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Characteristics and Production Costs of U.S. Corn Farms

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In this report... The production costs for a bushel of corn ranged from an average of \$1.19 per bushel for those farmers in the lowest quartile to \$3.67 per bushel for corn farmers in the highest quartile, ranked by production costs per bushel. Producers with high corn production costs per bushel tended to have both lower than average yields and higher than average corn costs per acre. Corn producers in the Heartland and Prairie Gateway had lower corn production costs per bushel than corn producers in the Northern Crescent and Southeast. Part-time farmers and farmers with small corn acreage tended to have high corn production costs per bushel.

Keywords: corn, costs of production, cost variation, corn production practices, farm characteristics.

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Overview

In 1996, corn was the leading U.S. crop in terms of both acreage and production value. Favorable weather conditions in 1996 resulted in an above-average national corn yield of 127.1 bushels per harvested acre. At \$2.71 per bushel, the 1996 market-year corn price was above average but down from the previous year (U.S. Dept. of Agriculture, National Agricultural Statistics Service Web site). In 1996, operating and ownership costs for producing corn ranged from an average of \$1.19 per planted bushel for 25 percent of the growers with the lowest costs to an average of \$3.67 per planted bushel for the 25 percent of growers with the highest costs. Some 79 percent of U.S. corn farmers produced 93 percent of the Nation's corn for less than \$2.71 per bushel (fig. 1)¹. Corn production costs per acre totaled \$230.38 in 1996, compared with gross production value of \$369.70 per acre for corn, including corn silage. The capital cost for machinery and equipment was the largest component of production costs per acre. Fertilizer expenditures per acre were the second largest cost item, followed by chemical, seed, and fuel expenditures.

With the passage of the 1996 Federal Agricultural Improvement and Reform (FAIR) Act, the Government removed acreage restrictions on program crops and instituted production flexibility contract payments that are not linked to commodity grain prices (Young and Westcott, 1996). Under the FAIR Act, grain producers face increased risk from low grain prices. Prior to the FAIR Act, deficiency payments rose when grain prices were low, in effect stabilizing farmers' incomes. Unlike deficiency payments, contract payments are fixed under the FAIR Act; thus, farmers' incomes may be more volatile as grain prices fluctuate. Between 1996 and 2000, the marketing-year average corn price dropped from \$2.71 to \$1.85 per bushel. The decline in grain prices increased the financial pressure on many

¹ Costs exclude storage and marketing costs.

farmers, prompting government officials to enact emergency assistance programs to aid them. Government officials, researchers, and extension agents need financial information on various categories of farmers to effectively develop and implement programs that help farmers remain financially viable. Studies by Plumley (1991), Purdy (1997), and Sonka (1991) and their colleagues have shown that one factor in determining farm financial success is financial efficiency (see glossary). Farmers who are more successful tend to maintain lower ratios of costs to output, while less successful farmers have higher costs per unit of output.

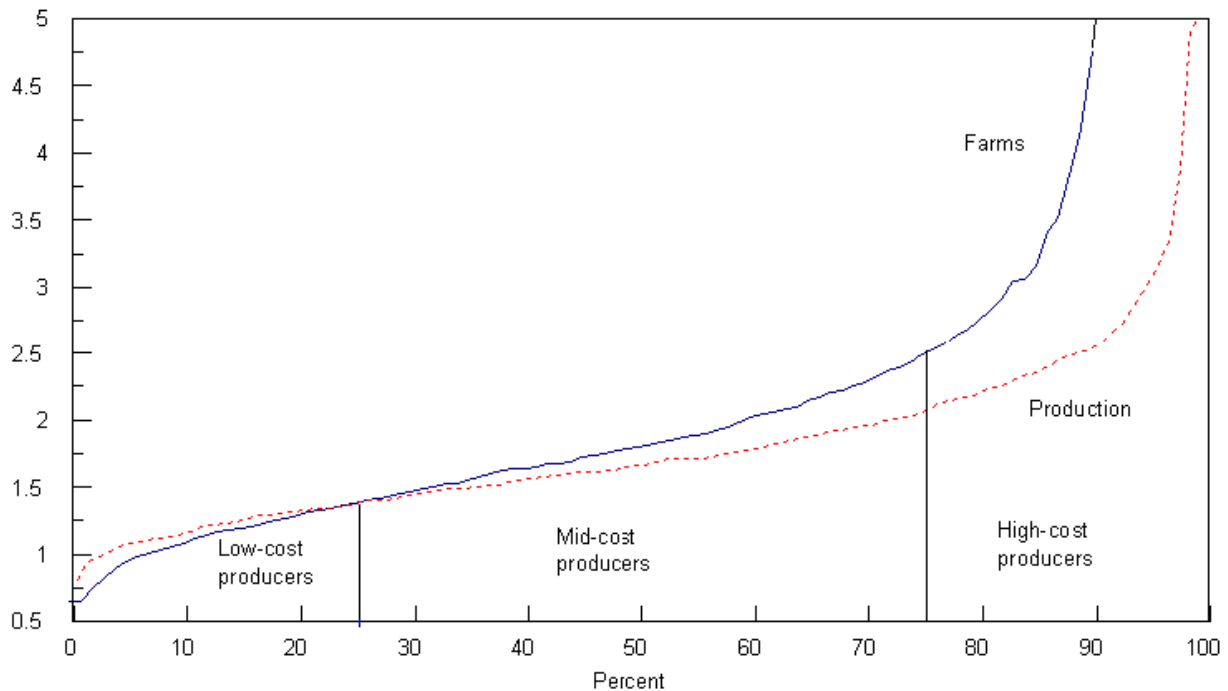
The objective of this report is to present information about the costs of producing corn in the United States and to examine how these production costs vary among different segments of the farm population. Factors that contribute to the variability in corn production costs per bushel are identified for various categories of farm producers. The categories used in this report are characterized by corn production costs per bushel, region, farm typology, and farm acreage (see glossary). Corn producers are ranked by their corn production costs per bushel to analyze factors associated with low and high production costs. Corn producers in different regions are compared to gain insights into regional variations in production costs. Farm typology is used to examine the relationship between farm types and corn production costs. Characteristics of farms based on planted corn acreage are compared, since farms may vary by acreage. Data in this report are derived from a special corn cost-of-production survey undertaken as part of the 1996 Agricultural Resource Management Study (ARMS) (see glossary). This was the latest survey to collect data on farmers' costs for corn production.

This report uses corn production costs as an indicator of financial success and assesses the characteristics of producers who are likely to be successful corn growers.

Figure 1

Cumulative distribution of corn farms and corn production by production costs per bushel for 1996

Dollars per bushel



Source: 1996 Agricultural Resource Management Study.

Production costs are the sum of the operating and ownership costs for inputs provided by operators, landlords, and contractors ([see glossary](#)).

Operating costs are the sum of costs that vary directly with the amount of corn produced.

Ownership costs are costs related to capital items that are consumed during the annual production process, such as farm machinery and equipment.

Production costs are used 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 in order to maintain viable farming operations. Since ownership costs are fixed in the short term, most farmers can remain in business for several years as long as they can meet their short-term

obligations. In the long term, producers wishing to maintain successful farming operations must be able to both meet their operating costs and replace capital assets consumed during the production process.

In the analysis for this report, ERS follows the computational standards recommended by the American Agricultural Economics Association (AAEA) Task Force on Commodity Costs and Returns (AAEA, 1998).

Costs Varied Significantly Among Corn Producers

Corn yields and enterprise size distinguished low-cost producers from mid- and high-cost producers.

For analysis by cost, corn producers are ranked based on production costs per bushel and grouped into quartiles. Mid-cost producers occupy the two middle quartiles while low- and high-cost producers fall into the end quartiles. Low-cost growers produced 35 percent of total corn production for \$1.43 or less per bushel, while high-cost growers produced 8 percent of the corn with production costs exceeding \$2.50 per bushel (table 1). High-cost producers averaged \$3.67 in costs per bushel in contrast to low-cost producers, who averaged \$1.19 per bushel, a difference of \$2.48. Among the regions, the Heartland had the smallest percentage of its corn producers in the high-cost category, while the Northern Crescent and Southeast had over one-third of their corn producers in the high-cost category (fig. 2).

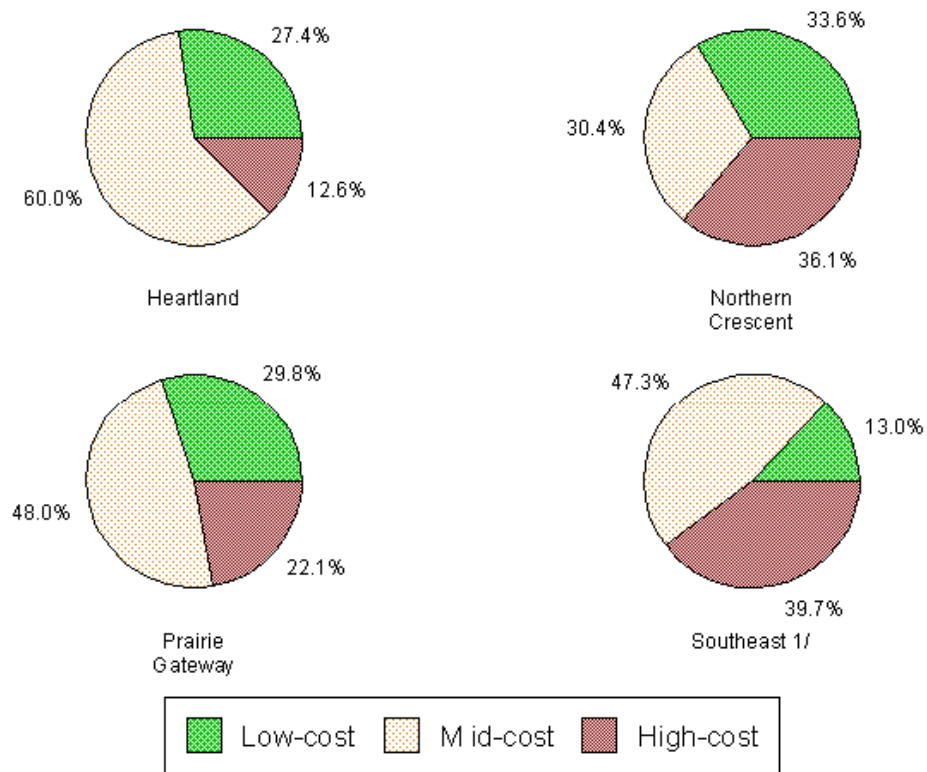
Differences in yields and costs per acre determine producers' rank in the cost distribution. As table 1 shows, high-cost producers had yields averaging 72 bushels per acre in 1996 compared with average yields of 154 bushels per acre for low-cost producers. Differences between actual and expected yields indicate the extent that uncontrollable factors, such as weather and pest infestations, may have affected yields. Yields of high-cost producers were nearly 50 bushels below their expected yields in 1996, while the yields of low-cost producers exceeded their expectations by 14 bushels. High-cost producers' expected yield of 120 bushels per acre was significantly less than low-cost producers' expected yield of 140 bushels per acre. Additionally, high-cost farms had production costs averaging nearly \$80 per acre higher than low-cost farms. Even if each category of farmers had achieved its expected yields, high-cost producers would still have production costs exceeding those of the low-cost producers by \$0.87 per bushel. Thus, despite the lower-than-expected yields of many high-cost producers

during 1996, their relative costs and expected yields suggest that many of them are likely to be chronic high-cost growers.

