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Characteristics and Production Costs of U.S. Soybean Farms, 1990

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In this report... *The average variable cost of producing a bushel of soybeans was \$2.11 in 1990. Individual farm costs ranged from 50 cents to more than \$10 per bushel. Regional differences in production practices and growing conditions influenced production costs. Soybean growers in the North had a significant cost advantage over producers in the South. Variations in acreage and yield were also important in distinguishing among individual farm costs, but were closely related to regional differences.*

Average U.S. crop acreage planted to soybeans declined by 11 percent between 1981-85 and 1986-90. The reduction in planted soybean acres was not uniform among producing regions. Falling returns from soybeans relative to returns from competing crops dramatically reduced soybean acreage in the South (USDA, NASS, 1991). Average acreage in the Southeast and Delta declined by 40 and 26 percent, respectively, between 1981-85 and 1986-1990. A strong soybean-corn price ratio in the late 1980's kept soybean production steady in the North. North Central producers planted only 3 percent fewer acres, while Northern Plains producers increased average soybean acreage by 22 percent. Provisions of the 1985 farm legislation, including corn base planting requirements and higher target prices, limited expansion. More flexible planting options introduced in the 1990 farm legislation allow soybean growers to be more responsive to changes in relative crop prices.

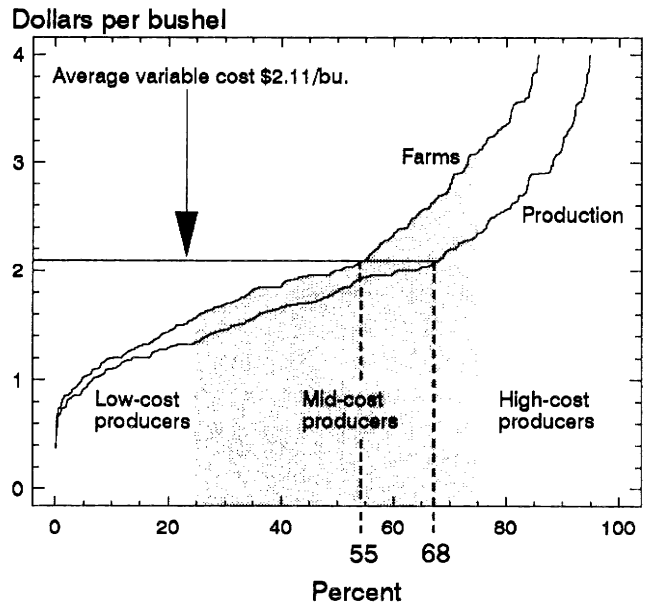
This report compares selected farm characteristics and production costs among soybean producers. Producers are grouped according to variable costs, enterprise sizes, and production regions (see Glossary). Data are from the 1990 Farm Costs and Returns Survey (FCRS) of U.S. soybean farms. Responses to the 1990 FCRS represented 271,841 farms producing 1.44 billion bushels of soybeans on about 43.6 million acres (75 percent of U.S. soybean production and acreage; USDA, NASS, 1991). Soybean growers in the Northeast and Southern

Plains were not surveyed because of their minor share of soybean production and limited survey funds. Nonresponse and survey design limitations also inhibited full coverage of U.S. soybean farms.

The average variable cost of producing soybeans on FCRS farms was \$69.86 per acre, or \$2.11 per bushel, in 1990. Estimated variable costs were converted to a per-bushel basis and ranked from lowest to highest to form a weighted cumulative distribution of farms and production (fig. 1). To analyze factors contributing to variations in production costs, soybean farms were divided into low-, mid-, and high-cost groups (see Glossary).

Figure 1
Cumulative distribution of soybean variable production costs, 1990

About 55 percent of FCRS soybean farms had variable costs at or below the average cost of \$2.11 per bushel, representing 68 percent of soybean production.



Source: 1990 Farm Costs and Returns Survey

Costs Varied Significantly Among Soybean Producers

Location, acreage, and yield distinguished low- from high-cost producers.

Twenty-five percent of soybean farms surveyed had variable costs per bushel of \$1.57 or less. These low-cost producers accounted for about 35 percent of the total FCRS soybean production (table 1). High-cost producers, with per-bushel variable costs of \$3.11 or more, accounted for only 10 percent of the total production.

Differences in per-acre costs and yields determined whether producers were low- or high-cost. High-cost producers yielded only 18 bushels of soybeans per acre, compared with 43 bushels for the low-cost producers (table 1)¹. The difference between actual and normal yield indicates to what extent uncontrollable factors, such as weather, affected yields. Actual yield was about 10 bushels below normal by high-cost producers, while low-cost producers achieved their expected yield. However, low-cost producers expected about 14 bushels per acre more than high-cost producers, suggesting that in the absence of uncontrollable factors, many of the high-cost producers would remain in the high-cost group. Also, average variable cost per acre for the high-cost producers was about \$40 higher than that of the low-cost group (table 2). The 1990 yield was important in classifying producers by cost level, but relative expected yields and per-acre costs suggest that many producers typically have low or high costs.

Enterprise and farm size also distinguished low- from high-cost producers. Low-cost producers planted an average of 54 more acres of soybeans than high-cost producers and operated farms averaging 85 acres larger (table 1). About 65 percent of high-cost producers had farm sales less than \$40,000, compared with only 22 percent of the low-cost producers. Soybeans also made up a larger portion of the value of farm production on low-cost farms (29 percent) than on high-cost farms (16 percent).

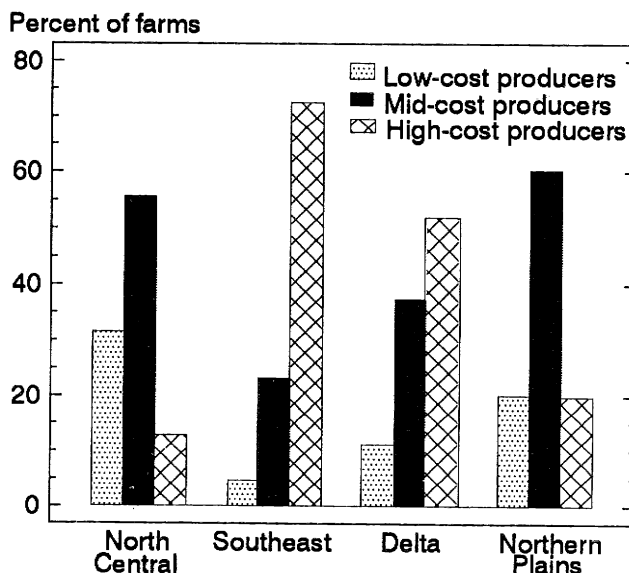
More than 70 percent of Southeast and more than 50 percent of Delta producers were in the high-cost group (fig. 2). Less than 15 percent of producers in both regions were low-cost growers. Nearly one-third of North Central soybean growers were low-

cost producers, with 13 percent in the high-cost group. About 20 percent of Northern Plains producers fell into the low- and high-cost groups.

