The William H. Miner Agricultural Research Institute August 2021

FARM REPORT

In This Issue:

FROM THE PRESIDENT'S DESK: INTEREST IN AUTOMATED MILKING SYSTEMS

Interest in automated milking systems (AMS) continues to grow in the U.S. Although AMS are far less common than traditional milking parlors, more systems are installed each year. Understanding the basic differences between AMS and milking parlors is increasingly important for those of us in the dairy industry.

In addition to the obvious equipment and management differences between AMS and conventional parlor systems, the nature of the human-animal relationship also differs. Farmers tend to spend less time interacting with cows in an AMS, and at the same time cows tend to be less fearful of people. "These cows are calm." is a common reaction when people visit an AMS herd for the first time.

Milk yield per AMS and milk yield per cow are two common measures used to assess productivity of AMS. Researchers at the University of Minnesota studied 33 AMS farms in Minnesota and Wisconsin (J. Dairy Sci. 2018. 101:8327). All used free-flow cow traffic, and the average number of cows per FTE was 90. Whether the facility was new or retrofitted had no effect on milk yield per AMS or per cow. Likewise, free-stall surface (mattress, sand, or waterbed), manure removal system, and number of AMS per pen (1/pen or >1/pen) did not influence milk production.

However, feed push-up strategy did affect milk yield. The AMS herds with automatic feed push-up produced 20% more milk per AMS than herds that pushed up feed manually. They also produced over 10 pounds/cow per day more milk. Interestingly, herds with H or J bunks (i.e., self-contained bunks) were intermediate between automatic and manual feed push-up. These results reinforce previous work that emphasized the importance of keeping feed in front of the cow and within easy reach to optimize feeding behavior and milk yield.

Other important factors that boost milk production per AMS are greater age of the cows, higher milking frequency, faster cow milking speed, number of cows per AMS, and daily amount of concentrate offered through the AMS. On the other hand, milk yield per AMS is reduced by excessive time required to prep the udder prior to milking, apply teat disinfectant after milking, and higher amounts of residual concentrate per cow.

The size of the area in front of the AMS has not always been related to milk yield, but

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FOR YOUR READING PLEASURE

The *Journal of Nutrient Management* is published quarterly by W.D. Hoard and Sons, and is available free of charge to "qualified subscribers", including livestock farmers and other agricultural professionals. I highly recommend it for anyone serious about managing nutrients on the farm — which should include all dairy farmers. For subscription information contact: *Journal of Nutrient Management*, PO Box 801, Fort Atkinson, WI 53538-9980.

The May 2021 issue includes an excellent article, "The Fuss Over Phosphorus", by Thomas Menke, an agronomic and environmental consultant in Greenville, Ohio. He notes that while the phosphorus in manure is much less soluble than the P in commercial fertilizers, it's highly plant-available "due to the organic matrix that is broken down by soil microbes to release phosphorus when plants need it". Therefore, the P in manure is a time-release nutrient! Menke goes on to state that replacing fertilizer P with manure P can improve water quality.

Do you know how much manure P you apply to each field? The only way you can come even close is to have your manure analyzed since there are <u>huge</u> differences in the nutrient content of dairy manure depending on how much water has been added and the ration P content. After you know the manure analysis, calculate how much manure was applied to each field. (Number of loads times gallons or tons per load divided by acres.) After doing these calculations you may discover that for some fields starter P isn't needed at all. You can get higher crop yields by using less (or no) starter fertilizer in a high-fertility soil than by using high rates of starter fertilizer in a low-fertility soil. I'm certainly not opposed to the use of commercial fertilizer: Most fields will still need significant amounts of N and K for corn production, and plenty of K for alfalfa and alfalfa-grass. But the phosphorus balance on most dairy farms is decidedly positive — soil reserves of P are increasing every year — so if soil fertility is changing maybe your crop fertilization program needs to change with it.

— Ev Thomas
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"I KNOW I SHOULD HAVE…" (A CROP CONSULTANT'S LAMENT)

I've forgotten how many times a farmer has requested a visit for me to view what turned out to be an on-going disaster. In many of these cases upon arriving at the scene of the crime the first words out of the farmer's mouth were: " I know I should have…" followed by a variety of admissions, including "…read the label." "…read the seed tag." "…calibrated the fertilizer spreader." "…had my soil tested ." "…used an insecticide." Of course, by the time I was called in it was usually too late to correct the problem. I'm sure that production animal veterinarians have had similar experiences, often with fatal results (to the critter, not the farmer though a few vets must have been tempted.) The sorry results of these "should haves" included a field of dead corn plants from applying Roundup to non-Roundup Ready corn (oops); spotty corn population because of no seed treatment; and stunted, red and purple corn seedlings after planting in soil with a 5.5 pH.