The \$80 difference in the production costs per acre between high- and low-cost corn producers stems mostly from four expenditure items: (1) capital recovery of machinery and equipment; (2) fertilizer; (3) fuel, lube, and electricity; and (4) repairs. Capital recovery, an estimate of the annual value of machinery and equipment that is consumed, accounted for nearly 40 percent of the cost difference. The annual machinery and equipment costs per acre for high-cost producers were nearly 65 percent higher than for low-cost producers. On average, low-cost producers had just over 200 corn acres over which to spread their fixed machinery costs in comparison to 134 acres for high-cost producers. The fertilizer expenditures per acre were lowest for producers in the low-cost category. Low-cost producers may have obtained fertilizer at lower prices than high-cost producers, since there were no significant differences in fertilizer use between producers in these categories (table 2). Higher fuel expenditures per acre for high-cost producers may be attributed to their greater percentage of irrigated acreage (table 3) and their higher number of field trips (table 2).

More low-cost producers planted corn after soybeans, while more high-cost producers followed corn with corn. High-cost producers were generally older and less educated than low-cost producers. High-cost corn producers were twice as likely to be 65 years or older than low-cost producers. Also, 35 percent of high-cost producers were retired or had nonfarm occupations, compared to 18 percent of low-cost producers.

Figure 2
Distribution of cost categories, by region, 1996



1/ Southeast includes Eastern Uplands and Southern Seaboard.
 Source: 1996 Agricultural Resource Management Study.

Table 1—Corn production costs and returns on 1996 ARMS corn farms, by cost group

Item	Low (a)		Mid (b)		High (c)	
Percentage of corn farms	25		50		25	
Percentage of corn acres	29	bc	54	ac	16	ab
Percentage of corn production (<i>bushels</i>)	35	bc	57	ac	8	ab
Size:						
Total operated acreage per farm	640		613		583	
Planted corn acreage per farm	206	c	212	c	134	ab
Yield in bushels per acre:						
Actual	154	bc	135	ac	72	ab
Expected	140	c	137	c	120	ab
Production costs per bushel (<i>dollars</i>)						
Actual	1.19	bc	1.83	ac	3.67	ab
Expected	1.31	bc	1.79	ac	2.18	ab
Costs and returns per planted acre (<i>dollars</i>):						
Gross value of production	431.57	bc	379.52	ac	226.01	ab
Operating costs	129.55	bc	172.41	a	175.60	a
Seed	25.95		27.29	c	25.78	b
Fertilizer	37.69	bc	50.91	a	50.91	a
Soil conditioners	0.14	c	0.15	c	0.21	ab
Manure	*0.64		#0.45		#0.99	
Chemicals	23.23	bc	29.24	a	28.91	a
Custom operations	8.88	bc	12.65	a	*11.12	
Fuel, lube, and electricity	16.81	bc	27.33	a	28.48	a
Repairs	10.80	bc	16.80	ac	21.34	ab
Purchased irrigation water	#0.78		#0.14		0.00	
Interest on operating capital	3.14	bc	4.15	a	4.22	a
Hired labor	1.48	bc	*3.32	a	3.64	a
Ownership costs	53.84	bc	73.62	ac	86.98	ab
Capital recovery: machinery, equipment	48.06	bc	66.35	ac	78.80	ab
Taxes and insurance	5.78	bc	7.27	a	6.98	a
Production costs	183.39	bc	246.02	ac	262.58	ab
Value of production less operating costs	302.02	bc	217.11	ac	50.42	ab
Value of production less production costs	248.19	bc	133.49	ac	-36.57	ab

Coefficient of Variation (CV) = (Standard Error/Estimate)*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 indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.

Table 2—Production practices on 1996 ARMS corn farms, by cost group

Item	Low (a)		Mid (b)		High (c)	
Seeding rate per acre (<i>kernels</i>)	27,057		27,655		26,637	
Row width (<i>inches</i>)	32.4	<i>c</i>	31.7		32.4	<i>a</i>
Fertilizer use (<i>percentage of farms</i>):						
Nitrogen	93		97		90	
Phosphorous	73	<i>b</i>	81	<i>a</i>	78	
Potassium	82		87		83	
Manure	39	<i>b</i>	19	<i>ac</i>	33	<i>b</i>
Test nitrogen level (<i>percentage of farms</i>)	9	<i>b</i>	17	<i>ac</i>	12	<i>b</i>
Use recommended level (<i>percentage of farms</i>)	77		63		65	
Fertilizer quantity on reporting farms:						
Nitrogen (<i>lbs/acre</i>)	125	<i>b</i>	139	<i>a</i>	128	
Phosphorous (<i>lbs/acre</i>)	68	<i>b</i>	80	<i>a</i>	74	
Potassium (<i>lbs/acre</i>)	54		55		49	
Chemical use (<i>percentage of farms</i>):						
Herbicides	93		95		91	
Insecticides	19		26		19	
Chemically treated acres on reporting farms:						
Herbicides (<i>acre-treatments</i>)	2.7		2.7		2.6	
Insecticides (<i>acre-treatments</i>)	1.0		1.2		1.1	
Custom operations (<i>percentage of farms</i>):						
Any custom operation	48	<i>b</i>	58	<i>ac</i>	40	<i>b</i>
Preparation, cultivation, or planting	5		9		6	
Fertilizer/chemical	27	<i>b</i>	36	<i>ac</i>	20	<i>b</i>
Harvest	22		22	<i>c</i>	14	<i>b</i>
Drying	13	<i>b</i>	20	<i>a</i>	14	
Total labor hours per acre	2.1	<i>bc</i>	2.6	<i>ac</i>	3.5	<i>ab</i>
Unpaid	1.9	<i>bc</i>	2.3	<i>ac</i>	3.1	<i>ab</i>
Paid	.2	<i>bc</i>	.4	<i>a</i>	.4	<i>a</i>
Farms with paid labor (<i>percent</i>)	18		17		14	
Tillage systems (<i>percentage of farms</i>):						
Conventional	64		69		69	
Reduced	24	<i>c</i>	23	<i>c</i>	12	<i>ab</i>
Conservation	36		31		31	
No-till	10		12		11	
Machinery:						
Planter width (<i>rows</i>)	6.6	<i>c</i>	6.8	<i>c</i>	5.5	<i>ab</i>
Harvester width (<i>rows</i>)	4.6	<i>b</i>	5.0	<i>ac</i>	4.5	<i>b</i>
Tractor horsepower (<i>largest used</i>)	141	<i>c</i>	145	<i>c</i>	127	<i>ab</i>
Speed of tillage/planting operations (<i>acres/hr</i>)	8.3	<i>c</i>	7.7	<i>c</i>	5.5	<i>ab</i>
Speed of harvest operations (<i>acres/hr</i>)	5.1	<i>c</i>	4.8	<i>c</i>	3.2	<i>ab</i>
Total trips across field (<i>number</i>)	7.7	<i>bc</i>	8.2	<i>a</i>	8.1	<i>a</i>
Tillage and planting trips (<i>number</i>)	3.3	<i>c</i>	3.5		3.8	<i>a</i>
Drying:						
Bushels dried (<i>percentage</i>)	47	<i>b</i>	62	<i>a</i>	54	
Moisture removed (<i>percentage points</i>)	2.2	<i>b</i>	4.1	<i>ac</i>	2.7	<i>b</i>

Coefficient of Variation = (Standard Error/Estimate)*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 indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.

Table 3—Characteristics of 1996 ARMS corn farms and corn producers, by cost group

Item	Low (a)		Mid (b)		High (c)	
Corn acreage (<i>percentage</i>):						
Dryland	92	<i>b</i>	84	<i>a</i>	82	
Irrigated	8	<i>b</i>	16	<i>a</i>	18	
Production value:						
All commodities (<i>dollars per farm</i>)	256,004	<i>c</i>	222,144	<i>c</i>	156,844	<i>ab</i>
Corn (<i>dollars per farm</i>)	84,366	<i>c</i>	87,957	<i>c</i>	37,267	<i>ab</i>
Percentage of total production	31	<i>b</i>	44	<i>ac</i>	27	<i>b</i>
Corn acres harvested for grain (<i>percentage</i>)						
	95	<i>c</i>	97	<i>c</i>	90	<i>ab</i>
Corn acres harvested for silage (<i>percentage</i>)						
	5	<i>c</i>	3	<i>c</i>	10	<i>ab</i>
Precision agriculture (<i>percentage of farms</i>):						
Variable rate technology/soil grid sampling	*6	<i>bc</i>	11	<i>ac</i>	*2	<i>ab</i>
Harvested using yield monitor	*8		6		*3	
Previous crop (<i>percentage of farms</i>):						
Soybean	47	<i>c</i>	49	<i>c</i>	26	<i>ab</i>
Corn	21	<i>bc</i>	28	<i>a</i>	31	<i>a</i>
Other	32	<i>c</i>	23	<i>c</i>	43	<i>ab</i>
Commodities per farm (<i>number</i>)						
	3.1		3.0		3.2	
Percentage of corn farms with:						
Corn under contract	18		24	<i>c</i>	16	<i>b</i>
Cattle	61	<i>b</i>	45	<i>ac</i>	66	<i>b</i>
Hogs	17		20	<i>c</i>	11	<i>b</i>
Dairy	22		12	<i>c</i>	24	<i>b</i>
Soybeans	56		67	<i>c</i>	49	<i>b</i>
Hay	66	<i>b</i>	53	<i>a</i>	56	
Wheat	17	<i>bc</i>	26	<i>a</i>	33	<i>a</i>
Operator occupation (<i>percentage</i>) ¹ :						
Farming	82	<i>c</i>	81	<i>c</i>	65	<i>ab</i>
Non-farm	*15		*15		*20	
Retired	#3		#4		#14	
Operator age (<i>percentage</i>):						
Less than 50 years	54		48		48	
50 to 64	34		33		26	
65 or more	12	<i>bc</i>	18	<i>a</i>	25	<i>a</i>
Operator education (<i>percentage</i>):						
High school or less	56	<i>c</i>	55	<i>c</i>	71	<i>ab</i>
Some college	27		30	<i>c</i>	17	<i>b</i>
Completed college	17		16		12	
Financial characteristics per farm:						
Net cash income (<i>dollars</i>)	64,929	<i>bc</i>	41,446	<i>ac</i>	24,589	<i>ab</i>
Equity (<i>dollars</i>)	747,474	<i>c</i>	557,132	<i>c</i>	473,570	<i>ab</i>
Debt-to-asset ratio (<i>percent</i>)	11	<i>bc</i>	18	<i>a</i>	11	<i>a</i>
Rate of return on equity (<i>percentage</i>)	0	<i>b</i>	-3	<i>a</i>	-5	
Government payments (<i>dollars</i>)	6,573		6,739	<i>c</i>	4,803	<i>c</i>
Corn crop insurance (<i>percentage</i>)	51	<i>b</i>	66	<i>a</i>	53	

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indicates that CV is greater than 50.

a, b, c indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.¹May not add to 100 since percentages for hired managers are not shown.

