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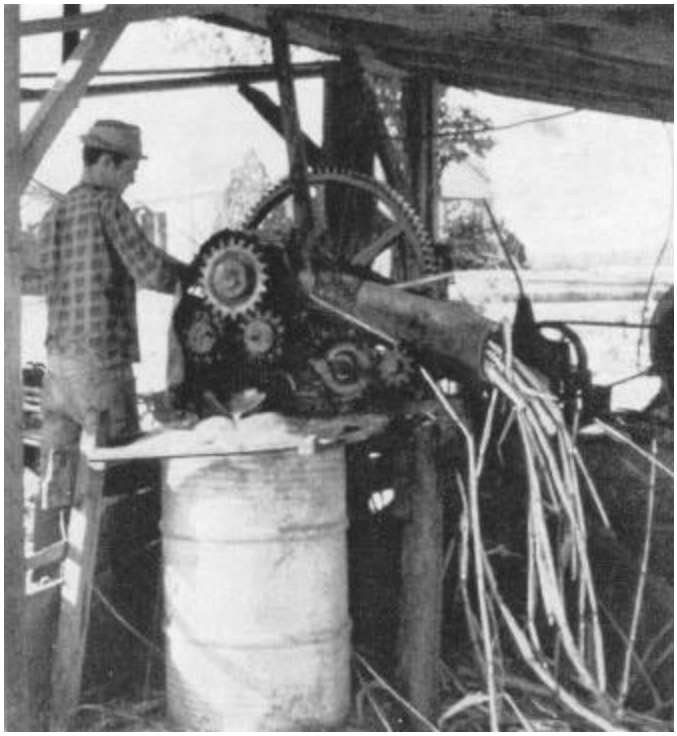
Costs and Returns from Producing and Processing Sorghum Syrup



by
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AGRICULTURAL EXPERIMENT STATION
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Introduction

THE PRODUCTION of sweet sorghum for syrup in Tennessee is not very extensive as compared to some of the more common crops. But it is an important source of income on some farms and in some areas of the state. In 1959, Census of Agriculture reported a total of 2,980 acres of sorghum grown for syrup in Tennessee with a total production of 215,378 gallons. About 63% of this was sold

Table 1. Major areas of sorghum production for syrup in Tennessee, 1949 and 1959[1]

County	Gallons produced		Acres grown	
	1949	1959	1949	1959
Benton	14,605	49,606	177	424
Warren	27,041	13,184	217	125
Fayette	9,003	9,572	212	216
Tipton	879	9,116	15	136
Shelby	10,607	7,150	118	153
DeKalb	6,317	6,333	84	111
Total (6 counties)	68,452	94,961	823	1,165
State	159,074	215,378	2,491	2,980

[1]U. S. Census of Agriculture

while about 37% was produced for home consumption. At prevailing prices the total sales of sorghum syrup for the State was slightly over $250,000.

Leading counties in syrup production and amounts of produc-

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tion in 1949 and 1959 are shown in Table 1. These six counties produced approximately 44% of the state production in 1959.

While some sorghum syrup is produced in most Tennessee counties, the only concentrated area of commercial production is located in the southeastern and central portions of Benton county. In 1959, 424 acres of sorghum grown for syrup were reported in Benton county, producing a total of 49,606 gallons of which 47,345 gallons were sold. Acreage grown in Benton county has been increasing since 1959. Thus Benton county reported 14% of the total acres of sorghum grown in the state in 1959, 23% of the total production and approximately 35% of the total sales. Warren county, the second largest producer, reported 10,599 gallons of sorghum syrup sales in 1959.

Sorghum Syrup Production in Benton County

Since sorghum syrup production is becoming a commercial enterprise on some farms, more information is needed about the relative profitability of the crop as compared to other alternatives. This report is intended to provide estimates of the inputs used, and costs and returns of producing sorghum for syrup. These estimates are based on information obtained from personal interviews with 39 sorghum syrup producers in Benton county. This information was based on data for the 1962 crop year.

