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Characteristics and Production Costs of U.S. Grain Sorghum Farms, 1990

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Farm Costs & Returns Survey

In this report... *Producing a bushel of grain sorghum cost U.S. farmers an average of $1.26 in variable cash expenses in 1990. Individual farm costs ranged from under $1 to more than $5 per bushel. Yields, production practices, and regional differences among growers influenced production costs. Sorghum growers in the Central Plains had a significant cost advantage over producers in the Southern Plains. Central Plains producers obtained higher yields at a lower cost, despite irrigating less of their sorghum acreage.*

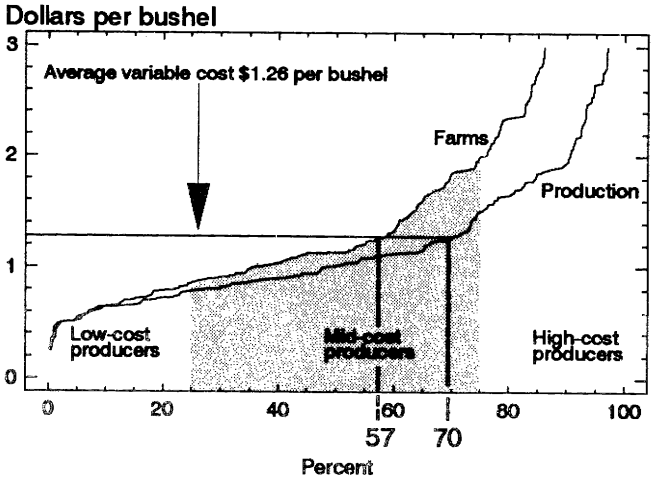
U.S. farmers produced 573 million bushels of grain sorghum on about 9.1 million acres in 1990 (USDA, NASS, 1991). Sorghum production was centered in the Central and Southern Plains, with Kansas, Nebraska, and Texas accounting for more than 75 percent of the 1990 harvest. Sorghum is popular in these areas because it resists drought better than crops such as wheat and corn. During the 1989-90 marketing year, 835 million bushels of sorghum were used, including grain carried over from previous marketing years (USDA, ERS, Feb. 1992). Of the 532 million bushels used domestically, 97 percent was used for livestock feed. About a third of U.S. grain sorghum was exported. U.S. sorghum exports have accounted for 70 percent or more of total world sorghum exports in the 1990's. Japan and Mexico are among the most important customers for U.S. sorghum.

This report compares selected farm characteristics and production costs among grain sorghum producers. Producers are grouped on the basis of variable cash expenses for sorghum production, production region, and enterprise size. Data are from the grain sorghum version of the 1990 Farm Costs and Returns Survey (FCRS). Producers surveyed represented about half of all U.S. grain sorghum acreage and production (USDA, NASS, 1991). Southeastern sorghum producers were not surveyed because of their relatively small contribution to total sorghum production and limited survey funds. Nonresponse and survey design limitations further limit coverage of all U.S. sorghum farms.

The average variable cost of producing grain sorghum on FCRS farms was $71.30 per acre, or $1.26 per bushel, in 1990. Thirty-six percent of farms had variable costs of $1 or less per bushel and accounted for nearly half of the total 1990 grain sorghum harvest. Estimated variable costs were converted to a per-bushel basis and ranked from lowest to highest to form a cumulative distribution of farms and production (fig. 1). Sorghum farms were divided into three groups, according to their level of variable cash expenses. The low-cost group was the 25 percent of farms with the lowest variable costs, and the high-cost group was the 25 percent with the highest variable costs. The remaining farms were in the mid-cost group.

Figure 1
Cumulative distribution of sorghum variable production costs, 1990

About 57 percent of FCRS sorghum farms had variable cash costs at or below the average cost of $1.26 per bushel, while about 70 percent of the total grain sorghum harvest was produced at or below the average variable cost.



Source: 1990 Farm Costs and Returns Survey

Costs Varied Greatly Among Sorghum Producers

Differences in per-acre costs and yields separated low- and high-cost producers. High-cost producers were concentrated in the Southern Plains.

Twenty-five percent of sorghum farms surveyed had variable costs of 86 cents or less per bushel and produced 33 percent of the total sorghum harvest. High-cost producers, with variable costs of $2 or more per bushel, produced 10 percent of the sorghum harvest.

Yields and per-acre costs determined whether farms were in the high- or low-cost groups. High-cost producers had both lower yields and higher variable costs per acre. Low-cost producers had an average yield of 83 bushels of sorghum per acre, compared with 23 bushels per acre for high-cost producers (table 1).[1] More than a fourth of the sorghum acreage planted for grain on high-cost farms was either abandoned or harvested as forage. Variable costs per acre averaged $18 less on low-cost farms than on high-cost operations (table 2). Normal yield indicates the yield expected by farmers, based on their knowledge of past yields and levels of input use. Differences between actual and normal yield result, to a large extent, from uncontrollable factors, such as weather. Low-cost producers achieved near-normal yields, but high-cost producers had yields less than half of the average normal yield (23 versus 54 bushels per acre). Despite spending more on variable inputs, high-cost producers expected 23 bushels per acre less than low-cost producers, suggesting that even with normal growing conditions, producers in the high-cost group are at a cost disadvantage relative to low-cost producers.

