>ab</i>	77
Percentage with operator working off-farm	*5	<i>cd</i>	*10	<i>d</i>	14	<i>ad</i>	39	<i>abc</i>	16
Percentage with spouse working off-farm	34		27	<i>c</i>	45	<i>b</i>	43		37
Operator occupation ( <i>percentage</i> ): <sup>4</sup>									
Farming	96	<i>d</i>	87		96	<i>d</i>	72	<i>ac</i>	88
Non-farm	#4	<i>d</i>	#5	<i>d</i>	#3	<i>d</i>	25	<i>abc</i>	9
Operator age ( <i>percentage</i> ):									
Less than 50 years	43	<i>b</i>	59	<i>a</i>	51		50		48
50 to 64 years	52	<i>b</i>	32	<i>a</i>	41		39		43
65 years or more	*5		*9		*8		*12		9
Operator education ( <i>percentage</i> ):									
High school or less	41	<i>d</i>	39	<i>d</i>	39	<i>d</i>	*15	<i>abc</i>	34
Some college	26		36	<i>c</i>	23	<i>bd</i>	38	<i>c</i>	30
Completed college	20	<i>d</i>	23	<i>d</i>	32		43	<i>ab</i>	29

See notes at end of table.

Continued—

**Table 6—Characteristics of rice farms and rice producers, by region, 2000—Continued**

Item	Ark. Non-Delta (a)	Miss. River Delta <sup>1</sup> (b)	Gulf Coast <sup>2</sup> (c)	California (d)	All regions <sup>3</sup>
Financial characteristics per farm:					
Farm equity ( <i>dollars</i> ) <sup>4</sup>	677,916 <i>b</i>	1,549,573 <i>acd</i>	611,476 <i>b</i>	739,287 <i>b</i>	847,612
Assets ( <i>dollars</i> )	788,110 <i>b</i>	1,702,769 <i>acd</i>	682,745 <i>b</i>	841,974 <i>b</i>	955,468
Debt ( <i>dollars</i> )	110,194	153,196 <i>c</i>	71,269 <i>b</i>	*102,688	107,856
Debt-to-asset ratio ( <i>percent</i> )	14 <i>b</i>	9 <i>a</i>	*10	12	11
Financial characteristics per farm household:					
Total household income ( <i>dollars</i> )	*63,060 <i>bd</i>	117,858 <i>a</i>	91,478	129,146 <i>a</i>	93,212
Farm income ( <i>dollars</i> )	*46,009	77,537	63,974	*80,347	62,871
Off-farm income ( <i>dollars</i> )	17,051 <i>bcd</i>	*40,321 <i>a</i>	27,504 <i>ad</i>	48,799 <i>ac</i>	30,341
Government payments per farm ( <i>dollars</i> )					
Loan Deficiency (LDP)	92,827 <i>b</i>	156,571 <i>ad</i>	126,492	92,637 <i>b</i>	110,949
Transition AMTA/FAIR	41,963 <i>b</i>	65,25 <i>acd</i>	49,322 <i>b</i>	41,764 <i>b</i>	47,221
Agricultural disaster	39,318 <i>b</i>	62,027 <i>ad</i>	47,339	35,761 <i>b</i>	44,071
Other Federal and State programs	*6,432 <i>bc</i>	13,280 <i>acd</i>	26,646 <i>abd</i>	6,769 <i>bc</i>	12,359
Conservation Reserve Program	*4,550	*7,529	*2,951	#8,343	5,698
Environmental Quality Incentive Program	*322 <i>d</i>	D	D	0 <i>a</i>	D
	#141 <i>b</i>	*1,246 <i>ad</i>	D	0 <i>b</i>	*260
Percent of operators receiving govt. payments					
Loan Deficiency (LDP)	99	98	100	99	99
Transition AMTA/FAIR	91 <i>cd</i>	85 <i>cd</i>	97 <i>abd</i>	68 <i>abc</i>	86
Agricultural disaster	72 <i>cd</i>	71 <i>c</i>	86 <i>abd</i>	54 <i>ac</i>	70
Other Federal and State programs	26 <i>bc</i>	41 <i>acd</i>	61 <i>abd</i>	*25 <i>bc</i>	35
Conservation Reserve Program	23 <i>cd</i>	20	16 <i>a</i>	*10 <i>a</i>	18
Environmental Quality Incentive Program	*10 <i>d</i>	#10 <i>d</i>	D	0 <i>ab</i>	*6
	*4 <i>d</i>	*11 <i>cd</i>	#2 <i>bd</i>	0 <i>abc</i>	4

<sup>1</sup> Mississippi River Delta includes parts of Arkansas, Mississippi, and northeast Louisiana.

<sup>2</sup> Gulf Coast includes southwest Louisiana and Texas.

<sup>3</sup> All regions includes observations not located in the four main regions.

<sup>4</sup> May not add to 100, since percentages for hired managers are not shown.

D = Data insufficient for disclosure.

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.

a, b, c, and d indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

## Rice Production Practices and Operator Characteristics Differed by Farm Typology

*Differences in production practices and costs among the farm typology classes were driven by the geographical mix of farms constituting each farm typology class.*

The ERS farm typology classifies farms using the annual value of agricultural sales, farmers' occupation, and farm asset values (see glossary). Data for limited-resource, retirement, and residential/lifestyle farms, farms operated by hired managers, and farms organized as cooperatives or nonfamily corporations are not shown in the farm typology tables in this section due to insufficient sample size for these farms in the 2000 ARMS. However, percentages across the farm typology classes include data for all farms. Rice farms excluded from the typology tables constitute 18 percent of all U.S. rice farms and account for 12 percent of the planted rice acreage. Most rice production was concentrated on large and very large farms, with large farming operations accounting for just over a fourth of all U.S. rice acreage and production, while very large operations accounted for half. Large and very large rice farms made up 64 percent of all U.S. rice farms in 2000 (fig. 5).

