Costs, Returns and Efficiency of Sorghum and Alternative Crop Production in Western Oklahoma

by
Luther G. Tweeten
and W. B. Back

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Luther G. Tweeten and W. B. Back
Department of Agricultural Economics

Traditionally, sorghums have been important cash and feed crops in Oklahoma. Only a limited amount of previous research has been done to evaluate the place of sorghums in short and long run production plans of farmers. Acreage restrictions and expected long run decline in demand for cotton and wheat creates a need for appraising alternatives for use of cropland.

The main emphasis of this study was to estimate costs and returns for sorghums and alternative crops in the commercial sorghum production areas in Oklahoma. Specifically, the main purposes of this study were:

(1) To assemble information on trends in production of sorghums, location of important producing areas. and characteristics of the farms within the commercial sorghum growing areas of Oklahoma,

(2) To evaluate sorghums and alternative crops on the basis of comparative returns and other factors; and,

(3) To examine relationship between farm size and efficiency of sorghum and alternative crop production.

Sources of Information

Areas in three counties, Caddo, Roger Mills and Texas, were selected as representative of the commercial sorghum producing areas in western Oklahoma. Seventy-two dryland grain and forage growers in these counties were selected at random and interviewed during the summer of 1956 to obtain information on production practices, yields and costs. This information was supplemented by a survey of 21 Beaver County sorghum producers conducted by the United States Department of Agriculture in 1957.

Published statistical data and estimates of production requirements and yields, contributed by agricultural specialists, was added to the information in order to compute costs and returns.

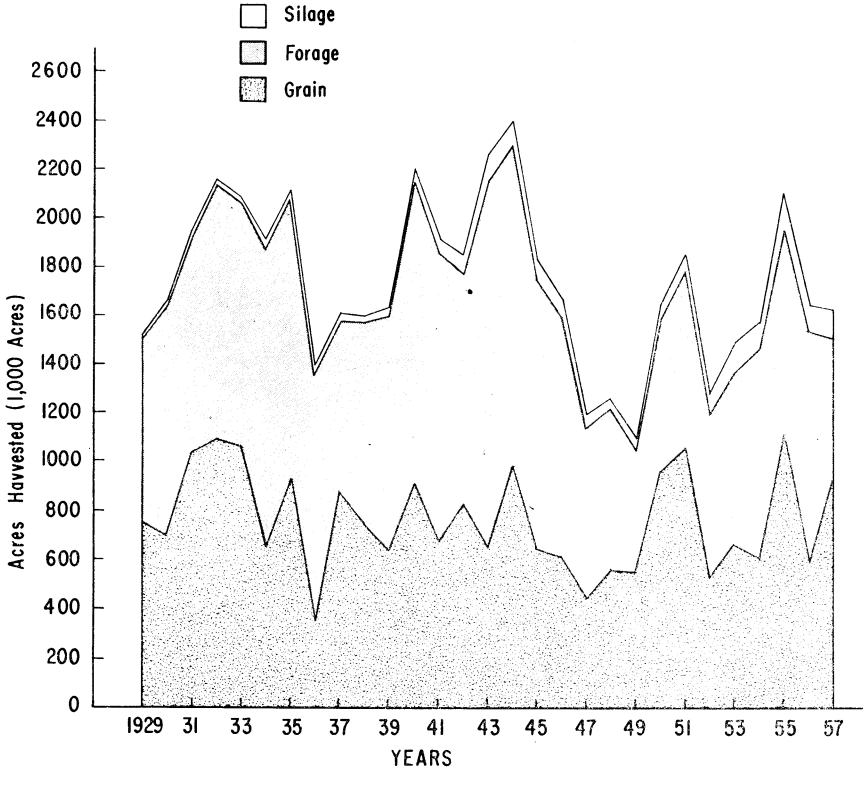
Trends and Location of Production

Three states, Texas, Kansas and Nebraska, exceeded Oklahoma in production of grain sorghum from 1948 to 1957. During this period, two states, Texas and Kansas, exceeded Oklahoma in production of

forage sorghum. The annual farm value of sorghums in the state, from 1948 to 1957, was about $25 million. This value was exceeded only by the average annual values of cotton and wheat in the past decade.

Acres of all sorghums harvested in the State reached a peak of about 24 million acres in 1944 (Figure 1). Except for the years of 1936 to 1939, the general trend in acres harvested was upward until 1944. After a drastic decline in production following World War II, an upward trend in acreage of sorghums occurred in the state. This trend was accentuated by the tightening of acreage restrictions on wheat, cotton and peanuts following the Korean War.[1]

Fig. 1 Trends in Acres Harvested of Sorghum in Oklahoma, 1929-1957.



Source: Oklahoma Crop and Livestock Reporting Service. (Sorghum grown for sirup production not included.)

