The William H. Miner Agricultural Research Institute April 2019

FARM REPORT

In This Issue:

FROM THE PRESIDENT'S DESK: CHANGE AND MORE CHANGE

Cows like consistency in their management environment, but the transition period is change, change, and more change! It is a time of social and physical change for both cows and first-calf heifers. Depending on a herd's grouping strategy, a cow might experience 5 or more pen changes during the transition from dry to milking. The change could be regrouping, novel physical and social environments, different feeds and rations, or variable stocking densities and overcrowding on too many farms.

What is natural for the cow around the time of parturition? An analysis of her time budget reveals that resting, ruminating, and feeding all tend to decline at calving, and our goal should be to minimize these reductions as much as possible. We need to encourage resting time since >90% of rumination should occur while the cow is lying down. Also, when the cow calves and moves into the fresh pen, management time expands and we must make sure that it doesn't exceed about 3.5 hours daily outside the pen or locked in headlocks, otherwise the cow will not have enough time to hit her targets for resting and eating.

We also need to remember that resting and eating behavior are linked during the transition period. Cows and first-calf heifers with greater resting and ruminating time on days -2 and -6 prepartum have greater dry matter intake ad milk yield during days 1 to 14 following calving.

The top five management stressors for transition cows are: 1) inadequate time spent in the close-up pen, 2) not grouping by parity, 3) improper movement between pens, 4) overstocking, and 5) heat stress. When these stressors are poorly managed on a farm we observe reduced intake and milk production, greater body fat mobilization, and diversion of nutrients from milk production to stress and(or) immune responses.

The crux of the challenge is that cows prefer predictable, non-competitive social environments. They naturally form attachments with other cows and have specific social preferences. But we don't make our grouping decisions based on these preferences; instead we group based on age, pregnancy status, nutrient requirements, or some other performance metric. So, a key question is how do we minimize the negative effects of regrouping on natural behavior, health, and herd performance?

If a cow spends less than 7 days in the close-up pen, she'll likely experience a prolonged period of social turmoil, a

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SPREADING IT

Most farmers have been waiting for the ground to thaw so that spring work can begin, including manure spreading. Practical considerations including snow depth limit the amount of manure that can be field-spread during the winter, and in some states environmental regulations make timing a legal issue.

Continued low milk prices make it especially important to use manure to supplement or in some cases substitute for commercial fertilizer. Doing so in an informed manner starts with a manure analysis. Manure sampling is a messy but necessary job — and annual manure analysis from each storage is required by CAFO Nutrient Management Plans. For "pit manure" don't assume that agitation will result in a homogeneous product: It will not, due to nutrient stratification. The manure in the top part of the pit will be lower in solids than that in the bottom because the solids start settling out as soon as agitation stops. The top portion will also have a higher ratio of K to P, partly because most of the K excreted by cows is in their urine. These differences greatly influence the nutrient content of a tanker of liquid or slurry manure depending on where it came from in the pit. I have no data on nutrient stratification in a "Slurrystore" but don't expect that it's much different than in a manure pit.

Take a manure sample soon after you start spreading pit manure. After you've spread about half the manure take a second sample. By the time you get back the analysis from the top half of the pit you'll probably be into the bottom half. That's OK because the reason for analysis is to determine how much of each major nutrient is in a tanker of manure from each level of the manure pit. The analyses will change slightly from year to year depending on how much precipitation fell since the pit was last emptied, but at least you'll have an idea of the nutrient content in each portion. It will also change if you considerably change the ration fed to the herd since most of the minerals cows eat wind up in the manure. Penn State recommends three sequential analyses while unloading a manure pit; three is better of course, but two is a good start.