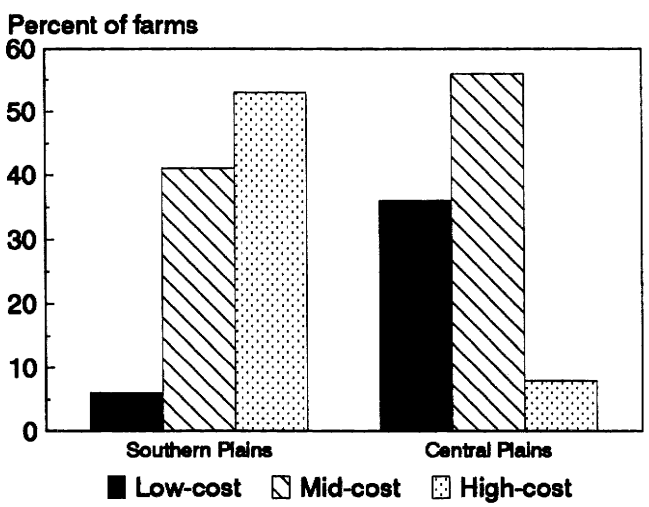
The influence of yield is apparent in the portions of total sorghum production coming from each of the cost groups. Although the same percentage of farms appeared in the high- and low-cost categories, low-cost operations produced a third of all sorghum, more than three times the sorghum produced on high-cost operations. Differences in average sorghum acreage planted on low- and high-cost operations did not explain the disproportionate amount of sorghum produced by low-cost operations. Low-cost operations averaged 132 acres of sorghum, compared with 138 acres for high-cost operations, indicating that size had little effect on whether producers were low- or high-cost.

More than half of sorghum operations in the Southern Plains were in the high-cost group, compared with 8 percent in the Central Plains (fig. 2). The Southern Plains had 38 percent of total FCRS sorghum farms, but contained 80 percent of high-cost operations.

High-cost producers spent about $18 more per acre than low-cost producers, with most of the difference resulting from higher fuel and labor costs (table 2). High-cost producers irrigated 15 percent of their sorghum acreage, low-cost producers only 2 percent. On farms with irrigation, hired laborers often move pipes or sprinklers, prepare ditches, and watch fields to ensure that they are watered evenly. Fuel and lubrication costs for irrigation pumps can be substantial. Such added expenses may have contributed to greater fuel and labor costs on high-cost farms. Also, more preplant tillage operations were used by high-cost producers (3.32 versus 4.42 times over). Custom operations costs were greater on high-cost operations, primarily due to more farms using custom harvesting.

Figure 2
Distribution of cost groups by region, 1990

More than half of sorghum operations in the Southern Plains were in the high-cost group, compared with 8 percent in the Central Plains.



Source: 1990 Farm Costs and Returns Survey

[1]Group 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 3).

Table 1--Characteristics of FCRS sorghum farms, by variable cost group, 1990
Low-cost producers accounted for 33 percent of the sorghum production and yielded 83 bushels per acre. High-cost producers accounted for 10 percent of production and yielded 23 bushels per acre.

Item	Unit	Cost group			All FCRS farms
		Low-cost producers	Mid-cost producers	High-cost producers	
Share of FCRS:					
Sorghum farms	percent	25	50	25	100
Sorghum production	percent	33	57	10	100
Sorghum yield	actual bu/ac	83	61	23	57
Sorghum yield	normal bu/ac	77	71	54	68
Size:					
Total operated acreage	acres	853	1,063	896	969
Planted sorghum acreage	acres	132	153	138	144
Acres harvested for grain	percent	100	98	74	93
Regions:					
Central Plains	percent of farms	90	69	20	62
Southern Plains	percent of farms	10	31	80	38
Sorghum production practices:					
Percent irrigated	percent of acreage	2	21	15	15
Percent dryland	percent of acreage	98	79	85	85
Previous crop on sorghum acres:					
Sorghum	percent of farms	26	37	53	38
Soybeans	percent of farms	30	19	3	18
Wheat	percent of farms	32	27	12	24
Field operations:					
Preplant tillage	times over	3.32	3.73	4.42	3.79
Postplant tillage	times over	0.7	0.53	0.69	0.61
Custom operations use:					
Any custom operations	percent of farms	16	36	39	32
Harvesting	percent of farms	7	21	26	19

Table 2--Sorghum variable production costs and returns per acre, by variable cost group, 1990
Variable costs per acre averaged $18 less on low-cost farms than on high-cost farms.

Item	Cost group			All FCRS farms
	Low-cost producers	Mid-cost producers	High-cost producers	
		Dollars		
Costs per bushel:				
Variable costs, actual yield	0.67	1.25	3.27	1.26
Variable costs, normal yield	0.72	1.09	1.35	1.05
Costs and returns per acre:				
Value of production[1]	164.10	128.01	50.26	117.29
Total variable costs	55.80	76.87	73.53	71.30
Seed	4.99	5.39	5.92	5.43
Fertilizer	15.83	19.32	15.94	17.71
Chemicals	9.91	10.93	8.48	10.11
Custom operations	2.07	5.09	4.59	4.29
Fuel, lube, and electricity	9.61	16.09	16.73	14.78
Repairs	10.22	11.16	11.74	11.09
Hired labor	3.17	8.35	9.45	7.45
Purchased irrigation water	0.00	0.48	0.57	0.39
Technical services	0.01	0.06	0.10	0.06
Returns above variable costs	108.30	51.13	-23.27	46.00

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

Effects of Enterprise Size on Production Costs

Enterprise size had little effect on per-acre production costs for operations with fewer than 500 sorghum acres, but costs were higher for farms with more acres.

Twenty-eight percent of sorghum farms had fewer than 50 sorghum acres, but produced only 4 percent of the 1990 harvest (table 3). Four percent of surveyed farms had 500 or more acres of sorghum and accounted for 19 percent of production. The majority of producers in the smallest category (fewer than 50 acres) and largest category (500 or more acres) were in the Southern Plains. Central Plains producers were predominant in the two mid-size groups.