Sometimes even the best farmers make mistakes — so do crop consultants! – but sometimes the disaster is the farmer. I remember, and not with fondness, trying to provide advice to a farmer who continually was half a season behind: He was ordering parts for his corn planter when other farmers were planting corn; he was thinking about planting corn when he should have been harvesting first cut alfalfa, and he was harvesting first cut when his neighbors were finishing second cut. On one of these visits he must have sensed my frustration because he told me not to get upset, that he wasn't farming as well as he knew how to! That problem resolved itself a year later when the farmer went out of business.

— E.T.

LAKE CHAMPLAIN BASIN PROGRAM GRANT SUPPORTS LEACHATE COLLECTION SYSTEM RENOVATION

Ensiled forages are the backbone of most dairy feed rations, but the ensiling of corn and hay crops produces leachate that can be very detrimental to the environment. Harvesting crops at the optimum moisture content (~65%) maximizes feed quality while minimizing the amount of leachate from the feed. But ensiling a crop that is roughly two-thirds water inevitably results in some leachate over time. Left unmanaged, the leachate presents an environmental risk as undiluted silage leachate has concentrations of phosphorus (P) and nitrogen (N) in a range similar to manure, is very acidic (pH 3.6 – 5.5) and has a high biological oxygen demand (BOD; the amount of oxygen consumed by microbes to decompose the leachate). Phosphorus and N loading to Lake Champlain are two of the primary drivers of impaired water quality and the occurrence of algal and cyanobacteria blooms. Additionally, low oxygen conditions, particularly in shallow regions of the lake, are an important precursor to these blooms, and the high BOD in leachate would exacerbate these conditions. Therefore, an effective and properly maintained silage leachate collection system is a critical component in a farm's nutrient management plan.

The essential function of a silage leachate collection system is to collect and store the undiluted leachate (low flow) during dry periods and to divert the leachate that is heavily diluted with rainwater or snowmelt (high flow) to a vegetated treatment area (VTA). The low flow can be collected and stored before application to cropland. When functioning properly, the high flow drains to a level lip spreader which distributes the flow along the upper width of the VTA. With proper distribution, the water will flow through the VTA as sheet flow. The vegetation then utilizes these nutrients for growth and the harvested crop will remove the nutrients and prevent build-up in the soil.

Concentrated flows can occur when flow is not distributed evenly, bypassing a significant portion of the vegetation, limiting treatment of the high flow water before it exits the VTA. If solids enter the distribution trench, they can disrupt this even distribution and leach nutrients which will add to the nutrient load that must be treated. The handling of solids is a challenge in all system designs and the efficacy of the system is often closely related to how well they are separated from the feed bunk runoff.

The original leachate collection system at Miner Institute was designed and installed in the early 2000s when these systems were still in the initial design phases. The system had several drawbacks compared to newer designs, most notably its inability to limit solids from entering the system, inhibiting its performance and requiring higher levels of maintenance. Miner Institute was awarded a $20,000 Pollution Prevention and Habitat Conservation Grant from the Lake

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WHAT'S HAPPENING ON THE FARM

Earlier this month we attended the Clinton County fair with 9 animals. Conner, the summer interns, and I got to exhibit one or two animals in the string. There's a lot of work and time that goes into preparing for the fair. Each day for the month of July the interns would spend at least an hour with their heifer, getting her friendly and forming a special bond. To prepare a heifer for the fair she needs to be able to walk calmly and slowly with a halter and be cleaned/clipped.

We had a great crew at the fair and at the farm ensuring things were running smoothly in both places. Our cows stay on the same schedule as if they were home. Chores would start at 5 AM getting them milked, fed, washed, and rebedded. I could list everyone's role but that would go on for a while. Needless to say, all of the Miner Institute staff really stepped up and played a huge role in making the week successful.

All this hard work throughout the week was rewarded Saturday during the show!

- We took two spring calves (born in March of 2021) which placed 4th and 5th in a deep class.
- Our Winter calf (born in December 2021) placed 6th.
- The summer yearlings (born in July of 2020) placed 2nd and 3rd .
- The two 4yr olds were 2nd and 3rd .
- Production cow (made over 243,000lbs) placed 1st .
- We were rewarded with 1st place senior best 3 females and premier breeder.

I had a great time at the fair but most importantly an unforgettable experience at Miner Institute. With that being said, my internship here concludes at the end of the month and I've decided to explore some different opportunities in the Finger Lakes region and Western NY. My time here really opened my eyes to the different options in the dairy industry and gain direction as to what I want to do. I have enjoyed working with Kevin and Conner on herd health, assisting Beth Ann with newborn calves, and discussing management topics with Steve. I can easily say I am leaving here with valuable information, a great experience, and lifelong friendships. I have been extremely thankful for this opportunity and will miss the farm/cows but excited for the future!

