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Concentrate Feed Handling Methods and Costs by Dairy and Beef Producers--Selected Utah Counties, 1961-1962

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CONCENTRATE FEED HANDLING METHODS AND COSTS BY DAIRY AND BEEF PRODUCERS — SELECTED UTAH COUNTIES, 1961-1962

by

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Kendell W. Brinkerhoff

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INTRODUCTION

Utah is historically an agricultural state with many resources adapted to livestock production. The beef and dairy industries in Utah account for 40 and 15 percent respectively of the total receipts received from agricultural marketings (7). Utah's resources are less adapted to poultry production compared to livestock production. Nevertheless, poultry production represents a significant portion of the total agricultural receipts. Production of livestock and poultry have expanded beyond the state's capacity to produce concentrate feed to benefit from economy of scale and to increase farm size through intensification. This feed deficit in Utah must be supplied from sources outside the state. It is estimated that Utah is dependent upon out-of-state sources for approximately 60 percent of the concentrate feed used. With a limited quantity of concentrate feed, livestock and poultry industries can be increased only by increasing the amount of feed procured from other areas. Since Utah is a deficit feed producing area, prices of feeds in Utah are based upon prices in surplus producing areas plus the cost of transferring feeds from these areas.

Production of livestock and poultry products in Utah exceeds the consumption of these products in Utah. In addition to the cost of transporting raw materials into the state the finished products must be transported to markets out-of-state. Livestock and poultry producers are at an economic disadvantage with other areas as a result of these transfer costs.

Margins of profit are becoming narrower. If Utah's livestock and poultry industries are to compete effectively with other areas, improved methods of feed handling are an important consideration. The initial cost of feed plus the cost of processing and transporting it to the point of use represents a significant portion of the total cost of livestock and poultry production.

The feed manufacturing industry in Utah has excess capacity in feed processing equipment. Commercial mills can double their present output with existing processing equipment before additional equipment is needed (5). However, with respect to over capacity consideration should be given to equipment which has less use because of location and little or no use because of obsolescence. Nevertheless, excess capacity or duplication of equipment result in inefficiency and waste for the industry as a whole.

PURPOSE OF THE STUDY

The objective of this study was to increase economic efficiency of feed procurement, processing and handling to enhance the competitive position of beef and dairy industries in Utah.

The specific objectives were:

1. To determine the relative importance of various methods of concentrate feed handling used by beef feeders in Sevier and Weber Counties and dairy producers in Salt Lake, and Cache Counties in Utah, 1961-62.
2. To compare costs of various methods of feed handling.
   a. The variation of costs which are prevalent.
   b. Factors which are influential in cost variation and their importance.
3. To appraise the alternative possibilities of feed handling which will decrease costs.

REVIEW OF LITERATURE

A previous study of feed handling practices and relative cost in the beef and dairy industries in Utah has not been made. A study was made by Dr. Roice H. Anderson on the cost of processing poultry feeds on the farm (1). The study involved 24 poultrymen, 16 of which were egg producers and 8 were turkey producers. The major objective was to determine the cost of purchasing and handling feed ingredients with on-farm processing equipment and to compare the results with the prices of commercially processed feeds. His study indicated that on-farm processing was warranted for producers using 100 tons of feed or more per year. However, certain qualifications were necessary before producers would benefit by using on-farm processing of poultry feeds.

Studies have been made in other areas which are closely related or cover parts of the study being undertaken here. A study was made by Carl J. Vosloh, Jr. and V. John Brensike (3). Data were gathered by mail survey in eight selected states throughout the United States. Their report stated that recent trends indicated an increased use of on-farm processing and mixing equipment, especially by larger operations.

A study by James A. Seagraves indicated that dairy, hog, and poultry producers could save on the average 6 to 10 cents per ton by bulk handling of feed (6).

V. John Brensike reported on the Changing Structure of Markets for Commercial Feeds (2). He pointed out that although the average plant volume of prepared animal feeds appeared to be increasing, new plant construction is toward lower feed handling capacities. The increasing

average volume by plants is due to smaller plants shifting to other types of goods. He indicated that some have changed classification of manufacturing. The report indicated a decrease in the number of establishments particularly in surplus feed producing states. There is a move toward decentralization of feed manufacturing because of: 1. Growth of demand, 2. demand for services and service competition, 3. transportation advantages, 4. absence of economics of scale beyond 30,000 tons per year. The report indicated that many plants increased operating costs by offering bulk handling and other services before quantity savings could be achieved by the mills.

A report made by Ray M. Oakley, Research Director, American Feed Manufacturers Association, stated that the commercial formula feed industry has expanded its volume 26 percent from 1952 to 1962. Most of the increase resulted from heavier feeding rates per animal (4).