Total variable costs were about \$40 per acre lower for the low-cost producers, a result of lower fertilizer, fuel, and labor costs (table 2). High-cost producers spent about \$16 per acre more for fertilizer than did low-cost producers. About 65 percent of the high-cost producers fertilized soybeans, compared with only 19 percent of low-cost producers. Low-cost producers most often planted soybeans after corn while high-cost producers more often planted soybeans after soybeans. Residual fertilizer from corn planted prior to soybeans may have increased soybean yield and reduced fertilizer requirements. Lower fuel and labor costs incurred by low-cost producers are the result of less intensive tillage practices. Around 27 percent of low-cost producers used some type of conservation tillage, compared with only about 10 percent of high-cost producers (McBride, 1992). Also, more high-cost producers had a major occupation other than farming. With less time to devote to farm production activities, high-cost producers spent more for hired labor.

Figure 2
Distribution of cost groups by region, 1990

The majority of Southeast and Delta producers were in the high-cost group, while most producers in the North were in the low- and mid-cost groups.



Source: 1990 Farm Costs and Returns Survey

¹Group means and percents presented in this report were statistically tested for significant differences. The discussions emphasize comparisons among groups only when means were significantly different at the 95-percent level (see Appendix 1).

Table 1--Characteristics of FCRS soybean farms, by variable cost group, 1990
Yield, size, and input use were among the factors distinguishing low- from high-cost producers.

Item	Unit	Cost group			All FCRS farms
		Low-cost producers	Mid-cost producers	High-cost producers	
Share of FCRS:					
Soybean farms	percent	25	50	25	100
Soybean production	percent	35	54	10	100
Soybean yield	actual bu/ac	43	33	18	33
Soybean yield	normal bu/ac	42	36	28	36
Size:					
Total operated acreage	acres	543	586	458	543
Planted soybean acreage	acres	175	173	121	160
Sales class¹--					
\$0-\$39,999	percent of farms	22	33	65	38
\$40,000-\$99,999	percent of farms	27	20	13	20
\$100,000-\$499,999	percent of farms	35	30	9	26
\$500,000 or more	percent of farms	17	17	13	16
Soybean production value	dollars	42,914	32,175	12,589	29,953
Farm production value	dollars	150,300	123,712	78,218	118,959
Major occupation:					
Farming	percent of farms	90	73	64	75
Other	percent of farms	10	27	36	25
Fertilizer use:					
Any fertilizer	percent of farms	19	39	65	40
Nitrogen	percent of farms	9	26	45	27
Phosphorus	percent of farms	14	35	61	36
Potassium	percent of farms	15	36	59	36

¹Data may not add due to rounding.

Table 2--Soybean variable production costs and returns per acre, by variable cost group, 1990
High-cost producers spent an average of \$40 more per acre than low-cost producers, with more than \$16 of the difference in fertilizer cost.

Item	Cost group			All FCRS farms
	Low-cost producers	Mid-cost producers	High-cost producers	
Dollars				
Costs per bushel:				
Variable costs, actual yield	1.21	2.13	5.08	2.11
Variable costs, normal yield	1.24	1.96	3.28	1.93
Costs and returns per acre:				
Value of production ¹	252.67	195.00	106.53	193.90
Total variable costs	52.32	70.75	92.44	69.86
Seed	11.15	13.39	11.71	12.47
Fertilizer	2.74	9.77	18.78	9.57
Chemicals	18.00	21.52	21.05	20.48
Custom operations	1.75	3.43	5.95	3.45
Fuel, lube, and electricity	7.87	8.60	12.02	9.05
Repairs	8.11	8.83	9.80	8.82
Hired labor	2.56	5.05	13.03	5.88
Purchased irrigation water	0.01	0.06	0.00	0.04
Technical services	0.16	0.10	0.10	0.11
Returns above variable costs	200.32	124.25	14.09	124.03

¹Value of production determined from the yield reported in the FCRS and State-level soybean harvest-month prices.

Farm Characteristics and Production Costs Varied by Size of Operation

Production costs were lowest for producers planting 200-399 acres of soybeans, while those growers with fewer than 50 acres or with 400 or more acres incurred the highest costs.

Nearly three-fourths of FCRS soybean farms had fewer than 200 acres and accounted for less than one-third of total production. Only 10 percent of farms had 400 or more acres of soybeans, but accounted for about 39 percent of the 1990 soybean crop (table 3).

Size of the soybean operation was related closely to size of the farming operation. Farms in the smallest size group averaged 27 acres of soybeans as part of 190 operated acres, while the largest group averaged 605 acres of soybeans on 1,519 operated acres (table 3). Seventy-nine percent of farms with fewer than 50 soybean acres had sales less than \$40,000, while 67 percent of farms with more than 400 soybean acres had \$500,000 or more in farm sales. The soybean operation was a greater proportion of farm acreage and value of production on larger farms. Soybeans accounted for 14 percent of farm acreage and 13 percent of total value of production on farms with fewer than 50 soybean acres. In contrast, soybeans comprised 40 percent of operated acreage and 34 percent of value of production on farms with 400 or more soybean acres.

Seventy-three percent of total soybean acreage was planted on rented acreage. The remaining 27 percent of soybean acreage was operator-owned. The proportion of soybean acres owned declined as size of operation increased (fig. 3). The smallest farms owned 67 percent of their soybean acreage, the largest farms, 19 percent. The largest farms planted 49 percent of their total soybean acreage on share-rented land. Share renting expands the size of the operation at less cost and spreads production risk between the operator and landlords.

