Automatic Milking Systems in the United States

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Several companies are planning to introduce Automatic Milking Systems (AMS) to the U.S. market in the next year. Small to medium size farms operated by families are the target market for the types of AMS likely to be introduced.

Despite a decade of change, the upper Midwest and Northeast continue to be dominated by small and moderate scale dairy farm operations that raise most of their own feed and rely principally on family labor. The number of small and moderate scale dairy farms in these states has been declining but they are still home to half of all dairy farms and roughly 40% of all dairy cows in the country. The viability of dairy farms is vital for the economic and social health of many areas of the United States.

Milking comprises about half of the labor expended on small dairy farms amounting to 40 to 50 million person-hours per year in Wisconsin. Milking in parlors, and especially in stall barns, is a difficult and undesirable task and poses considerable risk for traumatic as well as repetitive stress injury. Health issues, unusual work hours, and working conditions have made obtaining reliable milking labor a major concern of dairy producers.

Research suggests that at a herd size of about 200 cows, farm families begin to hire more labor than they provide to the operation themselves. Moreover, using conventional stanchion barn milking systems, it is difficult to milk more than 70 to 90 cows using only family labor. Many of the region's dairy farms are currently reaching this size threshold. The major options currently available to farms seeking to expand beyond that scale *while still relying on family labor* are low cost parlor designs (like swing parlors or flat barn renovations of stanchion barns) or intensive rotational grazing systems that provide more moderate labor demands on the cropping side of the operation.

Social trends in Europe have placed increased emphasis on animal and environmental welfare. This trend is also apparent in the U.S. Automated milking may enhance economic opportunities for small to medium sized farms, which present a more positive milk quality and animal welfare image to the public, pose less of an environmental risk, and are generally more socially acceptable, especially near urban areas. Many of the traditional areas of dairy production in the US are also located near urban areas.

Analysis of recent survey data suggests that the vast majority of dairy farms milking between 25 and 200 cows in Wisconsin operate enough cropland to safely dispose of nutrients in their dairy manure. However, a growing number of larger dairy farms (> 200 cows) maintain an inadequate cropland base for manure disposal and are forced to depend on formal and informal arrangements with neighboring crop farmers to meet nutrient planning goals or regulations. Additionally, the high concentrations of animals on larger dairies raise potential point-source pollution risks from possible manure lagoon leakage, overflow, or failures. In addition to the socio-economic benefits to farmers and rural communities, efforts to maintain mid-size dairy farms can also contribute to maintaining environmentally sound agricultural practices.

AMS technology can provide an option for moderately sized farms to reduce the labor requirements of milking, make them more attractive to the next generation of producers and more attractive to rural communities located near population centers.

Regulatory Issues

AMS technology is undergoing a regulatory review in both Europe and the U.S. At present, there is two AMS machines installed on a commercial dairy farm in Wisconsin and one in operation at the University of Wisconsin. A group made up of regulatory officials from the United States Food and Drug Administration (USFDA), the Wisconsin Department of Agriculture Trade and Consumer Protection (WDATCP), AMS manufacturers and faculty from the University of Wisconsin and has begun to address AMS regulatory issues. The rules that prescribe the minimum requirements for the production of milk that will be sold across state lines are established in the Pasteurized Milk Ordinance (PMO), which is issued by the USFDA.

While much of the current regulatory language will apply to AMS, there will be some parts of the PMO that will require expansion or revision. The current regulatory structure is based on the assumption that a person would be present during milking and cleaning of the milking machine. Changes in the PMO are proposed, debated and voted on at the National Conference of Interstate Milk Shippers (NCIMS). This organization meets every other year. Each state has a voting delegate to this conference and the USFDA has veto power over any proposals. It is anticipated that a proposal for a nationally approved pilot project for AMS technology will be made at the May 2001 NCIMS. If the performance of AMS technology is satisfactory during this pilot project a proposal for a general approval and modifications to the PMO would be presented at the 2003 NCIMS. Some of the AMS regulatory issues that have already been identified are described below.