SOURCE OF DATA

Data were obtained by personal interview from 57 beef feed lot operators in Sevier and Weber Counties and from 114 dairy producers in Salt Lake and Cache Counties. These counties were selected because of their relative importance in beef and dairy production. Feed handling practices for beef and dairy herds under 25 and 10 head respectively were not recorded. Extremely large beef feeding operations such as commercial feed yards were also omitted.

Lists of dairymen were obtained from the Boards of Health in Salt Lake City and Logan to represent Salt Lake and Cache Counties. The alphabetized list of producers in Cache County was sampled by taking every other name which provided 85 to be contacted. Only eighty-eight names of dairymen were listed on the Board of Health for Salt Lake County. After attempts were made to contact all of the 88 producers in Salt Lake County and the sample of 85 producers in Cache County, 59 and 55 complete records were obtained in the two counties respectively. Lists of beef feeders in Weber and Sevier Counties were obtained from Weber and Sevier County Agents to represent these counties. Attempts were made to contact all the 68 Sevier and the 39 Weber County producers listed. From these lists, 41 and 16 complete records were obtained from Sevier and Weber Counties respectively.

ANALYSIS OF DATA

Feed Handling, Procurement and Feeding Methods

Beef feeders in Sevier and Weber Counties and dairy producers in Salt Lake and Cache Counties handle their concentrate feeds by various methods in getting them to the farm to be consumed by livestock. The methods of feed handling among producers formed a continuum, but each producer was assigned to one of three methods because of the general way in which the majority of feed was handled. The three general classifications were designated as commercial, on-farm, and custom.

The commercial method refers to a commercial mix or formula feed considered to be a complete concentrate ration. A few producers were included who ordered the feed mixed to their specifications. Commercial feed was usually transported to the farm by the mill. Some producers in Cache County traded whole grain plus a cash differential for commercial mix. A few producers stored their barley at the mill at harvest time to be credited to the purchase of commercial mix. Some producers stored whole grains on their farms to be traded for commercial mix. As a service, these grains were hauled to the mill on a return trip by the bulk delivery truck. Producers who traded whole grain for commercial mix were included in the commercial method.

On-farm method refers to handling and processing the major feed ingredients in a ration with processing equipment on the farm. The processing units varied in size, capacity, and kind of processing. Grains processed by these units were produced on the farm or purchased

from various sources. Producers using the processing services of a mobile unit were included in this group. These mobile units traveled between farms and provided services such as grinding, rolling, molassifying, mixing, and conveying. The owners of these units usually supplied molasses when it was required. Additional labor was usually not required with the mobile unit as the auger system would both move the grain to the unit for processing and convey it to the point of use. Other ingredients were frequently mixed with the grain at this time. Mobile units were used primarily in Cache County.

Custom method refers to the use of commercial mill services for processing the main feed ingredients. These services consisted of rolling, grinding, mixing, etc. The producers as a general practice transported the feed. These feeds produced and stored on the farm were transported to the mill for processing and then back to the farm. The feeds purchased at the mill were processed and transported to the farm.

Characteristic of both on-farm and custom methods was the practice of purchasing supplemental feeds such as protein concentrate and dry beet pulp from commercial outlets and combining these with grains which were either produced or purchased.

Practices used by producers in moving feed to the manger varied and were not characteristic of any of the three methods of handling defined above. Some of the larger dairies used automatic feeders which metered and conveyed the feed from holding tanks to individual stalls. Some producers used overhead storage from which feed either fell to individual stalls or to a point where it was distributed by hand. A large number of the producers distributed the feed from an adjacent storage room to the individual stall by cart or buckets.

Methods used by beef feeders varied widely also in the way feed was moved to the manger. A few used converted poultry-feed bulk trucks. These tanks with a powered mechanism for unloading were usually mounted on a truck and facilitated unloading as the truck moved along the manger. Buckets were frequently used on small enterprises where storage was close to the feed lot. Some of the feeders stored feed in sacks near the manger. A few producers hauled feed to the feed lot daily with a truck. This study included all activities involved in getting feed to the manger.

Relative importance of various methods

The commercial method of feed handling was not used by beef producers in Sevier and Weber Counties (table 1). The relative importance of both on-farm and custom methods in these counties were similar with a slightly larger proportion of producers using on-farm processing in Weber County and a slightly larger proportion using the custom method in Sevier County. One-half of the dairy producers in Salt Lake County used the commercial method compared with about 30 percent in Cache County. Ten percent of producers in Salt Lake County used the on-farm method as compared with approximately 50 percent in Cache County. The custom method was most prevalent in Sevier and Weber Counties and least prevalent in Cache.

Table 1. Methods of feed handling in beef and dairy enterprises in selected counties in Utah, 1961-1962.

