FARM REPORT

In This Issue:

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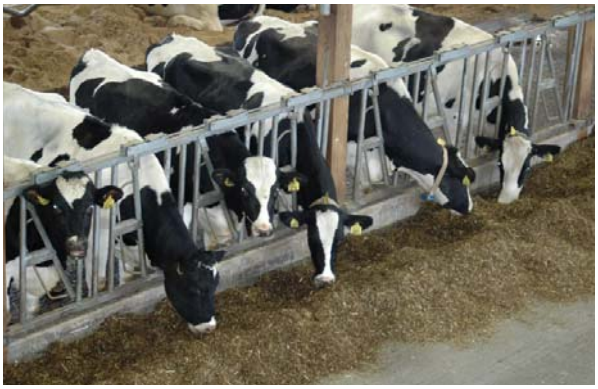
FROM THE PRESIDENT'S DESK: GETTING PUSHY AT THE FEEDBUNK



Recently I was asked about differences between headlocks and the simpler post-and-rail feed barriers. Do cows have a preference? Do they eat more feed with one system or the other? If pens are overcrowded, are headlocks a good idea? It's an important question that crops up regularly, so here is my answer to the consultant, slightly expanded and tied back to the published scientific literature.

In 2005, Marcia Endres, from the University of Minnesota working with the well-known University of British Columbia group, published the first direct comparison between headlocks and post-and-rail feed barriers that I am aware of (2005. J. Dairy Sci. 88:2377). They compared a standard design post-and-rail with a 24-in headlock and found that daily feeding time and dry matter intake did not differ between the two. This research agreed with an earlier farm study by Kansas State researchers that also found no difference in feed intake between post-and-rail and headlocks. Interestingly, there were about 21% fewer displacements at the feedbunk for cows fed in headlocks versus post-and-rail. This research led us to the conclusion that headlocks are effective at reducing aggression at feeding, and they especially enhance feed access for subordinate cows during peak feeding times (i.e., 1 to 2 hours after feed delivery).

Common industry recommendations also include: 1) avoiding the use of headlocks at the feedbunk for aversive procedures so that the cow does not equate the two which might negatively affect feeding behavior, and 2) making sure that cows are exposed to headlocks as growing heifers so that they won't be a new experience to the cow when she calves and enters a fresh pen or milking string.

Another study by the British Columbia group took the comparison one step further and looked at the interactions of feed barrier design with stocking density (2006. J. Dairy Sci. 89:126). In this study, they evaluated

See **FEED BUNK**, Page 2

RUMINATE ON THIS

Dairy cows consume forage fiber, which will be fermented in the rumen. This starts with the cow reducing the particle size of the forage and coating it in saliva. During the fermentation process, the fiber will be regurgitated and chewed again to help reduce particle size and is called rumination. Rumination is a vital part of the fermentation process that helps to breakdown the fiber and provides a buffer for the rumen. Cows spend on average 8 hours a day ruminating and prefer to ruminate while lying down compared to standing. As producers, we need to optimize this behavior to prevent poor rumen function such as sub-acute rumen acidosis (SARA).

The diet and environmental factors can cause decreases in rumination, such as not providing enough physically effective fiber in the diet. The environmental factors can range from heat stress to overcrowding and can decrease rumination from 10 to 20%. A study conducted at the Institute investigated the effect of overstocking (100% vs. 142%) and addition of chopped straw and reported no effect of stocking density or addition of chopped straw on rumination time. When cows were overstocked, it decreased the amount of time cows ruminated while in a stall by 5.3%. As cows have to compete for stalls, the amount of time spent in stalls decreases, which decreases the rumination while in a stall.

What the cows have for bedding can also affect the amount of rumination while lying. At the Institute we have sand-bedded free-stalls and mattresses with sawdust in free-stalls and have conducted trials in both. I summarized these trials in both pens and compared the amount of time cows ruminated while lying. The cows in the sand-bedded free-stalls spent 88.2% of the time ruminating while lying down and 11.8% ruminating while standing. The cows on mattresses with sawdust in free-stalls spent 78% of the time ruminating while lying and 22% while standing. This difference could be due to cows being more comfortable on sand compared to mattresses. To promote lying and rumination while lying, cows need to be comfortable.

Rumination is an important part of the fermentation process for dairy cows and can help to reduce particle size and buffer the rumen. Cows prefer to ruminate while lying down and maximizing this behavior will prevent any digestive upsets such as SARA. As producers, we can reduce lying time by overstocking the pen and what bedding we offer. So to maximize ruminating while lying, it is essential to provide opportunities to lie down and be comfortable.

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FEED BUNK, Continued from Page 1

manger space of 32, 24, 16, or 8 inches/cow in a post-and-rail system versus 1.33, 1.00, 0.67, or 0.33 headlocks per cow.

Not surprisingly, cows were displaced more frequently from the feedbunk as stocking density increased for cows fed at the post-and-rail. And again, not too surprisingly, the negative effects of overcrowding the feedbunk were most pronounced for subordinate cows such as first-calf heifers or smaller, less competitive cows.