Regional Characteristics Affect Production Costs

Differences in yields and production practices influenced regional variations in corn production costs per bushel.

Heartland corn farmers had the lowest average corn production costs at \$1.14 per bushel, followed by Prairie Gateway farmers with \$1.29 per bushel and Northern Crescent farmers with \$1.38 per bushel (table 4). Southeast corn farmers had the highest average production costs, at \$1.52 per bushel, despite their lower levels of seed and fertilizer inputs (table 5). In 1996, corn producers in the Heartland and Prairie Gateway had a cost advantage over Northern Crescent and Southeast corn producers (fig. 3). Excluding the marketing and storage costs, over 80 percent of the lowest cost corn producers in the Heartland and Prairie Gateway produced corn for less than the \$2.71 per bushel market-year price for 1996, compared with roughly 64 percent of Northern Crescent corn producers and 53 percent of Southeast corn producers.

The Heartland, with just over half of all corn producers and corn acreage, produced just over 70 percent of all U.S. corn. Heartland corn producers had the lowest production cost per bushel in 1996 due to their high average yield of 138 bushels per acre and costs that averaged \$226.52 per acre. The Heartland is especially well suited to corn production due to the region's climate and soil types. Temperatures there are moderate and the region's rainfall is sufficient for corn production (Neild and Newman, 1990). Corn accounts for just under 50 percent of the gross value of production on the region's corn farms (table 6). Over 80 percent of corn producers in the Heartland also raise soybeans. Farmers raising both corn and soybeans can frequently use some farm machinery for both crops, allowing them to spread their machinery costs over more acreage. This factor may contribute to the competitiveness of Heartland's corn producers.

In the Prairie Gateway, where nearly 15 percent of U.S. corn is grown, corn producers irrigate 72

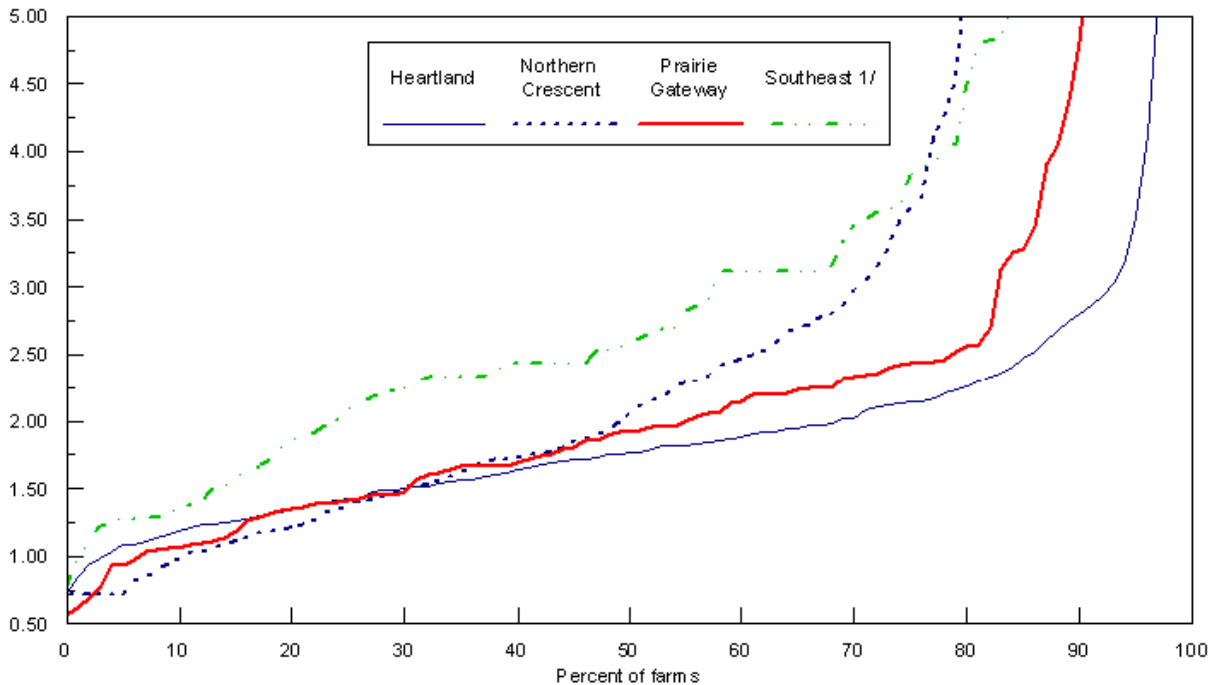
percent of the crop due to this region's relatively arid climate. Irrigation raises the production cost per acre significantly due to the expenditures needed to operate, repair, and replace irrigation equipment. The high expected corn yields of the Prairie Gateway producers offset their high production costs per acre, leaving their expected costs per bushel close to the average for the Heartland and Northern Crescent corn producers. The Prairie Gateway has the fewest corn producers, but on average its producers operate much larger farms (1,417 acres) and plant more corn acres per farm (328 acres) than corn producers in other regions. This allows Prairie Gateway's corn growers to spread the ownership costs of irrigation equipment and other machinery over more acreage so that they can be competitive with dryland producers.

Although nearly 25 percent of all corn farmers are located in the Northern Crescent, they produced just 12 percent of the 1996 corn bushels due to their relatively low yields and their small corn enterprises, which averaged 108 acres per farm. In 1996, Northern Crescent corn producers' average yield fell short of their expected yield by 22 bushels per acre. Farmers were asked to report costs on corn acres that were planted with the intention of harvesting the corn for grain. Sixteen percent of corn acreage intended for grain on Northern Crescent's farms was harvested for silage. With nearly three-fourths of Northern Crescent's corn producers raising cattle, and nearly half reporting dairy operations, most of the producers harvesting corn silage probably used the silage as feed. The relatively high percentage of corn acreage harvested for silage in the Northern Crescent significantly raised the region's per bushel production costs, since production costs, including those for silage, are included in the per bushel figures (see glossary).

Figure 3

Regional cumulative distribution of corn farms by production costs per corn bushel for 1996

Dollars per bushel



1/ Southeast includes Eastern Uplands and Southern Seaboard.
Source: 1996 Agricultural Resource Management Study.

Southeast corn producers have the highest expected and actual costs per bushel. Although their production costs per acre are closest to those of the Heartland producers, Southeast corn producers have the lowest average expected corn yield, while their actual yields match those in the Northern Crescent. Southeast corn yields are reduced in part due to heat, the unpredictability of rainfall during the critical tasseling and silking stage of corn production, and the lack of irrigated corn acreage (NCCES, 1995). Inputs on Southeast corn operations tend to be lower

compared with other regions, with less seed and fertilizer used and fewer corn farms applying chemicals (table 5). Southeast producers also tend to plant fewer corn acres (66 acres per farm) and use smaller farm machines. Capital recovery costs per acre are higher for this region compared with the Heartland and Northern Crescent because Southeast growers have fewer acres over which to spread their fixed investments. Southeast corn producers are also generally older, less educated, and more likely to work in nonfarm occupations than other corn producers.

Table 4—Corn production costs and returns per acre from 1996 ARMS corn farms, by region

Item	Heartland (a)		Northern Crescent (b)		Prairie Gateway (c)		Southeast ¹ (d)	
Percentage of corn farms	57	<i>bcd</i>	26	<i>acd</i>	7	<i>abd</i>	11	<i>abc</i>
Percentage of corn acres	68	<i>bcd</i>	15	<i>ad</i>	13	<i>ad</i>	3	<i>abc</i>
Percentage of corn production (<i>bushels</i>)	71	<i>bcd</i>	12	<i>a</i>	14	<i>ad</i>	3	<i>ac</i>
Size:								
Total operated acreage per farm	602	<i>bcd</i>	368	<i>ac</i>	1,417	<i>abd</i>	419	<i>ac</i>
Planted corn acreage per farm	231	<i>bcd</i>	108	<i>acd</i>	328	<i>abd</i>	66	<i>abc</i>
Yield in bushels per acre:								
Actual	138	<i>bd</i>	104	<i>ac</i>	143	<i>bd</i>	104	<i>ac</i>
Expected	137	<i>bcd</i>	126	<i>acd</i>	155	<i>abd</i>	111	<i>abc</i>
Production costs per bushel:								
Actual	1.14	<i>bcd</i>	1.38	<i>a</i>	1.29	<i>a</i>	1.52	<i>a</i>
Expected	1.15	<i>d</i>	1.14	<i>d</i>	1.19	<i>d</i>	1.42	<i>abc</i>
Costs and returns per planted acre (<i>dollars</i>):								
Gross value of production	385.35	<i>b</i>	297.11	<i>ac</i>	429.94	<i>bd</i>	346.33	<i>c</i>
Operating costs	159.69	<i>bc</i>	147.70	<i>acd</i>	190.06	<i>abd</i>	164.34	<i>bc</i>
Seed	27.32	<i>bd</i>	25.10	<i>acd</i>	27.23	<i>bd</i>	21.73	<i>abc</i>
Fertilizer	49.90	<i>bcd</i>	41.43	<i>ad</i>	42.33	<i>ad</i>	60.07	<i>abc</i>
Soil conditioners	0.09	<i>bcd</i>	0.43	<i>acd</i>	*0.01	<i>abd</i>	*0.99	<i>abc</i>
Manure	*0.44	<i>bc</i>	*2.08	<i>ad</i>	D		*0.23	<i>b</i>
Chemicals	28.57		26.37		26.50		25.63	
Custom operations	10.75		9.33		*14.28		*10.10	
Fuel, lube, and electricity	22.35	<i>c</i>	20.82	<i>c</i>	43.17	<i>abd</i>	19.09	<i>c</i>
Repairs	14.41	<i>cd</i>	14.82	<i>c</i>	24.12	<i>abd</i>	15.85	<i>ac</i>
Purchased irrigation water	0.00		0.00		#2.40		D	
Interest on operating capital	3.87	<i>bc</i>	3.53	<i>acd</i>	4.53	<i>abd</i>	3.86	<i>bc</i>
Hired labor	1.98	<i>bcd</i>	3.79	<i>ad</i>	*5.50	<i>a</i>	6.79	<i>ab</i>
Ownership costs	66.82	<i>cd</i>	68.39	<i>cd</i>	89.77	<i>abd</i>	78.46	<i>abc</i>
Capital recovery: machinery, equipment	60.50	<i>cd</i>	61.90	<i>cd</i>	79.69	<i>ab</i>	70.37	<i>ab</i>
Taxes and insurance	6.32	<i>cd</i>	6.49	<i>cd</i>	10.09	<i>ab</i>	8.09	<i>ab</i>
Production costs	226.52	<i>bcd</i>	216.09	<i>acd</i>	279.84	<i>abd</i>	242.81	<i>abc</i>
Value of production less operating costs	225.66	<i>b</i>	149.41	<i>ac</i>	239.88	<i>b</i>	181.98	
Value of production less production costs	158.84	<i>bd</i>	81.02	<i>ac</i>	150.10	<i>b</i>	103.52	<i>a</i>

D=Data insufficient for disclosure.