As sorghum acreage increased, farm size increased and sorghum made up an increasing percentage of acreage. Farms with fewer than 50 acres of sorghum had an average size of 400 acres and devoted about 7 percent of their acreage to sorghum. Farmers planted sorghum on 25 percent of the average 2,991 acres operated on farms that grew 500 or more acres of sorghum. Large sorghum acreage does not imply that a large portion of farm value of production will come from sorghum. The value of sorghum production used for feed is captured in the value of livestock production and not attributed to the sorghum enterprise. Nonetheless, on farms with 200 or more acres of sorghum, 23 percent of value of production came from sorghum, compared with less than 10 percent on farms with fewer than 200 sorghum acres.

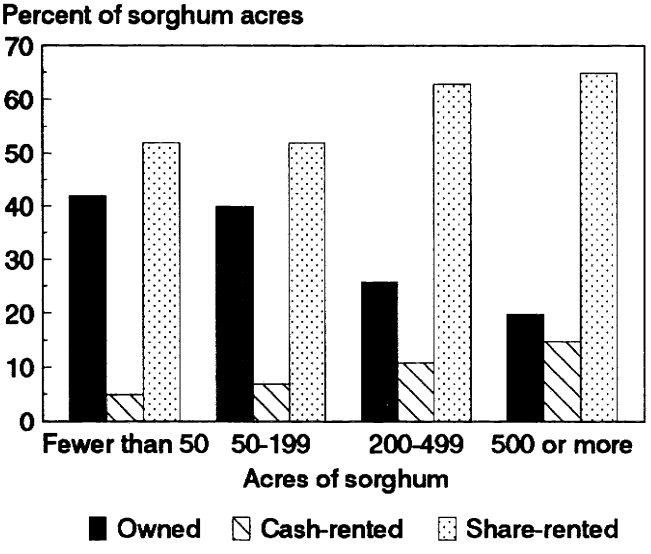
Farmers must often rent land to obtain an operation large enough to make a living and to justify the large investment needed for farm equipment. Among large sorghum farms, only 20 percent of sorghum acreage was owned by the operator, compared with more than 40 percent on farms with the smallest sorghum acres (fig. 3). All sizes of operations acquired more than half of their sorghum acreage through share-leasing arrangements. Under share leases, landowners receive a portion of the crop, often pay for part of operating expenses, and may participate in management decisions.

Yields were lowest for the smallest and largest sorghum farms, the result of the regional distribution of these groups. Per-bushel costs were highest on the smallest and largest farms. However, per-acre costs were lowest on the smallest farms and highest on the largest farms, reflecting the differences in production practices and input use among farms in these size groups.

Fuel and labor expenses per acre of sorghum increased as the number of sorghum acres planted increased. Operations with the largest sorghum acreage averaged $18 per acre in fuel expense; those in the smallest size group averaged $10 per acre (table 4). Labor expenses per acre on the farms with the most sorghum acreage were six times as high as labor expenses on farms with the least sorghum acres. Increased use of irrigation on larger farms likely explained some of their higher expense for labor and fuel. Farms with 500 or more acres of sorghum irrigated almost a fourth of their sorghum, compared with 8 percent for the smallest farms. The largest farms also used more preplant tillage operations, 5.05 times over, compared with 3.31 times over on the smallest farms. Fewer of the smallest farms used chemical herbicides and insecticides, resulting in a $2-3 savings per acre in chemical costs over the other size groups.

Figure 3
Distribution of land tenure by size groups, 1990

Operators owned more than 40 percent of sorghum acreage on farms with fewer than 50 acres, versus 20 percent on farms with more than 500 acres of sorghum.



Source: 1990 Farm Costs and Returns Survey

Table 3--Characteristics of FCRS sorghum farms, by enterprise size, 1990
Twenty-three percent of farms had 200 or more sorghum acres and accounted for about 60 percent of the 1990 harvest.

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-499	500 or more	
Share of FCRS:						
Sorghum farms	percent	28	49	19	4	100
Sorghum production	percent	4	36	41	19	100
Sorghum yield	actual bu/ac	45	65	57	47	57
Sorghum yield	normal bu/ac	66	68	67	70	68
Size:						
Total operated acreage	acres	400	906	1,501	2,991	969
Planted sorghum acreage	acres	27	92	313	748	144
Acreage harvested for grain	percent	84	97	92	90	93
Regions:						
Central Plains	percent of farms	46	73	62	32	62
Southern Plains	percent of farms	54	27	38	68	38
Sorghum production practices:						
Irrigated acres	percent of acres	8	12	13	23	15
Dryland acres	percent of acres	92	88	87	77	85
Production specialty:						
Cash grains	percent of farms	47	67	69	71	62
Livestock	percent of farms	42	24	16	8	27
Chemical use:						
Any chemicals	percent of farms	49	87	89	92	77
Herbicides	percent of farms	49	83	84	84	74
Insecticides	percent of farms	5	11	23	46	13
Field operations:						
Preplant tillage	times over	3.31	3.05	3.74	5.05	3.79
Postplant tillage	times over	0.32	0.62	0.60	0.67	0.61

Table 4--Sorghum variable production costs and returns per acre, by enterprise size, 1990
Labor expenses per acre on farms with 500 or more sorghum acres were six times as high as labor expenses on farms with fewer than 50 acres.

Item	Enterprise size (acres)				All FCRS farms
	Fewer than 50	50-199	200-499	500 or more	
			Dollars		
Costs per bushel:					
Variable costs, actual yield	1.37	1.06	1.20	1.73	1.26
Variable costs, normal yield	.93	1.01	1.03	1.15	1.05
Costs and returns per acre:					
Value of production[1]	92.41	131.55	117.00	103.71	17.29
Total variable costs	61.21	69.09	69.14	80.38	71.30
Seed	6.87	6.05	4.86	5.24	5.43
Fertilizer	20.59	18.33	17.32	16.91	17.71
Chemicals	7.65	9.77	10.22	10.91	10.11
Custom operations	4.88	5.32	3.80	3.57	4.29
Fuel, lube, and electricity	10.48	13.01	14.64	18.43	14.78
Repairs	8.69	10.16	11.32	12.49	11.09
Hired labor	1.99	6.24	6.45	12.08	7.45
Purchased irrigation water	0.00	0.20	0.45	0.65	0.39
Technical services	0.06	0.01	0.07	0.10	0.06
Returns above variable costs	31.20	62.46	47.86	23.34	46.00

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

Central Plains Growers Dominated 1990 Sorghum Production

Central Plains growers produced two-thirds of the 1990 sorghum crop and had a significant cost advantage over Southern Plains producers.