Method of handling	Beef enterprises		Dairy enterprises	
	Sevier	Weber	Salt Lake	Cache
	Number of producers			
Commercial	--	--	30	16
On-farm	13	6	6	27
Custom	28	10	23	12
All methods	41	16	59	55
	Percent of producers			
Commercial	--	--	50.8	29.1
On-farm	31.7	37.5	10.2	49.1
Custom	68.3	62.5	39.0	21.8
All methods	100.0	100.0	100.0	100.0

Relationship of size of herd to method of handling

There was no apparent relationship between the size of herd and method of handling with the exception of the beef enterprises in Weber and Sevier Counties (table 2). In both these counties the larger size herds existed among producers who used the custom method. Producers using the commercial method in Salt Lake County had slightly larger herds on the average while those using the commercial method in Cache County had slightly smaller size herds.

Table 2. Relationship of average size herd in each county to method of handling -- 4 Utah Counties, 1961-1962.

County	Commercial	On-farm	Custom	All methods
		Number of Head		
Beef feeders				
Sevier	--	119	145	137
Weber	--	181	233	213
Dairy producers				
Salt Lake	49	43	38	44
Cache	36	44	37	40

As expected, a marked difference in the average herd size existed between beef and dairy enterprises. The largest average size herd existed in Weber County of 213 as compared with 137 head in Sevier.

Amounts of feed purchased and produced

There was considerable variation among counties in the proportions of feed produced and purchased. About 97 percent of the feed used by Weber County beef producers and more than two-thirds of that used by dairymen in Salt Lake County was purchased (table 3). This is primarily due to specialized beef and dairy enterprises in these counties. Sevier and Cache County producers purchased a smaller percent of their concentrate feeds than did Salt Lake and Weber County producers. Beef producers in Sevier County and dairy producers in Cache County as a whole were diversified in their farming practices which provided more home produced feeds.

Table 3. Amount and proportion of concentrate feed purchased and produced in beef and dairy enterprises -- selected counties, Utah, 1961-1962

Counties	Tons of feed used per enterprise			Percent purchased
	Purchased	Produced	Total	
	Number of tons			Percent
Beef feeders				
Sevier	73.5	55.3	128.8	57.1
Weber	248.1	8.9	257.0	96.6
Dairy producers				
Salt Lake	52.3	23.4	75.7	69.1
Cache	33.8	33.0	66.8	50.6

Milo was shipped into Utah as a drought feed during the year studied. Milo used as a drought feed by beef and dairy producers was considered as feed purchased. For this study, drought grains were valued at market prices. In generalizing these data to subsequent years, it must be recognized that the proportions of feed purchased and produced were probably affected by the drought milo used in 1961-62.

Variability of feed purchased and produced

The variability in percent of feed purchased and produced among beef and dairy producers was measured by coefficients of variation (table 4). Comparison of counties indicated a lower variation in feed purchased and produced in Weber County. This is primarily due to the large number of producers who purchased all or the majority of the feed used. The amounts of feed produced in Weber County were usually a small percentage of the total feed used, hence a low variation existed among producers who produced feeds. Although 28 producers purchased all their feed in Salt Lake County, a relatively high variation existed because of other producers who purchased only a small proportion of feed. Only four producers in Salt Lake County produced all the feed used and the majority of those who produced feed produced over half of the feed used which accounted for the relatively low variation. The variation in percent of feed produced and purchased among beef producers in Sevier County and dairy producers in Cache County was quite similar. A characteristic of these counties is that beef or dairy enterprises are generally operated in conjunction with diversified farming operations, hence the practice of producing and purchasing feed are more divergent.

Table 4. Variability in percent of feeds purchased and produced among producers -- selected counties, Utah, 1961-1962.

County	Purchased		Produced	
	Mean*	Coefficient of variation	Mean	Coefficient of variation
	percent	percent	percent	percent
Sevier	45.0	27.5	55.2	27.8
Weber	89.0	20.9	11.0	21.8
Salt Lake	65.5	34.9	34.5	25.6
Cache	48.3	29.5	51.7	28.6

*This column differs from table 2 because each producer was given equal weight.

Concentrate feeding rates by county

On the average, beef feeders fed more concentrate feed per head per day than dairy producers. Rates of concentrate feeding per head per day to beef animals in Weber County were 13.2 pounds and 10.9 pounds to beef animals in Sevier County (table 5). Rates of concentrate feeding to the dairy herds in Salt Lake and Cache Counties were nearly identical or 9.4 and 9.2 pounds respectively. The rates of feeding would be expected to be greater among the more specialized feeding enterprises as shown in Weber County.

Table 5. Feeding periods and rates of feeding -- selected counties, Utah, 1961-1962.