Coefficient of Variation = (Standard Error/Estimate)*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, d indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.¹Southeast includes Eastern Uplands and Southern Seaboard.

Table 5—Production practices on 1996 ARMS corn farms, by region

Item	Heartland (a)		Northern Crescent (b)		Prairie Gateway (c)		Southeast ¹ (d)	
Seeding rate per acre (<i>kernels</i>)	27,527	<i>d</i>	27,591	<i>d</i>	27,264	<i>d</i>	24,828	<i>abc</i>
Row width (<i>inches</i>)	32.0	<i>d</i>	31.6	<i>d</i>	31.6	<i>d</i>	34.4	<i>abc</i>
Fertilizer use (<i>percentage of farms</i>):								
Nitrogen	96		89		96		94	
Phosphorous	81	<i>c</i>	86	<i>c</i>	31	<i>abd</i>	87	<i>c</i>
Potassium	86	<i>c</i>	86	<i>c</i>	69	<i>abd</i>	87	<i>c</i>
Manure	20	<i>bc</i>	58	<i>acd</i>	*7	<i>abd</i>	15	<i>bc</i>
Test nitrogen level (<i>percentage of farms</i>)	14	<i>bcd</i>	8	<i>ac</i>	41	<i>abd</i>	8	<i>ac</i>
Use recommended level (<i>percentage of farms</i>)	56	<i>bc</i>	75	<i>a</i>	81	<i>a</i>	71	
Fertilizer quantity on reporting farms:								
Nitrogen (<i>lbs/acre</i>)	134	<i>bc</i>	93	<i>ac</i>	159	<i>abd</i>	125	<i>bc</i>
Phosphorous (<i>lbs/acre</i>)	78	<i>c</i>	71	<i>c</i>	*20	<i>abd</i>	73	<i>c</i>
Potassium (<i>lbs/acre</i>)	60	<i>c</i>	52	<i>c</i>	36	<i>abd</i>	52	<i>c</i>
Chemical use (<i>percentage of farms</i>):								
Herbicides	97	<i>bcd</i>	94	<i>a</i>	92	<i>a</i>	77	<i>a</i>
Insecticides	25	<i>bcd</i>	16	<i>ac</i>	36	<i>ab</i>	15	<i>ac</i>
Chemically treated acres on reporting farms:								
Herbicides (<i>acre-treatments</i>)	2.7	<i>bd</i>	2.4	<i>a</i>	2.6		2.0	<i>ac</i>
Insecticides (<i>acre-treatments</i>)	1.1		1.0	<i>c</i>	1.3	<i>bd</i>	1.0	<i>c</i>
Custom operations (<i>percentage of farms</i>):								
Any custom operation	59	<i>bd</i>	39	<i>ac</i>	65	<i>bd</i>	33	<i>a</i>
Preparation, cultivation, or planting	9	<i>bcd</i>	6	<i>ad</i>	*5	<i>a</i>	#2	<i>ab</i>
Fertilizer/chemical	42	<i>bcd</i>	*12	<i>ac</i>	22	<i>ab</i>	14	<i>a</i>
Harvest	20		*18		22		20	
Drying	21	<i>bcd</i>	14	<i>ad</i>	*12	<i>ad</i>	*2	<i>abc</i>
Total labor hours per acre	2.5	<i>bd</i>	3.5	<i>ac</i>	2.4	<i>bd</i>	5.1	<i>ac</i>
Unpaid	2.4	<i>bcd</i>	3.2	<i>ac</i>	1.7	<i>abd</i>	4.4	<i>ac</i>
Paid	.2	<i>d</i>	.2	<i>d</i>	*.6		.7	<i>ab</i>
Farms with paid labor (<i>percent</i>)	17	<i>c</i>	13	<i>c</i>	28	<i>abd</i>	*16	<i>c</i>
Tillage systems (<i>percentage of farms</i>):								
Conventional	67	<i>c</i>	73	<i>c</i>	56	<i>abd</i>	71	<i>c</i>
Reduced	27	<i>bd</i>	10	<i>ac</i>	28	<i>bd</i>	*8	<i>ac</i>
Conservation	33	<i>c</i>	*27	<i>c</i>	44	<i>abd</i>	29	<i>c</i>
No-till	12	<i>b</i>	*7	<i>acd</i>	*15	<i>b</i>	*16	<i>b</i>
Machinery:								
Planter width (<i>rows</i>)	7.4	<i>bd</i>	5.0	<i>ac</i>	7.7	<i>bd</i>	4.1	<i>ac</i>
Harvester width (<i>rows</i>)	5.2	<i>bcd</i>	3.7	<i>ac</i>	6.6	<i>abd</i>	3.7	<i>ac</i>
Tractor horsepower (<i>largest used</i>)	152	<i>bd</i>	123	<i>acd</i>	163	<i>bd</i>	89	<i>abc</i>
Speed of tillage/planting operations (<i>acres/hr</i>)	8.0	<i>bcd</i>	4.9	<i>ac</i>	10.2	<i>abd</i>	4.2	<i>ac</i>
Speed of harvest operations (<i>acres/hr</i>)	4.7	<i>bcd</i>	2.9	<i>ac</i>	7.9	<i>abd</i>	2.8	<i>ac</i>
Total trips across field (<i>number</i>)	8.0		7.9	<i>c</i>	8.3	<i>b</i>	8.0	
Tillage and planting trips (<i>number</i>)	3.3	<i>bcd</i>	3.6	<i>a</i>	3.8	<i>a</i>	4.1	<i>a</i>
Drying:								
Bushels dried (<i>percentage</i>)	59	<i>bc</i>	48	<i>a</i>	*25	<i>ab</i>	*43	
Moisture removed (<i>percentage points</i>)	4.5	<i>bcd</i>	2.4	<i>acd</i>	*1.1	<i>ab</i>	0.8	<i>ab</i>

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¹ Southeast includes Eastern Uplands and Southern Seaboard.

Table 6—Characteristics of 1996 ARMS corn farms and corn producers, by region

Item	Heartland (a)		Northern Crescent (b)		Prairie Gateway (c)		Southeast ¹ (d)	
Corn acreage (percentage):								
Dryland	95	cd	98	c	28	abd	99	ac
Irrigated	5	cd	2	c	72	abd	1	ac
Production value:								
All commodities (dollars per farm)	216,614	bd	183,699	a	353,754	abd	146,453	ac
Corn (dollars per farm)	94,596	bcd	32,746	ac	146,845	abd	*18,895	ac
Percentage of total production	46	bd	22	ac	46	bd	17	a
Corn acres harvested for grain (percentage)								
	99	bcd	83	acd	99	abd	98	abc
Corn acres harvested for silage (percentage)								
	1	b	16	a	D		D	
Precision agriculture (percentage of farms):								
Variable rate technology/soil grid sampling	11	bd	*2	ac	*7	b	*2	a
Harvested using yield monitor	6	bd	*3	ac	*15	bd	#1	ac
Previous crop (percentage of farms):								
Soybean	66	bcd	14	a	20	a	18	a
Corn	19	bc	37	a	46	ad	29	c
Other	15	bcd	49	ac	35	ab	53	ac
Commodities per farm (number)								
	3.1		3.3	d	3.1		2.6	b
Percentage of corn farms with:								
Corn under contract	28	bd	8	ac	27	bd	*8	ac
Cattle	45	bd	74	ac	49	b	65	a
Hogs	24	bcd	9	a	*9	a	*10	a
Dairy	8	b	47	ad	D		11	b
Soybeans	81	bcd	36	a	34	a	*32	a
Hay	49	b	78	acd	55	b	52	b
Wheat	22	c	*28	c	49	abd	*20	c
Operator occupation (percentage) ² :								
Farming	80	d	82	d	80	d	50	abc
Non-farm	16		15		13		#21	
Retired	#4		#3		D		#21	
Operator age (percentage):								
Less than 50 years	51		50		51		*41	
50 to 64	32		34		34		*22	
65 or more	16		16		*15		*38	
Operator education (percentage):								
High school or less	56	cd	63	cd	45	abd	80	abc
Some college	28	d	*27	d	29	d	*8	abc
Completed college	16	c	11	c	27	abd	*12	c
Financial characteristics per farm:								
Net cash income (dollars)	43,597	d	46,747	d	64,792	d	#13,553	abc
Equity (dollars)	587,616	d	626,978		656,103	d	444,769	ac
Debt-to-asset ratio (percent)	16	d	*12		20	d	9	ac
Rate of return on equity (percentage)	#-1		*-6	c	#4	bd	#-6	c
Government payments (dollars)	6,860	bcd	3,368	acd	15,029	abd	*2,050	abc
Corn crop insurance (percentage)	67	d	52	d	67	d	*25	abc

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¹ Southeast includes Eastern Uplands and Southern Seaboard.² May not add to 100 since percentages for hired managers are not shown.

Corn Production Costs Differ Across Farm Typology

Differences in yields, inputs, and farm and farmer characteristics lead to differences in production costs per bushel among the farm typology classes.

Farm typology classifies farms using the annual value of agricultural sales, farmers' occupation, and farm asset values (see glossary). For corn farms, farm typology and the size of the corn acreage are positively related. As the value of a farm's gross sales increase, the total acreage per farm and corn acreage per farm increase as well (table 7). Small family farms, those with annual sales of \$250,000 and under, account for roughly four-fifths of all corn farms and just over half of the corn production. Larger family farms have lower average production costs per bushel than small farms due to higher yields. Large family farms and part-time family farms have significant differences in their expected average production cost per bushel. Very large farms have the highest production costs per acre, but they also have the highest expected and actual yields. Very large farms have the highest average fuel expenditures per acre since a relatively high percentage of their acres was irrigated. The Prairie Gateway has the highest percentage of very large farms (fig. 4).

Part-time farmers, with their small corn plots that averaged 67 acres, had corn production costs per acre in the same range as all other farmers. A high percentage of part-time farmers elected to have custom work performed on their corn enterprises, especially custom harvesting (table 8). As a result, part-time farmers had higher custom-work expenditures per acre than farmers who listed farming as their major occupation. All part-time farm operators had either nonfarm occupations or nonfarm businesses or were retired. Many part-time farmers may have found it more economically feasible to contract for custom harvesting than performing the work themselves. Part-time farm operators generally have smaller equipment and lower horsepower

tractors than other farmers. Nearly half of all part-time corn farmers are located in the Heartland, and one out of four in the Southeast. Half of all Southeast corn farmers farm part-time.

Operators of the larger corn farms are more likely to use risk management strategies than operators of small farms. Diversification is a risk management strategy used by farmers to mitigate the production and price risk associated with any one commodity. Large corn farms are more diversified than small ones, as shown from the average number of commodities grown per farm (table 9). Larger corn operations are also more likely to insure part of their corn crop to minimize losses if disaster strikes. A higher percentage of larger farm operators produced or sold some of their corn under contract. Marketing contracts generally reduce farmers' exposure to price variations, while production contracts for specialty corn usually provide for premium prices.

