

Sugarbeet Production-Effect of Selected Characteristics On Production Costs and Investment Requirements

Donald M. Hofstrand and Dale O. Anderson

Production costs and investment requirements in sugarbeet production are affected by several factors. These factors include the quantity and quality of resources, such as land and management; institutional factors, such as the level of sugarbeet allotment; and climatic factors. The extent to which these factors affect sugarbeet production costs and investment requirements in the Red River Valley are discussed in this article.

Method of Study

The sugarbeet production cost and investment data necessary to conduct the analysis reported in this article were obtained through a personal interview survey of 227 sugarbeet growers in the Red River Valley of North Dakota and Minnesota. A 12 percent stratified random sample of the farmers in the study area with sugarbeet contracts in 1968 were selected as the components of the sample.

The study was designed to test the hypotheses that climatic factors, farm size, size of sugarbeet allotment, and management were variables that significantly affect costs and investment requirements associated with the production of sugarbeets.

To test these hypotheses, the growers included in the study were stratified four different ways: (1) major sugarbeet factory areas, (2) cropland sized groups, (3) sugarbeet allotment sized groups, and (4) total cost-sized groups. These stratifications were designed to measure the influence of climate, farm size, sugarbeet allotment size, and management on production costs and investment requirements.

Stratifications

In the first stratification, producers were grouped according to their location in one of three major sugarbeet factory areas: (1) the Drayton factory area, (2) the Crookston and East Grand Forks factory area, and (3) the Moorhead factory area. The producers were also stratified into sugarbeet allotment size groups, as those having less than 100 acres, 100 to 199 acres, 200 to 299 acres, and 300 acres and above. In the third stratification, producers were grouped by those having less than 1,000

acres of cropland, 1,000 to 1,999 acres of cropland, and 2,000 acres or more of cropland. The fourth stratification selected the 20 percent of the producers in the sample having the highest production costs per acre and the 20 percent of the producers having the lowest costs per acre.

Results

Information obtained from the completed questionnaires of 227 growers was summarized and analyzed on the basis of the recorded information. Per-acre and per-ton production costs and investment requirements associated with sugarbeet production were determined. The average total costs for the 227 growers included in the sample was \$142.08 per acre or \$11.16 per ton (1). The total annual investment requirement was \$144.57 per acre or \$11.37 per ton. The following discussion will analyze the effect of climatic factors, farm size, beet allotment and management on production costs and investment requirements.

Factory Area Stratification

The sample of sugarbeet producers was grouped according to three different sugarbeet factory areas. A summary of selected physical characteristics and cost components of these groups and the entire sample are presented in Table 1.

Table 1. Average capital investment and average production costs per acre and per ton by sugarbeet factory area*

Item	Factory Area 1	Factory Area 2	Factory Area 3	Total
Number of Growers	69	112	46	227
Average Sugarbeet Acreage	114	131	157	131
Average Cropland Acreage	1,024	957	939	981
Average 1968 Sugarbeet Yield (tons/acre)	12.6	12.5	13.4	12.7 (per acre)
Average Annual Investment in Machinery	\$153.29	\$146.42	\$127.18	\$144.57
Annual Fixed Costs	65.17	63.22	58.26	62.95
Annual Variable Costs	79.51	79.59	76.89	79.13
Total Costs	145.22	142.81	135.15	142.08 (per ton)
Total Costs	\$ 11.48	\$ 11.41	\$ 10.12	\$ 11.16

*The three different factory areas listed in Table 1 are defined as follows: factory Area 1 represents producers located in the Drayton factory area, Area 2 represents producers located in the Crookston and East Grand Forks factory area, and Area 3 represents producers located in the Moorhead factory area.

Total costs per acre were \$145.22, \$142.81 and \$135.15 for factory areas 1, 2 and 3 respectively.

Hofstrand is Agricultural Economist and Dr. Anderson is Director, North Dakota Water Resources Research Institute, and Professor of Agricultural Economics, Report on North Dakota Agricultural Experiment Station, Project S-3-23. The research reported in this article and the research reported in the article "Sugarbeet Production Costs and Practices in the Red River Valley" published in the July-August, 1970, issue of the North Dakota Farm Research was supported in part by a grant from the Red River Valley Sugarbeet Growers Association.

