AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

United States
Department
of Agriculture

USDA

Economic
Research
Service

Economic
Information
Bulletin
Number 7

February 2006

Characteristics and Production Costs of U.S. Corn Farms, 2001

Linda Foreman

Electronic
Report

Visit Our Website To Learn More!

Want to learn more about Characteristics and Production Costs of U.S. Corn Farms, 2001 Visit our website at **www.ers.usda.gov.**

You can also find additional information about ERS publications, databases, and other products at our website.

National Agricultural Library Cataloging Record:

Foreman, Linda

Characteristics and production costs of U.S. corn farms, 2001.

(Economic information bulletin ; no. 7)
1. Corn—Prices—United States.
2. Cropping systems—United States—Cost of operation.
3. Corn industry—United States—Costs.

I. United States. Dept. of Agriculture. Economic Research Service.

HD9049.C8

Cover photo credit: Cumulas

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

United States Department of Agriculture

Economic Information Bulletin Number 7

February 2006

An Electronic Report from the Economic Research Service

www.ers.usda.gov

Characteristics and Production Costs of U.S. Corn Farms, 2001

Linda F. Foreman

Abstract

Corn production costs per bushel vary considerably among U.S. producers, depending on yields, farm location, tillage practices, irrigation, previous field usage, enterprise size, and weather. In 2001, the operating and ownership costs per bushel for corn ranged from an average of $1.08 for the 25 percent of U.S. producers with the lowest costs to an average of $2.98 for the 25 percent with the highest costs. Heartland corn producers had the lowest costs per bushel on average. Corn producers with small corn enterprises had the highest costs due to their lower-than-average corn yields. Operators of part-time and low-sales corn farms have higher production costs per bushel than operators of farms with higher sales. In 2001, 59 percent of corn producers earned a positive net return per bushel after covering their operating and ownership costs from the market value of corn. When loan deficiency payments (LDPs) on corn were added to the value of corn production, 64 percent of producers covered their corn operating and ownership costs. When income consists of the value of production, LDPs, production flexibility contract, market loss, and disaster assistance payments, 73 percent of producers earned a positive return per bushel after accounting for their operating and ownership costs.

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

Acknowledgments

The author thanks economists Allen Baker, Stan Daberkow, James Johnson, and William McBride, all of USDA's Economic Research Service, and Lawrence Falconer, Extension Economist at Texas A&M University, William Lazarus, Extension Economist at the University of Minnesota, and Alan Miller, Farm Business Management Specialist at Purdue University, for their many helpful comments and suggestions. Thanks also go to Courtney Knauth for her editing assistance, and to Anne Pearl for graphic design and text layout of the report.

Contents

Overview

- Importance of Corn 1
- Scope of This Study 2
- Data Sources 3
- Major Changes Influencing Corn Production 3
- U.S. Corn Crop in 2001 4
- Summary of Findings 6

Production Costs Vary Widely 8

Heartland Has the Lowest Corn Production Costs 16

Farm Enterprise Size 25

Operating and Ownership Costs Vary Across Farm Typology 33

Glossary 41

References 46

Overview

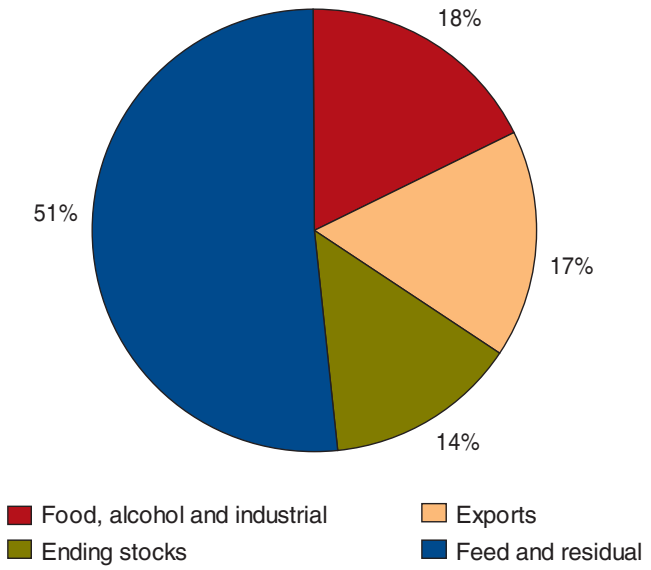
Importance of Corn

In terms of cash receipts, corn is the leading crop in the United States. In 2001, corn accounted for 16 percent of U.S. crop cash receipts and 8 percent of total receipts from U.S. agricultural production (McElroy et al., 2002).[1] Corn is grown in most States, but production is concentrated in the Heartland, where temperatures are moderate and rainfall is ample. Iowa and Illinois, the top corn-producing States, typically account for slightly more than one-third of the U.S. crop. Data from the 2002 Census of Agriculture indicate that 7 percent of all land in farms and 16 percent of all cropland was devoted to corn production, with 16 percent of all U.S. farms raising corn for grain or seed (USDA, National Agricultural Statistics Service, *2002 Census of Agriculture*). Between 70 and 80 million acres of U.S. cropland were planted to corn from 1992 to 2001 (USDA, NASS, June 2004 database).

Corn is the most widely produced feed grain in the United States, with half the available U.S. crop going into livestock feed (fig. 1; Baker, 2003). Hence, the supply and price of U.S. corn affects U.S. livestock producers. About 17 percent of the available U.S. corn output is used for seed, food products, and industrial products. Food items made from corn include starches, sweeteners, oil, and alcohol for beverages. Industrial products from corn include alcohol and fuel ethanol; corn is the primary feed grain used to produce ethanol (ERS corn briefing room, http://www.ers.usda.gov/Briefing/Corn/).

Global corn markets affect U.S. corn producers, since the United States produces more corn than domestic users demand. About 20 percent of the U.S. corn crop is exported (ERS corn briefing room, http://www.ers.usda.gov/Briefing/Corn/). U.S. corn producers compete with

Figure 1
Uses of U.S. 2001 corn crop



Data source: *Feed Yearbook*, RDS-2003, April 2003, Economic Research Service, USDA.

[1]Most data cited in this report are for 2001, the latest year data were collected from producers on their corn production costs through the Agricultural Resource Management Survey (ARMS) of the Economic Research Service, USDA.

producers in China, Argentina, and elsewhere to supply corn for the export market (Baker, 2003). The United States is the world's largest corn exporter, supplying about 63 percent of all corn exports in 1999-2001. China and Argentina, the two other major corn exporters, each supply less than 15 percent of the exported corn. Japan is by far the biggest purchaser of U.S. corn, followed by Mexico and Taiwan. About 13 percent of the U.S. corn crop, on average, remains unused at the beginning of the next corn season, comprising the ending stock inventory.

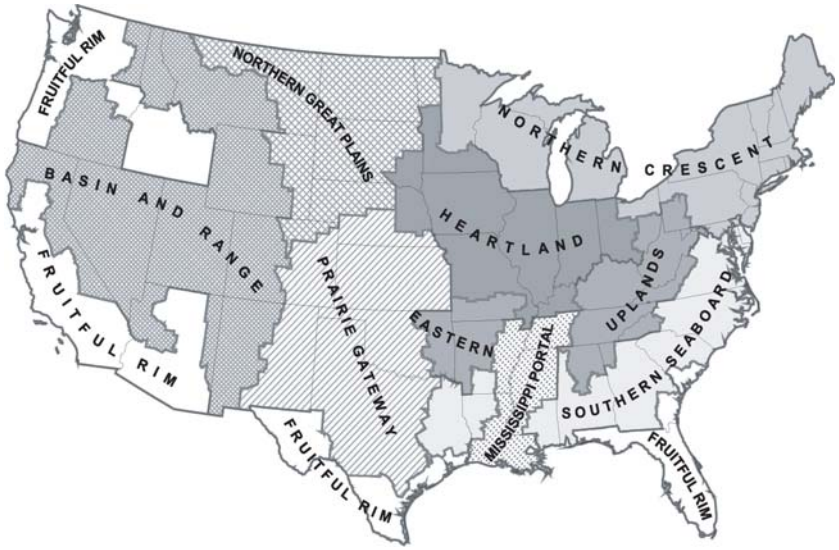
Scope of This Study

This report presents information about the costs of producing corn in the United States and examines how these costs vary among the different segments of the farm population. Farms producing corn are not homogeneous; corn producers have different goals in planting corn. They use a variety of production practices and levels of inputs and obtain different yields. Corn producers differ by age, education, and risk-comfort levels, and have different financial and agricultural resources. Many factors drive the diversity in corn costs and yields per acre, some of which are under producers' control, while others, such as weather and infestations, are not. Further, any policy affecting corn producers or corn production will have varying impacts on producers.

This study summarizes 2001 data on U.S. corn producers and their characteristics, farming techniques, input usage, and financial status to examine differences in corn farming. The study categorizes corn producers in order to investigate factors influencing production costs, such as farm practices, regional location, and characteristics of corn farms and their operators. Four categories of corn producers are examined, based on operating and ownership costs per bushel, region, size (the number of corn acres planted per farm), and farm typology (see glossary, farm typology).

Based on operating and ownership costs per bushel, corn producers are split into low-, mid-, and high-cost groups. The 25 percent of producers with the lowest operating and ownership costs per bushel are low-cost producers. High-cost producers are those in the top 25 percent of costs, and mid-cost producers are ranked between the low- and high-cost producers. The second categorization of corn producers is based on ERS regions (fig. 2), consisting of the Heartland, Northern Crescent, Northern Great Plains, Prairie Gateway, and Southeast regions. The Eastern Uplands, Southern Seaboard, and Fruitful Rim were combined to form the Southeast (see glossary, farm production regions). Data from a few corn producers in the Basin and Range were added to the Northern Great Plains. The third categorization of corn producers is based on the size of the corn enterprise, defined by the number of acres of corn planted with the intent of harvesting the corn for grain. The five sizes used in the analysis are those farms with less than 250 acres planted to corn and those with 250 to 499 acres, 500 to 749 acres, 750 to 999 acres, and 1,000 or more acres. The fourth categorization of corn farms is based on the ERS farm typology, which classifies farms according to annual gross agricultural sales, the producer's primary occupation, and farm assets (see glossary, farm typology).

Figure 2
U.S. Farm Resource Regions



Source: USDA, Economic Research Service.

Data Sources

This study uses data from the corn version of the 2001 Agricultural Resource Management Survey (ARMS) (USDA, ERS and NASS, 2001) to update an earlier study that used data from the 1996 ARMS (Foreman, 2001) (see glossary, Agricultural Resource Management Survey). In both studies, corn farms are those where at least 1 acre of corn was planted with the intention of harvesting the corn for grain rather than for seed or forage. The 2001 ARMS is the most recent survey to collect data on corn producers' production costs.[2]

Major Changes Influencing Corn Production

To compare results from this study of the 2001 U.S. corn producers with the 1996 study, one needs to be aware of some trends in corn production and of the major changes that influenced its production between 1996 and 2001 (Foreman, 2001). Data from NASS show corn yields have been rising, averaging 134 bushels per acre for 1997-2001, compared with 122 bushels for 1992-1996. Corn prices per bushel declined from an average of $2.56 in 1992-1996 to $2.00 in 1997-2001 as yields rose and acreage planted remained fairly stable. With the percentage decline in prices outpacing the percentage increase in yields, the average annual value of corn production fell by $38 per acre, from an average of $283 per acre in 1992-1996 to an average of $245 in 1997-2001. Over the same period, the variable costs of producing corn rose from an average of $148 per acre in 1992-1996 to $157 per acre in 1997-2001.

Some of the increased corn output was used for ethanol production, which has been rising in recent years (ERS corn briefing room, http://www.ers.usda.gov/Briefing/Corn/). Ethanol is a gasoline additive that reduces carbon monoxide emissions, and it is an alternative to another gaso-

[2]The next survey of corn producers, planned to take place in 2006, will collect data on costs of production and practices used in 2005.

line additive, MTBE, which was found to leach into groundwater (EPA, 1999). Groundwater contamination by MTBE recently caused several States, including California and New York, to ban the additive. Tax credits and various State production subsidies, as well as the cost and availability of substitute fuel additives (especially MTBE), affect the price and amount of ethanol usage. Corn used for ethanol production increased to 690 million bushels in 2001/02, up sharply from previous years.

Planting of genetically engineered corn for grain production on U.S. farms began in 1996 and became widespread by 2001 (ERS agricultural biotechnology briefing room, http://www.ers.usda.gov/Briefing/Biotechnology/). In 2001, 26 percent of the U.S. corn acreage was planted to genetically engineered varieties, with Bt corn planted on 18 percent of the acres and herbicide-resistant corn planted on 7 percent. Bt corn, engineered to be resistant to the European corn borer, produces its own insecticide (the *Bacillus thuringiensis* endotoxin), while the development of herbicide-resistant corn allows producers to use herbicides that would have formerly destroyed the corn along with the targeted weeds. Planting Bt and herbicide-resistant corn may lower chemical pesticide use on corn acreage and reduce yield losses.

U.S. Corn Crop in 2001

Some background on the 2001 corn crop will be helpful for interpreting the data in this report. Corn producers at the start of the 2001 planting season were facing low corn prices and high fertilizer prices, with uncertain fertilizer supplies (Baker et al., 2002). Ending stocks of corn were higher at the beginning of the 2001 corn planting season than in the previous 5 years. Large supplies kept corn prices low, with prices averaging $1.85 per bushel for the 2000/01 corn marketing season. By the spring of 2001, tight supplies of natural gas, a major input to fertilizer production, had boosted fertilizer prices, causing some U.S. manufacturers to cut fertilizer production. Hence, some farmers were uncertain whether they could obtain enough fertilizer for their corn crops. Overall, U.S. farmers reduced their corn acreage by 5 percent in 2001 over 2000 due to anticipated low corn prices, high fertilizer costs, and the attractiveness of alternative crops such as soybeans.

Despite a wet spring in some major corn-producing areas, U.S. average corn yields rose to an unprecedented level of 138.2 bushels per acre in 2001 from an average of 136.9 bushels the previous year (NASS, Quick Stats). (The average yield in 2003 and 2004 surpassed the 2001 average yield.) Despite the high 2001 yield, the reduction in planted corn acreage caused corn production to fall in 2001 from 2000. Reduced corn production helped to boost the 2001 average marketing year corn price to $1.97 per bushel, up 12 cents from 2000. In comparison, the national Commodity Credit Corporation (CCC) loan rate for corn was $1.89 per bushel in 2001 (Stuart, 2001).

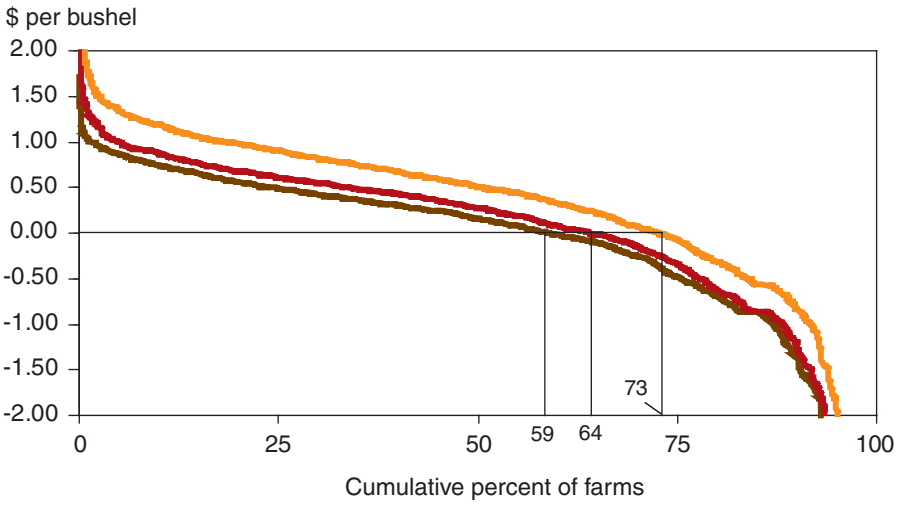
Good weather for corn production in the Southeast during 2001 boosted corn yields there (Baker, 2002), while a relatively dry August in the Northeast and Michigan lowered corn yields in the Northern Crescent. Drought in the Northern Great Plains caused some corn producers to harvest corn for forage—instead of grain—in nonirrigated fields.

While this report focuses on the distribution of corn production costs, the relationship between income from corn production and production costs has important longrun implications for producers (see box "Operating and Ownership Costs"). Producers' decisions to remain in corn production are often based on whether they can expect to recover their operating and ownership costs, on average. In 2001, 59 percent of all U.S. corn producers more than covered their operating and ownership costs per bushel from the market value of corn production, where market value was based on prices received during the corn harvest months (fig. 3). When loan deficiency payments (LDPs) for corn were added to the market value of corn production, 64 percent of producers had income that exceeded their operating and ownership costs. LDPs are government payments received by eligible corn producers when the posted county price for corn falls below the county CCC loan rate (see glossary, government payments).[3] Hence, LDPs are an income source from the current year's corn production.

Many corn producers also received production flexibility contract payments in 2001 based on their historical corn production. (Hence, production flexibility contract payments are decoupled from current corn production.) Other sources of income are market loss and disaster assistance payments for corn. Together, production flexibility contract, market loss, and disaster payments make up the list of direct government payments in 2001. If income from corn production is defined as the sum of direct government payments, LDPs, and market value of corn production, then 73 percent of the producers in 2001 had income that exceeded their operating and ownership costs (fig. 3).