On the Miner Institute farm — as on most farms — soil fertility (particularly phosphorus) is highest nearest the cow barn, progressively lower as the distance increases from manure pit to crop field. (Give me a field map of your farm labeled with soil test P for each field and I'll tell you where your dairy barn is located.) The first manure spread from our pit is lower in solids and P, and therefore a tanker full has somewhat less fertilizer value, especially P. We can apply a higher rate of this low-solids, low-P manure to fields near the barn, and as we get to the bottom part of the pit we can apply a lower rate of high-solids, high-P manure to our far-off fields (which usually have a greater need for the nutrients.)

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greater reduction in intake, and more lipid mobilization and metabolic disorders. Most studies have shown that a cow ought to spend at least 14 days in the close-up pen to minimize metabolic problems and maximize milk yield in the ensuing lactation. The number of moves from pen-to-pen is also important, and the incidence of abomasal displacements can nearly double when cows experience over 2 pen moves versus only 1 to 2 moves during the transition period.

To minimize turmoil within a pen when regrouping cows, new animals should be introduced into a pen in pairs or small groups rather than as individuals to promote greater lying after mixing. Never move single animals! Cows should be moved later in the day when it is quieter on the farm, and definitely not near feeding time which is the most competitive time of day on most farms. Finally, contiguous close-up and fresh pens may help when cows are later mixed together.

Overcrowding makes any situation worse. Headlock stocking density >80 to 90% or manger space <30 inches/cow will reduce feed intake, increase incidence of abomasal displacement, and curtail milk yield of first-lactation heifers. 100% stocking density of feed bunks in the fresh pen increase feeding rate and should be more like 80% to encourage natural feeding behavior.

Success is most likely when cows are managed to minimize change in their environment. The bottom line is that management plays a larger role in cow health and productivity than the ration itself in many cases. This is never truer than during the transition period.

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WATER QUALITY AND EDGE-OF-FIELD MONITORING

Impaired water quality is a challenge currently being faced by many regions and communities around the country. Here in the Lake Champlain Basin, we're faced with recurrent algae blooms in Lake Champlain that threaten drinking water supplies, recreational opportunities, and the tourism economy. In freshwater systems, phosphorus (P) is the primary limiting nutrient. While P is necessary for all forms of life, when the amount in freshwater rises above natural levels, algae have a food source that allows them to grow in much larger numbers than they otherwise could, causing problems that can cascade through the ecosystem.

All natural systems formed in the absence of developed societies and therefore all human activities contribute to shifting these ecosystems out of balance, whether it's the loss of wetland functions, discharges from wastewater treatment plants, or runoff from a variety of sources such as urban and residential areas, construction sites, and agriculture. The types of runoff just mentioned are also known as nonpoint source pollution and can carry elevated levels of P, among other pollutants. This form of pollution is extremely difficult to manage because it comes from a large land-base and the level of pollution varies in both location and time. The goal of the nutrient management research program here at Miner Institute is to understand how to minimize agriculture's part in this complex problem. By investigating practices that will minimize the export of nutrients from crop fields, we can keep them in the field where they will benefit the crops and the farm's profitability, and out of the water where they benefit nothing except the algae.

We currently have four projects ongoing that will help us reach these goals. For each of these projects we are continuously monitoring the rates of surface runoff and tile drainage (if installed) and analyzing the runoff for different forms of nitrogen (N), P, and total suspended solids (an estimate of erosion). Currently our longest-running site has four 0.25-acre field plots that have been used for several different projects since 2013. The current project is funded by the Northern New York Agricultural Development Program (NNYADP) and is now in its second year of monitoring the water quality in surface runoff and tile drainage from the alfalfa-grass plots.

Another project funded by the NNYADP is in collaboration with Adirondack Farms, who have given us the opportunity to install edge-of-field monitoring equipment on two of their fields (currently planted in corn). These fields have very similar characteristics [size (5.8 acres), soil type (Tonawanda silt loam), slope (mild), crop/nutrient application history], with the exception that in 2016, tile drainage was installed in just one of the fields. This allows us to gain a better understanding of how tile drainage is impacting the movement of water through the fields and the forms and quantity of exported nutrients.