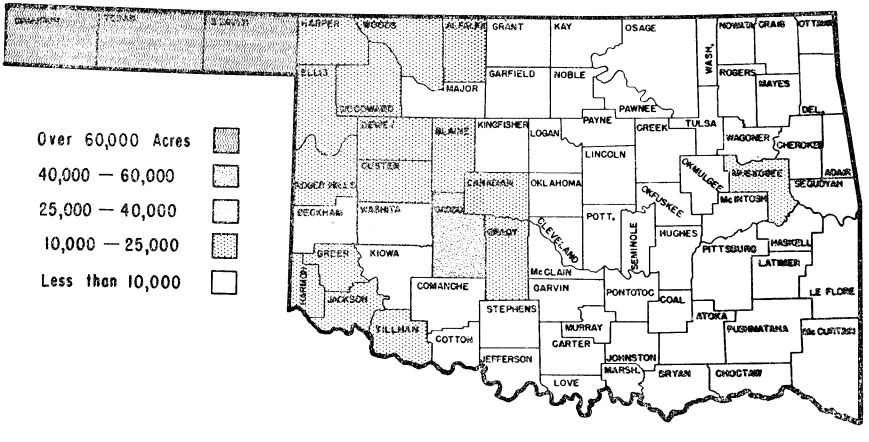
[1] The coefficient of correlation (r) between wheat, cotton and peanut acres planted (x_1) and acres of all sorghums planted (x_2) from 1946 to 1957 was .7, and was significant at the 99 percent confidence level.

More than 90 percent of the sorghum produced in Oklahoma since 1929 has been harvested for grain or forage. Although sorghum acreage harvested for silage has increased in recent years, the total harvested for that purpose has not reached 160 thousand acres. A general downward trend appeared in forage sorghum acreage particularly until 1949, although considerable year-to-year variation occurred in this acreage. Acreage harvested for grain since 1929 has been highly variable, but no upward trend was established. Of the nations total sorghum crop, Oklahoma produced an average of 6.5 percent from 1946 to 1950, 3.0 percent in 1956 and 2.7 percent in 1957. This decline resulted from a substantial increase in sorghum production by other states.

Sorghum production was well established in the panhandle counties of Oklahoma by 1909. In that year, Texas and Beaver counties each harvested about 65 thousand acres of grain sorghum and about 40 thousand acres of forage sorghum. Eighteen counties in the western part of the State each harvested more than 10 thousand acres of grain sorghum in 1909. Eight of these counties each harvested more than 10 thousand acres of forage sorghum.

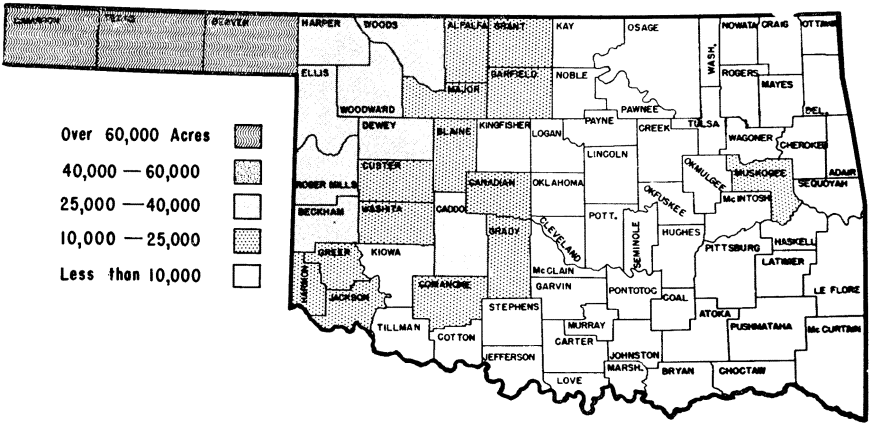
The acreage gradually is shifting eastward, but the panhandle countries continue to lead in production of both grain and forage sorghums (Figure 2 and 3). Production presently is centered in the western half of the State where drought resistant qualities increase its competitive position with alternative crops.

Fig. 2 Average Annual Acres of Grain Harvested by Counties, 1955-1957.



Source: Oklahoma Crop and Livestock Reporting Service.

Fig. 3 Average Annual Acres of Forage Sorghum Harvested by Counties, 1955-1957.



Source: Oklahoma Crop and Livestock Reporting Service.

In recent years, grain sorghum acreage has increased sharply in several eastern Oklahoma counties. Two possible reasons for the increase are: (1) the adoption of two new varieties, Redlan and Darset, which resist damage from birds, insects and disease, and (2) dry years such as 1954 and 1956 created interest in drought resistant crops such as sorghums.