Location of the milking machine: The current PMO requires that milking equipment be protected from contamination by odors, insects or vermin during cleaning and storage. In milking parlors the area where the milking units are stored must be separated from animal housing areas when not being used for milking. Suggestions for AMS are that a reasonable separation will be maintained between areas where milking is performed and manure storage and/or a means to separate milking units from the animal housing area either through the use of a door or a sealed storage location. People should also have access the milking machine through a pathway that does not pass through animal housing or feeding areas. Positive pressure ventilation in the milking area will help to keep insects and odors out. The floor of the milking area and areas near entrances/exits should be designed so that manure can be washed away. Area where cows are milked should have cleanable surfaces and be kept reasonable clean, as is currently required for milk rooms.

Separation of milking and cleaning circuits: Cleaning solutions must not enter milk. The cleaning circuit (any parts of the system which contain cleaning solutions such as detergents and acids) shall be separated from milk handling surfaces by either 1. A physical break (disconnect piping) or 2. A block and bleed valve system (double block valves with a bleed or drain valve between). Some automated cleaning systems will perform a periodic rinse of parts of the system and a less frequent wash of the entire system. The periodic rinsing may be done with water or a sanitizing solution. Consideration has been given to developing a second category for rinsing solutions similar to the present requirements for backflush systems. These rinsing systems must

be protected by a failure detectable apparatus whereas the cleaning circuit should be protected by a more stringent fail-safe apparatus

Milk quality detection and separation of abnormal milk: The detection and separation of abnormal milk has 3 aspects: 1. Accuracy of sensors for identification of abnormal milk. This is a technical issue unique to each machine and must be evaluated under field conditions. 2. Accuracy of cow identification is an issue particularly for cows treated with antibiotics. The management computer will make the decision to separate the milk from these cows if it has been given the proper information and if cow identification is accurate. 3. Adequacy of systems to remove antibiotic residues from milk contact surfaces. Some machines rinse milk contact surfaces after milking treated cows. This approach would require a change in the PMO, which currently requires a complete wash, and sanitize not just a rinse. The adequacy of the methods used by each type of machine will need to be assessed.

Washing Frequency: The PMO requires the manufacturer to specify a cleaning regime for every system. A minimum washing frequency of 3 times per day in regular intervals for the entire system has been suggested and some maximum idle (no cows being milked) time after which all or part of the machine must be cleaned. The various strategies to provide intermittent rinsing of parts of the system should be adequate to maintain low bacteria counts. Current regulations do not require the use of milk filters, although it is considered desirable and is widely practiced.

Teat washing and disinfection: Teats shall be effectively cleaned before milking. Cleaning solutions shall be effectively removed from the teats before teat cups are attached.

Sanitary Design: Milk contact surfaces shall comply with sanitary design as specified by the 3A standards. Exterior surfaces shall also be of washable material and design. Slip joints are allowable but are classified as hand clean areas. Sanitary fittings are required for pipes and long hoses and any part of the machine not disassembled for cleaning.

Economics

As with any technology, the economics of purchasing, maintaining and operating must be competitive with other production systems. Robotic milking systems tend to also have highly mechanized feeding and manure handling systems. Cow ID is required so that management decisions on milking and feeding can be made by a computerized management system. Some of the systems make use of automated concentrate feeders with Cow ID. Special facilities and automated cow handling equipment is required so that cows will voluntarily enter the milking area. It may be impractical or impossible to renovate existing buildings for these special purposes. The exact cost of robotic milking systems is unknown. Maintenance will be critical for the success of these highly mechanized systems.

Preliminary estimates indicate that the level of capital investment for robotic milking systems will considerable higher than for milking parlor operations on large farms and that the economic success and competitiveness will be highly dependant on the management level on the farm. In the near term, the use of robotic milking systems on US farms will remain a high-risk venture.