[3]The percentage of corn producers who received LDPs and production flexibility contract payments can be found in table 3.

Figure 3
Cumulative distribution of corn farms by net returns per bushel from 2001 ARMS



Net return = value of production minus operating and ownership costs.
Net return = value of production plus loan deficiency payments (LDPs) minus operating and ownership costs.
Net return = value of production plus loan deficiency (LDPs), production flexibility contract, market loss, and disaster assistance payments minus operating and ownership costs.

Value of production = yield times harvest-month price.

Summary of Findings

There is considerable variation in the per bushel operating and ownership costs of U.S. corn producers, ranging from an average of $1.08 for the 25 percent of producers with the lowest costs to an average of $2.98 for the 25 percent with the highest costs. Wide differences in corn yields and operating and ownership costs per acre contributed to the cost variation per bushel.

The Heartland, where most corn is produced, is especially well suited for corn production. Heartland corn producers have higher-than-average corn yields and moderate operating and ownership costs, making it the lowest cost production region for corn. Corn producers with small corn enterprises, measured by planted corn acreage, had the highest costs of corn production per bushel due to their lower-than-average corn yields, since their operating and ownership costs per acre were not significantly different. Operators of part-time and low-sales corn farms have higher corn production costs per bushel than operators of farms with higher sales. In 2001, 59 percent of corn producers earned a positive net return per bushel on corn after covering their operating and ownership costs from the market value of corn. When LDPs for corn were added to the value of corn production, 64 percent of producers more than covered their corn operating and ownership costs. When income

Operating and Ownership Costs

Producers must be able to cover their operating and ownership costs, on average, to remain in production over a period of several years (see glossary, operating and ownership costs). **Operating costs** are costs that vary directly with the amount of corn produced, including the expense of seed, fertilizer, chemicals, custom operation fuel, repairs, interest, and hired labor. Usually, producers will not plant corn unless they expect they will be able to cover their operating costs. **Ownership costs** are related to capital consumed during production, such as the costs to replace farm machinery and equipment. In the short term, producers can continue to grow corn if they can at least meet their operating costs. However, in the longer run, they will need to replace their farm machinery and equipment. Total costs also include the opportunity cost of land and unpaid labor and general farm overhead. Unpaid labor is valued at an off-farm wage rate, while the land costs are valued at the rental rate.

While all cost items are shown in tables 1, 4, 7, and 10, the opportunity costs for land, unpaid labor, and general farm overhead were not included when producers were grouped into low-, mid-, and high-cost categories for the analysis in the next section of this report.* These items were excluded because many producers willingly accept returns on their own labor and land that differ from the assumed opportunity costs used in this report. Some producers may accept different returns because they reap nonfinancial benefits from farming, such as being their own boss or fulfilling their preference for a rural lifestyle for themselves and their families. Other producers may accept different returns, since they may not be able to overcome financial or other obstacles to switching to nonfarm occupations (such as a lack of off-farm jobs within commuting distance of the farm).

*By including all cost items in the cost tables, we enable readers to choose which level of cost to use for their own analyses.

consisted of the value of production, LDPs, and direct government payments, 73 percent of producers earned a positive return per bushel after accounting for their operating and ownership costs.

Characteristics and Production Costs Bulletins

This is one of a series of Economic Information Bulletins (formerly called Statistical Bulletins) on the *Characteristics and Production Costs* for selected commodities. The last bulletin on corn (Foreman, 2001) was based on data from the 1996 ARMS survey, while the present bulletin is based on data from the 2001 ARMS survey. In these bulletins, producers are categorized by their operating and ownership costs, region, enterprise size, and farm typology. Within each category, the variation of production costs, production practices, input use levels, and the characteristics of the farm operator and farm are examined.

The data used in these reports are derived from commodity-specific versions of the ARMS survey. ARMS is an annual survey of agricultural commodity producers. Producers of major crops are surveyed regarding their income and expenses related to a specific commodity on a rotating basis, every 3 to 8 years.

The following list of *Characteristics and Production Costs* bulletins shows titles available, as well as the survey year on which each is based and the publication date.
(The cover page for these reports on the ERS Web site, http://ers.usda.gov/publications/sb974/, provides links to each of them)

- *Characteristics and Production Costs of U.S. Corn Farms* (SB-974-1), 1996, August 2001
- *Characteristics and Production Costs of U.S. Cotton Farms* (SB-974-2), 1997, October 2001
- *Characteristics and Production Costs of U.S. Cow-Calf Operations* (SB-974-3), 1996, November 2001
- *Characteristics and Production Costs of U.S. Soybean Farms* (SB-974-4), 1997, March 2002
- *Characteristics and Production Costs of U.S. Wheat Farms* (SB-974-5), 1998, July 2002
- *Characteristics and Production Costs of U.S. Dairy Operations* (SB-974-6), 2000, February 2004
- *Characteristics and Production Costs of U.S. Rice Farms* (SB-974-7), 2000, March 2004
- *Characteristics and Production Costs of U.S. Sugarbeet Farms* (SB-974-8), 2000, October 2004

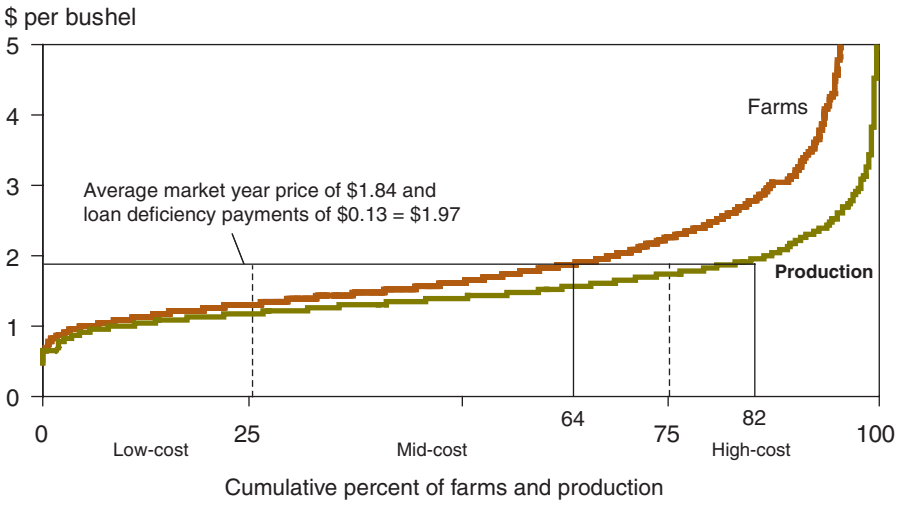
Production Costs Vary Widely

Wide differences in yields and in the operating and ownership costs per acre contributed to a $1.90 difference in the average production costs per bushel between low- and high-cost corn producers.

Operating and ownership costs vary greatly among producers due to differences in production and management practices, weather conditions, natural resources, and the efficiency of the farm operation. To facilitate the evaluation of factors associated with various cost levels, corn producers were ranked from lowest to highest based on their operating and ownership costs per bushel for corn in 2001 and grouped into quartiles.[4] Low- and high-cost producers are in the extreme quartiles, while mid-cost producers are those in the two mid-quartiles.[5] Low-cost producers raised 39 percent of the corn for less than $1.31 per bushel in 2001 on 35 percent of corn acreage (table 1 and fig. 4).[6] In contrast, high-cost corn producers raised 9 percent of the corn at a cost of over $2.26 per bushel on 14 percent of the corn acreage.

Operating and ownership costs averaged $2.98 per bushel for high-cost producers, more than 2.5 times the average cost of $1.08 per bushel for low-cost producers (table 1). Differences in yields and the operating and ownership costs per acre contributed to differences in the average costs per bushel between producers in the low- and high-cost categories. Low-cost corn producers obtained an average yield of 163 bushels per acre vs. the high-cost producers' yield of 90 bushels, a difference of 73 bushels, on average. Operating and ownership costs averaged $177 per acre for low-cost corn producers vs. $266 for high-cost producers, a difference of nearly $90. Total costs for low-cost producers averaged $302 per acre, with high-cost producers averaging $73 more in total costs. Differences in the costs per acre for fuel and capital recovery each accounted for about one-quarter of the difference between the operating and ownership costs for low- and high-cost producers, with fertilizer, chemicals, custom operations, and repair costs accounting for the remaining differences. The opportunity cost of land was higher—while the opportunity cost of unpaid labor per acre was

Figure 4
Cumulative distribution of corn farms and corn production by operating and ownership costs, 2001



Data Source: 2001 Agricultural Resource Management Survey (ARMS).

[4]See box "Operating and Ownership costs" for further information on why operating and ownership costs per bushel were used in this analysis.

[5]Quartiles represent one-quarter of the population or sample. Hence, the low-cost group comprises 25 percent of the farms with the lowest operating and ownership costs per bushel, while the high-cost group comprises 25 percent of the farms with the highest operating and ownership costs per bushel. Mid-cost producers are those ranking in the 26th through the 74th percentile of farm operations.

[6]The cost of $1.31 per bushel is the breakpoint between low- and mid-cost producers, while $2.26 per bushel is the breakpoint between mid- and high-cost producers.

Table 1—Corn production costs and returns per acre from 2001 ARMS corn farms, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)		Total
Percent of corn farms	25		50		25		100
Percent of corn acres	35		51		14		100
Percent of corn production (*bushels*)	39		52		9		100
Planted corn acreage per farm	332	*bc*	238	*ab*	137	*ab*	236
Corn acreage (*percent)*:							
Dryland	92	*bc*	83	*a*	79	*a*	86
Irrigated	*8	*bc*	17	*a*	21	*a*	14
Grain	100	*bc*	99	*ac*	88	*ab*	98
Silage	#0	*bc*	1	*ac*	*9	*ab*	2
Yield in bushels per planted acre:							
Actual	163	*bc*	146	*ac*	90	*ab*	144
Expected	162	*bc*	158	ac	135	*ab*	156
Operating and ownership costs per bushel (*dollars*):							
Actual	1.08	*bc*	1.63	*ac*	2.98	*ab*	1.53
Expected	1.09	*bc*	1.51	*ac*	1.98	*ab*	1.42
Total costs per bushel	1.86	*bc*	2.49	*ac*	4.20	*ab*	2.38
Costs and returns per planted acre:							
Gross value of production	295.91	*bc*	296.23	*ac*	183.60	*ab*	266.92
Operating costs	129.20	*bc*	172.31	*ac*	196.44	*ab*	160.59
Seed	32.36	*c*	32.89	*c*	30.26	*ab*	32.34
Fertilizer	38.66	*bc*	53.61	*ac*	48.81	*ab*	47.72
Soil conditioners	0.08	*bc*	0.13	*ac*	0.20	*ab*	0.12
Manure	*1.28	*bc*	2.65	*ac*	6.10	*ab*	2.65
Chemicals	22.89	*bc*	27.50	*a*	31.47	*a*	26.44
Custom operations	8.83	*c*	9.76	*c*	20.61	*ab*	10.94
Fuel, lube, and electricity	11.10	*bc*	24.23	*ac*	33.18	*ab*	20.88
Repairs	9.84	*bc*	15.52	*ac*	17.15	*ab*	13.76
Purchased irrigation water	0.00	*bc*	*0.32	*a*	*0.43	*a*	*0.22
Interest on operating capital	2.10	*bc*	2.79	*ac*	3.15	*ab*	2.60
Hired labor	2.06	*c*	2.91	*c*	5.09	*ab*	2.92
Ownership costs	47.46	*bc*	66.26	*a*	69.82	*a*	60.18
Capital recovery, machinery. and equipment	42.66	*bc*	60.60	*a*	63.20	*a*	54.69
Taxes and insurance	4.80	*bc*	5.66	*a*	6.62	*a*	5.49
Operating and ownership costs	176.66	*bc*	238.57	*ac*	266.27	*ab*	220.78
Economic costs	125.80	*c*	125.02	*c*	109.44	*ab*	123.13
Opportunity cost of land	95.75	*bc*	86.16	*ac*	64.45	*ab*	86.50
Opportunity cost of unpaid labor	19.25	*bc*	27.18	*a*	31.20	*a*	24.96
General farm overhead	10.80	*c*	11.68	*c*	13.79	*ab*	11.67
Total costs	302.46	*bc*	363.59	*ac*	375.70	*ab*	343.90
Value of production less operating costs	166.70	*bc*	96.92	*ac*	*-12.84	*ab*	106.10
Value of production less operating and ownership costs	119.24	*bc*	30.66	*ac*	-82.66	*ab*	45.92
Value of production less total costs	#-6.56	*bc*	-94.36	*ac*	-192.10	*ab*	-76.98

Notes: Coefficient of variation (CV) = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, *b*, and *c* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

lower—for low-cost than for high-cost producers. The higher opportunity costs of land used by low-cost producers likely reflected the land's higher productivity. Low-cost producers' average and expected yields were higher than those of high-cost producers.

A large portion of the 73-bushel difference in average yield between low- and high-cost producers may be attributable to weather, pest problems, and other uncontrollable factors that significantly reduced yields below those expected by high-cost producers in parts of the Northern Crescent, Prairie Gateway, and Southeast. While yields of low-cost producers exceeded their expectations by 1 bushel per acre, the yields of high-cost producers were 45 bushels less per acre than they expected. Although low-cost producers generally exceeded their expected yields, almost 40 percent of them did not meet their expectations, compared with 80 percent of high-cost producers who did not. Expected yields are important because producers base their planting decisions partly on crop projections. Even if high-cost producers had achieved their expected yields, many of them would remain high-cost producers because their expected yields were lower and their operating and ownership costs per acre higher than those of producers in the low- and mid-cost categories. Differences in expected corn yields between the low- and high-cost producers averaged 27 bushels per acre, with an average expected yield of 162 bushels per acre for low-cost producers and 135 bushels for high-cost producers (see glossary, expected yield). High-cost corn producers had lower expected corn yields due mainly to their locations; a larger percentage of them were located in the Northern Crescent and Southeast compared with low-cost producers. These regions are less than desirable for corn production: Northern Crescent producers confront a shorter corn-growing season, while those in the Southeast face hot summers with unpredictable rainfall.

High-cost corn producers' average operating and ownership costs were nearly $90 more per acre than those of low-cost producers. High-cost producers spent $22 more per acre on average for fuel, lube, and electricity and incurred $21 more for capital recovery of machinery and equipment than low-cost corn producers. Fuel costs for irrigation accounted for $20 of the $22 per acre difference in fuel expenditures. High-cost producers irrigated 21 percent of their corn acreage, compared with 8 percent of low-cost producers. Most of the liquefied petroleum (LP), gas (propane), and natural gas used by the high-cost producers went to operate irrigation pumps. In addition to spending more on fuel for irrigation, high-cost producers spent $2 more on fuel per acre for field operations than low-cost producers.

Half of the $21 difference in the cost per acre for capital recovery of machinery and equipment between high- and low-cost producers is attributable to differences in farm machinery costs and half to differences in irrigation equipment costs. These differences are partially accounted for by the higher number of field operations and a higher percentage of irrigated corn acreage among high-cost producers. High-cost corn producers averaged 3.5 field operations for tillage and planting compared with 2.5 for low-cost producers. High-cost corn producers were less likely to use conservation or reduced tillage practices than low-cost producers (see table 2 and glossary entry, tillage systems). High-cost producers were also more likely to

Table 2—Production practices on 2001 ARMS corn farms, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)		Total
Seed variety (*percent of acreage*):							
Herbicide-resistant	13		13		16		13
Bt	28		25		#22		26
Other varieties	58		62		62		61
Specialty seed (*percent of acreage*)	*6		*4		*10		6
Fuel use:							
Gasoline (*gals/acre*)	1.4	*bc*	1.9	*a*	1.9	*a*	1.8
Diesel (*gals/acre*)	3.3	*bc*	7.4	*a*	6.8	*a*	5.9
LP gas (*gals/acre*)	2.7	*bc*	5.6	*a*	*9.1	*a*	5.1
Natural gas (f^3/*acre*)	*70	*bc*	*475	*a*	*998	*a*	406
Electricity (*kwh/acre*)	*32		50		*53		44
Fertilizer/manure use:							
Nitrogen (*percent of farms*)	94		98		97		97
Phosphorous (*percent of farms*)	71	*bc*	87	*a*	90	*a*	84
Potassium (*percent of farms*)	64	*bc*	79	*a*	78	*a*	75
Nitrogen (*lbs/acre*)	125	*b*	143	*ac*	125	*b*	134
Phosphorous (*lbs/acre*)	43	*b*	50	ac	43	*b*	46
Potassium (*lbs/acre*)	54	*b*	65	*a*	55		60
Chemical use:							
Herbicides (*percent of acreage*)	97		99	*c*	97	*b*	98
Insecticides (*percent of acreage*)	24		32		27		28
Herbicides (*lbs/acre*)	2.1		2.2		2.4		2.2
Insecticides (*lbs/ acre*)	0.1	*bc*	0.1	*ac*	0.2	*ab*	0.1
Previous crop (*percent of acreage*):							
Soybean	85	*bc*	69	ac	37	*ab*	70
Corn	*11	*bc*	21	ac	36	*ab*	20
Idle or Conservation Reserve program	*1	*bc*	4	ac	*17	*ab*	5
Custom operations (*percent of farms*):							
Any custom operation	77	*c*	78	*c*	66	*ab*	75
Preparation, cultivation, or planting	7		6		5		6
Fertilizer/chemical	62	*c*	64	*c*	49	*ab*	60
Harvest/hauling	18		17		19		18
Labor hours per acre	1.3	*bc*	1.9	*a*	2.3	*a*	1.8
Unpaid	1.1	*bc*	1.6	*a*	1.8	*a*	1.5
Paid	0.2	*c*	0.3	c	0.4	*ab*	0.3
Farms with paid labor (*percent*)	22		18		19		19
Tillage systems (*percent of farms*):							
Conventional	28	*bc*	36	*ac*	54	*ab*	38
Reduced	32	*c*	28	*c*	17	ab	26
Conservation	40	*c*	37		29	*a*	36
No-till	23	*bc*	16	*a*	15	*a*	17
Machinery:							
Planter width (*feet*)	22.1	*bc*	20.2	*ac*	16.5	*ab*	19.7
Harvester width (*feet*)	15.1	*bc*	14.2	*ac*	12.3	*ab*	14.0
Tractor PTO horsepower (*largest used*)	177		169		155		168
Speed of tillage/planting operations (*acres/hr*)	11.2	*bc*	9.3	*ac*	6.8	*ab*	9.2
Speed of harvest operations (*acres/hr*)	7.0	*bc*	5.4	*ac*	4.1	*ab*	5.7
Total trips across field (*number*)	4.5	*bc*	5.1	*ac*	5.4	*ab*	5.0
Tillage and planting trips (*number*)	2.5	*bc*	3.0	*ac*	3.5	*ab*	3.0

Notes: Coefficient of variation (CV) = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, *b*, and *c* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

produce corn on land that had been idled (including land coming out of the Conservation Reserve Program) during the previous year. Using conventional tillage and planting corn on previously idled land normally increases the number of field operations needed to prepare the field for planting, increasing machine usage and fuel consumption (see glossary, number of field operations). Since high-cost corn producers irrigate a higher percentage of their corn acreage, they also have higher capital recovery costs for irrigation equipment.