About 62 percent of FCRS sorghum farms were located in the Central Plains, and they accounted for 66 percent of total production (table 5). The 38 percent of farms in the Southern Plains accounted for only 34 percent of production. According to U.S. crop production estimates in the States comprising each region, the sorghum version of the FCRS represented 56 and 49 percent, respectively, of Southern and Central Plains sorghum production in 1990 (USDA, NASS, 1991).

More than 40 percent of farm operations in the Southern Plains had sales less than $40,000. Nearly three-fourths of farm operations producing sorghum in the Central Plains had sales between $40,000 and $500,000. However, the Southern Plains had a higher proportion of sorghum farms with sales of $500,000 or more.

Southern Plains sorghum farms had below-normal sorghum yields in 1990, producing just 70 percent of the crop expected in a normal year. The poor crop forced growers to abandon 14 of every 100 acres intended to be harvested for grain. Central Plains sorghum producers had a much better year; yields were 92 percent of normal, and growers abandoned only 3 of every 100 acres intended for grain sorghum.

Central Plains sorghum growers had a significant cost advantage over producers in the Southern Plains (table 6). Per-acre variable costs were about $14 lower on Central Plains farms. Higher per-acre costs and poor yields in the Southern Plains caused per-bushel costs to be 74 cents higher than in the Central Plains, and about 50 cents above normal. Cost per bushel of normal yield was also higher in the Southern Plains ($1.22 versus $0.93). While per-bushel costs were well above normal in the Southern Plains during 1990, relative expected yields and per-acre costs suggest that these growers typically have higher costs than in the Central Plains.

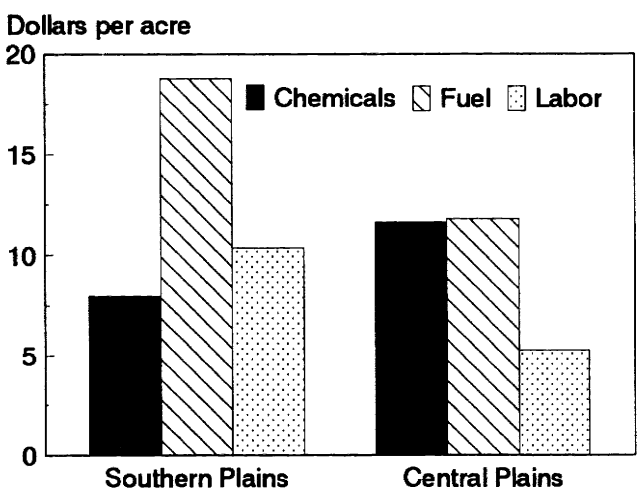
Higher per-acre costs in the Southern Plains resulted from greater fuel and labor costs (fig. 4). Growers spent about $7 per acre more for fuel and $5 per acre more for labor than in the Central Plains. More irrigated acreage (25 versus 8 percent) and more tillage operations contributed to the higher costs. Also, more Southern Plains producers had a major occupation other than farming. With average farm acreage nearly the same in each region, Southern Plains growers may have had less time to devote to farm production activities and had to hire more labor. Chemical costs were higher in the Central Plains, the result of more herbicide use. About 90 percent of Central Plains producers applied chemicals to sorghum acres, compared with 56 percent in the Southern Plains.

Sorghum producers in the Central Plains were generally younger than those in the Southern Plains. About 55 percent of farm operators in the Central Plains were less than 50 years of age. In the Southern Plains, 67 percent of operators were 50 or more years old.

In both the Central and Southern Plains, sorghum was most commonly planted on land that had been used to grow sorghum in the previous year. Wheat was the second most common crop to precede sorghum in both regions. Central Plains farmers used land previously planted to soybeans for a quarter of their 1990 sorghum acreage.

Figure 4
Chemical, fuel, and labor expenses by region, 1990

Lower chemical costs in the Southern Plains only partially offset higher fuel and labor costs.



Source: 1990 Farm Costs and Returns Survey

Table 5--Characteristics of FCRS sorghum farms, by region, 1990
Despite irrigating three times as much sorghum acreage, producers in the Southern Plains yielded nearly 20 bushels per acre below Central Plains producers.

Item	Unit	Region		All FCRS farms
		Central Plains	Southern Plains	
Share of FCRS:				
Sorghum farms	percent	62	38	100
Sorghum production	percent	66	34	100
Sorghum yield	actual bu/ac	65	46	57
Sorghum yield	normal bu/ac	70	65	68
Size:				
Total operated acreage	acres	990	934	969
Planted sorghum acreage	acres	133	161	144
Acres harvested for grain	percent of acres	97	86	93
Sales class--[1]				
$0-$39,999	percent of farms	18	43	28
$40,000-$99,999	percent of farms	41	18	32
$100,000-$499,999	percent of farms	31	24	29
$500,000 or more	percent of farms	10	15	12
Sorghum production practices:				
Irrigated acres	percent of acres	8	25	15
Dryland acres	percent of acres	92	75	85
Major occupation:				
Farming	percent of farms	90	74	84
Other	percent of farms	10	26	16
Chemical use:				
Any chemicals	percent of farms	90	56	77
Herbicides	percent of farms	89	50	74
Insecticides	percent of farms	11	17	13
Field operations:				
Preplant tillage	times over	3.08	4.79	3.79
Postplant tillage	times over	0.49	0.77	0.61

[1]Data may not add due to rounding.