Per-acre variable production costs were lowest for producers with 200-399 soybean acres, while the highest costs were incurred by producers in the smallest and largest size groups (table 4). Higher costs for the smallest farms can, to a large extent, be attributed to greater custom operations costs. About 47 percent of farms with fewer than 50 soybean acres used custom operations, with about 41 percent using custom harvesting. Small farms more often use custom services, such as planting and harvesting, because their small acreage does not justify ownership of the specialized equipment. The largest farms (400 or more acres) had higher

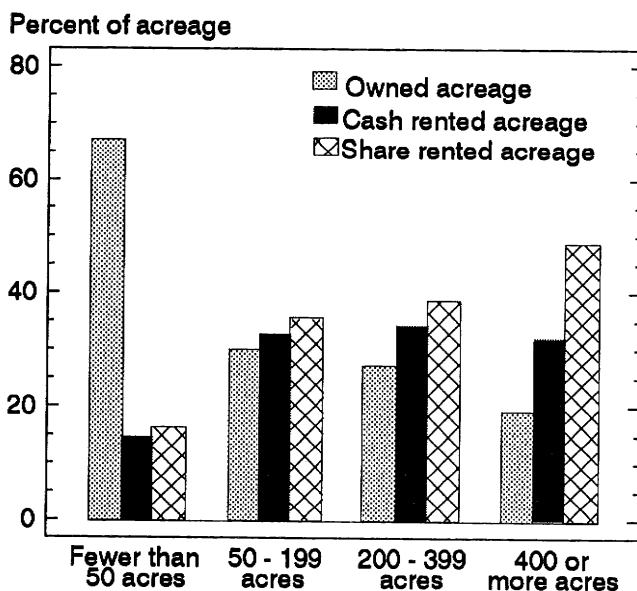
costs due to greater expenses for fertilizer and hired labor. More of the largest farms used fertilizer (58 percent) than the other farms. Hired labor is more important on larger farms because of the greater acreage.

The average farm debt-to-asset ratio increased with farm size. The smallest farms had a debt-to-asset ratio of 0.11, compared with 0.23 for the largest farms. Likewise, larger farms were more likely to be in the marginal solvency class (see Glossary), indicating a greater degree of financial leverage. Smaller farms were more often in the marginal income class, suggesting that even though farm income was negative in 1990, they remained financially stable.

Operators of smaller farms were more likely to work off the farm, tended to be older (above 50 years of age), and had less education than operators of larger farms. Most large farm operators were younger than 50 years of age, and more than half had attended college.

Figure 3
Distribution of land tenure by size groups, 1990

The percentage of operator-owned soybean acreage declined and rented acreage increased as size of the soybean enterprise increased.



Source: 1990 Farm Costs and Returns Survey

Table 3--Characteristics of FCRS soybean farms, by enterprise size, 1990

Only 10 percent of farms had 400 or more soybean acres, but they accounted for 39 percent of total production.

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-399	400 or more	
Share of FCRS:						
Soybean farms	percent	31	42	16	10	100
Soybean production	percent	5	27	30	39	100
Soybean yield	actual bu/ac	32	32	35	32	33
Soybean yield	normal bu/ac	35	36	38	36	36
Size:						
Total operated acreage	acres	190	462	800	1,519	543
Planted soybean acreage	acres	27	105	271	605	160
Sales class¹--						
\$0-\$39,999	percent of farms	79	30	5	d	38
\$40,000-\$99,999	percent of farms	16	29	14	d	20
\$100,000-\$499,999	percent of farms	4	27	63	30	26
\$500,000 or more	percent of farms	d	13	18	67	16
Soybean production value	dollars	4,109	19,259	54,380	111,427	29,953
Farm production value	dollars	31,693	101,897	194,683	328,367	118,959
Financial position:¹						
Favorable	percent of farms	47	67	59	48	57
Marginal income	percent of farms	46	20	16	14	26
Marginal solvency	percent of farms	3	9	20	33	12
Vulnerable	percent of farms	4	4	6	4	4
Custom operations use:						
Any custom operations	percent of farms	47	31	38	18	36
Planting	percent of farms	15	2	3	d	6
Fert/chem application	percent of farms	16	17	30	9	18
Harvesting	percent of farms	41	22	5	4	23

¹Data may not add due to rounding.

d = Insufficient data for disclosure.

Table 4--Soybean variable production costs and returns per acre, by enterprise size, 1990

The smallest and largest farms had the highest variable costs per acre, due to frequent use of custom operations on small farms and greater expenses for fertilizer and labor on large farms.

Item	Enterprise size (acres)				All FCRS farms
	Fewer than 50	50-199	200-399	400 or more	
Dollars					
Costs per bushel:					
Variable costs, actual yield	2.25	2.10	1.87	2.29	2.11
Variable costs, normal yield	2.09	1.86	1.76	2.09	1.93
Costs and returns per acre:					
Value of production ¹	187.23	187.14	206.66	190.54	193.90
Total variable costs	72.48	67.27	66.05	74.00	69.86
Seed	13.68	13.39	12.84	11.41	12.47
Fertilizer	8.07	7.00	6.53	13.69	9.57
Chemicals	21.41	20.78	21.39	19.50	20.48
Custom operations	9.58	5.07	3.30	1.62	3.45
Fuel, lube, and electricity	9.99	8.86	9.27	8.89	9.05
Repairs	7.44	8.55	8.80	9.20	8.82
Hired labor	1.84	3.59	3.75	9.51	5.88
Purchased irrigation water	0.37	0.00	0.00	0.04	0.04
Technical services	0.08	0.04	0.17	0.13	0.11
Returns above variable costs	114.75	119.87	140.61	116.54	124.03

¹Value of production determined from the yield reported in the FCRS and State-level soybean harvest-month prices.

Regional Factors Influenced Soybean Production Costs

Differences in yield, acreage, and production practices contributed to regional variations in production costs.

Nearly two-thirds of FCRS soybean farms were located in the North Central region and accounted for 74 percent of production (table 5). About 16 percent of the farms were in the Southeast and 14 percent in the Northern Plains, each accounting for about 9 percent of production. Only 5 percent of soybean farms were in the Delta, with about 7 percent of production. According to U.S. crop production estimates in the States comprising each region, the soybean version of the FCRS represented 80, 99, 59, and 70 percent, respectively, of the North Central, Southeast, Delta, and Northern Plains soybean production in 1990 (USDA, NASS, 1991).

Soybean growers in the northern regions had a significant cost advantage over producers in the southern regions (fig. 4). Nearly 62 percent of North Central soybean growers had variable costs less than \$2 per bushel, compared with only 11 percent in the Southeast and 14 percent in the Delta. Per-bushel costs were highest in the Southeast, where only 40 percent of producers had variable costs below \$4 per bushel and only 58 percent under \$6 per bushel. More than 90 percent of producers in the North Central and Northern Plains had per-bushel variable costs below \$4. With soybean prices ranging from \$5.60 to \$6.00 during 1990, more northern soybean producers were able to cover variable costs than southern producers.

Favorable growing conditions in the North Central and Northern Plains regions resulted in near-normal yields. However, dry conditions throughout much of the South, especially in the Southeast, limited soybean yield potential. Soybean yield in the Southeast was about 8 bushels below normal. Per-bushel variable costs in the southern regions were more than \$1 above costs in the northern regions (table 6). Much of the higher costs can be attributed to the effects of dry weather. However, southern soybean growers had the highest per-acre costs. Cost per bushel of normal yield was also highest in southern regions, more than 75 cents above costs in the North. While per-bushel costs were above normal in the South during 1990, southern soybean growers appear to typically have higher costs than northern growers.