High-cost producers also spent more per acre for custom operations and fertilizer than low-cost producers, averaging $21 per acre for custom operations vs. $9 per acre for low-cost producers and $49 per acre for fertilizer vs. $39 per acre for low-cost producers. The greater custom costs of high-cost producers for harvesting and hauling accounted for most of the $12 per acre difference in custom operation costs, although the percentages of high- and low-cost farm operations using custom harvesting and hauling did not differ. Some of the difference in the average custom harvesting and hauling costs between the high- and low-cost groups may have resulted from higher per acre fees for work on small corn acreage to cover the fixed costs of custom operators, such as the transport of operators, machinery, and wagons to the harvest site, as well as the labor costs to arrange for the custom work. The $10 difference in fertilizer costs per acre between low- and high-cost producers is largely attributable to higher nitrogen prices in the Northern Crescent than in the Heartland, since low- and high-cost producers applied the same amounts of nitrogen, phosphorous, and potassium per acre. Northern Crescent corn producers were more likely to be high-cost producers than Heartland producers.

Low-cost corn producers had larger farms and more corn acreage than high-cost producers. Low-cost producers operated farms averaging 841 acres, while owning 299 of these acres (table 3). Low-cost producers planted 332 acres of corn per farm, compared with 137 acres for high-cost producers. Producers with more acreage may benefit from using larger farm implements and from economies of scale as they spread their fixed machinery costs over more acreage. Low-cost producers used planters with an average width of 22 feet, compared with 17 feet for high-cost producers. Harvester width averaged 15 feet for low-cost producers and 12 feet for high-cost producers. Larger farm machinery allows producers to cover more acres, lowering their labor costs per acre and optimizing their field operations. Total labor hours per acre averaged 1.3 for low-cost producers, with 1.1 hours per acre for unpaid labor. In contrast, high-cost producers averaged 2.3 total labor hours per acre, with 1.8 hours of that labor unpaid. The fewer labor hours per acre for low-cost producers contributed to their lower hired labor cost per acre and lower opportunity costs for unpaid labor.

Low-cost corn producers were more likely than high-cost producers to raise soybeans as well as corn (83 percent vs. 53 percent). Eighty-five percent of low-cost producers, compared with 37 percent of high-cost producers, planted corn in fields where soybeans were planted the previous year. Crop rotation is beneficial because it frequently disrupts the growth cycle of plant diseases, insects, and weeds, reducing the need for pesticides (Penn State College, 2004). Planting corn after a legume crop such as soybeans often

Table 3—Characteristics of 2001 ARMS corn farms and corn producers, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)		Total
Production value:							
All commodities (*dollars per farm*)	262,642	*bc*	204,310	*ac*	117,358	*ab*	193,225
Corn (*dollars per farm*)	80,411	*bc*	51,583	*ac*	19,576	*ab*	49,154
Percent of total production value	31	*c*	25	*c*	17	*ab*	25
Size (*acres per farm*):							
Total operated	841	*bc*	670	*ac*	519	*ab*	667
Owned and used	299		280		268		281
Cash-rented	303	*c*	257	*c*	160	*ab*	241
Share-rented	236	*bc*	128	*ac*	85	*ab*	140
Commodities per farm (*number*)	3.7		3.7		3.4		3.6
Percent of farms marketing commodity:							
Corn under contract	22	*c*	16	*c*	5	*ab*	14
Corn only	*3	*c*	*6		8	*a*	6
Cattle	47		45		52		48
Hogs	14	*c*	14	*c*	6	*ab*	12
Dairy	*6	*c*	10	*c*	15	*ab*	11
Soybeans	83	*c*	76	*c*	53	*ab*	71
Wheat	17		22		22		21
Hay	17	*c*	21		26	*a*	21
Cotton	*1		*1		#9		#3
Operator occupation (*percent*):							
Farming	77		77		73		76
Nonfarm	20		21		23		21
Retired	#2		*2		*4		*3
Percent with off-farm work:[1]							
Operators	37		39		46		40
Spouses	53		50		44		49
Farm organization (*percent*):							
Sole/family proprietor	85		85		88		86
Partnership	*8		9		*6		8
Family corporation	*8		6		*5		6
Operator risk-comfort level[2]	5.3	*c*	5.2	*c*	4.8	*ab*	5.1
Operator age (*percent*):							
Less than 50	55	*bc*	44	*a*	38	a	45
50 to 64	32		38		39		37
65 or more	13	*c*	17	*c*	23	*ab*	18
Operator education (*percent*):							
High school	48		52		48		50
Some college	27	*b*	21	*a*	27		24
Completed college	17		16		11		15

See notes at end of table.

Continued—

Table 3—Characteristics of 2001 ARMS corn farms and corn producers, by cost group—Continued

Item	Low (*a*)		Mid (*b*)		High (*c*)		Total
Input usage strategies (*percent of farms*):							
Forward-purchased inputs	39	*c*	39	*c*	17	*ab*	33
Shopped for best price	37		37		*28		34
Negotiated input prices	36	*c*	38	*c*	27	*ab*	35
Purchased used machinery	39	*b*	31	*a*	36		34
Leased machinery	13	*bc*	6	*a*	*4	*a*	7
Crop insurance on corn (*percent of acreage*)	87	*bc*	81	*a*	78	*a*	82
Basic catastrophic	19		20		19		20
Buy-up	13		17		20		16
Federal Revenue	5	*b*	37	*a*	35		40
Financial characteristics per farm:							
Farm assets (*dollars*)	948,471	*c*	905,088	*c*	728,526	*ab*	865,729
Farm debt (*dollars*)	157,439	*bc*	121,760	*ac*	74,037	*ab*	116,499
Farm equity (*dollars*)	791,032	*c*	783,328	*c*	654,488	*ab*	749,230
Debt-to-asset ratio (*percent*)	17	*bc*	13	*ac*	0	*ab*	13
Government payments per farm (*dollars*)	35,572	*bc*	27,788	*ac*	15,259	*ab*	26,051
Farms receiving government. payments (*percent*)	93	*c*	89	*c*	80	*ab*	87
Loan deficiency (LDPs)	89	*bc*	81	ac	66	*ab*	79
For corn	68	*c*	66	*c*	48	*ab*	62
Production flexibility contract (AMTA)	83	*c*	77	*c*	67	*ab*	75
For corn	60	*c*	58	*c*	47	*ab*	56
Disaster	47		52		47		49
For corn	31		34		29		32
Income per farm household:							
Total household income (*dollars*)	57,173	*c*	54,435	*c*	39,692	*ab*	50,968
Farm income (*dollars*)	25,553	*c*	20,052	*c*	9,897	*ab*	18,477
Off-farm income (*dollars*)	31,620		34,383		29,795		32,491

Notes: Coefficient of variation (CV) = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, and c indicate that estimates are significantly different from the 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.
[2]On a scale of 0-10, with 0=avoidance of risks and 10=high tolerance for risk.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

reduces the amount of fertilizer needed for the corn crop. Continuous corn production is generally associated with lower corn yields and higher costs (University of Illinois Extension, 2004).

Low-cost corn producers reported being more comfortable with risks than high-cost producers. In a direct measure of operators' comfort in making decisions, operators rate their comfort levels on a scale from 0 to 10, with 0 indicating that the operator avoids risks as much as possible and 10 indicating the operator takes any risks that may benefit the corn operation. On average, low-cost producers ranked themselves at 5.3, while high-cost producers ranked themselves at 4.8. Other risk measures indicate that low-cost producers do take more risks. One risk indicator is the ratio of the

value of corn production to the total value of agricultural production. Higher ratios sometimes indicate higher risks for the farm operation, since different corn prices or yields would likely cause a greater percentage of change in the income earned by operations with the higher ratios. This ratio averaged 31 percent for low-cost corn producers, compared with 17 percent for high-cost producers. Another risk indictor is a solvency measure, the debt-to-asset ratio (see glossary, debt-to-asset ratio). Higher values indicate more risk for the farming operation, since lenders are less likely to extend additional credit to those with higher ratios. Low-cost producers had an average debt-to-asset ratio of 17 percent, compared with 10 percent for high-cost producers.

Low-cost producers' higher comfort levels with risks may be partly attributable to differences in the ages of operators in the low- and high-cost groups; 55 percent of low-cost producers were age 50 years or younger, compared with 38 percent of high-cost producers. Operators 65 years and older constituted 13 percent of the low-cost producers and 23 percent of the high-cost group. Younger producers may be more willing to increase their debt relative to their assets, knowing they have a longer time to repay it.

Even though low-cost corn producers report more comfort with risk than high-cost producers, low-cost producers appear more likely to take steps to mitigate their risks. Low-cost producers insured 87 percent of their corn acreage, compared with 78 percent for high-cost producers.

Sixty-eight percent of low-cost producers received loan deficiency payments for corn in 2001 vs. 49 percent of high-cost producers. Eligible producers receive loan deficiency payments when the county loan rates for corn are greater than the posted county price. Without these payments, 59 percent of producers covered their corn operating and ownership costs from the gross value of their corn production. When loan deficiency payments were added to the corn value of production, 64 percent of producers covered their costs (fig 4).

Heartland Has the Lowest Corn Production Costs

Favorable yields and relatively low operating and ownership costs per acre in 2001 continue to make the Heartland, where the majority of U.S. corn is produced, a low-cost corn production region.

The Heartland dominates the U.S. corn market, with more than half of the Nation's corn acreage, corn farms, and corn production. With 59 percent of U.S. corn farms, the Heartland produced 70 percent of the U.S. corn crop in 2001 on 67 percent of the total corn acreage (table 4). The Prairie Gateway, with 9 percent of the corn farms, was second in corn production, with 15 percent of the bushels produced in 2001 on 14 percent of the corn acreage. The Northern Crescent ranked third, with 9 percent of the corn production, 19 percent of the corn farms, and 11 percent of the corn acreage. Together, the Northern Great Plains and Southeast accounted for 6 percent of U.S. corn production, 13 percent of the corn farms, and 8 percent of the corn acreage.

With $1.40 in operating and ownership costs per bushel of corn and total costs of $2.25 per bushel, Heartland corn producers had the lowest average costs in 2001. In contrast, the other regions had average operating and ownership costs ranging from $1.80 to $1.90 per bushel, while their total costs ranged from $2.57 to $2.89 (fig. 5). Heartland corn producers' average costs were at least $0.32 per bushel less than the costs for producers in the other regions. The lower costs were due to their higher yields and to operating and ownership costs per acre that ranked second-lowest among the regions. Corn yields of 151 bushels per acre in the Heartland rivaled the 150 bushels on the mostly irrigated acreage in the Prairie Gateway, while corn yields averaged 119 bushels per acre or less in the Northern Crescent, Northern Great Plains, and Southeast. Heartland corn producers had operating and ownership costs averaging $210 per acre, about the same as Northern Great Plains and Southeast producers, but lower than the costs of Northern Crescent and Prairie Gateway producers. Total costs per acre were less in the Heartland than in the Prairie Gateway because a lower percentage of corn land is irrigated in the Heartland. Producers in the Northern Great Plains and Southeast had lower total costs of production per acre, due largely to lower land rental rates, since producers in these regions expect to receive lower corn yields.

Heartland corn producers were the most likely to grow soybeans and to have planted them prior to their 2001 corn crop (table 5). Eighty-six percent of Heartland corn producers grew soybeans in 2001, compared with 40 to 65 percent of corn producers in other regions. Rotating corn with soybeans enhances corn yields and may reduce the corn crop expenditures (Peel, 1998). Soybeans fix nitrogen into the soil, reducing the amount of nitrogen needed from fertilizers. Frequently, insecticide applications on corn can be reduced when corn is rotated with soybeans; the rotation interrupts pest cycles, especially those of the corn rootworm. In addition, planting corn and soybeans in the same year may help producers to properly time their field operations, especially those for planting and harvesting, by distributing labor and machine use over a longer period.

Table 4—Corn production costs and returns per acre from 2001 ARMS corn farms, by region

Item	Heartland (*a*)		N. Crescent (*b*)		N. Great Plains (*c*)		P. Gateway (*d*)		Southeast[1] (*e*)	
Percent of corn farms	59		19		5		9		8	
Percent of corn acres	67		11		5		14		3	
Percent of corn production (*bushels*)	70		9		4		15		2	
Planted corn acreage per farm	270	*bde*	138	*acde*	281	*bde*	344	*abce*	*84	*abcd*
Corn acreage (*percent*):										
Dryland	95	*cde*	96	*cde*	72	*abde*	39	*abce*	88	*abcd*
Irrigated	5	*cde*	*4	*cde*	28	*abde*	61	*abce*	*12	*abcd*
Grain	99	*be*	96	*ad*	92		99	be	93	*ad*
Silage	1	*be*	*4	*ad*	#7		1	be	*6	*ad*
Yield per planted acre (*bushels*):										
Actual	151	*bce*	119	*ad*	111	*ad*	150	*bce*	116	*ad*
Expected	160	bce	144	*ade*	139	*ade*	157	*bce*	131	*abcd*
Operating and ownership costs per bushel (*dollars*):										
Actual	1.40	*bcde*	1.90	*a*	1.80	*a*	1.83	*a*	1.83	*a*
Expected	1.32	*bcde*	1.57	*acd*	1.45	*abde*	1.75	*abc*	1.62	*ac*
Total costs per bushel (*dollars*)	2.25	*bcde*	2.89	*acd*	2.57	*ab*	2.60	*ab*	2.69	*a*
Costs and returns per planted acre (*dollars*):										
Gross value of production	273.01	*bcde*	222.08	*acde*	198.06	*abde*	298.50	*abce*	254.39	*abcd*
Operating costs	154.11	*cd*	162.33	*cd*	142.00	*abd*	198.19	*abce*	150.75	*d*
Seed	33.00	*bce*	31.72	*ae*	30.42	*ae*	31.21	*e*	27.65	*abcd*
Fertilizer	49.85	*cd*	45.36	*c*	33.38	*abde*	44.50	*ac*	49.15	*c*
Soil conditioners	0.09	*bcde*	0.44	*acd*	0.00	*abde*	*0.02	*abce*	0.53	*acd*
Manure	1.73	*bd*	10.37	*acde*	*2.85	*b*	*0.99	*abe*	*2.64	*bd*
Chemicals	26.67	*c*	25.40	*c*	20.19	*abd*	28.90	c	23.53	
Custom operations	9.77		11.08		10.85		*16.33		11.02	
Fuel, lube, and electricity	16.18	*d*	17.94	*de*	19.84	*de*	46.77	*abce*	14.13	*bcd*
Repairs	12.21	*bcd*	13.93	*ad*	14.45	*ad*	20.52	*abce*	14.59	*d*
Purchased irrigation water	0.00	*cd*	0.00	*cd*	*2.29	*abe*	*0.74	*abe*	0.00	*cd*
Interest on operating capital	2.50	*cd*	2.61	*cde*	2.26	*abd*	3.20	*abce*	2.41	*bd*
Hired labor	2.10	*cde*	*3.48		5.48	*a*	5.02	*a*	5.11	*a*
Ownership costs	56.42	*bd*	62.73	*ad*	58.67	*d*	76.27	*abce*	61.31	*d*
Capital recovery, machinery, and equipment	51.27	*bd*	57.01	*ad*	53.55	d	69.64	*abce*	53.31	*d*
Taxes and insurance	5.15	*de*	5.72	*e*	5.12	*de*	6.63	*ac*	8.00	*abc*
Operating and ownership costs	210.53	*bd*	225.06	*acd*	200.68	*bd*	274.46	*abce*	212.06	*d*
Economic costs	129.59	*bcde*	117.44	*ace*	85.01	*abde*	115.03	*ace*	99.98	*abcd*
Opportunity cost of land	96.90	bcde	67.56	*ace*	53.20	*abd*	71.11	*ace*	47.17	*abd*
Opportunity cost of unpaid labor	22.20	*bde*	34.54	*ac*	21.08	*bde*	29.56	*ace*	39.07	*acd*
General farm overhead	10.49	*bde*	15.34	*ac*	10.74	*bd*	14.37	*ac*	13.74	*a*
Total costs	340.13	*cde*	342.50	*cde*	285.69	*abde*	389.49	*abce*	312.04	*abcd*
Value of production less operating costs	118.90	*bc*	59.75	*ade*	56.06	*ade*	100.31	*bc*	103.64	*bc*
Value of production less operating and ownership costs	62.47	*bcd*	#-2.98	*ade*	#-2.62	*ade*	*24.04	*abc*	*42.33	*bc*
Value of production less total costs	-67.12	*bce*	-120.42	*acde*	-87.63	*abe*	-90.99	*abe*	-57.64	*bcd*