In this study, use of a feed barrier that provided physical separation between adjacent cows – which is exactly what a headlock does – reduced competition at the feedbunk and the number of aggressive interactions and displacements. This improved overall feeding activity. Essentially, headlocks help to define a cow's eating space for her. Headlocks reduce a dominant cow's ability to displace multiple cows at one time by simply moving down a section of feedbunk and threatening from the side. A useful analogy would be "shucking peas in a pod."

More recently, researchers from the UK (2010. Appl. Anim. Behav. Sci. 127:20) compared 22 or 8 inches of feedbunk space per cow with a post-and-rail system versus vertical bars (but not headlocks) that created individual head space for the cow. So, their feed barrier comparison was not exactly like the previous studies, though similar. Like the Canadian studies, there was no effect of feed barrier type on dry matter intake. Also, similar to the previous research, they observed that individual feeding space made it more difficult to displace another cow. They did notice more aggression with the vertical feed bars, unlike the previous work, and so more research is needed to really tease this aspect apart.

The bottom line is that you can expect no difference in feed intake between headlocks and post-and-rail systems. And if your pens are overcrowded there may well be an advantage for your cows as they seek to eat in a competitive feeding situation.

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CATCH MY DRIFT? PROCEDURES HELP KEEP COSTS LOW

One of the projects I've been working on during my time at Miner Institute is optimizing the current state of our Standard Operating Procedures (SOPs) and training methodology. I'm no stranger to following procedure to the letter; I spent the better part of a decade as a vaccine manufacturing technician and a quality assurance specialist for a large biologics and rare-disease drug company. In this type of environment, the consequences of not following procedures are stiffer than most. If the drug isn't formulated properly, testing procedures aren't appropriately followed, or packaging materials aren't accurate the end result could very likely be death or a severe adverse event for the consumer. Initials are required at every step for accountability and traceability. And no, the FDA is not above digging through the trash if they have reason to believe that information may have been inadvertently discarded. (I've seen them do this.) While procedural drift in the agriculture industry may not result in as dire of an outcome, small changes over time can cause safety concerns and threaten your bottom line.

"Close enough", "good enough", "this is how it's written but we do it this way because it's easier". Seems harmless, right? If the teat dip exposure time is 30 seconds, but I wipe and strip at 28, what's that two seconds matter? The feed mixing time is 10 minutes, but I've got something else to do, so 9 should be good enough. These are two of the examples that a recent article from Penn State Extension provided in discussing the financial and occupational safety repercussions that can result from even the smallest of procedural drifts over time, and the impact that a cavalier approach to compliance can have. Procedural drift is defined in the article as "The difference between what is written in a policy and procedure and what is happening in real life on a day-to-day basis." Not only do well-written and managed procedures protect your finances and your employees, they contribute to the consistency that cows seek by providing the means for everyone to do the task the same way, each time. Routine tasks can become boring, and it's tempting to cut a few corners in what seems to be a more efficient manner of doing things. But if those two seconds less of exposure time means that not all bacteria on the teat have been killed, or that one minute shorter mixing time means that there's now a risk for feed sorting or metabolic issues, you're potentially facing a costly result that could be prevented by simply following procedure. Those two seconds or one minute could be the difference between paying for mastitis treatment and having less milk in your tank, or time and money wasted trying to mitigate unnecessary digestive issues. Perhaps most importantly, safety is also compromised when shortcuts are taken, and costs and lost time related to injury from improper use of equipment can really take a toll on labor.

It's important to remember that procedures are not arbitrarily written. Measurements, timing, and other values are proven and effective best practices to achieve highest levels of safety and quality, and exist within a procedure for a reason. As a management strategy, there are several ways to ensure that your procedures are consistent, functional, and realistic for your employees' day-to-day needs to lessen the temptation of protocol drift. When writing a procedure, make sure it is written in language that is easily understood by all. Target a 7th-grade reading level for vocabulary, and don't write too technically or scientifically. Seek input from reliable employees who perform the tasks daily to help structure procedures in ways that make sense, and for use of proper terminology. Involving employees in the writing and editing process will help them feel like their input matters and their voice is heard. If employees ask why something is done a particular way, explain in terms of the end result to put it into context. Review your procedures in a timely fashion to make sure that nothing is out of date, too vague, or difficult to understand, and retrain or refresh employees as needed. Finally, monitor employees to make sure procedures are being followed, and enforce as necessary.

The Penn State article encourages the reader to take time to think about "all of the little things that could be just a bit off track" with regard to operations, and what the potential impact could be. I encourage you to do the same; I bet you'll be surprised at what you find.

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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

HIGH-CHOP CORN SILAGE

One of the topics suggested by readers was high-chop corn silage "from a digestibility standpoint." There was a fair amount of interest in high-chop corn silage about 15 years ago, which is when Miner Institute did field-length strip trials comparing 8" and 17" chop heights. There even was some interest in a 30" chop height, but that seems rather extreme since in fields with short plants it could result in a new type of silage: Tasselage!

This corn was chopped at a 17" chop height. Expect the corn silage from this field to be higher in starch and predicted milk per ton but lower in yield. High chop corn silage is a good option when overall corn yields are high but not for corn that's much above or below the recommended 32-35% DM harvest stage.