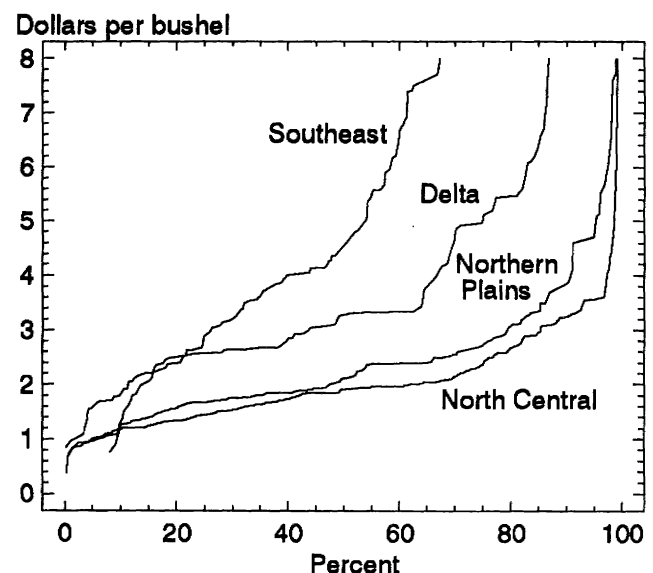
At \$59.15, the Northern Plains had the lowest per-acre variable costs of all regions. Lower fertilizer and chemical costs resulted in the cost savings.

Only 22 percent of producers in the Northern Plains applied any fertilizer to soybeans in 1990, compared with about 40 percent of all soybean producers. Lower fuel and labor costs gave North Central producers a substantial cost advantage over southern producers. Many of the North Central soybean growers used conservation or reduced tillage systems (34 percent), which reduce fuel and labor requirements (see Glossary).

Per-acre variable costs were highest in the Southeast (\$85.59), due primarily to greater fertilizer costs, which, at \$23.12 per acre, were about \$15 higher than any other region. About 81 percent of farms in the Southeast fertilized soybeans. Variable costs were higher in the Delta than in northern regions because of greater fuel and labor costs. A relatively high percentage of acreage in the Delta was irrigated (15 percent), which requires more fuel and labor. Also, Delta growers used conventional tillage systems almost exclusively (97 percent), while more producers in the North used conservation tillage.

Figure 4
Regional cumulative distributions of soybean variable production costs, 1990

Northern soybean growers had a significant cost advantage over southern growers. More than 90 percent of northern producers had variable costs of \$4 per bushel or less.



Source: 1990 Farm Costs and Returns Survey

Table 5--Characteristics of FCRS soybean farms, by region, 1990

The North Central region accounted for nearly two-thirds of the FCRS farms and produced nearly three-fourths of the total soybean production.

Item	Unit	Region				All FCRS farms
		North Central	Southeast	Delta	Northern Plains	
Share of FCRS:						
Soybean farms	percent	66	16	5	14	100
Soybean production	percent	74	9	7	9	100
Soybean yield	actual bu/ac	38	22	24	29	33
Soybean yield	normal bu/ac	40	30	28	32	36
Size:						
Total operated acreage	acres	502	528	698	708	543
Planted soybean acreage	acres	159	144	322	127	160
Sales class¹—						
\$0-\$39,999	percent of farms	36	59	36	24	38
\$40,000-\$99,999	percent of farms	19	13	14	33	20
\$100,000-\$499,999	percent of farms	29	14	30	26	26
\$500,000 or more	percent of farms	16	13	20	16	16
Soybean production value	dollars	33,632	18,185	44,840	20,292	29,953
Farm production value	dollars	118,590	92,973	162,748	135,093	118,959
Soybean production practices:						
Percent irrigated	percent of acreage	d	d	15	16	4
Percent dryland	percent of acreage	99	99	85	84	96
Percent double-cropped	percent of acreage	5	23	22	6	9
Fertilizer use:						
Any fertilizer	percent of farms	35	81	34	22	40
Nitrogen	percent of farms	22	55	18	18	27
Phosphorus	percent of farms	30	76	32	20	36
Potassium	percent of farms	34	74	33	8	36
Tillage system use:						
Conventional	percent of farms	66	92	97	60	71
Conservation	percent of farms	34	8	d	40	29

¹Data may not add due to rounding.
d = insufficient data for disclosure.

Table 6--Soybean variable production costs and returns per acre, by region, 1990

Variable costs in the southern regions exceeded costs in the northern regions by more than \$1 per bushel, the result of higher per-acre costs and lower yields in the South.

Item	Region				All FCRS farms
	North Central	Southeast	Delta	Northern Plains	
Dollars					
Costs per bushel:					
Variable costs, actual yield	1.80	3.91	3.15	2.02	2.11
Variable costs, normal yield	1.71	2.88	2.61	1.85	1.93
Costs and returns per acre:					
Value of production ¹	220.62	128.49	140.79	166.07	193.90
Total variable costs	67.56	85.59	74.18	59.15	69.86
Seed	13.52	9.69	10.48	11.54	12.47
Fertilizer	8.39	23.12	5.45	2.60	9.57
Chemicals	21.51	19.50	19.34	16.47	20.48
Custom operations	3.85	2.25	3.80	2.26	3.45
Fuel, lube, and electricity	7.82	10.22	13.05	11.31	9.05
Repairs	8.25	9.54	10.79	9.52	8.82
Hired labor	4.06	11.24	11.17	5.06	5.88
Purchased irrigation water	0.03	0.00	0.00	0.19	0.04
Technical services	0.12	0.02	0.10	0.21	0.11
Returns above variable costs	153.06	42.90	66.61	106.92	124.03

¹Value of production determined from the yield reported in the FCRS and State-level soybean harvest-month prices.

Glossary

Soybean farms represent those selected in the 1990 Farm Costs and Returns Survey, Soybean Cost of Production version. Soybean farms are defined as farm operations that planted soybeans in 1990 with the intent of harvesting beans.

Soybean production regions are groups of States with common cultural practices in raising soybeans: The North Central includes IL, IN, IA, MI, MN, MO, and OH; the Southeast includes AL, GA, KY, NC, SC, and TN; the Delta includes AR, LA and MS; and the Northern Plains includes KS, NE, ND, and SD.

Variable costs represent the costs for purchased inputs that are consumed in one production period. Variable costs depend on the chosen production practices, input quantities, and input prices.