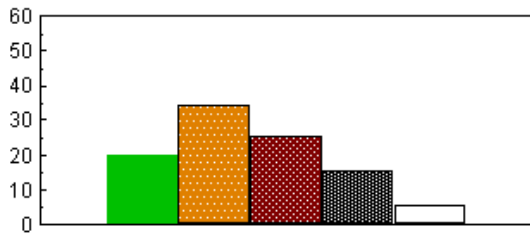
Small family farms differ from larger family farms in many characteristics other than size of the farm operation or the corn enterprise. Part-time operators are less likely to use conservation or no-till systems than operators of larger farms. Use of no-till conserves moisture (NCCES, 1995). Seeding rates on small farms are less than those on larger farms. Labor hours per acre for both field operations and overhead are greater on small farms. Smaller machines and lower horsepower tractors contributed to more labor hours expended per acre on small farms, and operators of small farms have less acreage over which to allocate their overhead hours. Operators of small farms are generally older and less well educated than their counterparts on larger farms.

Figure 4

Distribution of farms by farm typology in each region

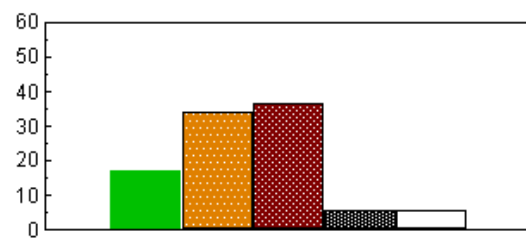
The size distribution of Heartland corn farms varies widely

Percent



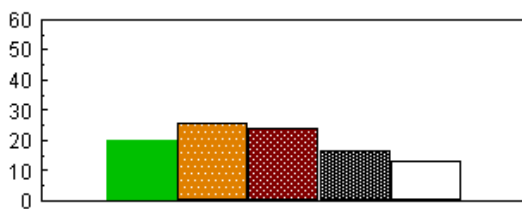
Most Northern Crescent corn producers have small farms

Percent



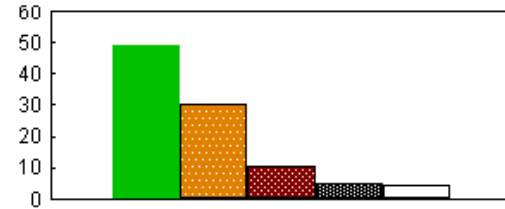
Prairie Gateway has the largest percentage of large and very large farms

Percent



Southeast corn farms tend to be small, part-time operations

Percent



Source: 1996 Agricultural Resource Management Study.

Table 7—Corn production costs and returns on 1996 ARMS corn farms, by farm typology

Item	Small family farms						Larger family farms			
	Part-time ¹ (a)		Low sales (b)		High sales (c)		Large (d)		Very large (e)	
Percentage of corn farms	23	<i>bde</i>	33	<i>acde</i>	26	<i>bde</i>	12	<i>abce</i>	6	<i>abcd</i>
Percentage of corn acres	8	<i>bcde</i>	19	<i>acd</i>	27	<i>ab</i>	26	<i>ab</i>	20	<i>a</i>
Percentage of corn production (<i>bushels</i>)	7	<i>bcde</i>	17	<i>acd</i>	25	<i>ab</i>	28	<i>ab</i>	23	<i>a</i>
Size:										
Total operated acreage per farm	281	<i>bcde</i>	399	<i>acde</i>	566	<i>abde</i>	1,239	<i>abce</i>	1,938	<i>abcd</i>
Planted corn acreage per farm	67	<i>bcde</i>	110	<i>acde</i>	192	<i>abde</i>	411	<i>abce</i>	640	<i>abcd</i>
Yield in bushels per acre:										
Actual	111	<i>de</i>	123	<i>de</i>	118	<i>d</i>	139	<i>abc</i>	138	<i>ab</i>
Expected	129	<i>e</i>	126	<i>de</i>	128	<i>de</i>	137	<i>bc</i>	145	<i>abc</i>
Production cost per bushel (<i>dollars</i>):										
Actual	1.49	<i>bde</i>	1.23	<i>ad</i>	1.30	<i>d</i>	1.11	<i>abc</i>	1.21	<i>a</i>
Expected	1.28	<i>de</i>	1.20		1.19		1.12	<i>a</i>	1.14	<i>a</i>
Costs and returns per planted acre (<i>dollars</i>):										
Gross value of production	313.97	<i>de</i>	342.94	<i>de</i>	336.31	<i>de</i>	392.20	<i>abc</i>	398.92	<i>abc</i>
Operating costs	168.15		153.31	<i>e</i>	157.49	<i>e</i>	161.77	<i>e</i>	177.26	<i>bcd</i>
Seed	25.76	<i>e</i>	24.38	<i>cde</i>	25.67	<i>be</i>	27.04	<i>b</i>	28.40	<i>abc</i>
Fertilizer	50.32		48.85		45.87		45.77		48.33	
Soil conditioners	*0.37	<i>d</i>	0.24	<i>d</i>	0.25	<i>d</i>	0.11	<i>abc</i>	*0.21	
Manure	#0.24		*0.15		*0.79		#0.76		#0.37	
Chemicals	26.86	<i>d</i>	24.71	<i>de</i>	27.15	<i>d</i>	32.39	<i>abc</i>	28.01	<i>b</i>
Custom operations	*21.13	<i>bcde</i>	10.39	<i>a</i>	9.36	<i>a</i>	8.99	<i>a</i>	10.36	<i>a</i>
Fuel, lube, and electricity	21.16		21.96	<i>e</i>	23.47		21.59		29.35	<i>b</i>
Repairs	15.84		16.29	<i>d</i>	16.94	<i>d</i>	13.32	<i>bce</i>	16.63	<i>d</i>
Purchased irrigation water	D		D		D		D		D	
Interest on operating capital	4.06		3.70	<i>e</i>	3.76		3.78		4.08	<i>b</i>
Hired labor	#1.20	<i>d</i>	1.17	<i>d</i>	*2.07		3.73	<i>ab</i>	5.52	
Ownership costs	71.12		74.41	<i>d</i>	70.85	<i>d</i>	65.26	<i>bc</i>	70.96	
Capital recovery: machinery, equipment	61.55		66.81	<i>d</i>	64.99	<i>d</i>	57.76	<i>bc</i>	65.13	
Taxes and insurance	9.62	<i>c</i>	7.60	<i>ce</i>	5.85	<i>abd</i>	7.50	<i>c</i>	5.83	<i>b</i>
Production costs	239.32		227.72	<i>e</i>	228.34	<i>e</i>	227.03		248.22	<i>bc</i>
Value of production less operating costs	145.81	<i>bde</i>	189.63	<i>ade</i>	178.82	<i>d</i>	230.43	<i>abc</i>	221.65	<i>ab</i>
Value of production less production costs	*74.64	<i>bde</i>	115.21	<i>ade</i>	107.98	<i>de</i>	165.17	<i>abc</i>	150.69	<i>abc</i>

D=Data insufficient for disclosure.

Coefficient of Variation = (Standard Error/Estimate)*100.

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indicates that CV is greater than 50.

a, b, c, d, e indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.

¹Part-time farms consist of retirement and residential/lifestyle farms plus farms with assets of \$150,000 or less that generate less than \$100,000 in annual sales. [See glossary.](#)

Table 8—Production practices on 1996 ARMS corn farms, by farm typology

Item	Small family farms						Larger family farms			
	Part-time ¹ (a)		Low sales (b)		High sales(c)		Large (d)		Very large (e)	
Seeding rate per acre (<i>kernel</i> s)	27,395	<i>b</i>	25,845	<i>acde</i>	26,898	<i>be</i>	27,515	<i>b</i>	28,893	<i>bcd</i>
Row width (<i>inches</i>)	33.8	<i>de</i>	33.8	<i>cde</i>	32.7	<i>bde</i>	30.9	<i>abc</i>	30.4	<i>abc</i>
Fertilizer use (<i>percentage of farms</i>):										
Nitrogen	98	<i>d</i>	95	<i>d</i>	88		100	<i>ab</i>	98	
Phosphorous	89	<i>bcde</i>	82	<i>a</i>	72	<i>a</i>	80	<i>a</i>	74	<i>a</i>
Potassium	93	<i>b</i>	87	<i>a</i>	78		91		86	
Manure	14	<i>bce</i>	31	<i>ad</i>	43	<i>ade</i>	21	<i>bc</i>	26	<i>ac</i>
Test nitrogen level (<i>percentage of farms</i>)	11	<i>e</i>	*13	<i>e</i>	*16		18		26	<i>ab</i>
Use recommended level (<i>percentage of farms</i>)	77		70		56		*57		66	
Fertilizer quantity on reporting farms:										
Nitrogen (<i>lbs/acre</i>)	129	<i>e</i>	123	<i>e</i>	125		131	<i>e</i>	158	<i>abcd</i>
Phosphorous (<i>lbs/acre</i>)	69		71		69	<i>e</i>	68	<i>e</i>	88	<i>cd</i>
Potassium (<i>lbs/acre</i>)	51		52		52		56		52	
Chemical use (<i>percentage of farms</i>):										
Herbicides	89		90	<i>cde</i>	98	<i>b</i>	99	<i>b</i>	99	<i>b</i>
Insecticides	*14	<i>e</i>	22	<i>cde</i>	26	<i>be</i>	26	<i>b</i>	36	<i>abc</i>
Chemicals acre-treatments on reporting farms:										
Herbicides (<i>acre-treatments</i>)	2.5		2.7		2.7		2.8		2.8	
Insecticides (<i>acre-treatments</i>)	1.0	<i>bd</i>	1.1	<i>a</i>	1.1		1.3	<i>a</i>	1.3	
Custom operations (<i>percentage of farms</i>):										
Any custom operation	52		47	<i>e</i>	48		50		61	<i>b</i>
Preparation, cultivation, or planting	*11	<i>cd</i>	*6		*4	<i>a</i>	#4	<i>a</i>	#4	
Fertilizer/chemical	28		28		28		35		28	
Harvest	31	<i>bde</i>	17	<i>ad</i>	*20		9	<i>ab</i>	*15	<i>a</i>
Drying	21		14		*12		13		*15	
Total labor hours per acre	3.1	<i>e</i>	2.9	<i>e</i>	3.0	<i>e</i>	2.4		2.1	<i>abc</i>
Unpaid	3.0	<i>de</i>	2.7	<i>de</i>	2.8	<i>de</i>	2.0	<i>abc</i>	1.5	<i>abc</i>
Paid	.1	<i>de</i>	.1	<i>de</i>	.2	<i>de</i>	.4	<i>abc</i>	.6	<i>abc</i>
Farms with paid labor (<i>percent</i>)	*3	<i>bde</i>	10	<i>ade</i>	17	<i>ade</i>	39	<i>abc</i>	44	<i>abc</i>
Tillage systems (<i>percentage of farms</i>):										
Conventional	82	<i>bcde</i>	72	<i>ac</i>	55	<i>ab</i>	66	<i>a</i>	56	<i>a</i>
Reduced	19	<i>d</i>	18	<i>d</i>	20	<i>d</i>	39	<i>abc</i>	*26	
Conservation	18	<i>bcde</i>	28	<i>ac</i>	45	<i>ab</i>	34	<i>a</i>	44	<i>a</i>
No-till	*8	<i>e</i>	9	<i>e</i>	11		15		19	<i>ab</i>
Machinery:										
Planter width (<i>rows</i>)	4.8	<i>cde</i>	5.3	<i>cde</i>	6.6	<i>abde</i>	9.2	<i>abce</i>	10.1	<i>abcd</i>
Harvester width (<i>rows</i>)	4.1	<i>cde</i>	4.1	<i>cde</i>	5.0	<i>abde</i>	5.7	<i>abce</i>	6.6	<i>abcd</i>
Tractor horsepower (<i>largest used</i>)	109	<i>cde</i>	122	<i>cde</i>	150	<i>abde</i>	187	<i>abce</i>	207	<i>abcd</i>
Speed of tillage/planting operations (<i>acres/hr</i>)	3.8	<i>cde</i>	5.4	<i>cd</i>	8.0	<i>abd</i>	9.9	<i>abc</i>	8.6	<i>a</i>
Speed of harvest operations (<i>acres/hr</i>)	3.3	<i>cde</i>	3.1	<i>cde</i>	4.7	<i>abe</i>	5.3	<i>ab</i>	5.9	<i>abc</i>
Total trips across field (<i>number</i>)	8.0	<i>c</i>	7.9		8.3	<i>ae</i>	8.0		7.6	<i>c</i>
Tillage and planting trips (<i>number</i>)	4.0	<i>de</i>	3.9	<i>de</i>	3.7	<i>de</i>	3.2	<i>abc</i>	3.3	<i>abc</i>
Drying:										
Bushels dried (<i>percentage</i>)	*30	<i>bcde</i>	49	<i>acd</i>	60	<i>ab</i>	65	<i>ab</i>	61	<i>a</i>
Moisture removed (<i>percentage points</i>)	*1.8	<i>cde</i>	2.8	<i>cde</i>	4.1	<i>b</i>	5.2	<i>ab</i>	5.0	<i>ab</i>

