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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 aboveaverage 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). 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

[^0]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-ofproduction 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


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

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 lowcost 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, highcost producers would still have production costs exceeding those of the low-cost producers by $\$ 0.87$ per bushel. Thus, despite the lower-thanexpected 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 lowcost producers. High-cost corn producers were twice as likely to be 65 years or older than lowcost 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 | $b c$ | 54 | $a c$ | 16 | $a b$ |
| Percentage of corn production (bushels) | 35 | $b c$ | 57 | $a c$ | 8 | $a b$ |
| 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 | $b c$ | 135 | $a c$ | 72 | $a b$ |
| Expected | 140 | c | 137 | c | 120 | $a b$ |
| Production costs per bushel (dollars) |  |  |  |  |  |  |
| Actual | 1.19 | $b c$ | 1.83 | $a c$ | 3.67 | $a b$ |
| Expected | 1.31 | $b c$ | 1.79 | $a c$ | 2.18 | $a b$ |

Costs and returns per planted acre (dollars):

| Gross value of production | 431.57 | $b c$ | 379.52 | $a c$ | 226.01 | $a b$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operating costs | 129.55 | $b c$ | 172.41 | $a$ | 175.60 | $a$ |
| Seed | 25.95 |  | 27.29 | c | 25.78 | $b$ |
| Fertilizer | 37.69 | $b c$ | 50.91 | $a$ | 50.91 | $a$ |
| Soil conditioners | 0.14 | c | 0.15 | c | 0.21 | $a b$ |
| Manure | *0.64 |  | \#0.45 |  | \#0.99 |  |
| Chemicals | 23.23 | $b c$ | 29.24 | $a$ | 28.91 | $a$ |
| Custom operations | 8.88 | $b c$ | 12.65 | $a$ | *11.12 |  |
| Fuel, lube, and electricity | 16.81 | $b c$ | 27.33 | $a$ | 28.48 | $a$ |
| Repairs | 10.80 | $b c$ | 16.80 | $a c$ | 21.34 | $a b$ |
| Purchased irrigation water | \#0.78 |  | \#0.14 |  | 0.00 |  |
| Interest on operating capital | 3.14 | $b c$ | 4.15 | $a$ | 4.22 | $a$ |
| Hired labor | 1.48 | $b c$ | *3.32 | $a$ | 3.64 | $a$ |
| Ownership costs | 53.84 | $b c$ | 73.62 | $a c$ | 86.98 | $a b$ |
| Capital recovery: machinery, equipment | 48.06 | $b c$ | 66.35 | $a c$ | 78.80 | $a b$ |
| Taxes and insurance | 5.78 | $b c$ | 7.27 | $a$ | 6.98 | $a$ |
| Production costs | 183.39 | $b c$ | 246.02 | $a c$ | 262.58 | $a b$ |
| Value of production less operating costs | 302.02 | $b c$ | 217.11 | $a c$ | 50.42 | $a b$ |
| Value of production less production costs | 248.19 | $b c$ | 133.49 | $a c$ | -36.57 | $a b$ |

Coefficient of Variation (CV) $=(\text { Standard Error/Estimate })^{*} 100$.

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

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

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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.

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

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

Coefficient of Variation $=(\text { Standard Error/Estimate })^{*} 100$.

* 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.
${ }^{1}$ May not add to 100 since percentages for hired managers are not shown.

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 threefourths 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).


1 / Southeast includes E astern 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 | $b c d$ | 26 | acd | 7 | $a b d$ | 11 | $a b c$ |
| Percentage of corn acres | 68 | $b c d$ | 15 | ad | 13 | ad | 3 | $a b c$ |
| Percentage of corn production (bushels) | 71 | $b c d$ | 12 | $a$ | 14 | ad | 3 | $a c$ |
| Size: |  |  |  |  |  |  |  |  |
| Total operated acreage per farm | 602 | $b c d$ | 368 | $a c$ | 1,417 | abd | 419 | $a c$ |
| Planted corn acreage per farm | 231 | $b c d$ | 108 | acd | 328 | $a b d$ | 66 | $a b c$ |
| Yield in bushels per acre: |  |  |  |  |  |  |  |  |
| Actual | 138 | $b d$ | 104 | $a c$ | 143 | $b d$ | 104 | $a c$ |
| Expected | 137 | $b c d$ | 126 | acd | 155 | $a b d$ | 111 | $a b c$ |
| Production costs per bushel: |  |  |  |  |  |  |  |  |
| Actual | 1.14 | $b c d$ | 1.38 | $a$ | 1.29 | $a$ | 1.52 | $a$ |
| Expected | 1.15 | $d$ | 1.14 | $d$ | 1.19 | $d$ | 1.42 | $a b c$ |

