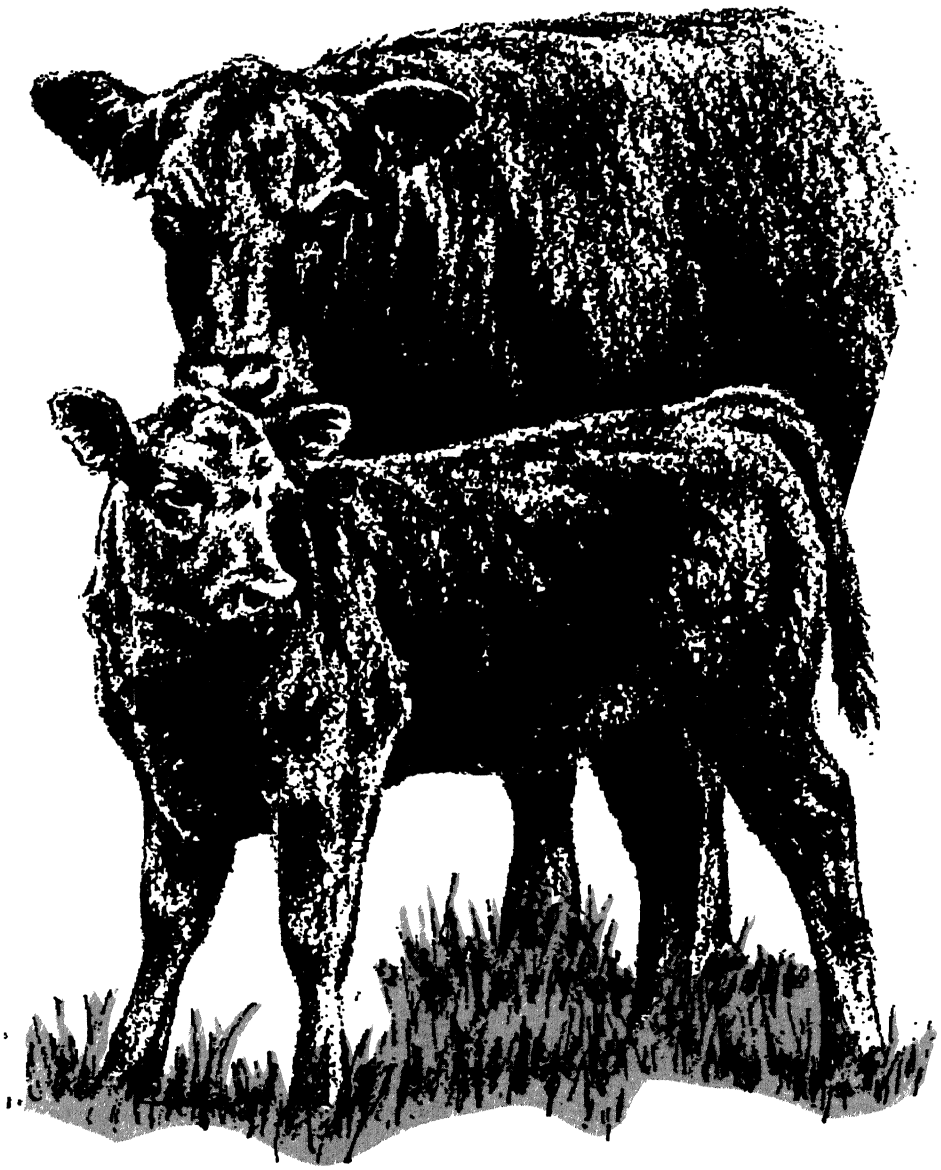
Research Bulletin 1186
June 1990



Case Studies in Southeast Ohio Cow-Calf Operations

Department of Agricultural Economics and Rural Sociology
Ohio Agricultural Research and Development Center
The Ohio State University

OARDC

Kirklyn M. Kerr, Director

Acknowledgements

The manuscript has benefitted from review and recommendations by M.T. Batte, A.E. Lines, D.P. Miller, and G.D. Schnitkey of the Department of Agricultural Economics and Rural Sociology, Ohio State University, as well as by anonymous reviewers outside OSU and OARDC. The authors wish to thank the 25 owner/operators whose participation made this study possible, and those who assisted in arranging for their participation, particularly J.C. Clay, Beef Specialist, Department of Animal Science, Ohio Cooperative Extension Service. The authors also are grateful to Pamela Brown and Janice DiCarolis for preparation of manuscript text and graphics.

(6-90-1M)

Contents

Case Studies In Southeast Ohio Cow-Calf Operations

Thomas T. Stout, Kevin F. Fowler, and D. Lynn Forster
Department of Agricultural Economics and Rural Sociology

Purpose

A 1963 study published by the Ohio Agricultural Research and Development Center (OARDC) determined that beef cow herds in southeastern Ohio generally were not profitable[1]. That investigation found profit to be more closely related to effective use of available farm resources than to any particular management system, and identified productivity per cow; calving percentages; and feed, labor, and overhead costs as key variables that had to be controlled (Shaudys and Sitterley).

This study uses 1987 data from 25 Southeast Ohio cow herds to re-examine those conclusions.

Background

Traditionally, cow-calf operations have been an important part of Ohio agriculture, particularly in Southeast Ohio where labor and forage are available for cattle[2]. Land that is too hilly for row crop farming provides a good source of low cost forage. Similarly, rural inhabitants with time not completely allocated to farm or nonfarm employment often raise beef cattle. Many Ohio counties have marginal land and underemployed labor. The unglaciated southeastern region contains many of these, and they support a large number of the state's beef cows

Over the past half-century, the U.S. cattle industry has grown in importance as a source of farm income, but the Ohio cattle industry has not (Table 1).

Table 1: Percentage of Cash Farm Receipts Derived from Livestock and Livestock Products, and from Cattle and Calves, United States and Ohio, Selected Years, 1930—1987

	Percent of Cash Receipts From			
	Livestock and Products		Cattle and Calves	
Year	U.S.	Ohio	U.S.	Ohio
1930	57.3	74.3	13.1	9.2
1960	55.8	60.1	21.7	14.2
1987	54.1	43.4	24.5	10.9

Source: Derived from *Economic Indicators of the Farm Sector*, Economic Research Service, USDA, and *Ohio Farm Income*, Ohio Agricultural Statistics Service.

Table 2: Number of Cattle Feedlots and Fed Cattle Marketings, by Size of Feedlot, Principal Feeding States, Selected Years, 1964-1987[1]

	More Than 1000 Head[2]		Less Than 1000 Head	
Year	Number of Lots	Percent of Cattle Fed	Number of Lots	Percent of Cattle Fed
1964	1,668	38.9	223,071	61.1
1976	1,796	67.2	130,739	32.8
1987	1,628	81.6	41,343	18.4

[1]In 1964 28 states were included, 23 in 1976, and 13 in 1987, reflecting the decline in farm feedlot activity. These 13 states accounted for 85 percent of all cattle feeding in 1987.
[2]More or less than 1000 head is the reporting device used by the USDA to identify commercial feedlots (usually much larger than 1000 head) and farm feedlots (usually much smaller than 1000 head).

Source: For 1964, *Livestock and Meat Situation*, ESCS, USDA; for 1976, *Livestock and Meat Statistics*, SRS, USDA; for 1987, *Cattle on Feed*, SRS, USDA.

Contributing to this Ohio pattern are the expanded importance of global grain markets, the rise of commercial feedlots in the west (Table 2), and the availability of off-farm jobs. Global markets and prices have made Ohio grains more attractive to sell than to feed, and off-farm jobs have become more attractive than livestock

[1]Sometimes a direct profit is not a primary goal (Nelson).