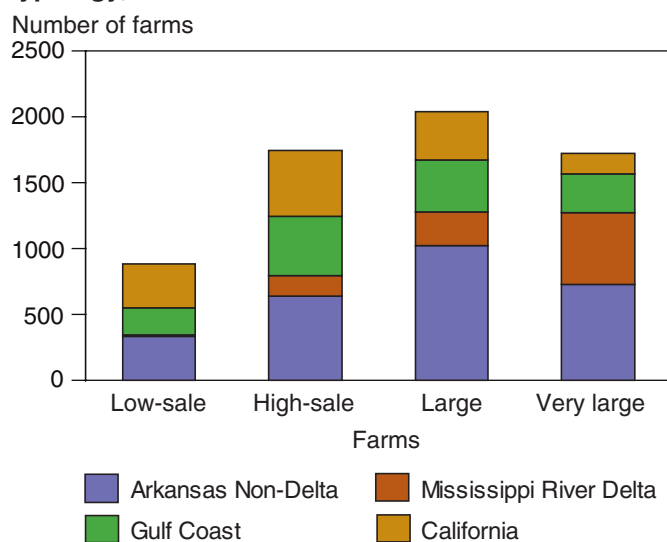
For rice farms, both the acreage devoted to rice production and the total operated acreage increased as farm size increased. Producers on very large rice farms planted an average of 774 acres of rice out of a total of 2,517 acres operated (31 percent of acres planted to rice) in

contrast to producers on low-sales farms, who planted an average of 112 acres of rice out of a total of 256 acres operated (44 percent). As farm size increased, cash-rent and share-rent acreage accounted for a larger proportion of total operated acreage. Low-sales farms cash- or share-rented 61 percent of their total operated acreage, while very large rice farms rented 87 percent. While the percentage of rented to operated acres varied significantly by farm size, the percentage of rice acreage that was cash- or share-rented did not vary significantly among farm typology classes.

Low-sales farms producing rice were primarily located in the Arkansas Non-Delta, Gulf Coast, and California rice-producing regions. These farms accounted for 12 percent of U.S. rice farms, but for just 4 percent of rice acreage (table 7). Low-sales farms had the highest overall cost for the rice enterprise and, at an average of \$452, the highest operating and ownership costs per acre—significantly more than the \$383 per acre for very large farms. Costs per cwt averaged \$6.91 in 2000 for low-sales farms compared with \$6.00 per cwt for all rice farms. Actual yields were lower than expected among all typology classes in 2000, with low-sales farms having the largest gap between their expected and actual rice yields. However, even if low-sales farms had achieved their expected yields, they still would have had the highest costs per cwt; their operating costs per acre for seeding, fertilizer, purchased irrigation water, and hired labor were highest on average. Some of these higher costs per acre were the result of production practices on low-sales farms.

Differences in rice production practices are often driven by differences in soil types and climate among regions. Low-sales farms aerial-seeded 75 percent of their rice acreage, the highest percent among the typology classes (table 8). In southwest Louisiana, aircraft seeding is done to control for the weed red rice (Louisiana State University Agricultural Center). In California, where red rice does not exist, aerial seeding helps to ensure that it does not become established. Aerial water-seeding of rice in California is done mainly to control weeds, especially Terrestrial Barnyard grass, by suppressing weed growth with a continuous flood (University of

Figure 5  
**Distribution of rice farms by region and farm typology, 2000**



Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

California Division of Agriculture and Natural Resources). Aerial seeding also saves time, lessens soil compaction, and allows producers to plant rice in fields too wet for dry planting methods. Aerial seeding usually involves custom work, which drives up the cost of custom operations for low-sales farms. Since it is used primarily for weed control, there is less need for herbicide applications on aerial-seeded acreage. Low-sales farms had the least rice acreage treated with herbicides, 86 percent, compared with the U.S. average of 97 percent. Hence, aerial seeding may have contributed to lower average chemical costs per acre on low-sales farms.

Large and very large farm operations were more likely to use conservation tillage practices on their rice acreage than the small farms. Conservation tillage practices lower machinery, fuel, and labor costs per acre, since they reduce the number of field operations.

Low-sales farms purchased a higher percentage of water used in rice production than very large farms. The low-sales farms were less likely to get irrigation water from wells for rice operations; their operators purchased 38 percent of the 49 inches of irrigation water used on the rice fields, in comparison with the operators of very large rice farms, who purchased 17 percent of their 43 inches of water. The location of low-sales and very large farms played an important role in determining whether operators bought irrigation water. California rice farm operators purchased 89 percent of the irrigation water they used for rice production, with most of the purchased water coming from irrigation districts. Texas rice farm operators purchased 57 percent of their irrigation water. Low-sales farms used well water to irrigate 58 percent of their rice acreage, compared with 79 percent for very large farm operations. The use of well water by farm size depends on the location of farms within the farm size classification. Since California rice farms made up a large percentage of low-sales farms and California farms purchased most of their water, low-sales farms depended less on well water than very large farms.

Slightly under half of the rice acreage on low-sales farms was used to grow long-grain rice, with the remaining acreage used for medium- and short-grain. In contrast, very large rice farms planted 84 percent of their rice acreage with long-grain rice. Long-grain rice is usually grown in the South, since its varieties are developed for the higher temperatures. Southern rice

producers also raise some medium- and short-grain rice, but this differs significantly from the strains in California. However, research is underway to develop medium- and short-grain varieties used in California for Southern production.

Low-sales farms were the least diversified farm operations among the typology classes. Conditions in California, southwest Louisiana, and the Gulf Coast in Texas typically do not allow other crops to be grown profitably in these locations. The soil in California's rice-growing region consists of fine-textured clay with poor water drainage, which prevents the growth of most other crops. That is why low-sales farms, a large percentage of which are in California, are the least likely to rotate crops on their rice acreage. The average number of agricultural commodities grown on low-sales farms was just 1.6, with 44 percent of these farms raising only rice. Soybeans were the second most popular crop, grown on 40 percent of the low-sales rice farms. Low-sales farms were highly dependent upon rice, which constituted 76 percent of their total production value during 2000. In contrast, rice accounted for 45 percent of the production value on very large rice farms, with just 14 percent of these farms producing only rice. Very large rice farms averaged 2.8 commodities per farm, with 79 percent of them also producing soybeans and 46 percent producing wheat.

In addition to variations in location, production costs, production practices, and diversification, there are significant variations in operator characteristics, farm organization, and financial position among farms in the different typology classes. Both the operator's age and educational level tended to be related to farm size, with age correlated negatively and education positively. Among low-sales farms, 70 percent of operators were at least 50 years old, in comparison with 46 percent for very large farms (table 9). About 30 percent of the operators with low-sales farms did not have a high school education, compared with less than 5 percent of operators with very large rice farms.

Farm organization also varies by farm size, with small farms more likely to be organized as sole or family proprietorships. Fifty-nine percent of very large farms had a partnership arrangement, the highest percent among the groups. Nearly 25 percent of large farms were organized as partnerships.