Costs and returns per planted acre (dollars):

| Gross value of production | 385.35 | $b$ | 297.11 | $a c$ | 429.94 | $b d$ | 346.33 | c |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operating costs | 159.69 | $b c$ | 147.70 | acd | 190.06 | $a b d$ | 164.34 | $b c$ |
| Seed | 27.32 | $b d$ | 25.10 | acd | 27.23 | $b d$ | 21.73 | $a b c$ |
| Fertilizer | 49.90 | $b c d$ | 41.43 | ad | 42.33 | ad | 60.07 | $a b c$ |
| Soil conditioners | 0.09 | $b c d$ | 0.43 | acd | *0.01 | $a b d$ | *0.99 | $a b c$ |
| Manure | *0.44 | $b c$ | *2.08 | ad | D |  | *0.23 | $b$ |
| 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 | c | 20.82 | $c$ | 43.17 | $a b d$ | 19.09 | c |
| Repairs | 14.41 | $c d$ | 14.82 | $c$ | 24.12 | $a b d$ | 15.85 | $a c$ |
| Purchased irrigation water | 0.00 |  | 0.00 |  | \#2.40 |  | D |  |
| Interest on operating capital | 3.87 | $b c$ | 3.53 | acd | 4.53 | $a b d$ | 3.86 | $b c$ |
| Hired labor | 1.98 | $b c d$ | 3.79 | ad | *5.50 | $a$ | 6.79 | $a b$ |
| Ownership costs | 66.82 | $c d$ | 68.39 | $c d$ | 89.77 | $a b d$ | 78.46 | $a b c$ |
| Capital recovery: machinery, equipment | 60.50 | $c d$ | 61.90 | $c d$ | 79.69 | $a b$ | 70.37 | $a b$ |
| Taxes and insurance | 6.32 | $c d$ | 6.49 | $c d$ | 10.09 | $a b$ | 8.09 | $a b$ |
| Production costs | 226.52 | $b c d$ | 216.09 | acd | 279.84 | $a b d$ | 242.81 | $a b c$ |
| Value of production less operating costs | 225.66 | $b$ | 149.41 | $a c$ | 239.88 | $b$ | 181.98 |  |
| Value of production less production costs | 158.84 | $b d$ | 81.02 | $a c$ | 150.10 | $b$ | 103.52 | $a$ |

$\mathrm{D}=$ Data insufficient for disclosure.
Coefficient of Variation $=(\text { Standard Error/Estimate })^{*} 100$.

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

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

$\overline{\mathrm{D}=\text { Data insufficient for disclosure. }}$
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.
${ }^{1}$ Southeast includes Eastern Uplands and Southern Seaboard.
${ }^{2}$ May not add to 100 since percentages for hired managers are not shown.


## Economic Research Service, USDA

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. Parttime 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


Prairie Gateway has the largest precentage of large and very large farms
Percent


Most Northem Crescent corn producers have small farms
Percent


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



Source: 1996 Agricultur al 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 | bde | 33 | acde | 26 | bde | 12 | abce | 6 | abcd |
| Percentage of corn acres | 8 | bcde | 19 | acd | 27 | $a b$ | 26 | $a b$ | 20 | $a$ |
| Percentage of corn production (bushels) | 7 | bcde | 17 | acd | 25 | $a b$ | 28 | $a b$ | 23 | $a$ |
| Size: |  |  |  |  |  |  |  |  |  |  |
| Total operated acreage per farm | 281 | bcde | 399 | acde | 566 | abde | 1,239 | abce | ,938 | abcd |
| Planted corn acreage per farm | 67 | bcde | 110 | acde | 192 | abde | 411 | abce | 640 | abcd |
| Yield in bushels per acre: |  |  |  |  |  |  |  |  |  |  |
| Actual | 111 | de | 123 | de | 118 | $d$ | 139 | $a b c$ | 138 | $a b$ |
| Expected | 129 | $e$ | 126 | de | 128 | de | 137 | $b c$ | 145 | $a b c$ |

