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Economic Returns from
GRAIN SORGHUM FED TO STEER CALVES
on Dryland Farms of the High Plains

in cooperation with the
UNITED STATES DEPARTMENT OF AGRICULTURE

TEXAS AGRICULTURAL EXPERIMENT STATION
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Summary

Livestock feeding affords an alternative market for grain and forage sorghum produced on dryland farms of the High Plains. An analysis of livestock feeding based on feeding trials at the Big Spring Field Station indicates that steer feeding provides some prospect for improving farm income.

Most farms have some facilities, including the water supply, that would be adequate for livestock feeding purposes. An added investment of about $6,300 would be required to provide facilities for feeding 100 head of steer calves. The annual cost of these added facilities would be about $850.

Based on the high grain ration fed at the Big Spring Field Station, the feed required per steer for a 180-day feeding period includes 1,900 pounds of sorghum grain, 360 pounds of cottonseed meal and 2,400 pounds (net) of silage. Although the average rate of gain per day will differ from year to year, these quantities of feed can be expected to give an average daily gain of 2 pounds, or 360 pounds of gain, market weight basis, per steer during a feeding period of 180 days.

At average yields, a total of 220 acres of cropland would be required to provide grain and silage for 100 steers.

Variations in the price of grain have a substantial effect on the cost per pound of gain. Each 25-cent increase in the price per hundred pounds of grain sorghum raises the cost per pound of gain by 1.57 cents. A $10 per ton increase in the price of cottonseed meal causes a one-half cent rise in the cost per pound of gain.

For steers costing 16 cents per pound and fed 180 days, the total cost per pound of gain, exclusive of labor and management costs, ranges from 16.63 cents with $1.25 per 100 pounds of grain sorghum and $60 per ton cottonseed meal to 23.03 cents for the same steer fed on $2.25 grain sorghum. The total cost per pound of gain, exclusive of labor-management costs, is increased .04 cent for each 1-cent increase in the initial cost of steers.

The selling price required to break even, labor-management costs excepted, is affected by the initial price of the steers and by the price of sorghum grain and cottonseed meal. Each 25-cent increase in the price of grain sorghum raises the break-even price by .70 cent per pound, whereas each $10 per ton increase in the price of cottonseed meal raises the break-even price by .23 cent per pound.

When the initial steer cost per pound is lower than the cost per pound of gain, the feeder realizes the full increase in price on the initial steer weight but receives less than the full amount on the gain.

With comparable feed prices, the total cost per pound of gain, labor-management costs excepted, is slightly higher on a 150-day feeding enterprise, irrespective of the level of feed prices. With grain sorghum prices at or below $1.75 per hundredweight, the selling price required to break even is a little lower on the 180-day feeding enterprise, whereas with grain prices above $1.75 the break-even price per pound is slightly lower on the 150-day feeding enterprise.

With grain sorghum at $1.50 per hundredweight, a marketing margin of 1 cent per pound will not provide a labor-management return equivalent to hired wages. With grain sorghum at $2 per hundredweight, a 2.5 to 3-cent marketing margin is required to provide a labor-management return equivalent to hired wages on steers with an initial cost of 18 and 19 cents, whereas with steers costing 16 and 17 cents, a 3.5 to 4-cent margin is required. With the feed and cattle prices that have prevailed in recent years, a marketing margin of 3 to 4 cents per pound would be required for steer feeding to provide a labor-management income equal to hired wages during the feeding period.

Economic Returns from Grain Sorghum Fed to Steer Calves on Dryland Farms of the High Plains

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DRYLAND AGRICULTURE in the southern part of the Texas High Plains has a high degree of production and price risk. Crop yields often are reduced by lack of moisture or high wind movement. When moisture and other conditions are favorable, the same conditions often exist in other areas producing similar crops, and prices frequently are depressed.

The present land use and cropping systems have evolved through more than 40 years of farming experience. It may be assumed that present crop-production techniques and the varieties planted have proved most advantageous. This suggests that the more immediate prospect for improving farm income lies in a modification of existing crop-disposal methods.

This study analyzes the economic feasibility of steer feeding as an alternative to the sale of grain sorghum. It is based on the results of crop production and steer-feeding experiments conducted at the Big Spring Field Station.

Physical Resources

The southern part of the High Plains is a broad sloping plane ranging in elevation from 3,800 feet in Cochran County to 2,400 feet at Big Spring. Much of the area has a smooth, almost flat, surface. Other parts are gently undulating to rolling with a topography characteristic of wind-blown sand.

Three general classes of soil — sandy loams, loamy sands and sand — are closely associated with these topographic differences. The sandy loam soils are found on the smoother areas, whereas the lighter textured loamy sands and sands cover the parts that are more rolling.

All three soil classes can produce crops up to the limits of existing moisture supplies. Wind action also limits crop production on the loamy sands and sands.

At Big Spring, the September 1 to August 31 precipitation averaged 18.05 inches during the 41-year period, 1916-56, Table 1. Except for the recent drouth years, distribution of rainfall has been favorable for cotton and grain sorghum production. At Seminole, on the western side of the area, annual precipitation averaged slightly over 16 inches, with a somewhat less favorable seasonal distribution than that received at Big Spring.

Throughout this area, the peak rainfall occurs in May, tapers off in June and reaches a low during July and early August. Another peak occurs during the last week in August; it is followed by a decline through September and October to an extreme low during the winter. Practically all rain falls as intense showers with a large amount of runoff, or in showers that evaporate the next day.

Crop Adaptation

Both research at the Big Spring Field Station and farmer experience show that cotton and

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TABLE 1. PRECIPITATION AND CROP YIELDS, 1916-56, BIG SPRING FIELD STATION, BIG SPRING, TEXAS

Year	Precipitation Sept. 1-Aug. 31	Cotton lint	Grain sorghum	Sumac fodder	Sumac silage
	Inches	— — — Pounds per acre — — —			
1916	17.40	169	1,090	12,520	24,164
1917	7.05	8	162	2,860	5,520
1918	7.55	83	000	5,100	9,643
1919	25.11	476	2,749	13,500	26,055
1920	30.84	581	1,757	13,440	25,939
1921	15.23	176	1,392	4,780	9,225
1922	21.75	199	1,479	8,400	16,212
1923	19.05	390	1,647	6,400	12,352
1924	18.43	217	331	3,380	6,523
1925	14.13	259	638	4,920	9,498
1926	22.00	296	1,061	8,120	15,672
1927	18.25	187	998	4,420	8,531
1928	22.07	341	1,241	6,100	11,773
1929	15.82	210	661	6,800	13,124
1930	18.82	202	1,097	3,880	7,488
1931	17.39	319	1,299	5,800	11,194
1932	33.86	281	1,380	9,960	19,223
1933	20.62	330	1,061	9,000	17,370
1934	12.23	236	1,711	4,800	9,264
1935	20.22	314	922	7,400	14,282
1936	17.08	184	1,090	3,400	6,562
1937	23.64	371	1,560	4,770	9,206
1938	24.23	262	1,688	6,400	12,352
1939	14.69	229	1,659	3,630	7,006
1940	14.75	281	661	3,880	7,489
1941	26.49	379	1,400[1]	10,000	19,300
1942	24.25	240	1,080	6,250	12,063
1943	18.47	225	1,575	4,130	7,971
1944	15.58	277	900	6,880	13,278
1945	26.82	217	2,650	6,380	12,313
1946	11.50	150	500	3,130	6,041
1947	15.46	262	700	3,380	6,523
1948	14.11	165	500	4,000	7,720
1949	16.65	296	925	1,880	3,628
1950	22.26	356	950	2,500	4,825
1951	12.27	90	18	1,380	2,663
1952	5.58	0	0	0	0
1953	11.80	66	475	1,060	2,046
1954	23.93	73	525	2,400	4,632
1955	16.01	107	850	3,080	5,944
1956	6.80	0	0	0	0
Average	18.05	232	1,055	5,368	10,356

[1]Dwarf yellow milo used through 1940, combine type sorghums 1941-56 inclusive.

sorghum are the only crops that fit satisfactorily into this climatic environment. Yields of corn, wheat and millet are low and cowpeas and peanuts leave the soil loose and susceptible to wind erosion.