Sorghum syrup production in Benton county was concentrated in the Eagle Creek and Big Sandy areas. About 92% of the 1962 production was in the Eagle Creek area and about 8% was produced in the Big Sandy area. Total acres of sorghum grown for syrup in 1962 on the 39 farms were 691, or an average of 17.7 acres per farm. From this acreage a total of slightly over 67,000 gallons of processed syrup was made, or an average production per acre of about 95 gallons. If the cost of containers is deducted, the average sales price was $1.97 per gallon. Average value of production per farm was $3,320. About 54% of the sorghum grown for syrup was produced on rented land.

The combination of sorghum syrup production and processing was an important enterprise on many of the 39 farms. Twelve of the farms grew 25 acres or more of sorghum for syrup production. Only 12 of the farms reported any cotton acreage. These 12 farms grew an average of 6.4 acres of cotton (Table 2). Corn was grown on about 70% of the farms. Soybeans or peanuts were reported on 7 of the farms. Livestock were reported on most of the farms, but in most cases livestock or livestock products did not provide

Table 2. Major enterprises on 39 Benton county farms producing sorghum for syrup, 1962

Enterprise	Unit	No. of farmers reporting	Av. per farm reporting
Sorghum	Acre	39	17.7
Cotton	Acre	12	6.4
Corn	Acre	27	23.0
Beef cattle	Number	15	22.9
Dairy cattle	Number	10	4.1
Sows	Number	16	3.2

an important source of income for the farmer. Fifteen of the farmers reported an average of 22.9 beef animals, and 10 of the farmers reported an average of 4.1 dairy animals. Twenty-three of the farmers reported some hogs but numbers of hogs were generally small.

Because of the few producers interviewed and the wide diversity of production conditions, it was impossible to determine the effect of specific production practices on yield or quality of syrup produced. Following is a summary or description of the practices used.

Soil

Sorghum was grown on a variety of soils. Production was about equally divided between bottomland and upland soils. Most soils used for sorghum production were moderately-drained to well-drained. Since 1962 was a relatively dry year, sorghum syrup yields were somewhat higher on the poorly and moderately-drained soils than on the well-drained soils. This would, of course, not necessarily be true in years of average or above-average rainfall.

Fertilization practices

All of the farmers reported using a complete fertilizer in 1962. In most cases the analysis used was 6-12-12. Rates of application varied from 100 pounds to 600 pounds per acre and averaged about 300 pounds per acre. Since 1962 was an unusually dry year and the sorghum was grown on widely varying types of soils, it was not possible to determine any relationship between level of fertilizer use and yield of syrup. Only four of the producers had limed the land used for sorghum production in the past 4 years.

Variety and seed source

Past research has indicated that variety is one of the most important factors affecting the quantity and quality of syrup pro-

duced. The major variety grown in Benton County in 1962 was Honey (Mississippi Honey Drip) with 24 of the 39 farmers reporting this variety. Hasting was reported on 6 farms and Golden Prolific was used by 5 farmers. Other varieties reported were White African, Waicona, White Amber, and Sugardrip. Not enough information was available to attempt to compare the relative yields of the different varieties. Most of the farmers (over 80%) saved their own seed from year to year.

Insect control

None of the producers used any insect or disease control measures. About one-third of the producers mentioned some damage from rust, lice, and/or bud worms. Most of the farmers felt that insect and disease damage were not serious enough to affect yield appreciably.

Estimated Costs and Returns of Producing Sorghum Syrup

Costs and Returns from Sorghum Syrup Production with Custom Processing

The major items of costs in processing sorghum were for harvesting and processing. Harvesting costs were mostly labor costs while processing costs were predominately labor and fuel for cooking. In this section processing cost and returns will be determined on the basis of payment of one-third share of the processed syrup to the processor. Slightly over a third of the producers had their syrup processed by someone else while the other two-thirds owned a processing facility.