Total cost per acre for Area 2 was quite similar to the \$142.08 per acre total cost for the entire sample. Total costs per acre for the Drayton factory area were about three dollars higher and the total costs per acre for the Moorhead factory area were about seven dollars lower than the per acre total costs of the entire sample. The higher total cost of factory area one and the lower total costs of factory area three are reflected in the fixed costs. Fixed costs are those costs incurred regardless of whether production occurs or not. Fixed costs for factory areas one, two and three are \$65.17, \$63.22 and \$58.26 per acre respectively.

A slight variation existed between total variable costs. Variable costs are costs incurred only if production occurs. Per-acre total variable costs for factory areas one, two and three were \$79.51, \$79.59 and \$76.89 respectively.

Average annual investment is the amount a grower has invested in machinery in any one year.¹ More operations in factory area three were done with leased machinery or custom hired than in the other factory areas. Therefore, a smaller investment in machinery was required for factory area three. Average annual investment in machinery requirements was \$153.29, \$146.42 and \$127.18 for factory areas one, two and three respectively.

Sugarbeet Allotment Stratification

The sample of sugar beet producers was divided into four different sized sugarbeet allotment acreage groups. A detailed listing of the results of these groupings and the results of the total sample is presented in Table 2.

Total costs per acre were \$144.73, \$140.62, \$137.12 and \$139.50 for allotment acreage size groups one, two, three and four respectively. As the size group became larger, total costs per acre decreased, except in group four, where the total cost per acre increased from that of size group three. The decrease in costs resulting from larger size groups was caused in part by the decrease in fixed costs. Fixed costs were \$66.02, \$61.48, \$59.32 and \$58.31 for the size groups one through four respectively. Size group four's larger per acre total cost over that of size group three occurred due to the large variable cost of group four.

Total cost per ton of producing sugarbeets is \$11.75, \$11.09, \$10.30 and \$9.60 for size groups one, two, three and four respectively. Size group four reflected the lowest cost when computed on a per-ton basis because of the high yield of sugarbeets in group four.

Table 2. Average capital investment and average production costs per acre and per ton by sugarbeet allotment size groups*

Item	Sugarbeet Allotment Size Group				
	Group 1	Group 2	Group 3	Group 4	Total
Number of Growers	99	82	36	10	227
Average Sugarbeet Acreage	75	128	229	362	131
Average Cropland Acreage	597	1,002	1,607	2,193	981
Average 1968 Sugarbeet Yield (tons/acre)	12.3	12.6	13.3	14.5	12.7
	(per acre)				
Average Annual Investment in Machinery	\$172.44	\$136.80	\$102.97	\$ 81.97	\$144.57
Annual Fixed Costs	66.02	61.48	59.32	58.31	62.95
Annual Variable Costs	78.71	79.14	77.80	81.19	79.13
Total Costs	144.73	140.62	137.12	139.50	142.08
	(per ton)				
Total Costs	\$ 11.75	\$ 11.09	\$ 10.30	\$ 9.60	\$ 11.16

*The four different allotment acreage size groups are defined as follows: group one represents growers with less than 100 acre allotments, group two represents growers with 100-199 acre allotments, group three represents growers with 200-299 acre allotments, and group four represents growers with 300 or more acre allotments.

Average annual investment in machinery decreased significantly from the smaller size groups to the larger size groups. Average annual investment was \$172.44, \$136.80, \$102.97 and \$81.97 for size groups one, two, three and four respectively. This decrease resulted generally from spreading the machinery investment over a larger number of acres. However, there was no loss in production due to spreading the machinery investment over a larger number of acres as indicated by the increase in yield from 12.3 tons per acre in size group one to 14.5 tons per acre in size group four.

Farm Size Stratification

The sample of sugarbeet producers was divided into three different cropland acreage size groups. A summary of selected physical characteristics and cost components by these groupings and the entire sample are presented in Table 3.

The total costs per acre were \$141.67, \$143.30 and \$140.29 for cropland size groups one, two and three respectively. There does not appear to be any relationship between average total cost per acre and size of farm. However, a relationship appears to exist between average total cost per ton and farm size. The total costs per ton for the cropland size groups were \$11.35, \$10.90 and \$10.45

¹Average annual investment was computed as follows:

$$\text{average annual investment} = \frac{\text{new cost plus salvage value}}{2}$$

for groups one, two and three respectively. A slight decrease in total cost per ton exists due to an increase in farm size.