Counties	Number of producers	Average days on feed	Amount of feed used per head	
			Tons per year	Pounds per day
	number	number	number	number
Beef feeders				
Sevier	41	173	.94	10.9
Weber	16	183	1.21	13.2
Dairy producers				
Salt Lake	59	365	1.72	9.4
Cache	55	365	1.67	9.2

Cost of Feed by Various Methods of Handling

Comparing the total cost of the feed ingredients at the manger by the three methods indicated that the commercial method was highest or $58.28 per ton as compared to $49.98 for the on-farm and $51.96 for the custom methods (table 6).

For the on-farm and custom method, the ingredient costs per ton were $45.91 and $45.96 respectively. Although the ingredient cost per ton for the two methods were essentially the same, the relative importance (91.8 and 88.5 percent) to the total cost was slightly different because of the difference in processing and handling costs. When the on-farm and custom methods were combined, the ingredient cost represented 90 percent

and processing and handling costs represented 10 percent of the total cost per ton. On the assumption that similar ingredient costs were represented in the commercial method, ingredient cost would represent 80 percent and processing and handling would represent 20 percent of the total cost per ton.

Table 6. Feed ingredient and processing and handling costs per ton by method of feed handling -- selected Utah Counties, 1961-1962.

Cost Item	Commercial	On-farm	Custom
		Cost per ton	
Ingredient cost	$57.13*	$45.91	$45.96
Processing & handling cost	1.15	4.07	6.00
Total	58.28	49.98	51.96

*Includes feed ingredients and processing and handling costs incurred by the commercial mills.

Commercial method

Commercial mills usually indicate a guaranteed analysis of their formula feeds in terms of crude protein, crude fat, crude fiber, and minerals. A varied number of ingredients are indicated as being used in the feed, but the specific ingredients and the proportions of each are usually withheld.

The cost of commercial mix includes the cost of the feed ingredients plus the processing and handling costs incurred by the mill. The relative importance of ingredient and processing and handling costs are not known

and cannot be directly compared with the on-farm and custom methods. Only the total cost per ton was comparable among the methods of handling.

The processing and handling costs shown in table 6 for the commercial method result from two things, namely: the costs incurred by producers in getting the commercial mix to the feed manger and these costs incurred in combining other feeds with commercial mix. Barley and dry beet pulp were the primary feeds used in conjunction with commercial mix.

An itemized cost of the commercial method was not obtained, hence the following cost analysis will include only the on-farm and custom methods.

Comparison of on-farm and custom methods

The following analysis treats separately the difference between ingredient and processing and handling costs and the major factors associated with these differences in the on-farm and custom methods.

Comparison of feed ingredient cost.

Total ingredient cost per ton of $45.91 for the on-farm and $45.96 for the custom methods were nearly identical (table 7). Varied kinds of feed ingredients were used in the on-farm and custom methods. Barley was the major feed ingredient used by both methods comprising respectively 64.2 and 70.5 percent of the total ingredient cost. On the average less barley was used in the on-farm method than the custom method but when combining the other grains, milo, oats, corn, and wheat, nearly identical expenditures were made of approximately 78 percent by cost. Less protein concentrate was used in the on-farm than in the custom method

but similar expenditures were made for higher protein ingredients when bran was included. Expenditures for dry beet pulp were approximately 10 percent of the total cost in both on-farm and custom methods. Vitamins and other growth stimulants were often supplied pre-mixed in a protein concentrate.

Table 7. Comparison of feed ingredient costs per ton by method of handling -- selected Utah Counties, 1961-1962

Feed ingredient	On-farm		Custom	
	Cost per ton	Percent	Cost per ton	Percent
	dollars	percent	dollars	percent
Barley	29.46	64.2	32.39	70.5
Milo	3.92	8.5	1.10	2.4
Oats	1.36	3.0	.68	1.5
Corn	.04	--	1.08	2.3
Wheat	1.00	2.2	.39	.8
Protein concentrate	3.46	7.5	4.81	10.5
Bran	1.53	3.3	.45	1.0
Dry beet pulp	4.64	10.1	4.26	9.3
Commercial ration	.11	.1	.67	1.5
Miscellaneous	.39	.8	.13	.3
Total ingredients	45.91	100.0	45.96	100.0

Variation of ingredient cost among producers. In spite of the nearly identical ingredient cost by the two methods of feed handling, considerable variation existed among producers. The variation of ingredient cost per ton from the mean among producers measured by standard deviation was $3.70. Assuming normal distribution, approximately 68 percent of the observations would fall within one standard deviation on each side of the mean. Proportions of feed ingredients and the variation in ingredient prices account for the variation. Because of the importance of barley in the ration, the variation of the cost of barley was measured to determine this source of variation in relation to ingredient cost. Other grains which were substituted for barley were grouped with barley to determine proportions of grain in relationship to ingredient cost. It should be recognized that the other ingredient prices and the price variation associated with them have some influence on variation in ingredient costs. Because these individual ingredient costs are relatively small and highly variable in use among producers, their effects on total ingredient costs per ton were not analyzed.

