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Minnesota Farm Business Notes

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INVESTMENT IN DAIRY FACILITIES AND HERD SIZE

Boyd M. Buxton and Harald R. Jensen*

In this article we discuss the relationship between investment per cow and size of dairy herd for four alternative housing arrangements. Our purpose is not to specify the best arrangement for a particular farm situation but to illustrate how average investment per cow depends on herd size.[1] The question we try to answer with each housing arrangement is: How does average investment per cow vary when **new** facilities are built for various herd sizes?

Procedure Used

The four alternative dairy housing arrangements are:

1. Stanchion barn.
2. Loose housing loafing shed.
3. Cold free stall barn.
4. Warm free stall barn with inside feeding and liquid manure handling.

The component parts of these four arrangements are divided into housing, milking, and feeding facilities (see the table). For example, housing facilities with the stanchion barn include the main barn, a barn cleaner, stalls, pens, calf stalls, well, and waterers. Milking facilities include the milkhouse, bulk tank, and a three-unit pipeline milker. Feeding facilities include the silo (with unloader) and storage for ear corn.

We estimated the initial investment for each component from information obtained from building and equipment dealers.

Fixed and Variable Investmests

The fixed investment is that part of the total investment that does not depend on herd size. For example, to build a larger loafing shed to house one additional cow and her replacements requires only added length to the shed. The fixed investment is the investment in the two ends that are required regardless of the shed length or cow numbers.

The variable investment per cow is the increase in total investment required initially to build larger facilities for handling one additional cow and her replacements. Therefore, the variable investment per cow for a loafing shed represents the increase in total investment required to build a shed with enough additional length to house one more cow and her replacements.

The sum of the investments for component parts provides an estimate of total fixed and variable investments for housing, milking, and feeding facilities (see totals in the table). To compute the total investment for a particular herd size, multiply the variable investment per cow times the number of cows and add the fixed investment.

Average Investment

For all four housing arrangements, the average investment per cow is lower for large herds than for small herds.

Stanchion Barn—This arrangement is similar to the conventional two-story stanchion barns in Minnesota. The barn

(Continued on page 2)

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[1] Investment figures assume that new dairy facilities are built to the exact needs of the given herd size, i.e., there is no unused capacity such as excess housing or feed storage space.

Costs and Returns of Beef Cow Herds

A. R. Wells and S. A. Engene

The number of beef cows in Minnesota increased from 303,000 to 513,000, or by nearly three-fourths, from January 1, 1956 to January 1, 1965. The largest percentage increase in beef cow numbers occurred on farms in northeastern and north-central Minnesota. This article discusses the economics of maintaining beef breeding herds in these areas. The information is based on records from 94 farmers with herds ranging from 16 to 231 cows.

Costs and Returns for 1964

In 1964, gross returns averaged $78 per cow on these farms (see table 1). This return was basically the value of feeders and cull cows sold, minus depreciation on herd bulls.

The gross return in 1964 did not cover the market value for all resources used. The estimated cost of these resources was $111 per cow—$33 more than the gross return. On this basis, beef breeding herds were not profitable for these farmers.

However, other factors such as the return over a period of years affect the decision to keep a beef breeding herd. Beef cattle prices were unusually low in 1964. The price of feeder calves in Kansas City averaged $22.50 compared with an average of $27 for the 8 years of 1959 through 1966. The relationship was about the same for cull cows. Over the 8 years, gross returns would have been about 20 percent above the 1964 return or $94 per cow. But even this return would not have covered market prices for all resources; the loss would have been about $17.