Average farm asset, debt, and equity values increased as farm size increased, with low-sales farms having the lowest debt-to-asset ratio (5 percent). In 2000, farm income for the principal operator averaged \$4,776 for low-sales rice farms compared with \$161,812 for operators of very large rice farms. Off-farm income averaged \$38,000 for low-sales farms and between \$25,000 and

\$27,000 per farm for high-sales, large, and very large farms. Household income per farm family for low- and high-sales farms, at \$43,400 and \$37,300 respectively, was significantly lower than the average household income for large farms (\$89,000) and very large farms (\$187,700).

**Table 7—Rice production costs and returns on rice farms, by farm typology, 2000**

Item	Small family farms				Larger family farms			
	Low sales (a)		High sales (b)		Large (c)		Very large (d)	
Percent of rice farms	13.7		27.4		31.7		27.1	
Percent of rice acres	3.7		16.3		29.4		50.6	
Percent of rice production	3.3		15.0		26.7		47.4	
Type of rice grown ( <i>percent of rice acres</i> ):								
Long grain	*50	d	65	d	72	d	85	abc
Medium and short grain	*50	d	35	d	28	d	*15	abc
Yield in cwt per acre:								
Actual	65	d	68		66		69	a
Expected	72		71		71		71	
Ratoon crop produced ( <i>percent of rice farms</i> ) <sup>1</sup>	#6		*5		*6		#8	
	Dollars							
Operating and ownership costs/cwt:								
Costs/actual yield	6.91	d	6.37	d	6.20		5.56	ab
Costs/expected yield	6.24	d	6.12	d	5.83		5.37	ab
Costs and returns per planted acre:								
Gross value of production	352.84	d	369.59		362.98		377.57	a
Operating costs	331.34		327.96		309.17		285.67	
Seed	25.68		25.31	d	23.26		22.53	b
Fertilizer and soil conditioners	57.76		47.11		49.03		43.01	
Chemicals	37.19	b	55.72	ac	42.78	b	48.52	
Custom operations	82.33		75.81		63.92		56.95	
Fuel, lube, and electricity	56.84		61.27		56.85		52.82	
Repairs	23.99		20.22		20.61		20.02	
Purchased irrigation water	*18.14		*8.07		*12.37		*7.67	
Interest on operating capital	8.45		8.28	d	7.54	d	7.00	bc
Hired labor	#12.55		*8.15		8.66	d	3.50	c
Ownership costs	120.24		103.66		101.85		97.57	
Capital recovery of machinery & equipment	101.12		84.88		84.23		83.00	
Taxes and insurance	*19.12		18.78	d	17.62		14.57	b
Total operating and ownership costs	451.58	d	431.62		411.02		383.24	a
Value of production less operating costs	#21.50		#41.63	d	*53.81		91.90	b
Value of production less operating and ownership costs	*-98.74	d	*-62.03	d	*-48.04		#-5.67	ab

<sup>1</sup> Ratoon crop is a second crop grown from the stubble of the first crop.

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.

a, b, c, and d indicate estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

**Table 8—Production practices and input use on rice farms, by farm typology, 2000**

Item	Small family farms				Larger family farms			
	Low sales (a)		High sales (b)		Large (c)		Very large (d)	
Previous crop ( <i>percent of farms</i> ):								
Soybeans	*37		37	d	46		52	b
Rice	57	d	45		40		33	a
No crop (fallow)	#6	b	14	a	11		*10	
Seed quantity ( <i>lbs per acre</i> )	143	d	134	d	125		115	ab
Method of planting seed ( <i>percent of acres</i> ):								
Aerial	75	bcd	55	acd	36	abd	19	abc
Drilled-dry	*22	bcd	42	acd	60	abd	78	abc
Tillage systems ( <i>percent of acres</i> ):								
Conventional	100	cd	99	c	95	ab	91	a
Reduced	#3		*5		*9		*8	
Conservation	0	cd	#1	c	#5	ab	#9	a
Fertilizer use ( <i>percent of farms reporting use</i> ):								
Nitrogen	98		98		99		100	
Phosphorous	*68		66	c	51	b	52	
Potassium	*46		51	c	36	b	48	
Fertilizer quantity ( <i>lbs/acre</i> ):								
Nitrogen	137		124	d	144		149	b
Phosphorous	54	d	31		31		25	a
Potassium	27		24		23		29	
Chemical use ( <i>percent of acres treated</i> ):								
Herbicides	86		94	d	97		98	b
Insecticides	#19		34	d	*22		*16	b
Fungicides	*21		27	c	17	b	*23	
Chemical use ( <i>number of acre-treatments</i> ):								
Herbicides	1.7	bcd	2.6	a	2.5	a	2.9	a
Insecticides	*0.1		0.1	d	*0.1		*0.0	b
Fungicides	*0.2		*0.4		*0.2		*0.2	
Custom chemical application ( <i>percent of acres</i> )	51	cd	71		74	a	73	a
Custom-operations cost ( <i>dollars per acre</i> ):								
Drying	*25		24		21		19	
Fertilizer	11		13		12		13	
Chemical	9		10		10		9	
Seed	7	cd	6	d	4	ad	2	abc
Fuel usage:								
Gasoline ( <i>gal/acre</i> )	1.8		1.8		*2.9		2.0	
Diesel ( <i>gal/acre</i> )	32.2		34.3		35.8		30.3	
LP gas ( <i>gal/acre</i> )	*2.3		*2.4		#1.9		*2.2	
Natural gas ( <i>cubic ft/acre</i> )	#282.0		*619.0		*343.0		#862.0	
Electricity ( <i>kilowatt hour/acre</i> )	#115.8		*152.1		*114.4		119.9	
Inches of irrigation water per acre	49		42		42		43	
Percentage of water purchased	38	d	*30		30		*17	a
Drying rice ( <i>percent of production</i> ):								
Custom dried	55		57		64	d	44	c
Dried other than custom	*23		29		24		35	
Dried by coop or buyer	*22		15		*13		21	
Percentage moisture removed drying rice	D		6.3		5.4		5.6	
Paid labor hours per acre	1.8		2.3		#1.5		2.0	
Unpaid labor hours per acre	2.5	b	0.8	ad	#3.1		2.7	b

D = Data insufficient for disclosure. 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.

a, b, c, and d indicate estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.



