United States Department of Agriculture

Statistical Bulletin Number 974-4

March 2002

Electronic Report from the Economic Research Service

www.ers.usda.gov

Characteristics and Production Costs of U.S. Soybean Farms

Linda Foreman and Janet Livezey[1]

In this report…Average soybean production costs ranged from $2.13 per bushel for producers in the lowest cost quartile to $6.00 per bushel for those in the highest cost quartile. Heartland, West, and Northern Crescent producers had lower soybean production costs per bushel than Mississippi Portal and Southeast producers. Producers in higher sales classes and producers with 250 to 750 acres of soybeans had lower production costs than other soybean producers. Off-farm income was an important source of household income for many soybean producers.

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

[1]Agricultural Economists, Resource Economics Division, Economic Research Service, USDA

Overview

In 1997, soybeans were the second leading U.S. crop in terms of harvested acreage (69 million acres) and production value ($17.4 billion). U.S. farmers planted 70 million acres of soybeans that year, about 6 million more acres than in 1996 (U.S. Dept. of Agriculture, National Agricultural Statistics Service website).

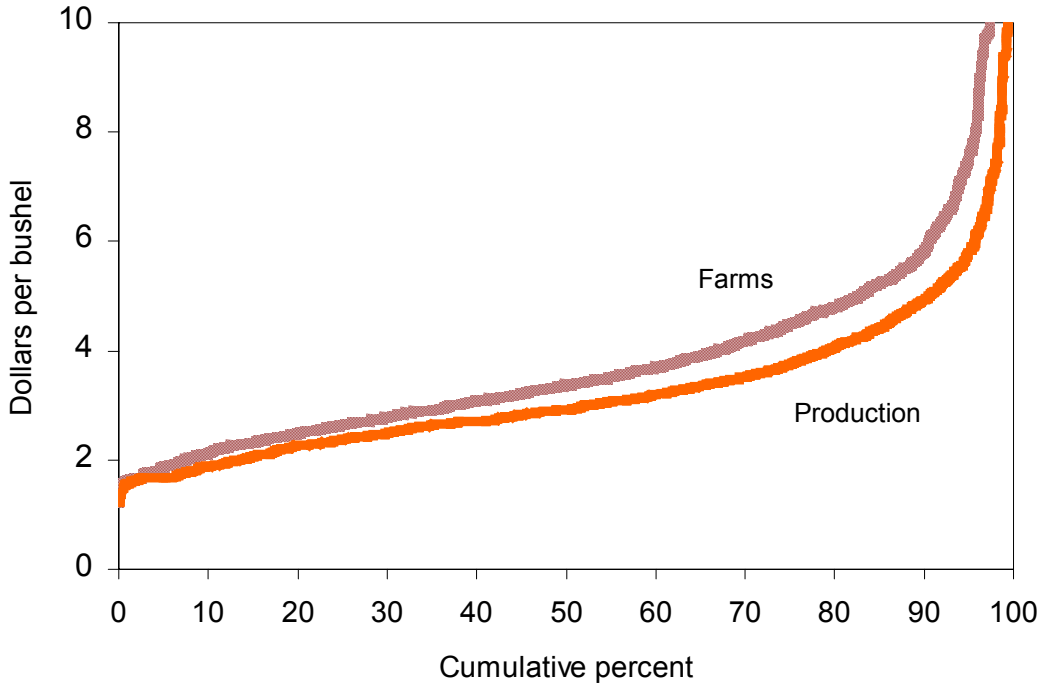
Several factors led to this surge in soybean acreage, including strong soybean prices, the absence of acreage set-aside programs, increased crop rotations with soybeans, and optimum soybean planting conditions. In addition, nearly all supply controls on U.S. field crop production (which were tied to deficiency payments) were eliminated by the 1996 Federal Agriculture Improvement and Reform Act (FAIR). As a result, farmers could increase soybean plantings when market conditions were favorable, since they no longer risked losing future government payments on program crops (such as corn and wheat). Soybean acreage also increased sharply between 1996 and 2001 due partly to low production costs per bushel (see glossary). Widespread adoption of herbicide-tolerant varieties and low-till production practices helped keep soybean production costs low. Even falling market prices did not halt the rise in soybean acreage, since farmers were insulated from declining market prices by loan deficiency payments (Ash, 2001).

In 1997, the production costs for soybeans ranged from an average of $2.13 per planted bushel for the 25 percent of the growers with the lowest costs to an average of $6.00 per planted bushel for the 25 percent of the growers with the highest costs. Favorable weather conditions resulted in a near-record average yield of 39 bushels per acre, reducing the production costs per bushel. U.S. soybean farmers produced 97 percent of the Nation's soybeans for less than the 1997 season-average price of $6.47 per bushel (fig.1). Soybean production costs per acre totaled $137.77 in 1997. The gross production value of soybeans was $278.77 per acre.

This report presents the costs of producing U.S. soybeans and examines how these costs vary among different segments of the farm population. Soybean producers, agricultural producers with at least 1 acre of planted soybeans, are ranked by their production costs per bushel to analyze factors associated with low and high production costs. In addition, producers in different regions are compared to gain insights into regional variations in production costs. Farm typology is used to examine the relationship between farm sizes and soybean production costs. Characteristics and soybean production costs are compared among farms with varying amounts of soybean acreage. Data in this report are derived from a special soybean cost-of-production survey undertaken as part of the 1997 Agricultural Resource Management Survey (ARMS) (see glossary). This was the latest survey to collect data on farmers' costs for soybean production. In the analysis for this report, ERS follows the computational standards recommended by the American Agricultural Economic Association (AAEA) Task Force on Commodity Costs and Returns (AAEA, 1998).

Production costs are the sum of the operating and ownership costs for consumable inputs provided by operators, landlords, and contractors (see glossary). Production costs exclude marketing and storage costs. Operating costs are the sum of costs that vary directly with the amount of soybeans produced. Ownership costs are costs related to capital items consumed during the annual production process, such as farm machinery and equipment. Production costs are used for this report since farmers must be able to meet their short-term operating costs and, in the longer run, replace assets consumed during the production process. Since ownership costs are fixed in the short term, most producers can remain in business for several years as long as they can meet their short-term obligations. In the long-term, producers maintaining successful farming operations must be able to pay their

Figure 1
Cumulative distribution of soybean farms by production costs per bushel, 1997



Source: 1997 Agricultural Resource Management Survey.

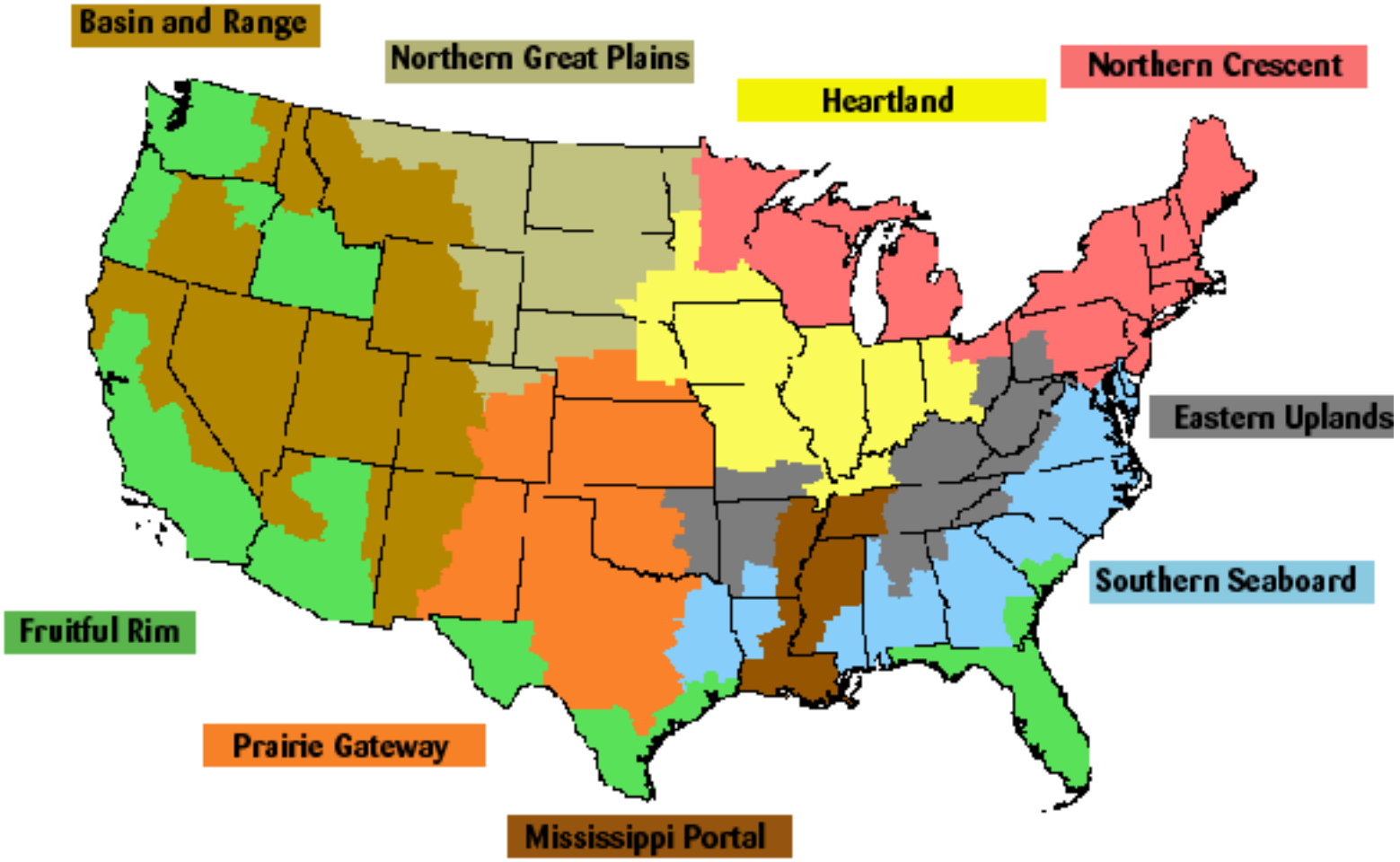
operating costs and replace capital assets consumed during the production process.

This report found that low-cost producers had an average production cost of $2.13 per bushel compared with $6.00 per bushel for high-cost producers in 1997. A substantial yield difference of 20 bushels per acre and $77 in soybean production costs per acre existed between the high- and low-cost producers. The $77 difference in the production costs per acre was mainly generated by differences in capital recovery of machinery and equipment, repairs, fertilizer and chemicals, and fuel, lube, and electricity. Low-cost producers had half the machinery costs per acre of high-cost producers.

Regional production practices and growing conditions strongly influenced differences in yields and production costs per bushel among soybean producers. Soybean growers in the North had lower costs per bushel compared with those in the South, with 84 percent of the low-cost producers residing in the Heartland (fig. 2).

Farms with higher annual sales had lower soybean production costs per bushel due to their higher yields rather than lower production costs per acre. Producers with 250 to 750 acres of soybeans had lower production costs per bushel than producers with 750 or more acres due to their higher yields. Producers with 750 or more soybean acres were more likely to double-crop their soybeans with wheat. Double-cropping frequently reduces soybean yields due to later planting.