(Continued on page 3)

Table 1. Costs and returns for 94 beef cow herds, northeastern and north-central Minnesota, 1964

Item	Amount
Calves weaned per cow	0.84
Average weight of calves weaned, lb.	415
Value per cwt. of calves	$20
Beef produced per cow, lb.*	424
Value of beef produced per cow*	$78
Costs per cow:	
Pasture	$12
Other feed	57
Labor	14
Buildings and equipment	10
Direct variable costs	18
Total costs	$111
Return over all costs	—$33

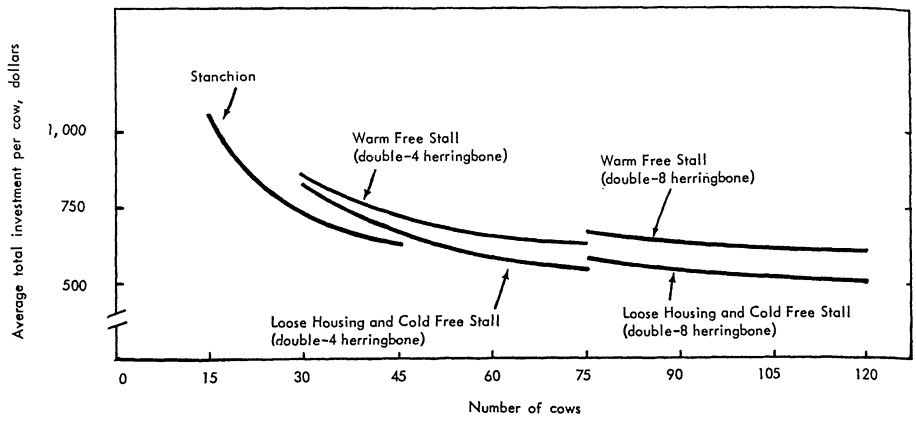
* (Sales + butchered + transfer to feedlot + closing inventory) — (opening inventory + purchases + transfer from feedlot)

Dairy Facilities . . .

(Continued from page 1)

is equipped with a three-unit pipeline milking machine, bulk tank cooler, and gutter cleaner. A silo unloader is assumed in an upright silo. Baled hay is fed from the mow; silage and grain are fed with a cart.

Total investments for 30- and 45-cow herds are $22,192 ($9,346 + $428.20 × 30 cows) and $28,615 ($9,346 + $428.20 × 45 cows), respectively. Therefore, average investment per cow for dairy facilities is $740 for the 30-cow herd and $636 for the 45-cow herd. The curve labeled "stanchion" in the figure illustrates how average investment per cow declines as dairy facilities are built for larger herds.



Average total investment per cow for four alternative dairy systems by herd size.

Loose Housing—This arrangement houses the herd in an open loafing shed and on straw or other bedding material. A separate insulated barn is provided for young calves and maternity animals.

The same ration is fed in this system as in the stanchion barn. However, silage is fed in mechanical bunks, baled hay in bunks adjacent to a hay storage shed, and grain in the milking parlor.

Estimated fixed and variable (additional per cow) investments in housing, milking, and feeding facilities for four alternative dairy systems

Facility	Stanchion		Loose housing		Cold free stall		Warm free stall	
	Fixed	Additional per cow	Fixed	Additional per cow	Fixed	Additional per cow	Fixed	Additional per cow
	dollars							
Housing facilities:								
Main barn	1,440	224.0*	1,350	113.9†	1,350	91.0†	1,800	241.9‡
Barn cleaner	1,175	8.1	.....	.....	.....	.....	.....	.....
Paving and curbing	.....	.....	0	35.1	0	37.5	0	30.2
Stalls	0	30.0	.....	.....	0	20.7	0	19.5
Pens and calf stalls	0	4.8	0	4.8	0	4.8	0	4.8
Fences and gates	0	0	655	4.2	655	4.2	35	0
Wells and waterers	850	5.9	1,300	6.4	1,300	6.4	870	4.4
Milking facilities:								
Milkhouse	1,070	0	.....	.....	.....	.....	.....	.....
Bulk tank	1,850	30.4	1,850	30.4	1,850	30.4	1,850	30.4
Milking parlor	.....	.....	7,200	0	7,200	0	5,523§	0
Three-unit pipeline milker	1,875	0	.....	.....	.....	.....	.....	.....
Feeding facilities:								
Silo	960	71.2	960	71.2	960	71.2	960	129.1
Mechanical bunks	.....	.....	336	17.5	336	17.5	336	17.5
Baled hay storage	0	0	0	44.1	0	44.1	.....	.....
Storage for ear corn	126	33.8	126	33.8	126	33.8	126	6.0
Total investment¶:								
75 cows or less	9,346	428.2	13,777	361.4	13,777	361.6	11,500	483.8
More than 75 cows	.....	.....	17,177	361.4	17,177	361.6	14,277	483.8