Table 6--Sorghum variable production costs and returns per acre, by region, 1990
Southern Plains growers spent about $15 more per acre to produce sorghum than growers in the Central Plains.

Item	Region		All FCRS farms
	Central Plains	Southern Plains	
		Dollars	
Costs per bushel:			
Variable costs, actual yield	1.00	1.74	1.26
Variable costs, normal yield	.93	1.22	1.05
Costs and returns per acre:			
Value of production[1]	125.58	106.11	117.29
Total variable costs	65.19	79.55	71.30
Seed	5.05	5.93	5.43
Fertilizer	17.47	18.05	17.71
Chemicals	11.67	7.99	10.11
Custom operations	3.10	5.89	4.29
Fuel, lube, and electricity	11.83	18.77	14.78
Repairs	10.71	11.60	11.09
Hired labor	5.27	10.38	7.45
Purchased irrigation water	0.01	0.90	0.39
Technical services	0.08	0.04	0.06
Returns above variable costs	60.40	26.56	46.00

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

Glossary

Sorghum farms are farm operations that planted sorghum in 1990 with the intent of harvesting grain. Information about sorghum farms in this report came from the 1990 Farm Costs and Returns Survey, Sorghum Cost of Production version.

Sorghum production regions are groups of States with common cultural practices in raising sorghum. The Central Plains includes South Dakota, Nebraska, Iowa, Colorado, Kansas, Missouri, and Illinois. The Southern Plains includes New Mexico, Texas, Oklahoma, and Arkansas.

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

Low-cost producers are the 25 percent of U.S. sorghum producers with the lowest per-bushel total variable costs. Those producers had per-bushel variable costs of 86 cents or less.

High-cost producers are the 25 percent of U.S. sorghum producers with the highest per-bushel total variable costs. Those producers had per-bushel variable costs of $2 or more.

Enterprise size categories are specified as farms with under 50 sorghum acres, 50-199 acres, 200-499 acres, and 500 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 commodities produced and used on the farm, 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 (sales 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 sorghum on their operation.

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Appendix table 1--Characteristics of FCRS sorghum farms, by cost group, 1990

Item	Unit	Cost group			All FCRS farms
		Low-cost producers	Mid-cost producers	High-cost producers	
Share of FCRS:					
Sorghum farms	percent	25	50	25	100
Sorghum production	percent	33	57	10	100
Sorghum yield	actual bu/acre	83	61	23	57
Sorghum yield	normal bu/acre	77	71	54	68
Size:					
Total operated acres	acres	853	1,063	896	969
Planted sorghum acres	acres	132	153	138	144
Acres harvested for grain	percent of acres	100	98	74	93
Sales class--[1]					
$0-$39,999	percent of farms	29	14	53	28
$40,000-$99,999	percent of farms	d	39	20	32
$100,000-$499,999	percent of farms	33	32	18	29
$500,000 or more	percent of farms	d	14	9	12
Sorghum production value	dollars	18,682	17,735	6,307	15,081
Farm production value	dollars	114,068	138,660	69,299	115,056
Region:					
Central Plains	percent of farms	90	69	20	62
Southern Plains	percent of farms	10	31	80	38
Sorghum acreage tenure:[1]					
Owned	percent of acres	40	24	35	30
Cash-rented	percent of acres	6	10	16	10
Share-rented	percent of acres	55	66	49	59
Sorghum production practices:					
Irrigated	percent of acres	2	21	15	15
Dryland	percent of acres	98	79	85	85
Fallowed	percent of acres	5	11	11	10
Previous crop on sorghum acres:[1]					
Sorghum	percent of farms	26	37	53	38
Soybeans	percent of farms	30	19	3	18
Wheat	percent of farms	32	27	12	24
Financial position:[1]					
Favorable	percent of farms	71	68	55	65
Marginal income	percent of farms	9	13	23	15
Marginal solvency	percent of farms	18	14	5	13
Vulnerable	percent of farms	3	5	17	7
Production specialty:[1]					
Cash grains	percent of farms	70	69	40	62
Other crops	percent of farms	d	10	22	11
Livestock	percent of farms	d	21	37	27
Major occupation:					
Farming	percent of farms	92	90	65	84
Other	percent of farms	8	10	35	16
Operator age:[1]					
Under 35 years	percent of farms	16	11	5	11
35-49 years	percent of farms	32	49	15	36
50-65 years	percent of farms	32	31	54	37
More than 65 years	percent of farms	20	9	26	16
Operator education:[1]					
Less than high school	percent of farms	25	12	26	19
Completed high school	percent of farms	44	37	45	40
Some college	percent of farms	18	19	9	16
Completed college	percent of farms	13	32	21	25

[1]Data may not add due to rounding or omission of possible categories.
d = insufficient data for disclosure.

Appendix table 2--Input use of FCRS sorghum 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	6	6	6	6
Rate, one time	lbs/acre	6	5	6	6
Acres reseeded	percent of acres	4	4	4	4
Fertilizer use:					
Any fertilizer	percent of farms	92	94	71	88
Nitrogen	percent of farms	92	94	71	88
Phosphorus	percent of farms	41	52	38	46
Potassium	percent of farms	24	30	26	28
Fertilizer use:					
Nitrogen	lbs/acre	76	72	87	76
Phosphorus	lbs/acre	14	18	16	17
Potassium	lbs/acre	5	7	9	7
Chemical use:					
Any chemicals	percent of farms	89	87	45	77
Herbicides	percent of farms	88	84	40	74
Insecticides	percent of farms	13	14	11	13
Herbicide use	acre-treatments	1.31	0.93	0.76	0.98
Insecticide use	acre-treatments	0.15	0.31	0.16	0.24
Field operations:					
Preplant tillage	times over	3.32	3.73	4.42	3.79
Postplant tillage	times over	0.70	0.53	0.69	0.61
Field operations:					
Preplant tillage	hours per acre	0.45	0.49	0.58	0.49
Postplant tillage	hours per acre	0.15	0.09	0.11	0.12
Custom operations:					
Any custom operations	percent of farms	16	36	39	32
Fert/chem application	percent of farms	6	20	17	16
Technical services	percent of farms	d	6	d	4
Harvesting	percent of farms	7	21	26	19

[1]Total seeding rate includes reseeding.
d = insufficient data for disclosure.