Types of Farming

Three types of farming predominate in this area. Cattle ranching on an extensive scale is practiced throughout the area and is the main type of farming in the western and southern portions. Production of cotton and grain sorghum on medium-sized to large, fully mechanized farms predominates in the more heavily developed eastern and northern portions of the area. Livestock production is a minor enterprise on farms of this type. The third type of farming combines livestock and forage sorghum production along with cotton and grain sorghum production. It is practiced to some extent in the more heavily developed areas, although it is more abundant in the less heavily developed sandy areas adjacent to the extensive cattle ranches.

Before acreage control programs, cotton regularly occupied about 70 percent of the total cropland, depending mainly on moisture conditions at planting time. Grain sorghum is the second most important crop. Many farmers plant only cotton and grain sorghum. Some forage-type sorghum, usually for on-farm use, is produced on farms with livestock enterprises.

Crop Yields and Production Requirements

Crop yields are extremely variable, reflecting variations in the amount and distribution of the precipitation received. These year-to-year differences in yield are shown in Table 1, which presents 41 years of yield history on the Big Spring Field Station. Before 1940, the station yields were somewhat higher than the average for Howard county. Since 1940, when mechanization of the farms was essentially completed, yields at the station and county average yields have been about the same.

Further evidence of the variable nature of crop yields is given in Table 2. From 75 to 80 percent of the yields received during 1916-56 were in the median and below classes. Also yields in the lowest class occur two to five times more often than yields in the top class, Table 2.

Correlation of crop yields with September 1 to August 31 precipitation indicates that 60 to 70 percent of the year-to-year variation in crop yield is caused by variation in the amount of precipitation received.[1] The remaining variation is attributable to the effects of maldistribution of precipitation, insects, disease and other weather damages.

A recent study of dryland farm operations in this part of the High Plains shows that 2.2 tractor-hours and 5.1 man-hours are required for preharvest operations on cotton, whereas only 1.7 man-hours and 1.7 tractor-hours are required for preharvest operations on grain sorghum.[2]

For all practical purposes, preharvest production requirements of grain and forage-type sorghums are identical. Grain sorghum commonly is harvested with a combine, whereas forage-type sorghum usually is harvested with a binder.

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[1]Moldenhauer, Wm. C. and Keating, Fred E., "A Study of Relationships Between Climatic Factors and Yields of Cotton, Milo and Kafir at Big Spring, Texas." Research Report No. 295, Soil and Water Conservation Research Branch, ARS, USDA in cooperation with the Texas Agricultural Experiment Station, April 1956.

[2]Martin, J. R., "Income Variations Due to Yields on Dryland Farms in the Southern High Plains Area of Texas, Owner-operated and Tenant-operated Farms". A thesis submitted to the Graduate School of the Agricultural and Mechanical College of Texas.

TABLE 2. DISTRIBUTION OF SPECIFIED COTTON, GRAIN SORGHUM AND SORGHUM SILAGE YIELDS, BY YEARS, BIG SPRING FIELD STATION, 1916-56[1]

Cotton			Sorghum grain			Sorghum silage		
Lint yield, pounds per acre	Years		Grain yield, pounds per acre	Years		Silage yield, pounds per acre	Years	
	No.	Percent		No.	Percent		No.	Percent
0-100	7	17.0	0-500	10	24.4	0-5,000	7	17.1
101-200	8	19.5	501-1,000	10	24.4	5,001-10,000	17	41.5
201-300	16	39.0	1,001-1,500	12	29.2	10,001-15,000	9	21.9
301-400	8	19.5	1,501-2,000	7	17.1	15,001-20,000	5	12.2
Over 401	2	4.9	Over 2,001	2	4.9	Over 20,001	3	7.3

[1]Based on Table 1.

Crop Returns

Based on the prices paid during 1956, the total cost of preharvest power, labor and materials used in cotton and grain sorghum production amounts to $10.75 and $5.75 per acre, respectively. Harvesting and associated costs were about 8.5 cents per pound of lint cotton in 1956. Assuming 1956 prices, a yield of 120 pounds of seed cotton (45 pounds of lint and 75 pounds of seed) is required to defray the annual specified costs. Grain sorghum commonly is harvested at a custom rate of $2 per acre, plus a hauling charge of 5 to 10 cents per hundredweight, depending on grain hauling distance. At these rates, a grain sorghum yield of approximately 500 pounds per acre is required to defray the specified production costs. Land, management and other overhead costs are not included in these costs. Assuming 1956 prices and 1916-56 average yields, Table 1, the returns above specified costs are about $46 and $10 per acre for cotton and grain sorghum, respectively.

With cotton acreage reduced from an average of 64 percent of the cropland in 1949 to approximately 40 percent in 1956, the need for an alternative source of farm income is evident. Land diverted from cotton production has been planted chiefly to grain sorghum since it is the best alternative crop.

The returns from grain sorghum are comparatively low and extremely variable, Table 1. Dryland farmers need increased returns from grain sorghum production. Moisture limits grain sorghum yields: consequently, the most likely prospect for improving the production returns is in an alternative method of grain disposal. Cattle feeding provides an alternative to the present cash marketing method of disposal.

Analysis of Steer-feeding Operations

This study is based on the feed requirements and rate of gain developed in more than 20 years of steer-feeding trials at the Big Spring Field Station. The study is designed to help answer the question: does cattle feeding represent a profitable alternative to the present cash marketing of grain sorghum? The answer to this question depends on the relation of grain, cottonseed meal and livestock prices. This study provides information that will help individual operators appraise the prospects for profit or loss under various feed-livestock cost-price situations.

Although there are several types of feeding operations, this study covers only the prospects for profit from steer calves fed the basic high-grain ration used at the Big Spring Field Station.

The appraisal is based on the principle of added returns minus added costs. Neither the production costs nor the land, management and risk-bearing cost enter into the calculation. They are sustained under present conditions and they

TABLE 3. AVERAGE QUANTITIES OF FEED USED, RATE OF GAIN AND FEED COST PER POUND OF GAIN, BY SPECIFIED FEEDING PERIODS AND GRAIN PRICES[1]

Feeding period, days	Feed requirements per day by specified periods			Gain per day[2]	Cost per pound of gain,[3] with varying grain sorghum prices[4]				
	Grain	Cottonseed meal	Silage		1.25	1.50	1.75	2.00	2.25
	Pounds				Cents				
0 - 28	3.64	1.97	21.32	2.29	6.25	6.93	7.55	8.19	8.84
29 - 56	6.85	1.65	16.96	2.02	8.23	9.24	10.37	10.60	12.52
57 - 84	10.67	1.86	14.32	2.54	8.45	9.66	10.84	12.04	13.25
85 - 112	12.68	2.07	10.10	2.27	10.58	12.11	13.62	15.14	16.68
113 - 150	14.56	2.20	9.05	2.55	10.35	11.88	13.41	14.92	16.44
151 - 181	14.00	2.27	6.39	1.98	13.03	14.93	16.78	18.68	20.53
Average - 180	10.59	2.00	13.33	2.27	9.51	10.83	12.15	13.35	14.78

[1]Adapted from TAES Progress Reports 1089, 1190 and 1407 by J. M. Jones, et al.
[2]Feedlot weights, 450-pound initial weight.
[3]Sixty dollars per ton cottonseed meal assumed with each grain sorghum price.
[4]Dollars per hundredweight.

will be sustained to a similar extent under a livestock-feeding program. The specified costs indicate the importance of cotton in the agricultural economy of the area and provide a comparative basis for gross farm incomes with and without a livestock-feeding program.