* Includes cement work in main barn and loose housing facilities for heifers. The smallest feasible stanchion barn—32 feet wide and 50 feet long—would adequately handle 16 cows and their replacements.

† Includes a separate warm (insulated) building for calves up to 12 months old and for maternity animals. The smallest feasible housing shed—about 50 feet wide and 60 feet long—would adequately handle about 25 cows and their replacements.

‡ Includes liquid manure tanks and separate housing for heifers. The smallest feasible warm free stall—about 50 feet wide and 60 feet long—would adequately handle about 25 cows and their replacements.

§ The cost of the milking parlor is less for this housing system than for the others because the parlor is constructed in the warm barn.

¶ Except for the stanchion barn arrangement, the total investment for 75 cows or less includes investment for a double-4 herringbone milking parlor; the total investment for more than 75 cows includes investment for a double-8 herringbone milking parlor ($10,600 for the loose housing and cold free stall arrangements and $8,300 for the warm free stall arrangement).

Cold Free Stall Barn—Investment in this arrangement is the same as for loose housing. The higher investment per cow for free stalls is just offset by a lower investment per cow for the main pole frame barn; free stall housing requires less building space per cow than the loose housing arrangement.

For loose housing and cold free stall arrangements, total investments for 45- and 70-cow herds are estimated at $30,049 ($13,777 + $361.60 × 45 cows) and $39,089 ($13,777 + $361.60 × 70 cows), respectively. Average investments per cow are $678 for the 45-cow herd and $558 for the 70-cow herd.

In the figure the curve labeled "loose housing and cold free stall" illustrates how average investment per cow declines as the dairy facilities are built for larger herds. Because a double-8 instead of a double-4 herringbone milking parlor is assumed for herds of more than 75 cows, the average investment jumps upward at that point.

Warm Free Stall Housing—This system houses the milking herd in an insulated free stall barn. The barn also provides space for young calves, maternity pens, and a double-4 herringbone milking parlor. Older heifers are housed in a separate shed.

Roughage is stored in upright silos and fed through bunks constructed down the center of the warm barn. A silage, corn grain, and protein supplement ration is fed from September to May. During the summer, haylage is put up in silos and fed in mechanical bunks. Grain is fed in the milking parlor year around.

Total investments for the 45- and 70-cow herds are estimated at $33,271 ($11,500 + $483.80 × 45 cows) and $45,366 ($11,500 + $483.80 × 70 cows), respectively. Average investments per cow for dairy facilities are $739 for the

45-cow herd and $648 for the 70-cow herd. See the curve labeled "warm free stall" in the figure.

Total investments in cold and warm free stall housing systems (double-8 herringbone milking parlor) for a 120-cow herd are estimated at $60,569 ($17,177 + $361.60 × 120 cows) and $72,333 ($14,277 + $483.80 × 120 cows), respectively. Average investments per cow are $505 for the cold and $603 for the warm free stall systems.

Implications

Our results demonstrate that the average investment per cow is influenced substantially by both herd size and housing system. Therefore, both factors must be considered when building new dairy facilities. An increased business volume (more cows) from a given total investment in dairy facilities is possible when investment per cow decreases either with size of herd or with choice of another dairy system.

The annual cost per cow for dairy facilities is related closely to the initial investment per cow; depreciation, taxes, insurance, repairs, maintenance, and interest charges increase with increases in initial investment. If we assume that dairy facilities must be paid for over a 15-year period, the annual cost is about 15 percent of the initial investment.