Table 3. Estimated performance rates and costs per acre of machine services used in producing sorghum for syrup

Operation	Machine used	Hours once over	Total hour per acre	Cost per acre: Variable costs[a]	Cost per acre: Fixed cost[b]	Cost per acre: Total cost
					Dollars	
Turning	2-bottom plow	1.5	1.5	$ .08	$ .66	$ .74
Discing	7-8 ft. disc	.5	1.2	.07	.90	.97
Fert. application	8-ft. spreader	.6	.6	.03	.27	.30
Planter	2-row planter	.6	.6	.05	.73	.78
Cultivating	2-row cultivator	.67	2.0	.08	1.38	1.46
Tractor	Medium size	—	5.9	4.01	2.12	6.13
Total				$4.32	$6.06	$10.38

[a]Fuel, grease, oil, repairs.

[b]Depreciation, housing insurance and capital charge.

In determining production costs it was assumed that land preparation, fertilizer application, planting, and cultivation were performed with tractor and associated equipment. The machines used, hours of use, and the assumed costs per hour of use[1] are shown in Table 3. Estimated amount of labor required for each operation through harvesting is shown in Table 4. Labor estimates shown are averages of the amount of required labor estimated by the farmers. Of the total of 79.4 hours of labor required from land

Table 4. Estimated labor required per acre by operations (through harvest) for producing sorghum for syrup, 39 farms, Benton county, 1962

Operation	Hours/acre	Percent of total production labor
Land preparation	2.7	3.4
Planting and fertilizing	1.2	1.5
Cultivating	2.0	2.5
Stripping	25.8	32.5
Cutting sorghum	19.5	24.6
Removal of heads	15.3	19.3
Haul to mill	12.9	16.2
Total	79.4	100.0

preparation through delivery to the mill, 73.5 hours per acre were required for harvesting and hauling to the mill.

Estimated costs and returns from 1 acre of sorghum are shown in Table 5. Cost of production items are divided into machine cost, fertilizer cost, and labor and land charge. Machine costs as shown in Table 3 include both fixed and variable costs. Variable machine costs include estimated costs of fuel and oil for tractor, and grease and repairs on all machines used. Fixed costs include estimates for depreciation, housing costs, and a prorated charge for capital or money tied up in machine investments.

Fertilizer costs are based on an application rate of 300 pounds of 6-12-12 per acre. Initially the value of labor was assumed to be $1.00 per hour. A land charge of $7.50 per acre was based on an estimated land value of $150 per acre and 5% capital return. On this basis, the total costs of production were $105.53 per acre.

In 1962, the average yield of syrup was 95 gallons per acre.

[1]Variable and fixed costs of owning and operating particular machines were based on average amount of use of these machines on medium-size farms. Since machine costs are greatly dependent on the amount of annual use of the machines, machine costs would likely be somewhat higher than shown on small farms and somewhat lower than shown on large farms. Cost data shown in the table were taken from unpublished estimates of the Department of Agricultural Economics and Rural Sociology.

Table 5. Estimated costs and returns per acre from sorghum syrup production *with custom processing*

	Unit	Amount	Price per unit	Total value
Costs:[1]				
Machines: Tractor	hrs.	5.9	$1.04	$ 6.13
Other machines	hrs.	5.9	—	4.25
Fertilizer (6-12-12)	cwt.	3.0	2.75	8.25
Labor	hrs.	79.4	1.00	79.40
Land charge	acre	1.0	7.50	7.50
Total cost				$105.53
Returns:[2]				
Syrup	gal.	95.0	$1.97	$187.15
Less processing cost	gal.	31.67	1.97	62.38
Gross value to grower				$124.77
Net returns per acre				19.24
Total net returns to labor ($79.40 + $19.24				98.64
Returns to labor per hour (79.4 hours)				1.24
Returns to labor per hour (assume same production inputs)[3]				
75-gallon yield				.91
125-gallon yield				1.73
150-gallon yield				2.15

[1]Labor was charged at $1.00 per hour even though much of labor may not have been hired. Land charge was based on an estimated land value of $150/acre and capital charge of 5%.

[2]Value shown for the syrup per gallon is after deductions were made for cost of the container. Returns are computed on the basis of custom processing with one-third share rate as the cost. Average yield of processed syrup per acre was 95 gallons in the area in 1962.

[3]Harvesting labor might be slightly higher for the 125- and 150-gallon yields.