Basic Assumptions

The study is based on the feed and equipment requirements necessary to feed 100 head of steer calves. The 100-head basis for appraisal is based on the consensus of individuals familiar with livestock feeding and general farming operations in the study area. It was concluded that this is about the maximum number that one man could feed and also conduct necessary farm operations without assistance. The feeding program involves the use of weaned calves taken directly from pasture to feedlot during the last part of October or early November and fed for 180 days.

The rate of feedlot gains by specified feeding periods, Table 3, reflects results obtained under experimental conditions. Results obtained in experiments usually are somewhat higher than those obtained under general farm conditions. For this reason, this analysis is based on an average gain of 2 pounds, market weight, per animal per day. This is approximately .14 pound less per day than the long-time average daily gains obtained at the Big Spring Field Station.

Cost Items

ANNUAL COST OF FEEDING FACILITIES AND EQUIPMENT

An initial investment of $6,260 would be required to provide the equipment and facilities needed to feed 100 steers, Table 4. The equipment and facilities listed in Table 4 are necessary to supplement existing on-farm facilities. It is assumed that the present farm water supply is adequate, with the indicated expenditure for additional storage and piping. It is assumed also that existing facilities, plus the indicated improvements of $1,000, will provide an adequate feed-mixing room. The other items and facilities listed in Table 4 usually are not found on cash-crop or crop-livestock farms in this area.

Labor costs for feeding are not included in this study. Although a steer feeding enterprise of this size is not likely to utilize a man's time fully, it will preclude most if not all off-farm employment. In lieu of labor costs, therefore, prospective returns are presented as "labor-management income."

FEED COSTS

Five grain sorghum prices, ranging in 25-cent intervals from $1.25 to $2.25 per hundredweight, and three cottonseed meal prices, ranging from $60 to $80 per ton, are used in the analysis. Silage costs are based on the labor, power and machinery costs required to move the green crop from the field and place it in the silo, plus the market value of average yields of grain sorghum, less harvesting costs. With this pricing technique, the per ton cost of silage increases or decreases as the price of grain sorghum increases or decreases.

STEER COSTS

The analysis is based on the use of 100 head of 450-pound steer calves, feedlot weight basis, with an initial cost of $16, $17, $18 and $19 per hundredweight. A 2-percent death loss including 75 percent of the feed required on the lost steers during a 180-day feeding period is charged against the entire feeding operation.

INTEREST COSTS

An interest charge of 6 percent per annum is charged for 6 months on the initial investment in

TABLE 4. COST OF SPECIAL EQUIPMENT AND FACILITIES NEEDED FOR FEEDING OPERATIONS

Item	New cost[1]	Expected life	Average annual cost			
			Depreciation	Interest[2]	Repair and maintenance	Total
	Dollars	Years	Dollars			
Corrals and chutes	455.00	20	22.75	14.70	45.50	82.95
Feed troughs	215.00	10	21.50	6.45	10.75	38.70
Water supply improvements	300.00	20	15.00	9.00	15.00	39.00
Trench silos[3]	230.00	12	19.15	6.90	20.00	46.05
Grain storage facilities	1,500.00	30	50.00	45.00	15.00	110.00
Feed mixing room[4]	1,000.00	20	50.00	30.00	50.00	130.00
Silage harvester	1,680.00	12	140.00	50.80	50.00	240.40
Feed grinder	160.00	16	10.00	4.80	20.00[5]	34.80
Wagon trailer	250.00	15	16.60	7.50	20.00	44.10
Front-end loader	395.00	10	39.50	11.85	15.00	66.35
Miscellaneous equipment	75.00					25.00
Total	6,260.00		384.50	186.60	261.25	857.35

[1]Estimated on the basis of 1956 prices.
[2]Six percent interest on half of new cost.
[3]Two 150-ton capacity trench silos.
[4]Half of estimated new cost of 20' x 20' feed mixing and storage room added to existing facilities.
[5]Includes cost of energy required for feed grinding.

feeder steers. A similar interest charge on the $6,260 investment in additional equipment and steer-feeding facilities is included in the $857 annual cost of these items, Table 4.

Assuming that an operator has an alternative use for his capital (the market value of the amount of grain sorghum required for feeding purposes), or that he is operating on borrowed production capital, the repayment of which must be deferred for the time required to conduct the feeding operation, a 6 percent interest charge is levied against the market value of the grain sorghum. Assuming also that an operator buys his cottonseed meal in the fall, 6 percent interest for the time involved is charged against the price of cottonseed meal. A similar interest rate also is charged against the cost of silage.

MARKETING COSTS

A charge of 75 cents per hundredweight, market weight basis, is levied to cover transportation and marketing costs of the steers.

Feed and Land Requirements

The amount of grain, cottonseed meal and silage per animal per day and the daily rate of gain by specified feeding periods are given in Table 3. This is the basic high-grain ration used as a check ration in feeding trials at the Big Spring Field Station. The total quantity of feed required per animal for the 180-day feeding period follows:

Item	Quantity, pounds
Grain sorghum	1,900
Cottonseed meal	360
Sorghum silage	2,400 (net)
Salt	11

At average yields, Table 1, the production from 190 acres in grain sorghum is required to provide the grain for 100 head of steers for 180 days. The gross silage requirement for a 100-steer feeding operation amounts to 150 tons during a 180-day feeding period. At an average silage yield of 5.2 tons per acre, Table 1, approximately 30 acres in sumac sorghum will be required to provide silage needs. With average yields, the total cropland required to produce grain and silage for 100 steers amounts to 220 acres for a 180-day feeding period.

Because of the wide variation in sorghum silage yields, Table 1, the acreage planted to sumac sorghum will vary from year to year depending on the supply of silage that can be built up and maintained. One or more years with above-average silage yields would provide a silage reserve large enough to permit a substantial reduction in sumac acreage. A series of below-average silage yields would require an above-average acreage in sumac to provide the needed silage supplies. The foregoing acreage requirement for both grain and silage are based on average yields with sufficient silage storage capacity for 2 years of feeding operations.

The returns from cotton production indicate that the full allotted acreage of cotton is likely to be planted, irrespective of the profitableness of a livestock-feeding enterprise. This suggests that a steer-feeding enterprise involving 100 head of steer calves may require a 640-acre farm. The enterprise could be conducted on a smaller farm, provided the operator foregoes part or all of this cotton production or purchases part of the grain needed.

TABLE 5. QUANTITIES AND COST OF FEED, 100 STEER CALVES, AT FIVE GRAIN SORGHUM AND THREE COTTONSEED MEAL PRICES, 180-DAY FEEDING PERIOD

Cost item	Quantities required, 100 steers[1]	Grain sorghum, dollars per hundredweight				
		1.25	1.50	1.75	2.00	2.25
		Dollars				
Cottonseed meal, $60 per ton						
Sorghum grain	189,000 pounds	2,362[4]	2,835[4]	3,307[4]	3,780[4]	4,252[4]
Cottonseed meal	35,800 pounds	1,074[5]	1,074	1,074	1,074	1,074
Salt at 1.25 cents	1,100 pounds	14	14	13	13	13
Silage[2]	150 tons	528	609	690	771	852
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		4,078	4,632	5,185	5,739	6,292
Cottonseed meal, $70 per ton						
Sorghum grain	189,000 pounds	2,362	2,835	3,307	3,780	4,252
Cottonseed meal	35,800 pounds	1,253[5]	1,253	1,253	1,253	1,253
Salt at 1.25 cents	1,100 pounds	14	14	14	14	14
Silage[2]	150 tons	528	609	690	771	852
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		4,257	4,811	5,364	5,918	6,471
Cottonseed meal, $80 per ton						
Sorghum grain	189,000 pounds	2,362	2,835	3,307	3,780	4,252
Cottonseed meal	35,800 pounds	1,432[5]	1,432	1,432	1,432	1,432
Salt at 1.25 cents	1,100 pounds	14	14	14	14	14
Silage[2]	150 tons	528	609	690	771	852
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		4,436	4,990	5,543	6,097	6,650

[1]Quantities based on requirements after a 2-percent death loss occurring during the last quarter of the feeding period.
[2]Silage requirements based on amount required after spoilage and waste.
[3]Estimated at $1 per head.
[4]Each 25 cent per hundredweight change in grain sorghum prices changes total feed cost by $554.
[5]Each $10 per ton change in cottonseed meal price changes total feed cost by $179.