There's renewed interest in increasing corn silage chop height, which simply is a trade-off between yield and quality: Maintain a constant weight of kernels in a decreased weight of corn silage dry matter, and starch % increases. You might think that leaving the bottom of the stalk in the field would result in much higher NDF digestibility, but NDF-d changes less than many folks think it should — university dairy nutritionists included. This includes one respected enough to be anointed as Eminent Ruminant Nutritionist (ERN), a term I coined many years ago, first saddling Charlie Sniffen with the designation. This fellow had his research staff do a high-chop corn trial, and when they cranked out the numbers and he saw what he considered to be the small differences in NDF-d he was incredulous — so much so that he had them re-run the analyses. The analyses were right, his presumptions were wrong.

In a summary of 11 trials comparing 7" and 19" chop heights, high-chop corn silage had 7% lower yield but was 5% higher in predicted milk per ton of silage (based on an equation using NDF-d). Milk per acre was about 2% less with high chop. These results are similar to what Miner Institute found in its research.

Should you high chop corn silage? Three comments to help in making this decision:

- First, what is your current chop height? Not what you assume it is; have you actually measured the height of your corn stubble? Some farmers will discover that they're chopping higher than they think they are — 8-9", not 6-7". Chop height is often influenced by field topography. California farmers chopping corn on stone-free, laser-leveled fields sometimes chop at 2". Is it any wonder that "Left Coast" corn silage is higher in yield but lower in quality than that grown in the Northeast? Ash levels are also higher…hmmm. One North Country farmer told me that his chop height is just above the biggest stone left in his fields. If you're already chopping at 10", don't expect as much of a change from going to 18" as if your chop height was 6".
- Don't chop BMR corn, which has high NDF-d from top to bottom. Don't chop immature corn — lots of that will be around this fall — since stalk digestibility is higher in immature corn, and there's not much grain in milk-stage corn. And don't chop corn that's much over 35% DM at 6-8" chop height because high chopping could increase dry matter % enough to make it hard to ferment.
- There's nothing magic about 6" vs. 18" chop height. Any change in chop height will affect silage quality. (Some report lower butterfat % when feeding high chop CS.) The good news is that you don't have to make final chop height decisions until it's time to harvest. If the crop is at typical corn silage maturity (32-25% DM), yields are high and sale or storage options are limited, raise chop height just enough to fit the crop into your silos. Put high-chop corn in a separate silo and analyze it before feeding since you may be able to reduce grain feeding rates. As always, do this in consultation with your dairy feed consultant.

— *E.T.*

WATER QUALITY IN COLD ENVIRONMENTS

In the three previous issues of the *Farm Report* I shared results from three edge-of-field (EOF) water quality monitoring projects that are currently ongoing at Miner Institute. I concluded last month's article stating that a common theme across these three projects (not to mention all of our previous EOF projects) was the importance of the nongrowing season (NGS) as the critical period for runoff and nutrient losses. I'm certainly not the first to make this observation and as luck would have it, the most recent issue of the Journal of Environmental Quality highlighted this topic with a special section that includes the findings of 23 recent studies designed to improve our understanding of agricultural water quality in cold environments. The first article, by Liu et al., synthesizes the findings of the individual articles that follow with a discussion of the challenges unique to agricultural systems in cold environments, what is driving the runoff and nutrient loss processes, the state of our knowledge on how best to manage these systems, and areas that future research should address.

As any farmer in the Northeast knows, one of the primary challenges is our short growing season. This results in management decisions that may be difficult to avoid, but are not ideal from a water quality perspective. Fall application of manure is a prime example of this. Many studies have demonstrated that a significantly greater percentage of applied nutrients remain in the field for crop uptake when applied in spring as compared to the fall. However, the short period of time between when fields are first trafficable in the spring and when crops must be planted, in addition to the limitations of manure storage, often necessitates fall manure applications on many farms. Recognizing and understanding this risk is important and best management practices (BMPs) must be evaluated in how effectively they can address this concern.

One of the reasons that fall nutrient applications present such a risk is because the nongrowing season (NGS) often contributes the majority of annual runoff, even though there is often a similar amount of precipitation compared to the growing season (GS). This may vary some from year to year, but in the first three years of an EOF project at Miner Institute, about 75% of annual runoff and nutrient loss occurred between November 1st and May 1st. Very similar results were found by multiple research projects conducted in the Great Lakes region that were included in the special issue.

The increased rates of runoff in the NGS, despite similar precipitation totals, is the result of several factors. First, there are much lower rates of evapotranspiration due to the cold weather and absence of a growing crop. Therefore, water (and nutrients) is naturally removed from the soil at a much slower rate and thus is more available for runoff. Second, as the soil freezes there is limited to no movement or further storage of water in the soil profile. Once there is a frozen surface layer, or a frost layer at depth in the soil, there will be limited infiltration and any subsequent rain or snowmelt will only be able to drain through surface runoff processes. Finally, in contrast to rainfall that tends to be more evenly distributed over time, snow tends to accumulate until warm conditions result in the release of most or all of the snow water. This sudden release of meltwater (and possibly rain) greatly exceeds the water holding capacity of the soil and causes high rates of surface runoff (and tile drainage if unfrozen ground).

