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Is robotic milking right for you

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Introduction

Automatic milking systems (AMS) are becoming more common in the US with a steady growth taking place throughout the US. It is estimated that there are ~12,000 AMS farms in the world. In North America there are over 2500 AMS on over 1000 farms. Most of these are located in the upper Midwest and Northeastern US. The majority of AMS in operation today are single box systems, with a robotic arm serving one or 2 to 5 boxes, depending on the manufacturer. Most common AMS in operation in North America are Lely and DeLaval (1 box systems), but GEA Farm Technologies and AMS-Galaxy are growing their AMS market share. There are also several companies designing automated milking systems for rotary and parallel parlors. Within the next year there will be partially or fully automated rotary parlor systems installed in the US.

Because of the growth in this technology and the lack of data from the upper Midwest US, we decided to conduct a field study at the University of Minnesota to describe these systems and learn about best management practices. We have been working with 52 RMS farms in MN and WI and collected housing information, description of management practices (using a questionnaire), and downloaded robot software data. We also scored cows for locomotion, severe hock lesions and hygiene. We have started to summarize and evaluate the daily data downloaded from the robot computer for every cow on every farm for 2013-2014. Along with describing what is happening day-to-day on the farm, these data will allow us to further investigate factors associated with productive parameters on the dairy and make some inferences about cow preferences and behavior.

Below is a brief summary of some of our results:

- Farms averaged 2.8 AMS/farm (1 to 8 AMS/farm).
- 58% of the barns were new and 42% were retrofitted AMS units in existing barns
- 47% of the farms had automatic alley scrapers, 21% had slatted floors, 6% had bedded packs and 26% scraped alleys manually
- 75% of the farms had exclusively free flow cow traffic, 23% had exclusively guided flow traffic and 2% had both a free flow and guided flow cow traffic system in separate barns
- 85% of the farms had mechanical rotating brushes
- 21% of the farms had robotic feed pushers that pushed up the ration on a pre-determined schedule
- 41.5% of the farms had mattresses, 26% sand, 13% waterbeds, 9.5% mattress and
- Lameness prevalence was 40.9% for mattress, 21.5 for pasture, 22.5 for sand, 19.0 for bedded pack, and 35.3 for waterbeds
- Average feed bunk space was 20 inches/cow (range 10.2 to 42)
- Average number of milkings/day was 2.6; it has been suggested that greater than 2.4 is best.
- Average milk production per robot per day was 4,325 lbs; it has been suggested that greater than 4,500 lbs is best. We had 5 herds that averaged over 5000 lbs per robot daily for over a year.
- Amount of concentrate fed in the AMS unit was 2 to 25 lbs per day depending on stage of lactation and type of system (free flow 2-25 lbs, avg 11.2; guided flow 2-18 lbs, avg 7.9)

- Partial Mixed Ration (PMR) in guided flow systems was higher in energy (0.015 Mcal/lb) and lower in NDF (2.1%) than in free flow systems
- In free flow herds the PMR was balanced for milk production levels of 10 to 30 lb less than the herd's average production
- In guided flow herds the PMR was balanced for 9 to 20 lb less than the average production
- Our observations indicate that the 'milk first' guided system is better than 'feed first'
- There were herds with >90 lb/cow/day average with both free flow and guided flow systems

Why consider an automatic milking system?

The milking process is well suited for robotic technology. It is a repetitive process where the teats are found and cleaned, abnormal milk identified, cows are milked and post dipped. Most farms are already using some automation in the milking process, such as take offs.

When we asked producers about the top reasons for installing AMS, three reasons were consistently mentioned. These were improved lifestyle, the desire to not have to manage labor or as much labor and their own human health concerns. Other reasons that were mentioned included the desire to have the latest technology and consistency of milking.

Is an AMS right for you?

Based on our research and interactions with producers and advisors, we have learned there are questions you need to ask yourself if you are interested in using this technology:

1. Do you or your employees like working with cows?

If you install an AMS, you still need to work hard and pay close attention to your cows. We have seen in our research that the most successful producers enjoy working with cows and don't have the attitude of putting a robot in the barn and leaving cows to their own. Barn and stalls need to be cleaned daily, cows bred and treated, cows fetched, cows fed, etc. It just makes one chore – the tedious milking chore – easier since you don't have to do it yourself, giving you more work time flexibility. That is very helpful especially for smaller operations run with family labor. Our survey and others showed that the biggest reason farmers installed AMS is for flexibility of time.

2. Can you have the best ration/feeding management?

How and what cows are fed in an AMS farm is one of the most important keys for success.
The interaction between cow behavior, activity, her diet, feed consumption and cow health and production is complicated (Rodenburg, 2011).

In our study, we asked nutritionists to rank five feeding factors they thought were keys to AMS feeding success: PMR energy content, PMR starch content, consistency of the PMR (consistent mixing and delivery), consistent push up of PMR, and palatability of the pellet. Nutritionists working with these dairies indicated that consistent mixing and pellet quality (palatability and hardness of the pellet) were the two biggest feeding factors contributing to AMS success. These results agree with comments made by dairy producers on our visits and existing research. Rodenburg and Wheeler (2002) showed that in a free flow system when feeding a high quality pellet vs a low quality pellet, voluntary milkings increased from 1.72 to 2.06/cow/day. Many producers in our survey had tried feeding a meal instead of a pellet in the milking box. Overall this proved unsuccessful and they reverted back to feeding a pellet. Pellets should be hard, free from fines and made from palatable ingredients. At farm start-up nutritionists and farmers focused on developing a pellet formula that encouraged milking box visits. Once they had a pellet that worked well, other factors became more important.