TABLE 6. SUMMARY OF COSTS ASSOCIATED WITH FEEDING 100 HEAD OF STEERS, 180 DAYS

Cost items	Initial cost of steers, dollars per hundredweight[1]			
	16	17	18	19
	— — — Dollars — — —			
Investment in steers[2]	7,200	7,650	8,100	8,550
Interest on steer investment[3]	216	229	243	256
Annual equipment cost	857	857	857	857
Marketing cost[4]	595	595	595	595
Interest on feed cost[3]	122	122	122	122
Feed cost[5]	4,078	4,078	4,078	4,078
Total[6]	13,068	13,531	13,995	14,458

[1]450-pound steers, feedlot weight, finished at 810 pounds, market weight.
[2]100 head of 450-pound steers at indicated purchase price.
[3]Six percent interest on investment in steers for 6 months.
[4]Based on 75 cents per hundredweight market weight basis.
[5]Feed cost with $1.25 per hundredweight grain sorghum and $60 per ton cottonseed meal.
[6]For feed costs at other prices of grain and cottonseed meal, add $554 for each 25-cent increase in grain sorghum price and $179 for each $10 per ton increase in cottonseed meal price.

Substituting cottonseed hulls for silage in the ration would also permit the enterprise to be conducted on a smaller farm. Cottonseed hulls have been substituted satisfactorily for sorghum silage in cattle-feeding trials at the Big Spring Field Station. Silage in the ration does not necessarily reduce the cost of feeding but it does reduce the cash outlay required to conduct feeding operations.

Feed Costs

The total quantities of feed and total feed costs at five grain sorghum prices and three cottonseed meal prices are shown in Table 5. The effects of a change of 25 cents per 100 pounds in price of grain sorghum are shown by the change in the total cost of feed, reading from left to right in Table 5, whereas the effects of a $10 increase in the price of cottonseed meal are shown by the change in totals from top to bottom.

Each 25 cents per hundredweight change in the price of grain sorghum changes the total feed bill by $554. A $10 per ton change in cottonseed meal changes the total feed bill by $179.

Total Cost of Steer Feeding

The cost of feeding is affected materially by the age and condition of the steers, their purchase price, quantity of feed fed, cost of feed, length of feeding period and rate of gain. In this analysis, the quantity of feed fed and the rate of gain are held constant for all cost-price combinations. For each initial steer cost, the total cost of feeding is determined for each sorghum price with cottonseed meal at $60, $70 and $80 per ton. This provides a total of 15 feed-cost combinations for each initial steer price, or 75 determinations of feeding cost.

Total feeding costs, excluding labor, are summarized in Table 6 for four initial steer prices, one grain sorghum and one cottonseed meal price. The basis for adjusting the total feed cost to other grain and cottonseed meal prices is given in Table 6, footnote 6.

Cost per Pound of Gain

The cost per pound of gain is affected similarly by the factors that influence total feeding cost. In this study, the total gain, market weight basis, amounts to 35,280 pounds on initial lots of 100 steer calves. The cost per pound of gain based on four initial steer costs, five grain sorghum prices and one cottonseed meal price is shown in Table 7. The basis for adjusting to other cottonseed meal prices is given in Table 7, footnote 2.

With $60 per ton cottonseed meal the cost per pound of gain ranges from 16.63 to 23.03 cents depending on grain and steer prices. Each 25 cents per hundredweight increase in price of the grain raises the cost per pound of gain by 1.57 cents. Differences between the per pound cost of gain at different initial steer prices are due solely to interest charges on the higher investment in steers.

The cost of gain exceeds 16 cents a pound, even with the lowest combinations of feed prices. To avoid a loss on the feeding operation, feeder steers with an initial cost of $16 or $17 per hundredweight must be sold at a higher price than their original cost. With the lowest combination of feed prices, there is a small labor-management return on feeder steers bought and sold at a price of $18 or more, Table 7.

TABLE 7. COST PER POUND OF GAIN AND SELLING PRICE PER POUND REQUIRED TO BREAK EVEN, AT FOUR INITIAL STEER PRICES AND FIVE GRAIN SORGHUM PRICES, 180-DAY FEEDING PERIOD[1]

Initial steer price per pound	Sorghum grain cost per hundredweight	Cost per pound of gain[2]	Selling price per pound required to break even[2]
Cents	Dollars	— — Cents	— —
16	1.25	16.63	16.46
	1.50	18.20	17.16
	1.75	19.77	17.86
	2.00	21.34	18.56
	2.25	22.91	19.26
17	1.25	16.67	17.04
	1.50	18.24	17.74
	1.75	19.81	18.44
	2.00	21.38	19.14
	2.25	22.95	19.84
18	1.25	16.71	17.63
	1.50	18.28	18.33
	1.75	19.85	19.03
	2.00	21.42	19.73
	2.25	22.99	20.43
19	1.25	16.75	18.21
	1.50	18.32	18.91
	1.75	19.89	19.61
	2.00	21.46	20.31
	2.25	23.03	21.01

[1]Does not include cost of labor used in feeding.
[2]With $60 per ton cottonseed meal. A $10 per ton change in meal price changes the cost of gain by .50 cent per pound and the price required to break even by .23 cent per pound.

Price Required to Break Even

The selling prices required to defray all costs except labor and management are shown in Table 7. This is designated as the break-even price. At these prices, the operator recovers all his costs but receives nothing for his labor or management.

Table 7 shows that, when grain sorghum costs $1.50 or more per hundredweight or when cottonseed meal sells for $70 or more per ton, a market price higher than the initial steer cost of $16 or $17 per hundredweight is required to break even. With $60 a ton cottonseed meal and $1.25 per hundredweight of grain sorghum, the break-even price on steers with an initial cost of $18 or $19 per hundredweight is slightly lower than the initial cost. Each 25 cents per hundredweight increase in grain sorghum price raises the break-even price by .70 cent per pound.

The margin between buying and selling prices that is required to break even is shown in Figure 1. The 0, or no-margin line, in Figure 1 represents the point at which the buying and selling price of steers is the same. For steers with an initial cost of 16 cents a pound, this would be 16 cents, or for 19-cent steers, the selling price at this point is 19 cents per pound. To determine the price required to break even, add or subtract the indicated margin to the initial purchase price of the steers. For example, the price required to break even on 16-cent steers fed $2 grain sorghum is 18.56 cents (16 cents plus 2.56 cents). Similarly, for 19-cent steers fed on $1.25 grain, the price required to break even is 18.21 cents (19 cents minus .79 cents). Other break-even prices for the various combinations of steer and feed prices can be determined similarly.

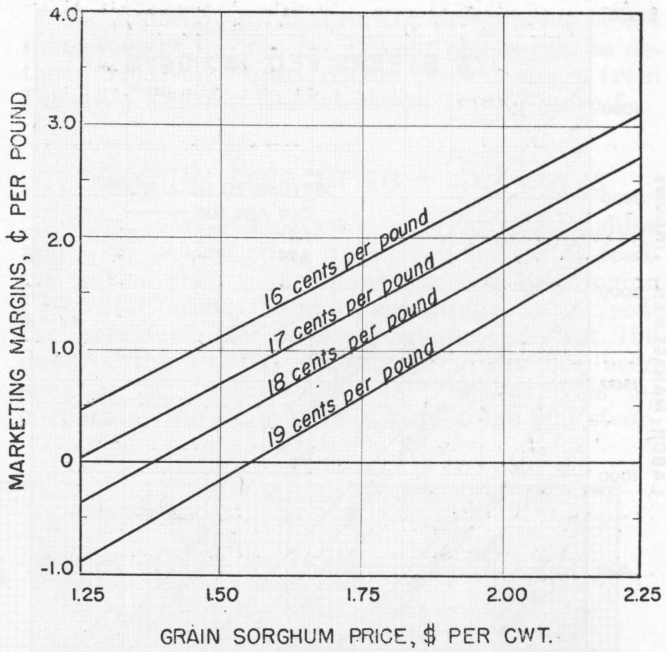


Figure 1. Marketing margins required to break even related to initial steer cost and grain sorghum prices.