[2]Cattle and calf income ranked fifth among 18 agricultural enterprise categories in Ohio in 1987. This includes, in addition to feeder calf sales, fed cattle and replacement sales, including dairy (but excludes milk and all dairy product sales). In the 17 sampled southeastern counties, where cow-calf operations are common and cattle feedlots are not, this income category ranked first in 4 counties, second in 7, third in 3, fourth in 2, and fifth in 1 (Ohio Farm Income).

as sources of supplementary income.

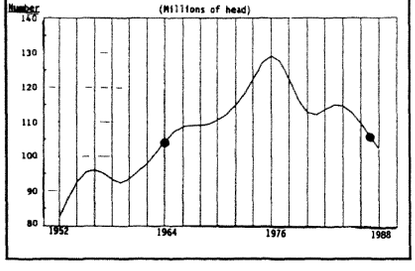
But beef cows in Ohio have been less affected by these trends, perhaps because they are forage consumers (rather than grain) and because they can be more accommodating to part-time farming and off-farm jobs than can most livestock enterprises. Notice in Table 3 that the Ohio January 1 inventory of beef cows in 1987 stood at 84.4 percent of the 1964 level, while the inventory of all cattle and calves had fallen to 67.9 percent of the 1964 level, reflecting the decline of feedlots and the disappearance of small dairy herds that once were common. Notice also that farms with cattle and calves fell from 66.9 to 46.8 percent of all Ohio farms. But the percentage of farms with beef cows was unchanged (Table 3).

These comparisons of 1987 (the study year) with 1964 are appropriate for two reasons: (1) 1964 is the census year closest to the 1963 study by Shaudys and Sitterley, cited above, and reflects conditions at that time. Also, (2) U.S. January 1 inventory of cattle and calves has a cyclical pattern that can confuse temporal comparisons. But the inventory level in 1964 and 1987 was approximately the same. Hence, 1964-1987 changes that are observed in Ohio cannot be attributed to movements in the U.S. cattle cycle (Figure 1).

Most Ohio beef herds are small, illustrating their compatibility with off-farm jobs and part-time farming. However, the number and importance of small herds has declined, roughly in proportion to the decline in farm numbers (Table 4). Also, the Shaudys/Sitterley conclusions would suggest that these declines reflect a response to small financial rewards or outright losses.

Larger cow herds, 30 head or more, increased in number during the 1964-1987 period, perhaps in response to profit, or to a more determined expectation of it. This is the group from which candidates were recommended for interviews in this study. On size alone, these could be top Ohio operations. Only 11 percent of Ohio beef operations are this large, but they account for more than 40 percent of the Ohio beef cow population (Table 4).

Figure 1: Cattle and Calves on Farms January 1, Three-Year Moving Average, United States, 1952-1989 (USDA)



The Sample

Twenty-five cow herds in 17 southeastern Ohio counties were selected for this study (Figure 2). All were recommended as operations well-regarded by knowledgeable observers (including extension specialists, marketing associations, and trade groups). Hence, these operations were not a representative sample[3]. For example, nearly 60 percent of Ohio beef cows are in herds of less than 30 head (Table 4). But herds of this size were specifically excluded, supposing that larger herds might enjoy some size advantages or be more carefully managed for profit. These herds, therefore, are 25 individual cases that were selected in search of profitable operations, and with the expectation at the outset that they might serve as models for other profit-seekers to follow. Each operator was then interviewed about his 1987 cow-calf operation.

Table 3: All Farms, Farms With Cattle and Calves, and With Beef Cows; Selected Comparisons, Ohio, January 1, 1964 and 1987.

Ohio Census Item	1964	1987	1987 as a percent of 1964
All farms	120,381	79,277	65.9
Farms with cattle and calves	80,497	35,123	43.6
Percent of all farms	66.9	46.8	—
Farms with beef cows	29,303	19,417	66.3
Percent of all farms	24.3	24.5	—
All cattle & calves (January 1)	2,163,522	1,469,662	67.9
Beef cows (January 1)	337,448	284,646	84.4
Beef as percent of all	15.6	19.4	—

Source: Ohio Census of Agriculture.

[3]Participants were selected, however, to reflect differences in herd size and management approaches in many counties.

The Questionnaire

Each year the Ohio Cooperative Extension Service estimates costs and revenues for a variety of Ohio farm enterprises. The Cow-Calf Enterprise Budget for 1987 provided a basis for determining data requirements for this research (see Table 5, for example). A questionnaire for personal interviews was developed to meet these requirements. The questionnaire also provided for additional information that could supplement or sharpen the customary enterprise budget requirements. Inventory changes (year to year) and the allocation of joint costs (shared by more than one farm enterprise) were areas where complete data were particularly important.

Information was obtained (a) about cash costs and revenues for grain and forage as well as for cow-calf enterprises, (b) about inventory change for grain and forage as well as for cows and bulls, and (c) about joint costs such as rent, taxes, insurance, mortgage interest, depreciation, maintenance and repairs, and their allocation among all the enterprises on the farm.

The appendix to this publication provides details about cost definitions, joint-cost allocating procedures, and the assumptions that these definitions and procedures required. A summary of definitions and procedures appears in Figure 3.

The questionnaire that was developed was then sharpened and streamlined after two preliminary interviews outside the sample area showed how improvements could be made.

The Interview Process

Operators were visited and interviewed in the summer of 1988 about their 1987 operations. They consulted records for their responses. Estimates were accepted as proxies where records were silent or unavailable. However, the questionnaire contained cross-checks which exposed inconsistencies. These needed to be resolved before estimates were acceptable. Sometimes follow-up phone calls were required for final clarifications.

Interview results produced detailed cost and revenue information for each of 25 complete farm operations in 17 southeastern Ohio counties. Consequently, most of the information on prices and costs, as recorded in Table 5 for example, was reported by respondents from their records. The procedures for necessary estimates such as the determination of joint costs are, as noted, summarized in Figure 3 and detailed in the Appendix.

The cow-calf enterprises ranged in size from 27 to 628 cows. (The smallest, when selected in 1988, had more than 30 cows but happened to have been culled below 30 in 1986-87.) The average herd size was 140 cows. Median herd size was 102 (Table 6).

Table 4: Number of Farms With Beef Cows and Number of Beef Cows, by Herd Size, Ohio, January 1, 1964 and 1987

Beef Cows per Herd	1964		1987		1987 as a percent of 1964	
	Farms	Cows	Farms	Cows	Farms	Cows
Under 10	18,479	89,084	9,842	46,327	53.3	52.0
10-29	9,134	158,676	7,422	120,106	81.3	75.7
30-49	1,185	47,195	1,356	49,221	114.4	104.3
50-99	420	29,424	616	39,676	146.7	134.8
100+	85	13,069	181	29,316	212.9	224.3
All	29,303	337,448	19,417	284,646	66.3	84.4

Source: Ohio Census of Agriculture, U.S. Department of Commerce.

Figure 2: Seventeen Ohio Counties Where Beef Cow Herd Owners Were Interviewed About Their 1987 Operations in 1988.