Many producers commented that even minor changes in the PMR moisture, consistency of the mix (i.e. long hay that is difficult to process to a consistent length) and changes in forage quality affected visits.

These complicated interactions between feeding management, voluntary visits and milk production can be challenging. High forage/low energy PMR helps drive cows to the robot, but may limit milk production. A high energy PMR may increase the number of late lactation fetch cows. If feed moisture changes and rations are not adjusted promptly, visits may drop. This drop in visits will result in a decrease in milk production and an increase in number of fetch cows (cows that did not visit the robot voluntarily during a specified time period and need to be brought up to the milking box). The increase in fetch cows may disrupt other cow behaviors resulting in even a bigger decrease in visits and decrease in milk production leading to a downward spiral creating much frustration for the producer.

3. Is your barn comfortable and well designed?

Cow comfort is important in any dairy production system. For AMS, it is even more important that cows are healthy and willing to come to the milking station, so for example, a high prevalence of lameness will probably increase the number of fetch cows and reduce efficiency of the robot. It is necessary to have good cow flow (be it free or guided) so that we don't hinder attendance to the robot.

Some design attributes that will improve labor efficiency:

- Automatic manure removal system
- Split entry for free flow traffic
- Drovers lanes
- Sort pens near the robot for special needs cows and cow management activities or headlocks
- Excellent ventilation
- Consider all right or left handed robots or both in each pen. Some cows do not adjust well to switching robot orientation.

4. Are you handy with equipment?

These systems are hi-tech and expensive. If you can learn how to fix little things, it will help make AMS more affordable to you in the long run and reduce the number of failures and problems that can affect robot efficiency. This will keep your repair costs low and improve AMS performance. A key factor for success in AMS farms is the amount of milk produced per robot per day. Excellent dairies are getting 5,000+ pounds per day.

5. Is the service provider dedicated to your success?

What is the service provider's assistance at start up? Do they have skilled technicians for major repairs and routine maintenance? If the AMS breaks down for a long period of time, things can get really out of control and create a 'train wreck' very fast. Keep it at top performance!

6. Do you like technology?

Get the most out of it. Robots take more technical skill that other milking systems. The manager should enjoy using software for the greatest benefit.There is so much information about every cow that you can use to optimize performance and health. AMS companies are developing even more decision making tools that will help organize your day and create a task list every morning.

7. Do the economics make sense?

Because milking robots are a large investment, it is important to develop a realistic cash flow and carefully think about how much capital you want to tie up in your milking system. We have developed a partial budget tool to comparing the economics of robotic and conventional milking systems. The tool is available online at: z.umn.edu/robotmilker. This tool will perform an economic analysis based on user inputs. There are tabs that

create sensitivity graphs, compare multiple scenarios, and show a yearly cash flow graph based on loans. This can allow you to do a quick assessment on how robots may affect profitability.

A sophisticated piece of equipment requires money to maintain and repair. You can't just go to the local hardware store to get all the parts you need. Please be financially prepared.

8. Do you have strong management skills?

As one of our successful project collaborators, Doug Kastenschmidt, said: "Management makes milk. Robots only harvest it!"

9. What are your future expansion plans?

Currently the box type robots on the market are able to milk about 50 to 70 cows per box. If future expansion is planned, expansion must be in 60-cow increments and increased investment in robots will be required. In parlor systems, increasing milking hours is often all that is required.

Mindset change with automatic milking system

Robot time is very valuable in AMS. The focus should be on milk per robot per day. This is done by maximizing the milk per minute of box time and optimizing the percent of time the robot is idle.

The main factors affecting milk per minute of box time include:

- Prep and attached time – this is affected by cow cooperation, teat placement, udder balance and the ability of the laser and/or camera's to find the teats.
- Cow milking speed
- Milking permission settings – not allowing cows to milk until predicted milk production is higher will increase milk per minute of box time. However this may decrease milk/cow/day and visits/cow/day.
- Machine settings and maintenance – clean lasers and camera's and prep settings can minimize prep and attach time.
- Optimum free time – suggested free time is 10%, but some dairies have excellent visits and milk per cow with less free time.
- Optimize milking refusals per cow
- Ideal cow confirmation – robot milking systems have difficult attaching to cows with crossed rear teats, deep udders and severe reverse tilt.

The focus is to balance milk/cow/visit (milking permission), milk/cow/day and number of cows per robot. To optimize AMS performance long term, cull cows with slow milking speed, and slow prep and attach time. This will make your robotic system much more efficient.

Summary

The milking process fits well with robotic technology. Robotic technology is getting better and there will be more options in the future. Taking a whole system approach in design and management will maximize the AMS performance. Focusing on feed management and good cow management are a two major factors to AMS success. It is important to develop realistic cash flows for financial success.

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