Figure 2
U.S. farm resource regions



Cost Per Bushel Varies Widely

Wide differences in yields and production costs per acre contributed to a $4.87 difference in the average cost per bushel between low- and high-cost soybean producers.

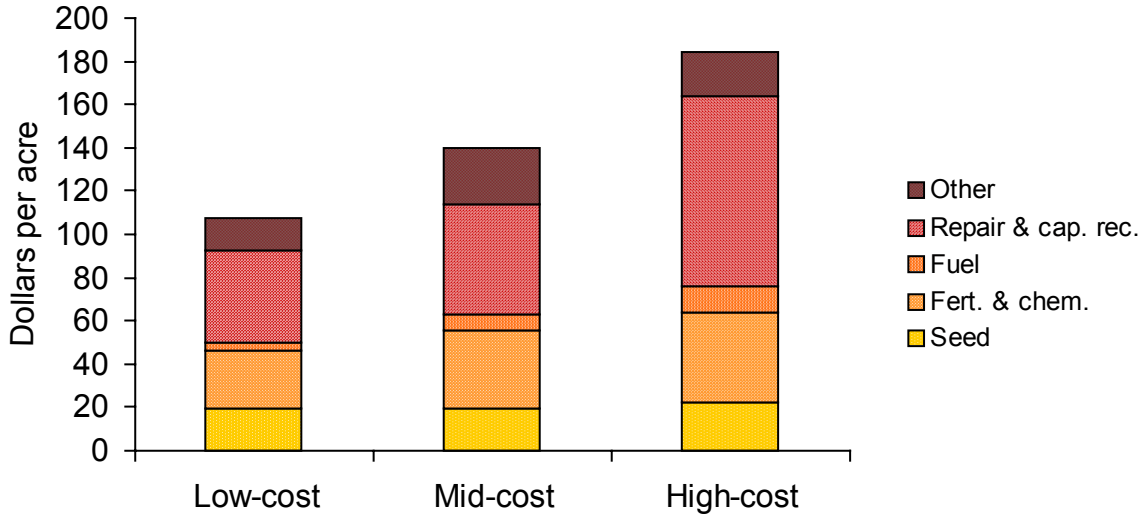
Soybean producers were ranked from lowest to highest based on production costs per bushel and grouped into quartiles. Low- and high-cost producers are in the extreme quartiles while mid-cost producers are those in the two mid quartiles. Low-cost producers raised 37 percent of the soybeans for less than $2.65 per bushel in 1997 using 31 percent of total soybean acreage (table 1 and fig. 1). In contrast, high-cost soybean producers raised 14 percent of the soybeans at a cost of over $4.50 per bushel using 19 percent of the total soybean acreage. Production costs averaged $6.00 per bushel for high-cost producers, more than double the average production costs of $2.13 per bushel for low-cost producers.

Production costs per bushel have two components, costs per acre and yields. Low-cost producers had both lower production costs per acre and higher yields compared to high-cost producers. Low-cost producers averaged $107.28 in production costs per acre compared to $184.68 for high-cost producers, while simultaneously achieving yields of 50 bushels per acre compared to 31 for high-cost producers in 1997. Cost differences between low- and high-cost producers were accentuated by the unusually high yields of low-cost producers and the unexpected low yields of the high-cost producers. Low-cost producers had yields that exceeded their expectations by four bushels per acre compared to high-cost producers, whose yields were five bushels per acre lower than their expected yields. Differences between actual and expected yields provide insight into the effects of unusual events, such as bad weather or insect infestations, on production. However, even if the high- and low-cost producers had achieved their expected yields, their ranking in the cost distribution would be nearly the same, since low-cost producers' expected yields were higher and their production costs were lower than those of high-cost producers.

The 20-bushel difference in the average soybean yields between low- and high-cost producers may be partly attributable to the higher percentage of the high-cost producers who either planted soybeans in the previous year or double-cropped soybeans with wheat. Planting soybeans after soybeans tends to reduce yields in the second year due to pest infestations and diseases (Pepper). Also, plant growth-inhibiting chemicals are released from soybean residue as it decomposes, causing a reduction in soybean yields in the following year. Double-cropping with wheat frequently causes a delay in planting soybeans, and since soybeans are sensitive to the length of day and night, a planting delay until mid-June or later tends to reduce soybean yields as well (Pepper).

The $77 difference in the production costs per acre between low- and high-cost producers was mainly generated by differences in four items: (1) capital recovery of machinery and equipment; (2) repairs; (3) fertilizer and chemicals; and (4) fuel, lube, and electricity (see fig. 3). Capital recovery (the value of farm machinery and equipment consumed during the annual production process) accounts for 46 percent of the difference, with each of the other items accounting for 12 percent or less. High-cost producers' machinery costs per acre were double those of low-cost producers, despite the high-cost producers' use of lower horse-powered tractors and smaller swath machinery. Only 32 percent of high-cost soybean producers used conservation tillage systems compared to 69 percent of the low-cost producers (table 2). Conservation tillage systems decreased the usage of machinery and labor by reducing the trips across a field. The reduced machinery usage led to lower costs per acre for capital recovery, machinery repairs, and fuel. In

Figure 3
Production costs per acre for soybeans by cost category, 1997



Source: 1997 Agricultural Resource Management Survey.

addition, low-cost producers had an average of 281 soybean acres and were able to spread fixed machinery costs over more acreage than high-cost producers who averaged 161 acres of soybeans. On average, fertilizer costs per acre were $8 higher for high-cost producers than for low-cost producers. Not only were high-cost producers more likely to apply fertilizers than low-cost producers, but they also applied more nitrogen per acre (38 pounds versus 14 pounds). Low-cost producers were more likely than high-cost producers to apply fertilizer for the crop planted before soybeans, intending to use the carryover of phosphorus and potassium for soybeans. High-cost producers irrigated 18 percent of their soybean acreage while low-cost producers irrigated less than 1 percent. Irrigation raises the per-acre costs for fuel, electricity, machinery repairs, and machinery ownership since irrigation systems require energy and additional machinery.

Although the total acreage operated per farm did not differ significantly between low- and high-cost producers, high-cost producers had lower average values of annual agricultural production, $151,888 per farm, compared to $301,755 per farm for low-cost producers. The ratio of the value of soybean production to total agricultural production, a measure of the importance of soybeans to the farm operation, was nearly identical for low-, mid-, and high-cost producers. The average value of farm equity for low-cost producers, at $635,944 per farm, was $173,077 higher than that for high-cost producers.

High-cost producers operated farms with lower annual sales, earned less farm income, and had lower total household incomes than low-cost producers (table 3). The principal operator of low-cost soybean enterprises earned more farm income than operators of high-cost enterprises. Farms with low-cost soybean enterprises were more likely to have more than one household receiving income from the farm operation. Fourteen percent of farms with low-cost production had multiple households sharing income from a farm operation compared to 9 percent for high-cost producers. The farm income per household of the principal operator (see glossary) averaged $29,682 for low-cost

enterprises and $14,426 for high-cost enterprises.

The average off-farm income earned by soybean producers and their families was nearly equal for each cost group. Approximately two-thirds of the farm families in each cost category received income from off-farm work. Operators of high-cost soybean farms were more likely to have a non-farm occupation as their principal occupation than operators of low-cost farms. There were no significant differences in operators' educational level or age among the cost categories.

Most low-cost soybean producers, 84 percent, are located in the Heartland, the major soybean production region, while 14 percent are located in the West or Northern Crescent (see fig. 2 for regional map). The West consists of the Northern Great Plains and the Prairie Gateway. High-cost soybean producers are more evenly distributed across regions than the low-cost producers with half or more of the high-cost producers located outside of the Heartland. Only 17 percent of the Heartland producers were high-cost soybean producers in 1997 compared to nearly 65 percent of the Mississippi Portal and Southeast producers.

Table 1–Soybean production costs and returns on 1997 ARMS soybean farms, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)	
Percent of soybean farms	25	*b*	50	*ac*	25	*b*
Percent of soybean acres	31	*bc*	50	*ac*	19	*ab*
Percent of soybean production (*bushels*)	37	*bc*	49	*ac*	14	*ab*
Size:						
Total operated acreage per farm	709		625		533	
Planted soybean acreage per farm	281	*bc*	233	*ac*	161	*ab*
Avg. number of commodities per farm	2.9		2.8		2.8	
Yield in bushels per acre:						
Actual	50.4	*bc*	42.2	*ac*	30.8	*ab*
Expected	46.9	*bc*	41.7	*ac*	35.9	*ab*
Production costs per bushel (*dollars*)						
Actual	2.13	*bc*	3.30	*ac*	6.00	*ab*
Expected	2.29	*bc*	3.35	*ac*	5.15	*ab*
Costs and returns per planted acre (*dollars*):						
Gross value of production	328.13	*bc*	275.13	*ac*	205.36	*ab*
Operating costs	65.53	*bc*	82.72	*ac*	104.61	*ab*
Seed	19.02		19.23	*c*	22.20	*b*
Fertilizer	4.06	*bc*	8.80	*ac*	12.51	*ab*
Soil conditioners	0.09	*c*	0.09	*c*	0.13	*ab*
Manure	0.34	*b*	*1.35	*a*	*0.46	
Chemicals	22.77	*bc*	27.66	*a*	29.02	*a*
Custom operations	6.13	*b*	5.76	*a*	*5.61	
Fuel, lube, and electricity	4.39	*bc*	6.96	*ac*	12.22	*ab*
Repairs	6.15	*bc*	9.24	*ac*	15.29	*ab*
Purchased irrigation water	0.00		0.00		#0.18	
Interest on operating capital	1.61	*bc*	2.02	*a*	2.50	*a*
Hired labor	0.96	*bc*	*1.59	*a*	4.49	*a*
Ownership costs	41.75	*bc*	56.71	*ac*	80.06	*ab*
Capital recovery of mach. and equip.	36.43	*bc*	49.45	*ac*	72.20	*ab*
Taxes and insurance	5.32	*bc*	7.26	*a*	7.87	*a*
Production costs	107.28	*bc*	139.43	*ac*	184.68	*ab*
Value of production less operating costs	262.60	*bc*	192.41	*ac*	100.75	*ab*
Value of production less production costs	220.85	*bc*	135.70	*ac*	20.68	*ab*

Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
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.