Figure 3: Working Outline of the Cost Allocation Procedure Used In This Research

Receipts	
Feeder Calf Revenue:	Weaning weight x weaning percent x sale price
Cull Cow Revenue:	Cow cull value x (culling rate—death rate)
Cull Bull Revenue:	Bull cull value x (culling rate—death rate) ÷ (cows per bull)
Total Receipts:	Sum the above three items
Variable Costs—Feed	
Pasture:	(Share of rent on leased land + estimated pasture rent on owned land) ÷ number of cows
Hay:	(Herd consumption ÷ number of cows) x price
Other:	(Silage consumption x corn grain equivalent + grain consumption x price) ÷ number of cows
Salt and Mineral:	Total expense ÷ number of cows
Variable Costs—Other	
Health Program:	Total expense ÷ number of cows
Marketing:	<(Some producers combined two or more of these)
Supplies & Misc.:	
Interest on Operating Loan:	Share of total expense based on total variable costs ÷ number of cows
Total Variable Costs:	The above eight items
Fixed Costs	
Hired Labor:	Share of total hired labor expense based on operator estimates of time spent working with the cows ÷ number of cows
Cow Replacement:	Cow replacement cost x culling rate
Bull Replacement:	Bull replacement cost x culling rate ÷ (cows per bull)
Fence & Facilities:	(Share of building depreciation + share of building repairs + average annual fence repairs) ÷ number of cows
Equipment:	(Share of fuel, oil, repairs, and depreciation based on operator estimated use) ÷ number of cows
Insurance:	Share of total expense based on percent of farm sales ÷ number of cows
Total Fixed Cost:	Sum the above six items
Total Costs:	Sum total variable costs and total fixed costs
Return	
Over Variable Costs:	Total revenue—total variable costs
Over Total Costs	Total revenue—total costs

Table 5: Average Costs and Revenues Per Cow[1], Standard OSU/OCES Enterprise Budget[2] and 25 Cow-Calf Operations in Southeast Ohio, 1987

Item	OSU/OCES 1987 Budget[2]	25 Herds in Study	15 Herds Made Money	10 Herds Lost Money
	(Dollars)			
Receipts				
Feeder Calves	272	384	393	371
Cull Cows and Bulls	69	84	101	59
Total Receipts	341	468	494	430
Variable Costs				
Feed				
Pasture	52	31	28	35
Hay	120	186	139	238
Other	0	30	33	25
Salt and Mineral	4	9	6	12
Total Feed Cost	176	256	206	310
Health Program	8	10	6	15
Marketing (inc. trucking)	10	1	0	1
Supplies and Misc.	10	10	7	15
Interest on Operating Capital	10	5	4	6
Total Variable Cost	214	282	223	347
Fixed Costs				
Labor Charge	45	10	11	9
Cow Replacement	100	77	93	53
Bull Replacement	13	15	17	11
Interest on Breeding Animals	48	—	—	—
Fence and Facilities	51	34	23	49
Management Charge	17	—	—	—
Equipment	—	61	53	75
Insurance	—	9	6	13
Total Fixed Cost	274	206	203	210
Total Costs	487	488	426	557

[1]Costs are per cow unit which includes calves and bull shares.
[2]Column 1 of this table shows 1987 budget estimates for Ohio cow-calf enterprises that were prepared by the Ohio Cooperative Extension Service and The Ohio State University.
Source: Survey data and *Ohio Livestock Enterprise Budgets, 1987*, MM-390, OCES, OSU, Columbus, November 1986.

Table 6: Herd Size Characteristics, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Characteristics	Herd Size Categories (Head) (Under 60) "Small"	(60-119) "Moderately Small"	(120-179) "Moderately Large"	(180 and up) "Large"	All Herds
Number of Herds	5	11	4	5	25
Average Size	45	89	148	341	140
Median Size[1]	48	86	151	261	102
Range in Size	27-57	70-116	135-165	180-628	27-628

[1]Calculated middle numbers in the array of herd sizes.
Source: Survey data.

Results

On the average, these cow-calf operations failed to cover total costs per cow in 1987 (Table 5, Column 2). Fifteen operations were profitable (Table 5, Column 3), but made less per cow than the other ten lost (Table 5, Column 4). Consequently, on average, these 25 operations were unprofitable.

Comparisons between the survey results and the 1987 standard enterprise budgets in Table 5 identify important differences[4]. Even unprofitable enterprises averaged a higher revenue per cow than the standard budget, and they were able to generate a positive return over cash (variable) costs. But the most critical difference between profitable and unprofitable enterprises appeared to be the level of these variable costs. More than any other single factor, profitability (i.e., a positive return over variable plus fixed costs) was related to successful variable cost containment. A further examination of this initial assessment constitutes the remainder of this publication.

[4]There is a major difference between the OCES Enterprise Budget (Column 1) and the results of this research (Columns 2, 3, 4). Column 1 identifies all costs, including opportunity costs for capital and management. Any return above Column 1 costs is a pure (economic) profit. Columns 2-4 identify direct costs, e.g. interest to borrowed capital or wages to hired labor, and treat return over costs as net farm income (to management, family labor, and owner equity). Also, Columns 2-4 employ some definitions and computations that depart from customary procedure. For example, deaths are here included with culls, which departs from convention but contributes to conceptual clarity. A careful examination of Figure 3 and the Appendix will disclose other small but distinctive attributes of the accounting procedures used here.

Analysis

Analysis of Size

Although these operations were large by statewide standards, the range in herd size (27—628) was extreme. This discussion therefore treats these herds in four size categories (Table 6). Treating them in groups also conceals data for individual operations which might otherwise be recognized by their size, particularly among the largest operations.

Small cow herds may or may not be kept with monetary expectations foremost among the goals of ownership (Nelson). But among larger operations it is reasonable to suppose that profit expectations are what explain and justify the substantial human and financial commitments that are required. Moreover, the effort to minimize these commitments (because they are substantial) might reasonably be regarded as the core of the management burden. Do profit prospects for Ohio cow-calf operations improve as herd size increases? That is the principal question this analysis by size examines.

Income: Calf revenue per cow increased slightly as herd size increased (Table 7). This was due not to variations in price, but mostly to increases in weaning (sale) weight as herd size increased. Differences by herd size appeared to be unimportant except for the largest herds, which had high weaning rates and higher weights and prices than the others. In all cases, of course, individual profit prospects are enhanced by successful efforts to maximize price, weight, and weaning rate.

Income was also derived from the sale of cull cows and bulls, but typically this was canceled by the cost of replacements. Although culling rates varied widely among these herds, they tended to be matched by replacement rates. But there was usually a net replacement cost, due to deaths (included with culls) and to price differentials between culls and replacements (Table 8).

Variable Costs: About 90 percent of all variable costs were feed costs (Table 9). The principal feed cost was hay. Controlling hay costs appeared, therefore, to be central to the whole task of managing variable costs. Success at this task was not closely related to herd size in this analysis.

But perhaps this should not be expected; perhaps there are management challenges that are substantially different as herd size changes. For

example, were smaller herds a modest part of larger, diversified operations? Did large herds have less shelter? Were their consumption needs higher? Were feeding conditions less controlled? Was more feed wasted? There was such diversity here that these herds were hard to generalize. But it is clear that minimizing hay cost is central to effective variable cost control, and large herd size did appear to make the job harder, not easier.

Fixed Costs: Fixed costs were substantially higher for the smallest herds. For all sizes, the principal costs were replacements (Table 8), and capital investments (Table 10). There was not a clear pattern of cost trends over size for any of these cost components. This suggests that these size categories either (a) contained a mixture of operations that served differing purposes and had differing cost requirements, or else that (b) size advantages were obscured by varying levels of management skill that failed to consistently capture those advantages. The first of these possibilities will be examined in an analysis of diversification. Some indication of the answer to the second possibility lies in Tables 11 and 12.

Return Over Costs: Except for the smallest size category, most of these operations averaged close to break-even (Table 11). That is to say, after these herds had paid all their bills, as set forth in Table 5, all the income per cow was about used up. But those paid bills represented income—pasture rental or hay sales, hired labor, etc.—to the larger farm operation of which they were usually a part. But hay usually can be sold, or pasture rented, or labor otherwise employed. Whether such income

Table 7: Feeder Calf Revenue per Cow, by Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Income Factor	Herd Size Categories			
	Under 60	60-119	120-179	180 and up
	(dollars)			
Price per cwt.	$ 82	$ 78	$ 81	$ 83
Sale Weight (lbs.)	531	512	537	628
Weaning Rate (pct.)	87	91	85	90
Calf Revenue (per cow)	$363	$365	$369	$460

Source: Survey data.

