CORRAL PLANNING AS AN AID TO CLEAN COWS

C. F. Kelly

The California dairyman attempts to meet the sediment limits in milk by keeping the cows as clean as possible while they are outside the milking barn, and by removing the mud, dirt, and manure from each cow by washing immediately before milking. The washing procedure is costly in both time and water, and may not entirely remove the dirt. It ranges from a gentle washing with warmed water, in the elevated stalls of the north, (which I am sure the cows like but which may not be particularly efficient in removing caked manure) to the tearing, vicious attack with a one-inch hose carrying 25 to 35 gallons of water per minute under a velocity pressure of 15 to 60 lbs. per sq. inch, as used in most of the stanchion barns in the south. The latter method may take from 1/2 to 1 minute of time and 10 to 20 gallons of water per cow.(1)*. In addition, many dairymen are installing sprinklers in holding corrals to "loosen up" the dirt, and these, with their booster pumps, are costly. To make washing seem more doubtful, some sanitarians and milk specialists question the benefits of even clean water draining down the flanks of a presumably clean cow into the teat cups. Keeping the cows clean in the corral is a more sensible approach to the sediment problem.

Because this state has such a wide annual and geographical variation in climate and dairy management methods, the problem of corral planning with relation to keeping the cows clean can not have a single answer. Table I indicates what the dairyman in each of the several milk producing areas of the state is faced with. The reader may not agree with the break down in all cases; nevertheless, it is a starting point.

Table I. Housing and management methods for several dairy areas in California.

Area	Summer	Winter
San Diego	Dry lot	Dry lot, no housing.
Los Angeles	" "	Dry lot, no housing.
Bakersfield	" "	" " , some pasture.
Fresno	" "	" " " "
Sacramento	Pasture	Feed barn, loafing area.
San Francisco 1/	Dry lot	Feed barn, pasture.
Red Bluff	Pasture	Feed barn, loafing area.
Eureka	Pasture, dry lot	" " " "

1/ Taken as representing Marin County

* Numbers in parentheses refer to references at end of article.

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There are of course many exceptions to this schedule and it may be that these are the dairymen having trouble with sediment. But it seems to me that a dairyman who follows the summer management methods indicated in Table I will for the most part have few dirty cows. Pastured cows are usually clean. And, in our rainless summers, the area of dry lot corrals normally used has been found through experience to be balanced with the evaporation rate of the area so that urine and feces are quickly dried unless they are concentrated through use of improperly designed shades, shaded waterers or feed bunks, etc. It is in the winter that the lot becomes a mud wallow and the feed barn a manure pit.

Table II indicates the almost impossible drying job in all areas if it is expected to let the rain fall on the corral and then dry it by evaporation.

Table II. Precipitation for (a) wettest month on record (usually January) and (b) wettest month in period 1921 to 1950, for several California milk producing areas (2).

Area	(a) (inches)	(b) (inches)
San Diego	7.60	2.57
Los Angeles	12.42	3.37
Bakersfield	4.61	1.12
Fresno	6.73	1.66
Sacramento	12.20	3.31
San Francisco	11.47	4.07
Red Bluff	20.71	4.23
Eureka	13.97	6.20

How does the winter drying problem compare with the summers'? Suppose a cow drinks 20 gallons of water a day and disposes of all of it in the corral through urine and feces, and that she has been provided with 400 sq. ft. of corral area. In one 31 day month she drinks 620 gallons, which spread over the 400 sq. ft. amounts to less than 1/4 inch. And the possible evaporation rates are tremendously different -- relative humidities of over 80% are common during winter wet periods in the same areas that have dry air of 10-20% in the summer daytimes.

The system of winter time corrals, feed barns, lounging areas, etc. must be designed to keep the cow out of the mud and manure, and at the same time provide her a comfortable thermal environment and a place to lie down when she is not eating. Because no detailed studies in this field have been made by our Department of Agricultural Engineering, I can only discuss various designs of individual structures and let the reader consider how they will fit into a "system" for his area.

Feeding Platforms

Feeding platforms or ramps, for the feeding of hay, green-chop and silage, usually have a space of 2 1/2' per cow at the manger and a paved area extending out 10 to 12' in front of the manger. This gives each cow an area of 25 to 30 sq. ft. of good solid footing, which seems to be ample if the animals have a

hill or comparatively dry area to lie down on when they are not eating.