Average annual investment in machinery decreased significantly from the smaller size groups to the larger size groups. Average annual investment was \$158.08, \$125.41 and \$104.15 for size groups one, two and three respectively. This variation resulted from spreading the investment requirements over larger sugarbeet allotments. Also, more of the nonspecialized machinery is allocated to crops other than sugarbeets in the larger cropland acreage size groups.

Table 3. Average capital investment and average production costs per acre and per ton by cropland size groups*

Item	Cropland Size Groups			Total
	Group 1	Group 2	Group 3	
Number of Growers	147	59	21	227
Average Sugarbeet Acreage	101	175	216	131
Average Cropland Acreage	566	1,330	2,830	981
Average 1968 Sugarbeet Yield (tons/acre)	12.5	13.2	13.4	12.7
	(per acre)			
Average Annual Investment in Machinery	\$158.08	\$125.41	\$104.15	\$144.57
Annual Fixed Costs	64.00	61.83	58.85	62.95
Annual Variable Costs	77.67	81.47	81.44	79.13
Total Costs	141.67	143.30	140.29	142.08
	(per ton)			
Total Costs	\$ 11.35	\$ 10.90	\$ 10.46	\$ 11.16

*The three different cropland acreage size groups are defined as follows: group one represents growers with less than 1,000 acres of cropland, group two represents growers with 1,000-1,999 acres of cropland, group three represents growers with 2,000 or more acres of cropland.

Production Cost Stratification

The sample of sugarbeet producers was divided into two total production cost groups. The results of these groupings and the entire sample are presented in Table 4.

The total costs per acre were \$120.53 and \$166.73 for groups one and two respectively. These figures compare to a total cost of \$142.08 per acre for the entire sample. The greatest portion of the \$46.20 variation between groups one and two was due to the \$32.49 variation in total variable costs. Group one reflected a total variable cost of \$63.34, while group two reflected a total variable cost of \$95.83 per acre. A large portion of the variation in total variable costs was due to variation in fertilizer, chemical, harvesting and hired labor costs. Total fixed cost accounted for \$13.71 of the \$46.20

Table 4. Average capital investment and average production costs per acre and per ton by production cost groups*

Item	Group 1	Group 2	Total
Number of Growers	46	46	227
Average Sugarbeet Acreage	147	117	131
Average Cropland Acreage	1,131	969	981
Average 1968 Sugarbeet Yield (tons/acre)	12.3	12.9	12.7
	(per acre)		
Average Annual Investment in Machinery	\$130.62	\$158.72	\$144.57
Annual Fixed Costs	57.19	70.90	62.95
Annual Variable Costs	63.34	95.83	79.13
Total Costs	120.53	166.73	142.08
	(per ton)		
Total Costs	\$ 9.83	\$ 12.94	\$ 11.16

*The two total production cost size groups are defined as follows: group one represents the 20 percent of the producers having the lowest production costs per acre and group two represents the 20 percent of the producers having the highest production costs per acre.

variation in total cost with \$57.19 and \$70.90 for groups one and two respectively.

The variation in average annual investment was not as large as that of total costs. Average annual investment was \$130.62 and \$158.72 for groups one and two respectively. These figures compare to a \$144.57 annual investment requirement for the entire sample.

SUMMARY

The results of the study indicated a variation in total production costs and investment requirements within stratifications. A variation existed between sugarbeet factory areas. The Drayton factory area had higher and the Moorhead factory area had lower production costs and investment requirements than the Crookston and East Grand Forks factory areas. There does not appear to be any relationship between farm size and per-acre production costs. However a relationship of slightly decreasing per-acre production costs from increasing sugarbeet allotment size existed. Also, a relationship of greatly decreasing per-acre investment requirements existed from increasing either farm size or sugarbeet allotment size. A \$46.20 per-acre production cost differential existed between the 20 percent of the growers with the highest production cost per acre and the 20 percent with the lower production costs per acre. A \$28.10 per-acre differential existed in investment requirements between these two groups.

REFERENCE

A detailed report of the cost and investment requirements of the 227 growers included in the sample is presented in Hofstrand, Donald M. and Anderson, Dale O., "Sugarbeet Production Costs and Practices in the Red River Valley," *North Dakota Farm Research*, Vol. 27, No. 6, July-August, 1970, pp. 3-5.