Table 8: Cull Revenues and Replacement Costs per Cow, by Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Revenue and Cost	Herd Size Categories			
	Under 60	60-119	120-179	180 and up
	(dollars)			
Cull Revenue	56	81	171	48
Gross Replacement Cost	56	91	180	58
Net Replacement Cost	0	10	9	10

Source: Survey data.

Table 9: Variable Costs Per Cow, By Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Variable Costs	Herd Size Categories			
	Under 60	60-119	120-179	180 and up
	(dollars)			
All Feed Costs	259	244	240	287
Grain and Supplement	18	18	12	24
Pasture	43	24	35	27
Hay	185	176	174	218
Silage	3	18	11	9
Salt/Mineral	10	8	8	9
All Other[1]	28	24	22	32
Total Variable Costs	287	268	262	319

[1]Includes veterinary, drugs, vaccinations, trucking, marketing charges, supplies, and miscellaneous, including straw.

Source: Survey data.

Table 10: Fixed Costs per Cow, by Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Fixed Costs	Herd Size Categories			
	Under 60	60-119	120-179	180 and up
		(dollars)		
Equipment	82	48	55	75
Fences/Facilities	66	15	43	33
Insurance	21	6	5	9
Hired Labor	1	16	5	9
Total Fixed Costs	170	85	108	126

Source Survey data

Table 11: Per Cow Revenues, Costs, and Return Over Costs, by Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Herd Size Category	Total Revenue[1]	Total Costs[2]	Return Over Total Costs
Under 60	419	513	-94
60-119	446	444	+2
120-179	540	550	-10
180 and up	508	503	+5

[1]Calf revenue (Table 7) plus cull revenue (Table 8).
[2]Gross replacement cost (Table 8) plus variable costs (Table 9) plus fixed costs (Table 10).
Source: Survey data.

Table 12: Total Costs per Dollar of Total Revenue Among Profitable and Unprofitable Operations, by Herd Size Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Profitability	Herd Size Category			
	Under 60 (5 herds)	60-119 (11 herds)	120-179 (4 herds)	180 and up (5 herds)
		(dollars)		
Sample	1.24	1.00	1.01	0.99
Profitable	0.61	0.85	0.95	0.86
Unprofitable	1.78	1.30	1.37	1.14
Percent Profitable	40	64	75	60

Source: Survey data.

could or could not have been realized without having a cow herd at all is always an assessment that management needs to make.

Profitability: Recall (from Figure 3 and footnote 4) that "profit" in this analysis is the net return to unpaid operator labor, management, and capital. Charges for these owned resources were not included in computing variable or fixed costs. Tables 11 and 12 offer a summary of this residual return per cow and per dollar of total cost. A positive return was realized for some herds in all size categories, but this occurred less frequently with the smallest herds. Note that the severe failure to cover costs among small herds (−$94, Table 11) was an average for five herds, but two of these earned a profit (Table 12), so the loss for the other three was more severe than the 5-herd average (compare Table 11 and Table 12). Note also that the difference between profit and loss was smaller among the remaining herds (Table 12 and Figure 4).

Analysis of Diversity

Another approach to the search for profitability among these operations was to examine how they fit into the larger operation of which they were a part. In the following pages these herds are sorted by the percent of gross farm income that was generated by the cow-calf operation. Those that provided half or more of total farm income were called "specialized" cow-calf operations. Those that contributed less were called "diversified" operations (Table 13).

Income: Highly specialized operations averaged largest in size (Table 13) and achieved the best results in calf sale prices, sale (weaning) weights,

and calf revenue per cow (Table 14). Cull revenue was matched closely by replacement costs because cull and replacement rates tended to move together. Net replacement costs were smallest for the specialized herds (Table 15).

Variable Costs: Sorting these herds into diversified/specialized categories produced a wide range in variable cost averages, due mostly to a wide range in hay costs. Lowest costs were among those herds that were modest parts of diversified farm enterprises. (Table 16).

Hay cost used in this study was the estimated local market value of hay actually fed. Variations in cost were due to several apparent factors that were not closely related to herd size or diversity: (1) The length of the feeding period varied with different management objectives. Some operators had fall calves; some sold yearlings; some used hay as a substitute for other feeds, including pasture. (2) There was a range in hay quality, from stubble clippings in on-site round bales, to wire tied bales of straight alfalfa. But the quantity fed did not vary as much as this range in quality would warrant. (3) Other forms of waste were apparent: examples include goodwill toward the cattle and a concern for their welfare, accompanied by an uncertainty about their actual needs; a low regard for the value of hay as a marketable product and an attitude that the cost of waste was inconsequential; and feeding hay on the ground without racks or bunks.

Fixed Costs: Lowest costs were associated with diversified herds. The sharing of fixed investments between the cow herd and other farm enterprises helped to minimize herd

Figure 4: Cost per Dollar of Total Cow-Calf Revenue, by Herd Size Categories, 25 Southeast Ohio Operations, 1987.

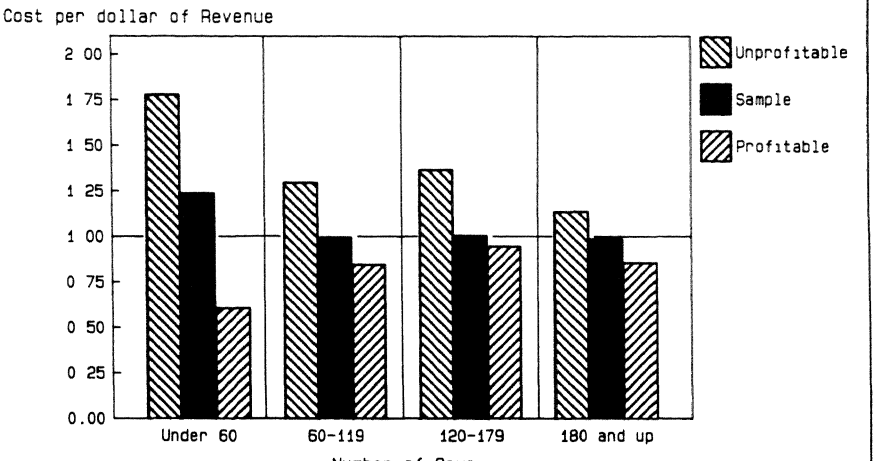


Table 13: Herd Diversity Characteristics, 25 Cow-Calf Operations in Southeast Ohio, 1987.

	Diversity Categories (Percent of Farm Sales)			
Characteristic	(Under 20) "Highly Diversified"	(20-49) "Moderately Diversified"	(50-79) "Moderately Specialized"	(80-100) "Highly Specialized"
Number of Herds	8	7	6	4
Mean Size	94	127	119	286
Median Size[1]	81	110	98	245
Range in Size	38-180	55-217	48-261	27-628[2]

[1]Calculated middle number in the array of herd sizes.
[2]Although the 27-cow herd accounted for most of the gross farm income, the household was supported by nonfarm income.
Source: Survey data.

Table 14: Feeder Calf Revenue per Cow, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

	Income Diversity Category (Percent)			
Income Factor	Under 20	20—49	50—79	80—100
Price per Cwt.	$ 79	$ 80	$ 80	$ 82
Sale Weight (lbs.)	550	518	524	617
Weaning Rate (pct.)	92	85	87	92
Calf Revenue per Cow	390	349	364	464

Source: Survey data.