The main requirements of a good feeding platform are that it be kept clean, that it be easily cleaned, and that there be a place for it to be cleaned into. The farmer cannot be expected to clean the platform if the second and third features are not good. This is illustrated in Figure 1. There is a good solid footing under the mud and manure, but the cows do not have much of a choice between 6" and 18" of filth. There was no place for the water and mud to either flow or be pushed to.

In 1952, because of numerous requests from the field, we undertook the preparation of a feeding floor plan for the University Plan Service. Preliminary sketches of various designs were sent for comments to several Farm Advisors, State and county milk specialists and sanitarians, and others. There was little agreement with our suggestions; in fact almost every one had other ideas. Finally, in 1954, two years later, University Plan No. C-226, "Feeding Floors for Dairy and Beef Cattle" was approved and made available (3). This one sheet plan includes 4 platform and 8 manger designs, and a 3 page mimeograph discussion. A small reproduction is shown in Figure 2. Feeding floor types A and B were suggested from the Los Angeles area. There is no curb at the side away from the manger, so that water will run off at the low side. During rainy weather the dirt approach may become a mire. Where this plan is used with a roof, as under a feeding and hay storage barn, eavetroughs should be used to reduce rain water on the pavement and surroundings to a minimum. Type C, with a curb on the back side, is excellent, especially where manure can be saved in a pit. A small bulldozer, run parallel to the mangers, will provide easy cleaning. Gates must be placed between corral pens so that the tractor can have a clear run from one end of the floor to the other. Type D, with large gutter, was popular in the Fresno area. The gutter collects the liquid manure and prevents formation of a mudhole at the rear of the platform.

The floor should slope away from the manger at 1/2" per foot, and Types C and D should in addition have a lengthwise slope, parallel to the manger, of at least 1" in 10'. Make use of a hillside for a natural slope if possible.

Locating piles of baled hay at the back of the mangers may shade the feeding floors and prevent drying, even in the summer. For best drying the manger should be oriented east and west, with the hay piled to the north. Where this is not possible, run the mangers north and south and stack the hay on the east, to take full advantage of the afternoon sun.

Some corral and feed pen costs are given in University of California Circular 414, revised (4).

Feeding Barns

Large feeding barns, for safely storing hay and protecting the animals from rain, are popular in Northern California. In general, all requirements of the unprotected feeding floor apply to the feeding barn. For easy cleaning there should be a concrete curb at the outer edge and either a concrete manger or a concrete curb next to the manger to act as bumpers for a mechanical scraper.

The concrete floor must be as smooth as is consistent with safe travel by the cows, and must slope lengthwise of the barn at least 1" in every 10'-00". There must be an easy traffic pattern for the tractor, with not too many gates and doors to open and close. There must be help available to clean the barn while the cows are being milked, or are in another clean place. A typical feeding barn is shown in Figure 3.

The most common fault with feeding barns is that there is no convenient place for disposing of the manure. If the dairyman is to clean the floor twice a day, (which it should be) there must be a pit, manure saucer, or other manure storage area within a few feet of the barn. Figure 4 shows one of the best solutions; locate the barn on the edge of a hill so that the manure can be pushed over the edge. Experience shows that the pit or storage area should be large enough to hold practically the entire winters' "production".

Corrals

The shape, size, location, and equipment of the corral or drylot area where the cows are kept when they are not on pasture are important in keeping the cows clean. There are three general types:

1. Rectangular, with separate feed and cow traffic lanes.
2. Rectangular, with combined feed and cow traffic lanes.
3. Pie-shaped, with the milking barn holding corral in the center and the feed mangers on the circumference of a partial circle. A pie-shaped corral is shown in Figure 5.

Rectangular corrals, Type 1, have the disadvantage, in wet weather, that the cows must walk across the corral, through the mud, when moving from the feeding platform to the milking barn. This of course is an advantage in the summer because feces and urine are spread over a larger area. Drainage is difficult because, no matter which way the ground slopes, the run-off flows onto the feed platform, the cow lane, or an adjacent pen.

Type 2 rectangular pens have the wintertime advantage that cows will be on pavement from the time they leave the barn until they reach the manger, and that the ground can be graded away from the feeding platform without causing a flow of mud into another traffic lane or pen. But in summer the cows will bunch around the manger most of the day and the manure and fly problem will usually be much worse than with a Type 1 corral. Furthermore, the pens will need to be wider to allow for the required length of manger plus a gate, and a self-unloading truck used for spreading feed must go in-and-out of gear each time it passes a gate.