Table 2–Production practices on 1997 ARMS soybean farms, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)	
Seed:						
Drilled *(percentage of farms)*	57	*c*	54	*c*	48	*ab*
Rows *(percentage of farms)*	42	*c*	45	*c*	50	*ab*
Planting width for drilled *(inches)*	8.3		8.6		8.3	
Planting width for rows *(inches)*	25.0		26.8		27.5	
Seeding rate *(lbs/acre)*	65	*bc*	69	*a*	69	*a*
Herbicide-resistant variety *(percentage of farms)*	14		10		10	
May plant date *(percentage of farms)*	82	*c*	78	*c*	63	*ab*
June plant date *(percentage of farms)*	8	*bc*	15	*ac*	30	*ab*
July plant date *(percentage of farms)*	*3		3		5	
Fertilizer use (*percentage of farms*):						
Nitrogen	9	*bc*	25	*ac*	34	*ab*
Phosphorous	15	*bc*	35	*ac*	45	*ab*
Potassium	12	*bc*	32	*ac*	42	*ab*
Manure	10		12		12	
Fertilizer quantity on reporting farms:						
Nitrogen (*lbs/acre*)	*14	*c*	24	*c*	38	*ab*
Phosphorous (*lbs/acre*)	82		87		84	
Potassium (*lbs/acre*)	45		50		51	
Farms using fertilizer from previous year *(percentage)*	48	*bc*	37	*a*	32	*a*
Chemical use:						
Herbicides (*percentage of farms)*	97	*bc*	97	*a*	93	*a*
Herbicides (*acre-treatments*)	2.6		2.9		3.0	
Custom operations (*percentage of farms*):						
Any custom operation	34		40		42	
Preparation, cultivation, or planting	14	*b*	8	*a*	9	
Fertilizer/chemical	*9	*c*	14	*a*	18	
Harvest	20		21		21	
Total labor hours per acre	1.1	*bc*	1.6	*ac*	2.2	*ab*
Unpaid	1.0	*bc*	1.4	*ac*	1.6	*ab*
Paid	0.1	*bc*	0.2	*ac*	0.6	*ab*
Farms with paid labor (*percent*)	16		17		21	
Tillage systems (*percentage of farms*):						
Conventional	31	*bc*	57	*ac*	68	*ab*
Reduced	18	*bc*	28	*a*	26	*a*
Conservation	69	*bc*	43	*ac*	32	*ab*
No-till	32	*bc*	21	*ac*	14	*ab*
Machinery:						
Planter width (*feet*)	14.0		14.9	*c*	13.4	*b*
Harvester width (*feet*)	14.9	*c*	14.4	*c*	12.8	*ab*
Tractor horsepower (*largest used*)	157	*c*	156	*c*	141	*ab*
Speed of tillage/planting operations (*acres/hr*)	10.3	*bc*	8.8	*ac*	7.8	*ab*
Speed of harvest operations (*acres/hr*)	8.5	*bc*	6.5	*ac*	5.4	*ab*
Total trips across field (*number*)	6.1	*bc*	7.1	*ac*	7.4	*ab*
Tillage and planting trips (*number*)	2.7	*bc*	3.4	*ac*	3.8	*ab*

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

Table 3–Characteristics of 1997 ARMS soybean farms and soybean producers, by cost group

Item	Low (*a*)		Mid (*b*)		High (*c*)	
Soybean acreage (*percentage*):						
Dry land	100	*bc*	97	*ac*	82	*ab*
Irrigated	0	*bc*	3	*ac*	18	*ab*
Production value:						
All commodities (*dollars per farm*)	301,755	*bc*	213,919	*ac*	151,888	*ab*
Soybeans (*dollars per farm*)	88,536	*bc*	65,645	*ac*	37,313	*ab*
Percentage of total production	38		39		37	
Previous crop (*percentage of farms*):						
Soybeans	*7	*bc*	13	*ac*	24	*ab*
Corn	83	*bc*	73	*ac*	53	*ab*
Other	10	*c*	14	*c*	23	*ab*
Percentage of farms double-cropped w/wheat	*1.9	*bc*	4.1	*ac*	9.5	*ab*
Percent of soybean farms with:						
Cattle	46	*bc*	40	*a*	41	*a*
Hogs	23	*bc*	14	*a*	*10	*a*
Dairy	*5		8	*c*	6	*b*
Corn	91	*c*	87	*c*	73	*ab*
Wheat	23	*c*	28	*c*	37	*ab*
Cotton	#1	*bc*	*3	*a*	*3	*a*
Rice	D		1	*c*	5	*b*
Soybeans under contract	18	*c*	13		9	*a*
Operator occupation[1] (*percentage*):						
Farming	75	*c*	71	*c*	57	*ab*
Non-farm	19	*c*	24	*c*	30	*ab*
Retired	#5		5	*c*	11	*b*
Operator age (*percentage*):						
Less than 50 years	51		50		43	
50 to 64 years	29		34		33	
65 years or more	19		16		24	
Operator education (*percentage*):						
High school	47		50		48	
Some college	33		30		27	
Completed college	14		13		13	
Financial characteristics per farm:						
Farm equity	635,944	*c*	542,631	*c*	462,867	*ab*
Government payments	10,828	*bc*	9,040	*a*	7,705	*a*
Farms sharing farm income (*percentage*)	14.0	*c*	13.5	*c*	8.7	*ab*
Debt-to-asset ratio (*percent*)	18.8	*c*	17.1	*c*	14.0	*ab*
Return to equity *(percentage)*	#0.3		*-1.4		*-3.6	
Financial characteristics per farm household:						
Total household income	61,269	*c*	65,882	*c*	48,174	*ab*
Farm income	29,682	*c*	28,046	*c*	14,428	*ab*
Off-farm income	31,587		37,836		33,746	
Percentage with off-farm wage or business inc.	67		70		64	

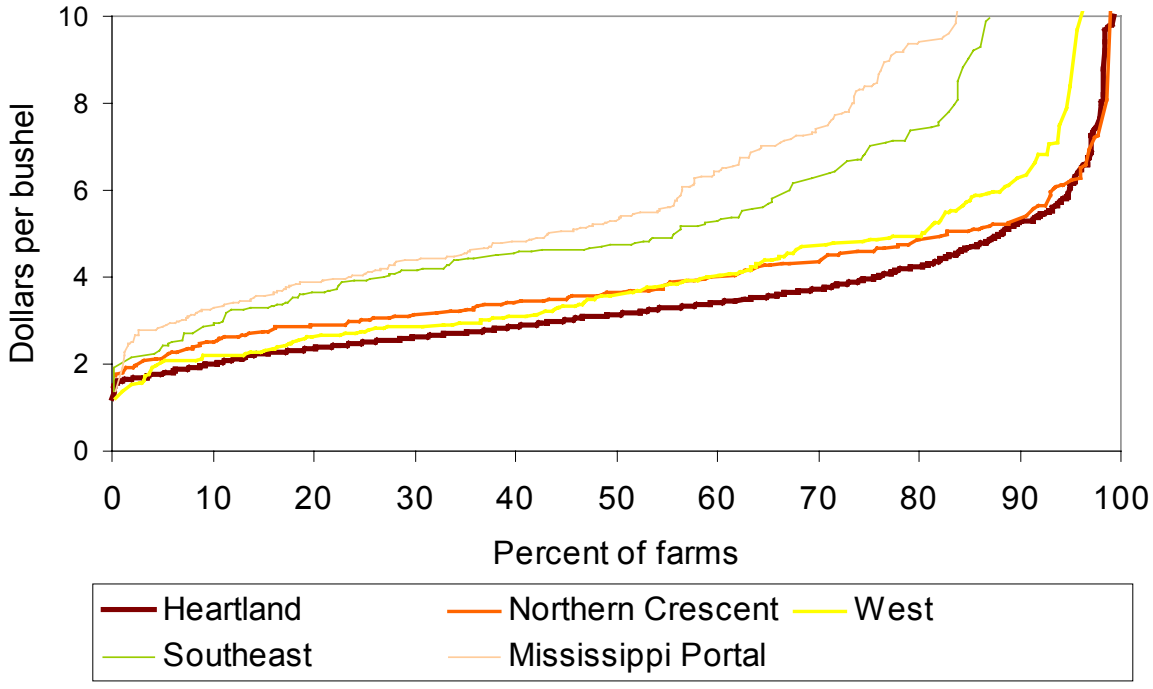
D=Data insufficient for disclosure.
Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
***** indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, and *c* indicate that estimates are significantly different from the indicated group 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.

Region

Favorable yields and lower production costs per acre continue to make the Heartland the low-cost region for soybean production. Production costs per bushel were lower in the Heartland, West, and Northern Crescent than the Mississippi Portal and Southeast.

The Heartland's soybean producers, with production costs totaling $2.92 per bushel, had the lowest average production costs followed by producers in the West and Northern Crescent with costs of $3.55 per bushel and $3.44 per bushel respectively (fig. 2 and fig. 4). The West consists of the Northern Great Plains and the Prairie Gateway, and the Southeast consists of the Eastern Uplands and the Southern Seaboard. Higher cost producers were found in the Mississippi Portal (with production costs of $5.05 per bushel) and in the Southeast (with costs of $4.55 per bushel). Lower yields averaging 32 bushels or less in the Mississippi Portal and Southeast were the chief cause of their high production costs per bushel. Actual yields were less than the expected yields for both regions in 1997 due to their hot and dry summer weather. However, even if the Mississippi Portal and Southeast producers achieved their expected yields, their production costs per bushel would still have exceeded those

Figure 4
Cumulative distribution of soybean farms by region and by operating and ownership costs per bushel, 1997



West includes Northern Great Plains and Prairie Gateway.
Southeast includes Eastern Uplands and Southern Seaboard.
Source: 1997 Agricultural Resource Management Survey.

in the other regions due chiefly to lower expected yields (table 4). Soybean producers in these regions are more likely to double-crop soybeans with wheat, which results in a later soybean planting date and reduced soybean yields. If Southeast producers' yields had equaled their expected yields, they would have had lower production costs per bushel than Mississippi Portal producers.

In 1997, Heartland producers realized better yields and lower production costs per acre than producers in other regions. The Heartland is especially suited for soybean production due to the region's climate, soil, topography, and efficient transportation system. The Mississippi River allows barges to move large quantities of harvested commodities to major Gulf ports for export. Heartland producers are more likely than producers in most other regions to employ a conservation tillage system on their soybean operation (table 5). Conservation tillage frequently reduces the number of trips across a field, saving labor expenditures per acre. Heartland soybean producers farmed an average of 232 acres of soybeans per farm, more acres than producers in most other regions. Soybeans accounted for nearly one-third of the annual gross value of production for Heartland soybean producers (table 6). Heartland producers are more likely to simultaneously raise corn and to rotate their soybeans with corn.

For producers in the West (the Northern Great Plains and Prairie Gateway), soybean production costs per bushel averaged $3.55 in 1997. Their soybean production costs per bushel were about equal to producers in the Heartland and Northern Crescent but lower than those in the Mississippi Portal and Southeast. However, their average soybean production cost per acre was not significantly different from the other regions. West producers operated 10 percent of all U.S. soybean farms, controlled 8 percent of the soybean acreage, and produced 7 percent of the soybeans. Although the soybean producers in the West had large farms that averaged 1,020 acres, only 188 acres on average were used for soybeans. West producers were most likely to rotate their soybeans with a crop other than corn. They were also the producers most likely to raise wheat in addition to soybeans. Producers in the West irrigated 16 percent of their soybean acreage, second only to Mississippi Portal producers. Although soybean producers in the West had more farm acreage than most, the value of their agricultural production ($204,501 per farm) was below those in the Mississippi Portal and Southeast.

Northern Crescent producers raised soybeans at an average cost of $3.44 per bushel, higher than the average for Heartland producers, but lower than the average for Mississippi Portal and Southeast producers. Soybean production costs per acre for Northern Crescent producers were higher than those in the Heartland and about the same as those in the other regions. The Northern Crescent producers obtained an average soybean yield of 43 bushels per acre in 1997, the second highest regional yield. The Northern Crescent had 13 percent of the U.S. soybean producers and 7 percent of the soybean acreage and production. Northern Crescent soybean producers had the smallest total acreage per farm and smallest soybean acreage per farm. They tied with those in the Mississippi Portal and the Southeast for the highest average labor hours expended per acre of soybeans. Northern Crescent producers were more likely to simultaneously operate dairy enterprises. Conventional tillage was used on soybeans by 69 percent of the Northern Crescent producers, the second highest rate among the regions. Northern Crescent producers, with their smaller-than-average farms, tended to use smaller machinery on their soybean enterprises. Just over 40 percent of the Northern Crescent producers hired custom harvesters for their soybeans.