Table 15: Cull Revenue and Replacement Costs per Cow, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Revenue and Cost	Income Diversity Category (Percent)			
	Under 20	20—49	50—79	80—100
	(dollars)			
Cull Revenue	76	40	154	70
Gross Replacement Cost	86	52	158	74
Net Replacement Cost	10	12	4	4

Source. Survey data.

Table 16: Variable Costs per Cow, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Variable Costs	Income Diversity Category (Percent)			
	Under 20	20—49	50—79	80—100
	(dollars)			
All Feed Costs	193	278	301	271
Grain and Supplement	22	12	17	24
Pasture	30	25	88	32
Hay	117	219	234	188
Silage	16	14	4	14
Salt/Mineral	8	8	8	13
All Other[1]	26	13	27	50
Total Variable Costs	219	291	328	321

[1]Includes veterinary, drugs, vaccinations, trucking, marketing charges, supplies, and miscellaneous, including straw.

Source: Survey data.

Table 17: Fixed Costs per Cow, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Fixed Costs	Income Diversity Category (Percent)			
	Under 20	20—49	50—79	80—100
	(dollars)			
Equipment	46	36	60	141
Fences/Facilities	30	25	43	56
Insurance	6	5	6	11
Hired Labor	14	11	4	8
Total Fixed Costs	96	77	113	216

Source: Survey data.

costs (Table 17). Where joint cost determinations had to be made, a criteria for the share to be assigned to the cow herd was the percent of gross income to the entire operation that was contributed by gross sales from the cow herd. Hence tractors or discs that might be employed in corn or beans as well as in fields used for forages would be shared, although equipment like balers might be assigned according to the share of hay fed versus sold, and items like manure spreaders would be shared according to their use among different livestock enterprises. The cow herd might own the spreader if cows were the only livestock enterprise, but be assigned only a small share of it if there was a feedlot on the farm. As cow-calf operations grew in size and became separate, specialized operations, the need for equipment rose as the herds got larger, and the share of equipment costs borne by the herd rose as well (Table 17).

Return Over Costs: Average return over costs was positive only for the most diversified operations where the cow herd contributed the least to gross farm income. Average losses were highest among specialized operations (Table 18).

Profitability: Some operations in all categories were profitable, but the likelihood for profitability was highest among the most diversified operations (Table 19, and Figure 5.).

Analysis of Cost Control

No single cow/calf operation managed to minimize each of the per-cow costs that are itemized in Table 5. What is examined in Table 20 is differences in cost categories among those operations that had the lowest

costs versus those that had the highest. Three sorts were made in the construction of Table 20, which compares highest and lowest to the average figures for (a) feed costs, (b) all other variable costs, and (c) fixed costs, excluding replacements.[5]

Hence there is no given herd identity here that follows through all three categories. The eight operations that registered the lowest feed costs might have been entirely different from whatever eight registered the lowest nonfeed variable costs, and yet another eight might have managed the lowest fixed costs. What is being examined here is the potential for success or failure at cost control. The object was not to identify characteristics of those who succeeded or failed, but to see what kinds of cost control figures might conceivably be possible.

What emerged were total costs (by categories) that ranged from $224 to $610 per cow, compared to a $396 average. The interesting thing about this sort is that, at per cow costs of $224, every herd in the survey made enough income to be profitable, and at per cow costs of $610, no herd made enough money to turn a profit (Table 21).

Table 21 summarizes per cow costs for each of the 25 operations participating in the survey. Replacement costs and sales have been excluded, so calf sales in Column 1 represent the total income realized by each herd. Herds are arrayed in ascending order of total cost, shown in Column 5. Also, since hay cost emerged as a conspicuous variable, it has been shown separately from other feed and nonfeed variable costs in Columns 2 and 3.

[5]Replacement income and costs are excluded because changes in herd size in any particular year may give an impression of profit or loss in that year that had nothing to do with long term management plans or cost controls.

Table 18: Per Cow Revenue, Costs, and Return Over Cost, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

Herd Diversity (Percent)	Total Revenue[1]	Total Costs[2]	Return Over Total Costs
	(dollars)		
Under 20	466	401	+65
20-49	389	420	-31
50-79	518[3]	599[3]	-81
80-100	534	611	-77

[1]Calf revenue (Table 14) plus cull revenue (Table 15).
[2]Gross replacement cost (Table 15) plus variable costs (Table 16) plus fixed costs (Table 17)
[3]These figures include high cull revenues and replacement costs (Table 15).

Source: Survey data.

Table 19: Total Cost per Dollar of Total Revenue Among Profitable and Unprofitable Operations, by Herd Diversity Categories, 25 Cow-Calf Operations in Southeast Ohio, 1987.

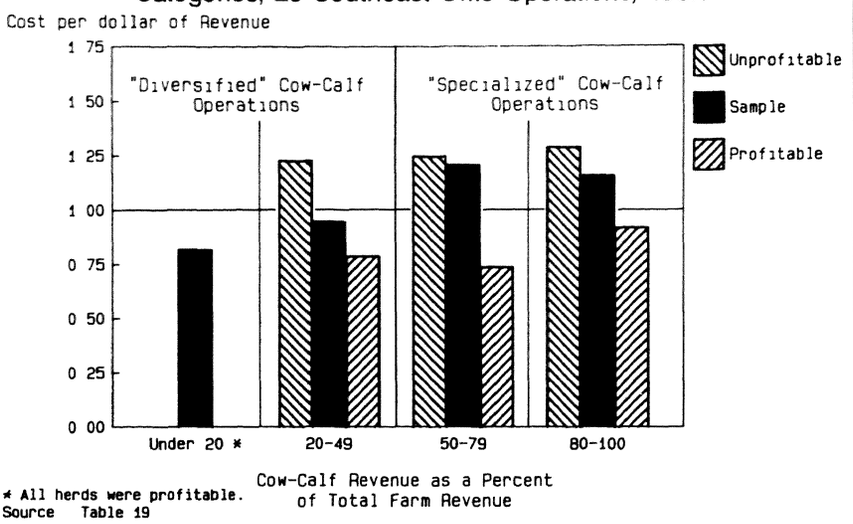
Profitability	Income Diversity Category (Percent of Farm SAles)			
	Under 20 (8 herds)	20-49 (7 herds)	50-79 (6 herds)	80-100 (4 herds)
Sample	0.82	0.95	1.21	1.16
Profitable	0.82	0.79	0.74	0.92
Unprofitable	—	1.23	1.25	1.29
Percent Profitable	100	43	33	50

Source: Survey data.

Return over total costs appears in the next-to-last column, and return over variable costs in the last. Note that, while only 15 herds realized a positive return over total costs (profit), 20 herds managed a positive return over variable (operating) costs, which exclude fixed costs. Since fixed costs are not cash costs associated with daily operations, they are easier to overlook and allow management sometimes to suppose mistakenly that a year was profitable because there was money left over after all the cash costs had been paid.

It is easy to suppose that cow herds are profitable because so many of the costs, even variable costs, are so obscure that no method of valuation is beyond persuasive criticism. Pasture and hay provide examples. (1) Cow herds are recommended for their ability to glean value from resources that are unmarketable and peripheral to mainline farm enterprises like row crops, finishing floors, and feedlots. (2) But determining net profit for the cow herd invites the use of opportunities foregone, as accounting devices, including rental for pasture

Figure 5: Cost per Dollar of Total Cow-Calf Revenue, by Herd Diversity Categories, 25 Southeast Ohio Operations, 1987.