Coefficient of Variation = (Standard Error/Estimate)*100.

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¹ Part-time farms consist of retirement and residential/lifestyle farms plus farms with assets of \$150,000 or less that generate less than \$100,000 in annual sales. See [glossary](#).

Table 9—Characteristics of 1996 ARMS corn farms and corn producers, by farm typology

Item	Small family farms			Larger family farms	
	Part-time ¹ (a)	Low sales (b)	High sales (c)	Large (d)	Very large (e)
Corn acreage (percentage):					
Dryland	85	88 <i>e</i>	87 <i>e</i>	90 <i>e</i>	74 <i>bcd</i>
Irrigated	#15	*12 <i>e</i>	*13 <i>e</i>	*10 <i>e</i>	26 <i>bcd</i>
Production value:					
All commodities (dollars per farm)	50,459 <i>bcde</i>	101,267 <i>acde</i>	221,196 <i>abde</i>	431,549 <i>abce</i>	968,446 <i>abcd</i>
Corn (dollars per farm)	21,223 <i>bcde</i>	36,804 <i>acde</i>	70,664 <i>abde</i>	177,381 <i>abce</i>	280,609 <i>abcd</i>
Percentage of total production	39	36 <i>d</i>	32 <i>d</i>	41 <i>bc</i>	35
Corn acres harvested for grain (percent)	97	98	90	98	98
Corn acres harvested for silage (percent)	D	1	9	2	2
Precision agriculture (percentage of farms):					
Variable rate tech./soil grid sampling	#3	*5 <i>de</i>	*6 <i>de</i>	*20 <i>bc</i>	*16 <i>bc</i>
Harvested using yield monitor	D <i>de</i>	*3 <i>de</i>	*5 <i>de</i>	*17 <i>abc</i>	19 <i>abc</i>
Previous crop (percentage of farms)					
Soybean	42 <i>d</i>	38 <i>d</i>	*30 <i>de</i>	65 <i>abce</i>	48 <i>cd</i>
Corn	21 <i>bce</i>	33 <i>ad</i>	32 <i>ad</i>	22 <i>bce</i>	32 <i>ad</i>
Other	36 <i>d</i>	29 <i>d</i>	38	17 <i>abe</i>	20
Commodities per farm (number)	2.4 <i>bcde</i>	2.9 <i>acde</i>	3.6 <i>ab</i>	3.5 <i>ab</i>	3.7 <i>ab</i>
Percentage of corn farms with:					
Corn under contract	15 <i>bde</i>	10 <i>acde</i>	26 <i>be</i>	39 <i>ab</i>	42 <i>abc</i>
Cattle	44 <i>c</i>	57 <i>cd</i>	68 <i>abde</i>	44 <i>bc</i>	52 <i>c</i>
Hogs	*7 <i>bcde</i>	21 <i>a</i>	*17 <i>a</i>	28 <i>a</i>	*16 <i>a</i>
Dairy	*2 <i>bcde</i>	17 <i>ac</i>	32 <i>abde</i>	16 <i>ac</i>	14 <i>ac</i>
Soybeans	51 <i>de</i>	50 <i>de</i>	63 <i>de</i>	48 <i>abc</i>	42 <i>abc</i>
Hay	46 <i>bc</i>	65 <i>ade</i>	63 <i>ade</i>	48 <i>bc</i>	42 <i>bc</i>
Wheat	17 <i>de</i>	25 <i>e</i>	28 <i>e</i>	33 <i>a</i>	44 <i>abc</i>
Operator occupation (percentage)					
Farming	0 <i>bcde</i>	100 <i>a</i>	100 <i>a</i>	100 <i>a</i>	100 <i>a</i>
Non-farm	73 <i>bcde</i>	0 <i>a</i>	0 <i>a</i>	0 <i>a</i>	0 <i>a</i>
Retired	37 <i>bcde</i>	0 <i>a</i>	0 <i>a</i>	0 <i>a</i>	0 <i>a</i>
Operator age (percentage):					
Less than 50 years	38 <i>cd</i>	37 <i>cde</i>	69 <i>ab</i>	65 <i>ab</i>	54 <i>b</i>
50 to 64 years	36	32	27	29	41
65 or more	*26 <i>cde</i>	32 <i>cde</i>	*4 <i>ab</i>	*6 <i>ab</i>	*5 <i>ab</i>
Operator education (percentage):					
High school or less	57 <i>bd</i>	71 <i>ade</i>	*59 <i>d</i>	39 <i>abc</i>	43 <i>b</i>
Some college	27 <i>b</i>	16 <i>ade</i>	28	39 <i>b</i>	36 <i>b</i>
Completed college	*16	12 <i>d</i>	13	21 <i>b</i>	*20
Financial characteristics per farm:					
Net cash income (dollars)	7,567 <i>bcde</i>	14,570 <i>acde</i>	48,008 <i>abde</i>	88,595 <i>abce</i>	218,805 <i>abcd</i>
Equity (dollars)	352,453 <i>cde</i>	387,405 <i>cde</i>	654,879 <i>abde</i>	947,963 <i>abce</i>	1,355,826 <i>abcd</i>
Debt-to-asset ratio (percent)	*11 <i>de</i>	12 <i>de</i>	*14	20 <i>ab</i>	22 <i>ab</i>
Rate of return on equity (percentage)	*-5 <i>cde</i>	-9 <i>cde</i>	#0 <i>abde</i>	*7 <i>abce</i>	17 <i>abcd</i>
Government payments (dollars)	1,896 <i>bcde</i>	3,623 <i>acde</i>	6,315 <i>abde</i>	12,805 <i>abce</i>	22,756 <i>abcd</i>
Corn crop insurance (percentage)	43 <i>cde</i>	52 <i>cde</i>	72 <i>ab</i>	75 <i>ab</i>	75 <i>ab</i>

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indicates that CV is greater than 50.

a, b, c, d, e indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.¹ Part-time farms consist of retirement and residential/lifestyle farms plus farms with assets of \$150,000 or less that generate less than \$100,000 in annual sales. [See glossary.](#)

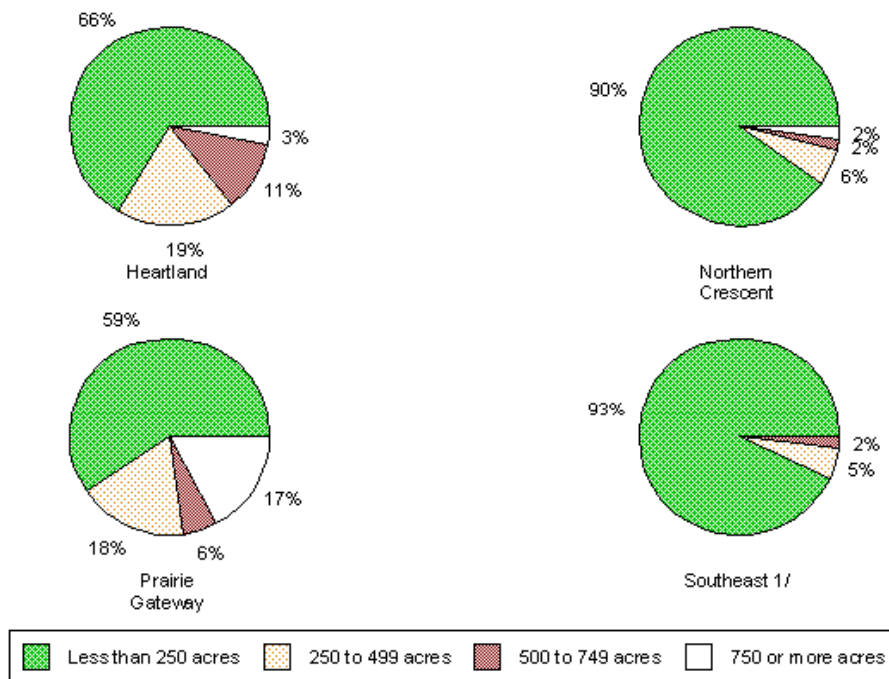
Farm Characteristics and Operating Costs Related to Corn Acreage

Farms with large corn acreage have lower production costs per bushel, due largely to their higher yields, than farms with small corn acreage.

Farms with the smallest corn acreage, those with 250 acres or less of corn, comprise 75 percent of all U.S. corn farms and produce 29 percent of U.S. corn output (table 10). While 90 percent or more of the corn farms in Northern Crescent and Southeast had less than 250 acres of corn in 1996 (fig. 5), nearly half of the farms with the smallest corn acreage are located in the Heartland. At the other extreme, fewer than 4 percent of corn farms planted over 750 acres to corn, yet this 4 percent produced just under 20 percent of U.S. corn. Farms with the largest corn acreage are mainly located in the Heartland and Prairie Gateway. Farms with the largest corn acreage comprise most of Prairie Gateway corn farms, while they constitute a minority of Heartland corn farms.

Production costs per bushel in 1996 generally declined as the corn acreage per farm increased (table 10). Although farms with the smallest corn acreage had the lowest average corn production costs per acre, they had the highest average production costs per bushel due to their low yields in 1996. Had expected conditions prevailed, it appears that production costs per bushel would have been much the same for the farms with less than 750 corn acres. However, unit costs would have been significantly lower for producers with 750 or more corn acres, suggesting a cost advantage for these operators.

Figure 5
Distribution of farms with different sizes of corn acreage, by region, 1996



1/ Southeast includes Eastern Uplands and Southern Seaboard.
 Source: 1996 Agricultural Resource Management Study.