Mississippi Portal soybean producers represented only 5 percent of all U.S. soybean producers, but they produced 9 percent of the crop using 12 percent of the soybean acreage. Producers in this region on average had the

largest farms and the largest soybean enterprises, when size is measured by acreage. On average, they planted 523 acres of soybeans per farm, half their farm acreage. With production costs averaging $5.05 per bushel, Mississippi Portal producers were high-cost producers due primarily to their lower soybean yields. In comparison to other regional producers, they were more likely to plant soybeans following soybeans, a practice that results in lower yields. Mississippi Portal producers were also the most likely to plant in June or later, and delayed planting reduces soybean yields. Nearly one out of four Mississippi Portal producers double-cropped soybeans following winter wheat. While double-cropping frequently delays soybean plantings, it also allows producers to spread their fixed costs over two crops and receive a second income from their wheat acreage. Producers in southern latitudes are more likely to double-crop due to their longer growing seasons. Mississippi Portal producers were the most likely to use conventional tillage systems and to hire labor for their soybean operations. They were also more likely to irrigate their soybean acreage and to use larger machinery in their soybean enterprises.

Southeast soybean producers (those in the Eastern Uplands and Southern Seaboard) also constituted just 5 percent of all U.S. soybean producers and accounted for 3 percent of both soybean acreage and production. Southeast producers had relatively high production costs of $4.55 per bushel. While their production costs per acre were not significantly different from those in most other regions, Southeast producers' expected yields were lower. A hot and dry summer in the Southeast in 1997 reduced soybean yields from producers' expected values. Southeast soybean producers were less likely to use herbicides than producers in other regions, and they generally planted soybeans later than producers in the northern regions. More than a quarter of the Southeast's soybean acreage was double-cropped with wheat, and on average Southeast producers used smaller farm machinery on their soybeans.

Soybeans accounted for just 10 percent of the gross value of agricultural commodities of Southeast producers, the smallest percent for all regions.

Table 4–Soybean production costs and returns per acre from 1997 ARMS soybean farms, by region

Item	Heartland (*a*)		West[1] (*b*)		Northern Crescent (c)		Mississippi Portal *(d)*		Southeast[2] (*e*)	
Percent of soybean farms	68	*bcde*	10	*acde*	13	*abde*	5	*abce*	5	*abcd*
Percent of soybean acres	70	*bcde*	8	*ade*	7	*ade*	12	*abce*	3	*abc*
Percent of soybean production (*bushels*)	74	*bcde*	7	*ade*	7	*ade*	9	*abce*	3	*abc*
Size:										
Total operated acreage per farm	581	*bcd*	1,020	*ace*	112	*abde*	1,069	*ace*	539	*bcd*
Planted soybean acreage per farm	232	*bcde*	188	*acd*	119	*abde*	523	*abce*	158	*acd*
Avg. number of commodities per farm	2.8	*cde*	2.8		3.1	*ad*	2.5	*ace*	3.1	*ad*
Yield in bushels per acre:										
Actual	45	*bcde*	40	*ade*	43	*ade*	31	*abc*	32	*abc*
Expected	44	*bde*	39	*acde*	43	*abde*	33	*abce*	36	*abcd*
Production costs per bushel:										
Actual	2.92	*bcde*	3.55	*ade*	3.44	*ade*	5.05	*abc*	4.55	*abc*
Expected	2.98	*bcde*	3.63	*ade*	3.42	*ade*	4.80	*abce*	4.10	*abcd*
Costs and returns per planted acre (*dollars*):										
Gross value of production	294.52	*bcde*	254.61	*acde*	277.66	*abde*	219.25	*abc*	223.04	*abc*
Operating costs	78.91	*de*	80.52	*e*	90.03		88.31	*a*	92.50	*ab*
Seed	19.59		20.06		22.81		18.72		18.82	
Fertilizer	7.20	*ce*	4.83	*ce*	13.31	*abe*	*7.58	*e*	22.07	*abcd*
Soil conditioners	0.09	*bcde*	*0.02	*acde*	0.17	*abde*	0.05	*abce*	*0.60	*abcd*
Manure	*1.00	*bde*	#0.15	*ac*	*2.00	*bde*	#0.07	*ab*	#0.22	*ac*
Chemicals	26.85		23.47		25.70		26.13		25.23	
Custom operations	5.94		6.44		5.89		5.03		* 5.29	
Fuel, lube, and electricity	6.42	*bd*	9.41	*ace*	7.15	*bd*	10.08	*ace*	6.35	*bd*
Repairs	8.64	*bd*	11.21	*ace*	9.01	*bd*	13.15	*ace*	8.61	*bd*
Purchased irrigation water	0.00		#0.61		0.00		0.00		0.00	
Interest on operating capital	1.94	*e*	1.95	*e*	2.20		2.07		2.23	*ab*
Hired labor	1.25	*de*	*2.36	*d*	*1.78	*d*	5.44	*abce*	*3.09	*ad*
Ownership costs	53.40	*bd*	61.86	*ad*	56.54	*abd*	70.30	*abce*	55.02	*d*
Capital recovery of mach. and equip.	46.56	*bd*	53.68	*ad*	49.67	*d*	64.56	*abc*	49.86	*d*
Taxes and insurance	6.84	*de*	8.18	*de*	6.92	*e*	5.74	*ab*	5.16	*abc*
Production costs	132.31	*cde*	142.37		146.57	*a*	158.61	*a*	147.52	*a*
Value of production less operating costs	215.61	*bcde*	174.09	*ade*	187.62	*ade*	130.94	*abc*	130.54	*abc*
Value of production less production costs	162.21	*de*	112.24	*d*	131.09	*d*	60.64	*abc*	75.51	*a*

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 indicated group at the 90 percent or better level using the t-statistic.
[1] West includes Northern Great Plains and Prairie Gateway.
[2] Southeast includes Eastern Uplands and Southern Seaboard.

Table 5–Production practices on 1997 ARMS soybean farms, by region

Item	Heartland (*a*)		West[1] (*b*)		Northern Crescent (c)		Mississippi Portal *(d)*		Southeast[2] (*e*)	
Seed:										
Drilled *(percentage of farms)*	53	*bcd*	40	*ac*	73	*abde*	37	*ace*	56	*cd*
Rows *(percentage of farms)*	46	*bcd*	60	*ace*	26	*abde*	59	*ace*	43	*bcd*
Planting width for drilled *(inches)*	8.5	*c*	8.4		7.6	*ad*	9.0	*c*	8.6	
Planting width for rows *(inches)*	26.2	*b*	28.7	*ad*	25.2		25.9	*b*	28.7	
Seeding rate (*lbs/acre*)	69	*bcd*	65	*acd*	77	*abde*	59	*abce*	67	*cd*
Herbicide-resistant variety *(percentage of farms)*	10	*de*	12	*e*	*8	*de*	19	*ac*	21	*abc*
May plant date *(percentage of farms)*	80	*bde*	72	*ade*	76	*de*	41	*abc*	50	*abc*
June plant date *(percentage of farms)*	12	*bcde*	23	*ade*	19	*ade*	48	*abc*	36	*abc*
July plant date *(percentage of farms)*	*3	*de*	1	*de*	D		*7	*abe*	13	*abd*
Fertilizer use (*percentage of farms*):										
Nitrogen	17	*bce*	32	*ade*	44	*ad*	19	*bce*	46	*abd*
Phosphorous	28	*bcde*	9	*acde*	61	*ab*	47	*abe*	62	*abd*
Potassium	23	*cde*	30	*cde*	49	*ab*	44	*ab*	59	*ab*
Manure	11	*bcd*	3	*ace*	25	*bde*	#1	*ace*	11	*bcd*
Fertilizer quantity on reporting farms:										
Nitrogen (*lbs/acre*)	25	*e*	20	*e*	*16	*e*	*33		50	*abc*
Phosphorous (*lbs/acre*)	91	*d*	D		83	*de*	66	*abc*	84	*c*
Potassium (*lbs/acre*)	53	*bc*	36	*ade*	35	*ade*	52	*bc*	51	*bc*
Farms using fertilizer from prev. yr. *(percentage)*	44	*bcde*	25	*ae*	24	*ae*	26	*a*	35	*abc*
Chemical use:										
Herbicides *(percentage of farms)*	97	*e*	93	*e*	98	*e*	95	*e*	84	*abcd*
Herbicides (*acre-treatments*)	2.8	*e*	2.6	*d*	2.8		3.0	*be*	2.5	*ad*
Custom operations (*percentage of farms*):										
Any custom operation	36	*c*	40	*c*	54	*abe*	43		40	*c*
Preparation, cultivation, or planting	11	*d*	11	*d*	#8		#2	*ab*	D	
Fertilizer/chemical	14	*bd*	9	*ade*	*12	*d*	26	*abc*	*24	*b*
Harvest	17	*bc*	26	*acd*	41	*abde*	15	*bc*	16	*c*
Total labor hours per acre	1.4	*cde*	1.5	*cde*	2.0	*ab*	1.9	*ab*	2.0	*ab*
Unpaid	1.3	*cde*	1.3	*cde*	1.8	*abd*	1.0	*abce*	1.6	*abd*
Paid	0.1	*de*	*0.2	*d*	0.2	*de*	0.	*abc*	0.4	*c*
Farms with paid labor (*percent*)	15	*de*	19	*d*	16	*de*	54	*abce*	26	*cd*
Tillage systems (*percentage of farms*):										
Conventional	48	*cde*	52	*cde*	69	*abde*	84	*abce*	56	*abcd*
Reduced	26	*e*	31	*cd*	*19	*b*	25	*be*	*14	*ad*
Conservation	52	*cde*	48	*cd*	31	*abde*	16	*abce*	44	*acd*
No-till	24	*bcde*	13	*acd*	17	*abde*	9	*abce*	34	*acd*
Machinery:										
Planter width *(feet)*	14	*bcde*	17	*ace*	12	*abd*	17	*ace*	11	*abd*
Harvester width *(feet)*	15	*cde*	14	*cde*	9	*abd*	17	*abce*	11	*abd*
Tractor horsepower (*largest used*)	156	*cde*	150	*de*	136	*ad*	183	*abce*	123	*abd*
Speed of tillage/planting operations (*acres/hr*)	9.0	*cde*	8.9	*cde*	6.5	*abd*	11.0	*abce*	6.1	*abd*
Speed of harvest operations (*acres/hr*)	7.0	*ce*	6.8	*ce*	5.4	*abd*	6.5	*ce*	5.0	*abd*
Total trips across field (*number*)	6.9	*bd*	6.3	*acd*	7.2	*bde*	8.1	*abce*	6.5	*cd*
Tillage and planting trips (*number*)	3.2	*bcd*	3.6	*ade*	3.5	*ade*	4.4	*abce*	2.9	*bcd*

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 indicated group at the 90 percent or better level using the t-statistic.
[1] West includes Northern Great Plains and Prairie Gateway.
[2] Southeast includes Eastern Uplands and Southern Seaboard.

