Dairy Buildings

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There is much more to be considered in planning a dairy farm than merely the plan of an individual building. The use of labor-saving equipment and work-simplification methods of management should be considered along with all the buildings planned. The organization and location of each of the dairy buildings should be considered with respect to each other, the other buildings, and the whole farm. Roads, lanes, fields, drainage, prevailing winds, sun, all the elements of landscaping, and other special factors should be considered in planning the farm layout.

Oregon has approximately 47,500 farms on which dairy cows are kept. Of this number, approximately 9,000 reported sales of dairy products over $4,000.00 and herds of more than 15 cows. Therefore, 38,500 farms, or over 80 per cent, require structures for fewer than 15 cows each.

It is the purpose of the designs presented in this bulletin to present suggestions for better stabling and the newest trends in

Figure 1. A one-story structure combining the loafing barn with the milking room and milkhouse on the far end. A haykeeper for chopped hay on the left, and two silos on the right.
stabling for the greatest number of producers. If these producers are to aid in increasing the use of dairy products, these products must be produced under the best practicable sanitary conditions which must be provided at a minimum cost per cow.

Elaborate buildings and equipment are not necessary. Good planning, sanitation, and labor-saving devices are very important.

**Planning the farmstead layout**

The farmstead group should present a good picture from the highway and the farm court should be visible from the house.

The farmhouse itself will normally come first in planning the farmstead and it should be properly located to take advantage of the views, sun, and protection from the elements. It should be located so that chore routes and supervision of the farmstead are made easy. It is well to separate the dwelling from the animal housing units and lots by a distance of at least 100 feet “up wind” and the setback from the highway should be at least 75 feet.

The arrangement of the farmstead and the dairy structures will depend on connection with the highway for receiving purchased feed and other supplies and for the shipping of milk or cream to market. Utilities such as power and electric service, water, drainage, walks, and driveways are essential parts of planning.

The lay of the land—topography—influences the planning of individual building as well as the layout of the farmstead. For example, a basement barn located partly in a bank or hill is easy to construct with a driveway directly into the main floor. On a level site such a driveway would not be economical. Topography will determine drainage to a considerable extent because grading is expensive and is best kept to a minimum. Well drained lots will save money later in good herd management. Hard surfaced exercise lots may be smaller than unpaved ones. An allowance of 70 to 150 square feet per cow should be made. If it is not possible to pave an entire lot, it may be stripped with hard surface leading from the stable to the feed racks, water trough, milking barn, and lanes. The milkhouse and milking barn should be located so that prevailing winds will carry dust and odors away from them, particularly during the dry season. Fire hazards should be kept in mind. Plans for future expansion should also be considered.

In the colder areas, windbreaks of trees will provide protection from the wind and drifting snow.

Lanes to pasture, roads to fields, and accessibility to service buildings and the service yard are important points to keep in mind.

For additional information on farm layout see Extension Bulletin 685.
Figure 2. A low-cost outside feed rack with overhead shelter, satisfactory for feeding silage and long hay.

Good planning saves labor

Good, efficient planning reduces the number of man hours required to care for a cow, which in turn lowers the cost of production. Approximately 150 man hours of labor per year are required to care for a dairy cow. In making changes, dairymen must keep in mind the desirability of reducing time and labor required for each chore. Careful planning is needed when remodeling or building from a new start.

Kinds and amounts of feed stored, methods of feeding, and location of storage in relation to feeding area are important points in the efficient layout.

Another important factor that has received too little consideration is the elimination of heavy work by the use of power equipment even though it may not always be a timesaver.

Adequate drinking water important

Adequate fresh clean water should be provided at all times. Records show that when water is readily available for dairy cows,
they may produce a minimum of 10 per cent more milk and a like amount of butterfat without increasing feed rations. Water kept warm in the wintertime will pay extra dividends.

**Sanitary requirements**

The U. S. Public Health Service, the State, and various city milk codes have established certain requirements for handling the milk from the cow to the consumer. All building plans should have the approval of the local milk sanitation authorities.

Pure clean water is essential to cooling milk and washing milk utensils.

In dairy houses there is always waste water and this must be disposed of in a sanitary manner. A four-inch drain to a large settling tank or septic tank and disposal through a dry well or field tile system can be used.

**Types of dairy barns**

There are two major systems of stabling dairy cows in general use today. One is the conventional stanchion or stall barn. The other is the loose housing barn called by various names: loafing barn, sleeping shed, free run, or pen barn. The milking can be done in the regular stanchion barn if the barn meets grade requirements. If the stanchion barn does not meet grade requirements, milking may be done in a separate milking parlor.

**The stanchion barn**

The stanchion type barn offers several advantages over the loose housing barn. These are as follows:

1. Individual feeding is possible.
2. The herd can be easily displayed.
3. Less bedding is required.
4. Cows in heat do not disturb the herd.
5. Well suited for two-story type of structure permitting storage of hay, bedding, and grain conveniently located overhead.