Notes: Coefficient of variation = (standard error/estimate) x 100. * indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50. *a*, *b*, *c*, *d*, and *e* indicate 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, Southern Seaboard, and Fruitful Rim.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Table 5—Production practices on 2001 ARMS corn farms, by region

Item	Heartland (*a*)		N. Crescent (*b*)		N. Great Plains (*c*)		P. Gateway (*d*)		Southeast[1] (*e*)	
Seed variety (*percent of acreage*):										
Herbicide-resistant	12	*c*	9	*ce*	34	*abde*	*14	*c*	20	*bc*
Bt (insect-resistant)	27	*be*	16	*ac*	30	*be*	29	*e*	*8	*acd*
Other varieties	61	*bce*	75	*acd*	36	*abde*	56	*bce*	72	*acd*
Specialty seed (*percent of acreage*)	5	*c*	#4		D		#12		#3	
Fuel use:										
Gasoline (*gals/acre*)	1.7	*b*	2.2	*ac*	1.8	*b*	1.8		1.9	
Diesel (*gals/acre*)	4.8	*cde*	5.7	*cd*	8.4	*ab*	9.9	*ab*	7.1	*a*
LP gas (*gals/acre*)	5.1	*bce*	3.9	*a*	*2.8	*a*	*7.		*1.3	*abd*
Natural gas (f^3/*acre*)	*138	*d*	*166	*d*	D		2,065	*ab*	D	
Electricity (*kwh/acre*)	26	bcd	16	*acd*	*82	*ab*	138	*abe*	#29	d
Fertilizer/manure use:										
Nitrogen (*percent of farms*)	96	*e*	97		95		98		99	*a*
Phosphorous (*percent of farms*)	80	*be*	93	*acde*	78	*be*	77	*be*	97	*abcd*
Potassium (*percent of farms*)	77	*bcde*	92	acde	36	*abde*	25	*abce*	96	*abcd*
Nitrogen (*lbs/acre*)	135		133		122	*d*	139	*ce*	120	*d*
Phosphorous (*lbs/acre*)	50	*cd*	48	*cd*	35	*abe*	32	*abe*	56	*cd*
Potassium (*lbs/acre*)	71	*bcd*	80	*acde*	14	*abde*	7	*abce*	63	*bcd*
Chemical use:										
Herbicides (*percent of acreage*)	99	*bde*	96	*a*	97		95	*a*	95	*a*
Insecticides (*percent of acreage*)	27	*bde*	18	*ade*	22	*de*	46	*abc*	39	*abc*
Herbicides (*lbs/acre*)	2.3	*c*	2.2	*c*	1.2	*abde*	2.2	*c*	2.0	*c*
Insecticides (*lbs/acre*)	0.1	*de*	0.1	*de*	0.1	*de*	0.2	*abc*	0.3	*abc*
Previous crop (*percent of acreage*):										
Soybean	85	*bcde*	51	*ade*	48	*ad*	30	*abc*	35	*ab*
Corn	12	*bcde*	29	*ad*	27	*ad*	43	*abc*	41	*a*
Idle or Conservation Reserve program	*1	*bcd*	*10	*e*	*6	*ade*	*18	*ace*	#2	*bcd*
Custom operations (*percent of farms*):										
Any custom operation	83	*bde*	66	*ade*	75	*e*	76	*abe*	*35	*abcd*
Preparation, cultivation, or planting	6	*e*	7	*e*	*9	*e*	#7	*e*	#1	*abcd*
Fertilizer/chemical	73	*bcde*	43	*ace*	57	*abe*	51	*ae*	*20	*abcd*
Harvest/hauling	14	*bd*	21	*a*	20		28	*a*	*22	
Labor hours per acre	1.5	*bde*	2.3	*ace*	1.7	*be*	2.2	*ae*	2.9	*abcd*
Unpaid	1.3	*be*	2.1	*ac*	1.2	*bde*	1.7	*ce*	2.2	*acd*
Paid	.2	*cde*	.2	*cde*	*.5	*ab*	*.5	*ab*	.6	*ab*
Farms with paid labor (*percent*)	19	*cde*	17	*cde*	30	*abe*	30	*abe*	*8	*abcd*
Tillage systems (*percent of farms*):										
Conventional	31	*be*	58	*acd*	32	*be*	26	*be*	60	*acd*
Reduced	32	*bcde*	19	*ae*	23	*ae*	20	*ae*	*7	*abcd*
Conservation	37	*bd*	23	*acd*	45	*b*	54	*abe*	*32	*d*
No-till	16	*d*	14	*d*	20	*d*	30	*abc*	*18	
Machinery:										
Planter width (*feet*)	21.8	*be*	14.6	*acd*	22.5	*be*	20.8	*be*	15.1	*acd*
Harvester width (*feet*)	14.7	*bce*	11.4	*acd*	15.2	*bde*	17.5	*abce*	10.6	*acd*
Tractor PTO horsepower (*largest used*)	174	*bc*	141	*acd*	210	*abd*	171	*bc*	*161	
Speed of tillage/planting operations (*acres/hr*)	10.2	*be*	6.2	*acd*	10.0	*be*	10.0	*be*	6.0	*acd*
Speed of harvest operations (*acres/hr*)	5.9	*bde*	4.1	*acd*	5.6	*bde*	7.0	*abce*	3.8	*acd*
Total trips across field (*number*)	4.7	*bce*	5.6	*ad*	5.2	*a*	4.9	*be*	5.6	*ad*
Tillage and planting trips (*number*)	2.8	*bcde*	3.5	*a*	3.3	*a*	3.2	*a*	3.2	*a*

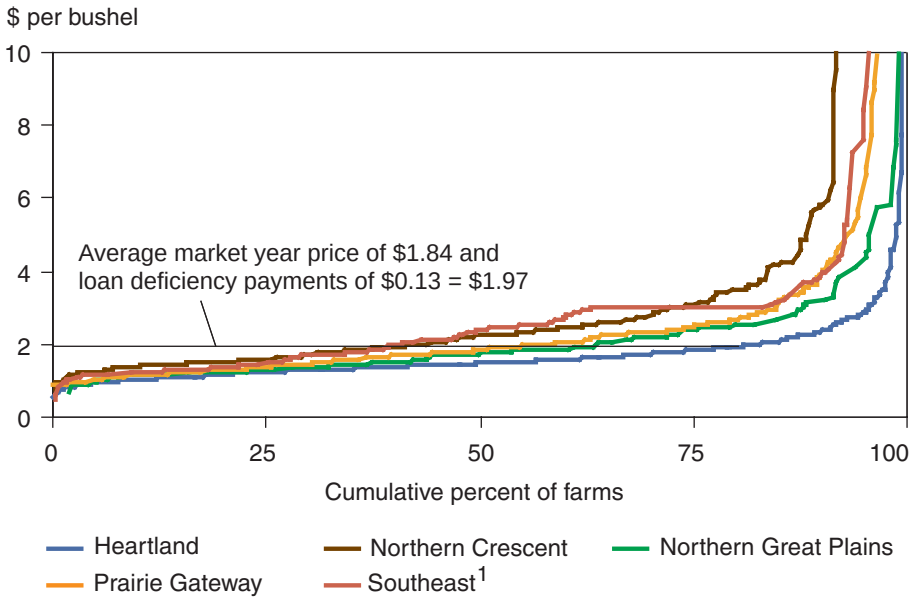
D=Data insufficient for disclosure. Coefficient of variation = (standard error/estimate) x 100.

* indicates that CV is greater than 25 and less than or equal to 50. # indicates that CV is greater than 50. *a*, *b*, *c*, *d*, and *e* indicate 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, Southern Seaboard, and Fruitful Rim.

Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Figure 5
Cumulative distribution of corn farms by operating and ownership costs by region for 2001



[1]Southeast includes Eastern Uplands, Southern Seaboard, and Fruitful Rim.
Data Source: 2001 Agricultural Resource Management Survey (ARMS).

Heartland corn producers reduced expenditures on their corn acreage by controlling the number of field operations. On average, Heartland producers had 2.8 tillage and planting trips and 4.7 total field operations, the lowest among regional corn producers in 2001 (see glossary, number of field operations). Fewer field operations mean lower fuel and machinery repair costs, as well as lower capital recovery costs for farm machinery.

Corn is a major agricultural commodity for Heartland producers. In the Heartland, 44 percent of all farmland controlled by corn producers was devoted to corn production, compared with 19 to 36 percent for corn producers in other regions (table 4 and table 6). Heartland corn producers derived 30 percent of their total production value from corn, similar to the 33 percent for Prairie Gateway producers (table 6). Producers in other regions derived an average of 15 percent or less of their total production value from corn. When a large percentage of a farmer's gross income is derived from one commodity, any change in prices or yields for that commodity can have a large impact.

Forty-four percent of Heartland producers forward-purchased inputs in 2001, compared with 3 to 31 percent of corn producers in other regions, who may not have suppliers willing to agree to forward-purchasing. Forward-purchasing makes inputs available to producers at a preset price before the inputs are delivered. If prices increase later, the producer realizes a benefit. However, if prices decline, the producer remains obligated to pay the higher price. Forward-purchasing may also be used to ensure availability of a preferred input, such as a specific seed variety.

Table 6—Characteristics of 2001 ARMS corn farms and corn producers, by region

Item	Heartland (*a*)		N. Crescent (*b*)		N. Great Plains (*c*)		P. Gateway (*d*)		Southeast[1] (*e*)	
Production value										
All commodities										
(*dollars per farm*)	197,971	*bd*	126,581	*acd*	*294,629	*b*	266,723	*ab*	197,568	
Corn (*dollars per farm*)	60,226	*bcde*	17,374	*acde*	43,491	*abde*	88,286	*abce*	11,296	*abcd*
Percentage of total production value	30	*bce*	14	*ade*	*15	*ad*	33	*bce*	6	*abd*
Size (*acres per farm*):										
Total operated	619	*bcde*	382	*acd*	1,513	*abe*	1,486	*abe*	429	*acd*
Owned and used	234	*bcd*	197	*acd*	766	*abe*	634	*abe*	217	*cd*
Cash-rented	231	*bcde*	164	*acd*	612	*abde*	391	*abce*	178	*acd*
Share-rented	153	*bde*	*11	acd	*135	*bde*	455	*abce*	*22	*acd*
Commodities per farm (*number*)	3.6	*bd*	3.3	*acd*	3.9	*b*	4.3	*abe*	3.4	*d*
Percentage of corn farms marketing:										
Corn under contract	18	*bce*	*6	*ade*	*4	*ad*	23	*bce*	*3	*abd*
Corn only	*3	*be*	*9	*ad*	#8		#2	*be*	*19	*ad*
Cattle	41	*bcd*	56	*a*	64	*a*	58	*a*	54	
Hogs	15	*bcd*	*8	*a*	*5	*a*	*6	*a*	#9	
Dairy	7	*bd*	28	*acde*	*5	*b*	#2	*abe*	*9	*bd*
Soybeans	86	*bcde*	48	*acd*	65	*ab*	60	*ab*	*40	*a*
Wheat	16	*bcd*	22	*acde*	48	*abe*	51	*abe*	*10	*bcd*
Hay	16	*bcd*	31	*a*	27	*a*	32	*a*	*21	
Cotton	D		0	*d*	0	*d*	4	*bc*	#32	
Operator occupation (*percent*):[2]										
Farming	75	*cd*	74	*cd*	91	*ab*	84	*ab*	74	
Nonfarm	23	*cd*	22	*c*	#9	*ab*	15	*a*	*20	
Retired	*3	*c*	*4	*c*	0	*abe*	#1		*6	*c*
Percent with off-farm work:										
Operators	40	*d*	44	*cd*	*28	*b*	26	*ab*	*50	
Spouses	51	*b*	40	*a*	48		49		58	
Farm organization (*percent*):										
Sole/family proprietor	86		88	*d*	89	*d*	79	*bce*	89	*d*
Partnership	7		9		*8		8		7	
Family corporation	7	*bc*	*1	*ade*	*3	*ad*	*12	*bc*	*4	*b*
Operator risk-comfort level	5.3	*bd*	4.7	*ace*	5.4	*bd*	4.9	*ac*	5.3	*b*
Operator age (*percent*):										
Less than 50	47		41		38		40		*49	
50 to 64	36		38		45		35		*38	
65 or more	17	*d*	21		*17		25	*ae*	*13	*d*
Operator education (*percent*):										
High school	51		57	*de*	50		45	*b*	*33	*b*
Some college	21	*c*	22	*c*	39	*ab*	27		*39	
Completed college	17	*bc*	*8	*ad*	*6	*ad*	18	*bc*	*14	

See notes at end of table.

Continued—

Table 6—Characteristics of 2001 ARMS corn farms and corn producers, by region—Continued

Item	Heartland (*a*)		N. Crescent (*b*)		N. Great Plains (*c*)		P. Gateway (*d*)		Southeast[1] (*e*)	
Input use strategies (*percent of farms*):										
Forward-purchased inputs	44	*bde*	18	*ade*	*31	*e*	28	*abe*	*3	*abcd*
Shopped for best price	35	*c*	32	*c*	23	*abd*	36	*c*	*40	
Negotiated input prices	36	*ce*	36	*e*	27	*a*	35	*e*	#12	*abd*
Purchased used machinery	34		37		32		35		#33	
Leased machinery	7	*de*	*6	*de*	*7	*d*	15	*abce*	#2	*abd*
Crop insurance on corn (*percent of acreage*)	83	*bde*	65	*acd*	88	*be*	92	*abe*	66	*acd*
Basic catastrophic	18	*e*	28		19		*19		29	*a*
Buy-up	15	*c*	13	*c*	32	*abde*	16	*c*	21	*c*
Federal Revenue	43	*be*	16	*acde*	35	*be*	50	*be*	*8	*abcd*
Financial characteristics per farm:										
Farm assets (*dollars*)	848,895	*cd*	833,610	*cd*	1,053,002	*abe*	1,095,889	*abe*	732,515	*cd*
Farm debt (*dollars*)	132,857	*be*	86,053	*acde*	156,739	*be*	141,708	*be*	*39,405	*abcd*
Equity (*dollars*)	716,038	*cd*	747,558	*d*	896,263	*a*	954,181	*abe*	693,110	*d*
Debt-to-asset ratio (*percent*)	16	*be*	10	*ace*	15	*be*	13	*e*	*5	*abcd*
Government payments per farm (*dollars*)	29,816	*bcde*	12,161	*acd*	40,600	*abe*	40,976	*abe*	12,212	*acd*
Farms receiving government. payments (*percent*)	92	*bce*	75	*acd*	98	*abe*	97	*be*	67	*acd*
Loan deficiency (LDP)	88	*bce*	58	*acd*	95	*abde*	86	*bce*	*51	*acd*
For corn	70	*be*	50	*acde*	69	be	70	*be*	*25	*abcd*
Production flexibility contract/AMTA	84	*be*	57	*acd*	78	*b*	83	*be*	*54	*ad*
For corn	64	*bce*	44	*ade*	44	*ad*	64	*bce*	*24	*abd*
Disaster	53	*bd*	34	*acd*	65	*b*	72	*abe*	#35	*d*
For corn	37	*bcde*	25	*ade*	21	*ade*	49	*abce*	*6	*abcd*
Income per farm household:										
Total household income (*dollars*)	53,187	*b*	44,280	*ae*	*40,493		46,872		59,928	*b*
Farm income (*dollars*)	20,843	*b*	10,895	*a*	*20,417		*21,861		*15,955	
Off-farm income (*dollars*)	32,344	*cde*	33,385	*cd*	20,076	*abe*	25,012	*abe*	43,973	*acd*

Notes: D=Data insufficient for disclosure.
Coefficient of variation = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, *b*, *c*, *d*, and *e* indicate 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, Southern Seaboard, and Fruitful Rim.
[2]May not add to 100 since percentages for hired managers are not shown.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Northern Crescent—In 2001, Northern Crescent corn producers averaged $1.90 in operating and ownership costs per bushel, higher than the costs for Heartland producers, but about the same as those of corn producers in the Northern Great Plains, Prairie Gateway, and Southeast. Total costs averaged $2.89 per bushel, significantly higher than the average costs in all other regions except the Southeast. Corn yields in the Northern Crescent averaged 119 bushels, lower than the yields in the Heartland and Prairie Gateway. In the Prairie Gateway, irrigation is used to achieve higher yields. Northern Crescent corn producers averaged $225 per acre in operating and ownership

costs and $343 per acre in total costs. These costs were lower than those of producers in the Prairie Gateway, where irrigation raises costs, but higher than the average costs of Northern Great Plains producers, who had the lowest per acre costs.