Relationship of cost of barley to ingredient cost per ton. The sources of price variation of barley were many; and variation in barley prices exerted a predominate influence on ingredient costs. Records were sorted by barley prices into four groups and the ingredient costs per ton tabulated to determine the nature of this relationship (table 8). The number of records were not equal in each group because of the number of specific prices involved. The relationship was direct between barley price and ingredient cost and approached linearity. As the average price

of barley increased from $39.33 to $46.86 per ton, a difference of $7.53, the cost of ingredients changed from $42.44 to $47.57, a difference of $5.13.

Table 8. Relationship of cost of barley to ingredient cost per ton -- 4 Utah counties, 1961-1962

Cost of barley per ton		Number of records	Percent of barley	Tons of feed used	Ingredient cost per ton
Range	Average				
dollars	dollars	number	percent	number	dollars
<40.09	39.33	39	70.0	67.5	42.44
40.10-43.09	41.98	23	73.6	123.4	44.63
43.10-44.90	43.93	26	81.0	192.7	46.87
>44.90	46.86	37	68.4	140.7	47.57
Total	43.01	125	71.1	125.5	45.96

The percent of barley in the feed showed no particular relationship to cost of barley. It seems reasonable to assume that at high prices of barley, substitution of other grains for barley would take place; however, the prices of other grains available to individual producers were essentially at the same level as barley prices on a feed-value basis.

Estimates of barley prices obtained from producers whether produced or purchased were based upon market price. The average price of barley per ton used in the feed year 1961-62 was $43.00 with a standard deviation from the mean of $3.20. The standard deviation of producer grown barley was $3.40 compared to $3.00 for purchased barley. It is reasonable to assume that the differences in price variability which existed between

produced and purchased barley were due primarily to producers who raised all their barley and who were farther removed from knowledge of market prices. Price of barley on the average were lower by $1.00 per ton for produced barley than for purchased barley. Other sources of barley price variation included season of the year, location of enterprise, quality, quantity purchased, as well as estimating errors by the respondents. Attempts were made to get the average price of barley during the feed year from each respondent. When prices paid for barley throughout the feed year were available weighted averages were taken to represent the barley price. Price differences due to quantity or quality were not identified. Location differences for both purchased and produced barley were apparent between Sevier and Cache Counties. The average price of purchased barley per hundred weight in Sevier was $2.23 as compared with $2.13 in Cache County and for produced barley $2.20 in Sevier County as compared with $2.06 in Cache County (table 9). Since Montana and Southern Idaho are Utah's major sources of barley, these price differences are consistent with transportation distance. Barley price levels in Salt Lake and Weber Counties were between those of Cache and Sevier Counties. Most other ingredients were within the price range of barley with the exception of a few ingredients such as protein concentrate.

Percent of grain related to ingredient cost per ton. The relationship of the proportion of all grains in the ration to ingredient cost per ton indicate a slight inverse relationship (table 10). As the percent of grains in the nation increased from 56 to 100 percent, ingredient cost showed a general tendency to decrease; however, the relationship was not consistent. As the proportion of grain increased, the ingredient cost per ton approached average barley prices.

Table 9. Variability of cost of home grown and purchased barley among beef and dairy producers -- selected counties, Utah, 1961-1962.

County	Purchased				Produced			
	Number of observations	Price range	Average price	Standard deviation	Number of observations	Price range	Average price	Standard deviations
	number	dollars	dollars	number	number	dollars	dollars	number
Sevier	18	40.00-47.60	44.60	.60	35	40.00-50.00	44.00	3.20
Weber	15	41.00-47.40	44.00	2.40	1	--	44.00	--
Salt Lake	9	40.00-46.00	43.00	2.20	26	36.00-50.00	42.00	3.80
Cache	22	37.00-50.60	42.60	4.00	31	36.00-50.00	41.20	2.80
Total	64	37.00-50.60	43.60	3.00	93	36.00-50.00	42.60	3.40

Table 10. Relationship of percent of grain used to ingredient cost -- 4 Utah Counties, 1961-1962

Percent grain		Number of records	Cost of barley	Ingredient cost
Range	Average			
range	percent	number	dollars	dollars
Low quarter	56.4	32	42.89	46.84
Medium low quarter	74.1	30	42.89	45.28
Medium high quarter	88.4	31	42.93	46.91
High quarter	99.8	32	43.14	44.22
Total	79.7	125	42.97	45.93

Comparison of processing and handling costs.