Low-cost producers are the 25 percent of U.S. soybean producers with the lowest per-bushel total variable costs. Those producers had variable costs per-bushel of \$1.57 or less.

High-cost producers are the 25 percent of U.S. soybean producers with the highest per-bushel total variable costs. Those producers had variable costs per-bushel of \$3.11 or more.

Enterprise size categories are specified as farms with under 50 soybean acres, 50-199 acres, 200-399 acres, and 400 or more acres.

Production specialty is the farm production classification that represents the largest portion of gross commodity receipts from the farm operation.

Value of production is an estimate of the total value of all farm products produced on a farm, excluding the value of intermediate products such as corn fed to livestock.

Financial position describes the financial health of a farm business from a combination of income (net farm income) and solvency (debt/asset ratio)

measures. Farms are categorized into one of four classes:

- **Favorable**--positive income and debt/asset ratio less than 0.40. These farms are generally considered financially stable.
- **Marginal income**--negative income and a debt/asset ratio less than 0.40. Periods of negative income may not pose financial difficulties if these farms are carrying a low debt load and can either borrow against equity or obtain income from off-farm sources.
- **Marginal solvency**--positive income and a debt/asset ratio above 0.40. A high debt/asset ratio may be acceptable if these farms can generate enough income to service their debt and meet other financial obligations.
- **Vulnerable**--negative income and a debt/asset ratio above 0.40. These farms are generally considered financially unstable.

Economic class is an economic classification of farm size. The classification is based on the gross receipts, including gross annual sales of crops; livestock, poultry, and products; miscellaneous agricultural products; and all Government payments of the farm operation.

Normal yield, or expected yield, is the yield per acre farmers reported that they normally attained by growing soybeans on their operation.

Conservation tillage farms are those that had an estimate of 30 percent or more of the previous crop residue covering the soil when soybeans were planted (McBride, 1992).

Conventional tillage farms are those that had an estimate of less than 30 percent of the previous crop residue covering the soil when soybeans were planted (McBride, 1992).

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Appendix 1: Data Reliability

Survey results are only indications of the total population. They may differ from data collected in a complete census using the same questionnaires, instructions, and enumerators. A measure of this sample variability, called sampling error, is available from survey results. Sampling errors may be expressed as a percentage of the estimate. These percentages represent the relative standard error of the estimate and are often referred to as coefficients of variation (C.V.). In general, the smaller the C.V. the greater the reliability of the estimate.

The average total variable cash cost for all farms, \$69.86 per acre, has a C.V. of 2.37 percent. The confidence interval based on a 95-percent probability for total variable cost per acre of producing soybeans in the United States is estimated to be \$66.61-\$73.11. The relative standard error of estimate can also be used to evaluate the statistical significance of differences of means between groups. For example, the appropriate t-statistic for a comparison of total variable cost per acre between low- and high-cost producers can be constructed by taking the difference between the mean of the two groups (TVC) and dividing by the square root of the sum of

the squared standard errors of the two groups (SE^2). Or:

$$t = \frac{(TVC_{\text{low-cost}} - TVC_{\text{high-cost}})}{(SE^2_{\text{low-cost}} + SE^2_{\text{high-cost}})^{0.5}}$$

$$= (52.32 - 92.44) / (1.864 + 15.763)^{0.5} = -9.556$$

Differences among means of the characteristic and cost and return items for the various groupings presented in this report were statistically tested. Although t-statistics are not reported here, the discussion in each section emphasizes comparisons among the groups only when means were significantly different at the 95-percent level.

Survey data are also influenced by nonsampling errors, which are not measurable or known. Nonsampling errors may be introduced by enumerators, respondents, and questionnaire design, among other factors. Efforts were made to minimize these errors and maintain survey accuracy, including training of data collectors, detailed review and edit of data, and analysis for comparability and consistency.

Appendix table 1--Coefficients of variation of soybean variable costs and returns, by cost group, 1990

Item	Cost group			All FCRS farms
	Low-cost producers	Mid-cost producers	High-cost producers	
	Percent			
Costs per bushel:				
Variable costs, actual yield	1.83	2.25	6.39	3.55
Variable costs, normal yield	2.04	2.39	6.46	3.11
Costs and returns per acre:				
Value of production	1.68	1.95	5.97	2.04
Total variable costs	2.61	2.53	4.29	2.37
Seed	4.10	6.71	10.22	4.50
Fertilizer	22.58	17.22	16.05	12.63
Chemicals	3.77	5.99	6.12	3.72
Custom operations	27.39	20.15	28.34	14.44
Fuel, lube, and electricity	2.60	5.40	4.63	3.31
Repairs	2.75	2.55	3.08	1.72
Hired labor	17.55	13.47	19.23	12.72
Purchased irrigation water	72.96	56.76	100.74	52.03
Technical services	52.84	32.12	44.88	25.95
Returns above variable costs	1.71	2.60	45.96	3.78

Appendix table 2--Coefficients of variation of soybean variable costs and returns, by enterprise size, 1990

Item	Enterprise size (acres)				All FCRS farms
	Fewer than 50	50-199	200-399	400 or more	
	Percent				
Costs per bushel:					
Variable costs, actual yield	5.14	3.70	5.27	7.25	3.55
Variable costs, normal yield	4.34	3.37	4.17	6.39	3.11
Costs and returns per acre:					
Value of production	5.24	2.70	3.57	4.01	2.04
Total variable costs	3.63	3.48	3.35	4.53	2.37
Seed	6.77	5.93	6.07	10.09	4.50
Fertilizer	18.43	17.01	15.20	16.81	12.63
Chemicals	6.97	7.86	3.41	7.10	3.72
Custom operations	26.65	27.53	17.51	28.65	14.44
Fuel, lube, and electricity	18.06	6.86	4.67	5.19	3.31
Repairs	13.01	3.48	3.52	2.07	1.72
Hired labor	37.94	26.50	16.47	17.45	12.72
Purchased irrigation water	80.52	na	100.03	50.46	52.03
Technical services	56.78	44.47	47.35	36.69	25.95
Returns above variable costs	8.12	4.07	5.68	8.20	3.78

na = not applicable.