There are numerous consequences on the nutrient dynamics with these changes in drainage processes. When water is forced to run off the surface, there is limited opportunity to interact with the bulk of the soil profile and to allow nutrients to be immobilized by soil particles. If the surface soil is completely frozen, there will be virtually no interaction between the nutrients in runoff and the soil. However, if and when the surface soil isn't completely frozen, this may present yet another type of risk, as the surface is often more enriched with nutrients relative to soil at greater depth. During prolonged saturation as can occur with snowmelt, soils may release phosphorus (P) to drainage water and fields with high levels of P may further contribute to nutrient losses.

Not all cold climates are the same, but many of the studies in the special section took place in the Great Lakes region and have many similarities to the challenges we face in the Lake Champlain Basin. One of the messages of this article is that many BMPs were developed in warmer regions and then adopted in colder regions. There is likely to be minimal difference in BMP performance during the growing season as these periods are relatively similar. However, in some cases, these practices may exacerbate water quality conditions due to the extreme differences in NGS runoff and nutrient loss processes in cold climates.

The introductory article references cover crops and no-till production as two such practices that have been widely adopted, but deserve a second look in cold environments. While

See **WATER QUALITY**, Page 11

SILK PURSES AND SOWS' EARS

Getting corn planted on time was difficult and in some cases impossible due to horrible weather. Corn planted in May should be silking in August, but what about the more than 50% of NY's intended corn crop that in early June was still sitting in the seed bag? It's almost certain that dry matter yields will be reduced for corn planted in June unless we have a lot of heat in August and September accompanied by sufficient rainfall. Even favorable weather probably won't be enough for corn planted after mid-June. Switching to earlier-maturing hybrids will have helped, so will late-planted corn's tendency to make up for lost time. As we've noted before, one answer to the question "Will my corn mature for silage before a killing frost?" is another question: "When did it silk?" Normally it takes the corn plant 6 to 7 weeks to progress from silking to 32-35% whole plant dry matter. Corn that silks by mid-August has a good chance of reaching full silage maturity before the first 28°F frost, which on average occurs in early October in much of Northern NY, mid to late October in the rest of the state. A whole lot of corn won't be silked by mid-August — what then?

1. Every day past mid-August that corn hasn't yet silked means that you'll need increasingly good late summer weather to reach silage maturity. The 6-7 week guideline assumes summer weather conditions, not the shorter, cooler days of late September. Therefore, hope for the best but plan for the worst — and don't expect miracles.
2. As mentioned in the June Farm Report, avoid ensiling very immature corn in upright silos, especially concrete stave silos because sub-30% DM corn silage increases deterioration of the bottom staves. Drive-over piles and bunker silos are a better place for immature corn silage but you'll need to manage the silage effluent — a hot-button issue with environmental regulators. Ensiling immature corn silage in a silage bag can make a real mess. There really is no "good" place to ensile early milk-stage corn.
3. Waiting for frost to dry corn leaves and increase whole plant dry matter is a time-honored but risky proposition, especially if the corn is in fields that don't handle fall rain very well (which may be why they weren't planted until June). Corn ears that have tightly wrapped husks can mold very quickly after a killing frost, and often a spell of warm, sunny weather (great for mold formation) follows a hard frost.
4. Even though it's one more expense, you should apply a bacterial inoculant to your corn as it's chopped regardless of the dry matter content. This is particularly important if you're chopping after frost since frost — or even a run of cool fall weather — reduces the population of "wild" fermentation bacteria.
5. Finally, take photos of your sodden fields and sad-looking corn for future reference. Eventually the dairy economic situation should improve enough that you'll have some money to invest in capital improvements. At that time seriously consider subsurface drainage for these fields. If you're deciding between that and another capital investment (including something with shiny paint) look at those photos and remember the spring of 2019.

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BE THANKFUL FOR WHAT YOU HAVE

The Bride and I recently had two missionaries to Thailand — husband and wife — as house guests for a week. They've spent the past 23 years in a city of over 1 million about 8 hours south of the capital of Bangkok and were in the states for some R&R for a few weeks before heading back. The husband had once been the pastor in a church near here, and we were a convenient base of operations during their stay.