Characteristics of Farms in Survey

Twenty-one of the farms in the sample were located in Caddo County, 25 in Roger Mills County and 26 in Texas County. Farms in each of the counties were classified into two size groups about equal in number on the basis of cropland areas operated. In Caddo County, the farms with less than 160 acres of cropland were classed as small farms, and farms with more than 160 acres of cropland were classed as large farms. In Roger Mills and Texas Counties, the dividing line between small and large farms was 300 and 800 acres of cropland, respectively.

The characteristics of these farms differed among counties and between size groups within the counties. The large farms had a higher percentage of tenancy and more emphasis on crops relative to livestock than the small farms in each of the three counties (Table 1). However, both tenancy and emphasis on livestock varied among counties. Nearly three-fourths of the land operated in Texas County was rented, but in Roger Mills County, the farmers in the survey rented less than half of the land they operated.

Table 1.—Land and Livestock Organization of Farms Surveyed in Caddo, Roger Mills and Texas Counties.

Classification	Caddo			Roger Mills			Texas		
	Less Than 160 A Cropland	Greater Than 160 A Cropland	All Farms	Less Than 300 A Cropland	Greater Than 300 A Cropland	All Farms	Less Than 800 A Cropland	Greater Than 800 A Cropland	All Farms
(Per farm)									
Number of farms	11	10	21	13	12	25	13	13	26
Total acres	199	377	284	613	1008	803	574	1239	906
Tenure:									
Percent owned	44	28	34	66	53	58	31	24	26
Percent rented	56	72	66	34	47	42	69	76	74
Cropland:									
Percent cropland	41	66	57	31	45	40	83	91	89
Percent non-cropland	59	34	43	69	55	60	17	9	11
Livestock:									
Animal units	21	36	28	38	37	38	11	18	14
Cropland acres per animal unit	4	7	6	5	12	8	43	63	57

Source: Survey of 72 sorghum producers in Caddo, Roger Mills and Texas Counties in 1956.

Caddo County had the highest degree of emphasis on livestock with an average of six cropland acres per animal unit, and Texas County had the least degree of emphasis on livestock with 57 cropland acres per animal unit. The degree of livestock emphasis was consistent with survey results which indicated that three out of four farmers in Caddo and Roger Mills counties grew grain sorghum for feed only, but only one out of 13 farmers in Texas County grew grain sorghum for feed only. Nearly all forage sorghum was fed to livestock, and the proportion of all sorghums grown for forage on surveyed farms in 1956 was 37 percent in Caddo County, 38 percent in Roger Mills County, and only 12 percent in Texas County.

The greater emphasis on livestock by the small farms correlated with the relatively high percentage of non-cropland and sorghum acreage on the small farms (Table 2). Much non-cropland acreage was used for pasture, and sorghums were used for livestock feed. The survey indicated that in 1955 about 50 percent of the grain sorghum grown on small farms was fed, but only about 20 percent was fed on the large farms.

Survey results indicated that grain sorghum was grown mainly as a cash crop on large farms. In 1955, about 80 percent of the grain sorghum grown on these farms was sold. Allotment crops comprised

Table 2.—Cropland Organization of Farms Surveyed in Caddo, Roger Mills and Texas Counties.

Classification	Caddo			Roger Mills			Texas		
	Less Than 160 A Crop-land	Greater Than 160 A Crop-land	All Farms	Less Than 300 A Crop-land	Greater Than 300 A Crop-land	All Farms	Less Than 800 A Crop-land	Greater Than 800 A Crop-land	All Farms
(Per farm)									
Total cropland acres	81	248	160	192	458	320	477	1130	804
Allotment crops[a]									
Acres	24	104	62	36	105	69	179	528	354
Percent of cropland	30	42	39	19	23	22	38	47	44
Sorghums:									
Acres	27	50	38	83	202	140	202	383	293
Percent of cropland	33	20	24	43	44	44	42	34	37
Other crops									
Acres	19	57	37	34	43	39	7	10	9
Percent of cropland	23	23	23	18	9	12	1	1	1
Residual cropland[b]									
Acres	11	37	23	39	108	72	89	209	148
Percent of cropland	14	15	14	20	24	22	19	18	18

Source: Survey of 72 sorghum producers in Caddo, Roger Mills and Texas Counties in 1956.
[a]Wheat, cotton and peanuts.
[b]Idle, fallow, crop failure.

from about one-fourth to one-half the total cropland acres, which indicated a relatively heavy emphasis on income from cash crops on large farms.

Large machinery inventories further evidenced the crop emphasis on large farms. Machinery investment per farm averaged about 200, 70 and 30 percent higher on the large than on the small farms in Caddo, Roger Mills and Texas counties, respectively. In general, operators in Texas County has substantially larger machinery investments than operators in Caddo and Roger Mills counties. Types of machinery also differed considerably among areas. Differences in types of machinery were reflected by production practices. For example, to prepare a seedbed for sorghums, Caddo County farmers typically used a moldboard plow, Roger Mills County farmers a lister plow, and Texas County farmers a one-way plow.