**Table 9—Characteristics of rice farms and rice producers, by farm typology, 2000**

Item	Small family farms		Larger family farms	
	Low sales (a)	High sales (b)	Large (c)	Very large (d)
Production value:				
All commodities ( <i>dollars per farm</i> )	55,020 <i>bcd</i>	150,344 <i>acd</i>	247,746 <i>abd</i>	647,678 <i>abc</i>
Rice ( <i>dollars per farm</i> )	41,716 <i>bcd</i>	92,926 <i>acd</i>	142,976 <i>abd</i>	289,891 <i>abc</i>
Percentage of rice to total production value	76 <i>bcd</i>	62 <i>ad</i>	58 <i>ad</i>	45 <i>abc</i>
Size:				
Total operated acres per farm	256 <i>bcd</i>	752 <i>acd</i>	1,215 <i>abd</i>	2,517 <i>abc</i>
Acres of cropland per farm	236 <i>bcd</i>	654 <i>acd</i>	1,080 <i>abd</i>	2,417 <i>abc</i>
Harvested rice acreage per farm	108 <i>bcd</i>	242 <i>acd</i>	374 <i>abd</i>	737 <i>abc</i>
Diversification:				
Average number of commodities per farm	1.6 <i>bcd</i>	2.2 <i>ad</i>	2.4 <i>ad</i>	2.8 <i>abc</i>
Percent of rice farms with only rice	*44 <i>d</i>	32 <i>d</i>	*23	*14 <i>ab</i>
Percent of rice farms with:				
Soybeans	*40 <i>cd</i>	50 <i>cd</i>	67 <i>ab</i>	79 <i>ab</i>
Wheat	#8 <i>bcd</i>	26 <i>ad</i>	32 <i>ad</i>	46 <i>abc</i>
Cotton	D	#3 <i>d</i>	7 <i>ad</i>	21 <i>abc</i>
Corn	0 <i>bcd</i>	#7 <i>ad</i>	*6 <i>ad</i>	18 <i>abc</i>
Cattle	#10	*11 <i>d</i>	13 <i>d</i>	#4 <i>bc</i>
Fruit, vegetable, nursery	D	*9 <i>c</i>	D	#4
Land tenure:				
Acres owned per farm	*113 <i>bcd</i>	209 <i>ad</i>	277 <i>ad</i>	451 <i>abc</i>
Acres cash-rented per farm	*85 <i>bcd</i>	*285 <i>ad</i>	275 <i>ad</i>	988 <i>abc</i>
Acres share-rented per farm	*72 <i>bcd</i>	264 <i>acd</i>	650 <i>abd</i>	1,194 <i>abc</i>
Farm organization ( <i>percent of farms</i> ):				
Sole/family proprietor	87 <i>cd</i>	83 <i>cd</i>	68 <i>abd</i>	35 <i>abc</i>
Partnership	#12 <i>cd</i>	*9 <i>cd</i>	24 <i>abd</i>	59 <i>abc</i>
Family corporation	D	*8 <i>a</i>	*7 <i>a</i>	*6
Percentage acreage insured	70	65 <i>c</i>	83 <i>b</i>	78
Percentage with operator working off-farm	*19 <i>d</i>	*13 <i>d</i>	*9	#4 <i>ab</i>
Percentage with spouse working off-farm	*36	37	35	41
Operator occupation ( <i>percentage</i> ):				
Farming	100 <i>c</i>	100 <i>c</i>	94 <i>ab</i>	98
Operator age ( <i>percentage</i> ):				
Less than 50 years	*29 <i>cd</i>	46	51 <i>a</i>	54 <i>a</i>
50 to 64 years	*57	40	42	44
65 years or more	*13	*14 <i>d</i>	*7	#3 <i>b</i>
Operator education ( <i>percentage</i> ):				
High school	*28	33	37	35
Some college	*28	32	29	32
Completed college	#14	31	27	30

See notes at end of table.

Continued—

**Table 9—Characteristics of rice farms and rice producers, by farm typology, 2000—Continued**

Item	Small family farms		Larger family farms	
	Low sales (a)	High sales (b)	Large (c)	Very large (d)
Financial characteristics per farm:				
Farm equity ( <i>dollars</i> )	506,295 <i>cd</i>	575,970 <i>cd</i>	787,090 <i>abd</i>	1,183,812 <i>abc</i>
Farm assets ( <i>dollars</i> )	535,103 <i>cd</i>	661,772 <i>cd</i>	884,225 <i>abd</i>	1,346,624 <i>abc</i>
Farm debt ( <i>dollars</i> )	*28,807 <i>bcd</i>	*85,802 <i>ad</i>	97,135 <i>ad</i>	162,812 <i>abc</i>
Debt-to-asset ratio ( <i>percent</i> )	*5 <i>bcd</i>	13 <i>a</i>	11 <i>a</i>	12 <i>a</i>
Financial characteristics per farm household:				
Total household income ( <i>dollars</i> )	*43,403 <i>cd</i>	#37,338 <i>cd</i>	89,098 <i>abd</i>	187,743 <i>abc</i>
Farm income ( <i>dollars</i> )	#4,776 <i>cd</i>	#11,344 <i>cd</i>	63,686 <i>abd</i>	161,076 <i>abc</i>
Off-farm income ( <i>dollars</i> )	38,628 <i>b</i>	25,994 <i>a</i>	25,412	26,667
Government payments per farm ( <i>dollars</i> )				
Loan deficiency (LDP)	*14,426 <i>bcd</i>	24,965 <i>acd</i>	43,254 <i>abd</i>	102,492 <i>abc</i>
Transition AMTA/FAIR	*8,152 <i>bcd</i>	27,341 <i>acd</i>	41,145 <i>abd</i>	90,162 <i>abc</i>
Agricultural disaster	2,639 <i>bcd</i>	*11,216 <i>a</i>	10,774 <i>ad</i>	*22,364 <i>ac</i>
Other Federal and State programs	D	*4,358	*4,470	*11,515
Conservation Reserve Program	D	#282	#317	#101
Environmental Quality Incentive Program	0 <i>d</i>	D	D	#500 <i>a</i>
Percent of operators receiving govt. payments				
Loan deficiency (LDP)	97	100	100	99
Transition AMTA/FAIR	90	88	86	93
Agricultural disaster	*55	69	70	80
Other Federal and State programs	*24	39	35	38
Conservation Reserve Program	D	20	*17	20
Environmental Quality Incentive Program	D	*7	#5	#4
	0 <i>d</i>	D	#4	*9 <i>a</i>

D=Data insufficient for disclosure.