Table 6–Characteristics of 1997 ARMS soybean farms and soybean producers, by region

Item	Heartland (*a*)		West[1] (*b*)		Northern Crescent (c)		Mississippi Portal *(d)*		Southeast[2] (*e*)	
Soybean acreage *(percentage)*:										
Dry land	98	*bde*	84	*ace*	98	*bd*	79	*ace*	100	*abd*
Irrigated	*2	*bde*	16	*ace*	# 2	*bd*	21	*ace*	0	*abd*
Production value:										
All commodities (*dollars per farm)*	212,171	*cde*	204,501	*d*	160,580	*de*	374,257	*abc*	315,609	*ac*
Soybeans (*dollars per farm*)	68,816	*bcde*	49,349	*acde*	32,924	*abd*	123,973	*abce*	31,435	*abd*
Percentage of total production	32	*bce*	24	*de*	21	*ade*	33	*bce*	10	*abcd*
Previous crop (*percentage of farms*):										
Soybeans	12	*cde*	16	*cd*	*5	*abde*	59	*abce*	27	*acd*
Corn	80	*bde*	37	acde	76	*bde*	13	*abce*	50	*abcd*
Other	8	*bcde*	47	*acde*	19	*abd*	29	*abc*	23	*ab*
Percentage of farms double-cropped w/wheat	2.5	*bde*	*5.8	*ade*	D		25.6	*ab*	25.7	*ab*
Percent of soybean farms with:										
Cattle	40	*bd*	56	*ad*	50	*d*	17	*abce*	47	*d*
Hogs	18	*bcd*	*7	*a*	*10	*a*	#4	*a*	*11	
Dairy	4	*bcde*	*2	*ace*	29	*abde*	D	*acd*	10	*abc*
Corn	92	*bde*	57	*acd*	85	*bde*	32	*abce*	66	*acd*
Wheat	23	*bcde*	59	*acde*	37	*ab*	36	*ab*	42	*ab*
Cotton	# 1	*bde*	0	*ade*	D		24	*abe*	*11	*abd*
Rice	# 0	*d*	0	*d*	D		37	*abe*	0	*d*
Soybeans under contract	13	*de*	12	*d*	11	*d*	27	*e*	8	*ad*
Operator occupation[3] (*percentage*):										
Farming	69	*d*	69	*d*	59	*d*	79	*abc*	68	
Non-farm	25	*d*	25	*d*	26	*d*	10	*abce*	22	
Retired	5	*c*	#5		*14	*a*	*9		*7	
Operator age (*percentage*):										
Less than 50 years	47	*b*	59	*ae*	51		54	*be*	41	
50 to 64 years	34	*b*	24	*ae*	28	*e*	28	*e*	41	*bcd*
65 years or more	19		*17		22		18		18	
Operator education (*percentage*):										
High school	50	*e*	44		51		42		41	*a*
Some college	30	*d*	37	*d*	30		21	*ab*	28	
Completed college	13	*d*	*15		*10	*d*	22	*ab*	*16	
Financial characteristics per farm:										
Farm equity *(dollars)*	544,631	*e*	575,174	*e*	490,257	*de*	612,474	*c*	542,745	*abc*
Government payments *(dollars)*	8,436	*cde*	10,415	*cde*	5,762	*abd*	27,567	*abe*	6,011	*abd*
Farms sharing farm income *(percentage)*	11	*d*	12	*d*	17		21	*ab*	16	
Debt-to-asset ratio (*percent*)	17.4		16.4		16.7		16.0		13.6	
Return to equity *(percentage)*	#-1.5	*e*	#-5.3	*e*	*-6.8	*de*	#7.2	*c*	#6.8	*abc*
Financial characteristics per household:										
Total household income *(dollars)*	58,710	*d*	58,506	*d*	52,694	*d*	104,334	*abce*	56,125	*d*
Farm income	24,289	*cd*	*24,539	*d*	*11,845	*d*	69,944	*abce*	*19,517	*d*
Off-farm income	34,421		33,967		40,849		34,390		36,608	
Percentage with off-farm wage, business inc.	70	*de*	72	*de*	63		53	*ab*	53	*ab*

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 indicated group at the 90 percent or better level using the t-statistic.
[1] West includes Northern Great Plains and Prairie Gateway.
[2] Southeast includes Eastern Uplands and Southern Seaboard.
[3] May not add to 100, since percentages for hired managers are not shown.

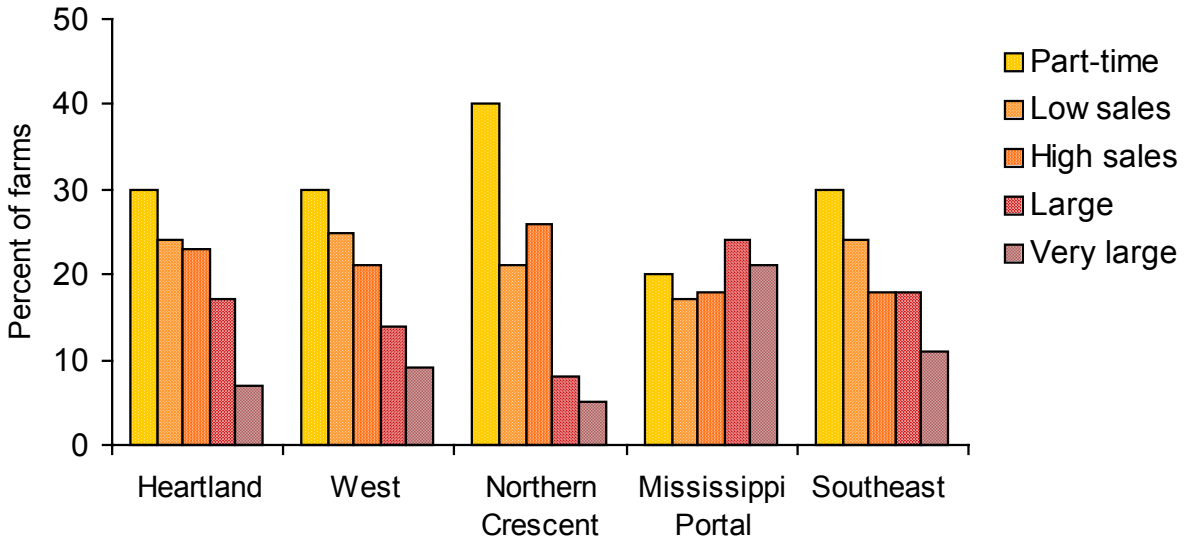
Farm Typology

Farms with higher sales have lower production costs per bushel due primarily to their higher yields rather than lower production costs per acre.

ERS's farm typology classifies farms based on the annual value of agricultural sales, farmers' occupation, and farm asset values (see glossary). Soybean acreage and total farm acreage were positively correlated with a farm's annual value of gross sales. In the United States, part-time farms composed 31 percent of the soybean enterprises while producing 11 percent of soybeans using 12 percent of the soybean acreage in 1997 (table 7). Part-time farm operations were generally smaller, averaging 89 acres of soybeans and 239 acres per farm. At the opposite extreme, very large farms comprised 8 percent of soybean farms and produced 23 percent of soybeans using 22 percent of the soybean acreage. Very large farms averaged 649 acres of soybeans and 1,833 total acres. A high percentage of the soybean farms in the Northern Crescent consisted of part-time or low-sales operations (fig. 5). In contrast, a relatively high percentage of the Mississippi Portal farms were classified as large or very large farm operations.

Part-time and low-sales farms are distinguishable from high-sales and larger farms. Part-time and low-sales farms experienced higher production costs per bushel, due mainly to lower average yields than high-sales and larger farms. Soybean production costs per bushel averaged $3.60 for part-time farm operations and $3.54 for low-sales operations, exceeding the costs of producers with high-sales and larger farms that ranged from $3.02 to $3.29 per bushel (table 7). Part-time and low-sales farms obtained average yields of 38 to 40 bushels in contrast to yields of 43 to 45 bushels for high-sales and larger farms.

Figure 5
Distribution of soybean farms by region and farm typology, 1997



West includes Northern Great Plains and Prairie Gateway.
Southeast includes Eastern Uplands and Southern Seaboard.
Source: 1997 Agricultural Resource Management Survey.

Soybean producers with high-sales and larger farms were more likely to use conservation tillage systems than soybean producers with part-time and low-sales farm operations (table 8). Conservation tillage often helps to retain soil moisture, which may enhance soybean yields and increase the need for herbicides to prevent or reduce problem weeds (Jasa). Conservation tillage also reduces farm machinery usage and the hours of field work.

High-sales and larger farms expended significantly fewer labor hours per acre of soybeans than part-time and low-sales farms while using more hired labor. Operators of high-sales and larger farms also used tractors with higher horsepower and farm machinery with wider swaths in their soybean enterprises, reducing their fieldwork hours. Although operators of larger farms were more likely to hire labor, they were less likely to use custom labor than operators of part-time and low-sales farms.

Soybean producers in the part-time and low-sales classes had low farm incomes and depended less on farm income as a source of household income than other soybean producers. Households operating part-time farms received an average of $1,537 from farm income and $50,590 from off-farm sources in 1997 (table 9). By definition, the vast majority of part-time producers were either retired or had nonfarm occupations with 21 percent listing retirement as their principal occupation. Farm families with low-sales farm operations received an average of $800 from farm income and $28,332 from off-farm sources for the lowest total household income among the farm typology groups, $29,131. By definition, farm operators of low-sales farms listed farming as their principal occupation, yet 31 percent of these operators were at least 65 years old. Households operating high-sales and larger farms received more income from farm sources than off-farm sources, yet these farms also had considerable off-farm incomes. High-sales farms had total household incomes averaging $44,180 with farm income contributing an average of $24,713 in 1997. Only households of soybean farms with low and high sales had an average household income beneath the U.S. average household income of $49,692 in 1997. Average household income for larger soybean farms exceeded $90,832 in 1997 with the farm-income component alone exceeding the average U.S. household income.