Since the average sales value was $1.97 per gallon (after deducting 30¢ per gallon for container) the gross value of sorghum syrup per acre was $187.15. The usual custom rate charged for processing was one-third. If we deduct one-third of the value of the syrup for processing, this would result in an adjusted gross value per acre of $124.77. After deducting the cost of production estimated above, the net return was $19.24 per acre. This would indicate that returns to labor were somewhat in excess of the assumed $1.00 per hour. If we add this return to the estimated labor charge made earlier, the net return to labor averaged $98.64 per acre. Since the total labor required—excluding processing—was 79.4 hours, this would represent an average return to labor of $1.24 per hour.

Since yields of sorghum syrup are influenced considerably by weather, one could assume that yields would fluctuate from year to year due to weather effects even though production and cultural practices remained unchanged. In 1961, average production

of sorghum syrup per acre in the Benton County area was about 129 gallons. Estimates of returns to labor are also shown in Table 5 for yields of 75, 125, and 150 gallons of syrup per acre assuming no differences in production costs. Under these conditions, returns per hour would average 91¢ for 75-gallon yield, $1.73 for 125-gallon yield, and $2.15 for 150-gallon yield.

Costs and Returns from Processing Phase

Twenty-four of the 39 producers owned a mill and other facilities for processing syrup. Most of these processing plants were used not only for processing of the owners' production, but were also used to perform custom processing for other farmers. One processing plant was used solely for doing custom processing for others. As indicated earlier, the usual custom charge was one-third of the syrup made.

The usual processing plant consisted of:

1. Crushing mill or juice extraction equipment and associated power source. Nineteen of the 25 mill owners used tractors as the source of power while the other 6 used electric motors (5 to 7½ h.p.).
2. Buildings used to house the processing equipment and used for temporary storage of the syrup until marketed.
3. Fuel system for heat used in the cooking process.
4. Cooking or evaporation pans and heat chamber upon which the pans are placed.

Investments and cost estimates for various items of processing equipment are shown in Table 6. Many of the crushing mills used in the Benton County production area were purchased as used equipment. Most of the mills now in use were acquired in the past 5 years. The average cost of the mills when acquired was

Table 6. Investments and annual cost of buildings and equipment for sorghum syrup processing

Item	Average investment	Estimated life	Annual depreciation	Estimated annual repairs	Annual capital charge[1]	Total annual cost
Mill (juice extraction)	$320	15	$21.33	$20.00	$ 8.00	$ 49.33
Buildings	450	20	22.50	15.00	11.25	48.75
Fuel system (gas)	290	12	24.17	—	7.25	31.42
Cooking pans	124	4	31.25	—	3.10	34.35
Total			$99.25	$35.00	$29.60	$163.85

[1]Calculated at 5% rate on one-half of original investment.

approximately $320, but varied between $75 and $600. With minor repairs from time to time, this equipment was expected to last about 15 years.

Buildings used to house the processing equipment varied from completely new concrete block buildings to older type structures which had been renovated to meet state sanitary regulations for syrup production. Estimated average investment in buildings was approximately $450 and expected life of buildings was assumed to be 20 years. Investment in buildings varied from practically nothing to over $1,500.

Twenty-one of the 25 processors used butane gas as the source of heat for cooking the syrup while 4 of the processors used wood for heating purposes. Average investment in a butane gas heating system was approximately $290. As with the other equipment, cost varied considerably, with a range from $180 to $500. For cost calculations, the fuel system was assumed to last 12 years.

The other item of investment in processing facilities was the cooking or evaporation pans. A few of these had been purchased as used equipment. Types of cooking pans used included copper, galvanized steel, and stainless steel. The average investment in cooking pans was about $125. Producers' estimate of the average life of cooking pans was 4 years.

Table 7. Estimated costs and returns from processing sorghum syrup *on custom basis*

	Cost/day	Cost/gal. made[1]	Percent of processing cost
Processing costs for 10-hour day			
Labor (41 hrs. @ 1.00/hr.)	$41.00	$.331	53.6
Fuel (150 gal. butane)	19.60	.158	25.6
Fixed cost (equipment and buildings)[2]	7.60	.061	10.0
Tractor use (8 hrs. @ $1.04)	8.32	.067	10.8
Total	$76.52	$.617	100.0
Gross returns per 10-hour day			
Syrup (41.3 gal. @ $1.97/gal.)[3]			$81.36
Net returns per day			4.84
Total net returns to labor ($41.00 + $4.84)			45.84
Returns per hour of labor			1.12

[1]Based on processing an average of 124 gallons of syrup per day.