* All herds were profitable.
Source Table 19

Table 20: Average Costs per Cow Compared to Eight Highest-Cost and Eight Lowest-Cost Possibilities, 25 Cow-Calf Operations in Southeast Ohio, 1987.[1]

Cost Item	Cost Category		
	Highest Cost 8	All Herds	Lowest Cost 8
Feed Costs:			
Grain/Supplement	12	18	14
Pasture	27	31	32
Hay	299	187	88
Silage	8	12	24
Salt/Mineral	8	9	6
Other Variable Costs	51	26	9
Total Variable Costs	405	282	173
Fixed Costs:			
Equipment	107	61	26
Fence/Facilities	64	34	15
Insurance	18	9	5
Hired Labor	16	10	5
Total Fixed Costs[2]	205	114	51
Total Costs	610	396	224

[1]Feed cost, other variable costs, and fixed cost sorts were made separately. The 8 lowest or highest variable cost herds are not necessarily the same as the 8 highest or lowest fixed cost herds.
[2]Excluding cow and bull replacement costs, thus assuming no change in herd size.
Source: Survey data.

(because the pasture could have been rented) and market value for hay (which could have been sold), although the initial justification for the cow herd was to generate a value from some resource that would otherwise be lost. Cow-calf operators who subscribe to the argument that pasture or hay has no value beyond what the cows can make of it find little difficulty in generating a profit above the cash costs that do need to be paid. It is possible that the two arguments here represent extremes. Argument (1), above, probably undercharges the cattle, and argument (2) perhaps overcharges them for the resources they use. A compromise between these extremes might be to charge a market or rental value for hay or pasture, multiplied by the local probability that these could in fact actually be sold or rented at all. Marginal hay, fences, and pastures that represent a manageable nuisance to their owner may not generate very attractive market prospects, but that might be exactly why the owner can make money from his cows and the renter/hay-buyer cannot. Even good market offerings will go begging when nobody in the neighborhood is interested in a cow herd. Owner interests in such circumstances quickly gravitate toward argument (1), above, as they hustle to find some cows of their own to salvage some value from their unmarketable resource.

When calf sales in Table 21 are laid against just the cash costs that cow owners incur, any of the 25 shown in the table can give the *appearance* of having been profitable.

Notice in Table 21 that, as total costs rise, hay costs rise rather consistently along with them; high hay costs, of

Table 21: Summary of Per Cow Calf Sales, All Costs Excluding Replacements, and Return Over Costs, 25 Cow-Calf Operations in Southeast Ohio, 1987. (Arrayed by total cost)

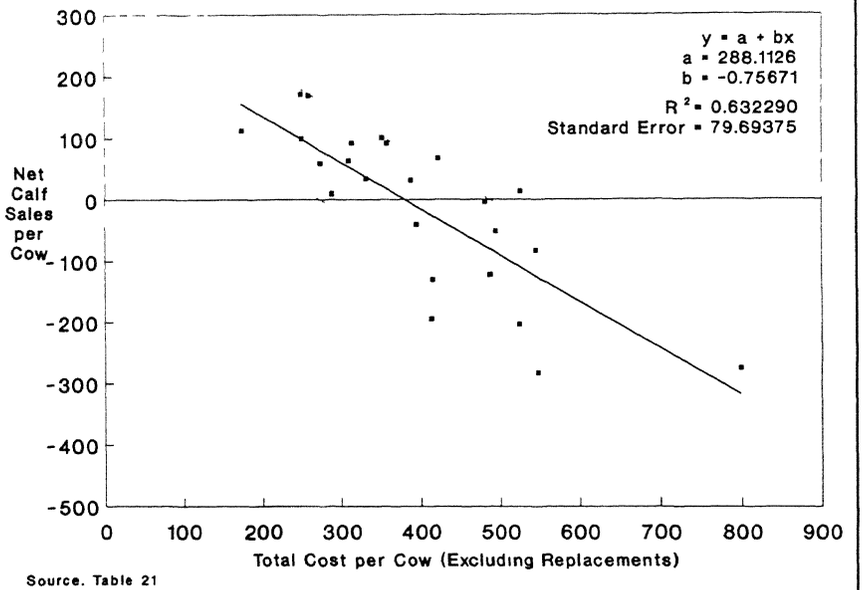
Herd	Calf Sales	Costs Excluding Replacements				Return Over Costs	
		Hay	Other Variable	Fixed	Total	Total	Variable
1	286	84	61	29	174	112	141
2	420	112	87	50	249	171	221
3	349	59	88	103	250	99	202
4	428	65	69	125	259	169	294
5	333	108	105	61	274	59	120
6	296	121	65	102	288	8	110
7	298	177	56	55	288	10	65
8	372	92	168	49	309	63	112
9	405	165	78	70	313	92	162
10	365	159	83	89	331	34	123
11	451	63	114	174	351	100	274
12	448	132	52	173	357	91	264
13	418	279	46	62	387	31	93
14	354	229	70	96	395	-41	55
15	218	310	56	47	413	-195	-148
16	284	232	80	103	415	-131	-28
17	489	307	54	61	422	67	128
18	477	243	103	135	481	-4	131
19	364	239	144	104	487	-123	-19
20	442	355	63	76	494	-52	24
21	320	392	76	56	524	-204	-148
22	538	278	51	196	525	13	209
23	462	230	198	117	545	-83	34
24	265	194	124	230	548	-283	-53
25	524	136	174	489	799	-275	214
Average[1]	384	188	94	114	396	-11	103

[1]Averages subject to rounding error.
Source: Survey data.

course, are a primary explanation for high total costs. But not entirely so. As hay costs rise there is a tendency for fixed and other variable costs to rise also.This pattern is clear in Table 21. Most of the careful cost-watchers are near the top of the table, and so are the profit-makers. At the other extreme, toward the bottom of the page, are clustered the losing operations that let other costs, as well as hay costs, go beyond the ability of the cow herd to support. Among profitable herds, total costs averaged $318 (replacements excluded), and hay was nearly half of that total. But among unprofitable herds, costs averaged $510, and hay still accounted for only half of the total. So while hay is the biggest and most visible cost, it may not be the only culprit if the herd loses money. What the table seems to suggest is that hay costs may be indicative of cost management lapses elsewhere: if hay costs are high, maybe other, less visible, costs are high also.

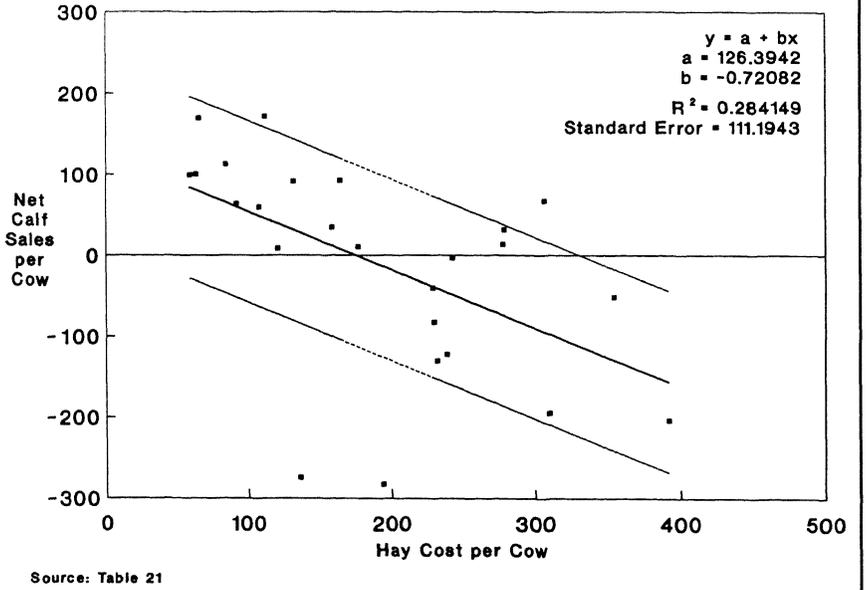
The information in Table 21 invites prescriptive suggestions. Herd 2, for example, combined cost control with high cow productivity to rank highest in profit. Herd 1, also profitable, and even more effective at cost control, would benefit from improved herd productivity. Herd 11, with good cow productivity and controlled hay costs, sacrificed some profit to a higher than average fixed cost burden. Herd 17 would exceed all others in profit if hay costs were cut in half. Other prescriptive possibilities occur as one examines the numbers for each of the herds in Table 21.