Returns from Steer Feeding

Prospective labor-management returns or losses on a steer-feeding enterprise at one of the four initial steer cost levels studied, 19 cents per pound, are shown in Table 8. Labor-management income for the various cost price combinations that provide a net return are shown in Figures 2-5.

The bases for appraising prospective returns at other cost-price levels have been included at various points in the text and in footnotes to the pertinent tables. Since quantities of feed and pounds of beef produced are constant, these adjustments in costs or receipts permit a ready determination of prospective returns at other cost-price levels.

1. Receipts=price received for 79,380 pounds of beef, market weight basis. This quantity of beef includes the initial weight of steers plus feedlot gains minus a 2-percent death loss — 900 pounds of initial weight. Thus a 1-cent change in the price received for steers will change the gross receipts by $793.80, depending on the direction of change. For each of the following changes in cost, add or subtract, depending on the direction of price change, the indicated amount to or from the nearest total cost entry in Table 6.

Item and unit of change	Effect on total cost, dollars
Grain sorghum, 25 cents per hundredweight	$554.00
Cottonseed meal, $10 per ton	179.00
Initial steer cost, 1 cent per pound	13.00

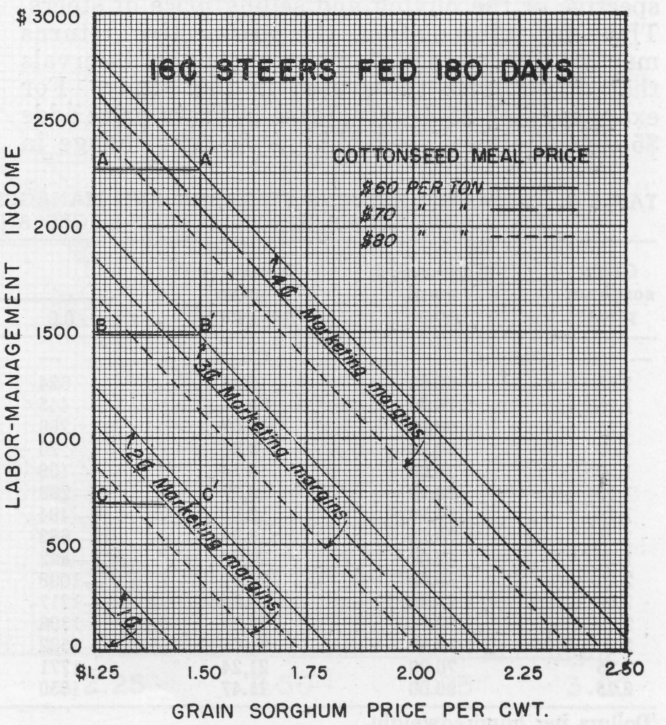


Figure 2. Labor-management income related to marketing margins and feed prices. Based on the returns from 100 head of steers fed 180 days with an initial cost of 16 cents per pound and a 2-percent death loss.

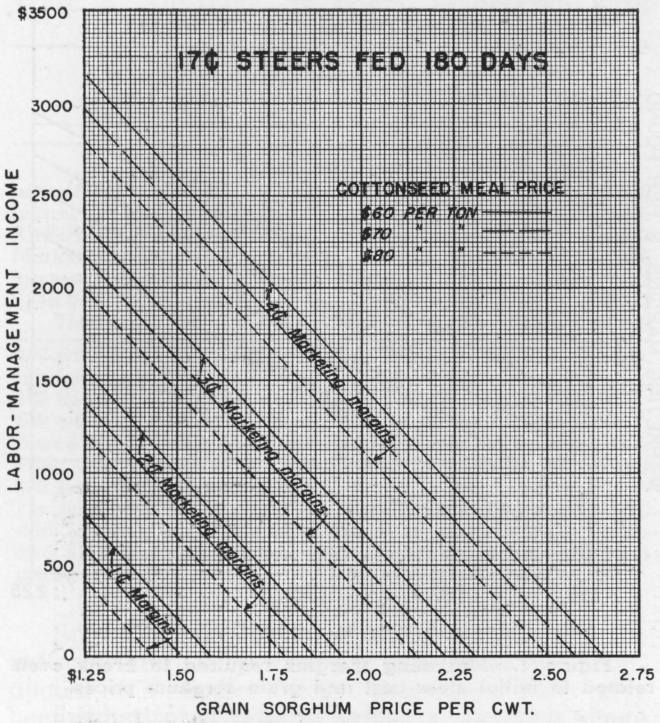


Figure 3. Labor-management income related to marketing margins and feed prices. Based on the returns from 100 head of steers fed 180 days with an initial cost of 17 cents per pound and a 2-percent death loss.

Feed requirements and rate of gain are held constant at all price levels. Consequently, any change in the price of grain or cottonseed meal will have a similar effect on total feed cost irrespective of the buying and selling price of steers. Thus, by interpolation, the prospective returns may be determined for price change intervals that differ from those used in this study. For example, each 25-cent increase in grain price adds $554 to the total feed bill. A 30-cent change in grain price would increase the total feed bill by $665 ($554 ÷ 25 cents = $22.16 x 30 cents = $664.80). The effects of other grain or cottonseed meal prices or fractions of a cent change in steer price can be determined by similar calculations.

In Table 8, the selling price above initial steer cost is designated as "marketing margins in cents per pound" and thereafter is referred to as "marketing margins."

A marketing margin of 1 cent or more per pound, depending on feed costs, is required to provide a net labor-management return on 16 and 17-cent steers, Figures 2 and 3. With the lower feed-cost combinations, there is a small net return on 18 and 19-cent steers sold on a "no margin" basis, Figures 4 and 5.

The marketing margin required to provide a net labor-management return at all steer prices is increased 1 cent for each 25-cent increase in grain sorghum price.

Prospective labor-management returns under a wide range of cost-price conditions can be determined from Figures 2 - 5. These data also can be adjusted by the amounts or proportions of the amounts shown in footnotes to Table 8 to indicate prospective returns under other cost-price combinations.

Prospective returns, at marketing margins that provide a labor-management income, may be read directly from the appropriate figures. For example, the market price of grain sorghum and the price that must be paid for cottonseed meal and feeder steers are known at the beginning of the season. The selling price of steers, or the marketing margins, is the unknown item. Working with the known items—steer cost and grain and meal prices—the prospective feeder can approximate his labor-management income by se-

TABLE 8. ESTIMATED RETURNS TO LABOR AND MANAGEMENT FROM FEEDING 100 STEERS, PURCHASED AT 19 CENTS PER POUND, UNDER SPECIFIED FEED PRICES AND MARKETING MARGINS, 180-DAY FEEDING PERIOD

Grain sorghum price[1]	Cottonseed meal price[2]	Break-even price per pound[3]	Returns Marketing margins in cents per pound[4]				
			0.0	1.0	2.0	3.0	4.0
— — Dollars — —		Cents	— — — — — — — Dollars — — — — — — —				
1.25	60.00	18.21	624	1418	2212	3006	3800
1.25	70.00	18.44	445	1239	2033	2827	3621
1.25	80.00	18.67	266	1060	1854	2648	3442
1.50	60.00	18.91	70	864	1658	2452	3246
1.50	70.00	19.14	—109	685	1479	2273	3067
1.50	80.00	19.37	—288	506	1300	2094	2888
1.75	60.00	19.61	—484	310	1104	1898	2692
1.75	70.00	19.84	—663	131	925	1719	2513
1.75	80.00	20.07	—842	—48	746	1540	2334
2.00	60.00	20.31	—1038	—244	550	1344	2138
2.00	70.00	20.54	—1217	—423	371	1165	1959
2.00	80.00	20.77	—1396	—602	192	986	1780
2.25	60.00	21.01	—1592	—798	—4	790	1584
2.25	70.00	21.24	—1771	—977	—183	611	1405
2.25	80.00	21.47	—1950	—1156	—362	432	1226

[1]Dollars per hundredweight.
[2]Dollars per ton. For other meal prices, add or subtract $179 to profit or loss for each $10 per ton change in cottonseed meal prices.
[3]Selling price required to defray all but labor and management cost.
[4]Sales price in cents per pound above initial steer cost.

lecting what he considers the most likely marketing margin.