Production cost per bushel (dollars):

|  | 1.49 | $b d e$ | 1.23 | ad | 1.30 | $d$ | 1.11 | $a b c$ | 1.21 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $a$ | $a$ |  |  |  |  |  |  |  |  |
| Actual | 1.28 | $d e$ | 1.20 | 1.19 | 1.12 | $a$ | 1.14 | $a$ |  |

Costs and returns per planted acre (dollars):

| Gross value of production | 313.97 | de | 342.94 | de | 336.31 |  | 392.20 | $a b c$ | 398.92 | $a b c$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operating costs | 168.15 |  | 153.31 | $e$ | 157.49 | $e$ | 161.77 | $e$ | 177.26 | $b c d$ |
| Seed | 25.76 | $e$ | 24.38 | cde | 25.67 | be | 27.04 | $b$ | 28.40 | $a b c$ |
| Fertilizer | 50.32 |  | 48.85 |  | 45.87 |  | 45.77 |  | 48.33 |  |
| Soil conditioners | *0.37 | $d$ | 0.24 | $d$ | 0.25 | $d$ | 0.11 | $a b c$ | *0.21 |  |
| Manure | \#0.24 |  | *0.15 |  | *0.79 |  | \#0.76 |  | \#0.37 |  |
| Chemicals | 26.86 | $d$ | 24.71 | $d e$ | 27.15 | $d$ | 32.39 | $a b c$ | 28.01 | $b$ |
| Custom operations | *21.13 | bcde | 10.39 | $a$ | 9.36 | $a$ | 8.99 | $a$ | 10.36 | $a$ |
| Fuel, lube, and electricity | 21.16 |  | 21.96 | $e$ | 23.47 |  | 21.59 |  | 29.35 | $b$ |
| Repairs | 15.84 |  | 16.29 | $d$ | 16.94 | $d$ | 13.32 | $b c e$ | 16.63 | $d$ |
| Purchased irrigation water | D |  | D |  | D |  | D |  | D |  |
| Interest on operating capital | 4.06 |  | 3.70 | $e$ | 3.76 |  | 3.78 |  | 4.08 | $b$ |
| Hired labor | \#1.20 | $d$ | 1.17 | $d$ | *2.07 |  | 3.73 | $a b$ | 5.52 |  |
| Ownership costs | 71.12 |  | 74.41 | $d$ | 70.85 | $d$ | 65.26 | $b c$ | 70.96 |  |
| Capital recovery: machinery, equipment | 61.55 |  | 66.81 | $d$ | 64.99 | $d$ | 57.76 | $b c$ | 65.13 |  |
| Taxes and insurance | 9.62 | $c$ | 7.60 | ce | 5.85 |  | 7.50 | c | 5.83 | $b$ |
| Production costs | 239.32 |  | 227.72 | $e$ | 228.34 | $e$ | 227.03 |  | 248.22 | $b c$ |
| Value of production less operating costs | 145.81 | $b d e$ | 189.63 | ade | 178.82 | $d$ | 230.43 | $a b c$ | 221.65 | $a b$ |
| Value of production less production costs | *74.64 | bde | 115.21 |  | 107.98 | de | 165.17 | $a b c$ | 150.69 | $a b c$ |

$\mathrm{D}=$ 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.
$a, b, c, d, e$ 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.

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

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 .
$a, b, c, d, e$ 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.