Differences in processing and handling costs would be expected between on-farm and custom methods because of the practices of handling feed and the investment in equipment associated with each method. Total combined processing and handling cost per ton for the custom method was nearly $2.00 more than for the on-farm method or $6.00 and $4.07 respectively (table 11). Differences between total processing costs associated with each method were less apparent than total processing and handling costs. The cost of services was the largest cost item for the custom method representing 58.5 percent of the total cost. The service cost for the on-farm method of $.47 represented only 11.6 percent and was due primarily to the use of the mobile processing units by some producers in this group.

Depreciation of equipment was the major cost item for the on-farm method which represented 32.4 percent of total cost. The larger depreciation cost of $1.32 per ton for the on-farm method compared to $.49 per ton for the custom method represented the additional investment in equipment required by the on-farm group. The general types of equipment associated with the on-farm method consisted primarily of feed storage, rollers, grinders, and augers plus the portion of tractor and other power costs allocated to processing. The usual equipment used for the custom method consisted primarily of storage bins and augers. It must be recognized that some of the processing and handling costs resulted from equipment which was used to move the feed to the manger such as automatic feeders, converted poultry tank trucks, etc., which are not characteristic of either method of handling.

The labor required for processing feed per ton for the on-farm method was $.55 with no charge for the custom method. Direct labor cost was a significant proportion of total processing and handling costs. The direct labor cost for the custom method was the second largest cost item of $1.16 and the second largest cost item for the on-farm method of $.74. The mobile processing unit which required little extra labor by the producer reduced the labor charge for the on-farm method. The labor requirements normally associated with the on-farm method other than feeding and transporting grain were for moving grain from storage through the processing unit and into processed storage. The labor used for the custom method other than feeding was for loading, unloading, and transporting the feed to and from the mill. The rate charge for labor was held constant at $1.25 per man hour.

Table 11. Comparison of processing and handling cost per ton by method of handling feed -- 4 Utah counties, 1961-1962

Cost item	On-farm method		Custom method	
	dollars	percent	dollars	percent
Direct labor	.74	18.2	1.16	19.3
Transportation	.27	6.7	.46	7.7
Commercial storage*	--	--	.10	1.7
Services**	.47	11.6	3.51	58.5
Depreciation	1.32	32.4	.49	8.2
Interest	.38	9.3	.12	2.0
Repairs	.18	4.4	.11	1.8
Fuel	.16	3.9	.05	.8
Labor for processing	.55	13.5	--	--
Total processing and handling	4.07	100.0	6.00	100.0

* Storage costs associated with on-farm method and other storage costs for custom method are part of depreciation, interest, and repairs listed under processing.
** Consist of services such as rolling, grinding, mixing, etc.

Transportation costs for moving concentrate feed were nearly twice as great for the custom as compared with the on-farm method. While insurance and taxes are part of the processing costs as well as those itemized, they were so small that they were not identified.

Relationship of tons of feed to processing and handling costs.

Records were sorted by tons of feed used per producer into three groups to determine the relationship between feed used and processing and handling cost per ton by the on-farm and custom methods (table 12). The average tons used by the on-farm and custom methods were 105 and 140 with an average processing and handling cost of $4.07 and $6.00 respectively. As the tons of feed used by producers increased for both the on-farm and custom methods from small third to large third, per unit processing and handling cost decreased $2.64 and $3.01 respectively. Hence, an inverse relationship existed between tons of feed used and processing and handling costs.

Plotting the relationship of average tons of concentrate with the processing and handling costs per ton separately for each method, indicated that as more tons of feed were used unit cost per ton decreased at a decreasing rate (figure 1). However, the per unit processing and handling costs are at different levels on the vertical axis which indicate the difference of processing and handling costs associated with each of the methods. Although maximization of economics of scale based on these data were not specifically determined, it appears that most of the advantages of scale were obtained at average size for both methods.

Table 12. Relationship of tons of feed used to processing and handling costs per ton by the on-farm and custom methods -- selected Utah counties, 1961-1962.

Tons of concentrate	On-farm		Custom	
	Average tons	Processing and handling costs	Average tons	Processing and handling costs
	number	dollars	number	dollars
Small third	30.9	6.18	33.3	8.42
Medium third	70.3	4.81	77.4	7.31
Large third	219.0	3.54	313.5	5.41
Total	105.3	4.07	139.9	6.00
Number of observations		52		73

Use of on-farm processing equipment

Excess capacity of concentrate feed processing facilities has existed among the commercial mills in Utah of approximately 50 percent. Undoubtedly per unit fixed cost could have been decreased and better utilization of variable resources if equipment were used at full capacity. However, a considerable number of producers in each county have established on-farm processing units to compete directly with the commercial mills. Unless the processing capacity of these units were used at maximum levels, the excess capacity for the industry as a whole would be increased.