Procedure and Data for Estimates of Costs and Returns

In this study, estimates of comparative returns included only returns above the "costs that changed" when shifting land use. Operations which could not be performed by the typical machinery on surveyed farms were assumed custom hired.

The farmers interviewed listed wheat, cotton, peanuts, alfalfa, barley, oats and broomcorn as the major alternatives to sorghums on their farms. Eight crops, including sorghums, were considered alternatives in Caddo County, five in Roger Mills County and three in Texas County. In 1956, these crops comprised 71, 90 and 97 percent of all acres in crops on surveyed farms in Caddo, Roger Mills and Texas counties, respectively. Returns above variable costs were estimated for each crop in order to evaluate sorghums with alternatives in land-use.

Estimates of Yields and Prices

Separate estimates of yields, prices and costs were required for deriving estimates of comparative returns. Yield estimates reflect differences in soil and moisture conditions among counties (Table 3). Yields apply mainly to sandy, upland soils, and they do not necessarily depict county averages. In general, estimates are for "normal" moisture conditions, and actual yields may differ considerably from these estimates among years and among individual farms. No significant differences in yields obtained without use of fertilizer appeared between the large and small farms within each county.

Table 3.—Estimated Yields Per Acre for Alternative Crops on Land Used for Sorghums in Caddo, Roger Mills and Texas Counties.

Crop[a]		County		
		Caddo	Roger Mills	Texas
Grain sorghum	bu.	21.0	17.5	14.5
Forage sorghum	ton	1.9	1.6	1.3
Wheat	bu.	15	12	11
Lint	lb.	209	180	--
Seed	lb.	360	180	--
Peanuts	lb.	690		
Alfalfa	ton	1.5[b]	--	--
Oats	bu.	28	--	--
Barley	bu.	19	--	--
Broomcorn	ton	--	.125	--

Source: Yields based on estimates of 72 sorghum producers in Caddo, Roger Mills and Texas Counties, and adjusted by recommendations of soil scientists and farm management specialists.

[a]All crops except alfalfa non-fertilized. Typical fertilizer application and yields when fertilized as estimated by farmers surveyed in Caddo County were:

Crop	*Fertilizer per acre*	*Yield per acre*
Wheat	80 lbs. 13-39-0	19 bushels
Cotton	75 lbs. 10-20-10	255 lbs. lint, 439 lbs. seed
Peanuts	75 lbs. 6-24-24 60 lbs. 16-20-0 (cover crop)	900 lbs.

[b]Fertilized yield. Rate of application 150 pounds 0-20-0. Rate based on recommendation of Horace Harper, Professor, Department of Agronomy, Oklahoma State University. This rate of application may not have been typical.

Two sets of prices were included (Table 4). The set of short-term prices was designed to reflect price levels and relationships in the near future, and may be useful for short run land-use decisions. The long-run prices may be relevant for planning for the distant future. The general level of the long-run prices for the nation was agreed upon by the Agricultural Marketing Service, Soil Conservation Service, Forest Service and Agricultural Research Service for evaluating watershed and river basin development. These prices were adapted to Oklahoma conditions; but in applying these prices to an individual farm it may be desirable to further adapt them to fit the individual situation and future expectation.

Estimates of Production Costs

Production costs were based on typical production requirements for individual crops in each area and on current prices for labor and supplies. The estimated cost to produce an acre of grain sorghum varied among counties and between farm sizes within counties (Table 5). Except in Texas County, the total operating costs to produce an acre of grain sorghum were higher for the small farms than for the large farms. However, the components of operating costs varied between farm sizes

Table 4.—Prices Used in Estimating Gross Returns Per Acre for Different Crops.

Crop	Unit	Price Per Unit (Dollars)	
		Short Term	Long Term
Grain sorghum	bu.	.90	1.20
Forage sorghum	ton	14.50	16.00
Wheat	bu.	1.70	1.60
Cotton:			
Lint	lb.	.285	.240
Seed	lb.	.030	.033
Peanuts	lb.	.105	.080
Alfalfa	ton	23.00	25.00
Oats	bu.	.60	.75
Barley	bu.	.80	1.05
Broomcorn	ton	325.00	300.00

Source: Short term prices based upon seasonal average prices received by Oklahoma farmers in 1957 and upon announced government 1958-crop supports for Oklahoma.
Long term prices based upon "Agricultural Price and Cost Projection", United States Department of Agriculture, Washington, D. C., September, 1957; adjusted to Oklahoma conditions.