This project, now in its second year, is a unique opportunity to understand the tradeoffs in nutrient transport that may occur when tile drainage is installed. It has long been accepted that installing tile drainage can significantly decrease erosion and soil-bound P losses, but research has suggested that the increased subsurface drainage rates can also significantly increase the losses of dissolved P and N. Tile drainage can also significantly increase crop yields and allow for greater uptake of nutrients, an important factor to consider, particularly in the dairy industry where manure management is an important part of the system. There has been limited research in the Northeast quantifying these impacts and with increasingly unpredictable and extreme weather, our goal is to generate a long-term dataset that characterizes these tradeoffs under a variety of conditions.

The remaining two projects are paired-field studies funded by the NRCS and are intended to identify practices that will improve nutrient retention in fields with surface and subsurface drainage. These projects are designed to have a two-year "baseline" period where two fields are managed exactly the same, while monitoring the water quality of surface runoff and tile drainage from each field. In the third year of the project, a practice is implemented in one of the fields while there is no change in the other. One of these projects, now in its fourth year, is investigating the impacts that drainage water management (raising the water table to 1 ft below the soil surface) in the nongrowing season has on N and P losses from corn fields. The second study is still in the early stages, as we have just completed the first six months of monitoring these corn fields and will continue for another 18 months before switching one of the fields to no-till corn production.

In future issues of the *Farm Report* I'll share results from each of these studies and discuss how the research has improved our understanding of the impacts of these management practices.

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EARLY SIGNS OF A SICK CALF

Anyone who has fed or managed calves has likely worked through getting a calf over a case of diarrhea. I don't want to speak for everyone, but I think one of the least favorite jobs when working with calves is working with a calf with diarrhea. However, it's important to provide supportive care for the calf to help get a faster recovery. The first three weeks of age are when calves are the most susceptible to a disease challenge leading to diarrhea. Around 10 to 14 days of age will be when calves are likely to have the most issues. It can be frustrating and calves go downhill pretty fast. Supportive care to help maintain their hydration status is one of the most important tasks of helping a calf get through a bout of diarrhea. Picking up on the signs early is key to ensuring calves do not get severely dehydrated.

Look for the signs:

1. Slower intake. As calves are getting sick they might seem like they are taking a long time to drink their milk. Do they keep taking breaks? Are they not quite as aggressive as they usually are? Do they seem to play with the nipple bottle more than productive sucking? This would be my first indication that they're not feeling quite right. If this is noted start keeping a closer eye on the calf and offer electrolyte solution between milk replacer feedings.
2. Refusing milk or milk replacer. If a calf had been consistently consuming its allotment of milk or milk replacer and then starts refusing to finish this should be a major red flag. When a calf gets sick, its body naturally may reduce the amount of nutrients it's consuming. During this time additional electrolytes should be fed in between normal meal times. Don't completely stop feeding a calf with diarrhea milk or milk replacer! Continue to offer milk or milk replacer because the calf still needs nutrients to support basic functions and help mount an immune response.
3. Fecal consistency. The consistency of the feces is easy to observe but might not be the first indication that the calf is about to be sick. However, observing the consistency of the feces is a good indication of how severe and how long the calf is experiencing diarrhea. Usually feces that is firm or pudding-like would be normal for a young calf and feces that is runny or like water is diarrhea. Calves with feces that are runny or watery need additional fluids. Providing electrolyte solutions in between normal milk or milk replacer feedings is highly encouraged to replace the water and electrolytes they are losing in the feces. If the hydration of the calf cannot be maintained with oral electrolytes solution, additional fluids given subcutaneously or intravenously may be warranted. Consult with your veterinarian to make a plan for these calves on your farm.
4. Look at the eyes and skin tent test. These are additional indicators of how hydrated the calf is. For eyes, look how far the eye is away from the lid in the corner. A calf that is healthy should have eyes that are bright, glossy, and not sunken into the skull. The skin tent test is also a quick measure of how hydrated a calf is. To do this test pinch a section of skin on the neck of the calf and count how long it takes for the skin to go back into place. As calves lose hydration their eyes will recede back from the corner of their eye and their skin will take longer to go back into place. The rule of thumb is 2 mm gap in the eye and skin that takes 2-4 seconds to return is milk dehydration. At this stage provide oral fluids. Moderate dehydration is when the eyes are sunken 2-4 mm and the skin test takes 6-8 seconds. If the calf has strong suckle response continue with oral fluids, if no suckle response the calf will require other forms of hydration. Finally, calves with eyes sunken more than 4 mm and a skin tent greater than 6 seconds will require additional fluid therapy to correct the severity of their dehydration.

