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FARM REPORT

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FROM THE PRESIDENT'S DESK – LOAFING AROUND THE BARN

Ever since we've moved as an industry to housing dairy cows indoors for most if not all the year, there has been interest in understanding how providing an open, loafing area may enhance natural behaviors, health, or productivity. Research tells us that access to a loafing area with typical free-stall barns may allow cows to more freely engage in social, grooming, and estrous behavior, to say nothing about any potential effects on feeding and resting.

A recent report by Scottish researchers (Appl. Anim. Behav. Sci. 245:105511) set up a fairly simple test of two types of loafing areas designed to enhance typical free-stall housing. In their study, lactating Holstein cows could express their preference for one of two types of loafing areas: 1) a concrete floored and roofed area that also allowed natural light to enter, or 2) a grassy paddock sized similarly to the hard-surface option. The researchers kept the grass mowed to a height of less than about 1.5" to minimize any desire of the cows to graze. In other words, they mainly wanted to test the cow's preference for loafing environment rather than ability to access feed.

In this study, a gate allowed cows to exit the free-stall pen and enter a concrete yard with two lanes that led to either the paddock or the hard-surfaced and roofed loafing area. Neither option had feed or water available. Following a 2-day training period the cows within the free-stall barn were allowed free access to both loafing areas for 5 days between 8:45 am and 12:45 pm and again from 3:30 pm to 6:30 pm.

What did the researchers observe? Cows used the paddocks more often than the concrete loafing area although individual cows did differ considerably which is probably no surprise. Overall, cows spent about 33% of their time outside the free-stall barn and 86% of this time outdoors was spent loafing in the paddock. Preference tended to be affected by the weather, which makes sense. When rainfall had been high the day of the observation and the previous 5 days, cows preferred the covered concrete loafing area more than the paddock and lay down mainly in the free stalls.

The researchers found that the cows behaved differently in the two loafing areas as well. In the paddock with short-clipped grass the cows spent 69% of their time lying down, but when in the hard surfaced loafing area they stood essentially 100% of the time.

As a result of this basic difference between the two loafing choices (i.e, standing on concrete versus lying in the paddock), there was a clear difference in which behaviors the cows engaged in for each loafing area. In the grassy paddock, cows spent more of their time resting, sleeping, and ruminating while resting. In contrast, cows

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A FOURTH MAJOR NUTRIENT?

As noted in a previous Farm Report article, EPA efforts to remove sulfur dioxide from the air have been very successful. When sulfur dioxide combines with air and water it forms sulfuric acid, the main component of acid rain. U.S. precipitation now contains much less sulfur; this is good for the environment but it's increased the need for sulfur fertilizers. With extremely high fertilizer prices the last thing you want is additional expense, but where needed, a small investment in sulfur may be very profitable.

Research at several universities including Cornell has found economical alfalfa yield increases from annual applications of 10 to 30 lbs. of sulfur per acre. Recent Minnesota research got a gain of $228/acre in alfalfa yield over a two-year period by the application of 10 lbs. of sulfur per year. That's $228 for about $1.00 worth of sulfur fertilizer!

This level of response may sound too good to be true and on many dairy farms it probably is, but that's actually good news. That's because slurry or liquid dairy manure contains about 2 lbs. of plant-available sulfur per 1000 gallons, and about 1 lb./ton in solid manure + bedding. Therefore, an application of 5000 gallons or 10 tons of manure/acre will supply about as much sulfur as was used in the Minnesota research. Sulfur will leach through the soil, but manure applications on corn fields will probably supply enough sulfur for 2 to 3 years following the last application. Therefore, you should start looking for sulfur deficiencies in 2nd and 3rd year alfalfa fields. Because phosphorus doesn't leach, regular applications of dairy manure often result in high soil test P requiring little or no fertilizer P. Therefore, in some fields sulfur might be considered to be a major nutrient because more fertilizer S than P is needed.