The pie-shape corral, found in largest numbers in San Diego County, has advantages as far as economy of travel by man and beast is concerned, because each pen has a direct opening into the milking barn holding corral (1). The cows, if well trained, will gather near the narrow end at milking time and wait until the gate is opened. But, if carried to extremes, this bunching is not advisable in summer time and is a definite disadvantage in winter time. However, by paving a semicircular standing area here, the pie-shape corral is a very good arrangement in the summer time, and has about the same disadvantages as the Type 1 rectangular corral in the winter.

Winter Corrals

A number of dairy men in both the north and south use small pastures, each holding a string of cows, which they call "winter corrals" and use only during the wettest periods. Although the cows would soon trample the grass or alfalfa in to a quagmire if left there, the idea is to remove them in a few days to another "winter corral" or back to the rectangular pens, thus allowing some time for each to dry. They seem to work quite well, and it is a fact that plain mud washes off easier than a mixture of mud and manure.

Mounds

The dairyman does not make as good use of "mounds" in the corrals as does the beef feed lot operator. (See Figure 6). A bulldozer can, at relatively low cost, push dirt into a pile in the center of the pen immediately after the pens are cleaned. The cows seem to appreciate both the dry solid area and the opportunity of getting up high enough to see what is on the other side of the fence. The usual disadvantage to the mound is that the animals must almost swim to get there. No thought is given to a paved entrance or approach to the pile.

Dairymen in the Humboldt area make good use of saw dust and shavings for constructing the piles; one farm I visited had 500 loads in a mound about 4' deep and 150' in diameter. Sacramento and San Joaquin Valley dairymen occasionally use rice hulls.

The Mid-West Lounging Barn

There has been much written regarding the loose housing system for dairy cattle (5,6,7,8). While we in California practice this system insofar as milking the cows in a barn separate from their feeding and rest areas, there are certain other features that should be considered here. The typical Mid-West arrangement includes, in addition to the milking barn and holding corral, a roughage feeding area, a resting area, and a paved barn yard. Quoting from reference (5), some of the recommended standards are as follows:

"The feeding area for the cows should be paved, sloped away from the manger, and be readily accessible for cleaning..... This arrangement requires about 45 sq. ft. (of paved area) per cow when manger and feed alley are included..... The feeding area is not bedded or allowed to become partially covered with wasted hay as cows may lie down there and get extremely dirty. The feeding area should be cleaned as required and kept free of hay or litter which might encourage cows to bed down on it..... Cows do not often chose to lie down on a bare paved concrete floor.

"The resting area should have ceiling or roof high enough to accomodate a manure pack 3 or 4 feet in depth..... To keep the cow free from any accululation of manure on the udder and flanks, the bedded area must be given daily attention. Enough bedding must be used to prevent the manure pack from becoming soft and punched up. The resting area should be free of all feeding, watering and cross traffic..... Once a portion of the bedded area becomes soaked with water the bedding pack will have to be completely removed and a fresh bedding pack started from the floor..... The pack should be in an open or well ventilated barn with from 40 to 60 sq. ft. of area per animal..... Storage for at least 1 1/2 to 2 tons of bedding per cow in the northern zone should be provided.

"It is suggested that at least 100 sq. ft. of paved barn lot area be provided for each cow and the minimum should not be less than 60 to 70 sq. ft. and it should be arranged for access by power equipment for regular cleaning..... Good exposure to the south or east for sun is also essential..... Drainage of the paved barn lot is essential. A uniform slope of 1 inch in 4 feet is a minimum."

Stewart (6) in a review of the literature on the loose housing system concluded that the average recommendation was between 50 and 60 sq. feet of bedded area per cow, and that feeding of roughages should be at a separate location. The average use of bedding per cow per day was 6 lbs. in the Missouri study and 13 lbs. in Wisconsin. It was advised to turn under or remove fresh droppings twice a day.

The loose housing system is being followed in the new Dairy Research Center at the University of California at Davis, and we should have some information from Drs. Mead and Laben at the end of this winter as to the performance of a bedded area under our California conditions.

References

1. Time-travel studies of dairy layouts. C. F. Kelly and Thayer Cleaver, 1957. University of California mimeograph.

2. California climatological summary, U. S. Weather Bureau.

3. Plan No. C-226 available for 25 cents from Agricultural Publications, University of California, Berkeley 4, California.