Table 7–Soybean production costs and returns on 1997 ARMS soybean farms, by farm typology

Item	Small family farms						Larger family farms			
	Part-time[1] (*a*)		Low-sales (*b*)		High-sales (*c*)		Large (*d*)		Very large (*e*)	
Percent of soybean farms	31	*bcde*	23	*ade*	22	*ade*	16	*abce*	8	*abcd*
Percent of soybean acres	12	*cde*	12	*cde*	24	*abd*	30	*abce*	22	*abc*
Percent of soybean production (*bushels*)	11	*cde*	10	*cde*	24	*abd*	32	*abce*	23	*abd*
Size:										
Total operated acreage per farm	239	*bcde*	380	*acde*	650	*abde*	1,039	*abce*	1,833	*abcd*
Planted soybean acreage per farm	89	*bcde*	114	*acde*	232	*abde*	413	*abce*	649	*abcd*
Avg. number of commodities per farm	2.4	*bcde*	2.8	*acde*	3.1	*ab*	3.2	*ab*	3.1	*ab*
Yield in bushels per acre:										
Actual	40	*bcde*	38	*ade*	43	*a*	45	*ab*	43	*ab*
Expected	40	*cde*	39	*cde*	42	*abd*	44	*abc*	43	*ab*
Production cost per bushel (*dollars*):										
Actual	3.60	*cd*	3.54	*cd*	3.14	*ab*	3.02	*ab*	3.29	
Expected	3.61	*cd*	3.45	*cd*	3.18	*ab*	3.08	*ab*	3.31	
Costs and returns per planted acre (*dollars*):										
Gross value of production	261.12	*bcde*	243.77	*acde*	277.28	*abd*	294.09	*abc*	281.91	*ab*
Operating costs	86.36	*bc*	75.51	*ade*	78.03	*a*	82.85	*b*	83.64	*b*
Seed	19.68	*b*	17.11	*ade*	18.18		19.67	*b*	19.99	*b*
Fertilizer	8.95		5.44	*de*	6.66		8.84	*b*	8.50	*b*
Soil conditioners	0.23	*be*	0.15	*a*	0.16		0.16		0.13	*a*
Manure	*0.33	*c*	*0.52		*0.81	*a*	#1.51		*1.19	
Chemicals	27.98	*bce*	25.87	*a*	27.86	*a*	26.79		25.62	*a*
Custom operations	9.68		7.45		4.85		5.68		4.36	
Fuel, lube, and electricity	7.17		6.77		6.92		7.13		7.59	
Repairs	9.35		9.49		9.51		8.83		10.05	
Purchased irrigation water	D		0.00		#0.08		D		D	
Interest on operating capital	2.13	*bc*	1.86	*a*	#1.92	*a*	2.01		1.98	
Hired labor	*0.83	*de*	0.87	*de*	1.08	*de*	2.21	*abce*	4.19	*abc*
Ownership costs	57.03		58.05		55.79		53.19		57.30	
Capital recovery of mach. and equip.	48.60		49.00		48.74		48.04		51.73	
Taxes and insurance	8.43	*cde*	9.05	*cde*	7.05	*abde*	5.15	*abc*	5.57	*abc*
Production costs	143.39	*bc*	133.56	*a*	133.82	*a*	136.04		140.94	
Value of production less operating costs	174.76	*cde*	168.26	*cde*	199.25	*ab*	211.24	*ab*	198.27	*ab*
Value of production less production costs	117.73	*cde*	110.21	*cde*	143.46	*ab*	158.05	*ab*	140.97	*ab*

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

Table 8–Production practices on 1997 ARMS soybean farms, by farm typology

Item	Small family farms						Larger family farms			
	Part-time[1] (*a*)		Low-sales (*b*)		High-sales(*c*)		Large (*d*)		Very large (*e*)	
Seed:										
Drilled *(percentage of farms)*	59	*bc*	46	*a*	52	*a*	52		49	
Rows *(percentage of farms)*	39	*bc*	53	*a*	48	*a*	48		50	
Planting width for drilled *(inches)*	7.7	*bcde*	8.6	*a*	8.9	*a*	8.6	*a*	8.8	*a*
Planting width for rows *(inches)*	27.9	*de*	29.6	*de*	29.0	*de*	23.5	*abc*	25.3	*abc*
Seeding rate (*lbs/acre*)	76	*bcde*	64	*a*	68	*a*	67	*a*	66	*a*
Herbicide resistant variety *(percentage of farms)*	10	*e*	7	*de*	8	*e*	*16	*b* 22		*abc*
May plant date *(percentage of farms)*	74		68	*c*	80	*b*	79		73	
June plant date *(percentage of farms)*	18	*d*	24	*cd*	15	*b*	10	*ab*	17	
July plant date *(percentage of farms)*	*5	*cde*	*5	*cde*	*2	*ab*	*1	*ab*	*2	*ab*
Fertilizer use (*percentage of farms*):										
Nitrogen	29	*ce*	21		22	*a*	*23		20	*a*
Phosphorous	39	*bc*	26	*ad*	29	*ad*	39	*bc*	33	
Potassium	34	*bc*	24	*a*	27	*a*	33		28	
Manure	9		9	*e*	11		*13		14	*b*
Fertilizer quantity on reporting farms:										
Nitrogen (*lbs/acre*)	16	*cd*	*22		26	*a*	26	*a*	*29	
Phosphorous (*lbs/acre*)	78		91		75	*d*	96	*c*	75	
Potassium (*lbs/acre*)	44		55		47		56	*e*	41	*d*
Farms using fertilizer from prev. yr. *(percentage)*	30	*bcde*	38	*a*	46	*a*	5	*a*	43	*a*
Chemical use:										
Herbicides (*percentage of farms)*	96	*d*	93	*cde*	99	*b*	99	*ab*	98	*b*
Herbicides (*acre-treatments*)	2.8		2.6	*de*	2.8		3.0	*b*	2.9	*b*
Custom operations (*percentage of farms*):										
Any custom operation	46	*ce*	40	*c*	30	*abd*	39	*c*	34	*a*
Preparation, cultivation, or planting	19	*bcde*	9	*ace*	5	*ab*	*5	*a*	#3	*ab*
Fertilizer/chemical	11	*d*	10	*de*	13	*d*	26	*abc*	18	*b*
Harvest	30	*cde*	28	*cde*	11	*ab*	9	*ab*	*11	*ab*
Total labor hours per acre	1.7	*de*	1.8	*cde*	1.6	*be*	1.5	*ab*	1.4	*abc*
Unpaid	1.6	*de*	1.7	*cde*	1.5	*bde*	1.2	*abce*	0.9	*abcd*
Paid	*0.1	*de*	0.1	*de*	0.1	*de*	0.2	*abce*	.5	*abcd*
Farms with paid labor (*percent*)	7	*cde*	9	*cde*	17	*abde*	36	*abce*	58	*abcd*
Tillage systems (*percentage of farms*):										
Conventional	63	*cde*	59	*ce*	45	*ab*	50	*a*	41	*ab*
Reduced	24		26		24		26		17	
Conservation	37	*cde*	41	*ce*	55	*ab*	50	*a*	59	*ab*
No-till	21		17		24		27		19	
Machinery:										
Planter width (*feet*)	15	*cde*	16	*cde*	18	*abde*	21	*abc*	22	*abc*
Harvester width (*feet*)	17	*bcde*	16	*acde*	18	*abde*	20	*abce*	22	*abcd*
Tractor horsepower (*largest used*)	131	*cde*	137	*cde*	168	*abde*	184	*abce*	209	*abcd*
Speed of tillage/planting operations (*acres/hr*)	6.4	*cde*	6.9	*cde*	8.6	*abde*	10.5	*abce*	11.6	*abcd*
Speed of harvest operations (*acres/hr*)	5.4	*cde*	5.4	*cde*	6.8	*abe*	7.4	*abe*	8.5	*abcd*
Total trips across field (*number*)	7.1		6.8		7.0		7.1		6.9	
Tillage and planting trips (*number*)	3.4		3.5		3.3		3.2		3.2	

Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, c, d, and *e* indicate estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.
[1] Part-time farms consist of retirement and residential/lifestyle farms plus farms with assets of $150,000 or less that generate less than $100,000 in annual sales. See glossary.

Table 9–Characteristics of 1997 ARMS soybean farms and soybean producers, by farm typology

Item	Small family farms			Larger family farms	
	Part-time[1] (*a*)	Low-sales (*b*)	High-sales (*c*)	Large (*d*)	Very large (*e*)
Soybean acreage (*percentage*):					
Dry land	98 *cde*	97 *e*	96 *ae*	95 *a*	90 *bc*
Irrigated	*2	#3	*4	*5	*10
Production value:					
All commodities (*dollars per farm*)	53,998 *bcde*	78,232 *acde*	218,340 *abde*	389,514 *abce*	914,768 *abcd*
Soybean (*dollars per farm*)	22,994 *bcde*	27,308 *acde*	66,906 *abde*	122,306 *abce*	191,381 *abcd*
Percentage of total production	42 *bcde*	35 *ae*	31 *ae*	32 *a*	29 *abc*
Previous crop (*percentage of farms*):					
Soybean	20 *c*	14 *c*	8 *abe*	15	16 *c*
Corn	65 *cd*	67 *c*	81 *abe*	77 *ae*	63 *cd*
Other	15 *d*	19 *cd*	11 *be*	8 *abe*	21 *cd*
Percentage of farms double-cropped w/wheat	*2.8 *be*	8.0 *acd*	*4.0 *b*	*3.9 *b*	*7.5 *a*
Percent of soybean farms with:					
Cattle	27 *bcd*	55 *ae*	50 *ae*	43 *a*	34 *bc*
Hogs	*6 *cde*	11 *cde*	20 *ab*	28 *ab*	25 *ab*
Dairy	*1 *bcde*	*5 *acd*	14 *abe*	12 *abe*	*5 *acd*
Corn	77 *cd*	80 *cd*	93 *abe*	92 *abe*	81 *cd*
Wheat	27 *e*	27 *e*	30 *e*	31 *e*	41 *abcd*
Cotton	#1 *de*	*0 *de*	*2 *e*	*3 *abe*	*14 *abcd*
Rice	*1 *bde*	D *acde*	*1 *bde*	*4 *abce*	8 *abcd*
Soybeans under contract	*5 *cde*	8 *cde*	15 *abde*	27 *abc*	26 *abc*
Operator occupation (*percentage*):					
Farming	#0 *bcde*	100 *ade*	100 *ade*	96 *abc*	97 *abc*
Non-farm	79 *bcde*	0 *ade*	0 *ade*	*2 *abc*	*2 *abc*
Retired	21 *bcde*	0 *a*	0 *a*	#2 *a*	#1 *a*
Operator age (*percentage*):					
Less than 50 years	45 *ce*	39 *cde*	55 *ab*	54 *b*	61 *ab*
50 to 64 years	32	30	36 *e*	35 *e*	25 *cd*
65 years or more	23 *cd*	31 *cde*	9 *ab*	*10 *ab*	*14 *b*
Operator education (*percentage*):					
High school	45 *c*	53	56 *a*	41	48
Some college	29	25	30	36	33
Completed college	17 *bc*	9 *ae*	9 *ae*	14	17 *bc*
Financial characteristics per farm:					
Farm equity (*dollars*)	286,987 *bcde*	372,604 *acde*	566,432 *abde*	786,316 *abce*	1,451,910 *abcd*
Government payments (*dollars*)	3,076 *cde*	3,533 *cde*	9,291 *abde*	16,454 *abce*	33,098 *abcd*
Farms sharing farm income (*percentage*)	*9 *de*	7 *cde*	13 *be*	16 *abe*	34 *abcd*
Debt-to-asset ratio (*percent*)	13 *cde*	12 *cde*	17 *abe*	19 *ab*	21 *abc*
Return to equity *(percentage)*	-6.4 *cde*	-8.6 *cde*	#-0.1 *abde*	9.6 *abc*	*10.8 *abc*
Financial characteristics per household:					
Total household income (*dollars*)	52,127 *bde*	29,131 *acde*	44,180 *bde*	90,832 *abce*	169,130 *abcd*
Farm income *(dollars)*	# 1,537 *cde*	#800 *cde*	24,713 *abde*	55,971 *abce*	127,180 *abcd*
Off-farm income *(dollars)*	50,590 *bcd*	28,332 *ace*	19,467 *abde*	34,862 *ac*	41,950 *bc*
Percentage off-farm wage, business inc.	83 *bcde*	61 *ade*	62 *ade*	71 *abc*	49 *abc*

Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, c, d, and *e* indicate estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.
[1] Part-time farms consist of retirement and residential/lifestyle farms plus farms with assets of $150,000 or less that generate less than $100,000 in annual sales. See glossary.