Northern Crescent corn producers had smaller farms and corn enterprises than other regional producers, operating an average of 382 acres in 2001, with 138 acres devoted to corn production. Only Southeast corn producers operated smaller farm operations and corn enterprises. Corn output constituted 14 percent of total agricultural production value on Northern Crescent farms, compared with 30 percent or more on Heartland and Prairie Gateway farms. Only 62 percent of Northern Crescent producers marketed some of their corn. The remaining 38 percent used the corn on their farms, most likely as cattle or dairy feed. Northern Crescent corn farms were the most likely to also operate a dairy enterprise. About half of the Northern Crescent corn farms raised cattle, about the same percentage as corn farms in other regions except for the Heartland.

Northern Great Plains and Prairie Gateway—In 2001, Northern Great Plains corn producers had operating and ownership costs averaging $1.80 per bushel, nearly the same as for corn producers in all other regions except the Heartland, where costs were lower. Total costs per bushel in the Northern Great Plains averaged $2.57, lower than in the Heartland but higher than in the Northern Crescent. Average corn yields in the Northern Great Plains were 111 bushels per acre in 2001, lower than corn yields in the Heartland and Prairie Gateway, and about equal to yields in the Northern Crescent and Southeast. The operating and ownership cost per acre of corn averaged $201, lower than the average for Northern Crescent and Prairie Gateway producers. Northern Great Plains producers averaged $286 in total costs per acre, the lowest among the regional producers. They spent less for fertilizer than corn producers in all other regions, and applied less phosphorous and potassium per acre than corn producers in all other regions except the Prairie Gateway. They also applied the least herbicide per acre, which may have contributed toward their low chemical cost per acre. In the Northern Great Plains, 34 percent of corn acreage was planted with herbicide-resistant corn seed, the highest percentage among the regions. Lower-than-average per acre costs for labor and land contributed to the low total costs of the Northern Great Plains producers.

Northern Great Plains and Prairie Gateway corn farms are similar in several ways. Both regions contain large farm operations with approximately the same total acreage. Northern Great Plains producers planted 281 acres of corn on farms averaging 1,513 acres, while Prairie Gateway producers grew 344 acres of corn on operations averaging 1,486 acres. Large farm operations are more likely to hire workers to meet some of their labor needs. In the Northern Great Plains and the Prairie Gateway, 30 percent of the corn producers used hired labor in their corn production. Northern Great Plains and Prairie Gateway climates are drier than those of other regions, so a higher percentage of their corn acreage is irrigated, 28 and 61 percent, respectively. Irrigation boosts several cost components, including fuel, repairs, and capital recovery of machinery and equipment. Producers benefit from irrigation if the increase in gross value of production from irrigation

more than offsets the irrigation costs. Northern Great Plains and Prairie Gateway corn producers are more likely to raise wheat than corn producers in regions with more rainfall, since wheat can tolerate drier climates (ERS wheat briefing room, http://www.ers.usda.gov/Briefing/Wheat/background.htm). Producers in arid regions have a limited variety of other crops that can be economically produced by dryland production methods.

Although Northern Great Plains and Prairie Gateway corn producers and farms are similar in many respects, they differ in significant ways. Actual and expected corn yields are greater in the Prairie Gateway than in the Northern Great Plains—yields of Prairie Gateway producers match the 150-bushel per acre yield achieved by Heartland corn producers. The higher percentage of irrigated corn land likely accounts for this region's higher-than-average yields. However, high production costs associated with irrigation offset the effect from high yields, leaving Prairie Gateway producers with an average of $1.83 in operating and ownership costs per bushel of corn and $2.60 in total costs per bushel. Corn producers in the Northern Great Plains and Southeast have per bushel costs on a par with Prairie Gateway producers.

Southeast—Corn producers in this region had the smallest corn enterprises, with an average of 84 acres of corn per farm. Although Northern Crescent corn producers operated farms of nearly the same overall size, they planted 138 acres of corn. Small enterprises are often at a disadvantage with regard to economies of scale. However, even with their small corn enterprises, Southeastern corn producers had $1.83 in operating and ownership costs and $2.69 in total costs per bushel, about the same as corn producers in all regions except the Heartland. Southeast corn producers' average yield of 116 bushels per acre was below that of Heartland and Prairie Gateway producers and essentially equal to yields of Northern Crescent and Northern Great Plains producers. However, only Prairie Gateway producers had significantly higher operating and ownership costs per acre than Southeast producers. Southeast producers had lower seed costs per acre than corn producers in all other regions. Fuel costs per acre were lower in the Southeast than in the Northern Great Plains and Prairie Gateway, since producers in the latter two regions irrigated a higher percentage of their corn acres. Higher average diesel and gasoline prices in the Northern Crescent also contributed to their higher fuel costs. The Southeast's lower rental rates for land used in corn production partially reflected the lower corn yields obtained on the land.

Some of the corn farm practices in the Southeast differ from those in other regions. Much of Southeast corn may be used on the farm where it is grown. Southeast producers were the least likely to forward-purchase inputs and were less likely than producers in other regions to negotiate input prices and lease farm machinery. The percentage of corn producers applying phosphorous and potassium was highest in the Southeast, although the amounts per acre were not significantly different from the amounts applied in several other regions. Southeast corn producers were also the least likely to use custom services in their corn operations. Their small enterprises partially explain why they incurred an average of 2.9 hours of labor per planted corn

acre, more than producers in any other region. Smaller enterprises tend to have smaller machinery, increasing the time spent per acre. Southeast corn producers are the most likely to raise cotton. Some Southeast cotton producers may grow corn as a rotational crop to reduce herbicide use on their cotton crop—growing corn allows them to spray broad-leaf herbicides on troublesome fields to decrease weeds on future cotton crops. Also, Southeast corn producers may plant corn to reduce the reniform nematode population that attacks soybeans, cotton, and vegetables (Kirkpatrick and Robbins, 1998).

Farm Enterprise Size

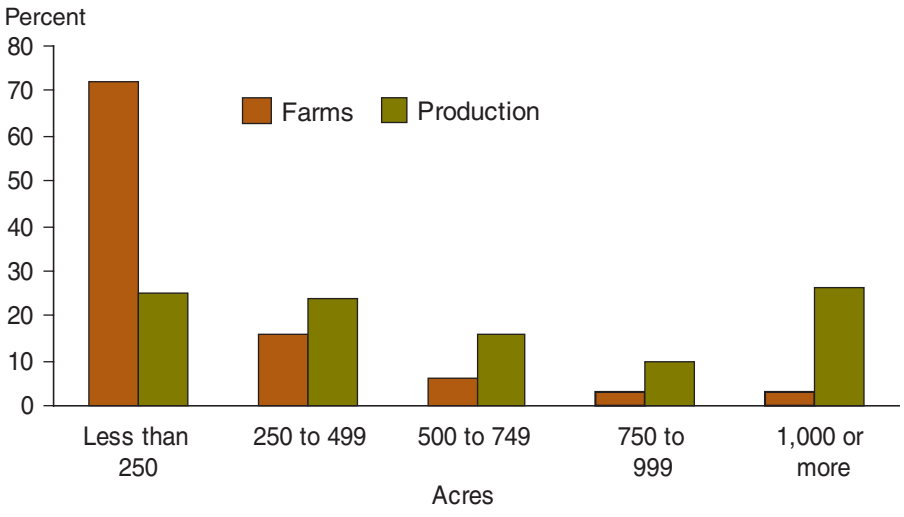
Yields were a major factor in cost differences per bushel among the different-size corn enterprises in 2001. Farm and operator characteristics, as well as the farm structure, also vary by the size of the corn enterprise.

There are some major differences in the costs, characteristics, and production practices that depend on the size of corn enterprises. Most U.S. corn production is concentrated on large farm enterprises that plant 500 or more acres of corn. These farms constituted just 12 percent of U.S. corn farms, but produced 51 percent of the corn in 2001 (fig. 6). Farms with the smallest corn operations, those with less than 250 acres of planted corn, comprised 72 percent of the U.S. corn farms but produced only 25 percent of U.S. corn in 2001.

The operating and ownership costs of corn ranged from an average of $1.70 per bushel for farms with the smallest corn acreage to $1.43 per bushel for farms with the largest acreage (table 7). When total costs are considered, the costs ranged from an average of $2.71 per bushel for operations with the smallest corn acreage to $2.18 for operations with the largest. On average, only operators with the smallest corn acreage (less than 250 acres of corn) had costs per bushel that were significantly higher than those of operators with larger corn enterprises. The average operating and ownership costs per acre and the total costs per acre did not vary significantly among the size groups. One might expect to find lower average costs per acre as the acreage increases due to economies of scale. However, the percentage of corn acreage that was irrigated rose as the average corn acreage per farm increased. The increased costs of irrigation likely masked the influence of the economies of scale, leaving the costs per acre almost the same among the different size groups.

Although average costs per acre did not vary much among the size groups, average yields varied significantly. Producers with less than 250 acres of

Figure 6
Distribution of corn farms and corn production by corn acreage per farm, 2001



Data Source: 2001 Agricultural Resource Management Survey (ARMS).

Table 7—Corn production costs and returns per acre from 2001 ARMS corn farms, by corn-planted acreage

Item	Less than 250 (*a*) acres		250-499 (*b*) acres		500-749 (*c*) acres		750-999 (*d*) acres		1,000 or more (*e*) acres	
Percent of corn farms	72		16		6		3		3	
Percent of planted corn acres	29		24		15		9		23	
Percent of corn production (*bushels*)	25		24		16		10		26	
Planted corn acreage per farm	93	*bcde*	353	*acde*	613	*abde*	888	*abce*	1,548	*abcd*
Corn acreage (*percent*):										
Dryland	91	*cde*	90	*e*	83	*a*	80	*a*	79	*ab*
Irrigated	9	*cde*	10	*e*	17	*a*	*20	*a*	22	*ab*
Grain	96	*bc*	98	*a*	99	*a*	98		98	
Silage	3	*bcd*	*1	*ad*	#1	*a*	0	*ab*	*2	
Yield in bushels per planted acre:										
Actual	127	*bcde*	141	*ace*	158	*ab*	151	*a*	158	*ab*
Expected	144	*bcde*	152	*ace*	166	*ab*	161	*ab*	166	*ab*
Operating and ownership costs per bushel (*dollars*):										
Actual	1.70	*bcde*	1.52	*a*	1.45	*a*	1.52	*a*	1.43	*a*
Expected	1.49	*bcd*	1.41	a	1.38	a	1.42		1.36	
Total costs per bushel (*dollars*)	2.71	*bcde*	2.39	*ace*	2.25	*ab*	2.29	*a*	2.18	*ab*
Costs and returns per planted acre (*dollars*):										
Gross value of production	235.47	*bcde*	259.61	*ace*	289.24	*ab*	276.18	*a*	294.92	*ab*
Operating costs	154.42	*cd*	154.56		166.76	*a*	166.29	*a*	168.35	
Seed	30.79	*bcde*	32.17	*ad*	33.22	*a*	34.70	*ab*	32.95	*a*
Fertilizer	46.82	*c*	46.05	*c*	53.74	*ab*	47.92		46.71	
Soil conditioners	0.23	*bce*	0.11	*ae*	0.09	*ae*	D		0.06	*abc*
Manure	3.79	*cde*	3.79	*cde*	*1.63	*ab*	1.79	*ab*	*1.04	*ab*
Chemicals	24.71	*e*	25.20		26.97		27.96		28.92	a
Custom operations	12.85	*bcd*	10.28	*ad*	10.31	*ad*	6.79	*abc*	*11.27	
Fuel, lube, and electricity	17.55	*de*	18.62	*de*	20.05	*e*	25.35	*ab*	26.11	*abc*
Repairs	13.45		13.57		14.24		14.75		13.65	
Purchased irrigation water	*0.28	*c*	#0.26		#0.06	*a*	D		#0.29	
Interest on operating capital	2.52		2.51		2.69		2.68		2.70	
Hired labor	1.44	*cde*	2.00	*cde*	*3.76	*ab*	*4.25	*ab*	4.64	*ab*
Ownership costs	60.45		60.20		62.25		62.86		57.49	
Capital recovery, machinery, and equipment	53.89		55.04		56.36		57.70		53.10	
Taxes and insurance	6.56	*bde*	5.15	*a*	5.89	*e*	5.16	*a*	4.39	ac
Operating and ownership costs	214.87		214.76		229.01		229.15		225.83	
Economic costs	128.29	*de*	122.64	*d*	125.75	*d*	114.85	*abc*	118.87	*a*
Opportunity cost of land	77.04	*bcde*	85.90	*ae*	94.35	*a*	84.75	*ae*	94.66	*abd*
Opportunity cost of unpaid labor	36.47	*bcde*	26.06	*acde*	20.67	*abe*	19.92	*abe*	14.22	*abcd*
General farm overhead	14.78	*bcde*	10.68	*a*	10.73	*a*	10.18	*a*	9.99	*a*
Total costs	343.16		336.40		354.76		344.00		344.70	
Value of production less operating costs	81.05	*bcde*	105.04	*ac*	122.48	*ab*	109.89	*a*	126.57	*a*
Value of production less operating and ownership costs	20.60	*bcde*	44.84	*a*	60.23	*a*	47.06	*a*	69.08	*a*
Value of production less total costs	-107.69	*bcde*	-77.80	*ae*	-65.53	*a*	-67.82	*a*	-49.79	*ab*

Coefficient of variation (CV) = (standard error/estimate) x 100.
D=Data insufficient for disclosure. * 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*, and *e* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

corn had an average corn yield of 127 bushels per acre, notably lower than that of all other producers. Average yields tended to increase with larger enterprise size, with one exception: the yields of operations with 750-999 acres. Expected yields were higher than actual yields, with the magnitude of expected yields—like that of actual yields—related positively to the size of the corn enterprise. If actual yields had met expectations, the relative ranking of producers by the costs per expected bushel would not be significantly different.

Farms with larger corn acreages tended to have higher yields due partly to their location. They were more likely to be located in the Heartland and Prairie Gateway, where corn yields are higher, than were farms with smaller corn acreages.

Corn enterprise size is related to farm size, structure, farm family characteristics, and operator characteristics. Operators with the smallest corn enterprises (less than 250 acres), planted an average of 93 acres of corn on farm operations averaging 387 acres (table 7 and table 8). In contrast, operators with the largest corn enterprises (1,000 or more acres) planted 1,548 corn acres while farming 3,184 acres overall. Factors related to farm structure, such as machinery size and labor hours expended per acre, are influenced by the size of the corn enterprise and farm. Planters, harvesters, and other machinery used for corn fieldwork tended to be larger on farms with larger corn enterprises. Planters averaged 17 feet wide on the smallest corn enterprises in contrast with 37 feet on the largest enterprises (table 9). Average width for harvesters ranged from 13 to 20 feet. Larger farm machinery allows the grower to cover more corn acreage in a given time, reducing labor cost per acre and allowing producers to cover more acreage during the optimal planting and harvesting days. Planting and harvesting during optimal periods improves yields and reduces costs (Ohio State, 2004; Penn. State, 2004). Similarly, the power takeoff (PTO) horsepower of tractors is positively related to enterprise and farm size. Higher PTO horsepower is required for larger farm machinery. Labor hours per acre averaged 2.3 hours on small corn enterprises, compared with 1.3 hours on the largest enterprises. The proportion of paid labor hours to total labor hours per acre is higher for larger enterprises. Only 11 percent of operators with the smallest corn enterprises used hired labor in their corn operations, compared with 64 percent of operators with the largest enterprises.

Operator characteristics differed somewhat with the size of the corn enterprise. Farms with large corn enterprises are more likely to be organized as partnerships or family corporations than those with smaller corn enterprises. Only 8 percent of farms with less than 250 corn acres were organized into partnerships or family corporations, compared with 55 percent of farms of 1,000 or more corn acres. Operators of small corn enterprises tended to be older, with 21 percent reporting their age as 65 or more, compared with 5 percent of operators of the largest corn enterprises. However, just 4 percent of the operators 65 and older listed their occupation as retired. The share of operators completing college ranged from 13 percent of those with less than 250 corn acres to 27 percent of those operating 1,000 or more corn acres. The age difference between farmers with the smallest and largest corn enterprises may help account for their educational difference, since producers

Table 8—Characteristics of 2001 ARMS corn farms, by corn-planted acreage

Item	Less than 250 (*a*) acres		250-499 (*b*) acres		500-749 (*c*) acres		750-999 (*d*) acres		1,000 or more (*e*) acres	
Production value:										
All commodities (*dollars per farm*)	111,630	*bcde*	303,043	*acde*	405,918	*abe*	442,273	*abe*	1,075,759	*abcd*
Corn (*dollars per farm*)	16,341	*bcde*	81,958	*acde*	158,438	*abe*	187,996		389,743	*abcd*
Percent of total production value	15	*bcde*	27	*acde*	39	*ab*	43	*ab*	36	*a*
Size (*acres per farm*):										
Total operated	387	*bcde*	1,057	*acde*	1,527	*abde*	1,789	*abe*	3,184	*abcd*
Owned and used	206	*bcde*	411	*ade*	433	*ade*	777	*abc*	812	*abc*
Cash-rented	116	*bcde*	408	*acde*	595	*abde*	600	*abe*	1,547	*abcd*
Share-rented	59	*bcde*	237	*acde*	498	*abe*	412	*abe*	812	*abd*
Commodities per farm (*number*)	3.5	*bce*	4.0	*ae*	4.0	*a*	3.8		3.8	*ab*
Percent of corn farms marketing:										
Corn under contract	8	*bcde*	28	*ae*	42	*a*	34	*a*	44	*ab*
Corn only	7	*bcde*	D		D		0	*a*	D	
Cattle	50	*d*	45		36		*34		39	
Hogs	11	*e*	14		*10		*11		7	*a*
Dairy	12	*bcde*	7	*ade*	*5	*ae*	#3	*ab*	*2	*abc*
Soybeans	65	*bcde*	87	*ac*	94	*abe*	90	*a*	86	*ac*
Wheat	18	*be*	30	*a*	26		*28		27	*a*
Hay	23	*bde*	18	*ade*	*18		*10	*ab*	10	*ab*
Cotton	#4		*2		#1		#2		#1	
Operator occupation (*percent*):[1]										
Farming	69	*bcde*	94	*ac*	100	*abde*	96	*ac*	97	*ac*
Nonfarm	28	*bcde*	*4	*ac*	0		D		D	
Retired	*4	*bcde*	#1	*a*	0		D		D	
Percent with off-farm work:										
Operators	47	*bcde*	23	*ae*	*24	*ae*	*13	*a*	*8	*abc*
Spouses	49		48		53		51		55	
Farm organization (*percent*):										
Sole/family proprietor	91	*bcde*	78	*ae*	69	*ae*	62	*a*	43	*abc*
Partnership	5	*bcde*	10	*ae*	*15	*ae*	*11	*ae*	*35	*abcd*
Family corporation	*3	*bcde*	12	*a*	*16	*a*	*27	*a*	*20	*a*
Operator risk comfort level	4.9	*bcde*	5.6	*ade*	5.4	*abe*	6.2	*abc*	6.4	*abc*
Operator age (percent):										
Less than 50	42	*bc*	50	*ac*	63	*ab*	51		51	
50 to 64	37		37		28		37		44	
65 or more	21	*bce*	13	*ae*	*8	*a*	#12		*5	*ab*
Operator education (*percent*):										
High school	51		48		41		45		47	
Some college	23	*c*	24	*c*	39	*abe*	*34		25	*c*
Completed college	13	*e*	18		19		20		27	*a*

See notes at end of table.