Table 5.—Summary of Operating Cost to Produce an Acre of Grain Sorghum in Caddo, Roger Mills, and Texas Counties. (In dollars)[a]

Item	Caddo		Roger Mills		Texas	
	Less Than 160 A Cropland	Greater Than 160 A Cropland	Less Than 300 A Cropland	Greater Than 300 A Cropland	Less Than 800 A Cropland	Greater Than 800 A Cropland
Machinery repair, gas, oil and lubrication	3.16	4.01	2.66	2.79	2.01	1.88
Hired labor	--	.62	--	.28	.22	.46
Custom operations	4.55	--	3.00	--	--	--
Seed	.38	.38	.46	.46	.54	.54
TOTAL OPERATING COST	8.09	5.01	6.12	3.53	2.77	2.88
Crop share rent (1/3)	5.95	5.95	4.78	4.78	4.35	4.35
TOTAL OPERATING COST (Including rent)	14.04	10.96	10.90	8.31	7.12	7.23

[a]Estimates of components of operating and overhead costs for grain sorghums and other crops budgeted can be obtained from the Department of Agricultural Economics, Oklahoma State University.

mainly due to differences in custom hiring. For example, the cost of machinery repair, gas, oil and lubrication was about 20 percent lower on the small farms in Caddo County because the combining and handling on these farms were typically performed by custom operators. In Texas County, total operating costs to produce an acre of grain sorghum were higher on the large farms because of the greater hired labor cost on large farms.

Total operating costs to produce an acre of grain sorghum were generally lower in Roger Mills County than in Caddo County, and were lower in Texas County than in Roger Mills County. These cost differences occurred from differences in production practices, size of operations, types and sizes of machinery and amount of custom operation and hired labor. The cost of seeding was higher in the more arid areas due to replanting and crop failure.

Estimates of Comparative Returns

The level of comparative returns from crops was higher on the large than on the small farms within each county (Tables 6, 7 and 8). However the ranking of crops from highest to lowest in comparative returns did not differ significantly between farm sizes within counties. Also, inclusion of rent as an operating cost made an insignificant difference in the ranking of the crops in order of comparative returns.

Comparative Returns Estimated with Short Term Prices

Caddo County

Generally, in Caddo County sorghums ranked just below allotment crops and alfalfa in comparative returns (Table 6). Forage sorghum appeared especially favorable, but lack of a cash market has reduced its attractiveness to many operators. On the other hand, estimated returns may underestimate the value of the crop to operators who feed livestock or who use field choppers or other methods to increase harvesting efficiency.

Alfalfa ranked high as an alternative particularly on large farms. Oats and barley ranked lowest among the crops in comparative returns. Utilization of small grain pastures offers an opportunity to increase returns from these crops and wheat.

Many farmers obtained substantial yield increases by using fertilizer, and only operators of large farms typically fertilized wheat, cot-

Table 6.—Estimated Comparative Returns Per Acre for Sorghums and Alternative Crops in Caddo County. (Short term prices in dollars)

Crops[a]	Gross Returns (Price x yield)	Comparative Returns			
		Returns Above Operating Costs		Returns Above Operating Costs (Including Rent)	
	All Farms	Less Than 160 A Cropland	Greater Than 160 A Cropland	Less Than 160 A Cropland	Greater Than 160 A Cropland
Grain sorghum	18.90	10.81	13.89	4.86	7.94
Forage sorghum	27.55	17.17	17.28	7.99	8.10
Wheat	25.50	16.30	19.71	8.05	11.46
Cotton	70.36	32.83	32.97	16.86	17.00
Peanuts	72.45	37.55	40.70	16.80	19.95
Alfalfa[b]	34.50	12.33	19.32	1.75	8.74
Oats	16.80	5.43	9.69	.30	4.56
Barley	15.20	5.26	8.94	.51	4.19

Source: Yields—See Table 3.
Prices—See Table 4.
Costs—See Table 5, footnote a.

aAll crops except alfalfa non-fertilized. Returns above operating costs on fertilized acres were computed separately. The results for large farms were as follows:

Crops	*Fertilizer*	*Additional Yield Per Acre*	*Additional Returns Above Variable Costs (Including Rent)*	
Wheat	80 lbs. 13-39-0	4 bushel	$ 2.75	$ 1.92
Cotton	75 lbs. 10-20-10	46 lb. lint 79 lb. seed	7.47	4.72
Peanuts	75 lbs. 6-24-24	210 lbs.	15.48	10.18

bIncludes annual fertilizer application of 150 lbs. 0-20-0.

ton and peanuts. The operators who fertilized these crops typically increased returns above operating costs from 13 to 48 percent (Table 6, footnote a).