4. Beef handling and feeding equipment. R. Albaugh, C. F. Kelly and H. L. Belton. University of California Circular 414, revised.

5. Standards for design and operation of loose housing systems for dairy cattle in the North Central Region. Jour. of Milk and Food Technology, pp. 302-312, Vol. 19, No. 11, Nov. 1956.

6. A field study of practice in loose housing of dairy cattle in Missouri. R. E. Stewart. Res. Bul. 468, University of Missouri, 1950.

7. Loose housing for the farm dairy. Thayer Cleaver and Deane Carter. Circ. 694, University of Illinois, 1952.

8. Dairy cattle housing. Bul. 470, University of Wisconsin, 1950.



Fig. 1 Cows in mud. Concrete feeding platform on right side of photo, with no place for mud to flow.

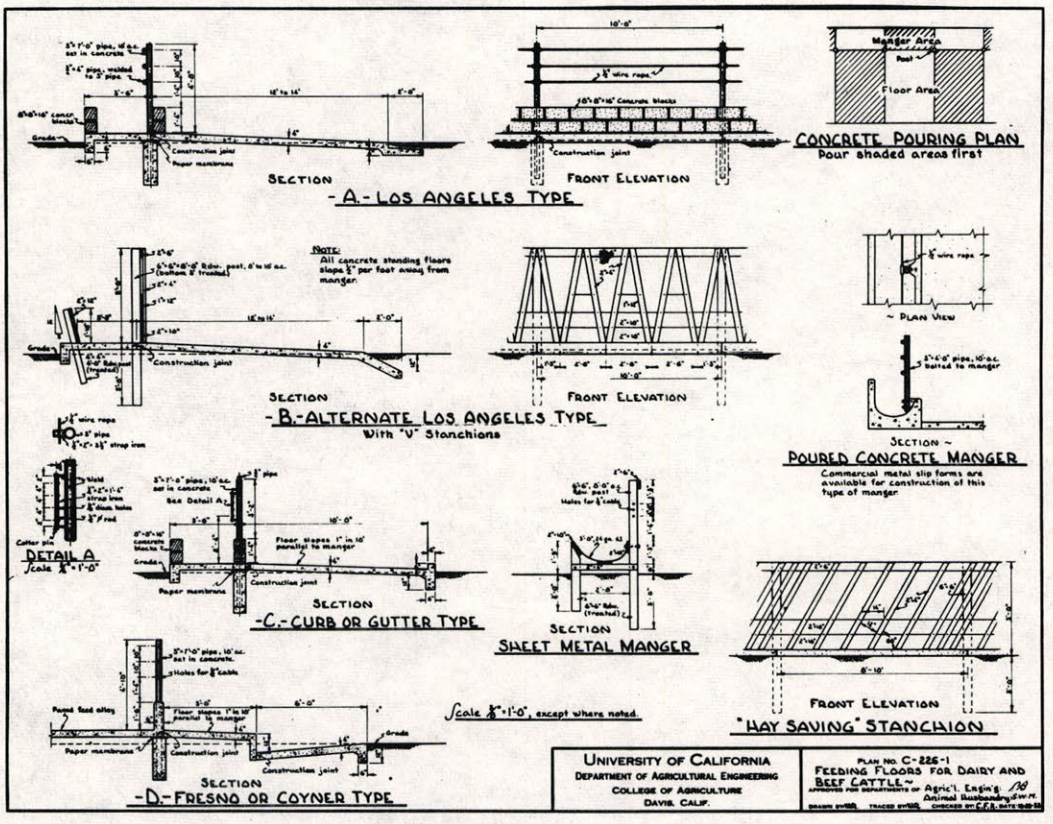

Fig. 2 University Plan No. C-226, available at $.25 from Agricultural Publications, University of California, Berkeley 4, California.