— Trina Bigelow
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AMS, Continued from Page 1

Ontario dairy researchers proposed that having a larger opening in front of the AMS improves cow flow. That recommendation makes sense since this could be a physical bottleneck area in the pen.

Not surprisingly, stocking density of AMS is critical. A Canadian study found that the mean stocking density of AMS was 55 cows per system with a free-stall stocking density of 90%. Cows in AMS stocked at 150% were displaced more at the free-stalls and feed-bunk than cows housed at 100 or 120% with similar trends in lying and rumination time.

Future research needs to determine optimal stocking densities for AMS systems. Optimal AMS stocking density will be a function of the target number of milkings per day, efficiency of cow movement through the AMS, and traffic flow that ensures that cows meet their time budget behavioral needs.

Research continues to be conducted on AMS systems. In the meantime, there are practical recommendations available for AMS management. The bottom line is that although we need to know more about automatic milking systems, two priorities are frequent and effective feed push-up and good stall comfort to boost resting time (neither is a surprise). Optimizing these factors can improve milk per AMS by up 20% according to research published to-date.

— Rick Grant
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UPDATE ON THE NEW CALF BARN

For the last several months we have been working hard on designing and building a new calf barn. This barn is designed to house calves from birth until a week or two after weaning. The calves will be housed in individual pens on either side of the barn, with the flexibility to create pairs or small groups. The pens for each calf are 4 ft by 8 ft and they feature wire mesh paneling in sections of the sides and back of the pens to optimize air flow.

Some of the main design features include a narrow barn (36 ft across) oriented east to west. The barn has 14-ft open sidewalls with bird wire. The sidewalls are covered with curtains that will automatically adjust based on the weather conditions outside. The floors will be concrete with specific pitches under the calves to help with drainage to the trough running along the length of the barn. This trough is also positioned beneath the buckets for easy dumping. A small service alley all the way around the barn keeps the calves away from the sidewall but also allows for easy access from both sides of the calf pens. Additional ventilation includes six fans mounted on the outside of the barn for positive pressure ventilation. Four of the fans will run continuously and bring in fresh air from the outside. These tubes are designed to layer this fresh air directly above the calves without causing a draft. The other two tubes are designed for the summer and will directly blow fresh air onto the calves above a specific temperature. The ceiling of the barn has a light spray foam to minimize condensation, as this is intended to be a cold barn. Furthermore, there are power operated chimneys that will automatically turn on when the humidity in the barn reaches a certain point as the ridge cap of the barn is solid. The automation will be adjusted as we learn how the barn works in the different seasons, but the goal is to have all of these ventilation pieces work together to control the climate in the barn.

We started the build in the first part of May and hope to be done in a couple of weeks. Currently, the tin and final exterior finishes are being done, the utility room and storage area are getting finished, and the concrete in the barn is being poured. Bird netting will be installed below the rafters and then the positive pressure tubes. Everyone is excited about the completion of the project and the opportunity it allows for the farm and research.

— *Sarah Morrison*
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CHARACTERIZE AND QUANTIFY HEIFER REPLACEMENT EFFICIENCY

An efficient system has optimized the processes in question and reduces or eliminates waste. If you consider milk production efficiency, we can track this routinely by quantifying the inputs (i.e., feed, labor, etc.) to the outputs (i.e., milk production). However, it can be a little more muddled when you start thinking about the efficiency of dairy replacements, but with a few critical considerations efficiency of replacements can be measured to improve overall farm profitability.

In a recent “Invited Review: Advances in efficiency of growing dairy replacements” in the Applied Animal Science journal, the authors discussed some opportunities and benchmarks for determining and optimizing replacement efficiency on farms. The authors proposed two metrics to assess the efficiency of replacements. The first is rearing efficiency or the proportion of heifers born alive that calve at or before the target age. The second is rearing effectiveness or the ratio of heifers born alive that calve at or before the target age and complete three lactations.

An estimated 12 to 35% of calves born alive don’t reach first calving, indicating an opportunity to improve rearing efficiency. Morbidity, mortality, or breeding effectiveness may be increasing the carrying cost of the replacement herd without any return as these animals never reach the milking herd. Furthermore, an estimated 8-17% of heifers entering first lactation don’t get to second lactation. Typically, income from milk production doesn’t offset the accrued costs of rearing until the animal enters second lactation. With both of these statistics in mind, there is an opportunity to improve rearing efficiency and effectiveness.

Rearing efficiency focuses on animals entering lactation, but there are several considerations for the age and maturity of the animal. Two main goals are to have the heifers raised calve within an appropriate time (i.e., 22-24 months of age), and the heifers should be appropriately grown when they enter lactation (i.e., 85% of mature body weight). Lowering age at first calving can reduce rearing costs; however, the replacements need to be appropriately grown for optimal milk production. Therefore, age at first calving and body size need to be carefully linked. Calving in early but having less developed animals might not improve the productive efficiency of that animal long-term.