The goal would be to be proactive about calves that are at risk of developing dehydration. Maintain their hydration status early by offering oral electrolytes in between milk or milk replacer feedings. Never mix electrolytes into milk or milk replacer. Provide water to calves at all times. Find a method of tracking the signs of calves that are sick on your farm and make it a goal to find the calves that are getting sick before they go off feed. On your farm, when are you able to identify calves first getting sick? Are there other signs you should be looking for?

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LACTIC ACID BACTERIA - THEIR IMPACT AFTER ENSILING

Most microbial additives for silage contain one or two species of bacteria from a group commonly called lactic acid bacteria because they produce lactic acid during forage fermentation. Their capacity to colonize plant surfaces, tolerate acidic conditions, and grow in the absence of oxygen allows them to survive the passage of feed through the stomach and to colonize the digestive tract. Lactic acid bacteria are thus considered beneficial microbes, a probiotic, protecting animals against several pathogens. On a daily basis, a cow fed a ration with 55 to 60% corn, grass, or legume silage will ingest more than a billion active cells of lactic acid bacteria.

Important changes are induced in the silage following inoculation with lactic acid bacteria. Some of these silage changes are specific to the genetic background of the different bacterial strains, which are grouped as either homofermentative or heterofermentative. The main difference between these groups is that homofermentative strains exclusively ferment sugars to lactic acid, while the second group can produce acetate as well.

A recent meta-analysis of 104 published articles on corn silage (Blajman et al., 2018. J. Appl. Microbiol.) showed that inoculation with lactic acid bacteria lowered silage pH, produced volatile fatty acids and lactic acid, improved aerobic stability (+ 65 hours), lowered the ADF content of the corn silage, and reduced proteolysis (i.e., lowered silage ammonium concentration).

Degradation of cell wall components leading to a reduction in ADF content during ensiling may be linked to an increase in dry matter intake by cattle. The number of cells of lactic acid bacteria was ten times higher, while yeasts and mold counts were ten times lower following inoculation. The gain in efficiency and aerobic stability was accompanied by a small decrease in water soluble carbohydrates, from 2.87 to 2.50% of dry matter. Several studies described how the plant cell wall is degraded by hydrolase enzymes. These studies reported that the degradation performed by these enzymes are more likely to improve silage quality when concentration of water-soluble carbohydrate is low.

The length of the fermentation process could also promote other benefits from the silage inoculant, including an increase in starch digestibility. Overall, transformation of the organic acids produced during the ensiling process will have a positive impact on the synthesis of microbial proteins in the rumen when the silage is consumed.

In a second meta-analysis published last year, a team from the University of Florida (Oliveria et al. 2018. J. Dairy Sci.) studied both the effects of inoculation with lactic acid bacteria and the performance of dairy cows. In the second part of their study, the data from 31 articles were analyzed for six parameters: dry matter intake, dry matter digestibility, milk yield, feed efficiency, milk fat, and milk protein. They observed that an optimal inoculation rate, equal or higher than 105 cfu per g (100 000 cells per g), was associated with an increase in milk yield. This improvement was independent of the type of forage and the species of lactic acid bacteria. Inoculation contributes to a significant increase in milk fat and milk protein production. Several hypotheses were proposed to explain the role of silage inoculant on milk yield: 1) increased dry matter intake due to lower butyric acid and ammonium concentrations, 2) lower concentration of biogenic amines, 3) reduced lignin concentration, 4) greater protein preservation, and 5) biohydrogenation of linoleic and linolenic fatty acids during ensiling.