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.

a, b, c, and d indicate estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

## Farm and Operator Characteristics Varied by the Size of the Rice Enterprise

*Rice production costs and the size of the rice enterprise, however, were not strongly linked.*

Farms with less than 250 acres of rice accounted for 43 percent of rice farms, but just 16 percent of the rice production (table 10). In contrast, farms with the largest rice enterprises, those with 750 or more acres of rice, comprised 11 percent of all U.S. rice farms and 33 percent of rice production. Gulf Coast and California rice farms made up about half of the farms with less than 500 acres of rice, while Arkansas Non-Delta rice farms accounted for over half the farms with 500 to 750 acres of rice (fig. 6). Arkansas Non-Delta rice farms also had the highest percentage of farms with 750 or more acres of rice.

In 2000, the mean operating and ownership costs for rice ranged from \$6.12 per cwt for those who planted less than 250 acres of rice to \$5.86 per cwt for those with 750 or more acres of rice (table 10), but the differences in the average cost per cwt were not statistically significant. Hence, one cannot conclude that the average cost for one size group is higher or lower than the average cost for another group (see glossary). The operating and ownership costs for rice, at \$454 per acre, were highest for operators with less than 250 acres of rice,

while averaging \$391 or less for operators with 500 or more acres of rice. Rice yields were highest for producers with the least rice acreage. However, the differences in the costs per acre and yields were not significant for farms with different-size rice enterprises.

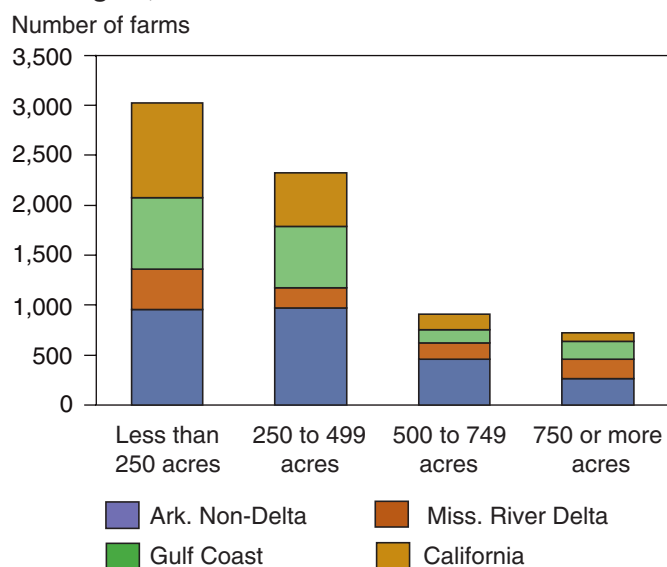
Among different-size rice enterprises, there were notable differences in the costs per acre for some inputs, such as the custom work, fuel, and irrigation water purchases. Producers with small rice enterprises had the highest custom operations cost per acre, due largely to their custom expenditures for harvesting and drying. Since Texas and California rice producers custom-dry about 80 percent of their rice, this helps to explain the high cost of custom work for producers with small rice acreage.

Producers with the smallest rice acreage had lower fuel costs per acre for producing rice due to their reduced consumption of nearly all types of fuel, including gasoline, diesel, liquid propane (LP), and electricity; only their natural gas consumption was higher. These producers use less fuel per acre for rice irrigation, likely because of their greater reliance on surface water rather than well water for irrigating their rice fields; well water requires fuel for pumping it to the surface. Greater use of custom operations also reduced fuel usage on farms with the smallest rice acreage.

The higher per acre cost of purchased water for farms with small rice enterprises was due to their greater dependence on outside supplies for irrigation. On average, nearly half of water used for rice production on these farms was bought from a source such as a water district. In contrast, producers with 250 acres or more of rice purchased, on average, less than 30 percent of their water. In California, where a third of small rice enterprises are located, rice producers purchased nearly all the water used on their rice operations.

Only a few rice production practices varied significantly according to size of the rice operation. Much of the variation was explained by geographical location of farms within the size class. For instance, producers with the smallest rice enterprises used aerial seeding on a

Figure 6  
**Distribution of rice farms by size of rice enterprise and region, 2000**



Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

higher percentage of their rice acres (57 percent) than producers with larger rice enterprises (37 percent or less) (table 11). Producers with smaller rice acreage also were less likely to rotate crops on their rice acreage. As noted earlier, rice fields in California and the Gulf Coast consist of soils that retain water, making it difficult to use these fields for crops that require drier land. Producers with the smallest rice acreage planted an average of 138 acres of rice compared with 1,105 acres for producers with the largest rice acreage. The percentage of land used in rice production that was cash- or share-rented ranged from 68 to 74 percent. The largest producers had significantly higher percentages of cash-rented rice acreage and had fewer field preparations and planting operations. Producers with less than 500 acres of rice were more likely to raise medium- and short-grain rice, since many of them farm in California. A higher percentage of producers with 750 or more rice acres reused water drained from rice fields compared with other rice producers. California producers also dried a higher percentage of their own rice.

Compared with production practices, there was more variation in the characteristics of rice farms and their operators among farms with different-size rice operations. As the size of the rice enterprise increased, rice tended to constitute a greater percentage of the total agricultural production value (table 12). However, other diversity measures indicated that farms with larger rice enterprises may have been more diversified. The percentage of producers growing only rice declined from 34 to 18 percent as the size of the rice enterprise increased. The average number of commodities per farm rose from 2.2 for farms with less than 250 acres of rice to 2.6 for farms with 750 or more rice acres. Half of producers with less than 250 acres of rice also raised soybeans and 65 percent raised wheat, while 65 percent of farms with 750 or more acres of rice grew soybeans and 37 percent grew wheat.

The size of the rice operation and the total farm acreage were positively correlated. Farms with less than 250 rice acres averaged 717 total acres per farm, the smallest total acreage among the size classes. In contrast, farms with 750 or more rice acres averaged a total of 3,246 acres per farm in 2000. Total cash- and share-rented acres comprised between 62 and 86 percent of the total operated acres.

Farm organization and the size of the rice enterprise were correlated. Sole proprietors operated 82 percent of farms with less than 250 acres of rice, compared to 72

percent for farms with 250 to 499 acres of rice and 40 percent or less for farms with 500 or more rice acres. Partnerships were the dominant form of organization for farms with 500 or more rice acres and the second most popular way of organizing the business when the rice enterprise was less than 500 acres. Family corporations made up a small percentage of rice farms.

Characteristics of rice farm operators varied somewhat with the size of their rice enterprise. Eighty-two percent of the operators with less than 250 acres of rice reported farming as their principal occupation, with most of the remaining operators reporting nonfarm occupations rather than listing themselves as retired. Ninety-two percent of operators with 250 or more acres of rice reported farming as their principal occupation. The differences in the mean ages of operators among the size classes were not correlated.