Appendix table 3--Characteristics of FCRS sorghum farms, by enterprise size, 1990

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-499	500 or more	
Share of FCRS:						
Sorghum farms	percent	28	49	19	4	100
Sorghum production	percent	4	36	41	19	100
Sorghum yield	actual bu/acre	45	65	57	47	57
Sorghum yield	normal bu/acre	66	68	67	70	68
Size:						
Total operated acres	acres	400	906	1,501	2,991	969
Planted sorghum acres	acres	27	92	313	748	144
Acres harvested for grain	percent of acres	84	97	92	90	93
Sales class--[1]						
$0-$39,999	percent of farms	64	18	6	0	28
$40,000-$99,999	percent of farms	21	44	24	3	32
$100,000-$499,999	percent of farms	12	28	48	55	29
$500,000 or more	percent of farms	3	10	23	42	12
Sorghum production value	dollars	2,016	9,846	34,868	72,394	15,081
Farm production value	dollars	51,655	120,578	148,560	308,819	115,056
Region:						
Central Plains	percent of farms	46	73	62	32	62
Southern Plains	percent of farms	54	27	38	68	38
Sorghum acreage tenure:[1]						
Owned	percent of acres	42	41	26	20	30
Cash-rented	percent of acres	5	7	11	15	10
Share-rented	percent of acres	52	52	63	65	59
Sorghum production practices:						
Irrigated	percent of acres	8	12	13	23	15
Dryland	percent of acres	92	88	87	77	85
Previously fallowed	percent of acres	4	7	13	9	10
Previous crop on sorghum acres:[1]						
Sorghum	percent of farms	36	39	41	38	38
Soybeans	percent of farms	17	22	9	d	18
Wheat	percent of farms	20	26	26	26	24
Financial position:[1]						
Favorable	percent of farms	64	69	60	53	65
Marginal income	percent of farms	18	13	14	24	15
Marginal solvency	percent of farms	13	12	14	d	13
Vulnerable	percent of farms	5	6	13	d	7
Production specialty:[1]						
Cash grains	percent of farms	47	67	69	71	62
Other crops	percent of farms	11	9	15	20	11
Livestock	percent of farms	42	24	16	8	27
Major occupation:						
Farming	percent of farms	61	93	94	91	84
Other	percent of farms	39	7	6	9	16
Operator age:[1]						
Under 35 years	percent of farms	15	9	8	15	11
35-49 years	percent of farms	23	42	40	33	36
50-65 years	percent of farms	45	31	41	42	37
More than 65 years	percent of farms	17	17	12	10	16
Operator education:[1]						
Less than high school	percent of farms	23	20	10	13	19
Completed high school	percent of farms	42	39	42	37	40
Some college	percent of farms	14	12	27	30	16
Completed college	percent of farms	21	29	21	19	25

[1]Data may not add due to rounding or omission of possible categories.
d = insufficient data for disclosure.

Appendix table 4--Input use of FCRS sorghum farms, by enterprise size, 1990

Item	Unit	Enterprise size (acres)				All FCRS farms
		Fewer than 50	50-199	200-499	500 or more	
Seed:						
Rate, total[1]	lbs/acre	7	6	5	6	6
Rate, one time	lbs/acre	7	6	5	6	6
Acres reseeded	percent of acres	4	4	4	4	4
Fertilizer use:						
Any fertilizer	percent of farms	82	91	88	87	88
Nitrogen	percent of farms	82	92	88	87	88
Phosphorus	percent of farms	57	38	50	48	46
Potassium	percent of farms	40	23	21	28	28
Fertilizer use:						
Nitrogen	lbs/acre	66	77	69	92	76
Phosphorus	lbs/acre	29	18	15	15	17
Potassium	lbs/acre	20	7	5	7	7
Chemical use:						
Any chemicals	percent of farms	49	87	89	92	77
Herbicides	percent of farms	49	83	84	84	74
Insecticides	percent of farms	5	11	23	46	13
Herbicide use	acre-treatments	0.60	0.98	1.06	0.92	0.98
Insecticide use	acre-treatments	0.06	0.12	0.19	0.52	0.24
Field operations:						
Preplant tillage	times over	3.31	3.05	3.74	5.05	3.79
Postplant tillage	times over	0.32	0.62	0.60	0.67	0.61
Field operations:						
Preplant tillage	hours per acre	0.60	0.40	0.47	0.64	0.49
Postplant tillage	hours per acre	0.07	0.12	0.11	0.11	0.12
Custom operations:						
Any custom operations	percent of farms	31	29	41	28	32
Fert/chem application	percent of farms	11	14	31	8	16
Harvesting	percent of farms	23	18	15	21	19

[1]Total seeding rate includes reseeding.