Continued—

Table 8—Characteristics of 2001 ARMS corn farms, by corn-planted acreage—Continued

Item	Less than 250 (*a*) acres		250-499 (*b*) acres		500-749 (*c*) acres		750-999 (*d*) acres		1,000 or more (*e*) acres	
Input use strategies (*percent of farms*):										
Forward-purchased inputs	25	*bcde*	52	*a*	57	*a*	62	*a*	64	*a*
Shopped for best price	28	*bce*	50	*a*	60	*a*	*43		51	*a*
Negotiated input prices	28	*bcde*	48	*ac*	65	*ab*	61	*a*	56	*a*
Purchased used machinery	31	*ce*	37	*e*	46	*ae*	35	*e*	68	*abcd*
Leased machinery	4	*bcde*	*9	*ace*	21	*abe*	*12	*ae*	45	*abcd*
Crop insurance (*percent of corn acreage*)	73	*cde*	80	*d*	86	*a*	88	*ab*	92	*ab*
Basic catastrophic	24	*cd*	20	*c*	12	*ab*	*17		19	
Buy-up	16		15		*16		*17		*15	
Federal revenue	20	*bcde*	38	*ace*	51	*ab*	41	*ae*	58	*abd*
Financial characteristics per farm:										
Farm assets (*dollars*)	626,251	*bcde*	1,237,741	*acde*	1,607,79	*abe*	2,098,006	*ab*	2,377,687	*abc*
Farm debt (*dollars*)	61,648	*bcde*	192,001	*acde*	251,349	*abe*	*394,891	*ab*	525,709	*abc*
Farm equity (*dollars*)	564,603	*bcde*	1,045,740	acde	1,356,399	*abe*	1,703,115	*ab*	1,851,979	*abc*
Debt-to-asset ratio (*percent*)	10	*bcde*	16	*ad*	16	*ae*	19	*a*	22	*abc*
Government payments per farm (*dollars*)	12,678	*bcde*	43,180	*acde*	70,602	*abde*	83,936	*abe*	144,526	*abcd*
Farms receiving government payments (*percent*)	81	*bde*	100	*a*	93		99	*a*	100	*a*
Loan deficiency (LDPs)	73	*bcde*	94	*ae*	92	*a*	97	*a*	98	*ab*
For corn	63	*bcde*	82	*ade*	84	*ab*	94	*ab*	93	*ab*
Production flexibility contract/AMTA	71	*bcde*	87	*ade*	84	*ae*	95	*ab*	98	*abc*
For corn	59	*bcde*	89	*ade*	82	*a*	92	*ab*	91	*ab*
Disaster	46	*be*	61	*a*	54		*47		62	*a*
For corn	36	*be*	52	*a*	46	*a*	*41		54	*a*
Income per farm household:										
Total household income (*dollars*)	44,458	*ce*	48,394	*ce*	78,981	*abe*	*82,540		153,230	*abc*
Farm income (*dollars*)	10,383	*bce*	20,946	*ace*	51,166	*abe*	#52,266		*124,070	*abc*
Off-farm income (*dollars*)	34,075		27,449		27,815		30,274		29,661	

Notes: D=Data insufficient for disclosure.
Coefficient of variation (CV) = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, *b*, *c*, *d*, and *e* indicate 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.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Table 9—Production practices on 2001 ARMS corn farms, by corn-planted acreage

Item	Less than 250 (*a*) acres	250-499 (*b*) acres	500-749 (*c*) acres	750-999 (*d*) acres	1,000 or more (*e*) acres
Seed variety (*percent of acreage*):					
Herbicide-resistant	18 *cde*	16 *cde*	*9 *ab*	*6 *ab*	10 *ab*
Bt	18 *de*	23 *d*	22 *d*	36 *abc*	35 *a*
Other varieties	63	61	68 *e*	55	55 *c*
Specialty seed (*percent of acreage*)	*1 *ce*	#3 *e*	*9 *a*	*3 *e*	*14 *abd*
Fuel use:					
Gasoline (*gals/acre*)	1.8	1.7	1.9	1.8	1.6
Diesel (*gals/acre*)	5.7	6.6	5.7	5.2	5.7
LP Gas (*gals/acre*)	4.5	5.5	4.1	6.6	*5.4
Natural gas (f^3/*acre*)	*154 *de*	*140 *de*	#424	*617 *ab*	899 *ab*
Electricity (*kwh/acre*)	33.0 *bd*	18.0 *ace*	51.6 *b*	70.8	*68.6 *b*
Fertilizer/manure use:					
Nitrogen (*percent of farms*)	96 *c*	98 *d*	99 *a*	100 *ab*	94
Phosphorous (*percent of farms*)	85 *e*	80	84	87 *e*	75 *ad*
Potassium (*percent of farms*)	78 *bce*	70 *ae*	66 *a*	66 *ab*	56 *ab*
Nitrogen (*lbs/acre*)	122 *bcd*	133 *ac*	150 *ab*	144 *a*	138
Phosphorous (*lbs/acre*)	47	44 *c*	54 *b*	48	43
Potassium (*lbs/acre*)	59 *c*	58 *c*	73 *abe*	62	52 *c*
Chemical use:					
Herbicides (*percent of acreage*)	96 *cde*	97 *de*	98 *ae*	99 *ab*	100 *abc*
Insecticides (*percent of acreage*)	22 *de*	24 *de*	28	38 *ab*	38 *ab*
Herbicides (*lbs/acre*)	2.0 *e*	2.1	2.2	2.1	2.5 *a*
Insecticides (*lbs/ acre*)	0.1	0.1	0.1	*0.2	0.1
Previous crop (*percent of acreage*):					
Soybean	66 *bc*	76 *ae*	82 *ade*	68 *c*	62 *bc*
Corn	20 *bc*	15 *ae*	13 *ade*	25 *c*	27 *bc*
Idle or Conservation Reserve program	6 *cd*	*5 *c*	*2 *ab*	*3 *a*	#7
Custom operations (*percent of farms*):					
Any custom operation	72 *bc*	81 *a*	82 *a*	77	80
Preparation, cultivation, or planting	8 *bcde*	*1 *a*	*2 *ad*	D *a*	#1 *a*
Fertilizer/chemical	58 *b*	66 *ae*	66	60	54 *b*
Harvest/hauling	21 *bcde*	10 *a*	10 *a*	*7 *a*	*13 *a*
Labor hours per acre	2.3 *bcde*	1.8 *ae*	1.6 *ae*	1.6 ae	1.3 *abcd*
Unpaid	2.2 *bcde*	1.6 *acde*	1.2 *abd*	1.2 *abe*	0.8 *abcd*
Paid	0.1 *bcde*	0.2 *ade*	*0.4 *a*	*0.4 *ab*	*0.4 *ab*
Farms with paid labor (*percent*)	11 *bcde*	31 *acde*	50 *abe*	52 *ab*	64 *abc*
Tillage systems (percent of farms):					
Conventional	45 *bcde*	23 *a*	21 *a*	25 *a*	18 *a*
Reduced	23 *be*	36 *a*	29 *e*	36	42 *ac*
Conservation	33 *bc*	41 *ac*	50 *abd*	39 *c*	39
No-till	16 *bc*	22 *a*	23 *a*	*16	17

See notes at end of table.

Continued—

Table 9—Production practices on 2001 ARMS corn farms, by corn-planted acreage—Continued

Item	Less than 250 (*a*) acres	250-499 (*b*) acres	500-749 (*c*) acres	750-999 (*d*) acres	1,000 or more (*e*) acres
Machinery:					
Planter width (*feet*)	16.9 *bcde*	23.4 *acde*	28.9 *abe*	30.7 *abe*	36.9 *abcd*
Harvester width (*feet*)	12.6 *bcde*	16.3 ade	17.1 *ae*	17.9 *abe*	20.4 *abcd*
Tractor PTO horsepower (*largest used*)	145 *bcde*	203 *acde*	223 *abde*	256 *abce*	291 *abcd*
Speed of tillage/planting operations (*acres/hr*)	6.3 *bcde*	9.8 *acde*	11.2 *abe*	11.8 *abe*	13.8 *abcd*
Speed of harvest operations (*acres/hr*)	4.0 *bcde*	5.6 *ade*	6.4 *ae*	6.6 *abe*	8.5 *abcd*
Total trips across field (*number*)	5.0	5.0	5.0	5.3	5.1
Tillage and planting trips (*number)*	3.1 *bcde*	2.7 *a*	2.6 *a*	2.9 *a*	2.6 *ad*

Notes: D=Data insufficient for disclosure. Coefficient of variation (CV) = (standard error/estimate) x 100.
*indicates that CV is greater than 25 and less than or equal to 50. # indicates that CV is greater than 50.
a, *b*, *c*, *d*, and *e* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

with larger corn enterprises tend to be younger and to have more education than those with smaller enerprises.

Several factors indicate that operators with larger corn enterprises are comfortable taking more risk than those with smaller enterprises. Operators reported their comfort level with risks on a scale from 0 to 10, with 0 indicating they avoid risk as much as possible and 10 indicating the most willingness to take on risks. Operators with the smallest corn enterprises ranked themselves at 4.9, while those with the largest enterprises ranked themselves at 6.4. Another risk measure is the percentage of the corn production value relative to total agriculture production value. Higher values indicate less farm diversification and greater reliance on corn for gross revenues. Hence, operators of these farms face increased financial risk from low corn prices or yields. Corn production value averaged 15 percent of total production value for operators of small corn enterprises, compared with 36 percent for operators of the largest enterprises. The debt-to-asset ratio is a solvency measure, with higher values indicating more financial risk, since lenders are less likely to lend additional funds to those with high ratios. Operators of small corn enterprises had debt-to-asset ratios averaging 10 percent, less than half that (22 percent) for operators of the largest corn enterprises.

Although operators of small corn enterprises indicate they are less comfortable taking risks than operators of the largest enterprises, operators of small enterprises seem less likely to take steps to mitigate risks. Small operators insured 73 percent of their corn acreage, on average, compared with 92 percent for operators of the largest enterprises. In addition, only 20 percent of the corn acreage in small corn enterprises was covered by revenue insurance, compared with 58 percent of acreage in the largest corn enterprises (see glossary, crop insurance). Revenue insurance covers significant revenue losses caused by either low yields or low prices. In contrast, basic catastrophic (CAT) or buy-up insurance reimburses producers only when they suffer low yields. Operators of the larger farm enterprises, with their higher debt-to-asset ratios, may have purchased crop insurance coverage as a condition for receiving a loan—lenders may encourage, or even require,

operators to purchase such coverage before being granted large loans. A lower percentage of those operating small corn enterprises implemented input strategies to reduce financial risk by lowering costs. For example, operators of small corn enterprises were less likely to forward-purchase inputs, to shop for best prices, or to negotiate input prices than operators of the largest corn enterprises (table 8).

Operators with the smallest corn enterprises were less likely to receive government loan deficiency payments (LDPs), production flexibility payments (AMTAs), or agricultural disaster payments than operators of the largest corn enterprises (81 percent vs. 100 percent) (see glossary, government payments). Just over half of the operators with the smallest corn enterprises received LDPs and AMTAs for corn, while 98 percent of the operators with the largest corn enterprises did. The absence of AMTA payments may indicate that smaller producers were planting corn on land without a historic corn base. When LDPs were added to the value of corn production, 64 percent of producers covered their operating and ownership costs, compared with 59 percent of producers who covered their costs based only on their gross value of corn production. Since AMTA payments are based on historical corn-base acreage, they should not be considered as income earned from the production of the annual corn crop.

Farm operators with the smallest corn enterprises were more likely to list off-farm work as their main occupation than operators with 250 or more planted corn acres. Sixty-nine percent of operators with the smallest corn enterprises listed farming as their main occupation, compared with 94 to 100 percent for those with larger corn enterprises. Almost half of the operators with the smallest corn enterprises reported off-farm work, while only 8 percent of the operators running the largest enterprises did. The percentage of farmers' spouses reporting off-farm work did not vary significantly among enterprise sizes nor did the average off-farm income per farm family (see glossary, farm household income).

Operating and Ownership Costs Vary Across Farm Typology

Operators of part-time and low-sales farms have higher corn production costs per bushel due to their lower yields. These farm operators approached risk management for their farm operations differently than operators of very large farms.

Farm typology classifies farms using the annual value of agricultural sales, farmer's occupation, and farm asset values (see glossary, farm typology). Data for farms operated by hired managers or organized as cooperatives or nonfamily corporations are not shown in the farm typology tables due to insufficient sample sizes in the 2001 ARMS. However, percentages across the farm typology classes include data for all farms. Corn farms excluded from the typology tables constitute less than 1 percent of total farms and about 1 percent of the planted corn acreage. Part-time farms include family farms that generate annual gross sales of less than $250,000 and whose operators list their occupation as nonfarm or retired, as well as farms generating less than $100,000 in annual sales and having less than $150,000 in farm assets, regardless of their operator's primary occupation.

Most U.S. corn production is concentrated on large farms with large corn enterprises. Larger family-operated corn farms, those with gross annual sales of $250,000 or more, constituted 24 percent of all U.S. corn farms in 2001 and produced 60 percent of the corn using 57 percent of the planted corn acreage (table 10). The Prairie Gateway and Northern Great Plains have the highest percentages of large and very large family corn farms compared with the other regions (fig. 7). However, the Heartland—which has many more farms than the other regions—contains the highest numbers of large and very large family-operated farms as well as part-time and low-sales farms. Small family corn operations in 2001 made up 76 percent of the U.S. corn farms but produced just 40 percent of the bushels, while planting 43 percent of the corn acreage. In 2001, part-time and low-sales farms averaged about 75 acres of planted corn per farm, in contrast to an average of 724 corn acres for very large family farms. The Southeast and Northern Crescent had higher percentages of part-time and low-sales farms than the other regions (fig. 7).