For example, annual costs per cow for the loose housing arrangement for 45- and 70-cow herds are $101.70 ($678 × 15 percent) and $83.70 ($558 × 15 percent), respectively—more than an $18 difference.

The higher investment for all herd sizes for the warm free stall arrangement compared with both loose housing and cold free stall arrangements results in higher annual costs per cow for dairy facilities regardless of herd size. Selection of this system must be justified on other grounds such as climate and labor efficiency. However, the average investment for the warm free stall system built for a 120-cow herd ($603) is less than the average investment for the cold free stall system built for a 45-cow herd ($678).

When planning the total dairy farm, investment in dairy facilities is only one consideration. Quantity and quality of labor and land available, capital position, crop and livestock alternatives, etc., also must be considered. Nevertheless, the variation in average investment per cow due to size of herd and type of dairy housing must be kept in mind. ■

Beef Cow Herds . . .

(Continued from page 1)

Another factor affecting the decision to keep a beef cow herd is that it can give some return for resources that might not have a market otherwise. For example, most of the feed used for the cow and calf herd is pasture or hay. Some hay and pasture may be needed to help control erosion or because no good alternative uses exist for the land.

According to the figures in table 1, costs other than feed were $42. The beef herd then gave a return to feed of $36 in 1964 or $52 as an average for the 8-year period. Therefore, the farmer could market his feeds through a beef breeding herd at a value equal to from one-half to three-fourths of what he could have gotten if a ready market had been available. For some farmers, this amount may be a good price.

Similarly, part-time farmers may look upon the beef herd as a means of marketing labor which otherwise would be idle. Also, the buildings and some equipment may be on the farm with no good alternative use.

Another factor that may make a beef cow herd profitable is better-than-average efficiency. For example, gross returns ranged from $38 to $141 per cow among these 94 farmers in 1964. Return over all costs ranged from —$100 to $45. With prices at the 8-year average, about one-half of the farmers would have covered market costs for all resources. Following are some things that affect high efficiency.

1. The percent calf crop apparently is the most important factor in profitable operation (see table 2). Costs per cow did not vary much with different levels of calf crop. With a cost of $110 per cow, the cost of producing a weaned calf would have been $122 with a 90-percent calf crop and $137 with an 80-percent crop.

2. Of course, the price received is important. An extra dollar per 100 pounds for the calves would have increased the gross return per cow by about $3.50. A farmer might receive higher prices by seeking the best markets, being informed about markets so he can bargain effectively, having calves ready at the most favorable time, having high quality calves, and having uniform lots of calves. However, some of these practices may increase costs.

3. High weaning weights increase return per cow but also involve higher costs (see table 3). With care in timing of breeding and better management, the extra costs of rapid gains might not offset the extra income.

4. Herd size has a mixed effect on profits. With large herds the cost of labor, shelter, and equipment per cow is reduced. However, large herds are more likely than small herds to take resources from more profitable enterprises; they may actually reduce the net return of the entire farm operation.

Table 2. Relationship of calving percentage to returns per cow, northeastern and north-central Minnesota, 1964

Percent calf crop	Total receipts per cow	Total costs per cow	Return over all costs per cow
	dollars		
90-100	87	111	—23
80-99	76	109	—33
70-79	71	111	—40
Below 70	61	118	—57

Table 3. Relationship of weaning weights to costs and returns per cow, northeastern and north-central Minnesota, 1964

Weaning weight (pounds)	Total receipts per cow	Total costs per cow	Return over all costs per cow
	dollars		
325-374	60	96	—36
375-424	76	105	—29
425-474	85	112	—28
475 and over	83	117	—35

Where Do Beef Cows Fit?

Beef cow herds may fit on farms where the farmer manages his beef cow herd with better-than-average efficiency. They also fit on farms where the beef cow herd does not have to pay market prices for all resources used. Many farms in northeastern Minnesota have buildings for which there is no use that pays market prices. Many farms in that area are well suited to hay and pasture, but the market for those crops may be limited.

