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Free-Stall vs. conventional Loose Housing: a comparison

Cooperative Extension Service Michigan State University

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Michigan dairy farmers are showing keen interest in free-stall housing. This system originated on dairy farms in eastern and western states. In it, each individual cow has her separate rest area. Its first use was reported in New York state in 1957 and in Washington state in 1960. In Michigan, free-stall housing units first went into operation in the fall of 1961. Less than 20 such units were estimated in operation in Michigan in the early part of 1963.

There are several reasons for the interest in this system. A major advantage is the saving in bedding—an item that is becoming increasingly scarce and costly. Farmers' experiences indicate that bedding requirements of free-stalls are only one-third to one-fifth as high as for conventional loose-housing.

A second advantage is that cows keep much cleaner. In a stall for each cow there is minimum of droppings. Expansion of herd size in conventional loose-housing systems has resulted in crowding and unsanitary conditions on many farms. A free-stall system of housing would prevent expansion beyond the capacity of the barn and thus maintain recommended sanitation standards. Dairymen also report less udder injury because cows are separated from one another.

Twenty-five dairy farms with free-stall housing were visited to obtain information on their operations, investments and annual costs. These dairy farms were located in Michigan, Indiana, Ohio, Pennsylvania, and New York.

Operational Differences

Building requirements and arrangements

There is very little difference in over-all building design and total layout between the free-stall, loose-housing and conventional loose-housing systems. Requirements for the free-stall resting area are:

(1) proper ventilation

(2) individual stalls for each cow

(3) concrete alleys

(4) good orientation to allow daily cleaning

(5) prevention of snow blowing into the building

In the conventional loose-housing system, 60 square feet of resting space per animal has usually been recommended. This is about twice the space required for an animal to lie down. It allows animals to move to the back of the building on cold nights, to the front on warm nights or to either end of the building to avoid winds or drafts. From 50 to 55 square feet per cow, depending on width of alley, are needed for free-stall housing. This allowance includes stalls and alleys.

Size of stalls observed range from 42 to 48 inches wide and from 7 to 8 feet long. For Holstein cows, a stall size of 7¼ to 7½ feet long and 45″ to 48″ inches wide appears to be desirable. In wider stalls small cows can turn around instead of backing out. Cows on one farm refused to enter stalls as narrow as 37 inches.

Width of alleys ranged from 8 to 14 feet, with most being 9 to 10 feet. A minimum alley width of 8½ feet seemed desirable for efficient use of equipment. For longer rows, width should be at least 9 to 10 feet.

Adequate ventilation of the free-stall area is a key factor in year-round operation. Since cows in free-stalls do not have the freedom of movement of those in conventional loose-housing, more attention to ventilation and management is required. Moisture accumulation in the winter and a heat building up in the summer can be real problems. During the warm months, several factors affect animal comfort and management problems. Stalls along outside metal walls tend to be

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excessively warm because of radiation. Concrete alleyways will be influenced by ground temperatures and hence are cooler than stalls during the warm months. Accordingly, cows will frequently lie in alleyways. Stall partitions restrict air movement. This makes it necessary to provide more openings in buildings for air movement. On the basis of observations of successfully operated free-stall barns, the following recommendations are made:

1) Have at least 50 percent of building front open—more is desirable.
2) Provide doors at opposite ends of alleys that can be opened for increased ventilation on warm days.
3) Leave opening between eaves of roof and side walls—2 inches to 4 inches is desirable, with wider space practical if protected by some overhang.
4) Use ridge ventilators spaced 18 to 20 feet apart or leave ridge roll off roof.
5) Provide openings between all stalls for air movement.
6) Keep the number of outside stalls to a minimum. Four or more rows of stalls is better than two. This reduces the number of stalls facing outside walls.

Labor and equipment differences

Some dairymen have expressed concern about possibly large amounts of hand work required to remove droppings from individual stalls. Experience has shown, however, that this is not a time consuming task. Dairy farmers surveyed reported 30 to 40 minutes daily was required to remove manure droppings from stalls, rake bedding in stalls and to scrape the alleys. This does not include the time needed to haul manure to the field. These herds ranged in size from 50 to 110 cows. One dairyman with 96 cows averaged 90 minutes daily in cleaning stalls, scraping alleys, and hauling manure to the field.

Free-stall housing requires more minutes of maintenance per day during the winter than does conventional loose-housing. Considerable time is saved in the spring when conventional loose-housing barns are cleaned of manure.

Both front end loaders and rear blades were used to remove manure from alleys. Hydraulic equipment with down pressure on bucket or blade was desirable, in fact necessary, during extended cold spells to clean alleys of manure frozen to the concrete. Some manual chopping was needed during the extremely cold winter of 1962-63. One dairyman used a small amount of salt in the alley after cleaning to prevent frozen manure.

A manure storage area may be an added feature for many loose-housing systems using free-stalls. Alleyways must be cleaned regularly, preferably daily or at least three times a week. During periods of heavy snow or rain, storing manure outside the paved yard may be necessary.