Roger Mills County

In Roger Mills County, Cotton, broomcorn and wheat exceeded sorghums in comparative returns per acre (Table 7). Broomcorn was less favorable as an alternative than returns indicate for three major reasons: (1) uncertainty of returns due to unusually high variation in year-to-year prices, (2) large harvest labor requirements and consequent high cash labor cost and (3) difficulty of obtaining labor to perform the harvest operation.

Texas County

In Texas County, comparative returns from sorghums were considerably below the returns from wheat (Table 8).

However, three principal reasons for the popularity of sorghums in these counties were: (1) lack of other crop alternatives for acres left idle after wheat allotments were planted, (2) as a catch crop after wheat failure and (3) some soils are better adapted to sorghums than to wheat.

In 1957, farmers had the alternative of diverting wheat land to the acreage reserve instead of to sorghums. Many farmers in the area took advantage of this opportunity. For example, according to a USDA survey in adjacent Beaver County in 1957, about 130 acres of wheat per farm were removed from production and placed under acreage reserve.

Table 7.—Estimated Comparative Returns Per Acre for Sorghums and Alternative Crops in Roger Mills County. (Short term prices in dollars)

Crop	Gross Returns (Price x yield)	Comparative Returns			
		Returns Above Operating Costs		Returns Above Operating Costs (Including Rent)	
	All Farms	Less Than 300 A Cropland	Greater Than 300 A Cropland	Less Than 300 A Cropland	Greater Than 300 A Cropland
Grain sorghum	15.75	9.63	12.22	4.85	7.44
Forage sorghum	23.20	12.15	12.40	4.42	4.67
Wheat	20.40	13.71	16.19	7.23	9.71
Cotton	60.60	32.96	33.04	19.21	19.29
Broomcorn	40.62	21.47	21.74	11.31	11.58

Source: Yields—See Table 3.
Prices—See Table 4.
Costs—See Table 5, footnote a.

Table 8.—Estimated Comparative Returns Per Acre for Sorghums and Alternative Crops in Texas County. (Short term prices in dollars)

Crop	Gross Returns (Price x yield)	Comparative Returns			
		Returns Above Operating Costs		Returns Above Operating Costs (Including Rent)	
	All Farms	Less Than 800 A Cropland	Greater Than 800 A Cropland	Less Than 800 A Cropland	Greater Than 800 A Cropland
Grain sorghum	13.05	10.28	10.17	4.93	5.82
Forage sorghum	18.85	10.79	9.71	4.51	3.43
Wheat	18.70	14.56	14.58	8.33	8.35

Source: Yields—See Table 3.
Prices—See Table 4.
Costs—See Table 5, footnote a.

Comparative Returns Estimated With Long Term Prices

In general, the application of long term prices in estimating comparative returns resulted in a more favorable position of the sorghums in relation to other crops as compared with the results obtained with short term prices (Table 9). Oats and barley also increased in significance when returns were estimated by use of long term prices. These changes in comparative advantage among the crops resulted directly from higher feed grain prices and lower prices of allotment crops (wheat, cotton and peanuts) as compared with current price relations among the crops.

Other Considerations in Making Land-Use Decisions

Factors other than comparative returns which may be involved in making land-use decisions include possible preference for a crop producing relatively low and stable returns rather than one producing relatively high but variable returns and the situation when crops are fed to livestock rather than sold for cash.

In general, since 1939, income from grain sorghum had about the same year-to-year variation per acre as income from cotton (Table 10). However, in the three counties studied, income per acre from grain sorghum was less variable than the income per acre from wheat and oats during the same period.

Income from oats per planted acre was considerably more variable than income per harvested acre. For oats, variability in income per harvested acre did not provide a satisfactory estimate of the risk. This resulted because heavy abandonment of low yielding acres in years when yields in general were lowered by drought or insects reduced the variation in yield per harvested acre.

Table 9.—Estimated Comparative Returns Per Acre for Sorghums and Alternative Crops in Caddo, Roger Mills and Texas Counties. (Long term prices in dollars)

	Comparative returns (Avg of all farms)		
	Returns above operating costs (Not including rent)		
Crop	Caddo	Roger Mills	Texas
Grain sorghum	18.65	16.18	14.58
Forage sorghum	20.08	14.68	12.20
Wheat	16.50	13.75	13.47
Cotton	24.58	25.83	--
Peanuts	21.88	--	--
Alfalfa	18.82	--	--
Oats	11.76	--	--
Barley	11.85	--	--
Broomcorn	--	18.48	--

Source: Yields—See Table 3.
Prices—See Table 4.
Costs—See Table 5, footnote a.

Texas County ranked highest and Caddo County lowest in yield variability among all crops. These results appear consistent with rainfall patterns in the three counties.