Lactic acid bacteria are active in the rumen, but they mainly colonize the solid matrices of the forage during the digestion process. They may play a prominent role in digestion of fiber as observed by the team of Dr. McAllister at Lethbridge (Yang et al., 2018. Frontiers in Microbiology). Their exact role in rumen digestion has not been studied, and this could open the door to important future research.

Using silage microbial inoculants to preserve the nutritional aspects of the forage has economic benefits based on the intake and milk responses. Other potential benefits are free of charge from these microorganisms that are important contributors to industrial biotechnologies.

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Is there something you would like to know more about?
Send Farm Report article suggestions to Rachel at dutil@whminer.com

"IT'S A DRY HEAT"

For what seemed like the 47th time in February (a pretty high incidence rate for a month that only has 28 days), I contemplated the possibility of filing for workmen's comp if the wind were to completely take me off of my feet while standing on a patch of ice that seems to be ubiquitous this time of year. Don't get me wrong- I love winter. I wouldn't have stayed in the Northeast if I didn't. But there are only so many times you can acrobatically catch yourself while slipping on the ice before your luck completely runs out. Saved by the universal law that wipeouts don't count unless someone else sees it, I maintain that I've managed to avoid any sort of completely spectacular failure. That's my story, and I'm sticking to it. Although if I do go down in front of an audience, I fully expect to be judged on style.

In late February I attended the Vermont Dairy Producer's Conference in Burlington, VT, and listened to a talk by Dr. Geoff Dahl from the University of Florida on the carryover effects of dry-period heat stress. As a skier I'm not one to wish for the speedy return of spring and warmer temperatures. The information contained in Dr. Dahl's talk suggests that in the interest of herd health and production, perhaps the warm weather can take its time getting here.

Heat stress isn't an uncommon plight for farms; as temperatures rise, producers brace for the potential impacts it will have on their lactating herd. Metabolic and physical effects on lactating cows under heat stress are often manifested in the forms of lower DMI and decreased milk yields, with recovery rates dependent on the duration of heat stress. The effects on your dry cows are significant, too! There are numerous benefits to cooling dry cows, such as improved milk yield during their next lactation, increased calf birth and weaning weights, and higher calf survival rates. Cooled dry cows also had increased mammary cell production, as well as greater numbers of circulating lymphocytes (white blood cells), which translate to enhanced innate immunity and thus improved efficiency of passive-transfer antibodies in colostrum. (We talked about passive immunity last month, remember?) Cows in these studies were divided into two groups: One had access to cooling (fans, sprinklers and shade), and one did not (shade only). Some interesting data points of note: Cows that were cooled over a 46-day dry period tended to have greater milk production and more desirable milk fat concentration during the first 30 weeks of lactation than those cows that were subject to heat stress during this time. Heat-stressed cows tended to have a 7 day shorter dry period than those with access to cooling, and birthed calves that were approximately 11 pounds lighter than those from cooled cows. Lowered levels of production from dry cows re-entering lactation in the cooler months following the summer suggest that the effects of heat stress are not just limited to this time period. Studies referenced in Dahl's presentation also showed that heat stress on dams in the last six weeks of pregnancy can negatively influence growth and reproductive performance in offspring up to and through their first lactation. The effects of heat stress on calves in utero resulted in increased mortality and reduced rate of immunoglobulin G (IgG) absorption in live births, slower growth rate throughout puberty, and inhibited reproductive performance at first breeding.