Figure 6: Total Cost: Estimated Relationship Between Calf Sales per Cow and Total Cost per Cow (Excluding Replacements), 25 Cow-Calf Operations in Southeast Ohio, 1987.



Source. Table 21

Figure 7: Hay Cost: Estimated Relationship Between Calf Sales per Cow and Hay Cost per Cow, 25 Cow-Calf Operations in Southeast Ohio, 1987.



Source: Table 21

Figures 6 and 7 are statistically estimated relationships between per cow profit and total cost (Figure 6) and profit and hay cost (Figure 7). The downward sloping line in each figure represents the obvious inverse relationship between rising costs (shown on the horizontal axis) and declining profits (shown on the vertical axis). This sloping solid line reveals that, on average, per cow profits in these 25 cow-calf operations had been eroded to zero when total costs per cow rose to about $375 (Figure 6), or hay costs rose to about $175 (Figure 7), and that profits declined by about $30-40 with every rise of $100 in total costs or $50 in hay costs. Moreover, information in the top right corner of each figure tells us that 63 percent of the variation in profit was explained by the variation in total cost (Figure 6), and that 28 percent of the variation in profit was explained by variation in hay cost (Figure 7). Remaining unexplained variations would have been related to unmeasured factors such as variations in cow productivity, or replacement costs, or errors in the data or the estimating process. The broken lines paralleling the solid line represent a range which encompasses approximately two-thirds of all the cost/profit coordinates that can be seen plotted on each figure.

Conclusions and Observations

Revenue: Livestock prices are determined in such intensely competitive circumstances that there is little any one operator can do to enhance prices for a product that is the same as what everyone else is selling. So revenue enhancement is related closely to heavy

calves and good cow productivity rather than (for the majority) to expectations for premium prices.[6] Low revenue in this study was related mostly to poor calf crops and, in some cases, to weak local markets. But another source of low revenue in this survey was the practice in some cases of transferring calves to the feedlot at artificially low weights and prices to aid the feedlot's profit prospects. This is managerially unsound, of course, because it introduces fictions into the bookkeeping and obscures where the true profit centers really lie.

Fixed Costs: Fixed costs usually were not a large factor affecting profitability in these 25 cases. With a few notable exceptions, fixed costs were modest and not extremely variable. Perhaps this was because cow herds typically existed as a **response** to opportunities in the form of (good or bad) pastures, fences, or facilities already in place. Where cow herds were the result of a predetermined **intent**, and that intent required the creation of a physical setting to accommodate it, herds lost money. Perhaps a profitable perception of a cow-calf operation is that: (1) it gleans value from resources that might otherwise lack value; that (2) cows can be profitable when confined to this small role; and that (3) cows become hard to manage for profit when they are supposed to fulfill grand expectations. What makes grand expectations hard to realize in the cow-calf business is that the great majority of competitors in it are willing to sell at prices that will cover only their own very modest expectations, and these may not even include a profit (Nelson).

Variable Costs: The biggest single variable cost associated with cow-calf profitability was hay cost. The variation in hay cost in this survey was extreme. Three explanations account for this variation: (1) quality exceeding nutritional requirements; (2) waste, in many forms; and (3) possible errors in value estimating methods. Whatever can be done to minimize hay cost probably will make a bigger and more direct contribution to profitability than will any other single factor.

The conclusions reached by Shaudys and Sitterley in their 1963 study of cow-calf operations in Southeast Ohio were summarized in the opening paragraph of this publication. Unlike that study, the survey reported here was not based on a representative sample. This survey was intended as 25 selected case studies of larger operations which might serve to illustrate successful management for profit.

The results of this survey, however, tended strongly to support the conclusions of Shaudys and Sitterley in 1963. For example: (1) Fifteen of these selected cases were profitable, but 10 were unprofitable enough to produce an unprofitable average for the 25. (2) Cow productivity, calving percentages, and calf weights were of course direct determinants of enterprise income. (3) Feed, labor, and overhead accounted for nearly all of the costs. But this survey also confirms the Shaudys Sitterley observation that (4) profitability appears to be more closely related to effective use of available resources than to any particular management approach. (For example, an enterprise operated solely as a cow-calf unit may be harder to manage for profit than one that functions as a supplementary enterprise, utilizing ancillary resources and sharing joint costs.) Finally, (5) this survey confirms the Shaudys-Sitterley conclusions concerning the great importance of controlling feed costs and identifies hay costs as the single most important cost component.

Appendix: Cost Definitions and Allocation Procedures

Total Revenue is the sum of feeder calf revenue, cull cow revenue and cull bull revenue (See Figure 3).

Feeder Calf Revenue is the product of weaning weight, weaning percent, and sale price. **Weaning weight** and **sale weight** are synonymous for the purposes of this research (as they are in many operations that wean calves by loading them on a truck bound for a sale barn or feedlot). The **sale price** is the actual price received for feeder calves or an estimated market value for calves sold or transferred to an owner-operated feedlot.

Cull Cow Revenue is the result of **cow cull value** times the percent of cows leaving the herd actually sold. **Culling rate** is the percent leaving the herd for any reason. **Death loss** is the percent leaving, but not being sold. It includes missing and stolen animals.

Cull Bull Revenue is similar except that it is divided by the cow-to-bull ratio in order to report it on a per-cow basis.

[6]Special efforts to find special markets and/or to offer a superior or distinctive product will yield price premiums. In this survey, reported price enhancement methods included club calves, washed calves, uniform truckload lots, and contacting additional buyers outside the immediate market area.

Total Variable Costs are the sum of total feed costs and health, marketing, supply, and operating interest costs.

Total Feed Costs are the sum of pasture, hay, salt and mineral, and other feed costs. The cost of **pasture** is the sum of cow's share of rent paid for leased pasture, or the estimated local rent value of owned pasture; all divided by the number of cows in the herd. **Hay** costs are the product of herd hay consumption and paid or estimated market value of the hay, on a per cow basis. **Salt and mineral** cost is the total expense for salt and minerals consumed in 1987 divided by the number of cows in the herd. **Other feed costs** are the sum of per cow silage consumption and per cow grain consumption times their respective values.

Health program costs include veterinary expense, drug and vaccination cost, and other health related expenses. **Marketing** costs are mainly trucking charges for hauling calves to market plus commission charges paid. **Supplies and miscellaneous** is a catch-all, but includes straw. Some producers combined health, marketing and supply costs in their records. Therefore, the sum of these "other" variable costs will be more useful than the parts.

Operating loan interest is the cow's share of the operating loan interest based on the percent of the principal applied to the cow-calf enterprise. This share was determined by dividing the cow-calf enterprises' total variable costs by the sum of all variable costs for the cow-calf enterprise, the grain enterprise, and the forage enterprise. Sometimes justifiable operator estimates of interest costs were available and were used instead.

Total fixed costs are the sum of hired labor, cow replacement, bull replacement, fence and facilities, equipment,and insurance costs.

Hired Labor is considered to be a fixed cost, although both permanent and part-time labor are included. It is simply a charge for the amount of time hired labor spent working with the cows divided by the number of cows in the herd.

Cow Replacement is the **replacement value** of cow times the percent of the herd culled in 1987. The **culling percent** is used rather than the actual replacement rate to keep inventory constant for reasons discussed later in this appendix.