In 1955, surveyed farmers fed nearly all the forage sorghum, but fed only about 30 percent of the grain sorghum produced on their farms. Farmers throughout Oklahoma utilized only half the grain sorghum produced on their farms for feed and seed from 1948 to 1957. Opportunities may exist for increased farm and commercial feeding of grain sorghums. Research indicates the crop is highly palatable and has feeding value ranging from 90 to 100 percent that of corn.[1]

Substitution of grain sorghum for corn by commercial feeders appears promising on the basis of the current grain sorghum-corn price relationship. A significant reduction in grain sorghum prices in relation to corn prices has occurred in Oklahoma since 1930.[2] During

[1] J. C. Hillier, R. W. MacVicar and Wilson Pond, "Grain Sorghum as a feed for Swine," *28th Annual Livestock Feeders' Day Report*, Department of Animal Husbandry and Oklahoma Agricultural Experiment Station, Oklahoma State University, April 17, 1954.
William J. Loeffel, *Grain Sorghums as Feeds for Beef Cattle and Hogs*, College of Agriculture and Agricultural Experiment Station, University of Nebraska, Lincoln, Nebraska, August, 1957.
"Harvesting, storing and Feeding Grain Sorghum" Mimeographed Circular prepared by members of the Agronomy, Agricultural Engineering and Animal Husbandry Departments, Iowa State College, Ames, Iowa, September, 1957.

[2] The equation was $Y = 1.09 - .0115X$ where $Y = \frac{\text{Grain Sorghum price ratio in Oklahoma}}{\text{Corn}}$, and X = year (1930-1957). $t_b = 4.66^{**}$

Table 10.—Variability in Income per Acre from Selected Crops in Caddo, Roger Mills and Texas Counties; 1939 to 1957.[a]

Crop	Caddo		Roger Mills		Texas	
	Per Planted Acre	Per Harvested Acre	Per Planted Acre	Per Harvested Acre	Per Planted Acre	Per Harvested Acre
Grain sorghum	.32[b]	.31	.34[b]	.34	.44[b]	.40
Cotton	.30[c]	.30	.37[c]	.36	--	--
Wheat	.38	.34	.57	.41	.69	.49
Oats	.51	.33	.63	.42	.82	.61

Source: Yields and prices—Oklahoma Crop and Livestock Reporting Service.

[a]Variability measured by coefficient of variations $\frac{S_{y.x}}{y}$ where X = year (1939-1957); Y = income (Season's average price received by farmers in Oklahoma multiplied by the county yield per acre).

[b]Actual yield per planted acre was unavailable. Grain sorghum yield per planted acre was estimated from a common estimate of acres planted of all sorghums, percentage of sorghum acres harvested for grain, and total grain sorghum production.

[c]Based on yield per acre in cultivation July 1.

recent years grain sorghum prices have been considerably below corn prices. For example, in 1957 the Oklahoma seasonal average price per bushel of grain sorghum was $.85; corn was $1.25. At these prices and an assumed feeding value of grain sorghum 90 percent of corn, $.94 would buy a quantity of grain sorghum equivalent in feeding value to a bushel of corn costing $1.25.

Efficiency of Crop Production

In general, operating costs per acre were considerably lower on the large than small farms in the three counties. Use of larger, more specialized machinery on large farms than on small farms decreased operating costs per acre but increased total overhead costs per farm.

Costs per unit of production were computed for alternative crops on each group of farms. Operating, overhead and land costs were included. Typical crop production practices, including operations performed and number of times over with equipment, were used for these estimates.

Differences in costs per unit of production resulted in general from conditions broadly associated with size (Table 11). Unit costs were lower for the large farms within each county. Also, counties with largest farms had the lowest unit costs. The unit cost of producing sorghums and other crops was higher in many instances than current market prices. This cost-price relation increases the farmers' awareness of the need to increase production efficiency if the opportunity to do so exists.

Table 11.—Comparative Per Unit Cost of Producing Sorghums and Alternative Crops in Caddo, Roger Mills and Texas Counties. (In dollars)

Crop[a]	Unit	Per Unit Cost of Production[b]					
		Caddo		Roger Mills		Texas	
		Less Than 160 A Cropland	Greater Than 160 A Cropland	Less Than 300 A Cropland	Greater Than 300 A Cropland	Less Than 800 A Cropland	Greater Than 800 A Cropland
Grain sorghum	bu.	1.23	1.07	1.09	.98	.94c	.79c
Forage sorghum	ton	17.72	15.73	17.36	15.81	16.79c	15.97c
Wheat	bu.	1.48	1.41	1.52	1.40	1.49	1.25
Cotton	bale	165.68	155.55	136.08	131.35	____	____
Peanuts	lb.	.101	.094	____	____	____	____
Alfalfa	ton	22.41	21.22	____	____	____	____
Oats	bu.	.79	.75	____	____	____	____
Barley	bu.	1.04	1.00	____	____	____	____
Broomcorn	ton	____	____	308	289	____	____

Source: Costs—See Table 5, footnote a.