Assuming that steers can be bought for 16 cents per pound, that the market value of grain sorghum is $1.50 per hundredweight and that cottonseed meal will cost $60 per ton, the prospective labor-management income is shown in Figure 2. Line A-A[1] in Figure 2 indicates labor-management income with a 4-cent marketing margin; Line B-B[1] indicates a 3-cent marketing margin and Line C-C[1] indicates labor-management income with a 2-cent marketing margin. Prospective labor-management income with other grain and meal prices fed to 16-cent steers can be determined from the data in Figure 2.

By a similar procedure, the prospective labor-management income for 17-cent steers can be determined from Figure 3; for 18-cent steers from Figure 4 and for 19-cent steers from Figure 5.

Feeding Enterprise—150 Days

With some steer-feed cost-price relationships and with certain other conditions, a shorter feeding period than that followed at the Big Spring Field Station may be more advantageous. A feeding period of 150 days, based on the first 150 days of the 180-day feeding program, has been selected for further analysis. The analysis incorporates the same basic assumptions and steer-

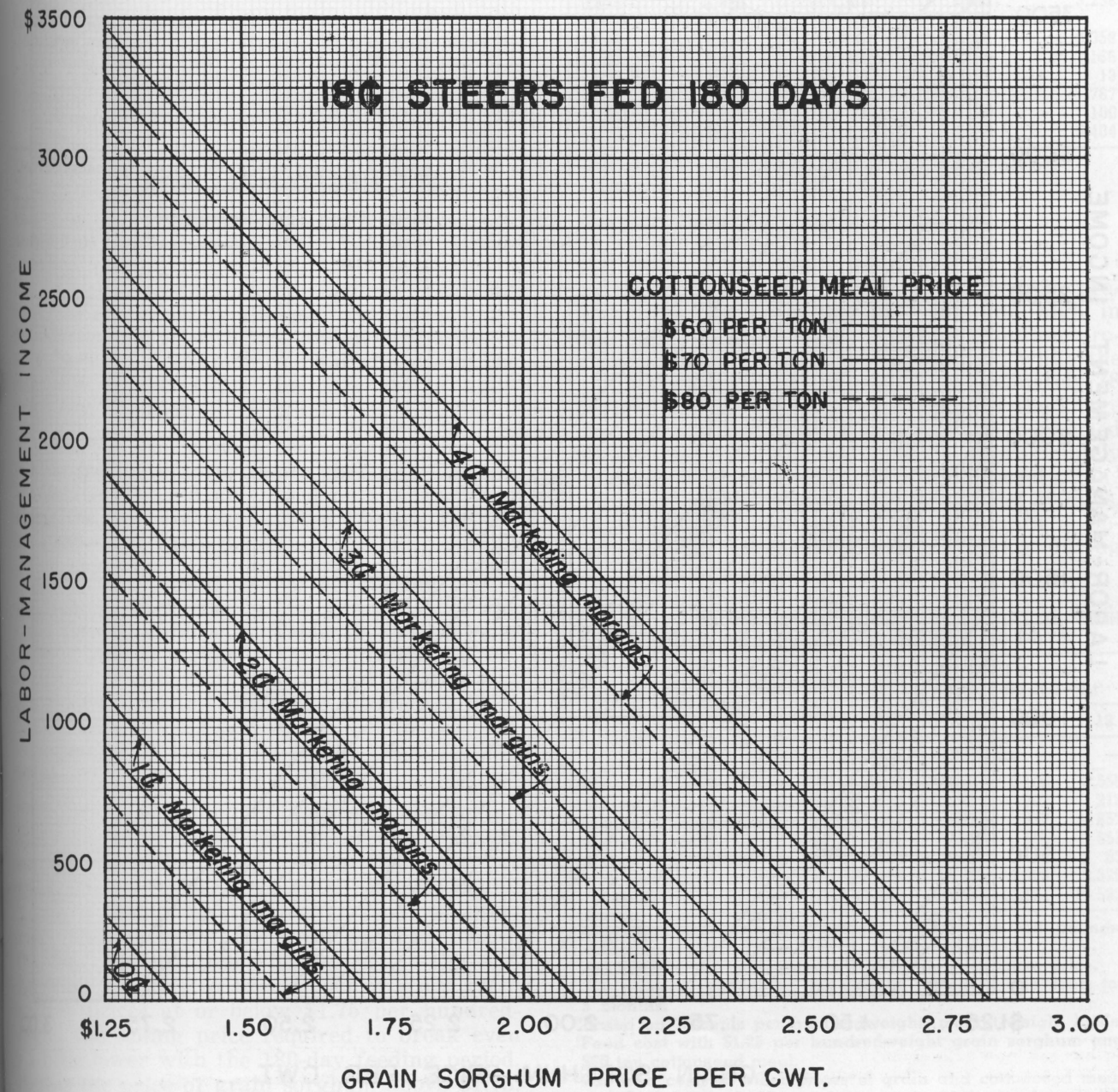


Figure 4. Labor-management income related to marketing margins and feed prices. Based on the returns from 100 head of steers fed 180 days with an initial cost of 18 cents per pound and a 2-percent death loss.

feed cost-price levels used in the analysis of the 180-day feeding enterprise.

Feed requirements and rate of gain were reported periodically in tests at the Big Spring Field Station. This permits an appraisal of feed costs and prospective returns at the end of each reporting period, Table 4. Estimates of feed costs may be made directly from the data in Table 4. However, to obtain the feed cost per pound of gain, the feedlot weights must be adjusted to market weights. In this part of the analysis, feedlot weights have been adjusted downward by 6 percent to compensate for shrinkage. This is approximately the same rate of shrinkage obtained in the longer feeding trials at the Big Spring Field Station.

The 150-day feeding period can be conducted with a minimum of conflict between crop produc-