The incomes of rice farm operators and their families were related to the size of the rice enterprise. In 2000, total household incomes averaged \$71,391 for those with less than 250 rice acres and \$75,492 for those with 250 to 499 acres of rice. In contrast, those with 500-749 acres of rice averaged \$136,800 in household income and those with 750 or more rice acres averaged \$165,699. Farm income was significantly higher for operators of farms with 500 or more acres of rice compared with those with less than 500 rice acres. Farm income averaged less than \$47,132 per operator with 500 or less acres of rice compared with more than \$136,800 for those with more than 500 acres of rice. While farm income was positively correlated with rice enterprise size, off-farm income was not. Off-farm income averaged \$30,341 for all rice farm operators in 2000, while averaging between \$27,423 and \$32,445 for operators with different sizes of rice enterprises. About 1 in 4 operators with fewer than 250 rice acres worked off the farm in comparison with less than 1 in 10 for operators with 250 or more rice acres.

Nearly all rice farms received direct Government payments, with loan deficiency payments (LDP) and transition payments comprising most of the total regardless of the size of the rice operation. The average loan deficiency and transition payment rose significantly as the size of the rice enterprise increased. In 2000, loan deficiency payments averaged \$21,344 for farms with less than 250 rice acres and increased to an average of \$127,136 per farm for farms with more than 750 rice acres. Transition payments averaged \$22,732 for farms

with less than 250 rice acres and \$105,783 for farms with over 750 rice acres.

The value of farm assets, debts, and net worth increased as the rice acreage per farm increased. The per farm value of farm assets rose from an average of \$667,489 for farms with less than 250 rice acres to \$2,176,322 for

farms with 750 or more acres of rice. A similar increase occurred for farm debt as it rose from \$53,176 for rice enterprises with less than 250 acres to \$270,326 for those with 750 or more acres. Equity ranged from an average of \$614,313 per farm to \$1,905,995 per farm for the farms with the smallest and largest rice enterprises.

**Table 10—Rice production costs and returns on rice farms, by rice-planted acreage, 2000**

Item	Fewer than 250 acres (a)	250-499 acres (b)	500-749 acres (c)	750 or more acres (d)
Percent of rice farms	43	33	13	#11
Percent of rice acres	16	31	20	*33
Percent of rice production (cwt)	16	32	19	*33
Type of rice grown (percent of rice acres):				
Long grain	55	69	77	81
Medium and short grain	45	31	#23	#19
Yield in cwt per acre:				
Actual	71	68	65	67
Expected	74	71	70	70
Ratoon crop produced (percent of farms) <sup>1</sup>	#6	8	#3	#10
<i>Dollars</i>				
Operating and ownership costs/cwt:				
Costs/actual yield	6.41	6.00	5.88	*5.86
Costs/expected yield	6.12	5.76	5.54	*5.56
Costs and returns per planted acre (dollars):				
Gross value of production	380.57	372.33	360.14	364.60
Operating costs:				
Seed	24.89	23.05	21.97	23.61
Fertilizer and soil conditioners	51.17	44.33	#43.02	*48.91
Chemicals	55.59	50.54	43.88	48.24
Custom operations	112.78 <i>bc</i>	74.00 <i>a</i>	60.94 <i>a</i>	#47.76
Fuel, lube, and electricity	*47.50	58.55	*55.17	63.54
Repairs	18.18	19.43	20.53	*18.55
Purchased irrigation water	*18.58	10.10	#6.93	#11.08
Interest on operating capital	9.30 <i>b</i>	7.89 <i>a</i>	7.09	*7.38
Hired labor	*25.68	24.44	*24.39	#29.41
Ownership costs	90.13	96.90	100.60	92.52
Capital recovery of machinery and equipment	74.13 <i>c</i>	79.04	86.49 <i>a</i>	*78.09
Taxes and insurance	16.00	17.86 <i>d</i>	14.11	14.43 <i>b</i>
Operating and ownership costs	453.79	409.22	384.52	*391.00
Value of production less operating costs	#16.91	60.01	#76.22	#66.12
Value of production less operating and ownership costs	*-73.22	*-36.89	#-24.39	#-26.40

<sup>1</sup>Ratoon crop is a second crop grown from the stubble of the first crop.

Coefficient of Variation (CV) = (standarderror/estimate) x 100.

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

# indicates that CV is greater than 50.

*a*, *b*, *c*, and *d* indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

**Table 11—Production practices and input use on rice farms, by rice-planted acreage, 2000**

Item	Fewer than 250 acres (a)	250-499 acres (b)	500-749 acres (c)	750 or more acres (d)
Previous crop ( <i>percent of farms</i> ):				
Soybeans	31	43	*47	#45
Rice	50	39	*44	*29
No crop (fallow)	*11	15	#8	#18
Seed quantity ( <i>lbs per acre</i> )	131	128	125	120
Method of planting seed ( <i>percent of acres</i> ):				
Aerial	56 <i>cd</i>	37	*24 <i>a</i>	*29 <i>a</i>
Drilled-dry	41 <i>cd</i>	52	73 <i>a</i>	69 <i>a</i>
Tillage systems ( <i>percent of acres</i> ):				
Conventional	96	97	93	92
Reduced	*7	*4	#3	#16
Conservation	*4	#3	#7	#8
Fertilizer use ( <i>percent of farms reporting use</i> ):				
Nitrogen	98 <i>cd</i>	99	100 <i>a</i>	100 <i>a</i>
Phosphorous	59	66	56	#56
Potassium	50	52	*45	#43
Fertilizer quantity:				
Nitrogen ( <i>lbs/acre</i> )	130	137	161	#139
Phosphorous ( <i>lbs/acre</i> )	37 <i>c</i>	31	25 <i>a</i>	31
Potassium ( <i>lbs/acre</i> )	28	28	31	#22
Chemical use ( <i>percent of acres treated</i> ):				
Herbicides	93	98	97	96
Insecticides	32	21	#15	#26
Fungicides	23	25	*15	#23
Chemical use ( <i>acre-treatments</i> ):				
Herbicides	2.4	2.8	*2.6	#2.9
Insecticides	0.4	0.4	#0.2	#0.4
Fungicides	*0.3	0.3 <i>c</i>	*0.2 <i>b</i>	#0.2
Custom chemical application ( <i>percent of farms</i> )	67	76	*76	*71
Custom-operations cost ( <i>dollars per acre</i> ):				
Drying	30 <i>c</i>	25	19 <i>a</i>	#12
Fertilizer	14	13	13	#13
Chemical	12	10	*8	9
Harvest	19 <i>bc</i>	*6 <i>a</i>	*3 <i>a</i>	D
Total including seed and cultivation	113 <i>bc</i>	74 <i>a</i>	61 <i>a</i>	#48
Fuel usage:				
Gasoline ( <i>gal/acre</i> )	*2.5	1.9	2.2	#4.7
Diesel ( <i>gal/acre</i> )	#25.7	36.4	*37.3	33.0
LP gas ( <i>gal/acre</i> )	*1.1	*2.3	*1.0	#3.1
Natural gas ( <i>cubic ft/acre</i> )	#228.0	*456.0	#166.0	#992.0
Electricity ( <i>kilowatt hour/acre</i> )	166.6	*115.2	*118.9	#138.8
Inches of irrigation water per acre	45	41	43	44
Percentage of water purchased	35	25	#17	#13

See notes at end of table.