Farms with the smallest corn acreage differ from the remaining corn farms in many ways, even though their production cost per acre was nearly the same as for farms with larger corn acreage. Those with the smallest corn acreage had the lowest operating cost per acre due to their low per acre costs for seed, fertilizer, and fuel. Fertilizer expenditures per acre were low since a comparatively low percentage of these farmers applied commercial fertilizers to their cornfields, and those who did applied them at lower rates (table 11). A higher percentage of farmers with smallest corn acreage used manure in their cornfields, likely reducing their commercial fertilizer needs. Farmers with the smallest corn acreage were more likely to have cattle or dairy in their production mix, providing a source of manure. Fuel expenditures were lower for farmers with smallest corn acreage since they were less likely to irrigate corn and usually removed less moisture from corn during the drying process. The capital costs of farm machinery and equipment for farms with small corn acreage were nearly equal to those with the larger corn acreage, despite the relatively small acreage over which they could spread their capital costs.

Farms with 250 or more corn acres had different production practices and tended to focus more on corn production than farms with the smallest corn acreage. Half or more of the total value of farm production on farms with the larger corn acreage is derived from corn (table 12). Farms with 250 or more corn acres were more likely to irrigate corn and to make heavier use of inputs such as fertilizers, chemicals, and seed than farms with the smallest corn acreage. Soybeans were more likely to be used as a rotation crop with corn on farms with the larger corn acreage. These farms were also more likely to use conservation tillage, especially a no-till production system, which may reduce the number of trips that an operator makes across a field. Operators of the farms with larger corn acreage have larger machines and more powerful tractors than operators with the smallest corn acreage.

The characteristics of farms with larger corn acreage mirror those found for larger family corn farms under farm typology. Operators of the farms with the larger corn acreage are generally younger and better educated (table 12). They have higher net cash incomes from farming and they are more likely to have insured the corn crop. Debt-to-asset ratios tend to be higher for farms with larger corn acreage.

Table 10—Corn production costs and returns on 1996 ARMS corn farms, by corn-planted acreage

Item	Fewer than 250 (a)	250-499 (b)	500-749 (c)	750 or more (d)
Percentage of corn farms	75 <i>bcd</i>	14 <i>acd</i>	7 <i>abd</i>	4 <i>abc</i>
Percentage of corn acres	32 <i>bcd</i>	27 <i>acd</i>	23 <i>abd</i>	18 <i>abc</i>
Percentage of corn production (<i>bushels</i>)	29 <i>bcd</i>	27 <i>ad</i>	25 <i>ad</i>	19 <i>abc</i>
Size:				
Total operated acreage per farm	388 <i>bcd</i>	944 <i>acd</i>	1,409 <i>abd</i>	2,255 <i>abc</i>
Planted corn acreage per farm	79 <i>bcd</i>	341 <i>acd</i>	578 <i>abd</i>	1,054 <i>abc</i>
Yield in bushels per acre:				
Actual	116 <i>bcd</i>	131 <i>ac</i>	143 <i>ab</i>	139 <i>a</i>
Expected	126 <i>bcd</i>	136 <i>ad</i>	139 <i>a</i>	147 <i>ab</i>
Production costs per bushel (<i>dollars</i>):				
Actual	1.28 <i>cd</i>	1.22	1.18 <i>a</i>	1.14 <i>a</i>
Expected	1.18 <i>d</i>	1.18 <i>d</i>	1.21 <i>a</i>	1.07 <i>abc</i>
Costs and returns per planted acre (<i>dollars</i>):				
Gross value of production	330.90 <i>bcd</i>	370.71 <i>ac</i>	406.54 <i>ab</i>	390.89 <i>a</i>
Operating costs	149.75 <i>bcd</i>	163.02 <i>a</i>	170.49 <i>a</i>	162.67 <i>a</i>
Seed	25.15 <i>bcd</i>	27.23 <i>a</i>	27.11 <i>a</i>	27.91 <i>a</i>
Fertilizer	43.42 <i>c</i>	48.04	50.62 <i>a</i>	47.48
Soil conditioners	0.30 <i>bcd</i>	0.12 <i>ad</i>	0.08 <i>a</i>	0.05 <i>ab</i>
Manure	0.62 <i>c</i>	*1.31 <i>c</i>	#0.20 <i>ab</i>	0.00
Chemicals	26.43	27.02	28.90	27.94
Custom operations	13.19 <i>bd</i>	8.78 <i>ac</i>	13.80 <i>b</i>	*8.47 <i>a</i>
Fuel, lube, and electricity	20.35 <i>bcd</i>	26.10 <i>a</i>	27.19 <i>a</i>	25.77 <i>a</i>
Repairs	15.20	16.97	15.89	14.96
Purchased irrigation water	D	D	0.00	#1.43
Interest on operating capital	3.64 <i>bc</i>	3.91 <i>a</i>	4.12 <i>a</i>	3.87
Hired labor	1.44 <i>bcd</i>	3.40 <i>a</i>	2.59 <i>a</i>	*4.78 <i>a</i>
Ownership costs	69.86	74.89 <i>d</i>	68.50	65.00 <i>b</i>
Capital recovery: machinery, equipment	62.50 <i>b</i>	68.20 <i>acd</i>	61.82 <i>b</i>	57.89 <i>b</i>
Taxes and insurance	7.36	6.69	6.68	7.11
Production costs	219.62 <i>b</i>	237.91 <i>a</i>	238.99	227.68
Value of production less operating costs	181.14 <i>bcd</i>	207.70 <i>ac</i>	236.05 <i>ab</i>	228.22 <i>a</i>
Value of production less production costs	111.28 <i>bcd</i>	132.81 <i>acd</i>	167.55 <i>ab</i>	163.22 <i>ab</i>

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Table 11—Production practices on 1996 ARMS corn farms, by corn-planted acreage

Item	Fewer than 250 (a)		250-499 (b)		500-749 (c)		750 or more (d)	
Seeding rate per acre (<i>kernels</i>)	26,332	<i>bcd</i>	27,539	<i>a</i>	27,575	<i>a</i>	28,283	<i>a</i>
Row width (<i>inches</i>)	33.4	<i>bcd</i>	32.1	<i>a</i>	31.5	<i>a</i>	30.2	<i>a</i>
Fertilizer use (<i>percentage of farms</i>):								
Nitrogen	93	<i>bd</i>	100	<i>a</i>	96		99	<i>a</i>
Phosphorous	80	<i>d</i>	76		75		66	<i>a</i>
Potassium	83	<i>b</i>	92	<i>ac</i>	84	<i>b</i>	89	
Manure	32	<i>bcd</i>	17	<i>ad</i>	*10	<i>a</i>	#5	<i>ab</i>
Test nitrogen level (<i>percentage of farms</i>)	11	<i>bd</i>	24	<i>a</i>	*20		32	<i>a</i>
Use recommended level (<i>percentage of farms</i>)	64		62		73		81	
Fertilizer quantity on reporting farms:								
Nitrogen (<i>lbs/acre</i>)	114	<i>bcd</i>	130	<i>acd</i>	146	<i>ab</i>	152	<i>ab</i>
Phosphorous (<i>lbs/acre</i>)	73	<i>d</i>	75		70	<i>d</i>	89	<i>ac</i>
Potassium (<i>lbs/acre</i>)	54		51		55		54	
Chemical use (<i>percentage of farms</i>):								
Herbicides	92	<i>bc</i>	99	<i>a</i>	98	<i>a</i>	97	
Insecticides	18	<i>bcd</i>	37	<i>a</i>	31	<i>a</i>	43	<i>a</i>
Chemical acre-treatments on reporting farms:								
Herbicides (<i>acre-treatments</i>)	2.6	<i>c</i>	2.7		2.8	<i>a</i>	2.8	
Insecticides (<i>acre-treatments</i>)	1.0	<i>bd</i>	1.2	<i>a</i>	1.1		1.3	<i>a</i>
Custom operations (<i>percentage of farms</i>):								
Any custom operation	49	<i>d</i>	57		59		61	<i>a</i>
Preparation, cultivation, or planting	8		*5		D		D	
Fertilizer/chemical	26	<i>bc</i>	42	<i>a</i>	43	<i>a</i>	33	
Harvest	24	<i>bcd</i>	8	<i>a</i>	*11	<i>a</i>	#6	<i>a</i>
Drying	17	<i>d</i>	15		*22	<i>d</i>	*8	<i>ac</i>
Total labor hours per acre	3.4	<i>bcd</i>	2.6	<i>ad</i>	2.3	<i>ad</i>	1.8	<i>abc</i>
Unpaid	3.2	<i>bcd</i>	2.3	<i>ad</i>	2.0	<i>ad</i>	1.2	<i>abc</i>
Paid	.2	<i>bcd</i>	.3	<i>ad</i>	.4	<i>a</i>	.6	<i>ab</i>
Farms with paid labor (<i>percent</i>)	10	<i>bcd</i>	37	<i>a</i>	29	<i>ad</i>	47	<i>ac</i>
Tillage systems (<i>percentage of farms</i>):								
Conventional	70	<i>c</i>	65		57	<i>a</i>	60	
Reduced	16	<i>bcd</i>	30	<i>a</i>	37	<i>a</i>	36	<i>a</i>
Conservation	30	<i>c</i>	35		43	<i>a</i>	40	
No-till	10	<i>d</i>	11	<i>d</i>	15		20	<i>ab</i>
Machinery:								
Planter width (<i>rows</i>)	5.4	<i>bcd</i>	8.1	<i>acd</i>	11.6	<i>abd</i>	12.3	<i>abc</i>
Harvester width (<i>rows</i>)	4.2	<i>bcd</i>	5.7	<i>acd</i>	6.3	<i>abd</i>	7.3	<i>abc</i>
Tractor horsepower (<i>largest used</i>)	122	<i>bcd</i>	175	<i>acd</i>	208	<i>ab</i>	227	<i>ab</i>
Speed of tillage/planting operations (<i>acres/hr</i>)	5.0	<i>bcd</i>	7.9	<i>acd</i>	10.1	<i>abd</i>	13.3	<i>abc</i>
Speed of harvest operations (<i>acres/hr</i>)	3.2	<i>bcd</i>	4.2	<i>acd</i>	5.7	<i>abd</i>	7.9	<i>abc</i>
Total trips across field (<i>number</i>)	8.0		8.3		7.8		7.9	
Tillage and planting trips (<i>number</i>)	3.7	<i>bcd</i>	3.4	<i>a</i>	3.1	<i>a</i>	3.0	<i>a</i>
Drying:								
Bushels dried (<i>percentage</i>)	44	<i>bcd</i>	60	<i>a</i>	60	<i>a</i>	63	<i>a</i>
Moisture removed (<i>percentage points</i>)	2.5	<i>bcd</i>	5.8	<i>a</i>	5.1	<i>a</i>	6.1	<i>a</i>

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Table 12—Characteristics of 1996 ARMS corn farms and corn producers, by corn-planted acreage