[2]Average amount of syrup processed per year was 2,680 gallons per mill. Since the average amount of syrup processed per 10-hour day was 124 gallons, a mill was operated, on the average, 21.6 days during the processing season.

[3] The standard charge for processing was one-third of the syrup.

Average total investment in processing and juice extraction equipment, excluding a tractor used as a power source, was $1,185 per mill.

Cost of processing syrup as presented in the following section and shown in Table 7 will assume butane gas is used for cooking and that tractor power is used to propel the juice extraction presses. On this basis, the cost of processing sorghum syrup will include the following: prorated annual cost of owning the processing equipment and buildings; cost of butane fuel; cost of operation of tractor for juice extractions; and the cost or value of the necessary labor for operating the processing plant.

Annual cost of owning the processing equipment is shown in Table 6. It includes depreciation, estimated repairs of juice mill and building, and an assumed charge on average capital invested. Annual depreciation on equipment was estimated to be $99.25, and annual repairs on building and juice mill was estimated to be $35.00. A 5% capital charge on $592 (½ of $1,185) would result in an annual capital charge of $29.60. Thus the average annual total cost of ownership of processing plant would be $163.85.

Since the above costs (called fixed cost) will be about the same regardless of the amount of sorghum syrup made in a given year, their importance will depend on how much syrup is processed through the facility during the year. Among the 25 processing plants, the amount of syrup processed in 1962 varied from slightly less than 1,000 gallons to over 5,000 gallons. Based on the average amount of syrup processed, or 2,680 gallons, the average fixed cost per gallon of syrup processed in 1962 was about 6 cents ($163.85 ÷ 2,680).

Other costs of processing syrup are called variable costs; that is, they vary in direct relation to the amount of syrup made. Variable costs include labor, fuel, and tractor use for propelling the juice extraction equipment. According to estimates made by owners of the processing plants, the average total amount of labor required to operate the processing facility for a 10-hour day was 41 hours. Butane gas fuel consumption for the same period averaged about 150 gallons. Tractor was assumed to be used for 8 hours during the 10-hour period. The average amount of syrup processed per day was 124 gallons. Thus, processing plants operated an average of 21.6 days during the processing season.

If we assume a charge of $1.00 per hour for labor and allocate the fixed cost among the average of 21.6 operating days, the total cost per 10-hour day of operating the processing plant was $76.52

as shown in Table 7. With an average of 124 gallons of syrup processed, the average cost per gallon processed would be around 62 cents. Processing costs would, of course, vary from mill to mill, depending largely on whether labor and fuel cost were greater or less than averages shown here. Variations in amounts invested in the processing plant and in extent of use of equipment would affect processing costs to a small extent. For example, if the processing plant was used to process 5,000 gallons per year rather than the 2,680 average used, total costs of processing would be reduced approximately 3¢ per gallon. If $1,800 was invested in the processing facility instead of the $1,184 average used in the above cost calculations, processing costs would be increased about 3 cents per gallon, assuming all other costs and performance rates were equal to the average for all processors.

Labor was the most important cost item, accounting for 53.6% of total processing cost. Fuel costs were 25.6% of processing costs, prorated annual share of equipment and building 10.0% and estimated cost of tractor use for propelling juice extractor 10.8% of processing cost.

For custom operations, the usual charge for processing the syrup was one-third of the product. Based on the average value of $1.97 per gallon of syrup, the processor would receive an average return of about 66¢ per gallon processed, or 4 cents per gallon above the estimated costs of production shown in Table 7. Viewed in a different way, if the processor made 124 gallons of syrup per day and received one-third of the amount as a return for his processing (41.3 gallon), the gross value of his share of the sorghum would be $81.36. Costs of production, on a 10-hour day basis, were $35.52 excluding labor charge. Thus the net return to labor (41 hours) per day was $45.84, or $1.12 per hour of labor used.

