MILKING PARLOR FOR THE FUTURE

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Predicting the methods and ways of future milking systems is not as risky as predicting the future milk price. In southeastern United States one may assume that some of the same factors which are important today will be important in the future. A few of these being, (1) herd size is influenced by the milking parlor throughput (2) mechanization must reduce labor and be cost effective (3) southeastern U.S. will continue to be early adapters of new technology. The adaptation and success of new technology and equipment will depend upon cost effectiveness, improvement or maintenance of milk quality or a reduction of disease (mastitis). The paper will discuss several factors which may affect your future milking operation.

RAPID EXIT STALLS

Rapid exit parlors were designed to increase parlor efficiency by releasing all cows in a parlor group simultaneously in a direction perpendicular to the entrance lane, thus decreasing operator time to exit cows. Time and motion data on rapid-exit parlors indicate that the concept of rapid-exit parlors does reduce exit time and increase milking parlor efficiency when compared to standard exit parlors. (Table 1)

Table 1.
Range of Milking Parlor Performance
(Cows per hour)

Parlor Size	Rapid-exit	Standard Exit
Double 10 (1)	46- 92	60-101
Double 12 (2)	84-115	92-124
Double 12 (1)	------	88-110
Double 16 (2)	96-127	104-151
Double 16 (1)	------	123-128
Double 20 (2)	130-163	145-180
Double 20 (3)	------	136-192
Double 24 (2)	------	170-205

( ) Number of Operators — Armstrong - Arizona 1988

Although rapid-exit stalls reduce cow exit time, it may not provide a corresponding increase in operator efficiency. If the operator already has 15-25% wait time between groups (sides), rapid-exits simply increase the operator's waiting time for the second side before those cows can exit and new cows can enter the parlor. Therefore, to increase parlor performance the operator must be given

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more stalls per side or an operator must be removed from the parlor to take the maximum advantage of rapid-exit. Observations on double-12 to double-20 equipped with rapid-exit stalls indicate that one operator will milk 85-90% of the parlor performance of two operators.

In large herringbone parlors several management practices such as an individual slow milking cow have a large effect on parlor performance. These cows must be grouped or removed from the herd. Group size should be maintained as the multiples of the size of one side of the parlor. For example: a double-20 with 148 cows in a milking group will have 12 empty places in the last group. Attempts to fill this void with cows from a second milking group usually results in mixing of groups. A management practice observed on several dairies with a large herringbone is to regroup milking string once a week to improve parlor efficiency.

FASTLANE STALLS

A stall referred to as a fastlane herringbone is available for retrofitting into parlors which are otherwise almost impossible to remodel without major modification of the building. These stalls fit into a conventional milking parlor with narrow return lanes either inside or outside the parlor. The stalls have a moving brisket rail which opens to provide additional width for cow entrance and exit. The moving brisket rail opens from a 28-inch milking position to a 37-inch entrance and exit position. The efficiency of its parlor can be increased at a moderate cost. This modification should be appealing to the owner of double-6 to double-10 parlors in areas where outside return lanes are preferred.

Observation and limited time and motion data would indicate that this modification could improve parlor efficiency approximately one-quarter of the total parlor capacity per hour. Example a double-10 herringbone has 20 stalls, one quarter of 20 is 5 cows per hour.

PARALLEL MILKING PARLOR

The parallel milking parlor (also called side-by-side) first appeared in Holland in the late 70's and is gaining in popularity. By 1980 there were side-by-side parlors ranging in size from 6 to 16 stalls on each side. The cows stand side-by-side or parallel to each other at a 90 degree angle facing away from the milker pit. (6) This orientation requires attaching the teat cups from the rear by reaching between the hind legs.

Cows were kept in this position in the parlor by self-locking stanchions. As each cow enters the parlor, she moves to the furthest stanchion which remains open until the cow places her head in the stanchion. This locks the stanchion and at the same time opens the adjacent stanchion for the next cow following, and so on.

In 1980, the C.L.W. Donkers Company of Holland (4) built a parallel parlor with dividers and flip gates similar in design to those now being built in the United States. Mason Farms, Ltd., a dairy in Marengo, Ohio, built a parallel parlor in 1980. (3) O'Callaghan and O'Shea (5) reported in 1988 that parallel parlors were being used in Ireland and Romania but did not appear to be widely adopted in other European countries.

Time and motion studies on a parallel parlor built in 1980 showed very little advantage in throughput over the conventional herringbone. (1) Cow entry was slowed because the sequential opening of each stanchion as the adjacent stanchion was filled and locked was less than fool proof. On numerous occasions cows failed to proceed to the furthest empty stall. When a cow entered a stanchion other than the open stanchion furthest from the parlor entrance, one or more stalls were left vacant and cows had to be released and reloaded into the parlor to fill the entire row before they could be milked.

Data collected on parallel parlors in 1988-90 are presented in Table 2. The parlor routine data would indicate a 10-12% increase in performance based upon shorter walking distance for both the cow and operator. To achieve this increase in parlor performance, a dairyman would need to add more stalls in a parallel parlor.

Parallel parlors represent a definite safety advantage in providing protection against a kicking cow. With the bottom rail of the splash panel at 25 to 27 inches above the cow platform, it is almost impossible for a cow to kick back at the operator. Danger from kicking can generally exist only with a very short animal, requiring the operator to reach further forward when attaching the milking unit. The reaching distance to attach the cups on the forward teats is slightly greater than in a herringbone, especially with cows of shorter length that can stand slightly forward. Access to the forward teats can be made easier by designing the pit floor 38 to 40 inches below the cow platform, which is about two inches more than is recommended for side attachment. Access is further enhanced by sloping the cow platform slightly so the front feet are about 3 inches lower than the rear.