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 e | 87 e | $90 \quad e$ | 74 bcd |
| Irrigated | \#15 | *12 e | *13 e | *10 e | 26 bcd |
| Production value: |  |  |  |  |  |
| All commodities (dollars per farm) | 50,459 bcde | 101,267 acde | 221,196 abde | 431,549 abce | 968,446 abcd |
| Corn (dollars per farm) | 21,223 bcde | 36,804 acde | 70,664 abde | 177,381 abce | 280,609 abcd |
| Percentage of total production | 39 | 36 d | $32 d$ | $41 b c$ | 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 de | *6 de | *20 bc | *16 bc |
| Harvested using yield monitor | D de | *3 de | *5 de | *17 $a b c$ | $19 a b c$ |
| Previous crop (percentage of farms) |  |  |  |  |  |
| Soybean | $42 d$ | $38 d$ | *30 de | 65 abce | 48 cd |
| Corn | 21 bce | 33 ad | 32 ad | 22 bce | 32 ad |
| Other | $36 d$ | $29 d$ | 38 | 17 abe | 20 |
| Commodities per farm (number) | 2.4 bcde | 2.9 acde | $3.6 a b$ | $3.5 a b$ | $3.7 a b$ |
| Percentage of corn farms with: |  |  |  |  |  |
| Corn under contract | 15 bde | 10 acde | 26 be | $39 a b$ | $42 a b c$ |
| Cattle | $44 c$ | 57 cd | 68 abde | $44 b c$ | 52 c |
| Hogs | *7 bcde | $21 a$ | *17 a | 28 a | *16 a |
| Dairy | *2 bcde | $17 a c$ | 32 abde | $16 a c$ | $14 a c$ |
| Soybeans | 51 de | 50 de | 63 de | $48 a b c$ | $42 a b c$ |
| Hay | $46 b c$ | 65 ade | 63 ade | $48 \quad b c$ | $42 b c$ |
| Wheat | 17 de | $25 e$ | 28 e | 33 a | $44 a b c$ |
| Operator occupation (percentage) |  |  |  |  |  |
| Farming | 0 bcde | $100 \quad a$ | $100 a$ | 100 a | $100 \quad a$ |
| Non-farm | 73 bcde | $0 \quad a$ | $0 \quad a$ | $0 \quad a$ | $0 \quad a$ |
| Retired | 37 bcde | $0 \quad a$ | $0 \quad a$ | $0 \quad a$ | $0 \quad a$ |
| Operator age (percentage): |  |  |  |  |  |
| Less than 50 years | 38 cd | 37 cde | $69 a b$ | $65 a b$ | $54 b$ |
| 50 to 64 years | 36 | 32 | 27 | 29 | 41 |
| 65 or more | *26 cde | 32 cde | *4 $a b$ | *6 ab | *5 $a b$ |
| Operator education (percentage): |  |  |  |  |  |
| High school or less | $57 \quad b d$ | 71 ade | *59 d | $39 a b c$ | 43 b |
| Some college | $27 \quad b$ | 16 ade | 28 | $39 b$ | 36 b |
| Completed college | *16 | $12 d$ | 13 | $21 b$ | *20 |
| Financial characteristics per farm: |  |  |  |  |  |
| Net cash income (dollars) | 7,567 bcde | 14,570 acde | 48,008 abde | 88,595 abce | 218,805 abcd |
| Equity (dollars) | 352,453 cde | 387,405 cde | 654,879 abde | 947,963 abce | 1,355,826 abcd |
| Debt-to-asset ratio (percent) | *11 de | 12 de | *14 | $20 \quad a b$ | $22 a b$ |
| Rate of return on equity (percentage) | *-5 cde | -9 cde | \#0 abde | *7 abce | 17 abcd |
| Government payments (dollars) | 1,896 bcde | 3,623 acde | 6,315 abde | 12,805 abce | 22,756 abcd |
| Corn crop insurance (percentage) | 43 cde | 52 cde | $72 a b$ | $75 a b$ | $75 a b$ |
| $\mathrm{D}=$ Data insufficient for disclosure. |  |  |  |  |  |
| Coefficient of Variation $=($ Standard Error/Estimate $) * 100$. <br> * indicates that CV is greater than 25 and less than or equal to 50 . |  |  |  |  |  |
| $a, b, c, d, e$ indicates that estimates are sig ${ }^{1}$ Part-time farms consist of retirement and $\$ 100,000$ in annual sales. See glossary. | ificantly different residential/lifestyl | from the indicated farms plus farms | group at the 90 pe with assets of \$150 | nt or better level 00 or less that gen | using the $t$-statistic. nerate less than |