Operating and ownership costs per bushel for corn production varied across farm typology classes. In 2001, the lowest operating and ownership cost per bushel—$1.45—was obtained by operators of very large farms. Their average yields of 157 bushels per acre were the primary reason for their lower costs per bushel. The highest operating and ownership costs per bushel occurred on part-time and low-sales farms, with costs averaging $1.67 per bushel on part-time operations and $1.76 on low-sales operations. Relatively low yields of 128 bushels per acre for part-time operators and 125 bushels for low-sales operators were the primary reason for their higher costs per bushel, since their average operating and ownership costs per acre were not significantly different from operators in the other farm typology groups. Just as the average operating and ownership costs per acre remained fairly constant across the farm typology groups, the average total costs per acre also did not vary significantly among the groups. Some of the cost saving from economies of scale achieved by the larger farms may have been

Table 10—Corn production costs and returns per acre from 2001 ARMS corn farms, by farm typology

Item	Small family farms						Larger family farms			
	Part-time (*a*)		Low-sales (*b*)		High-sales (*c*)		Large (*d*)		Very large (*e*)	
Percent of corn farms	25		26		25		15		9	
Percent of planted corn acres	8		9		25		28		29	
Percent of corn production (*bushels*)	7		8		24		28		32	
Planted corn acreage per farm	73	*cde*	76	*cde*	225	*abde*	412	*abce*	724	*abcd*
Corn acreage (*percent*):										
Dryland	95	*de*	92	*de*	92	*de*	82	*abc*	82	*abc*
Irrigated	#5d	*e*	*8	*de*	*8	*de*	18	*abc*	18	*abc*
Grain	98		98		97		96		99	
Silage	#1		*1		#2		*2		#1	
Yield in bushels per planted acre:										
Actual	128	*de*	125	*de*	132	*de*	145	*abce*	157	*abcd*
Expected	141	*cde*	139	*cde*	148	*abde*	156	*abce*	167	*abcd*
Operating and ownership cost per bushel (*dollars*):										
Actual	1.67	*e*	1.76	*e*	1.58		1.58		1.45	*ab*
Expected	1.52	*ce*	1.59	*ce*	1.41	*ab*	1.46		1.37	*ab*
Total costs per bushel (*dollars*)	2.72	*cde*	2.77	*de*	2.50	*ae*	2.40	*abe*	2.20	*abcd*
Costs and returns per planted acre (*dollars*):										
Gross value of production	237.02	*de*	231.17	*de*	243.39	*de*	266.66	*abce*	291.24	*abcd*
Operating costs	153.16	*d*	154.86		146.28	*de*	165.86	*ac*	169.58	*c*
Seed	31.36	*e*	29.83	*de*	30.88	*de*	32.64	*bce*	34.04	*abcd*
Fertilizer	49.36		46.50		43.15	*d*	50.62	*c*	49.55	
Soil conditioners	*0.31	*e*	0.37	*cde*	0.18	*be*	*0.14	*b*	0.11	*abc*
Manure	*1.21	*be*	*3.36	*a*	*2.20		*1.96		*3.63	*a*
Chemicals	23.27	*bce*	26.83	*a*	24.79	*e*	28.05	*a*	27.90	*ac*
Custom operations	15.00	cde	12.24		9.00	*a*	8.91	*a*	9.73	*a*
Fuel, lube, and electricity	15.71	*de*	17.48	*de*	18.55	*de*	22.30	*abc*	23.86	*abc*
Repairs	12.79		14.62		13.49		14.43		13.84	
Purchased irrigation water	#0.24		*0.58		#0.14		#0.09		#0.24	
Interest on operating capital	2.50		2.55		2.38	*de*	2.67	*c*	2.74	*c*
Hired labor	*1.41	*de*	*0.51	*cde*	*1.53	*bde*	4.04	*abc*	3.95	*abc*
Ownership costs	60.44		65.91	*c*	61.37		62.55	*c*	58.10	*ad*
Capital recovery, mach. & equipment	53.69		59.06		55.55		56.87		54.03	
Taxes and insurance	6.75	*de*	6.85	*e*	5.82	*e*	5.68	*ae*	4.07	*abcd*
Operating and ownership costs	153.16	*d*	154.86		146.28	*de*	165.86	*ac*	169.58	*c*

See notes at end of table.

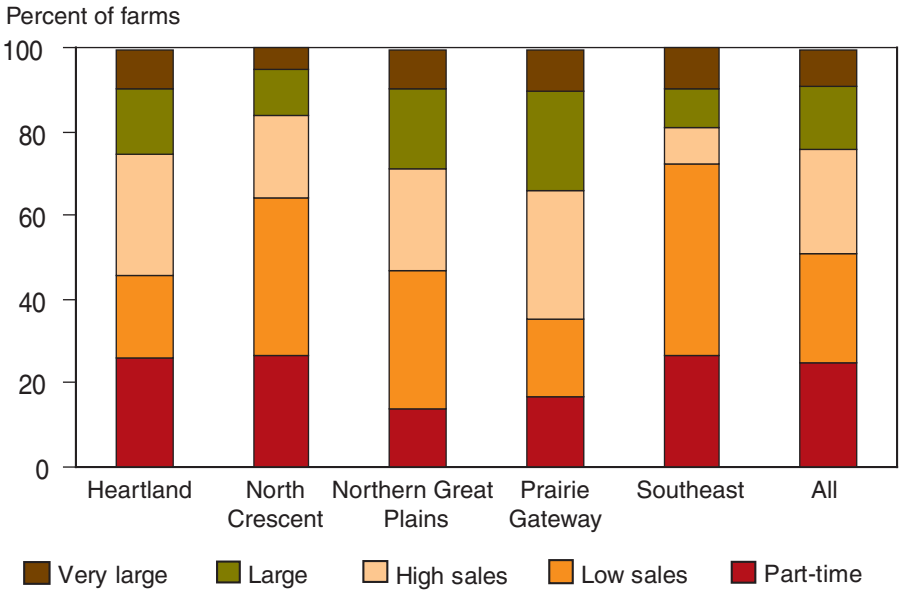
Continued—

Table 10—Corn production costs and returns per acre from 2001 ARMS corn farms, by farm typology—Continued

Item	Small family farms						Larger family farms			
	Part-time (*a*)		Low-sales (*b*)		High-sales (*c*)		Large (*d*)		Very large (*e*)	
Economic costs	135.28	*cde*	126.84		120.97	a	118.15	*a*	117.46	*a*
Opportunity cost of land	81.02	b	65.98	*acde*	78.59	*be*	82.11	*b*	89.71	*bc*
Opportunity cost of unpaid labor	38.78	*cde*	44.66	*cde*	31.21	*abde*	24.31	*abce*	18.40	*abcd*
General farm overhead	15.47	*cde*	16.20	*e*	11.16	*a*	11.73	*ae*	9.35	*abd*
Total costs	348.87		347.62		328.62	*d*	346.56	*c*	345.14	
Value of production less operating costs	87.88	*e*	80.31	*e*	100.10	*e*	102.43	*e*	124.18	*abcd*
Value of production less operating and ownership costs	38.49	*e*	*26.51	*cde*	48.00	*be*	49.71	*be*	71.90	*abcd*
Value of production less total costs	-42.46	*cde*	-44.24	*cde*	-12.81	*abe*	*-7.65	*ab*	#3.45	*abcd*

Coefficient of variation = (standard error/estimate) x 100. * indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50. *a*, *b*, *c*, *d*, and *e* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Figure 7
Distribution of farms by region and farm typology, 2001



Data Source: 2001 Agricultural Resource Management Survey (ARMS).

offset by higher irrigation costs, since larger farm operations were more likely to irrigate their corn acreage. Therefore, the average costs per acre for larger farm operations were not significantly different from those of the smaller farm operations. With the exception of part-time producers, the opportunity cost for land was higher in groups with higher yields, and yields were typically higher as farm size increased. Higher land costs per acre for larger farms were offset somewhat by lower opportunity costs for unpaid labor per acre.

Large family farms use larger and more powerful farm machinery in their corn operations than farms with lower sales. On very large farms, the maximum width of planters used in corn production averaged 28 feet, compared with 16 feet or less for part-time and low-sales farms (table 11). Harvesters for corn production averaged 5 feet wider on very large farms than on part-time and low-sales farms. The power takeoff for tractors used in the corn enterprise averaged 233 horsepower (hp) for very large farms, 130 hp for part-time farms, and 145 hp for low-sales farms. Larger and more powerful farm machinery allows larger farm operations to plant and harvest more corn acreage during the optimal times for these operations, which boosts yields and reduces costs.

On very large farms, 1.4 labor hours were needed to produce an acre of corn in contrast to 2.4 or more hours needed on part-time and low-sales operations. The use of larger machinery on larger operations reduced the labor hours per acre. The greater acreage of the large family farms contributed to their lower labor hours per acre, since the fixed hours expended for repair and management activities can be spread over more acres. Large family farms were more likely to hire labor; over 36 percent of them had some paid labor expenditures, compared with 18 percent or less of small family farms.

Part-time and low-sales farms were less diversified, in terms of the commodities they grew, than very large farms. Diversification is a risk-reduction strategy, since net returns from various agricultural enterprises often do not move in tandem (Harwood et al., 1999). Part-time farms averaged 3.2 commodities per farm and low-sales farms averaged 3.5 or less, while very large farms averaged 4.0 commodities in 2001 (table 12). Another measure of diversification is the percentage of the farm's total agricultural production value derived from corn. Higher values indicate that farms are less diversified and more at risk if returns from corn production are low. Part-time farms derived 38 percent of their total farm production from corn, compared with 19 percent for very large farms.

Smaller farms were less likely to have revenue or crop insurance on their corn acreage than very large farms. Revenue insurance offers operators more protection than basic catastrophic or buy-up insurance because revenue insurance covers losses occurring from both low crop yields and low prices, while basic catastrophic or buy-up insurance cover losses stemming from low yields only. Operators of part-time farms insured 70 percent of their corn acreage, compared with 85 percent for very large farms. Revenue insurance covered 18 percent of the corn acreage on part-time farms vs. 49 percent on very large farms. Farm lenders may require farm operations with large loans to carry crop insurance to help protect the lenders from losses. Very large farms had debt-to-asset ratios averaging 22 percent and an average debt of $451,504 per farm, compared with debt-to-asset ratios of 8 percent and $30,620 of debt per farm for part-time farm operations.

Operators of larger family farms were more likely to use strategies to reduce their input costs than operators of smaller farms. On average, 46 percent or more of the operators with very large farms forward-purchased inputs, comparison-shopped for the best price, negotiated prices, or purchased used

Table 11—Production practices on 2001 ARMS corn farms, by farm typology

Item	Small family farms			Larger family farms	
	Part-time (*a*)	Low-sales (*b*)	High-sales (*c*)	Large (*d*)	Very large (*e*)
Seed variety (*percent of acreage*):					
Herbicide-resistant	12	*11	16	12	13
Bt	18 *e*	*23	17 *e*	21	32 *ac*
Other varieties	70 *e*	66	67 *e*	66 *e*	55 *ac*
Specialty seed (*percent of acreage*)	*2	*2	#2	*5	*6
Fuel usage:					
Gasoline (*gals/acre*)	2.0 *e*	2.1 *e*	1.8	1.8	1.7 *ab*
Diesel (*gals/acre*)	4.7 *de*	5.2	6.3	6.9 *a*	6.1 *a*
LP gas (*gals/acre*)	4.5	*5.1	5.3	4.9	5.0
Natural gas (f^3/*acre*)	#69 *e*	#95 *e*	*165 *e*	#365	*634 *abc*
Electricity (*kwh/acre*)	#30.7	*35.7	*24.8 *e*	*57.1	64.9 *bc*
Fertilizer/manure use:					
Nitrogen (*percent of farms*)	97 *d*	97 *d*	95	99 *ab*	96
Phosphorous (*percent of farms*)	81 *bd*	87 *a*	84	91 *a*	86
Potassium (*percent of farms*)	79 *d*	81 *d*	76	69 *ab*	76
Nitrogen (*lbs/acre*)	120 *de*	125 *e*	125 *e*	138 *a*	146 *abc*
Phosphorous (*lbs/acre*)	46	53 *c*	41 *bde*	54 *c*	50 *c*
Potassium (*lbs/acre*)	55	52	56	57	60
Chemical use:					
Herbicides (*percent of acreage*)	96 *e*	98 *d*	96 *de*	99 *abc*	98 *c*
Insecticides (*percent of acreage*)	14 *cde*	16 *de*	23 *a*	34 *ab*	36 *abc*
Herbicides (*lbs/acre*)	2.0	1.9 *e*	2.1	2.1	2.4 *b*
Insecticides *(lbs/acre*)	*0.1	*0.1	*0.2	0.1	0.2
Previous crop (*percent of acreage*):					
Soybean	78 *bd*	65 *a*	73	67 *a*	72
Corn	16	25	*15	23	20
Idle or Conservation Reserve	*2 *bcd*	*5 *a*	5 *a*	*4 *a*	*3
Custom operations (*percent of farms*):					
Any custom operation	69 *de*	66 *de*	74	80 *ab*	80 *a*
Preparation, cultivation, or planting	12 *cde*	*7 *de*	*4 *ad*	*2 *abc*	*2 *ab*
Fertilizer/chemical	59	53 *d*	60	64 *b*	58
Harvest/hauling	24 *cde*	21 *cd*	11 *ab*	8 *ab*	*14 *a*
Labor hours per acre	2.4 *cde*	2.7 *cde*	2.0 *abe*	1.8 *abe*	1.4 *abcd*
Unpaid	2.3 *de*	2.7 *cde*	1.9 *bde*	1.4 *abce*	1.1 *abcd*
Paid	*.2 *de*	*.1 *de*	*.1 *de*	.4 *abc*	.4 *abc*
Farms with paid labor (*percent*)	*11 *cde*	*7 *cde*	18 *abde*	45 *abce*	36 *abcd*
Tillage systems (*percent of farms*):					
Conventional	43 *cde*	56 *cde*	32 *ab*	26 *ab*	25 *ab*
Reduced	20 *cde*	20 *ce*	29 *ab*	28 *a*	38 *ab*
Conservation	36 *bd*	24 *acde*	39 *b*	47 *ab*	37 *b*
No-till	17 *d*	*12 *d*	18 *d*	25 *abc*	*19

See notes at end of table.

Continued—

Table 11—Production practices on 2001 ARMS corn farms, by farm typology—Continued

Item	Small family farms			Larger family farms	
	Part-time (*a*)	Low-sales (*b*)	High-sales (*c*)	Large (*d*)	Very large (*e*)
Machinery:					
Planter width (*feet*)	15.4 *cde*	15.7 *cde*	19.9 *abde*	23.4 *abce*	27.8 *abcd*
Harvester width (*feet*)	11.6 *cde*	12.2 *cde*	14.8 *abe*	16.0 *ab*	17.1 *abc*
Tractor PTO horsepower (*largest used*)	130 *cde*	145 *de*	167 *ade*	197 *abce*	233 *abcd*
Speed of tillage/planting operations (*acres/hr*)	6.0 *cbe*	5.7 *cde*	8.7 *abde*	10.5 *abce*	11.7 *abcd*
Speed of harvest operations (*acres/hr*)	3.4 *cde*	3.6 *cde*	5.1 *abde*	6.0 *abce*	7.6 *abcd*
Total trips across field (*number*)	4.8 *b*	5.4 *ac*	4.9 *b*	5.1	5.2
Tillage and planting trips (*number*)	3.1 *b*	3.5 *acde*	2.8 *b*	2.8 *b*	2.9 *b*

Notes: Coefficient of variation = (standard error/estimate) x 100. * indicates that CV is greater than 25 and less than or equal to 50. # indicates that CV is greater than 50. *a*, *b*, *c*, *d*, and *e* indicate that estimates are significantly different from the indicated group at the 90-percent-or-better level using the *t*-statistic.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

machinery to save on costs. In contrast, less than 31 percent of part-time operators did so. Comparison shopping, negotiating prices, and evaluating used machinery are time-consuming, and producers not working other jobs may have more time for these activities. If producers are successful in reducing the cost per unit of their inputs, their production costs will be lower and their net revenues higher. However, lowering the cost per input unit does not ensure that a producer's costs will be lower than those of other producers. For example, prices for fuel and energy were higher in the Northern Crescent than the Heartland; a Northern Crescent producer who negotiated a lower fuel cost per gallon likely would have still paid a higher price per gallon than a Heartland producer. Also, producers on larger family farms were much more likely to irrigate their corn acreage. Since irrigation usually requires more energy use per acre than dryland production, the energy costs for irrigation will likely be higher even if the producer negotiates a lower fuel price.

Operators of smaller farms were less likely to participate in government programs that provide producers with LDPs, AMTAs, or disaster payments (see glossary, government payments). Over 91 percent of the operators with larger farms received some LDPs in 2001, compared with less than 73 percent of the operators of part-time and low-sales farms. The addition of LDPs to the gross value of corn production allowed 64 percent of the corn producers to cover their operating and ownership costs. In contrast, 59 percent of producers were able to cover their operating and ownership costs from the gross value of their corn production. The percentage of producers receiving AMTAs was similar to the percentage receiving LDPs. Less than half the operators of part-time and low-sales farms received production flexibility contract payments for corn, compared with 71 percent of operators with larger farms.

Table 12—Characteristics of 2001 ARMS corn farms and corn producers, by farm typology

Item	Small family farms						Larger family farms			
	Part-time (*a*)		Low-sales (*b*)		High-sales (*c*)		Large (*d*)		Very large (*e*)	
Machinery:										
Production value:										
All commodities (*dollars per farm*)	39,364	*cde*	47,621	*cde*	152,597	*abde*	318,431	*abce*	931,681	*abcd*
Corn (*dollars per farm*)	14,911	*cde*	12,713	*cde*	46,503	*abde*	96,180	*abce*	177,472	*abcd*
Percent of total production value	38	*bcde*	27	*a*	30	*e*	30	*ae*	19	*acd*
Size:										
Operated acreage per farm	236	*bcde*	290	*acde*	717	*abde*	1,202	*abce*	1,908	*abcd*
Owned and used	108	*bcde*	183	*acde*	299	*abde*	504	*abc*	630	*abc*
Cash-rented	80	*cde*	75	*cde*	232	*abde*	418	*abce*	877	*abcd*
Share-rented	45	*bcde*	25	*acde*	184	*abde*	275	*abce*	396	*abcd*
Commodities per farm (*number*)	3.2	*cde*	3.5	*cde*	4.0	*ab*	4.0	*ab*	4.0	*ab*
Percentage of corn farms marketing:										
Corn under contract	*8	*cde*	*7	cde	16	*abd*	29	*abc*	24	*ab*
Corn only	*8	*de*	9	*de*	#4		#3	*ab*	0	*ab*
Cattle	37	*bcde*	51	*a*	52	*a*	51	*a*	50	*a*
Hogs	*5	*cde*	*7	*cde*	16	*ab*	16	*ab*	25	*ab*
Dairy	#3	*bcde*	*8	*acd*	*17	*abe*	20	*abe*	*8	*acd*
Soybeans	64	*cde*	65	*cde*	77	*ab*	82	*ab*	78	*ab*
Wheat	14	*cde*	15	*cde*	27	*ab*	30	*ab*	28	*ab*
Hay	26	*de*	23	*e*	23	*de*	14	*ac*	12	*abc*
Cotton	*1	*de*	#8		1	*e*	*2	*ae*	4	*acd*
Operator occupation (*percent*):[1]										
Farming	*7	*bcde*	100	*ade*	100	*ade*	97	*abc*	98	*abc*
Nonfarm	82	*bcde*	0	*ad*	0	*ad*	#3	*abc*	#2	*a*
Retired	11	*bcde*	0	*a*	0	*a*	0	*a*	0	*a*
Percent with nonfarm work:										
Operators	84	*bcde*	40	*acde*	21	*abe*	20	ab	*12	*abc*
Spouses	56	*c*	45		44	*ad*	53	c	51	
Farm organization (*percent*):										
Solefamily proprietor	94	*cde*	95	*cde*	86	*abde*	76	*abce*	61	*abcd*
Partnership	*5	*de*	*4	*de*	*7	*e*	*11	*ab*	*21	*abc*
Family corporation	#1	*cd*	#1	*cd*	7	*abde*	13	*abc*	18	*abc*
Operator risk-comfort level	4.8	*cde*	4.7	*cde*	5.5	*abd*	5.5	*abce*	6.1	*abcd*
Operator age (*percent*):										
Less than 50	44	*e*	34	*cde*	50	*b*	53	*b*	56	*ab*
50 to 64	43		32		35		39		35	
65 or more	13	*b*	34	*acde*	16	*bd*	*8	*bc*	*10	*b*
Operator education (*percent*):										
High school	47		51		51		53		43	
Some college	22		*25		23		28		29	
Completed college	18	*b*	*8	*ade*	14		17	*b*	23	*b*

See notes at end of table.