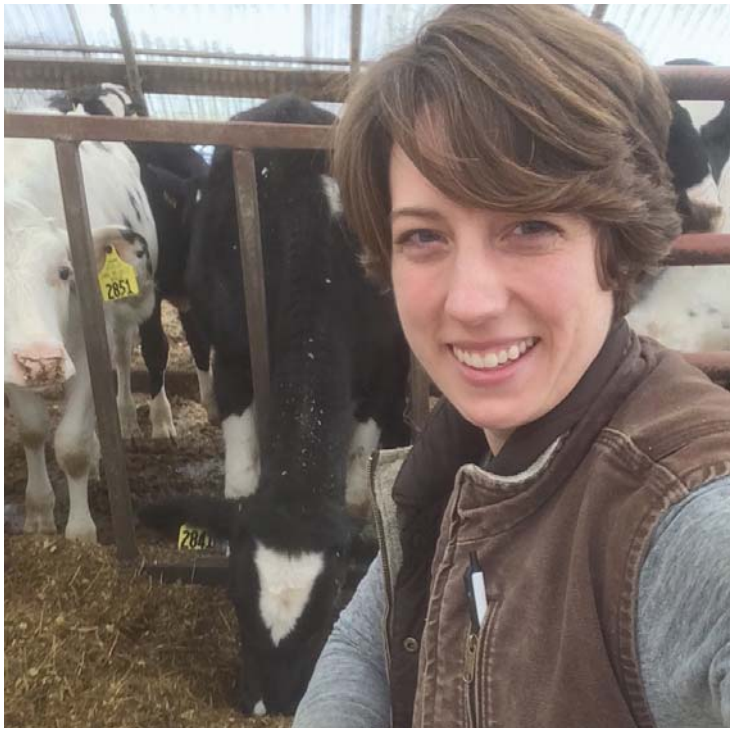
Those of us in the Northeast have spent quite a bit of time this spring and summer complaining about the rotten weather, and TB and I have been grousing because our home is next to the shore of the St. Lawrence River which has been at flood stage since May. Our problems were put into perspective when learning about air quality conditions where our missionary friends live. This morning the AQI (Air Quality Index) here was 4, which is very low — and low numbers are better. You can access a map of AQI for any zip code as well as any place in the world via the below URL. An AQI over 150 is considered "Unhealthy" while anything over 300 is "Hazardous to health" and may trigger emergency warnings from government environmental officials. I experienced an AQI of 280 during a brief stay in Shanghai, China and one of the guys I was traveling with and I had scratchy throats an hour after arrival. Sometimes the AQI in Thailand exceeds 800 (not a typo)! Our friends showed us a photo taken in their Thai kitchen (where they have an air quality monitor, which should tell you something) showing an AQI monitor reading of 550. They also mentioned how nice it was to be able to drink the tap water in our house since in Thailand even the locals don't drink what comes out of their taps.

Our local weather problems are distressing, but temporary — this too shall pass. We have much to be thankful for, including drinkable water and some of the cleanest air on the planet. Sometimes it takes brief exposure to how other folks live to remind us of this.

https://airnow.gov/index.cfm?action=aqi_brochure.index

— *E.T.*

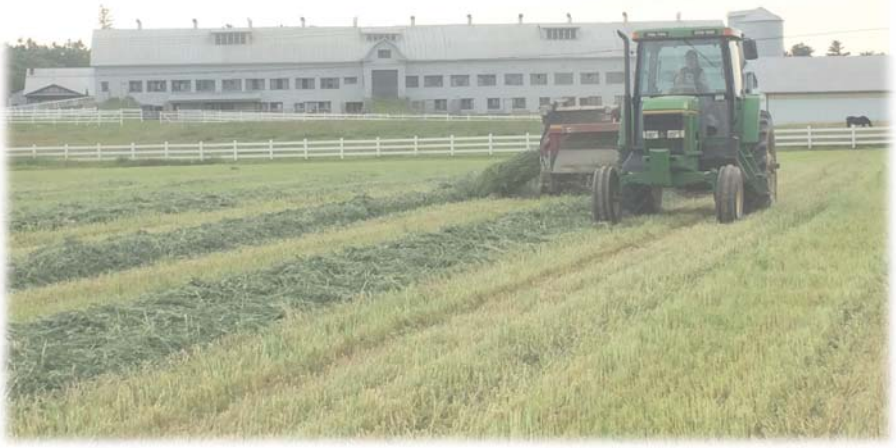
WHAT'S HAPPENING ON THE FARM



In the fall of 2006, I arrived at Miner Institute for a one-year herdsman internship. Little did I know the internship would turn into a full-time position, and I would stay at the farm for 13 years managing herd health, working with college students and research staff. I studied dairy management at the University of New Hampshire and knew that I wanted to work as a herdsman after graduation. The challenge of managing a dairy herd looked like a lot of fun…and I was right – it is a lot of fun! My college courses laid a strong foundation, but there was a different type of education I gained as I began to work on the farm. As I dug in and gained hands-on experience, everyone at the Institute was so patient with me and helpful; It's an environment that encourages and fosters education and learning. In time, I became more and more confident and knowledgeable, but managing a dairy herd remains a team effort. And I worked with a really wonderful team of people at the dairy! There is a bond that forms when you work hard together towards a common goal. We have worked together in the pouring rain, on -20 degree days, in blowing snow, on hot, humid summer days and on gorgeous, cool autumn days. We have been covered in manure, grease, sweat, silage effluent, calving fluid, and J-lube. We have worked together on fun, easy days and on stressful, overwhelming weeks. Together we have operated the dairy, keeping the cows healthy and productive; the herd size has grown, we've made progress genetically, our forage quality has continued to improve and our rolling herd average is up to 31,876 lbs. This has been the past 13 years of my life, and it has been quite a ride!

But this is my last Farm Report article because in August I'm heading off to a new adventure - nursing school! I am trading in my jeans and rubber boots for scrubs…I still get to use a stethoscope but no longer will I be listening for rumen contractions and a displaced abomasum!