Appendix table 5--Characteristics of FCRS sorghum farms, by region, 1990

Item	Unit	Region		All FCRS farms
		Central Plains	Southern Plains	
Share of FCRS:				
Sorghum farms	percent	62	38	100
Sorghum production	percent	66	34	100
Sorghum yield	actual bu/acre	65	46	57
Sorghum yield	normal bu/acre	70	65	68
Size:				
Total operated acres	acres	990	934	969
Planted sorghum acres	acres	133	161	144
Acres harvested for grain	percent of acres	97	86	93
Sales class--[1]				
$0-$39,999	percent of farms	18	43	28
$40,000-$99,999	percent of farms	41	18	32
$100,000-$499,999	percent of farms	31	24	29
$500,000 or more	percent of farms	10	15	12
Sorghum production value	dollars	14,369	16,241	15,081
Farm production value	dollars	109,205	124,594	115,056
Sorghum acreage tenure:[1]				
Owned	percent of acres	36	22	30
Cash-rented	percent of acres	8	14	10
Share-rented	percent of acres	56	64	59
Free-rented	percent of acres	0	0.15	0.07
Sorghum production practices:				
Irrigated	percent of acres	8	25	15
Dryland	percent of acres	92	75	85
Previously fallowed	percent of acres	9	10	10
Previous crop on sorghum acres:[1]				
Sorghum	percent of acres	39	37	38
Soybeans	percent of acres	25	6	18
Wheat	percent of acres	27	20	24
Financial position:[1]				
Favorable	percent of farms	67	63	65
Marginal income	percent of farms	9	23	15
Marginal solvency	percent of farms	16	7	13
Vulnerable	percent of farms	8	7	7
Production specialty:[1]				
Cash grains	percent of farms	71	48	62
Other crops	percent of farms	2	27	11
Livestock	percent of farms	28	25	27
Major occupation:				
Farming	percent of farms	90	74	84
Other	percent of farms	10	26	16
Operator age:[1]				
Under 35 years	percent of farms	13	7	11
35-49 years	percent of farms	42	27	36
50-65 years	percent of farms	31	47	37
More than 65 years	percent of farms	13	20	16
Operator education:[1]				
Less than high school	percent of farms	17	22	19
Completed high school	percent of farms	40	40	40
Some college	percent of farms	20	9	16
Completed college	percent of farms	22	28	25

[1]Data may not add due to rounding or omission of possible categories.

Appendix table 6--Input use of FCRS sorghum farms, by region, 1990

Item	Unit	Region		All FCRS farms
		Central Plains	Southern Plains	
Seed:				
Rate, total[1]	lbs/acre	5	7	6
Rate, one time	lbs/acre	5	6	6
Acres reseeded	percent of acres	4	4	4
Fertilizer use:				
Any fertilizer	percent of farms	94	77	88
Nitrogen	percent of farms	94	77	88
Phosphorus	percent of farms	47	44	46
Potassium	percent of farms	26	30	28
Fertilizer use:				
Nitrogen	lbs/acre	71	85	76
Phosphorus	lbs/acre	15	19	17
Potassium	lbs/acre	8	5	7
Chemical use:				
Any chemicals	percent of farms	90	56	77
Herbicides	percent of farms	89	50	74
Insecticides	percent of farms	11	17	13
Herbicide use	acre-treatments	1.13	0.77	0.98
Insecticide use	acre-treatments	0.14	0.37	0.24
Field operations:				
Preplant tillage	times over	3.08	4.79	3.79
Postplant tillage	times over	0.49	0.77	0.61
Field operations:				
Preplant tillage	hours per acre	0.35	0.65	0.49
Postplant tillage	hours per acre	0.10	0.13	0.12
Custom operations:				
Any custom operations	percent of farms	26	41	32
Planting	percent of farms	4	d	3
Fert/chem application	percent of farms	18	13	16
Technical services	percent of farms	5	d	4
Harvesting	percent of farms	9	35	19

[1]Total seeding rate includes reseeding.
d = insufficient data for disclosure.

Appendix 2: About the Accounting System

The accounting of costs and returns in this report follows USDA's Economic Research Service (ERS) methods and format. This format was revised in the early 1980's after reviews by commodity groups, land-grant university economists, and individual farmers (USDA, ERS, Mar. 1992). The National Agricultural Cost of Production Standards Review Board, established under the 1981 Agricultural and Food Act, provides an ongoing evaluation of the ERS methodology.

The costs and returns in this report are the same as those published for 1990 in the ERS *Economic Indicators of the Farm Sector* series. A new system to estimate commodity costs and returns, the Farm-Level Budget Model (FLBM), was implemented for sorghum in 1990. The FLBM replaces the Firm Enterprise Data System (FEDS) previously used to estimate costs and returns. Under the FLBM, costs and returns are calculated for each farm observation, and then farms are weighted to provide State, regional, and national estimates. Under the FEDS, State cost and return estimates were calculated as if all production of a commodity were produced on a single average acre in the State. In contrast to FEDS, estimates generated with the FLBM allow for distributional analyses presented in this report.

Three characteristics of the ERS estimates of crop costs and returns distinguish them from other cost accounting systems:

Government programs. Participants in price-support programs must take a portion of their acreage out of production, in return receiving payments based on production on their remaining acreage. Also, program participants may be required to incur costs by maintaining a cover crop or by controlling weeds on set-aside acreage. To provide information about production costs and returns in the absence of government programs, ERS cost of production estimates exclude both the costs and incomes associated with those programs. (For a further discussion of how including government payments changes costs and returns estimates, see Salassi and others, 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, 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.

Appendix 3: Data Reliability

Cost of production estimates from a representative sample of sorghum producers may differ from estimates made from a complete census using the same questionnaires, instructions, and enumerators. Survey data are also influenced by nonsampling errors, which are not measurable or known. Some possible causes of nonsampling errors are mistakes by enumerators, incorrect answers by respondents, and questionnaire design. Efforts made to minimize these errors and maintain survey accuracy included training of data collectors and detailed review and edit of completed questionnaires.