The same situation exists for farmers who have labor available that would earn no return. Many people in that area live on farms but hold nonfarm jobs. Almost one-half of the farmers interviewed were part-time farmers.

In general, a farmer should not think of starting or expanding a beef cow herd unless he can: (1) wean a 90-percent calf crop of good quality calves of about 450 pounds and (2) keep total costs per cow below $100. These factors, along with other good management practices, can make the beef cow herd a profitable enterprise. ■

In Review

Trends in Minnesota Dairying

J. V. Bambenek and S. A. Engene

Compared to 20 years ago, most cows on Minnesota dairy farms today give more milk, are part of larger herds, and are located in more specific dairy areas.

Minnesota dairymen increased milk production 23 percent in the past two decades, from 8.6 billion pounds in 1945 to 10.5 billion pounds in 1965. Although they reduced the number of cows from 1.6 to 1.2 million during the same period, milk production per cow increased greatly.

Most of this 23-percent increase occurred in the central part of the state with small increases in the rest of southern Minnesota. Dairying declined slightly in the northern half of the state (see figure).

In 1965 the average production per cow in Minnesota was 8,550 pounds—3,370 pounds above the 1945 level. High counties in 1965 were Meeker and Carver with 9,800 pounds per cow.

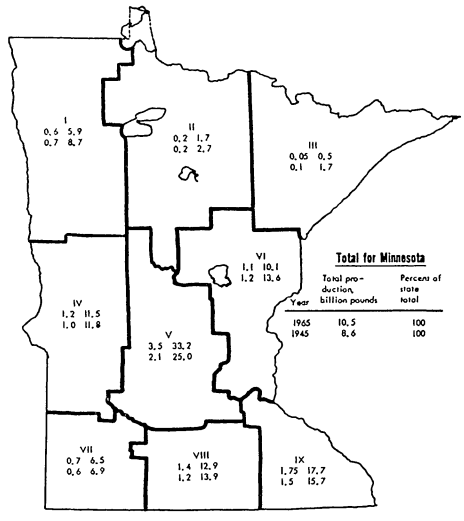
Difference among areas in production per cow is increasing (see table 1).

Table 1. Average production and increase in production per cow, by district, Minnesota

District	Average production per cow, 1965	Average increase in production, 1945-65
	pounds	
8	9,150	4,000
5	9,140	3,100
9	8,880	3,480
6	8,420	2,690
4	8,130	3,280
7	7,430	2,760
1	6,930	2,260
2	6,890	2,440
3	6,760	1,470
State	8,550	3,370

Table 2. Percentage of the state's cows in herds of different sizes, 1955 and 1965

Size of herd	Percent of cows 1955	1965
1-9	24	8
10-19	51	31
20-29	18	33
30-49	7	23
50 or more		5
All herds	100	100



Milk production (number on left) and percent of state's production (number on right), by districts for 1965 (top numbers) and 1945 (bottom numbers).

In 1965, average production per cow in areas 5, 8, and 9 was more than 2,000 pounds above levels in the three northern districts.

Production per cow probably will continue to increase; farmers who desire to stay in dairying must make it a profitable enterprise. Moreover, improvements in breeding and feeding are making higher production possible. Largest increases are likely to come in the main dairy area.

Milk production now is concentrated on fewer farms than in 1945. In 1965 the number of cows was down by 26 percent, but 42 percent fewer farmers had dairy cows. The number with herds of less than 10 cows was down by 68 percent and the number with from 10 to 19 cows was down by 48 percent. Many more farmers now have herds of 30 cows or more; about 5 percent of the cows of the state are in herds of 50 cows or more.

In the future, herd size is likely to increase because of mechanization, reduction in the number of farms, and financial pressure on small inefficient operators. Dairying in Minnesota probably will exist on even fewer farms with more cows per farm. Production per cow will increase. Moreover, production probably will concentrate into the central and southeastern counties. ■

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