Continued—

Table 12—Characteristics of 2001 ARMS corn farms and corn producers, by farm typology—Continued

Item	Small family farms						Larger family farms			
	Part-time (*a*)		Low-sales (*b*)		High-sales (*c*)		Large (*d*)		Very large (*e*)	
Input use strategies (*percent of farms*):										
Forward-purchased inputs	24	*cde*	20	*cde*	35	*abde*	55	*abc*	54	*abc*
Shopped for best prices	22	*cde*	32	*de*	35	*ade*	49	*abc*	51	*abc*
Negotiated input prices	28	*de*	26	*de*	35	*de*	50	*abc*	52	*abc*
Purchased used machinery	31	*e*	34		32	*e*	38		46	*ac*
Leased machinery	*5	*de*	*3	*cde*	6	*bde*	13	*abc*	*19	*abc*
Corn crop insurance (*percent of acreage*)	70	*cde*	75		79	*a*	83	*a*	85	*a*
Basic catastrophic	22		20		22		*18		16	
Buy-up	16		13		14		*17		18	
Federal Revenue	*18	*cde*	*32		39	*a*	37	*a*	49	*a*
Financial characteristics per farm:										
Farm assets (*dollars*)	393,776	*bcd*	576,291	*acde*	872,549	*abde*	1,395,217	*abce*	2,094,257	*abcd*
Farm debt (*dollars*)	30,620	*bcd*	40,426	*acde*	92,170	*abde*	230,272	*abce*	451,504	*abcd*
Equity (*dollars*)	363,156	*bcde*	535,866	*acde*	780,380	*abde*	1,164,944	*abce*	1,642,753	*abcd*
Debt-to-asset ratio (*percent*)	8	*cde*	7	*cde*	11	*abde*	17	*abce*	22	*abcd*
Government payments per farm (*dollars*)	8,189	*cde*	8,546	*cde*	25,552	*abde*	50,771	*abce*	86,136	*abcd*
Farms receiving government payments (*percent*)	79	*cde*	85	*de*	91	*a*	96	*ab*	95	*ab*
Loan deficiency (LDPs)	66	*cde*	73	*cde*	84	*ab*	93	*ab*	91	*ab*
For corn	50	*cde*	52	*cde*	71	*ab*	77	*ab*	74	*ab*
Production flexibility contract AMTA	66	*cde*	70	*de*	79	*a*	87	*ab*	88	*ab*
For corn	45	*cde*	46	*cde*	62	*ab*	71	*ab*	71	*ab*
Disaster	40	*cd*	46	*cd*	57	*ab*	58	*ab*	52	
For corn	28	*cd*	23	*cde*	38	*ab*	44	*ab*	38	*b*
Income per farm household:										
Total household income (*dollars*)	48,405	*bcde*	30,591	*ade*	37,458	*ade*	66,551	*abce*	129,887	*abcd*
Farm income (*dollars*)	*-3,880	*bcde*	#1,793	*acde*	16,783	*abde*	41,237	*abce*	97,050	*abcd*
Off-farm income (*dollars*)	52,285	*bcde*	28,797	*ac*	20,675	*abe*	25,313	*a*	32,837	*ac*

Notes: Coefficient of variation = (standard error/estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, *b*, *c*, *d,* and *e* indicate 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.
Data source: 2001 Agricultural Resource Management Survey, ERS, USDA.

Glossary

Agricultural Resource Management Survey (ARMS) corn version for 2001 is the source of data compiled for this report. The National Agricultural Statistics Service (NASS) and the Economic Research Service (ERS) collect production and cost data in the ARMS survey for each cost of production commodity on a rotating basis every 3 to 8 years. The survey data are weighted to represent all U.S. corn acreage. The target population for the 2001 ARMS corn survey was producers who planted corn for any purpose. Survey data were obtained from 2,930 corn producers in 19 States: Colorado, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, New York, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Texas, and Wisconsin. Since the purpose of the cost-of-production accounts is to measure the cost of grain production, this report includes data only on producers planting corn with the intention to harvest grain. Data on corn producers who raised corn for seed, silage, or other nongrain purposes were excluded from this analysis. The corn cost and return estimates, agricultural production practices, and producer and farm characteristics in this report are derived from the responses of 2,454 corn producers. The cost per bushel is computed by dividing production costs by the bushels of corn produced.

Corn farms are farms that planted at least 1 acre of corn in 2001 with the intent of harvesting the corn for grain.

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

Cost categories:

- Low-cost producers are the 25 percent of U.S. corn producers with the lowest operating and ownership costs. These corn producers had operating and ownership costs of $1.31 per bushel or less for corn.
- High-cost producers are the 25 percent of U.S. corn producers with the highest operating and ownership costs. These corn producers had operating costs of $2.26 or more per bushel.

Crop insurance for corn is a tool for managing the risk involved in producing corn. Crop insurance offers varying degrees of coverage on crop yields or revenue, for example:

- **Catastrophic (CAT)** insurance provided protection against losses in excess of 50 percent of a producer's proven yield in 2001 at 55 percent of the expected price. The producer paid $100 per crop per county for this coverage.
- **Buy-up** insurance provides better loss coverage than the basic catastrophic policy. Producers chose their desired coverage level, up to 85 percent of yield and up to 100 percent of price in 2001. Producers paid part of the premium, with the Federal Crop Insurance Corporation, part of the U.S. Government, paying the balance.

- **Federal Revenue** insures that producers will receive a specific revenue level regardless of their production quantity or price received for their commodity.

Crop rotation refers to the crops planted in the spring/summer of 2000 prior to the corn crop in 2001, 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 fix nitrogen into the soil. Therefore, producers usually supply nitrogen to their grass crops.
- **Idled land** is land that was fallowed in the prior crop-growing season—including land that was enrolled in the Conservation Reserve Program—before being planted to corn for the 2001 season.

Debt-to-asset ratio measures farm assets financed by lenders. A higher proportion of debt relative to assets indicates more financial risk. The ratio is the value of the operator's farm debt divided by the value of farm assets, expressed either as a percentage or fraction.

Expected yield is the yield that producers expected to receive on their corn acreage. Producers report their expected yield on the ARMS survey.

Farm enterprise size measures of the size of the corn operation on the farm. The unit of measure is the number of total corn acres planted. Five sizes for the corn enterprise are used in this report: less than 250 acres, 250 to 499 acres, 500 to 749 acres, 750 to 999 acres, and 1,000 or more acres.

Farm household income averaged $64,117 for all U.S farms and $50,968 for U.S. farm households that raised corn in 2001. The U.S. average household income totaled $58,208 in 2001. Farm household income is computed from ARMS data and is the sum of farm and off-farm income of farm households. The farm income of farm households excludes the farm income earned by landlords and contractors. It also excludes farm income generated by farms organized as nonfamily corporations or cooperatives or operated by hired managers. For farms with multiple operators or partners, the farm income, off-farm income, and household income figures used in this report are for the household of the principal farm operator. Farm income of farm households is defined as the net cash farm business income plus net income from farmland rental, and earnings of the operator household from farming activities, minus the sum of depreciation, gross farmland rental income, and farm business income received by other households (McElroy et al., 2002). Off-farm income consists of wages, salaries, net income from nonfarm businesses, interest, dividends, transfer payments, Social Security retirement, pensions, other retirement plans, gifts, net cash income from another farm operation, net income from farmland rental, and other off-farm sources. Average U.S. household income came from the Current Population Survey (Bureau of the Census, U.S. Department of Commerce, 2001).

Farm production regions are based on ERS farm resource regions (fig. 2). These consist of county groupings with similar soils and climates that favor production of selected crops and livestock and lead to the use of similar production practices within a region. The Southeast region was created by combining farms in the Eastern Uplands, Southern Seaboard, and Fruitful Rim due to limited samples in each of these regions. All observations from the Fruitful Rim were included in the Southeast, since the corn survey contained observations from only two States (Georgia and Texas) in the southeastern portion of the Fruitful Rim. Six corn producers who responded to the ARMS were located in the Basin and Range region of Colorado. These observations were reclassified and placed in Prairie Gateway region due to their proximity to this region. No corn farms were sampled in the Mississippi Portal.

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, as follows:

- **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 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, regardless of their primary occupation.
  - — **Low-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 family farms with annual gross sales of $100,000 or more, but less than $250,000, whose operators report farming as their major occupation.
- **Large 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 operated by hired managers. The data from these farms are excluded from the typology discussion and tables 10, 11, and 12, but are included in all other tables and discussions.

Government payments reported in the tables in this report are for the entire farm operation and for the corn crop. Loan deficiency payments (LDPs) are the payments made to producers who are eligible for—but have agreed to forgo—Commodity Credit Corporation (CCC) loans. Producers

receive loan deficiency payments when the county loan rates are greater than the posted county price.

The FAIR Act of 1996 (also known as the Agricultural Market Transition Act, or AMTA) included provisions for production flexibility contracts or AMTA payments (AMTAs). Under this act, a producer who had participated in the wheat, feed grain, cotton, and rice programs in any one of the 5 years prior to 1996 could receive a 7-year production flexibility contract for 1996-2002. In this act, the AMTA payments are fixed for each fiscal year. The act allowed farmers to plant 100 percent of their total contract acreage to any crop except fruits and vegetables and receive an AMTA payment.

Number of field operations is defined as the total number of acres covered during the field operation divided by the number of acres in the field. Tandem operations covering the entire field count as one field operation, since our purpose is to count the trips per hour across the field for figuring fuel and labor costs. Partial field operations are included. For instance, if a producer plants all the acres in a field and then replants half the field, the number of planting trips across the field would be 1.5. The number of field operations excludes custom field operations.

Operating and ownership costs include the costs for all participants in the corn production enterprise, including the operators, landlords, and contractors. Operating costs are those that vary with the amount of corn acreage planted, including 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, including 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. Capital recovery costs per acre are determined by calculating costs per hour (including an opportunity cost of money invested in the machinery) x hours of use per acre.

The operating and ownership 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. If no bushels were produced, the cost per bushel was set to the cost per acre. No attempt was made to reduce costs for producers who ultimately produced silage rather than corn.

Operator risk-comfort is a measure of the risk the operators are willing to accept on their farm operations. The respondent is asked to rank his/her comfort level with risks from 0 to 10, with 0 representing the desire to avoid risks as much as possible and 10 representing the most willingness to take risks.

Seed variety

- **Other** includes any corn seed that is a stacked gene variety (genetically modified for both insect and herbicide resistance), or is a variety that is both non-Bt and non-herbicide resistant. Stacked gene variety was planted on very few corn acres, usually less than 5 percent of the acres in any individual category within a group.
- **Specialty seed** is a special variety of corn seed, such as waxy, high-amylase, high-oil, high-lysine, low-phytate, white dent, or other specialized variety.

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

- **Conventional tillage** leaves less than 15 percent of the previous crop residue covering the soil.
- **Reduced tillage** leaves between 15 and 30 percent of the previous crop residue covering the soil.
- **Conservation tillage** leaves 30 percent or more of the previous crop residue covering the soil.
  - — **No-till** means that no tillage operations occur prior to planting. No-till is a subcategory of conservation tillage.

Total costs include the operating and ownership costs plus the economic costs of production. The economic costs are the sum of three items: the opportunity costs of land, the opportunity costs of unpaid labor, and the general farm overhead. Land is valued according to the average cash rental rate for land producing the commodity in the particular area. Unpaid labor hours are valued using an estimate of the wages earned off-farm by farm operators. General farm overhead costs include costs for farm supplies, marketing containers, hand tools, power equipment, maintenance and repair of farm buildings, farm utilities, and general business expenses. The total costs represent the full costs to producers for farming.

Value of production for corn is computed using a weighted average of the corn prices during the harvest months, with each harvest month price weighted by the quantity of corn sold during that month.

References

Baker, Allen, Edward Allen, and William Chambers. *Feed Situation and Outlook Yearbook*, FDS-2003, U.S. Dept. of Agriculture, Economic Research Service, April 2003.

Baker, Allen, Edward Allen, and William Chambers. *Feed Situation and Outlook Yearbook*, FDS-2002, U.S. Dept. of Agriculture, Economic Research Service, April 2002.

Bureau of the Census, U.S. Department of Commerce and Bureau of Labor Statistics, U.S. Department of Labor. *Current Population Survey*, 2001.

Foreman, Linda. *Characteristics and Production Costs of U.S. Corn Farms*, SB-974-1, U.S. Dept. of Agriculture, Economic Research Service, August 2001
http://www.ers.usda.gov/catalog/OneProductAtATime.asp?ARC=c&PDT=2 & PID=1234

Harwood, Joy, Richard Heifner, Keith Coble, et al. *Managing Risk in Farming: Concepts, Research, and Analysis.* U.S. Dept. of Agriculture, Economic Research Service, Agricultural Economic Report No. 774, March 1999.

Kirkpatrick, T. L., and Robert T. Robbins. *Nematodes of Cotton in Arkansas.* Coop Extension Service, University of Arkansas, FSA7523-2M-4-98RV, http://www.uaex.edu/Other_Areas/publications/HTML/FSA-7523.asp

Martin, Steven W., Fred Cooke, Jr., and David Parvin. *Economic Potential of a Cotton-Corn Rotation*. Mississippi Agricultural & Forestry Experiment Station, Bulletin 1124, September 2002.

McElroy, Robert, Roger Strickland, Jim Ryan, et al. *Agricultural Income and Finance Outlook*, AIS-79, U.S. Dept. of Agriculture, Economic Research Service, September 26, 2002.

Ohio State University, College of Food, Agricultural, and Environmental Sciences. *Ohio Agronomy Guide*, Bulletin 472, Accessed December 30, 2004, http://ohioline.osu.edu/b472/corn.html

Peel, Michael D. *Crop Rotations for Increased Productivity*. North Dakota State University Extension Service, NDSU, EB-48 January 1998, Accessed January 10, 2005, http://www.ext.nodak.edu/extpubs/plantsci/crops/eb48-1.htm

Penn State College of Agricultural Sciences Cooperative Extension. *The Agronomy Guide 2004*, Part 1, Section 4 Corn. Accessed September 29, 2004, http://agguide.agronomy.psu.edu/

Stuart, Dann. *USDA Announces 2001 County Loan Rates for Wheat, Feed Grains, and Oilseeds*. U.S. Dept. of Agriculture, Office of Communications, Release No. 0087.01, May 31, 2001.

University of Illinois Extension. *The Economics of Adding More Corn to Corn-Soybean Rotations*, Farm Economics Facts and Opinions, FEFO 04-20, November 30, 2004, http://www.farmdoc.uiuc.edu/manage/newsletters/fefo04_20/fefo04_20.html

U.S. Dept. of Agriculture, Economic Research Service. Agricultural Biotechnology Briefing Room: Accessed September 29, 2004, http://www.ers.usda.gov/Briefing/Biotechnology/index.htm

U.S. Dept. of Agriculture, Economic Research Service. Corn Briefing Room: Accessed September 29, 2004, http://www.ers.usda.gov/Briefing/Corn/

U.S. Dept. of Agriculture, Economic Research Service. Wheat Briefing Room: Accessed January 10, 2005, http://www.ers.usda.gov/briefing/wheat/background.htm

U.S. Dept. of Agriculture, Economic Research Service and National Agricultural Statistics Service (NASS). *Agricultural Resource Management Survey (ARMS)*, 2001, version 1.

U.S. Dept. of Agriculture, National Agricultural Statistics Service (NASS). Quick Stats, http://www.nass.usda.gov/QuickStats/

U.S. Dept. of Agriculture, National Agricultural Statistics Service (NASS). *2002 Census of Agriculture*, United States Summary and State Data, Vol. 1, Geographic Area Series, Part 51, AC-02-A-51, June 2004.

U.S. Environmental Protection Agency (EPA). *Achieving Clean Air and Clean Water*: *The Report of the Blue Ribbon Panel on Oxygenates in Gasoline*, EPA420-R-99-021, September 15, 1999.