These past years at the farm I have learned about hard work and attention to detail, prioritizing tasks and managing numerous tasks at once, working as a team and communication and leadership. These things will serve me well in my next career and for the rest of my life! I am incredibly thankful to have worked in the dairy industry and with such a great group of people at Miner Institute. I am really going to miss working alongside them – they are hard-working, kind and dedicated. To all the students that have come through the Institute – you made my job so rewarding! I loved being a herdsman, but also really loved working with the students, helping them gain hands-on experience in dairy management. It was a pleasure getting to meet and visit with Farm Report readers at dairy meetings! As I get started with school and a new schedule, it will be really strange not to be in the barn, working with the cows and employees on a daily basis. I am excited for this new adventure and at the same time incredibly thankful and happy for the time I spent working as a herdsman at Miner Institute!



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NEW INTERN AND SOME DAIRY *Faith*

Miner Institute has been a welcoming place the last few weeks as I begin my year-long research internship. I'm hoping that my experiences here will help me transition into a productive member of the dairy industry. I would like to pursue an M.S. in a field relating to ruminant nutrition and potentially become a nutritionist. From my experiences growing up on a small dairy farm in Oneida County, an education through 4-H and a B.S. at Cornell University, I've learned that dairy nutrition can have a huge impact on the health and productivity of dairy animals. But perhaps most importantly, dairy nutrition will determine the bottom line and success of a dairy business.

My ultimate career goal is to use biology and information science to help farmers run a successful dairy business. When I tell people this, they sometimes question this aspiration. Going to a larger and diverse university, I have non-ag friends that questioned the future value of studying agriculture. Probably most startling for me, I ran into hardened dairy farmers who questioned me in a similar manner, and I can understand why. The issues regarding consolidation, low milk margins, and labor in the dairy economy have been challenging. My family dispersed our dairy herd after my sophomore year at Cornell. But I don't highlight these challenges in pessimism. Although agriculture is changing, these changes are leading to opportunities for young people in the dairy industry. To anyone who might be hesitant in encouraging someone to pursue agriculture: there is still a bright future.

Demand for food isn't slowing. My internships have included working as a herdsman and as a sales intern for Purina/Land O'Lakes. Internships and other opportunities have also taken me to make cheese in Italy, work with cows in Ireland, and to analyze dairies in China. Working in these positions, it's clear there is still a need for workers and managers with an education like my own. Months before graduation, every member of my Dairy Fellows class was offered a position. These offers came from farm managers, governmental agencies, and even E-commerce titans. Some of my peers are continuing their education in graduate school, focusing in agricultural topics. From my personal experiences and the experiences of my peers, there are still many good jobs in dairy.

Look at the statistics: The USDA Economic Research Service has determined that agriculture and related industries account for 11% of U.S. employment, though direct on-farm positions account for approximately 1% of employment. There are still jobs in agriculture, but the skill sets needed for these jobs are shifting. Purdue University analyzed employment opportunities in the U.S. for college graduates in food, agriculture, renewable natural resources, and the environment. They found that in these fields, it's expected that 57,900 positions will open annually for graduates with bachelor's or advanced degrees. Half of the openings are projected to be in the form of business and management, almost a third will be focused towards STEM positions, while there will continue to be a large number of positions in education, communication, and governmental service. The current number of annual graduates with expertise in agricultural fields doesn't meet the demand. Employers are filling 39% of agricultural openings from applicants within biology, business administration, and engineering.

Purdue has further noted that available jobs mimic market trends supported by consumers and governmental policies. There is an increased need for skills in purchasing and marketing strategies as consumers are interested in E-commerce. As environments are changing, there's an increased demand for water, soil, and biomaterial engineers. Computerization and software development for precision agriculture is growing. There is still a high demand for animal production in poultry, dairy, and swine leading to opportunities for veterinarians, experienced managers, and technicians. Increase in food and environmental regulations means more inspectors and specialists.

The skills needed in agriculture are changing, but I'm very confident that many young professionals will find rewarding careers in dairy and agriculture. It's OK to encourage someone to pursue a career in this field. The field of agriculture and dairy is as important as ever, with changes leading to new opportunities. I'm very excited and hopeful for my career in the dairy industry. I look forward to my time here at Miner Institute, and if you're around the farm, please say hello!

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HAY OR NAY? WHEN TO CONSIDER FEEDING HAY TO CALVES

A common question I get is should I feed hay to my calves? Usually, I'll give a very safe answer of "It depends." However, to provide a little more context, following are several considerations when incorporating hay into your preweaning nutrition program.

What are we trying to achieve with our solid feed program in our calves? If you think about a beef calf out on pasture and nursing from mom, the calf will also mimic mom by starting to eat fresh grass. Fresh grass is an excellent source of sugars, fructans, non-lignified cell walls, which result in high butyrate fermentation. Fresh grass helps to stimulate the development of the rumen wall and provides some material for the calf to ruminate. However, the calf won't consume enough grass early on in the milk feeding phase to develop the rumen until closer to being weaned, which is typically much later than dairy calves, around 6 to 10 months of age. The main nutrient supply is from the milk. In contrast, we usually feed our dairy calves to develop the rumen to a greater extent within the first 2 to 3 months of age and wean them from milk at an earlier age. In both systems we have the goal of transitioning the calf to a ruminant that can digest and utilize solid feedstuff to meet maintenance and growth requirements.