Appendix table 3--Coefficients of variation of soybean variable costs and returns, by region, 1990

Item	Region				All FCRS farms
	North Central	Southeast	Delta	Northern Plains	
	Percent				
Costs per bushel:					
Variable costs-actual yield	3.03	11.64	11.14	4.89	3.55
Variable costs-normal yield	2.75	10.23	8.77	3.87	3.11
Costs and returns per acre:					
Value of production	2.15	6.96	8.55	5.00	2.04
Total variable costs	2.50	6.25	6.00	4.93	2.37
Seed	6.01	7.43	6.51	6.61	4.50
Fertilizer	17.50	13.78	19.22	24.42	12.63
Chemicals	5.06	7.86	7.78	4.47	3.72
Custom operations	19.12	31.43	25.04	24.73	14.44
Fuel, lube, and electricity	3.57	3.92	7.16	10.38	3.31
Repairs	2.29	3.02	5.13	3.29	1.72
Hired labor	14.29	28.42	12.63	28.15	12.72
Purchased irrigation water	50.31	na	na	82.50	52.03
Technical services	31.76	59.11	61.07	60.93	25.95
Returns above variable costs	3.10	29.52	20.12	6.77	3.78

na = not applicable.

Appendix table 4--Characteristics of FCRS soybean farms, by cost group, 1990

Item	Unit	Cost group			All FCRS farms
		Low-cost producers	Mid-cost producers	High-cost producers	
Share of FCRS:					
Soybean farms	percent	25	50	25	100
Soybean production	percent	35	54	10	100
Soybean yield	actual bu/ac	43	33	18	33
Soybean yield	normal bu/ac	42	36	28	36
Size:					
Total operated acreage	acres	543	586	458	543
Planted soybean acreage	acres	175	173	121	160
Sales class¹—					
\$0-\$39,999	percent of farms	22	33	65	38
\$40,000-\$99,999	percent of farms	27	20	13	20
\$100,000-\$499,999	percent of farms	35	30	9	26
\$500,000 or more	percent of farms	17	17	13	16
Soybean production value	dollars	42,914	32,175	12,589	29,953
Farm production value	dollars	150,300	123,712	78,218	118,959
Soybean acreage tenure:^{1,2}					
Percent owned	percent of acreage	31	24	29	27
Percent cash rented	percent of acreage	31	28	45	32
Percent share rented	percent of acreage	38	47	25	40
Soybean production practices:					
Percent irrigated	percent of acreage	d	4	8	4
Percent dryland	percent of acreage	99	96	92	96
Percent double-cropped	percent of acreage	3	9	18	9
Previous crop on soybean acres:¹					
Corn	percent of farms	81	66	31	61
Soybeans	percent of farms	9	14	38	18
Wheat	percent of farms	4	8	5	6
Other	percent of farms	7	12	26	14
Financial position:¹					
Favorable	percent of farms	65	61	43	57
Marginal income	percent of farms	16	24	41	26
Marginal solvency	percent of farms	16	12	6	12
Vulnerable	percent of farms	3	3	10	4
Debt-to-asset	ratio	0.17	0.20	0.14	0.18
Production specialty:¹					
Cash grains	percent of farms	70	72	54	67
Other crops	percent of farms	d	5	25	10
Livestock	percent of farms	26	24	21	23
Major occupation:					
Farming	percent of farms	90	73	64	75
Other	percent of farms	10	27	36	25
Operator age:¹					
Fewer than 35 years	percent of farms	14	25	9	18
35-49 years	percent of farms	38	30	29	32
50-65 years	percent of farms	37	36	45	39
More than 65 years	percent of farms	10	9	17	11
Operator education:¹					
Less than high school	percent of farms	24	10	26	18
Completed high school	percent of farms	43	40	34	40
Some college	percent of farms	20	28	25	25
Completed college	percent of farms	13	22	15	18

¹Data may not add due to rounding.

²Insufficient data prohibit reporting acreage free rented. Percentages may not add to 100.

d = insufficient data for disclosure.

Appendix table 5--Input use of FCRS soybean farms, by cost group, 1990

Item	Unit	Cost group			All FCRS farms
		Low-cost producers	Mid-cost producers	High-cost producers	
Seed:					
Rate, total ¹	lbs/acre	61	64	57	62
Rate, one time	lbs/acre	60	62	55	60
Acres reseeded	percent	d	3	4	3
Homegrown seed	percent	19	25	23	23
Purchased seed	percent	81	75	77	77
Fertilizer use:					
Any fertilizer	percent of farms	19	39	65	40
Nitrogen	percent of farms	9	26	45	27
Phosphorus	percent of farms	14	35	61	36
Potassium	percent of farms	15	36	59	36
Fertilizer use:					
Nitrogen	lbs/acre	5	7	8	7
Phosphorus	lbs/acre	24	35	36	34
Potassium	lbs/acre	35	67	67	63
Chemical use:					
Any chemicals	percent of farms	96	95	91	94
Herbicides	percent of farms	96	93	90	93
Insecticides	percent of farms	0	3	8	4
Herbicide use	acre-treatments	1.62	1.51	1.88	1.61
Herbicide acre-treatments:²					
One ingredient	percent	77	71	72	73
Two ingredients	percent	19	20	19	19
Three or more ingredients	percent	4	10	9	8
Tillage system use:					
Conventional	percent of farms	73	60	91	71
Conservation	percent of farms	27	40	9	29
Tillage and planting	field passes	3.63	3.45	3.95	3.62
Tillage and planting	hours per acre	0.52	0.53	0.83	0.60
Soil surface covered	percent	23	27	12	22
Custom operations use:					
Any custom operations	percent of farms	33	37	37	36
Land prep/cultivation	percent of farms	d	d	d	1
Planting	percent of farms	d	9	4	6
Fert/chem application	percent of farms	24	17	13	18
Technical services	percent of farms	4	4	d	4
Harvesting	percent of farms	11	25	33	24

¹Total seeding rate includes reseeded.

²Data may not add due to rounding.

d = insufficient data for disclosure.

Appendix table 6--Characteristics of FCRS soybean farms, by enterprise size, 1990