Retrofitting barns to include more sophisticated cooling equipment can be a costly investment, but sound practical applications for keeping cows cool can be just as beneficial. As the warmer weather approaches, take some time to review your farm's procedures for cooling and make sure they are up to par. First and foremost, ensure that cows have access to cool water at all times, as well as plenty of shade. Limit holding time in the parlor as much as possible, and don't stress cows out by moving them too fast in the heat. Check ventilation in barns, and use fans to keep air moving. If your barns are equipped with fans and soakers or misters, give them a quick check to make sure they are in working order.

In the interest of protecting the future of a herd and setting up calves for developmental success, make sure your dry cows have full access to the "cool-kids" club*.

*Author has, in fact, never been part of the cool-kids club.

─ *Cari Reynolds*
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SPRING CLEANING

It's that time of year when winter starts to wane and spring is slowly making an appearance. As we daydream of nice spring days to start working the fields and planting corn, it's now time to prepare our equipment and the farm for warmer weather. This time spent will allow for minimal breakdowns and delays. We also need to remember important equipment in the barn such as fans and misters. These are only a few ideas for the endless list you could create.

You may have spent many hours considering which hybrid to plant; one of the first steps is to get the seed in the ground. This is a very important step where errors in planting can mean diminished yields. Ideally the planter will take the seed from the seed hopper and place each seed individually at the correct spacing and depth. An Integrated Crop Management conference proceedings by Purdue University reported that incorrect spacing is due to misadjusted or malfunctioning planter mechanisms. This can range from wrong disc size, worn finger-pickup mechanisms, or loose belts or chains. They report that for every 1-inch increase in the standard deviation of plant-to-plant spacing reduces yield by roughly 2.5 bushels per acre. Taking time to make sure the planter is operating at its best will provide the reassurance that you are maximizing yield.

When temperatures are still hovering around freezing it is hard to think of heat stress and how to prepare for it. One of the easiest ways to prepare is cleaning barn fans and mister lines and valves. Dust from bedding and feeding among other things accumulates on the fans and electric motors. This could cause the fan to rotate at slower speeds which means less air movement and less efficient energy use. The other danger of dust accumulation on fan motors is that it can become a fire hazard as the dust clogs the air vents. Ample air flow free from dust and debris is essential for the fan motor to cool and prevent fire hazards. Misters are also a vital component of cow cooling, and clogged misters will cause dripping and uneven spray. This will result in wasted water and fewer cows that can cool themselves. Researchers at the University of Georgia reported that when the temperature humidity index (THI) was above 72 every 1-unit increase in THI equates to a reduction in milk production of 0.44 lb. More recent research has established heat stress starting at THI of 68. Cleaning fans and misters is a dirty and time-consuming job, but the cows will thank you by being more comfortable and producing more milk.

— *Mike Miller*
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ANNUAL REMINDER

Dollars are tight on dairy farms but you still should apply nitrogen on grass and mostly grass hay fields. N will increase yields — up to double depending on past manure practices — and (based on Miner Institute research) increase crude protein by about half, from 12% to 18% CP. Nitrogen starts to work almost immediately after spring green-up, so you'll make the gains in only 5 weeks or so. Note "make" instead of "see" because much of the yield increase is in a denser stand, not necessarily taller plants. Farmers tell me that they don't fully appreciate the difference early spring N makes until they look at the size of the windrows behind the mower.

Use about 70 lbs. of actual N—90 lbs. in especially good stands. A 50-50 combination of urea + ammonium sulfate is top choice, but if you manured the fields last year or over winter you could save a few bucks by using straight urea. April-applied manure is a great option providing you can get it done in a timely manner without making a lot of ruts. Some farmers can, most can't. N prices are up, but—pardon the double negative--this is something you can't afford not to do.

After first cut, by which time grass fields should have firmed up, these are prime candidates for manure application. It should be possible to meet the N needs of second cut grass with a moderate application rate, and one dose per season should provide all the P, K, and other nutrients most grass crops need. Given the abundance of manure on most dairies, I can't see why dairy farmers should ever need to apply any fertilizer except N to grass fields.

— *E.T.*

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Closing Comment

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