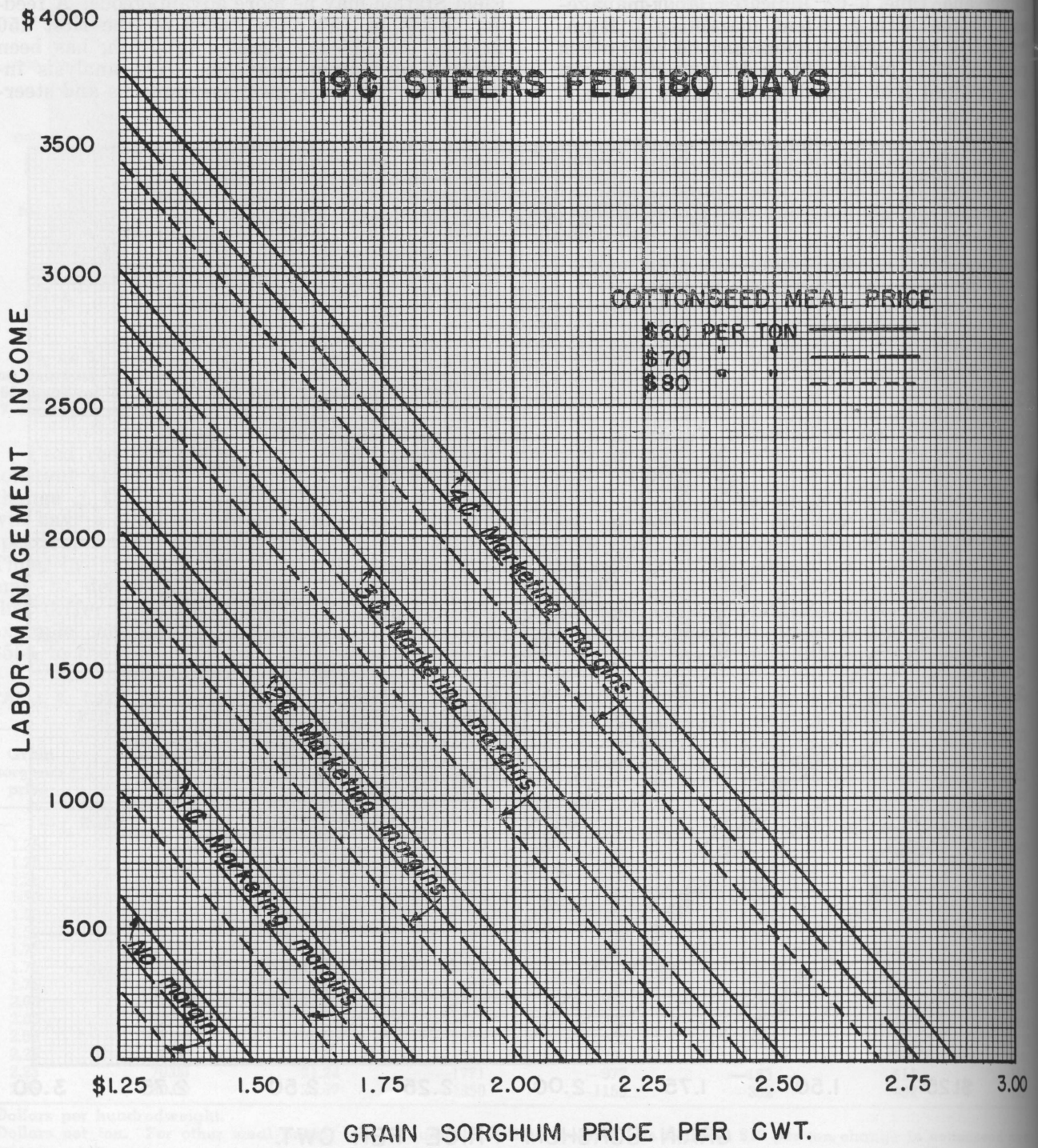


Figure 5. Labor-management income related to marketing margins and feed prices. Based on the returns from 100 head of steers fed 180 days with an initial cost of 19 cents per pound and a 2-percent death loss.

TABLE 9. QUANTITIES AND COST OF FEED, 100 STEER CALVES, AT FIVE GRAIN SORGHUM AND THREE COTTONSEED MEAL PRICES, 150-DAY FEEDING PERIOD

Cost item	Quantities required, 100 steers[1]	Grain sorghum, dollars per hundredweight				
		1.25	1.50	1.75	2.00	2.25
		Dollars				
Cottonseed meal, $60 per ton						
Sorghum grain	149,250 pounds	1,866[4]	2,239[4]	2,612[4]	2,985[4]	3,358
Cottonseed meal	29,150 pounds	874[5]	874	874	874	874
Salt at 1.25 cents	1,000 pounds	13	13	13	13	13
Silage[2]	135 tons	475	548	621	694	767
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		3,328	3,774	4,220	4,666	5,112
Cottonseed meal, $70 per ton						
Sorghum grain	149,250 pounds	1,866	2,239	2,612	2,985	3,358
Cottonseed meal	29,150 pounds	1,020[5]	1,020	1,020	1,020	1,020
Salt at 1.25 cents	1,000 pounds	13	13	13	13	13
Silage[2]	135 tons	475	548	621	694	767
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		3,474	3,920	4,366	4,812	5,258
Cottonseed meal, $80 per ton						
Sorghum grain	149,250 pounds	1,866	2,239	2,612	2,985	3,358
Cottonseed meal	29,150 pounds	1,166[5]	1,166	1,166	1,166	1,166
Salt at 1.25 cents	1,000 pounds	13	13	13	13	13
Silage[2]	135 tons	475	548	621	694	767
Miscellaneous and contingencies[3]		100	100	100	100	100
Total		3,620	4,066	4,512	4,958	5,404

[1]Quantities based on requirements after a 2-percent death loss occurring during the last quarter of the feeding period.
[2]Silage requirements include an allowance to cover spoilage and waste.
[3]Estimated at $1 per head.
[4]Each 25 cent per hundredweight change in grain sorghum price changes the total feed bill by $446.
[5]Each $10 per ton change in the price of cottonseed meal changes the total feed cost by $146.

tion and steer-feeding labor requirements. The total feed requirements are smaller, consequently, it can be conducted with less land or during years when low crop yields might curtail the size of the enterprise or necessitate the purchase of additional feed supplies.

Quantities and cost of feed required for the 150-day feeding enterprise are shown in Table 9. The data in Table 9 are based on the feed used during the first 150 days of the 180-day feeding trials shown in Table 4.

Although the total cost of conducting a 150-day feeding enterprise is less than that of the longer feeding enterprise, Table 10, the cost per pound of gain is higher in the short feeding period, Tables 7 and 11. This stems from the fact that overhead costs, which are practically identical for each feeding period, are distributed over fewer pounds of total gain in the short feeding period—29,400 vs. 35,280 pounds.

The cost per pound of gain and the selling price required to break even, labor and management costs excluded, are shown in Table 11. At comparable feed prices, the total cost per pound of gain is higher in the shorter feeding enterprise, irrespective of the level of feed prices. This does not hold true with respect to the selling price required to break even. With grain sorghum prices at or below $1.75 per hundredweight, the selling price required to break even is a little lower with the 180-day feeding period, whereas the price of grain sorghum above $1.75, the break-even price is slightly lower in the 150-day feeding period, Tables 7 and 11.

During the early part of the feeding program, the ration is low in grain and high in roughage—silage. As the feeding program progresses, the grain content is increased while the roughage is reduced, Table 4. Approximately 78 percent of the grain and 91 percent of the silage used in a 180-day feeding period is consumed during the first 150 days. Thus approximately 22 percent of the total grain and 9 percent of the total roughage is required during the last 30 days, when only 16.7 percent of the total gain is obtained. The higher proportion of grain during

TABLE 10. SUMMARY OF COSTS ASSOCIATED WITH FEEDING 100 HEAD OF STEERS FOR 150 DAYS

Cost items	Initial cost of steers, dollars per hundredweight[1]			
	16	17	18	19
	Dollars			
Investment in steers[2]	7,200	7,650	8,100	8,550
Interest on steer investment[3]	180	191	202	213
Annual equipment cost	857	857	857	857
Marketing cost[4]	551	551	551	551
Interest on feed cost[3]	83	83	83	83
Feed cost[5]	3,328	3,328	3,328	3,328
Total[5 6]	12,199	12,660	13,121	13,582

[1]450-pound steers, feedlot weight, finished at 750 pounds, market weight.
[2]100 head of 450-pound steers at indicated purchase price.
[3]Six percent interest on investment in steers and feed for 5 months.
[4]Based on 75-cents per hundredweight, market-weight basis.
[5]Feed cost with $1.25 per hundredweight grain sorghum and $60 ton cottonseed meal.
[6]For feed costs at other prices of grain and cottonseed meal add $446 for each 25-cent increase in grain sorghum price and $146 for each $10 per ton increase in cottonseed meal price.