Not all feeds are created equal when it comes to developing a rumen. Milk or milk replacer does little to develop the rumen, as the milk should be shunted past the rumen to the abomasum. Additionally, hay provides little substrate for fermentation and development of the rumen epithelium; however, it will increase the volume of the rumen with increased intake. It does this by increasing the musculature and volume of the rumen but provides limited microbial establishment or rumen epithelium development to contribute a significant amount of volatile fatty acids. A well-formulated starter will provide fermentable carbohydrates that will produce volatile fatty acids. Butyric acid and some propionic acid from the fermentation of starter will stimulate the development of the rumen epithelium and papillae in a similar manner to fresh grass that has soluble fiber and sugars. Therefore, feed type is very critical when considering what components to incorporate into the preweaning calf program. I would encourage you to look at pictures of rumen development taken at Penn State (https://extension.psu.edu/photos-of-rumen-development). These pictures show how different the effects of feedstuffs are!

Hay may not provide the nutrients to help develop the rumen but could promote other aspects of rumen health and development in calves. Physical characteristics of starter could impact the effectiveness of hay incorporation in the calf program. A study (Porter et al., 2007; PAS 23:395-400) evaluating either a pelleted or a mash (texturized) starter observed that calves fed the mash had earlier age to first rumination, increased starter intake, and increased average daily gain. While this study doesn't directly evaluate how hay impacts intake and growth, it highlights the impact that physical form of a diet in calves can impact intake and growth.

Other studies have evaluated incorporating chopped oat hay with a pelleted starter, finding that calves provided hay had higher starter intake and average daily gain compared to calves not supplied with hay. Furthermore, there have been other studies that have fed different types of forage fed to calves, and it appears that when chopped and included at 5% or less of total dry matter consumed there are some positive influences on starter intake and gain. Providing hay to calves fed pelleted starters could help provide some of the "chew" factor that a texturized starter might typically provide without providing hay. As calves start to develop their rumen, rumination is likely a critical part of creating good rumen health through buffering and microbial establishment, but we continue to learn more in this area. The information we do have indicates that hay can have some positive impacts on calf intake and growth. Ultimately, focusing on promoting starter intake in preweaning calf programs and immediately postweaning but including chopped hay could help increase pelleted starter intake and rumination in calves.

In my next Farm Report I hope to cover the different types of forage for calves and how the composition of forage and starter will influence success in calf programs. Stay tuned!

— Sarah Morrison
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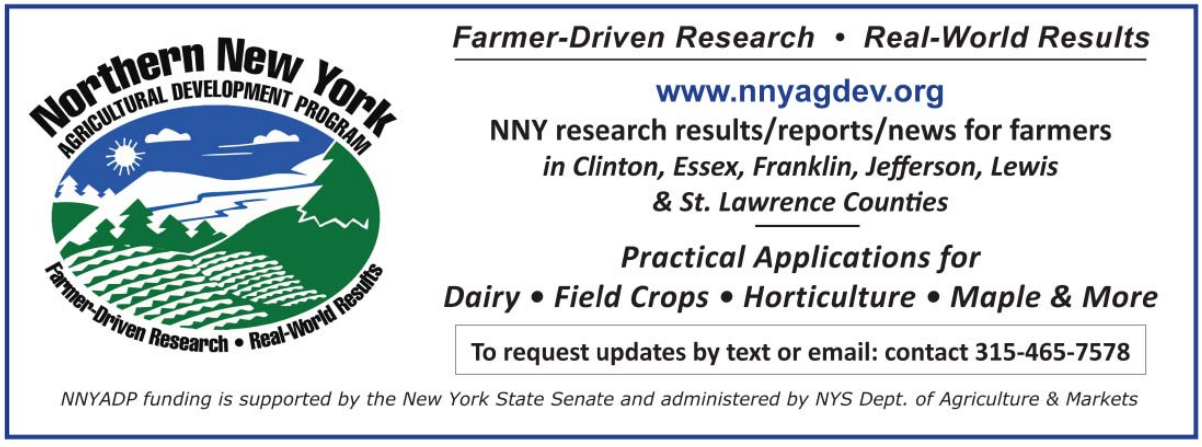

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WATER QUALITY, Continued from Page 5

these practices are extremely effective at reducing erosion-induced P nutrient losses (and nitrogen losses in the case of cover crops), they may increase dissolved P losses in some cases during the NGS, particularly during extremely cold winters. This is not an excuse to abandon these practices altogether, as they still have many other beneficial effects for soil health and crop production. However, it does point to the need to conduct additional EOF studies with these practices in order to understand more precisely how they function when they are adopted in cold environments. If they do pose new challenges, we need to identify additional practices that can be paired alongside them in order to fully achieve our regional water quality goals.