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-399	400 or more	
Share of FCRS:						
Soybean farms	percent	31	42	16	10	100
Soybean production	percent	5	27	30	39	100
Soybean yield	actual bu/ac	32	32	35	32	33
Soybean yield	normal bu/ac	35	36	38	36	36
Size:						
Total operated acreage	acres	190	462	800	1,519	543
Planted soybean acreage	acres	27	105	271	605	160
Sales class:¹—						
\$0-\$39,999	percent of farms	79	30	5	d	38
\$40,000-\$99,999	percent of farms	16	29	14	d	20
\$100,000-\$499,999	percent of farms	4	27	63	30	26
\$500,000 or more	percent of farms	d	13	18	67	16
Soybean production value	dollars	4,109	19,259	54,380	111,427	29,953
Farm production value	dollars	31,693	101,897	194,683	328,367	118,959
Soybean acreage tenure:^{1,2}						
Percent owned	percent of acreage	67	30	27	19	27
Percent cash rented	percent of acreage	15	33	34	32	32
Percent share rented	percent of acreage	16	35	39	49	40
Soybean production practices:						
Percent irrigated	percent of acreage	6	3	3	4	4
Percent dryland	percent of acreage	94	97	97	96	96
Percent double-cropped	percent of acreage	3	6	8	13	9
Previous crop on soybean acres:¹						
Corn	percent of farms	58	59	67	69	61
Soybeans	percent of farms	20	19	17	15	18
Wheat	percent of farms	4	8	5	9	6
Other	percent of farms	17	15	11	8	14
Financial position:¹						
Favorable	percent of farms	47	67	59	48	57
Marginal income	percent of farms	46	20	16	14	26
Marginal solvency	percent of farms	3	9	20	33	12
Vulnerable	percent of farms	4	4	6	4	4
Debt-to-asset	ratio	0.11	0.15	0.22	0.23	0.18
Production specialty:¹						
Cash grains	percent of farms	65	64	70	78	67
Other crops	percent of farms	12	10	4	13	10
Livestock	percent of farms	23	27	26	9	23
Major occupation:						
Farming	percent of farms	49	81	95	96	75
Other	percent of farms	51	19	5	4	25
Operator age:¹						
Fewer than 35 years	percent of farms	8	22	21	30	18
35-49 years	percent of farms	26	30	45	37	32
50-65 years	percent of farms	50	36	29	26	39
More than 65 years	percent of farms	16	12	5	7	11
Operator education:¹						
Less than high school	percent of farms	31	13	13	4	18
Completed high school	percent of farms	30	40	51	41	39
Some college	percent of farms	14	34	25	30	25
Completed college	percent of farms	25	13	11	25	18

¹Data may not add due to rounding.

²Insufficient data prohibit reporting acreage free rented. Percentages may not add to 100.

d = insufficient data for disclosure.

Appendix table 7--Input use of FCRS soybean farms, by enterprise size, 1990

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-399	400 or more	
Seed:						
Rate, total ¹	lbs/ac	62	61	67	58	62
Rate, one time	lbs/ac	60	59	65	57	60
Acres reseeded	percent	2	3	4	2	3
Homegrown seed	percent	13	13	20	34	23
Purchased seed	percent	87	87	80	66	77
Fertilizer use:						
Any fertilizer	percent of farms	43	37	34	58	40
Nitrogen	percent of farms	35	26	19	18	27
Phosphorus	percent of farms	40	32	29	54	36
Potassium	percent of farms	40	31	32	56	36
Fertilizer use:						
Nitrogen	lbs/acre	11	10	7	6	7
Phosphorus	lbs/acre	33	30	27	39	34
Potassium	lbs/acre	47	48	46	78	63
Chemical use:						
Any chemicals	percent of farms	90	95	99	99	94
Herbicides	percent of farms	89	93	99	99	93
Insecticides	percent of farms	4	4	3	3	4
Herbicide	acre-treatments	1.41	1.35	1.69	1.76	1.61
Herbicide acre-treatments:²						
One ingredient	percent	79	69	72	71	73
Two ingredients	percent	16	19	24	16	19
Three or more ingredients	percent	4	12	3	13	8
Tillage system use:						
Conventional	percent of farms	69	71	77	69	71
Conservation	percent of farms	31	29	23	31	29
Tillage and planting	field passes	3.68	3.52	3.79	3.61	3.62
Tillage and planting	hours per acre	0.79	0.55	0.49	0.41	0.60
Soil surface covered	percent	20	23	21	27	22
Custom operations use:						
Any custom operations	percent of farms	47	31	38	18	36
Land prep/cultivation	percent of farms	d	d	d	d	1
Planting	percent of farms	15	2	3	d	6
Fert/chem application	percent of farms	16	17	30	9	18
Technical services	percent of farms	2	2	8	6	4
Harvesting	percent of farms	41	22	5	4	23

¹Total seeding rate includes reseeded.

²Data may not add due to rounding.

d = insufficient data for disclosure.

Appendix table 8--Characteristics of FCRS soybean farms, by region, 1990

Item	Unit	Region				All FCRS farms
		North Central	Southeast	Delta	Northern Plains	
Share of FCRS:						
Soybean farms	percent	66	16	5	14	100
Soybean production	percent	74	9	7	9	100
Soybean yield	actual bu/ac	38	22	24	29	33
Soybean yield	normal bu/ac	40	30	28	32	36
Size:						
Total operated acreage	acres	502	528	698	708	543
Planted soybean acreage	acres	159	144	322	127	160
Sales class¹—						
\$0-\$39,999	percent of farms	36	59	36	24	38
\$40,000-\$99,999	percent of farms	19	13	14	33	20
\$100,000-\$499,999	percent of farms	29	14	30	26	26
\$500,000 or more	percent of farms	16	13	20	16	16
Soybean production value	dollars	33,632	18,185	44,840	20,292	29,953
Farm production value	dollars	118,590	92,973	162,748	135,093	118,959
Soybean acreage tenure:^{1,2}						
Percent owned	percent of acreage	27	28	16	33	27
Percent cash rented	percent of acreage	29	49	37	25	32
Percent share rented	percent of acreage	44	21	46	42	40
Production practices:						
Percent irrigated	percent of acreage	d	d	15	16	4
Percent dryland	percent of acreage	99	99	85	84	96
Percent double-cropped	percent of acreage	5	23	22	6	9
Previous crop on soybean acres:¹						
Corn	percent of farms	74	34	d	51	61
Soybeans	percent of farms	11	39	79	10	18
Wheat	percent of farms	3	4	3	25	6
Other	percent of farms	12	24	18	14	14
Financial position:¹						
Favorable	percent of farms	59	44	57	65	57
Marginal income	percent of farms	24	43	20	20	26
Marginal solvency	percent of farms	13	6	7	13	12
Vulnerable	percent of farms	4	7	16	2	4
Debt-to-asset	ratio	0.20	0.09	0.18	0.18	0.18
Production specialty:¹						
Cash grains	percent of farms	74	44	75	58	67
Other crops	percent of farms	5	34	23	d	10
Livestock	percent of farms	22	22	d	41	23
Major occupation:						
Farming	percent of farms	75	71	77	82	75
Other	percent of farms	25	29	23	18	25
Operator age:¹						
Fewer than 35 years	percent of farms	19	8	18	25	18
35-49 years	percent of farms	32	26	57	30	32
50-65 years	percent of farms	40	42	16	35	39
More than 65 years	percent of farms	9	24	9	10	11
Operator education:¹						
Less than high school	percent of farms	15	34	20	9	18
Completed high school	percent of farms	41	38	33	31	39
Some college	percent of farms	23	16	34	45	25
Completed college	percent of farms	20	12	14	14	18

¹Data may not add due to rounding.