Machine Kick-off is less of a problem than in a herringbone. Because the hoses reach the udder between the hind legs rather than beside the leg, she cannot bring her foot over the hose and pull off the unit.

The more compact arrangement of the cows reduces the building size requirement and the associated costs of construction. In addition, the distance between udders is reduced decreasing the amount of walking required of the operator.

One disadvantage of some concern is the location of the cow's tail. Unless the tails are docked, or trimming of the switch, they hang between the operator and the udder. A splash panel protects the operator from defecation, but if the tail is dirty, this represents an undesirable situation. Design of milking machine claws and detachers to milk from behind the cow is needed.

Table 2. Steady-State Throughput Performance of 32 Parallel Parlors

Parlor Size	Number of Operators	Cows\hour
Double 10*	2	90
Double 12	2	120
Double 12	1	96-106
Double 14	1	110-117
Double 16*	2	143-152
Double 20	1	128
Double 20	2	155-160
Double 20*	3	160-243
Double 25	2	225-230
Double 30	3	270
Double 32	3	288

*No detachers

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HYDRAULIC MILKING

In 1986, English farm magazines introduced the term "hydraulic milking." Benefits reported for this innovation included reduced teat end impacts from liner slips, faster milking, and improved teat end condition. The concept stems from research at the National Institute of Research in Dairying at Reading, England.

In a hydraulic milking unit the clawpiece incorporates ball valves at the base of the short milk tube. There is no air bleed between the ball valves and the teat ends, which causes the liner to flood with milk as milk is drawn from the teat. With the flooding of the liner with milk, liner wall movements are quite slow. The movement of the liner is controlled by the rate of milk flow through the ball valves at the end of the short milk tube. Large vacuum fluctuations do occur on the end of teat, but the valve prevents any reverse flow of milk or air. Cross transfer of milk between quarters is also reduced. The original claw unit with ball valves was made of stainless steel. Several companies in Europe are manufacturing the unit or a copy of the principle in a plastic claw (Ambic and Alfa-Laval). Initial problems on several models involving plastic breakage and cleaning difficulties seems to have been eliminated. Based on observation of units being offered for sale in England the concept has been slow in acceptance.

ROBOTS

The concept of automatic milking attachment using robots has been under development in The Netherlands for several years and is being observed by the press and public with interest and anticipation. German, English and French workers have also begun development of robot controlled milking machines. The interest in automatic machine attachment was spurred by a study conducted by William Rossing and colleagues at the Agricultural Engineering Institute in Wageningen, Netherlands. They used a concentrate feeding box in a stall equipped with manually attached milking equipment. The cows could enter the stall of their own free will and were milked each time they entered so long as they had not been milked within the past three hours. The cows visitied the stall on an average of 5.4 times per day and were milked an average of 4 times. The cows that entered the stalls and were milked more frequently (up to 5 times per day) had an 11 lb higher milk yield than those milked only twice daily.

The ultimate potential for robot attachment and the details on method and configuration remain speculative. The two Dutch companies involved in the development (Vicon and Gascoigne) are adapdting the robot to a side opening stall which the cow enters free choice. The Vicon unit milks from the side; the Gascoigne unit comes from behind the cow after the cow is positioned in the stall.

In a typical routine, the cow enters the stall to feed and is locked into a relatively fixed position. She is identified and the control system determines whether or not she is to receive feed and the time she was last milked. If a set period, say three hours, has not elapsed since she was last milked, the milking process will not be initiated. If sufficient time has elapsed the teats are washed, then located, and the milking unit is attached. During milking the milk temperature and conductivity are collected and recorded. Milk is collected, weighed and transported to cooling and storage. The machine is detached, the cow is given post-milking sanitation and released.

Several methods for locating the teats are being tried including photogenics, ultrasonics and infra-red sensing. It may be necessary to elimninate cows with poorly conformed udders from the herd also recently calved cows have caused a problem of teat location.

Many aspects of robic attachment and complete automation of milking still require considerable study and development. Many technical problems have been found during the field testing. The greatest challenge appears to be in teat location, washing and successful attachment. Milk quality problems are of concern and high levels of bacteria and free fatty acid have been experienced. The cow has a free-choice basis to the milking operator and some cows simply do not enter the stall to be milked.

The cost of equipment for completely automated milking has not been identified. Reports of $80,000 to $120,000 per robic unit quoted in farm magazine reports in September 1988 is lower than will actually be the case. Development costs alone on the Netherlands units has been estimated to be 20 million U.S. dollars. The total costs will be dependent upon capacity, that is, how many cows will each unit serve. This also has not been quantified, with estimates ranging from 40 to 100 cows.

It is likely that even when the units currently under development in Europe are perfected and in operation, further development and adaptation will be required before they will be suitable for large herds and milking systems in the United States. A unit is presently being installed at the University of Maryland which should give us useful information on its adaptability to United States conditions.

REFERENCES

1. Armstrong, D. V. 1985. Milking parlor and equipment automation - what next? Proceedings of Northwest Dairy Shortcourse. Washington State University Cooperative Extension pg 57-60.

2. Armstrong, D. V., M. J. Gamroth, W. T. Welchert. 1988. Parallel milking parlors (side-by-side) performance. J. of Dairy Sci., Vol. 71, Suppl. 1-215.

3. Dairy magazine. 1988 "From Our Readers." May 10:9.

4. Donkers, C. L. W. 1980. de Hudonk Zij-Aan-Jz Milkstal Company. Advertisement Bulletin.

5. O'Callaghan, E. and J. O'Shea. 1988. Milking systems in Europe. Milking system and milking management. Proc. NRAES-26, 11-23.

6. Quick, A. J. 1981. The side-by-side milking parlour. Ministry of Ag. Fisheries and Food, ADAS, DH Technical Ref.:5:54.