Disadvantages of the stanchion type of barn:

1. Regular cleaning requires more man hours.
2. Less chance to increase herd size without increasing size of barn.
3. Barn suitable only for dairy farming without major remodeling.
4. Separate manure pit and/or liquid manure tank required to preserve the manure properly.
5. It is more difficult to detect cows in heat.
6. Building construction generally more expensive.
7. Cows are more likely to be injured.
8. The cows may not be as comfortable as in the lounging shed.
9. Can be a serious fire hazard in a two-story barn.

If dry cows and young stock are kept in the same barn, considerable stall and pen space is required. However, an inexpensive shed may serve for overflow housing.

A single row of stanchions has proved the most practicable for herds up to 8 or 10 cows. For larger herds, a two-string barn has been found most desirable.

A face-out arrangement has worked out best and has some further advantages when a mechanical barn cleaner is used in that a narrower barn and litter alley is possible. Advantages of the two-story stanchion barn:

1. Economy of one roof and one foundation using standard construction.
2. All work is under one roof.
3. Food may be moved by gravity to the first floor.
4. Space requirements are at a minimum and less area is required for building construction because of the compact unit.

Disadvantages of the two-story stanchion barn:
1. Labor and energy required to climb is 15 times as great as moving the same distance on one level.
2. Danger—safety to workers and fire in mow.
3. Posts often located near or in the gutters make cleaning more difficult.
4. All feed stored in the mow has to be elevated to the second floor.

The pen barn plan

Farmer interest is developing rapidly in the system of stabling dairy cattle known as loose stabling. Under this system, dairy cows are allowed free run in a shed or barn and in feed lot or feedshed except when actually being milked. (Figure 1.)

The pen barn is now more practical than ever before because of the improvement in mechanical equipment for handling manure and new methods of herd management. With pen barns and milking parlors, milk can be produced under practical sanitary conditions. The so-called “milking parlor,” which is a normally associated part of the pen barn arrangement, was started because it provided more flexible, cheaper, and cleaner milking quarters. The milking parlor can also be used with conventional stanchion barns.

Loafing and feeding areas may be combined under the same roof but the feeding area should be separated and located on a con-
Figure 3. The old barn did not provide sufficient space for the increased herd. An arch roof shed furnished the extra area needed for lounging and feeding.

Concrete floor. Loafing shed space per cow should be figured on the basis of 60 or more square feet, exclusive of feeding area. Floors may be earth or concrete. The loafing shed should be constructed to allow accumulation of manure to a depth of 3 to 4 feet with a concrete wall about 4 feet high, and with 8 to 9 feet of clearance under the ceiling joists.

A building enclosed on three sides is satisfactory. In colder areas, several large open doorways widely spaced provide adequate passage for cows to enter and leave the building. (See Figure 3.) Large openings for cleaning equipment are essential. Doors, windows, and partitions should be arranged to avoid drafts. In colder climates, windbreaks are a help. (See Figure 5.)

Straw, sawdust, or shavings make ideal bedding. A loafing shed requires slightly more bedding than the conventional barn, but if the loafing area is gone through once or twice a day and droppings removed, piled, or turned, the bedding requirements can be reduced. It must be kept in mind that letting manure accumulate in this area provides one of the best types of warm bedding and a good method for manure storage. The bedding also absorbs the manure liquids. The increased fertilizer value will more than pay for any extra bedding.
Separate feeding and watering areas are desirable, but they should be close to the loafing area. It is advisable to pave the feeding and watering areas so that they can easily be cleaned at least every other day. As no bedding is used, the cows will seldom lie down in this area.

Manger space of 27 inches to 30 inches per cow is recommended depending on the size of the cows and the method of feeding. Hay and silage may be fed in the same manger or in a separate manger. (Figure 2.)

If, with the silage-hay feeding program, hay is kept before cows at all times, sufficient manger space for about half the cows will be adequate. The length of manger is determined by these feeding practices. The water facilities should be located in the feed area. In cold climates, provision should be made to keep the water from freezing.

The maternity stalls may be located in the loafing area, or in a separate building. Pens 10 feet by 10 feet are adequate and may be made with the use of portable panels. Locate calf pens convenient to milk room for easier supervision of feeding and watering. If a bull is kept, an exercise yard is essential, and the yard and pens should be conveniently located for feeding and breeding.

In large herds, a separate loafing and feeding area may be desirable for young stock. It should be located close to the milking
Figure 5. A one-story loafing barn. This type of building is relatively inexpensive and makes an excellent free-run area where additional building space is required.