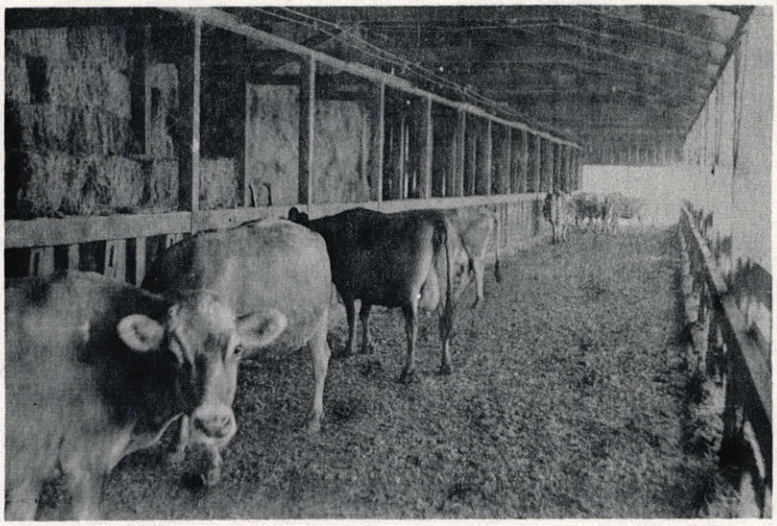

Fig. 3 Feed barn with concrete curbs at each side. Cleaned with tractor push-blade. Recently cleaned, it is still not too sanitary, but provides solid standing platform.

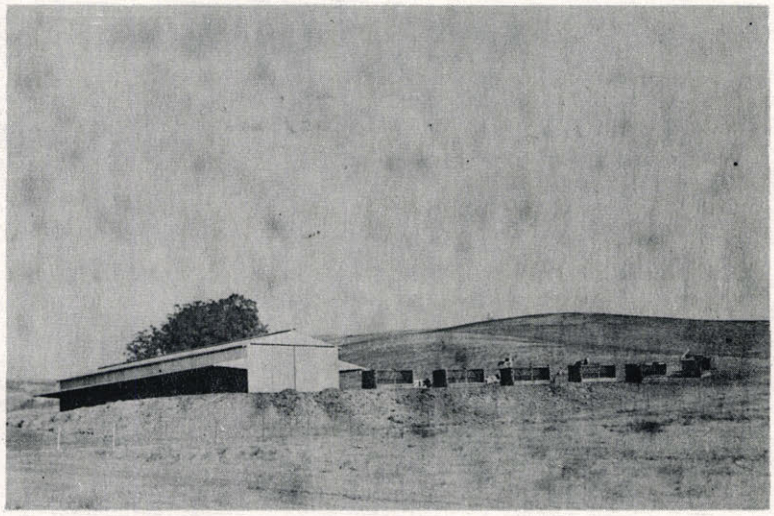

Fig. 4 A feed barn, with cantilever sides. Manure can be pushed over edge of hill and stored until spring.

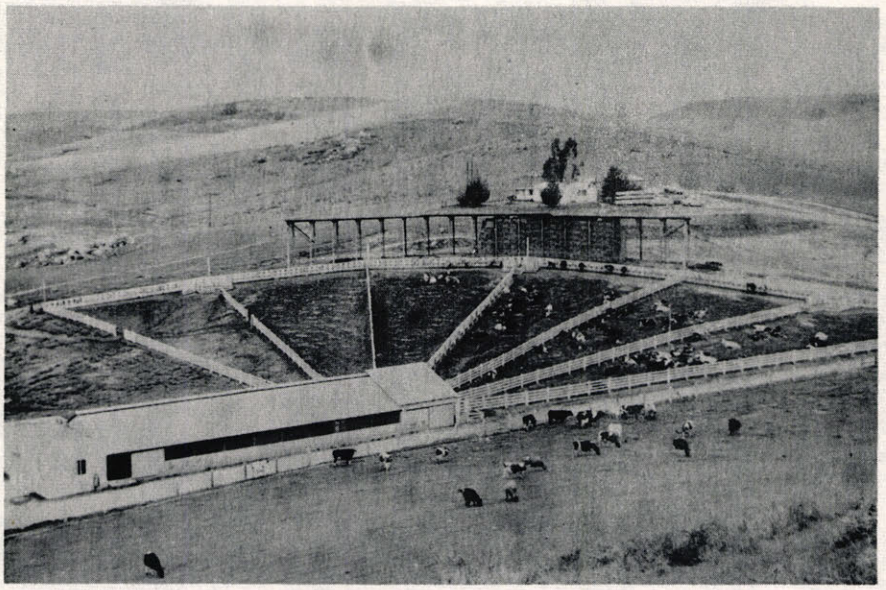

Fig. 5 A pie-shape corral has some advantages, some disadvantages.



Fig. 6 A mound of dirt in the corral provides a solid and dry lounging area but a solid walk-way to it, from the milking barn, must be constructed. This is usually not done.