A measurement was made to estimate the percent to which on-farm processing equipment was being used in the feed industry among beef and

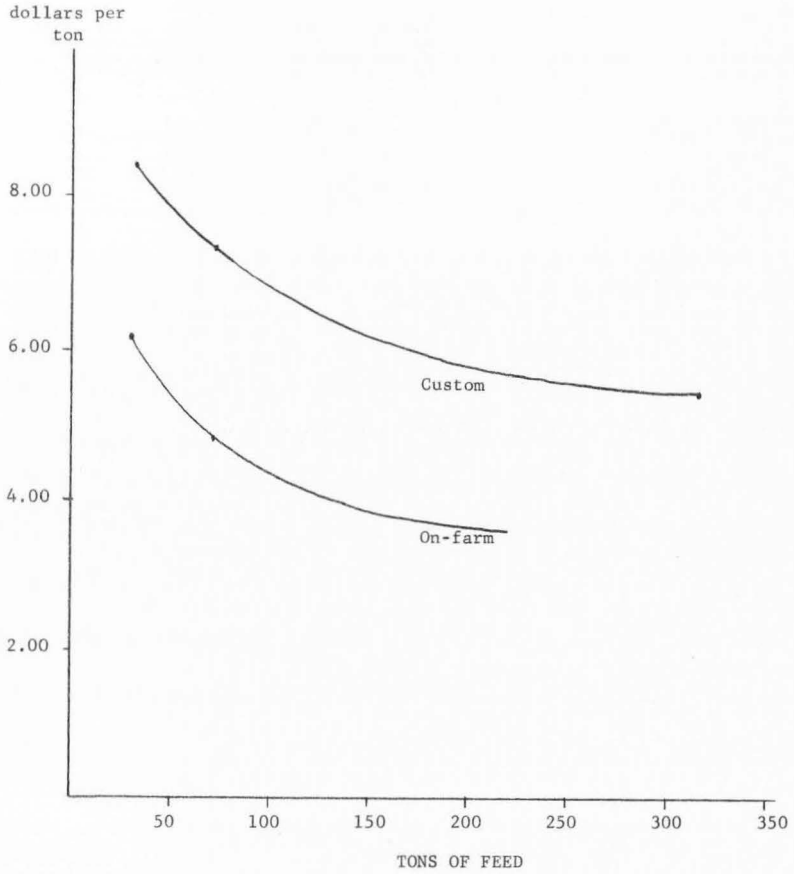

Figure 1. Relationship of tons of feed used to processing and handling cost per ton by the on-farm and custom method -- 4 Utah counties, 1961-1962.

dairy enterprises in the four counties. The on-farm processors were separated by beef and dairy industries. To determine the rate of processing actual tons processed and hours of processing were recorded. To estimate total possible tons processed an arbitrary base of four hours per day, six days per week was used. The use coefficients were determined in both beef and dairy enterprises from actual tons and total possible tons processed.

The 17 records of beef producers indicated that beef producers used their processing equipment at approximately 11 percent capacity. The 24 records of dairy producers used their equipment at 3.6 percent of capacity. Total over-all use coefficient of on-farm processing equipment was 6.1 percent (table 13).

It appears reasonable that to increase the use of on-farm processing equipment would have an affect on the per unit processing costs. It must be recognized that investments in some units are sufficiently low that additional use would not lower per unit cost significantly. Consideration must also be given to additional handling cost which would result from increased use of processing equipment. The important point is that on-farm processors were using their equipment at low capacity, and in spite of this, were able to process feed at lower cost than the custom method.

Table 13. Use ceofficients of on-farm processing equipment of beef and dairy enterprises -- 4 Utah counties, 1961-1962.

Item	Number of records	Processing days	Actual tons processed	Total possible tons processed	Use coefficient*
	number	number	number	number	percent
Beef	17	161.6	2,351.4	21,977.6	10.7
Dairy	24	313.0	1,449.3	40,564.8	3.6
Total	41	--	3,800.7	62,542.4	6.1

* Based upon a four-hour day, six-day week.

SUMMARY AND CONCLUSIONS

1. As a concentrate feed deficit area and a surplus producing area of livestock products, Utah is at an economic disadvantage with competing areas. Improved methods of feed handling can help minimize the effect of this disadvantage of transfer cost.

2. Data were obtained by personal interview from 57 beef feeders in Sevier and Weber Counties and 114 dairy producers in Salt Lake and Cache Counties relative to feed handling methods and costs. In order to determine the importance of various feed handling methods and the costs of each method, producers were classified by one of three methods, namely: commercial, on-farm, or custom.