Continued—



**Table 11—Production practices and input use on rice farms, by rice-planted acreage, 2000—Continued**

Item	Fewer than 250 acres (a)	250-499 acres (b)	500-749 acres (c)	750 or more acres (d)
Drying rice ( <i>percent of production</i> ):				
Custom dried	66	62	61	#31
Dried on-farm	17	26	*26	#53
Dried by coop or buyer	17	*12	*13	#16
Percentage moisture removed drying rice	6.3	6.0	5.9	5.7
Paid labor hours per acre	1.2 <i>cd</i>	1.5	2.1 <i>a</i>	2.1 <i>a</i>
Unpaid labor hours per acre	3.0 <i>d</i>	3.2 <i>cd</i>	2.5 <i>bd</i>	1.6 <i>abc</i>

D=Data insufficient for disclosure.

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.

a, b, c, and d indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

**Table 12—Characteristics of rice farms and rice producers, by rice-planted acreage, 2000**

Item	Fewer than 250 acres (a)	250-499 acres (b)	500-749 acres (c)	750 or more acres (d)
Production value:				
All commodities ( <i>dollars per farm</i> )	151,555 <i>bcd</i>	273,615 <i>acd</i>	430,750 <i>abd</i>	718,315 <i>abc</i>
Rice ( <i>dollars per farm</i> )	57,132 <i>bcd</i>	137,618 <i>acd</i>	233,630 <i>abd</i>	428,779 <i>abc</i>
Percentage of rice to total production value	38 <i>bcd</i>	50 <i>a</i>	54 <i>a</i>	60 <i>a</i>
Size:				
Total operated acres per farm	717 <i>bcd</i>	1,234 <i>acd</i>	1,710 <i>abd</i>	3,246 <i>abc</i>
Acres of cropland per farm	635 <i>bcd</i>	1,101 <i>acd</i>	1,632 <i>abd</i>	2,853 <i>abc</i>
Harvested rice acreage per farm	138 <i>bcd</i>	363 <i>acd</i>	600 <i>abd</i>	1,105 <i>abc</i>
Diversity:				
Percentage of farms with only rice	34	25	29	*18
Average number of commodities/farm	2.2	2.3	2.4	2.6
Percent of rice farms with:				
Soybeans	49 <i>bc</i>	63 <i>a</i>	68 <i>a</i>	65
Wheat	22 <i>bcd</i>	33 <i>a</i>	38 <i>a</i>	37 <i>a</i>
Corn	*7	*9	#6	*14
Cotton	10	*6	*7	*10
Cattle	*13 <i>c</i>	10	#5 <i>a</i>	#8
Fruit, vegetable, nursery	*10	D	D	D
Land tenure:				
Acres owned per farm	*284 <i>d</i>	247 <i>d</i>	*434	*789 <i>ab</i>
Acres cash-rented per farm	177 <i>bcd</i>	344 <i>ad</i>	357 <i>ad</i>	1,742 <i>abc</i>
Acres share-rented per farm	259 <i>bcd</i>	643 <i>acd</i>	931 <i>ab</i>	1,034 <i>ab</i>
Farm organization ( <i>percent of farms</i> ):				
Sole/family proprietor	82 <i>bcd</i>	72 <i>acd</i>	*40 <i>ab</i>	31 <i>ab</i>
Partnership	13 <i>bcd</i>	22 <i>acd</i>	47 <i>ab</i>	62 <i>ab</i>
Family corporation	*5	*6	*13	#7
Percentage acreage insured	69	72	81	83
Percentage with operator working off-farm	25 <i>bcd</i>	*7 <i>a</i>	#6 <i>a</i>	#9 <i>a</i>
Percentage with spouse working off-farm	35 <i>c</i>	34 <i>c</i>	49 <i>ab</i>	*38
Operator occupation ( <i>percentage</i> ): <sup>1</sup>				
Farming	82 <i>bcd</i>	92 <i>a</i>	94 <i>a</i>	93 <i>a</i>
Nonfarm	13	*6	#6	D
Operator age ( <i>percentage</i> ):				
Less than 50 years	45	48	55	54
50 to 64 years	42	45	40	44
65 years or more	12	*7	#5	D
Operator education ( <i>percentage</i> ):				
High school	34	34	34	33
Some college	31	28	29	*30
Completed college	26	32	34	33

See notes at end of table.