Costs and Returns from Production and Processing Phase

In Table 8 costs and returns have been computed on a per-acre basis, assuming the farmer did his own processing and based on usual practices and inputs used in 1962. Costs are divided into two categories: production costs and processing costs. No charge was made for labor, but rather net returns are an estimate of the return to labor.

Harvesting and processing were usually spread over a period of 4 to 6 weeks. Many of the producers made three or more plantings in order to spread the harvest period. The usual prac-

Table 8. Estimated costs and returns *per acre* for sorghum syrup, by yields per acre, *production and processing phase*

Item	Yield in gallons per acre			
	75	95	125	150
Production costs:				
Fertilizer (300#/ac., 6-12-12)	$ 8.25	$ 8.25	$ 8.25	$ 8.25
Tractor (5.9 hr. @ $1.04)	6.13	6.13	6.13	6.13
Other machines (disc, plows, cultivators, etc.)	4.25	4.25	4.25	4.25
Land charge	7.50	7.50	7.50	7.50
Total production costs	$ 26.13	$ 26.13	$ 26.13	$ 26.13
Processing costs:				
Annual equipment & building costs[1]				
Depreciation	$ 3.52	$ 3.52	$ 3.52	$ 3.52
Repairs	1.24	1.24	1.24	1.24
Capital charge	1.06	1.06	1.06	1.06
Fuel (butane gas)	11.80	14.96	19.68	23.61
Tractor use (juice extraction)	5.01	6.35	8.35	10.02
Total processing costs	$ 22.63	$ 27.13	$ 33.85	$ 39.45
Total average production and processing costs (excluding labor charge)	$ 48.76	$ 53.26	$ 59.98	$ 65.58
Returns:				
Gross value of syrup ($1.97/gal.)	$147.75	$187.15	$246.25	$295.50
Less production and processing cost	48.76	53.26	59.98	65.58
Net returns to labor	98.99	133.89	186.27	229.92
Total labor required (hrs.)	104.2	110.8	120.7	129.0
Net returns per hour	.95	1.21	1.54	1.78

[1]Based on an average of 2,680 gallons processed per mill per year and an average yield of 95 gallons per acre, each mill processed, on the average, the sorghum produced on 28.2 acres in 1962. Total annual costs of equipment and buildings are shown in Table 6.

tice was to process the syrup as soon as possible following harvest.

Total production cost through harvesting totaled $26.13 per acre. Fixed costs of equipment and buildings per acre were determined on the basis of an average of 28.2 acres of sorghum processed per mill. Variable costs of processing and gross returns are shown not only for the average of 95 gallons of syrup per acre realized in the area in 1962, but also at 75-, 125- and 150-gallon yield levels. Field production costs and prorated share of building and equipment costs per acre were assumed to be the same for all of the four yield levels. Fuel costs for cooking, cost of tractor power for juice extraction, and amount of labor required for processing increase as yield level is increased.

On this basis fixed costs for processing averaged $5.82 per acre and variable processing cost averaged $21.31 per acre for the 95-gallon yield level. Total costs of production and processing excluding labor cost averaged $53.26 per acre. Based on production of 95 gallons of syrup per acre valued at $1.97 per gallon, gross returns per acre of sorghum averaged $187.15. Net return per acre to labor averaged $133.89. Since the total labor required per acre for both production and processing averaged 110.8 hours, the average return per hour of labor was $1.21.

Returns are also shown in Table 7 based on assumed yields of 75, 125, and 150 gallons per acre. It was assumed that these yields could be achieved with the same field production practices—or at least with no additional cost—and that existing processing facilities in the area were adequate to handle the larger volume. Net returns per acre to labor were $98.44 for the 75-gallon-per-acre yield, $186.27 for the 125-gallon-per-acre yield and $229.92 for the 150-gallon-per-acre yield. This would represent an average return of 95 cents, $1.54, and $1.78 per hour of labor for the 75-, 125- and 150-gallon yield levels, respectively.

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