Management of cows in free-stalls

The free-stall housing system is not a "utopia" for dairymen. Stalls and the cows need daily attention for good results. Under similar management conditions, cows were much cleaner than in conventional loose-housing arrangements. This was accomplished by using only 25 to 35 percent as much bedding. Cows were remarkably clean even under rather poor management.

All stalls should be checked each day and any manure on the bedding raked into the alley. When stalls were the right length, only a few had droppings on the bedding. If stalls are too long, cows should be forced to stand near the alley. This can be done by placing a brisket board in front, or by installing a board or pipe head-height at the proper distance from the front. Also, it should be noted more manure will collect on a 6-inch concrete curb than on a 2-inch treated plank used for the curb.

Straw, wood shavings, sawdust, ground cobs, and poor quality hay were materials most commonly used as bedding. Most of the dairymen added new bedding about every 2 weeks.

Most cows adjust rapidly to free-stall housing. A few dairymen found it necessary to force a few cows to enter stalls at the start. Individual cows tended to use stalls in the same general area each day. No more labor was necessary than for conventional loose-housing in moving cows out of the barn and into the milking parlor.

The free-stalls are only a part of the total loose-housing system. The barn for the stalls, the feed storage, and feeding areas, as well as the other essential areas of a loose-housing system, must be properly designed to make the system work. Consideration should be given to the combined effects of the sun, the prevailing wind, drainage, waste, manure disposal, and the interrelationship of these factors.

If the system is planned for winter use without considering the effects of heat in the summer, the results may be undesirable. For example, several dairymen planned to have their cows outside during the summer. One dairyman had an excellent shaded area with a water tank and a hay rack a short distance from the barnyard. He did not plan to use the stalls during the hot weather. However, he provided a door at the back end of each alley, in case he wanted to use the stalls during the hot weather. Another dairyman provided doors at the end of the alleys plus hinged boards along the entire back side of the barn. These could be opened for ventilation when needed. The most desirable new set-ups provided vents on top of the roof for additional movement of air. In all cases, the barns were operated as a cold barn in

the winter. This appears very desirable. For some barns, it may be necessary to install fans if cows are to be housed in free-stalls during the summer.

It is necessary to provide separate loose-housing area for cows ready to freshen since free-stalls are not desirable maternity pens. Also, young heifers should not be housed in the free-stall barn designed for cows.

Comparative Investments

Investments for new structures

Budgets were prepared showing investments required for 60 cows in a conventional loose-housing system based on 60 square feet per cow and for a free-stall loose-housing system with 10-foot and 12-foot alleys. For 10-foot alleys, 51 square feet per cow are needed, and for 12-foot alleys, 56 feet are required. Cost of the loose-housing structure was calculated at $1.20 per square foot and stalls were estimated at $20 each when constructed of lumber. Cost of concrete alleyways was based on $.35 per square foot. To allow for investments in a scraper, manure storage, fans, and other equipment that might be needed in connection with free-stall housing, $600 was added.

Total investment, on the basis of these costs, were $4,320 for conventional loose-housing barns compared to $5,900 or $1,580 more for free-stall, loose-housing with 10-foot alleys (Table 1). Total investment with 12-foot alleys was $6,370 or $2,050 more than for the conventional loose-housing barn (Table 1). On a per cow basis, these extra investments were $26 and $34 for the free-stall housing with 10- and 12-foot alleys, respectively.

Table 1. Estimated investments and annual costs for conventional and free-stall housing, 60 cow dairy farm, 1963 prices.*

	Investments		
	Conventional loose-housing	10' alleys Free-stall housing	12' alleys
Square feet per cow	60	51	56
Investments in:	Dollars	Dollars	Dollars
Loose-housing barn	4,320	3,670	4,030
Stalls		1,200	1,200
Concrete alleyways		430	540
Extra investments†		600	600
Total investments	4,320	5,900	6,370
Annual costs:			
Depreciation, repairs and insurance‡	346	485	519
Interest (6% of 50% investment)	132	177	191
Bedding at $10 per cow (§)	600	200	200
Total annual costs	1,078	862	910

*Loose-housing barn at $1.20 square foot, stalls at $20.00 each and concrete alleyways at $0.35 square foot.

†Includes investments in scraper, manure storage, fans, etc. that might be needed in connection with the free-stall housing.

‡Calculated on basis of 8 percent of value of barn, stalls and concrete, and 10 percent of value of other equipment.

§One third as much bedding for free-stalls as for conventional loose-housing.

Converting loose-housing barns to free-stalls

Several Michigan dairymen have already converted and others are considering converting conventional loose-housing barns to free-stall housing. The relative costs of making this conversion will depend largely on the dimensions of the loose-housing barn and the number of obstacles involved. Some of the older, loose-housing barns have several rows of supporting poles within the building. Newer structures with no obstacles would be relatively simple to convert. Because of limitations imposed by dimensions of the structures, it has often been necessary to use alleys less than 10 feet wide.

Converting loose-housing to free-stall housing would probably cost from $20 to $50 per cow for the stalls, concrete alleyways, and other changes needed.