Figure 6. A 1½-story milking barn with grain storage and haykeeper silos on one side and milkhouse on opposite side.
area and feed supply to eliminate extra walking. In small herds, the young stock may run with the milk cows. While this pen barn system has many advantages, it also has some disadvantages. Therefore, a farmer must carefully study his own conditions and decide whether this system or the stanchion system will make it possible for him to produce high quality milk at the lowest possible cost.

Advantages of the loose housing system:

1. Milking is done in a clean, compact, and efficient milking room. Cows and stalls can be easily washed.

2. It permits changes in herd size. If an inexpensive loafing shed is built larger than needed for the present herd, at a later time more cows can be easily added without crowding. Herd may be increased or decreased without adding equipment or having equipment idle. Inexpensive sheds may be added. (Figure 4.)

3. The manure is well preserved.

4. Cleaning of the barn can be done in off seasons so that usual farm chores are kept to a minimum during time of haying and other peak loads. Manure is handled only once as it can be taken directly to the field when weather conditions are favorable.

5. Cows can be kept cleaner in a loafing barn with adequate bedding and good management program.

6. Barns can be more easily adapted and converted to other types of farming.

7. Injuries to cows are kept at a minimum and usually less than in a stanchion barn.

8. Herd health is improved and the productive life of cows is increased.

9. Cows can be quickly spotted in time of heat because they are free to mix at all times.

10. The building for the loafing and feed areas can be of inexpensive lumber and the simplest kind of pole barn or shed construction. Old buildings can be converted. (Figure 10.)

11. Less equipment in pens and stalls is required.

12. Cows can be more comfortable. Udders do not chill when cows lie on the soft warm bed.

Disadvantages:

1. Herds cannot be displayed easily.

2. It may be cold and uncomfortable for workers.

3. More bedding is needed.

4. Loafing sheds must be provided with adequate bedding to
maintain clean conditions—approximately 1½ tons of straw for each cow in a pen barn.

5. Cows in heat or bossy cows may disturb the herd. This can be minimized by removing them to separate pens.

6. Cows must be dehorned.

7. More space under cover is required than in stanchion-type barns. This amounts to about 10 to 15 per cent more, but it can be offset by lower construction costs.

Figure 7. A modern milking parlor and milkhouse. A loafing shed and feed area is being developed to the left.

The milking structure

The milking room, barn, or "parlor" should be adapted to the size herd and the system of management to be used. A number of plans are shown in this bulletin for the purpose of giving opportunity for selection of a plan best suited to the individual operator and his particular needs.

A herd of 20 to 30 cows can be milked in a 10-cow milking barn by making two or three changes of cows at each milking. Such an arrangement will allow ample time for grain eating. (Figure 6.) In contrast to this with the raised platform type of structure (Figure 7) where two or more cows may be milked at a time, grain eating time may be limited and with heavy grain feeding it may be
necessary to feed part of the grain elsewhere—for example, on the silage. The pen barn with a milking room can be labor saving and can make work easier. (See Figure 4.) By using a holding pen, one man can operate the raised platform milking parlor. Cows can become accustomed to almost any system of handling and milking. It is necessary, however, that the same system be used each day.

How long does it take to milk a cow?

Experience has shown that with the loafing shed and milking parlor or barn, one man with a milking machine can finish milking a cow every 3 to 4 minutes while a man with two milking machines and four stalls can finish milking a cow every 2 to 3 minutes.

How long does it take for a cow to eat her grain?

Recent observations show that it takes a cow about 5 to 6 minutes to eat four pounds of grain and about $8\frac{3}{4}$ minutes to eat seven pounds. The last few pounds take the longest in feed boxes with straight sides, flat bottoms, and square corners. This time can be shortened by building feed boxes with rounded corners.

In a three-cow milking parlor equipped with two single unit milkers, assuming it takes a minimum of 4 minutes per cow for milking, each cow will be in the milking room 5 to 6 minutes. In herds that are heavily grained, either a four-stall parlor or barn should be used or some grain be fed with the ensilage or in another place.

In small herds of up to 12 cows, a two-stall milking parlor might be desirable because of a lower investment. See Figure 8, plan 2.309.

Parlor type milking parlor

Figures 8 and 9, plans for various types of milking parlors, plans 2.306 to 2.309 and 2.3010 show the different types of raised platform parlors. The herdsman or milker is at all times in a standing position while working with the cows.

Plan 2.3011 shows a parlor with cows and milker standing at the same level. (Figure 8.) The cows enter at one door and leave by another. These doors and stall gates are operated by the milker with levers or rope controls in the milker's pit.

Advantages of milking parlor:

1. Operator can stand up for all work. Saves stooping and squatting about 2,500 times a year per cow.
2. Requires a minimum of walking.
3. Cow's udder can be washed with more ease and examined more carefully for injury.
Figure 8. Plans for various types of milking parlors.
4. A more compact and efficient arrangement.
5. Allows a continuous process.
6. Cost of a small parlor or milking barn is lower than cost of larger stanchion type barn required for the same herd.