²Insufficient data prohibit reporting acreage free rented. Percentages may not add to 100.

d = insufficient data for disclosure.

Appendix table 9--Input use of FCRS soybean farms, by region, 1990

Item	Unit	Region				All FCRS farms
		North Central	Southeast	Delta	Northern Plains	
Seed:						
Rate, total ¹	lbs/acre	64	53	60	63	62
Rate, one time	lbs/acre	62	52	56	61	60
Acres reseeded	percent	3	2	7	2	3
Homegrown seed	percent	22	26	17	31	23
Purchased seed	percent	78	74	83	69	77
Fertilizer use:						
Any fertilizer	percent of farms	35	81	34	22	40
Nitrogen	percent of farms	22	55	18	18	27
Phosphorus	percent of farms	30	76	32	20	36
Potassium	percent of farms	34	74	33	8	36
Fertilizer use:						
Nitrogen	lbs/acre	7	6	9	14	7
Phosphorus	lbs/acre	35	35	32	24	34
Potassium	lbs/acre	68	67	47	7	63
Chemical use:						
Any chemicals	percent of farms	98	84	95	90	94
Herbicides	percent of farms	96	81	95	90	93
Insecticides	percent of farms	d	11	10	d	4
Herbicide use	acre-treatments	1.52	1.88	2.15	1.27	1.61
Herbicide acre-treatments:²						
One ingredient	percent	71	81	75	73	73
Two ingredients	percent	19	14	19	24	19
Three or more ingredients	percent	10	4	5	2	8
Tillage system use:						
Conventional	percent of farms	66	92	97	60	71
Conservation	percent of farms	34	8	d	40	29
Tillage and planting	field passes	3.47	3.93	4.75	3.58	3.62
Tillage and planting	hours per acre	0.54	0.93	0.66	0.51	0.60
Soil surface covered	percent	25	12	5	27	22
Custom operations use:						
Any custom operations	percent of farms	38	32	37	28	36
Land prep/cultivation	percent of farms	d	d	d	d	1
Planting	percent of farms	7	3	d	4	6
Fert/chem application	percent of farms	21	8	23	13	18
Technical services	percent of farms	4	d	3	6	4
Harvesting	percent of farms	25	23	23	16	23

¹Total seeding rate includes reseeded.

²Data may not add due to rounding.

d = insufficient data for disclosure.

Appendix 2: About the Accounting System

The accounting of costs and returns follows the Economic Research Service methods and format. The methods and format have been developed over time with input from the National Agricultural Cost of Production Standards Review Board, which was established under the Agricultural and Food Act of 1981. This format was revised in the early 1980's after reviews by commodity groups, land-grant university economists, and individual farmers (USDA, ERS, 1992b).

The costs and returns presented in this report are the same as those published for 1990 in the *Economic Indicators of the Farm Sector* series published by USDA's Economic Research Service (ERS). A relatively new system to estimate commodity costs and returns, called the Farm-Level Budget Model (FLBM), was implemented for soybeans in 1990. The FLBM replaces a version of the Firm Enterprise Data System (FEDS) previously used to estimate costs and returns. Under the FLBM, the costs and returns are calculated for each farm, then farms are weighted to provide State, regional, and national estimates. Under the FEDS, cost and return estimates were calculated as if all production for a commodity were produced on a single average acre in the State. The FLBM allows for the distributional analysis presented in this report, but the FEDS does not.

There are three underlying characteristics of the ERS estimates of crop costs and returns that distinguish them from other cost accounting systems:

Government programs. ERS estimates exclude the direct effects of Government programs where possible. Thus, policymakers may be informed as

to production costs and returns in the absence of programs. Participants in an income-support program must set aside or conserve a portion of their acreage that would have been planted to a particular crop. In return, participants receive direct Government payments based on production of the crop on the remaining acreage. Participants may also be required to incur costs by maintaining a cover crop or by controlling weeds on set-aside acreage. ERS does not include either of these costs or direct payments for participating in the Government commodity-based income-support programs. For further discussion of the effects on commodity costs and returns of including the effects of Government programs, see Salassi, 1990.

Combined operation-landlord costs and returns. The estimates of costs and returns are for the farm operation and landlord combined, as if they were one business. Thus, each line item is for both the farm operation and landlord. The combined operation-landlord account also means that estimates of cash expenses do not include an expense for cash- and share-rent expenses paid by the farm operation to the landlord. A rental expense to the farm business is exactly canceled as an income to the landlord.

Separation of production and marketing costs. To separate the costs of production from the costs of marketing, the production costs are incurred to the point of first sale, or storage if the commodity is not sold immediately after harvest. Costs of drying and costs of hauling the crop to the elevator or processor are included. Because storage costs are excluded, the commodity is valued at its time of harvest.

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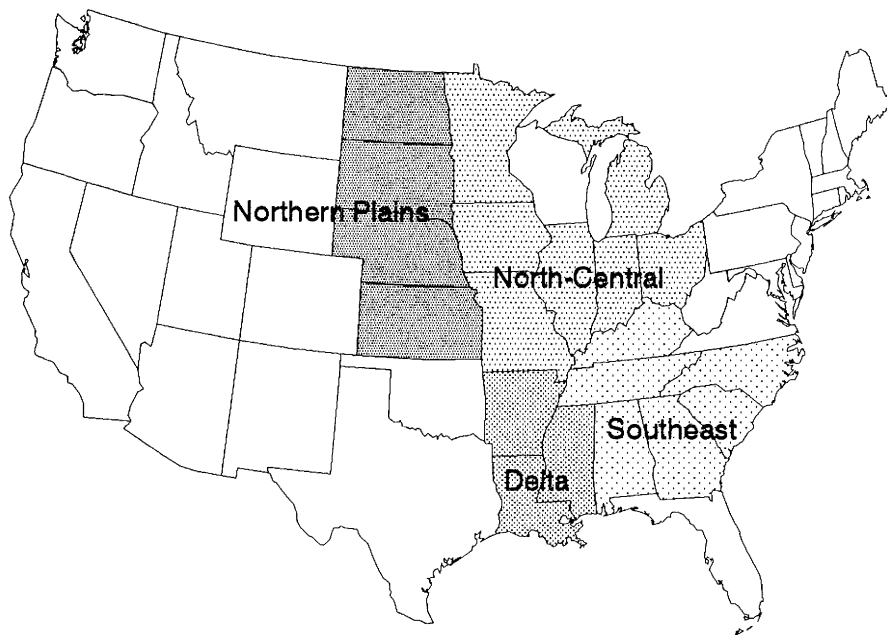
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Figure 5

Major U.S. soybean production regions, 1990



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