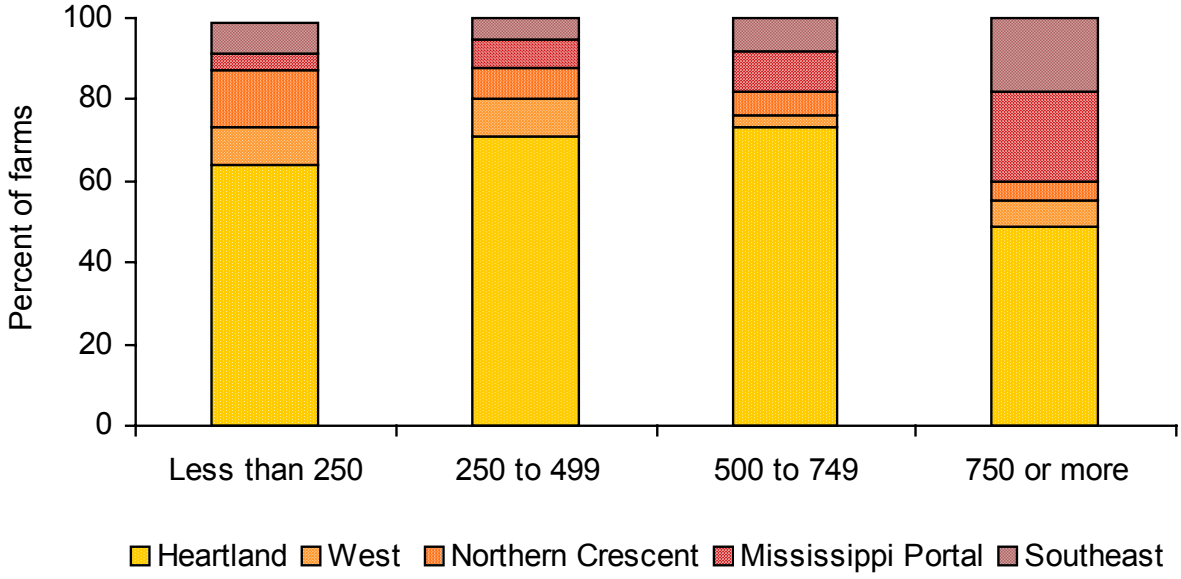
Farm and Operator Characteristics Vary by the Size of the Soybean Enterprise

Soybean production costs per acre, costs per bushel, and the size of the soybean enterprise were not strongly linked. Differences in regional costs were more important than size differences.

In 1997, those who planted 250 to 750 acres of soybeans had lower production costs per bushel than those planting less than 250 acres of soybeans (table 10). The average yields of soybean producers with 250 to 750 acres were higher than all other producers. Many operations with 250 to 750 acres of soybeans were located in the Heartland, where production costs per bushel were lowest and yields were higher (fig. 6). Producers with 750 or more acres of soybeans were more likely to be in the Southeast or the Mississippi Portal, where average soybean yields are lower due in part to their later planting dates. Southeast and Mississippi Portal soybean producers were more likely to double-crop soybeans following winter wheat (table 12). Double-cropping soybeans with wheat may reduce soybean yields due to the later soybean planting date. However, the double cropping allows producers to receive more income and spread the fixed costs of land and machinery over two crops rather than one. Production costs per acre and production costs per expected bushel did not vary significantly with the amount of planted soybean acreage.

Nearly 75 percent of all soybean producers planted less than 250 acres (table 10). These producers accounted for 30 percent of total U.S. soybean production and planted 31 percent of the soybean acreage. Those planting 250 to 499 acres of soybeans accounted for 16 percent of the soybean producers and nearly 25 percent of the soybean acreage and production. Those planting 500 or more acres comprised only 12 percent of the producers, yet they controlled 45 percent of the soybean acreage and produced 45 percent of the soybeans.

Figure 6
Distribution of soybean farms by planted soybean acreage and region, 1997



Southeast includes Eastern Uplands and Southern Seaboard.
West includes Northern Great Plains and Prairie Gateway.
Source: 1997 Agricultural Resource Management Survey.

Farms with larger soybean enterprises had a greater percentage of their total acreage devoted to soybean production. The percentage of acres devoted to soybeans ranged from 25 percent for farms with small soybean enterprises to 53 percent for farms with very large soybean enterprises. For farms with larger soybean enterprises, soybeans also accounted for a greater percentage of the farm's total agricultural commodity production. Soybeans were 21 percent of total production for small soybean enterprises and 39 percent for very large enterprises (table 12). This increased specialization in soybean production may have made risk management more important to operators with the larger soybean enterprises. More than 33 percent of the farms with 500 or more acres of soybeans had some soybeans under a production or marketing contract in contrast to less than 18 percent of farms with fewer soybean acres. Production contracts often provide for premium prices for specialty soybean crops, while marketing contracts can reduce producers' exposure to price variations.

Producers with fewer than 250 soybean acres differed substantially from those planting 250 or more soybean acres. Producers with small soybean enterprises used 1.9 hours of labor per acre of soybeans compared to 1.5 hours per acre for those with larger soybean enterprises (table 11). The percentage of farms employing hired labor in their soybean operations rose as the size of the soybean enterprise increased. Farms with small soybean operations had a higher percentage of their labor derived from unpaid family members. A higher percentage of those with small soybean enterprises used conventional tillage practices, which increased the number of labor hours spent in the field. The smaller swath of the farm machinery used in smaller soybean enterprises also contributed to their higher number of labor hours expended per acre.

Farm income averaged $15,521 for those operating small soybean enterprises compared to $114,762 for those with very large enterprises. When off-farm income is added to farm income, producers with small soybean enterprises had an average household income of $50,528, which is close to the 1997 U.S. average household income. In contrast, the average farm family income for those with over 750 acres of soybeans averaged $169,130. Operators of small soybean enterprises had an average debt-to-asset ratio of 14 percent compared to 20 percent for those larger soybean enterprises. The value of farm equity and Government payments was also positively correlated with the soybean acreage.

Table 10–Soybean production costs and returns on 1997 ARMS soybean farms, by soybean planted acreage

Item	Fewer than 250 (*a*)		250-499 (*b*)		500-749 (*c*)		750 or more (*d*)	
Percent of soybean farms	72	*bcd*	16	*acd*	7	*abd*	5	*abc*
Percent of soybean acres	31	*bcd*	24	*acd*	18	*abd*	27	*abc*
Percent of soybean production (*bushels*)	30	*bcd*	25	*ac*	20	*abd*	25	*ac*
Size:								
Total operated acreage per farm	372	*bcd*	879	*acd*	1,335	*abd*	2,211	*abc*
Planted soybean acreage per farm	92	*bcd*	347	*acd*	592	*abd*	1,163	*abc*
Avg. number of commodities per farm	2.8		2.8		2.9		2.8	
Yield in bushels per acre:								
Actual	42	*bc*	44	*ad*	46	*ad*	41	*bc*
Expected	42		42		44		41	
Production costs per bushel (*dollars*):								
Actual	3.45	*bc*	3.10	*a*	2.91	*a*	3.35	
Expected	3.43	*b*	3.21	*a*	3.04		3.29	
Costs and returns per planted acre (*dollars*):								
Gross value of production	270.25	*bc*	282.72	*a*	303.55	*ad*	267.99	*c*
Operating costs	82.40		79.79		85.29		70.06	
Seed	18.20	*c*	19.01	*c*	22.45	*ab*	20.23	
Fertilizer	7.21	*c*	7.63	*c*	11.21	*abd*	7.03	*c*
Soil conditioners	0.14	*bd*	0.07	*ac*	0.13	*bd*	0.06	*ac*
Manure	0.84	*c*	#0.63		*0.33	*a*	#1.47	
Chemicals	26.38		26.46		27.49		25.52	
Custom operations	8.27	*bd*	5.64	*ad*	5.95		*3.18	*ab*
Fuel, lube, and electricity	8.12	*bcd*	7.04	*a*	5.89	*a*	6.94	*a*
Repairs	10.06	*c*	9.51	*c*	7.86	*abd*	9.60	*c*
Purchased irrigation water	*0.11	*bc*	0.00	*a*	0.00	*a*	D	
Interest on operating capital	2.03	*d*	1.94		2.08		1.89	*a*
Hired labor	1.04	*bd*	1.84	*ad*	1.90	*d*	*3.08	*abc*
Ownership costs	60.72	*bc*	55.11	*a*	50.00	*ad*	56.88	*c*
Capital recovery of mach. and equip.	51.44	*c*	48.72		44.92	*ad*	51.52	*c*
Taxes and insurance	9.28	*bcd*	6.39	*acd*	5.08	*ab*	5.36	*ab*
Production costs	143.12	*b*	134.90	*a*	135.29		135.94	
Value of production less operating costs	187.84	*b*	202.93	*a*	218.26		188.93	
Value of production less production costs	127.13	*bc*	147.82	*a*	168.26	*a*	132.05	

Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, c, and *d* indicate that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.

Table 11–Production practices on 1997 ARMS soybean farms, by soybean planted acreage

Item	Fewer than 250 (*a*)		250-499 (*b*)		500-749 (*c*)		750 or more (*d*)	
Seed:								
Drilled *(percentage of farms)*	52		57		51		58	
Rows *(percentage of farms)*	46		43		49		40	
Planting width for drilled *(inches)*	8.3	*d*	8.4		8.3		8.8	*a*
Planting width for rows (*inches*)	29.8	*bcd*	26.8	*ad*	23.4	*a*	24.0	*ab*
Seeding rate (*lbs/acre*)	67		69		69		67	
Herbicide-resistant variety *(percentage of farms)*	9	*bcd*	14	*a*	25	*a*	16	*a*
May plant date *(percentage of farms)*	77	*d*	72		69		67	*a*
June plant date *(percentage of farms)*	16	*d*	19		*12	*d*	27	*ac*
July plant date *(percentage of farms)*	4	*d*	*2		*2		*1	*a*
Fertilizer use (*percentage of farms*):								
Nitrogen	23		25		20		21	
Phosphorous	32	*c*	31	*c*	48	*abd*	34	*c*
Potassium	29		29		35		30	
Manure	13	*bcd*	*8	*a*	*6	*a*	*5	*a*
Fertilizer quantity on reporting farms:								
Nitrogen (*lbs/acre*)	21		26		17		37	
Phosphorous (*lbs/acre*)	85		86		95		76	
Potassium (*lbs/acre*)	49		55		51		43	
Farms using fertilizer from prev. yr. *(percentage)*	34	*bcd*	50	*a*	52	*a*	49	*a*
Chemical use								
Herbicides *(percentage of farms)*	95	*bcd*	98	*a*	99	*a*	98	*a*
Herbicides (*acre-treatments*)	2.7	*d*	2.8	*d*	2.7	*d*	3.2	*abc*
Custom operations (*percentage of farms*):								
Any custom operation	42	*bd*	26	*a*	45	*d*	30	*ac*
Preparation, cultivation, or planting	12	*bcd*	*4	*a*	#4	*a*	#2	*a*
Fertilizer/chemical	12	*cd*	*14	*c*	36	*abd*	19	*ac*
Harvest	26	*bcd*	7	*ad*	#5	*a*	*2	*ab*
Total labor hours per acre	1.9	*bcd*	1.5	*ad*	1.3	*a*	1.3	*ab*
Unpaid	1.8	*bcd*	1.3	*acd*	1.0	*abd*	0.9	*abc*
Paid	.1	*bcd*	.2	*ad*	*.3	*a*	.4	*ab*
Farms with paid labor (*percent*)	11	*bcd*	29	*ad*	38	*a*	49	*ab*
Tillage systems (*percentage of farms*):								
Conventional	59	*bcd*	42	*a*	35	*a*	39	*a*
Reduced	27	*cd*	22	*d*	15	*a*	13	*ab*
Conservation	41	*bcd*	58	*a*	65	*a*	61	*a*
No-till	18	*bcd*	29	*a*	*35	*a*	34	*a*
Machinery:								
Planter width (*rows*)	12.9	*bcd*	16.4	*acd*	19.5	*ab*	20.2	*ab*
Harvester width (*rows*)	12.1	*bcd*	17.9	*acd*	20.6	*abd*	22.7	*abc*
Tractor horsepower (*largest used*)	137	*bcd*	175	*acd*	213	*ab*	221	*ab*
Speed of tillage/planting operations (*acres/hr*)	7.0	*bcd*	8.8	*acd*	10.5	*abd*	11.9	*abc*
Speed of harvest operations (*acres/hr*)	5.4	*bcd*	6.8	*acd*	7.6	*ab*	7.9	*ab*
Total trips across field (*number*)	7.0	*bd*	6.7	*a*	6.6		6.6	*a*
Tillage and planting trips (*number*)	3.5	*bcd*	3.1	*ad*	2.9	*a*	2.8	*ab*