Disadvantages of milking parlor:
If more than five pounds of grain are to be fed at each milking, an additional stall will normally be required. Additional stalls increase the size and equipment cost of the basic structure.

**Milking barn**

Figure 9, plot plan for one- and two-string milking barn, shows the type of milking room without the raised platform for the cows. Usually with this type, the number of stalls provided is determined by the size of herd up to a certain point. For smaller herds about \( \frac{1}{3} \) to \( \frac{1}{2} \) should be in at one time.
Some construction pointers

1. Before starting any remodeling or new construction, the complete layout plot of all the buildings should be planned on paper.

2. Details of individual buildings should then be drawn. Typical plans for various types of dairy buildings are available through the county extension offices or from companies selling equipment. Check your plans with your local milk inspector before you start construction.

3. After you have the complete plans made, check on these points:
   (a) Do plans meet all existing sanitary requirements?
   (b) Do you have signed approval of sanitary official?
   (c) Study route and sequence of all work routines. Can travel distance and time be shortened? Can heavy work be made easier by use of hand trucks, dolly carts, elevators, track carriers, etc.?
   (d) Do you have “line production”?

Remodeling

After one has decided on a particular system of milking plant, the planning for housing is the same whether it is new construction.
or remodeling. The same basic principles are followed. In remodeling, some adaptations in sizes, arrangement, details of construction and materials are necessary. If you have an old barn that is in good condition except for minor repairs but will not meet grade requirements for a milking barn or fill the requirements for the desired size herd, it may be better to use the old barn for a cow stable, hay storage, feed rooms, dry stock and pens, and add either an L or T extension to house the producing cows if the stanchion-type barn is desired. (Figure 10.)

If a pen system is desired, the old barn may be used for stable or loafing shed if it is large enough. It may be used for the necessary pens for young stock and feed area and a lean-to or new loafing shed adjacent to the old barn may be added.

In any case, if the old barn is in reasonably good condition, careful thought should be given to its possible use to establish an economical, efficient working unit.

The milkhouse

Figure 11 is a suggested layout of a milkhouse for a producer-shipper. Sanitary regulations require that milk be removed from the milking barn immediately and cooled after being produced. The milkroom or milkhouse is a separate room from the area where the cows are milked. Such a room is essential on any well-planned dairy layout for the convenience it provides in handling milk and in washing and storing the milk utensils.

The milkhouse is generally attached to or located near the milking barn or parlor. It may be a part of the same building with milking parlors when it is properly separated from the milking area.

The milkhouse should be located on well-drained ground and should not open directly into any stable or room used for domestic purposes. The lower section of the walls should be of either concrete or other impervious materials at least 36 inches high with a watertight joint at the floor. The floor likewise should be concrete or other impervious material smooth and graded to a trapped drain. The upper walls and ceiling should be smooth and finished with a light colored paint. The lower walls up 36 inches from the floor may be dark, light, or the same color as the upper walls and ceiling.

Adequate light, both natural and artificial, should be provided so that all milk-handling operations are clearly visible.

Adequate ventilation should be provided to prevent condensation and odors. All openings should be properly screened.

A good supply of hot and cold running water is essential in a milkhouse. Electric water heaters may be located in the milkhouse.
Two-compartment stationary metal wash and rinse vats are essential. When retailing raw milk, a three-compartment sink is required.

A dry-storage cabinet for milkhouse equipment and supplies is desirable.

The milkhouse should be designed so that it is easy to keep clean at all times, including all equipment, and should be used for no purpose other than handling milk and for equipment and cleaning supplies.

Provision should be made for adequately cooling the milk and for properly storing and holding both night and morning milk at the same time and maintaining the required average temperature.

**Sewage and waste water disposal**

Every dairy farm should have a sanitary toilet and lavatory conveniently located and properly constructed so as to be inaccessible to flies. Since an adequate water supply is essential for the milk-
house this also requires a disposal system for waste water. A flush toilet and washroom would appear the logical choice. A septic tank with the proper disposal of all waste water and sewage disposal is required when a water closet is installed.

Detailed milkhouse plans 5.24 and 5.25 are available from the Oregon State College Farm Building Plan Service. Plan 5.24 is for concrete and wood frame construction. Plan 5.25 is for masonry block construction. All plans must be approved by the local milk inspector. (Figure 11.)

Copies of these plans may be inspected at the county extension offices and instructions may be obtained for ordering either there or by writing the Farm Building Plan Service, Agricultural Engineering Building, Oregon State College.

Figure 12. Silos and chopped haykeeper on the left with lounging, feeding, bedding, and some hay storage under one roof. Raised-platform milk parlor is located behind the haykeeper.