Annual Costs of Owning and Operating the Two Systems

Input and price assumptions

In developing annual costs for the two systems, bedding requirements for the free-stall system were calculated one-third and one-fourth as high as for the loose-housing system. Costs for bedding on an annual basis for the conventional housing were calculated at $10, $20 and $30 per cow. The $10 annual cost is based on bedding available in adequate quantities from the farm or from farms in the vicinity. The $20 per cow cost would more nearly approach what many dairymen are now paying for bedding (1 to 1⅓ tons at $15 to $20 per ton). This is based on the use of ground cobs, straw, sawdust, wood shavings or a combination of these materials. These materials may be expected to cost more in the future.

Depreciation, repairs and insurance were calculated on the basis of 8 percent of the investments in the barn, stalls, and concrete, and 10 percent of the investment in other equipment and manure storage. Interest was charged at 6 percent of 50 percent of the value of new investments.

No differential charge was made for labor, use of tractors, scrapers, and spreaders in handling and hauling manure. Daily use of a tractor and scraper will be needed in cleaning the concrete alleys in a free-stall barn. There will be very little, if any, manure to haul in the spring, compared with regular loose-housing. Less time is required in hauling and distributing bedding in free-stall barns.

Comparative costs

The total annual cost of depreciation, repairs, insurance, interest, and bedding for the 60-cow dairy herd in conventional loose-housing was $1,078, with bedding charged at $10 per cow. These costs totalled $862 and $910 for the free-stall barns with 10-foot and 12-foot alleys, respectively (Table 1).

Annual savings in costs

On the basis of one-third as much bedding per cow as for loose-housing and a charge of $10 per cow, savings of free-stall housing totalled $213 and $168, and $3.60 and $2.80 per cow, for barns with 10-foot and 12-foot alleys, respectively (Table 2). Without other advantages, this small saving in cost would not encourage free-stall housing. When charging $20 per cow for bedding in the regular loose-housing system, annual savings per cow for free-stalls were $10.20 and $9.40 respectively, for the two alley widths. These savings per cow were $16.90 and $16.10 when bedding was valued at $30 per cow.

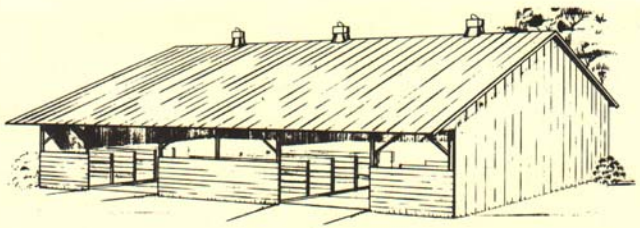
When it was assumed that free-stall housing would require one-fourth rather than one-third as much bedding per cow as conventional loose-housing, annual savings increased by $1.00 to $2.50 per cow (Table 2).

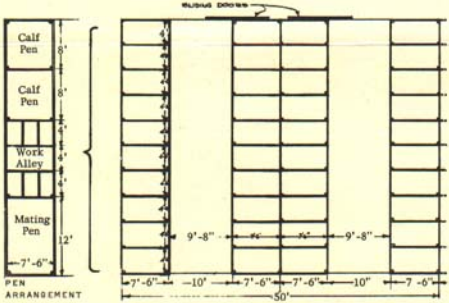
Dairymen considering changing to free-stall housing should apply costs which fit their own individual farms. Per cow investments and annual costs for conventional and free-stall housing are not likely to differ greatly for herds of 40 to 120 cows. When bedding is available in adequate quantities from farm produced straw or cobs, dairymen should price these materials at market value.

Table 2. Annual savings in costs resulting from using free-stall rather than conventional loose-housing, 60 cow dairy farm, alternative requirements and cost for bedding.

Relative bedding requirements and costs	Annual savings in costs			
	60 cow herd		Per cow	
	10' alleys	12' alleys	10' alleys	12' alleys
	Dollars	Dollars	Dollars	Dollars
One-third as much bedding with annual costs for bedding at:*				
$10 per cow	213	168	3.60	2.80
$20 per cow	613	568	10.20	9.40
$30 per cow	1,013	968	16.90	16.10
One-fourth as much bedding with annual costs for bedding at:*				
$10 per cow	263	218	4.40	3.60
$20 per cow	713	668	11.90	11.10
$30 per cow	1,163	1,118	19.40	18.60

**On the basis of 1/3 and 1/4 of the estimated costs of $10, $20 and $30 per cow annually for bedding for conventional loose-housing. A few observations indicate that with good management, the quantity of bedding required for the free-stalls may be even less.*





FREE STALL RESTING BARN

MSU Plan #723-4-78

Stalls—4' wide and 7½' long; curb—2" treated plank; alley—9'8". One row of stalls can be used for calf pens. Front stall should be closed to height of 4'. Use 4' divided partition in remaining stalls with bottom board approximately 14" above bedding level. Concrete alleys are 4" thick. To increase barn size, add multiples of 25'.

40' x 50' barn—40 stalls
40' x 75' barn—60 stalls
40' x 100' barn—80 stalls

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