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 E astern 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 | $b c d$ | 14 | acd | 7 | $a b d$ | 4 | $a b c$ |
| Percentage of corn acres | 32 | $b c d$ | 27 | acd | 23 | $a b d$ | 18 | $a b c$ |
| Percentage of corn production (bushels) | 29 | $b c d$ | 27 | ad | 25 | ad | 19 | $a b c$ |
| Size: |  |  |  |  |  |  |  |  |
| Total operated acreage per farm | 388 | $b c d$ | 944 | acd | 1,409 | $a b d$ | 2,255 | $a b c$ |
| Planted corn acreage per farm | 79 | $b c d$ | 341 | acd | 578 | $a b d$ | 1,054 | $a b c$ |
| Yield in bushels per acre: |  |  |  |  |  |  |  |  |
| Actual | 116 | $b c d$ | 131 | $a c$ | 143 | $a b$ | 139 | $a$ |
| Expected | 126 | $b c d$ | 136 | ad | 139 | $a$ | 147 | $a b$ |
| Production costs per bushel (dollars): |  |  |  |  |  |  |  |  |
| Actual | 1.2 | $c d$ | 1.22 |  |  | $a$ |  | $a$ |
| Expected | 1.1 | $d$ | 1.18 | $d$ |  | $a$ |  | $a b c$ |

Costs and returns per planted acre (dollars):

| Gross value of production | 330.90 | $b c d$ | 370.71 |  | 406.54 |  | 390.89 | $a$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Operating costs | 149.75 | $b c d$ | 163.02 | $a$ | 170.49 | $a$ | 162.67 | $a$ |
| Seed | 25.15 | $b c d$ | 27.23 | $a$ | 27.11 | $a$ | 27.91 | $a$ |
| Fertilizer | 43.42 | c | 48.04 |  | 50.62 | $a$ | 47.48 |  |
| Soil conditioners | 0.30 | $b c d$ |  | ad | 0.08 | $a$ | 0.05 |  |
| Manure | 0.62 | $c$ | *1.31 | $c$ | \#0.20 | $a b$ | 0.00 |  |
| Chemicals | 26.43 |  | 27.02 |  | 28.90 |  | 27.94 |  |
| Custom operations | 13.19 | $b d$ | 8.78 | $a c$ | 13.80 | $b$ | *8.47 | $a$ |
| Fuel, lube, and electricity | 20.35 | $b c d$ | 26.10 | $a$ | 27.19 | $a$ | 25.77 | $a$ |
| Repairs | 15.20 |  | 16.97 |  | 15.89 |  | 14.96 |  |
| Purchased irrigation water | D |  | D |  | 0.00 |  | \#1.43 |  |
| Interest on operating capital | 3.64 | $b c$ | 3.91 | $a$ | 4.12 | $a$ | 3.87 |  |
| Hired labor | 1.44 | $b c d$ | 3.40 | $a$ | 2.59 | $a$ | *4.78 | $a$ |
| Ownership costs | 69.86 |  | 74.89 | $d$ | 68.50 |  | 65.00 | $b$ |
| Capital recovery: machinery, equipment | 62.50 | $b$ | 68.20 | acd | 61.82 | $b$ | 57.89 | $b$ |
| Taxes and insurance | 7.36 |  | 6.69 |  | 6.68 |  | 7.11 |  |
| Production costs | 219.62 | $b$ | 237.91 | $a$ | 238.99 |  | 227.68 |  |
| Value of production less operating costs | 181.14 | $b c d$ | 207.70 |  | 236.05 |  | 228.22 | $a$ |
| Value of production less production costs | 111.28 | $b c d$ | 132.81 |  | 167.55 |  | 163.22 | $a b$ |

$\mathrm{D}=$ 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

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

$\mathrm{D}=$ 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.

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

$\overline{\mathrm{D}=\text { Data insufficient for disclosure. }}$
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.
${ }^{1}$ May not add to 100 since percentages for hired managers are not shown.


## Economic Research Service, USDA

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 cropgrowing 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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[^0]:    ${ }^{1}$ Costs exclude storage and marketing costs.