Coefficients of variation (C.V.), the standard deviation of an estimate divided by its average value, enable us to compare the variability of estimates of variable cost items, even if those cost items have greatly different magnitudes. In general, the smaller the C.V. the greater the reliability of the estimate. The average per-acre variable cost for all sorghum farms, $71.30, has a C.V. of 3.61 percent. This shows a moderate level of variation in per-acre variable costs among surveyed farms. Some individual cost items had more variability. For example, the variable cost for custom operations had an average value of $4.29 and a C.V. of 12.85. This cost item estimate shows more variability because, while some farmers pay custom operators to do everything from plant to harvest, other farmers have no custom work done.

A t-statistic can be used to evaluate the statistical significance of differences of means between groups. For example, the t-statistic for a comparison of total variable cost per acre between low- and high-cost producers is the difference between the mean of the two groups (TVC) divided by the square root of the sum of the squared standard errors (SE^2) of the two groups. Or:

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

$$= (73.53 - 55.80) / (6.73 + 43.33)^{.5} = 2.51$$

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, the discussion in each section emphasizes comparisons among the groups only when means were significantly different at the 95-percent level.

Appendix table 7--Coefficients of variation of sorghum 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	2.64	3.23	6.27	3.77
Variable costs, normal yield	2.34	3.85	7.99	3.21
Costs and returns per acre:				
Value of production	4.40	3.94	12.35	4.07
Total variable costs	4.65	4.70	8.95	3.61
Seed	6.97	6.34	8.51	4.29
Fertilizer	11.08	6.80	12.98	5.33
Chemicals	8.41	7.80	18.98	6.28
Custom operations	37.57	16.53	22.42	12.85
Fuel, lube, and electricity	5.34	9.23	15.53	6.88
Repairs	4.41	3.83	8.49	3.15
Hired labor	26.10	14.97	18.12	10.82
Purchased irrigation water	na	48.23	89.35	44.80
Technical services	99.92	47.43	98.53	48.57
Returns above variable costs	4.62	5.75	14.43	8.62

na = not applicable.

Appendix table 8--Coefficients of variation of sorghum variable costs and returns, by enterprise size, 1990

Item	Enterprise size (acres)				All FCRS farms
	Fewer than 50	50-199	200-499	500 or more	
			Percent		
Costs per bushel:					
Variable costs, actual yield	8.77	5.66	5.66	10.40	3.77
Variable costs, normal yield	7.03	5.19	4.92	7.98	3.21
Costs and returns per acre:					
Value of production	15.32	4.61	6.22	12.16	4.07
Total variable costs	10.97	5.97	6.15	6.83	3.61
Seed	10.83	7.54	6.66	9.14	4.29
Fertilizer	16.46	8.18	8.77	12.37	5.33
Chemicals	22.94	8.06	10.11	15.40	6.28
Custom operations	23.03	23.74	16.28	34.77	12.85
Fuel, lube, and electricity	11.27	11.13	11.32	14.24	6.88
Repairs	6.68	4.94	5.44	5.78	3.15
Hired labor	33.54	23.39	16.30	17.34	10.82
Purchased irrigation water	na	68.42	71.80	69.08	44.80
Technical services	96.47	68.51	50.57	98.53	48.57
Returns above variable costs	29.51	8.04	11.65	48.69	8.62

na = not applicable.

Appendix table 9--Coefficients of variation of sorghum variable costs and returns, by region, 1990

Item	Region		All FCRS farms
	Central Plains	Southern Plains	
		Percent	
Costs per bushel:			
Variable costs, actual yield	4.32	6.20	3.77
Variable costs, normal yield	3.42	5.40	3.21
Costs and returns per acre:			
Value of production	4.08	8.29	4.07
Total variable costs	3.98	5.91	3.61
Seed	5.87	6.11	4.29
Fertilizer	6.50	8.80	5.33
Chemicals	7.26	11.34	6.28
Custom operations	19.05	16.60	12.85
Fuel, lube, and electricity	8.24	10.19	6.88
Repairs	3.28	5.71	3.15
Hired labor	15.10	13.93	10.82
Purchased irrigation water	93.63	43.12	44.80
Technical services	59.62	80.30	48.57
Returns above variable costs	7.71	25.38	8.62

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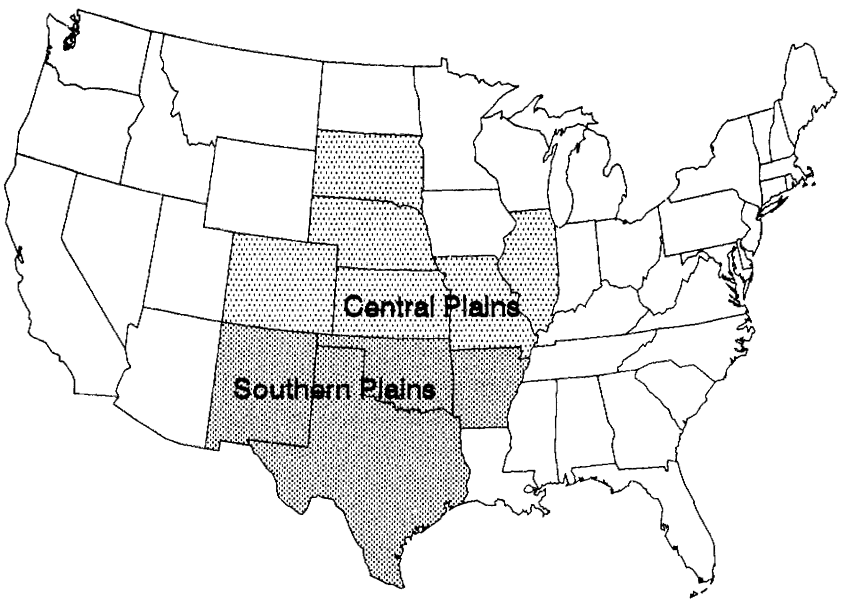
Figure 5

Major U.S. sorghum production regions, 1990



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