Once the bodyweight goal at calving is determined, the farm can implement the appropriate feeding strategy to maintain the required average daily gain to reach this goal. During this period, feed efficiency can be tracked; however, it will change. For example, calves on milk or recently weaned are the most feed efficient, while older growing animals become less efficient, especially when you remove the weight of the growing fetus. Track feed efficiency throughout the rearing period to minimize accrued rearing costs while maintaining growth goals.

Overall, there are some ways to evaluate efficiency on a short-term basis (feed efficiency) or on a long-term basis of the whole system (growing replacement animals to enter the milking herd i.e., rearing efficiency and effectiveness). Therefore, tracking the efficiency of animals entering the lactating herd and their longevity will help to make management decisions to improve the overall farm profitability.

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LUCK VS. TALENT

The other day I got a phone call from a dairy nutrition consultant asking me to comment on a client's forage analysis: first cut grass silage harvested at the perfect stage of maturity. It wasn't the nutrient content he was concerned about — it was the 50% dry matter content, and this was straight grass in a bunker silo! Normally this would be a recipe for disaster, but the farmer did several things right: He'd recently purchased a merger, spending big bucks in the process. He did so after participating in a webinar I did for the feed company selling him grain where I was extolling the virtues of mergers for hay crop silage production. And he harvested with all the knives in his chopper, when the grass was still immature: 30% ADF, 49% NDF on the fermented forage. (He hadn't intended on chopping at 50% DM, said the crop "just got away from him", something most farmers have had happen.) The consultant doubted the analysis so took a second sample with results almost identical to the first, so we're looking at real numbers. Often trying to pack first cut grass in a bunker silo with a dry matter % this high would be like packing mattresses — very bouncy! But the forage was chopped at a relatively small TLC and the farmer said that it packed very well. The proof is in the pudding — in this case the fermentation analysis — which showed that the forage had indeed fermented — pH 4.5 — with enough lactic acid (2.4%) for effective preservation. These pH and lactic acid numbers are what we'd expect for 50% DM alfalfa silage, while feed quality was so high it's almost "off the chart".

I ran into a similar situation many years ago, with a Franklin County (NY) dairy farmer who was wrapping small square bales of alfalfa-grass at 60% DM. He preferred at least 50% DM because he said that the bales handled better, didn't sag during handling. He had no fermentation analyses but insisted that the baleage was fermented — no mold. I made a bet with the farmer, told him to get a fermentation analysis and if the results showed more than a trace of lactic acid that I'd pay for the analysis. I lost that bet, much to the farmer's delight. And it was a relatively cheap education for the Crops Dude — some farmers can do everything just right and make stuff work that most farmers cannot.

Occasionally I wind up telling a farmer: You did a lot of things wrong, and while it worked out great this time don't ever do that again. (As when a farmer planted alfalfa with his sudan-sorghum and wound up with a really good catch of alfalfa, or when another farmer used 2,4-D for weed control in his alfalfa-grass seeding.) But I'm not sure that the above two cases are a matter of luck as much as skill. But for most farmers, as they say on TV: "Don't try this at home."

— *Ev Thomas*
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Champlain Basin Program to install a new system, covering approximately 50% of the final cost. Mike Contessa of Champlain Valley Agronomics was also instrumental in the process, providing essential guidance to our team on a design that would ultimately work best in our existing location.

The new system design utilizes a concrete drive-in settling basin with a drainage outlet for low flow that allows solids to drop out of suspension before the flow reaches the exit pipe. To prevent solids entering with high flow, there is a wooden skim bar that holds back the large floatable solids (Picture A). During dry periods, the low flow drains into the upright pipe (Picture B) and is pumped to a manure lagoon. During high flow, the upright pipe is closed and the high volume of water that enters is instead drained to the VTA via two 12-inch pipes. This design allows a large volume of water to enter the basin, but holds back the majority of the solids content before the water is drained. Following high flow events, the remaining water can be drained to the low flow collection tank, the skim bar removed, and a skid-steer can be driven down a ramp into the settling basin to remove and compost the solids.

Shortly after the new system was installed we had an intense rainstorm that tested the new system. As you can see in the pictures taken the day after, the majority of the solids remained on the front side of the concrete barrier, with only minimal amounts making it through to the back portion where the two pipes drain water to the VTA. Picture C shows the distribution system into the VTA, which evenly splits the flow along the full upper width of the vegetation, aided by a stone trench to further ensure even flow. There are holes drilled into the pipes just above the stone to allow water to flow out, or if a large amount of water is in the system, it can spill out the top. The openings at the top of the pipes also allow easy access to periodically remove any solids that did make it through. Getting used to a new system to manage will take some time, but overall, the new system appears to be outperforming the old, enhancing the environmental benefits of the system and ultimately should be an easier system to maintain.

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