Bull Replacement is the same as cow replacement except that the cost of replacing culled bulls is spread over the cow herd by dividing by the cow-to-bull ratio.

Fences & Facilities costs are the sum of the cows' share of building depreciation, building repair, and average annual fence repair divided by the number of cows in the herd. The cow's share of the building costs was based on the operator's estimate of the percentage of the usable building space that was used by the cow-calf operation to house cows, calves, replacement heifers, and bulls, but not feed.

Equipment cost is the estimated total of fuel, oil, repair, and depreciation costs incurred by machinery performing tasks for the cow-calf enterprise. The total cost of operating the machinery was multiplied by the operator's estimate of the percent of time in which they were used by the cow-calf enterprise.

Farmwide insurance costs were allocated to the cow-calf operation by multiplying the percent contribution to farm sales made by the cow-calf enterprise times the total insurance expense.

Total Costs are the sum of total variable costs and total fixed costs. Following the computation of per-cow costs and revenues, return over variable costs and return over total costs was derived on each enterprise budget.

Return over Variable Costs is total revenue minus total variable costs.

Return over Total Costs is total revenue minus total costs. Two additional, but integral, parts of the cost allocation procedure are the land cost allocation procedure and the underlying assumptions.

The Rent Allocation Procedure

The procedure used to allocate rental costs on leased land required six steps:

1) The total cost of rent on all leased acres as calculated.
2) If the costs were subdivided by the interviewee, they were identified with the individual farm tracts. Otherwise, the procedure continued on a total owned acres basis.
3) The acres of cropland, pasture and other land were listed for each farm tract or total depending on step 2.
4) In each category on each farm tract or total, the crops and other uses were listed along with the corresponding acreage and revenue,

if known. In cases where specifics were unavailable, the crop and land use revenues were aggregated and divided by the number of acres involved to give the average revenue per acre. This value was then used as an estimate of revenue per acre for those crops and uses. Idle land was not charged a rental cost.

5) The revenues were summed for each unit with an identified rental cost giving an estimate of the total revenue on those acres.

6) The cow-calf share was determined by dividing the revenue from all cow-calf harvested forages by the total revenue on those acres. That percent was multiplied by the total rental cost associated with those same acres to derive the pasture share of rent. The cow's share of each was then determined to be the percent of the pasture used by the cow-calf enterprise.

Assumptions Necessary for Cost Allocation

Several important assumptions and adjustments were necessary during the enterprise budget construction. These are central to understanding the analytical results.

First, to assure comparability of the individual enterprise cost structures for one year, a constant cow herd and bull inventory adjustment was needed. Therefore, the actual animal purchases and sales were adjusted to maintain the same number of cows and bulls in the herd at the end of the year as there were at the beginning. This was done by adjusting the number of cows and bulls reported as purchased, and by adjusting the number of heifers reported as sold on the enterprise budget. This assumption removed a major portion of the investment and disinvestment bias from the budgets.

Second, production and value estimates were needed to supplement the data in establishing per cow costs and revenues. Sources of these estimates included: (a) the Ohio Agricultural Statistics Service *Annual Report, 1987*, (b) industry rules of thumb, and (c) actual production data from other similar operations. It was assumed that these estimates would be reasonable proxies when actual data were unavailable. While blurring the picture somewhat, these estimates were necessary for analyzing the collected data in the enterprise budget format.

Third, in developing a charge for pasture, it was believed that there were two parts to the cost of pasture: a rental value on leased land and an animal-harvested forage value on owned land. In the case of rented pasture, the market reflects buyer and seller agreement of its value. Community rented rates provided an estimate of pasture values on owned land. Estimates of forage value consumed sometimes entered into joint cost determinations and these, too, were tied to rental rates. For example, typical pasture rental rates were \$5 per cow-calf pair per month and \$3 per cow per month. On the average, 86.5 percent of the cows in the sample had calves with them. There-fore, the herd rate is \$4.73 per cow in the herd per month. If the cows weighed between 1100 and 1400 pounds with calves averaging 355 pounds, an average pair would have weighed 1560 pounds and eaten about 5 percent of its weight or 78 pounds of dry matter daily. In a month, that is 2340 pounds of 1.17 tons of dry matter. Dividing \$4.73 per cow per month by 1.17 tons per month, the estimated value of animal harvested forage is \$4.05 per ton of dry matter.

Fourth, in the absence of specific information, operating loan interest could be allocated based on a percentage of the variable costs incurred by each of the major enterprises on the farm, thus assuming that the operating loan financed variable costs proportionately in each of the major enterprises.

Fifth, in deriving the costs of fence and facilities, it was assumed that building (and facility) depreciation, building repair costs and the average annual fence repair expense represented the relevant costs.

Sixth, and finally, it was necessary to assume that farmwide insurance could reasonably be divided among the enterprises based on the enterprise's contribution to total farm sales, assuming that sales are roughly proportional to the initial investment in an enterprise.

References

Armstrong, D.L., and E.T. Shaudys, "Profitability of Practices Affecting the Calf Crop of Beef Herds," Ohio Agricultural Experiment Station, *Research Circular 103*, May, 1961.

Babbie, E.R. *The Practice of Social Research*. 2nd edition. Belmont, CA: Wadsworth Publishing Company, Inc., 1979.

Blosser, R.H. "Economics of Improving Hill Land for Beef Production." Ohio Agricultural Experiment Station, *Research Bulletin 822*, 1958.

Lesser, W., R. Milligan, D. Fox, and W.A. Knoblauch. "The Economic Feasibility of Expanding Beef Production in New York and the Northeast: Summary Report." Cornell University, Department of Agricultural Economics, A.E. Ext. 82-18, A.S. Mimeo 60, 1982.

Morse, G.W. and D.L. Forster (principal investigators). "Technical Report on Agriculture's Contribution to Ohio's Economy," Governor's Commission on Agriculture. Columbus, Ohio. November 1984.

Nelson, T.R., "Economies of Size in Cow-Calf Production," *Great Plains Beef Cattle Handbook*, GPE-4950, (maintained by Regional Extension Project GPE-7), Department of Agricultural Economics, Oklahoma State University, Stillwater. July, 1982.

Parker, C.F. and R. W. Van Kueren. "Fall Calving Valuable for Ohio Beef Herds." *Ohio Report*. November/December 1975.

Shaudys, E.T. and J.H. Sitterley. "Cost of Producing Beef in Southeastern Ohio, 1954," Ohio Agricultural Experiment Station, *Research Circular 45*, 1957.

Shaudys, E.T. and J.H. Sitterley. "Costs, Returns, and Profitability of the Beef Cow-Calf Enterprise in Southeastern Ohio by System of Management." Ohio Agricultural Experiment Station, *Research Bulletin 937*, 1963.

White, A.B., M.T. Batte, and D. L. Forster. Optimal forage harvest and storage technologies for eastern beef cow-calf herds. *Journal of the American Society of Farm Managers and Rural Appraisers*, October 1988.

_____, "Cattle on Feed,' Agricultural Statistics Board, U.S. Department of Agriculture, December, 1988.

_____, "Census of Agriculture, 1987," U.S. Department of Commerce, AC87-A-35, April, 1989.

_____, "Livestock and Meat Situation," Economics, Statistics, and Cooperative Service, U.S. Department of Agriculture, 1966.

_____, "Livestock and Meat Statistics," Economic Research Service, U.S. Department of Agriculture, 1978.

_____, "Ohio Enterprise Budgets", Ohio Cooperative Extension Service, Ohio State University, Columbus, 1984-1988.

_____, "Ohio Farm Income," (data for 1930, 1960, 1987), Ohio Agricultural Statistics Sevice, U.S. Department of Agriculture, Columbus, selected years.


T · H · E
OHIO
STATE
UNIVERSITY
OARDC