Item	Fewer than 250 (a)		250-499 (b)		500-749 (c)		750 or more (d)	
Corn acreage (percentage):								
Dryland	96	<i>bcd</i>	86	<i>ad</i>	85	<i>ad</i>	71	<i>abc</i>
Irrigated	4	<i>bcd</i>	14	<i>ad</i>	15	<i>ad</i>	29	<i>abc</i>
Production value:								
All commodities (dollars per farm)	127,344	<i>bcd</i>	326,987	<i>acd</i>	510,957	<i>abd</i>	910,781	<i>abc</i>
Corn (dollars per farm)	27,451	<i>bcd</i>	130,795	<i>acd</i>	238,120	<i>abd</i>	453,403	<i>abc</i>
Percentage of total production	31	<i>bcd</i>	48	<i>acd</i>	54	<i>ab</i>	59	<i>ab</i>
Corn acres harvested for grain (percentage)								
	91		98	<i>d</i>	99		99	<i>b</i>
Corn acres harvested for silage (percentage)								
	8		1		1		D	
Precision agriculture (percentage of farms):								
Variable rate technology/soil grid sampling	4	<i>bcd</i>	*13	<i>ad</i>	20	<i>a</i>	28	<i>ab</i>
Harvested using yield monitor	*2	<i>bcd</i>	9	<i>ad</i>	*18	<i>ad</i>	37	<i>abc</i>
Previous crop (percentage of farms):								
Soybean	38	<i>bc</i>	55	<i>ac</i>	71	<i>abd</i>	51	<i>c</i>
Corn	27	<i>c</i>	30	<i>c</i>	*16	<i>abd</i>	36	<i>c</i>
Other	35	<i>bcd</i>	16	<i>a</i>	13	<i>a</i>	13	<i>a</i>
Commodities per farm								
	3.0		3.3		3.3		3.2	
Percentage of corn farms with:								
Corn under contract	11	<i>bcd</i>	49	<i>a</i>	47	<i>a</i>	58	<i>a</i>
Cattle	61	<i>bcd</i>	40	<i>a</i>	*31	<i>a</i>	42	<i>a</i>
Hogs	16		19		*26		*11	
Dairy	22	<i>bcd</i>	*6	<i>ac</i>	*2	<i>ab</i>	*5	<i>a</i>
Soybeans	50	<i>bcd</i>	87	<i>a</i>	89	<i>a</i>	78	<i>a</i>
Hay	63	<i>bcd</i>	45	<i>a</i>	*31	<i>a</i>	39	<i>a</i>
Wheat	25		24		34		37	
Operator occupation (percentage) ¹ :								
Farming	70	<i>bcd</i>	97	<i>a</i>	96	<i>a</i>	98	<i>a</i>
Non-farm	21	<i>b</i>	#3	<i>a</i>	D		D	
Retired	*8	<i>cd</i>	D		0	<i>a</i>	0	<i>a</i>
Operator age (percentage):								
Less than 50 years	45	<i>bc</i>	67	<i>ad</i>	64	<i>a</i>	50	<i>b</i>
50 to 64	32		25		34		38	
65 or more	23	<i>bcd</i>	*7	<i>a</i>	#2	<i>abd</i>	*12	<i>ac</i>
Operator education (percentage):								
High school or less	65	<i>bcd</i>	49	<i>ac</i>	32	<i>ab</i>	40	<i>a</i>
Some college	23	<i>c</i>	28		47	<i>a</i>	29	
Completed college	12	<i>bd</i>	23	<i>a</i>	*21		30	<i>a</i>
Financial characteristics per farm:								
Net cash income (dollars)	25,314	<i>bcd</i>	58,435	<i>acd</i>	102,539	<i>abd</i>	215,559	<i>abc</i>
Equity (dollars)	463,939	<i>bcd</i>	703,944	<i>acd</i>	1,070,900	<i>abd</i>	1,517,945	<i>abc</i>
Debt-to-asset ratio (percent)	12	<i>bcd</i>	19	<i>a</i>	19		22	<i>a</i>
Rate of return on equity (percentage)	*-5	<i>bcd</i>	#1	<i>acd</i>	11	<i>ab</i>	*11	<i>ab</i>
Government payments (dollars)	3,287	<i>bcd</i>	10,729	<i>acd</i>	15,553	<i>abd</i>	28,374	<i>abc</i>
Corn crop insurance (percentage)	52	<i>bcd</i>	80	<i>a</i>	79		86	<i>a</i>

D=Data insufficient for disclosure.

Coefficient of Variation = (Standard Error/Estimate)*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, d indicates that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.¹May not add to 100 since percentages for hired managers are not shown.

Agricultural Resource Management Study (ARMS) is the source of data compiled for this report. Corn cost and return estimates in this report are derived from the responses of 1,379 corn farmers in 16 States to a survey on corn production practices and costs as part of the 1996 ARMS. The target population for the corn survey was farmers who planted corn with the intention of harvesting the corn for grain. The National Agricultural and Statistics Service (NASS) and the Economic Research Service (ERS) collect production and cost data once every 5-8 years for each commodity on a rotating basis in the ARMS survey. The survey data are weighted to represent all U.S. corn acreage.

Cost categories

- **Low-cost producers** are the 25 percent of U.S. corn producers with the lowest production costs per harvested corn bushel. These corn producers had production costs of \$1.43 per bushel or less for corn. The cost per bushel is computed by dividing production costs by the bushels of corn produced.
- **High-cost producers** are the 25 percent of U.S. corn producers with the highest production costs per harvested corn bushel. These corn producers had operating costs of \$2.50 or more per bushel.

Corn farms are farms that planted at least one acre of corn in 1996 with the intent of harvesting the corn for grain.

Corn production regions are based on ERS's farm resource regions (fig. 6). These consist of county groupings with similar soils and climates that favor production of selected crops and livestock and lead to use of similar production practices on farms within a region. The Southeast region is the combination of the Eastern Uplands and Southern Seaboard. No corn farms were sampled in the Mississippi Portal or the Basin and Range.

Corn under contract is corn grown under a marketing contract or corn grown under a formal or informal arrangement to produce corn for processors, packers, canners, and integrators.

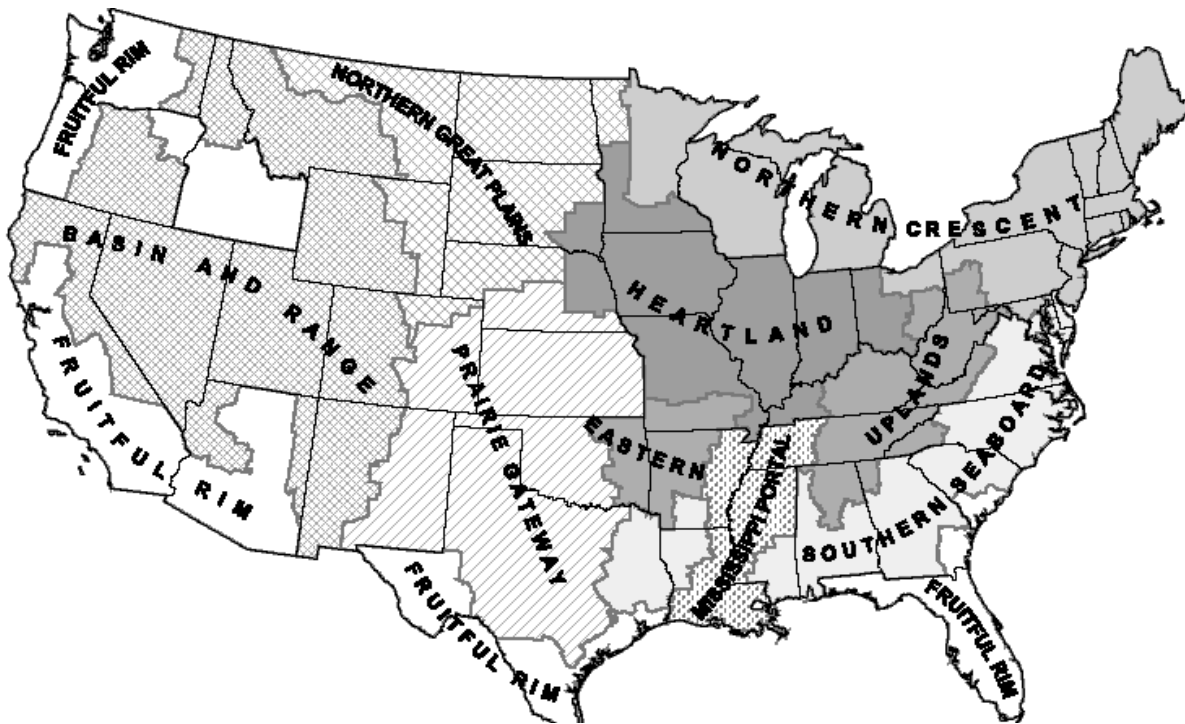
Crop rotation refers to the crops planted in the spring/summer of 1995 prior to the corn crop in 1996, described as follows:

- **Soybeans** are members of the legume family. Legumes are plants with bacteria on their nodules that take nitrogen from the air and convert the nitrogen to a form usable by plants.
- **Corn** is a member of the grass family. Grasses are plants that require nitrogen for growth but cannot generate nitrogen. Therefore, farmers usually supply nitrogen to grasses.
- **Other** includes fields rotated with any other crop other than soybeans or corn, as well as land that was fallowed in the prior crop-growing season or land taken out of the Conservation Reserve Program during 1996.

Farm typology is a way to classify farms based on the size of the farm operation, the operator's occupation, and farm asset levels. The size of the farm operation is based on the annual value of gross sales.

- **Small farms** are family farms with annual gross sales of \$250,000 or less. Family farms exclude farms organized as nonfamily corporations or cooperatives and exclude farms operated by hired managers.
 - **Part-time farms** are family farms that generate annual gross sales of less than \$250,000 and whose operators report a nonfarm occupation, as well as family farms that generate annual sales totaling less than \$100,000 whose operators report retirement as their occupation. All farms that generate less than \$100,000 in annual sales and have farm assets valued under \$150,000 are also included in the part-time farm definition.

Figure 6
Farm Resource Regions



- **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 with annual gross sales of \$100,000 or more but less than \$250,000, 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. These farms are excluded from the typology discussion and tables, but are included in all other tables and discussions.

Financial efficiency indicates how well a farm operation is utilizing resources (Boehlje, 1984). There are several measures of financial efficiency. One of the common ones is the ratio of expenses to the gross value of production, or its inverse. The ratio measures the amount of expenditure to generate a dollar of output. Lower values for the ratio indicate a more efficient use of resources than higher values.

Production costs are the sum of operating and ownership costs for all participants in the corn production enterprise, including the operators, landlords, and contractors. Operating costs are costs that vary with the amount of corn acreage

planted. These include the costs for seed, fertilizer, soil conditioners, manure, 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, the expenditures may be deferred but ultimately they must be paid if a producer is to maintain a viable farming operation.

The production costs include the costs on acreage that was planted with the intention of harvesting grain. The per acre production costs are divided by the bushels of corn produced. No attempt is made to reduce costs for those farmers who ultimately produced silage rather than corn.

Rate of return on farm equity represents the return earned by the equity in a farm operation as a percent of the value of farm equity. It is computed by subtracting the return to operator and unpaid labor and the return to management from the net farm income earned by the farm operation, dividing the total by the current value of the equity in the farm business, and multiplying by 100.

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

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