3. The commercial method was not used by producers in Sevier and Weber Counties. The commercial method was most prevalent in Salt Lake representing 51 percent and the on-farm method was most prevalent in Cache County representing 49 percent. Sixty-eight percent of the producers in Sevier County used the custom method compared with 63 percent in Weber County.

4. Weber and Salt Lake County producers purchased about 97 and 70 percent respectively of the feed used; whereas Sevier purchased 57 percent and Cache County 51 percent.

5. Total cost per ton of concentrate feed delivered to the manger by the commercial, on-farm, and custom methods was $58.28, $49.98, and $51.96 respectively.

6. Ingredient costs per ton for the on-farm and custom methods were identical and amounted to about $46 per ton or 90 percent of the

total cost of feed. Barley was the major ingredient accounting for about two-thirds of the total ingredient cost. All grains accounted for about 78 percent, the value of beet pulp 10 percent, and the value of high protein approximately 9 percent. The composition of the commercial feed was not available to the respondents in this study.

7. The average price of barley was $43.00 per ton with a standard deviation of $3.20 per ton. A price difference existed among counties consistent in direction with transportation costs from supply areas. The relationship of the cost of barley to ingredient cost was direct and essentially linear. Cost of barley showed little or no relationship to percent of barley used indicating that prices of other grains available to producers were essentially the same as barley prices on a feed value basis. The percent of total grains used in the ration to ingredient cost indicated a slight inverse relationship.

8. The processing and handling cost per ton for the on-farm and custom methods were $4.07 and $6.00 respectively. The on-farm method required greater investment in equipment by those using this method and slightly greater labor cost whereas the custom method required greater cost for commercial mill services and transportation. Tons of feed used related to processing and handling costs indicated economies of scale in both on-farm and custom methods.

9. On-farm processing undoubtedly added to the excess processing capacity of the feed industry as a whole. Based upon the premise for computation used in this study, beef feeders used their on-farm processing equipment at 11 percent capacity whereas dairy producers used their equipment at only 3.6 percent capacity. In spite of this, the on-farm method was the least cost method.

10. A careful analysis on each enterprise is necessary before producers should change methods of processing and handling their feeds. Some of the differences of total cost per ton between the commercial and the on-farm and custom methods resulted possibly from differences due to kind and proportion of ingredients used. Whether commercial mix was of greater value per ton because of increased beef and dairy production was not determined by the methods used in this study.

To consider methods of handling which require an investment in additional equipment and buildings would necessitate a per unit cost analysis at some level of ton usage. The cost figures represented in this study are average figures representing depreciated units at possibly lower processing and handling costs than with new buildings and equipment and at current price levels.

Some considerations with reference to the use of three alternative methods of handling are as follows:

a. The increased rates of production, if any, resulting from the use of commercial mix as compared with feed ingredient, combinations used by the on-farm and custom method.

b. Labor requirements vary for each method of handling. Hence, the need, availability, and cost of labor should be considered with respect to the total and interim annual needs in conjunction with other phases of farm operations.

c. The distance of the feeding enterprise from commercial mills, the proportion of feed produced and purchased, and the place of storage of whole grains. For example, the movement of concentrate feed is minimized by the on-farm method when the

enterprise is a long distance from the commercial mill and where the majority of the feed was produced and stored on the farm.

d. Consideration of the investment required for equipment and facilities at the various levels of actual and anticipated concentrate feed use.

e. The utility of convenience and preference associated with each method.

LITERATURE CITED

(1) Anderson, R. H. On-Farm Processing of Feeds by Utah Poultrymen, 1960. Utah State University Agricultural Experiment Station. Research Bulletin No. 2, 1960.

(2) Brenseke, V. John. The Changing Structure of Markets For Commercial Feeds. United States Dairymens Association. Marketing Research Service. Journal of Farm Economics. December 1958.

(3) Brenseke, V. J. and Vosloh, J. V., Jr. The Changing Feed Mixing Industry Practices in Selected States. Marketing Research Report No. 506. United States Dairymens Association. October 1961.

(4) Oakley, Ray M. Feed Industry Expansion Continues, American Feed Manufacturing Association, Incorporated, Bulletin, 1963.

(5) Roper, Orson B. A Description of the Policies and Procedures of Retail Feed Dealers in Utah, 1958. (M.S. thesis. Department of Agricultural Economics) Utah State University 1961.

(6) Seagraves, J. A. Bulk Feed Handling Reduces Labor Costs, 1958. Department of Agricultural Economics, North Carolina State College, Series No. 68, 1958.

(7) Utah Economic and Business Review. Reference V 22 No. 5. May 1962.