TABLE 11. COST PER POUND OF GAIN AND SELLING PRICE PER POUND REQUIRED TO BREAK EVEN, 150-DAY FEEDING PERIOD[1] AT FOUR INITIAL STEER PRICES AND FIVE GRAIN SORGHUM PRICES, 150-DAY FEEDING PERIOD

Initial steer price per pound	Sorghum grain cost per hundredweight	Cost per pound of gain[2]	Selling price per pound required to break even[2]
Cents	Dollars	— —	Cents — —
16	1.25	17.00	16.60
	1.50	18.52	17.20
	1.75	20.03	17.84
	2.00	21.55	18.42
	2.25	23.07	19.02
17	1.25	17.04	17.22
	1.50	18.56	17.83
	1.75	20.07	18.44
	2.00	21.59	19.04
	2.25	23.11	19.65
18	1.25	17.08	17.85
	1.50	18.60	18.46
	1.75	20.11	19.07
	2.00	21.63	19.67
	2.25	23.14	20.28
19	1.25	17.12	18.48
	1.50	18.63	19.09
	1.75	20.15	19.70
	2.00	21.67	20.31
	2.25	23.18	20.91

[1]Does not include cost of labor used in feeding.
[2]Sixty dollars per ton cottonseed meal. A $10 change in cottonseed meal price changes the cost of gain by .50 cent per pound and changes the price required to break even by .61 cent per pound.

the latter part of the 180-day feeding program accounts for the higher break-even price required when grain prices exceed $1.75 per hundredweight.

The shorter feeding period results in a lighter weight animal with less finish than those resulting from the longer feeding period. Such an animal is likely to sell at a lower price than those carrying a better finish.

Labor-management returns from the short feeding enterprise for an initial steer cost, 19 cents per pound, are shown in Table 12. The returns shown in Table 12 are derived in the same way as those shown for the longer feeding enterprise in Table 8.

These data, like those for the 180-day feeding period, may be adjusted to show prospective returns at other cost-price levels. The quantities of both feed and beef are smaller; consequently, the effects of price change are smaller.

Gross receipts with the 150-day feeding period reflect the sales of 73,500 pounds of beef. Thus a 1-cent change in the price of beef will raise or lower gross receipts $735.00, depending on the direction of price change.

The appropriate total feeding cost entry in Table 10 adjusted by the amounts or proportions of the amounts shown in footnote 6, Table 10, permits a determination of feeding costs at other steer and feed cost levels.

With higher total costs per pound of gain and fewer total pounds of gain, the prospective labor-management returns from the short feeding enterprise are lower at comparable price levels than those obtained in the 180-day feeding enterprise.

Effects on Farm Income

This appraisal of prospective labor-management returns from a steer calf feeding enterprise under various steer-feed cost-price combinations is based on the principle of added returns minus added cost. All farm-grown grain and roughage is charged to the steer-feeding enterprise at market price. Also, the annual cost of

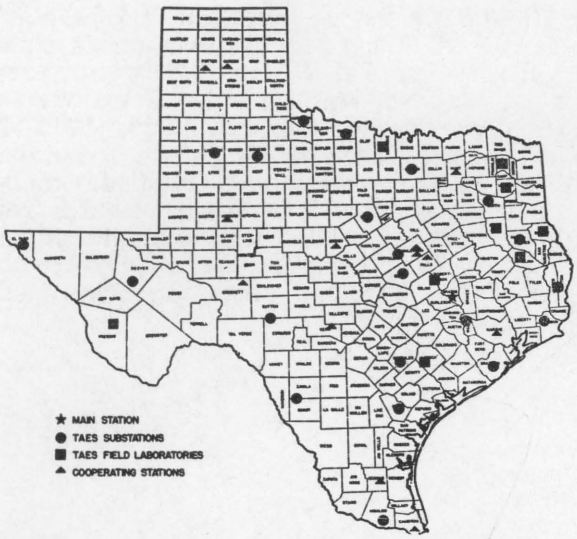
TABLE 12. ESTIMATED RETURN TO LABOR AND MANAGEMENT FROM FEEDING 100 STEERS, PURCHASED AT 19 CENTS PER POUND, UNDER SPECIFIED FEED PRICES AND MARKETING MARGINS, 150-DAY FEEDING PERIOD

Grain sorghum price[1]	Cottonseed meal price[2]	Break-even price per pound[3]	Returns Marketing margins in cents per pound[4]				
			0.0	1.0	2.0	3.0	4.0
— — Dollars — —		Cents	— — — — — — — —		Dollars — — — — — — — —		
1.25	60.00	18.48	383	1118	1853	2588	3323
1.25	70.00	18.68	237	972	1707	2442	3177
1.25	80.00	18.88	91	826	1561	2296	3031
1.50	60.00	19.09	—63	672	1407	2142	2877
1.50	70.00	19.29	—209	526	1261	1996	2731
1.50	80.00	19.49	—355	380	1115	1850	2585
1.75	60.00	19.70	—509	226	961	1696	2431
1.75	70.00	19.90	—655	80	815	1550	2285
1.75	80.00	20.10	—801	—66	669	1404	2139
2.00	60.00	20.31	—955	—220	515	1250	1985
2.00	70.00	20.51	—1101	—366	369	1104	1839
2.00	80.00	20.71	—1247	—512	223	958	1693
2.25	60.00	20.91	—1401	—666	69	804	1539
2.25	70.00	21.11	—1547	—812	—77	658	1393
2.25	80.00	21.31	—1693	—958	—223	512	1247

[1]Grain sorghum price in dollars per hundredweight.
[2]Cottonseed meal price in dollars per ton. For other meal prices, add or subtract $146 from returns for each $10 per ton change in meal price.
[3]Selling price required to defray all but labor and management cost.
[4]Selling price per pound above initial steer cost.

the added facilities and equipment required to conduct the feeding enterprise is charged against the feeding enterprise. Any steer-feed cost-price combination that provides a net labor-management return will, therefore, increase farm income by the amount of the labor-management return. By the same token, any steer-feed cost-price combination that provides a negative labor-management return will reduce farm income by the same amount compared with what it would have been if grain had been sold at the assumed prices.

A feeding enterprise involving 100 head of steer calves will not fully utilize a man's time during the feeding period. It will, however, prevent most off-farm employment. Farm wages reported from this general area during 1956-57 averaged about $175 per month. Thus, under the steer-feed cost-price combinations studied, a marketing margin of about 3 cents per pound is required to provide a labor-management return equivalent to farm wages. Actual marketing margins of the last few years have averaged about 4 cents a pound.



Location of field research units of the Texas Agricultural Experiment Station and cooperating agencies

State-wide Research

★

The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of ten parts of the Texas A&M College System

ORGANIZATION

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies. Cooperating agencies include the Texas Forest Service, Game and Fish Commission of Texas, Texas Prison System, U. S. Department of Agriculture, University of Texas, Texas Technological College, Texas College of Arts and Industries and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

OPERATION

THE TEXAS STATION is conducting about 400 active research projects, grouped in 25 programs, which include all phases of agriculture in Texas. Among these are:

Conservation and improvement of soil
Conservation and use of water
Grasses and legumes
Grain crops
Cotton and other fiber crops
Vegetable crops
Citrus and other subtropical fruits
Fruits and nuts
Oil seed crops
Ornamental plants
Brush and weeds
Insects
Beef cattle
Dairy cattle
Sheep and goats
Swine
Chickens and turkeys
Animal diseases and parasites
Fish and game
Farm and ranch engineering
Farm and ranch business
Marketing agricultural products
Rural home economics
Rural agricultural economics
Plant diseases

Two additional programs are maintenance and upkeep, and central services.

Research results are carried to Texas farmers, ranchmen and homemakers by county agents and specialists of the Texas Agricultural Extension Service

AGRICULTURAL RESEARCH seeks the WHATS, the WHYS, the WHENS, the WHERES and the HOWS of hundreds of problems which confront operators of farms and ranches, and the many industries depending on or serving agriculture. Workers of the Main Station and the field units of the Texas Agricultural Experiment Station seek diligently to find solutions to these problems.

Today's Research Is Tomorrow's Progress