[a] All crops non-fertilized except alfalfa. The annual rate of fertilizer application on alfalfa was 150 pounds 0-20-0.

[b] Includes operating, overhead and land cost.

[c] Preharvest practices differed between groups within Texas County.

Practices including expansion of farm size and use of fertilizer, certified seed and insecticides offer opportunities for increasing efficiency. A practice may be adopted if additional returns exceed additional costs. For example, use of fertilizer on wheat, cotton and peanuts in Caddo County was a profitable practice according to survey results. The additional cost of fertilizing wheat totaled $4.05 per acre; the estimated additional return from wheat was $6.80 per acre. Thus, under conditions assumed from these estimates, additional returns exceeded additional costs by $2.75 per acre.[1]

Opportunities exist for reducing unit costs by expanding farm size. Larger acreages permit better combinations of resources such as machinery and labor. Also, larger acreages than many of the farms in the survey contained may be necessary to justify ownership of some machinery. For example, if a new combine costs $6,000, and the cus-

[1] Assuming the farmer owns machinery to apply the fertilizer. If a fertilizer attachment is purchased, the additional cost of fertilizer application would increase to about $4.50 per acre, and the additional return per acre would decrease to about $2.30 per acre.

tom rate is $3.00 per acre, a farmer must combine abou 350 acres per year to break even with the custom rate (Table 12). A farmer who does not raise 350 acres might justify ownership by performing custom work or by placing considerable value on convenience and timeliness of combining his own crops. Break even acreages for other items of equipment may be computed by the formula:

$$\text{Break even acreage} = \frac{\text{Overhead cost per year}}{\text{Custom rate minus operating cost per acre}}$$

Machinery costs may be reduced by: (1) decreasing investment, (2) prolonging useful life and (3) increasing annual use. Investment may be decreased by buying used equipment, joint ownership of machinery or by owning less machinery and hiring custom work. The useful life of a machine may be prolonged by better care. Annual use can be increased by expanding farm size or by doing custom work.

Table 12.—Estimated Acreage Operated Per Year for a 12 Foot Self Propelled Combine in Northwestern Oklahoma Necessary to Break-even With Custom Rates.

Custom Rate Per Acre	New Price of Combine Dollars					
Dollars	*5000*	*5500*	*6000*	*6500*	*7000*	*7500*
2.00	504	554	604	655	705	755
2.50	370	407	444	481	519	556
3.00	293	322	351	381	410	439
3.50	242	266	291	315	339	363
4.00	206	227	248	268	289	310
4.50	180	198	216	234	251	270

Source: —See Table 5, footnote a.

Summary

The main objectives of this study were to evaluate sorghums as crop alternatives and to examine the relationship between farm size and crop production efficiency in western Oklahoma. This report was based primarily on information from 72 dryland sorghum producers in Caddo, Roger Mills and Texas counties in 1956. The report was supplemented by information from 21 Beaver County sorghum producers, agricultural specialists in the State, and published information.

Returns above operating costs (comparative returns) were estimated for crops which farmers considered alternatives on land suited for sorghum production. Allotment crops ranked highest in comparative returns estimated with short term prices. In general, sorghums ranked next, and appeared to be the most profitable alternatives for acres remaining after allotment crops are planted. However, alfalfa in Caddo and broomcorn in Roger Mills County also ranked high in comparative returns.

Returns also were computed using long term prices designed to aid farmers in determining long term trends in the relative profitability of crop production. Sorghums appeared considerably more attractive as alternatives when returns were estimated with long term prices. Comparative returns from grain sorghums exceeded comparative returns from wheat, but were lower than returns from cotton, peanuts, alfalfa, and broomcorn.

Income per acre from grain sorghum was less variable than income per acre from wheat and oats in Caddo, Roger Mills and Texas counties from 1939 to 1957. Income was about equally variable for cotton and grain sorghum in Caddo and Roger Mills counties during this period.

About 50 percent of the grain sorghum produced in Oklahoma is sold off farms where it is grown. Significant reduction in grain sorghum price in relation to corn price occurred since 1930, and the present grain sorghum—corn price ratio in Oklahoma favors the use of grain sorghum for feed.

Surveyed farms, in each county, were divided into two size groups based on total cropland acres. Operating costs per acre were lower on large than on small farms due to ownership of larger, more specialized machinery. Total overhead costs were higher on large farms, but larger acreages enabled farmers to spread these costs over more units of production. Total unit costs including operating, overhead and land costs were lower on the large farms.

Efficiency in crop production may be increased by adopting improved practices such as use of fertilizer if additional returns exceed the additional cost of adopting the practice. Opportunities may exist for improving efficiency through an increase in farm size. Increased size allows better combinations of land, farmer labor and machinery.