— Laura Klaiber
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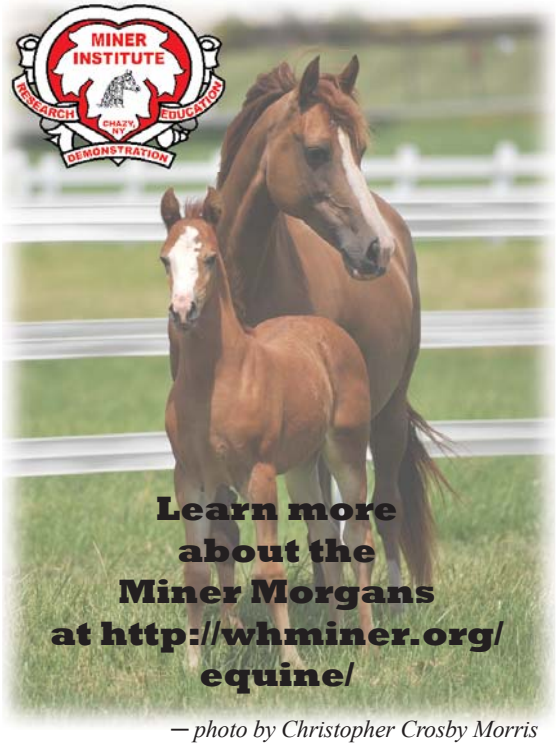

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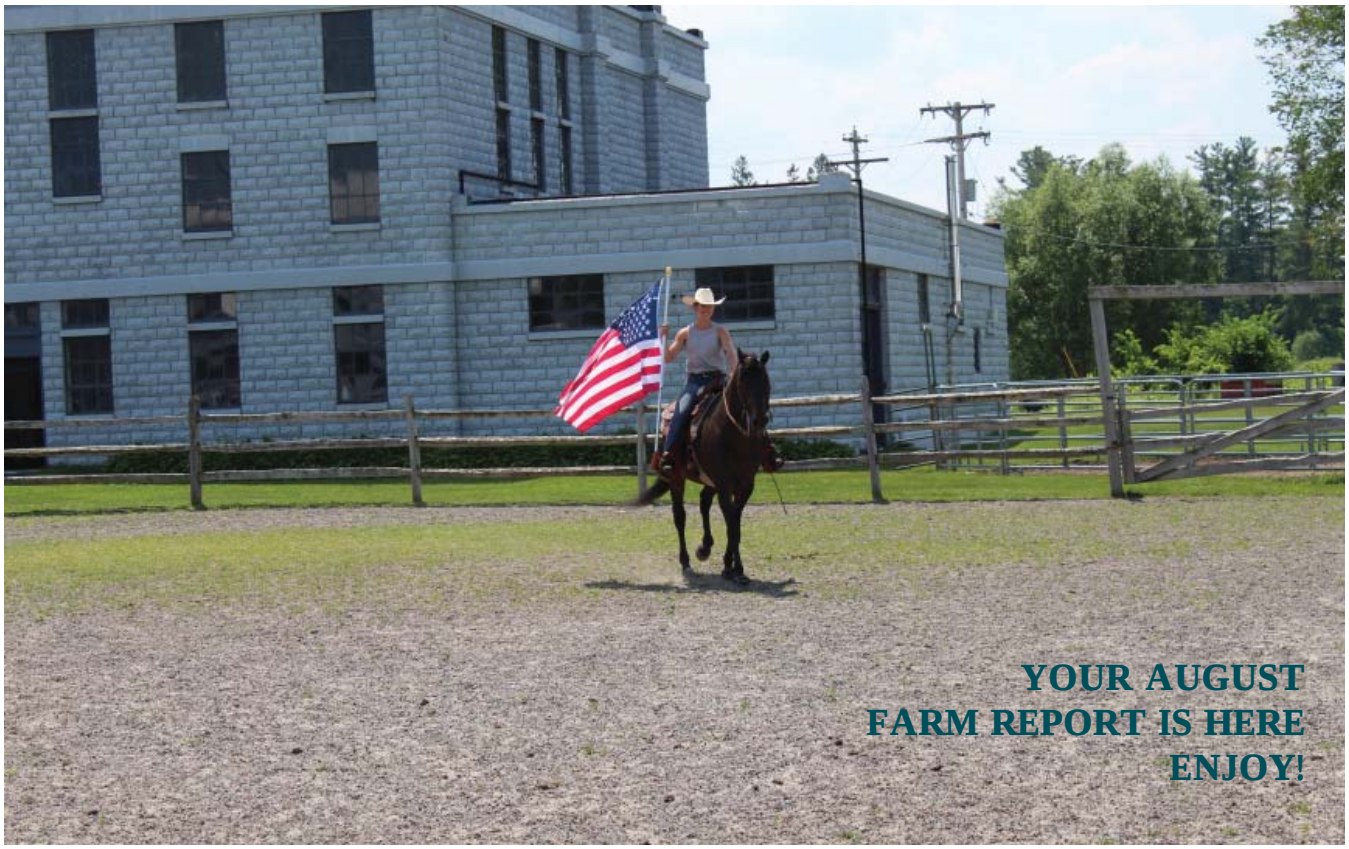

Closing Comment

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