D=Data insufficient for disclosure.
Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, c, and *d* indicate that estimates are significantly different from the indicated group at the 90 percent or better level using the t-statistic.

Table 12–Characteristics of 1997 ARMS soybean farms and soybean producers, by soybean planted acreage

Item	Fewer than 250 (*a*)		250-499 (*b*)		500-749 (*c*)		750 or more (*d*)	
Soybean acreage (*percentage*):								
Dry land	95		95		97		93	
Irrigated	5		*5		#3		*7	
Production value:								
All commodities (*dollars per farm*)	130,059	*bcd*	317,727	*acd*	464,905	*abd*	771,686	*abc*
Soybeans (*dollars per farm*)	26,953	*bcd*	99,261	*acd*	170,757	*abd*	304,245	*abc*
Percentage of total production	21	*bcd*	31	*ad*	37	*a*	39	*ab*
Previous crop (*percentage of farms*):								
Soybeans	12	*d*	15		*25		26	*a*
Corn	71	*d*	74	*d*	61		58	*ab*
Other	17	*b*	11	*a*	*14		16	
Percentage of farms double-cropped w/wheat	4.6	*d*	*4.0	*d*	*4.8	*d*	12.6	*abc*
Percent of soybean farms with:								
Cattle	46	*bcd*	35	*a*	28	*a*	25	*a*
Hogs	14		17		*24		*10	
Dairy	9	*bcd*	*3	*a*	*2	*a*	#2	*a*
Corn	83	*b*	90	*ad*	88		79	*b*
Wheat	28	*d*	30	*d*	35		42	*ab*
Cotton	*2	*d*	*2	*d*	*4		7	*ab*
Rice	*1	*bcd*	2	*ad*	*4	*ad*	14	*abc*
Soybeans under contract	8	*bcd*	18	*acd*	*36	*ab*	35	*ab*
Operator occupation (*percentage*)[1]:								
Farming	60	*bcd*	85	*ad*	91	*a*	95	*ab*
Non-farm	31	*bc*	*11	*a*	D		D	
Retired	9	*bc*	*3	*ac*	D		D	
Operator age (*percentage*):								
Less than 50 years	45	*bd*	57	*a*	57		60	*a*
50 to 64 years	32		36		32		32	
65 years or more	24	*bcd*	*7	*a*	#11	*abd*	*8	*ac*
Operator education (*percentage*):								
High school	50	*bcd*	49	*ac*	36	*ab*	45	*a*
Some college	28	*c*	32		43	*a*	30	
Completed college	13	*bd*	13	*a*	*14		21	*a*
Financial characteristics per farm:								
Farm equity (*dollars*)	421,325	*bcd*	613,100	*acd*	941,012	*abd*	1,459,361	*abc*
Government payments (*dollars*)	5,050	*bcd*	12,418	*acd*	20,085	*abd*	39,193	*abc*
Farms sharing farm income (*percentage*)	11	*cd*	10	*cd*	19	*abd*	39	*abc*
Debt-to-asset ratio (*percent*)	14	*bcd*	20	*a*	20	*a*	21	*a*
Return to equity *(percentage)*	*-3.6	*cd*	#-2.9	*cd*	*11.3	*ab*	*12.0	*ab*
Financial characteristics per farm household:								
Total household income *(dollars)*	50,528	*d*	61,758	*d*	63,514	*d*	191,462	*abc*
Farm income *(dollars)*	15,521	*bd*	33,257	*ad*	* 37,243	*d*	114,762	*abc*
Off-farm income *(dollars)*	35,007	*cd*	28,501	*d*	26,271	*ad*	*76,701	*abc*
Percentage with off-farm wage, business inc.	69	*d*	67		67		58	*a*

D=Data insufficient for disclosure.
Coefficient of Variation (CV) = (Standard Error/Estimate) x 100.
* indicates that CV is greater than 25 and less than or equal to 50.
# indicates that CV is greater than 50.
a, b, c, and *d* indicate that estimates are significantly different from the 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.

Glossary

Agricultural Resource Management Survey (ARMS) is the source of data compiled for this report. Soybeans cost and return estimates in this report are derived from the responses of 1,789 soybean farmers in 17 States to a survey on soybean production practices and costs as part of the 1997 ARMS. The target population for the survey was farmers who planted soybeans with the intention of harvesting the soybeans. The National Agricultural Statistics Service (NASS) and the Economic Research Service (ERS) collect production and cost data once every 5-8 years for each commodity on a rotating basis in the ARMS survey. The survey data are weighted to represent all U.S. soybean planted acreage in the surveyed States. The planted acreage in the surveyed States accounted for 93 percent of all U.S. soybean acreage.

Cost categories

- Low-cost producers are the 25 percent of U.S. soybean producers with the lowest production costs per harvested bushel of soybeans. These producers had production costs of $2.46 per bushel or less for soybeans. The cost per bushel is computed by dividing production costs by the bushels produced.

- High-cost producers are the 25 percent of U.S. soybean producers with the highest production costs per harvested bushel of soybeans. These producers had operating costs of $4.49 or more per bushel.

Crop rotation refers to the crop planted in the spring/summer of 1996 prior to the soybean crop in 1997, 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 it to a form usable by plants.

- Corn is a member of the grass family. Grasses are plants that require nitrogen for growth but cannot generate nitrogen. Therefore, farmers usually supply nitrogen to grasses.

- Other includes fields rotated with any other crop except for soybeans or corn, as well as land that was fallowed or left unseeded and uncultivated in the prior growing season, or land taken out of the Conservation Reserve Program during 1997.

ERS's farm typology classifies farms based on the size of the farm operation, the operator's occupation, and farm asset levels. The size of the farm operation is based on the annual value of gross sales.

- Small farms are family farms with annual gross sales of $250,000 or less. Family farms exclude farms organized as nonfamily corporations or cooperatives and exclude farms operated by hired managers.

  - Part-time farms are family farms that generate annual gross sales of less than $250,000 and whose operators report a nonfarm occupation, as well as family farms that generate annual sales totaling less than $100,000 whose operators report retirement as their occupation. All farms that generate less than $100,000 in annual sales, have farm assets valued under $150,000 and have household income under $20,000 are also included in the part-time farm definition.

  - Lower sales farms are family farms that have annual gross sales of less than $100,000 and farm assets of $150,000 or more, and whose operators report farming as their major occupation.

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

- Larger farms are family farms with gross annual sales of $250,000 or more.
    - Large farm operations are defined as farms with annual gross sales of $250,000 or more, but less than $500,000.
    - Very large farms are those with annual gross sales of $500,000 or more.
- Nonfamily farms are those organized as nonfamily corporations or cooperatives or those operated by hired managers. These farms are excluded from the typology discussion and tables, but are included in all other tables and discussions.

Farm household income averaged $52,562 for all U.S farms and $60,908 for U.S. farm households that raised soybeans in 1997. Data on farm household income is computed from the ARMS data and it is the sum of farm income and off-farm income of farm households. The farm income of farm households excludes the farm income earned by landlords and contractors. It also excludes the farm income generated by farms organized as nonfamily corporations or cooperatives or operated by hired managers. For farms with multiple operators or partners, the farm income, off-farm income, and household income figures used in this report are those for the household of the principal farm operator. Farm income of farm households is computed by taking net cash farm business income and subtracting depreciation, wages paid to the operator, gross farmland rental income, and the farm income received by other households, and then adding back the wages to operators, net income from farmland rental, and the earnings of the operator household from farming activities (ERS, AIS-67). Off-farm income consists of wages, salaries, net income from nonfarm businesses, interest, dividends, transfer payments, Social Security retirement, pensions, other retirement plans, gifts, and other off-farm sources.

Farms using fertilizer from previous year are the farms who responded yes to the following question on the 1997 ARMS soybean phase 2 survey, "Were fertilizers applied to the previous crop on this field with the intention of having the 1997 soybean crop utilize the carryover?" Frequently, farmers will apply sufficient phosphorus and potassium to a non-soybean crop for use by both the non-soybean crop and the soybean crop that follows.

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

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 on farms within a region. Regions are based on counties that have similar

soil and climatic traits. The West is a combination of the Northern Great Plains and the Prairie Gateway. The Southeast is the combination of the Eastern Uplands and Southern Seaboard. No soybean farms were sampled in the Fruitful Rim or the Basin and Range.

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

Soybean farms are farms that planted at least one acre of soybeans in 1997 with the intent of harvesting the soybeans.

Soybeans under contract are soybeans grown under a marketing or production contract. These contracts may be formal or informal arrangements made with processors, packers, canners, and integrators.

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

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

U.S. average household income was taken from the Current Population Survey (CPS), U.S. Department of Commerce, Bureau of the Census. In 1997, the average income for all U.S. households was $49,692.

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

References

Ash, Mark. (July 2001) *Soybeans: Background and Issues for Farm Legislation,* Electronic Outlook Report, Economic Research Service, U.S. Department of Agriculture, OSC-0701-01.

AAEA (American Agricultural Economics Association). (1998) *Commodity Costs and Returns Estimation Handbook*. Ames, IA.

Economic Research Service, Resource Economics Division, U.S. Department of Agriculture. *Agricultural Income and Finance Situation and Outlook,* Dec. 1997, AIS-67.

Jasa, Paul J., David P. Shelton, Alice J. Jones, and Elbert C. Dickey. (1991*) Conservation Tillage and Planting Systems, G91-1046,* Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

Pepper, Gary E., "Soybeans," Chapter 3, *2001-2002 Illinois Agronomy Handbook,* Cooperative Extension Service, University of Illinois at Urbana-Champaign.

U.S. Department of Agriculture, National Agricultural Statistics Service (NASS). Published Estimates Database, www.nass.usda.gov:81/ipedb/.