Continued—

**Table 12—Characteristics of rice farms and rice producers, by rice-planted acreage, 2000—Continued**

Item	Fewer than 250 acres (a)	250-499 acres (b)	500-749 acres (c)	750 or more acres (d)
Financial characteristics per farm:				
Farm equity ( <i>dollars</i> )	614,313 <i>cd</i>	711,409 <i>cd</i>	998,196 <i>abd</i>	1,905,995 <i>abc</i>
Farm assets ( <i>dollars</i> )	667,489 <i>cd</i>	816,144 <i>cd</i>	1,154,955 <i>abd</i>	2,176,322 <i>abc</i>
Farm debt ( <i>dollars</i> )	53,176 <i>bcd</i>	104,735 <i>ad</i>	156,758 <i>a</i>	270,326 <i>ab</i>
Debt-to-asset ratio	8 <i>bc</i>	13 <i>a</i>	14 <i>a</i>	12
Financial characteristics per farm household:				
Total household income ( <i>dollars</i> )	71,391 <i>cd</i>	*75,492 <i>cd</i>	136,800 <i>ab</i>	*165,699 <i>ab</i>
Farm income ( <i>dollars</i> )	38,947 <i>cd</i>	*47,132 <i>cd</i>	109,377 <i>ab</i>	*134,928 <i>ab</i>
Off-farm income ( <i>dollars</i> )	32,445	28,360	27,423	*30,770
Government payments per farm ( <i>dollars</i> )				
Loan deficiency (LDP)	57,368 <i>bcd</i>	97,149 <i>acd</i>	173,658 <i>abd</i>	277,381 <i>abc</i>
Transition AMTA/FAIR	21,344 <i>bcd</i>	38,054 <i>acd</i>	82,678 <i>abd</i>	127,136 <i>abc</i>
Agricultural disaster	22,732 <i>bcd</i>	40,735 <i>acd</i>	68,583 <i>abd</i>	105,783 <i>abc</i>
Other Federal and State programs	6,660 <i>bcd</i>	12,594 <i>a</i>	*14,712 <i>a</i>	*31,371 <i>a</i>
Conservation Reserve Program	*3,792	*5,349	#6,667	D
Environmental Quality Incentive Program	D	#277	D	#168
	D	#89	#895	D
Percent of operators receiving govt. payments				
Loan deficiency (LDP)	99	100	98	100
Transition AMTA/FAIR	82 <i>d</i>	88	88	94 <i>a</i>
Agricultural disaster	65 <i>c</i>	71	77 <i>a</i>	77
Other Federal and State programs	33	40	36	34
Conservation Reserve Program	19 <i>d</i>	19	*16	*10 <i>a</i>
Environmental Quality Incentive Program	*7	*5	D	#7
	#1 <i>c</i>	*4 <i>c</i>	*13 <i>ab</i>	D

<sup>1</sup>May not add to 100 since percentages for hired managers are not shown.

D=Data insufficient for disclosure

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.

a, b, c, and d indicate that estimates are significantly different from the group indicated in the column heading at the 90 percent or better level using the t-statistic.

Source: 2000 Agricultural Resource Management Survey, USDA, ERS.

## Glossary

**Agricultural Resource Management Survey (ARMS)** is the source of data compiled for this report. Rice costs and returns estimates in this report are derived from the responses of 607 rice farmers in five States to a survey on rice production practices and costs as part of the 2000 ARMS. The five States surveyed were Arkansas, California, Louisiana, Mississippi, and Texas. The target population for the survey was farmers who planted rice with the intention of harvesting it. The National Agricultural Statistics Service (NASS) and the Economic Research Service (ERS) collect production and cost data once every 5 to 8 years for each commodity on a rotating basis in the ARMS survey. The survey data are weighted to represent all U.S. rice-planted acreage in the surveyed States. The planted acreage in the surveyed States accounted for 94 percent of all U.S. rice acreage.

### Cost categories

- Low-cost producers are the 25 percent of U.S. rice producers with the lowest production costs per harvested hundredweight (cwt) of rice. These producers had operating and ownership costs of \$4.90 per cwt or less for rice in 2000. The cost per cwt is computed by dividing production costs by the cwt of rice produced.
- High-cost producers are the 25 percent of U.S. rice producers with the highest operating and ownership costs per cwt of rice. These producers had operating costs of \$7.43 or more per cwt in 2000.

**Crop rotation** refers to the crop planted in the spring/summer or fall of 1999 prior to the rice crop in 2000.

**ERS's farm typology** classifies farms based on size, where size is measured by the annual value of gross sales.

**Small farms** are family farms with annual gross sales of \$250,000 or less and whose operators report farming as their major occupation.

- Lower-sales farms are family farms that have annual gross sales of less than \$100,000 and farm assets of

\$150,000 or more and whose operators report farming as their major occupation.

- High-sales farms are those family farms whose annual gross sales are \$100,000 or more but less than \$250,000 and whose operators report farming as their major occupation.

**Larger farms** are family farms with gross annual sales of \$250,000 or more.

- Large farm operations are defined as farms with annual gross sales of \$250,000 or more, but less than \$500,000.
- Very large farms are those with annual gross sales of \$500,000 or more.

**Nonfamily farms** are those organized as nonfamily corporations or cooperatives or those operated by hired managers.

**Farm household income** averaged \$61,947 for all U.S. farms and \$57,045 for U.S. farm households that raised rice in 2000. Farm household income is computed from the ARMS data and is the sum of farm income and off-farm income of farm households. The farm income of farm households excludes the farm income earned by landlords and contractors. It also excludes the farm income generated by farms organized as nonfamily corporations or cooperatives or 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 are those for the household of the principal farm operator. Farm income of farm households is computed by taking net cash farm business income and subtracting depreciation, wages paid to the operator, gross farmland rental income, and the farm income received by other households, and then adding back the wages to operators, net income from farmland rental, and the earnings of the operator household from farming activities (ERS, AIS-67). Off-farm income consists of wages, salaries, net income from nonfarm businesses, interest, dividends, transfer payments, Social Security retirement, pensions, other retirement plans, gifts, and other off-farm sources.

**Production costs** are the sum of operating and ownership costs for all participants in the rice production enterprise, including the operators, landlords, and contractors. *Operating costs* include the costs for seed, fertilizer, soil conditioners, chemicals, custom operations, fuel, repairs, purchased irrigation water, interest, and hired labor. *Ownership costs* are costs related to capital items that are consumed during the year in the production process. Ownership costs include the capital recovery costs for farm machinery and equipment, non-real estate property taxes, and insurance. Capital recovery represents the value of farm machinery and equipment consumed in the annual production process. Capital recovery costs are a discretionary expense in any given year. In low-income years, these expenditures may be deferred, but ultimately they must be paid if producers are to replace capital assets and remain in production. Marketing and storage costs are excluded from production costs, as are the opportunity costs for land and unpaid labor.

**Rice farms**, for the purposes of this report, are farms that planted at least 1 acre of rice in 2000.

**Rice production regions** identified in this report include the Non-Delta area of Arkansas; California; the Mississippi River Delta, which includes areas of Mississippi, Louisiana, and Arkansas; and the Gulf

Coast, which includes southwest Louisiana as well as the Texas coast. These regions consist of county groupings with similar soil and climatic traits.

**Tillage systems** are defined by the amount of crop residue remaining on the soil from the previous crop.

- Conventional tillage leaves less than 30 percent of the previous crop residue covering the soil when another crop is planted.
- Reduced tillage leaves between 15 percent and 30 percent of the previous crop residue covering the soil when another crop is planted.
- Conservation tillage leaves 30 percent or more of the previous crop residue covering the soil when another crop is planted.
- No-till means that no tillage operations have occurred prior to planting.

**Value of production** is computed using rice prices during the harvest months. The harvest month price is multiplied by the total quantity of rice harvested during that month.

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