Because sulfur is leachable I'm not a fan of soil analysis for sulfur, especially since many farmers soil sample fields in the fall, long before alfalfa may need supplemental S. An easy and cheap way to diagnose a sulfur deficiency is by a field test after the first cut of alfalfa or alfalfa-grass. Armed with four marker flags and a cup of gypsum (hydrated calcium sulfate, easily found in garden stores), mark out a 10' x 10' area and spread the gypsum. If there's a sulfur deficiency you should see the difference in the alfalfa regrowth, usually as a darker green color. You could also have a tissue analysis done, with 0.25% S the critical value for alfalfa.

There are several sources of fertilizer sulfur, but if you're fertilizing alfalfa-grass, especially fields with a fair amount of grass, if a S deficiency is confirmed I'd suggest applying 100 lbs./acre of ammonium sulfate, 21-0-0-24S. (You could also do the above-described field test using a cup or two of ammonium sulfate.) If your fertilizer spreader won't apply this low a rate, have the ammonium sulfate custom-blended with muriate of potash (0-0-60) since by the 2nd or 3rd production year your alfalfa will probably need the potash. The 20 lbs. or so of N per acre in the ammonium sulfate will not hurt the alfalfa and will help the grass. Quirine Ketterings, Cornell U. Professor of Nutrient Management, notes that if your alfalfa responds to ammonium sulfate it could be due to the sulfur, but it could also be because something (probably low pH) is preventing proper N fixation. So make sure your soil pH is in the recommended range. If pH is OK (generally 6.5+) the response to ammonium sulfate is almost certainly from the S.

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in the hard-surfaced loafing area engaged in active behaviors such as grooming and social activity. Inactive time was spent standing rather than lying. An important point to bear in mind is that cows overall had longer lying bouts when they had access to either loafing area than when they were kept only in the free-stall pen.

What conclusions can be drawn from this study? First, we need to acknowledge that it only assessed two styles of loafing areas as part of a free-stall housing environment. In the real world, there can be many different loafing area conditions. Still, it's safe to say that even if cows spend much of their day within the free-stall pen they likely gain significant benefits from access to the loafing area. Weather understandably affects cow preference for where they choose to rest. Active behaviors such as social activity, estrus, and grooming are all greater when access to a loafing area is provided. That is worth knowing. For now, a practical take-home would be that loafing is not aimless idling, and we ought to spend more time than we ordinarily would thinking about enabling our cows' ability to loaf!

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SINGLE, OR READY TO MINGLE? COULD POOLING HIGH-QUALITY COLOSTRUM BENEFIT LONG-TERM CALF IMMUNITY?

Feeding colostrum from a single dam is considered the standard to ensure that calves achieve adequate passive transfer. Pooling of colostrum is generally discouraged due to high risk of disease transmission and lowered colostrum quality because of the variability of immunoglobulin (IgG) levels among dams. In the spirit of efficiency, pooling colostrum on farms isn't uncommon. A 2018 review of U.S. pre-weaned heifer raising practices published in the Journal of Dairy Science reported that of 104 farms surveyed across 13 states, 33 of those farms still pooled colostrum. Calves on U.S. farms fed pooled colostrum were 2.2 times more likely to experience failure of passive transfer than those calves fed colostrum from a single dam.

If colostrum is pooled it's recommended that only high-quality colostrum (≥50 mg/mL IgG or ≥22% Brix) from healthy cows be used, and pooling shouldn't be practiced where diseases could be transmitted through colostrum (i.e. Johne's Disease). But since every cow is different in terms of pathogen exposure and immune function, could pooling of colostrum (if of high quality) actually be of benefit to the calf in terms of exposure to disease-specific antibodies and other immune qualities from different dams?

A recent article in the Journal of Dairy Science from Teagasc, the agriculture and food development authority of Ireland, sought to close this knowledge gap by evaluating if pooled colostrum from several cows actually broadened the variety of antibodies that a calf received, and if this practice would improve disease-specific immunity throughout the first year of life. There is currently little data to compare immunity in calves fed either single-dam or pooled colostrum, and also to determine even in herds where mean colostrum IgG is high, if pooling can still affect colostrum quality. Understanding if there are differences in immunity between colostrum sources would give new insight and understanding of the places that pooled colostrum could be used.

In a nonconsecutive two-year study (2016 and 2018) that included 320 cows and 120 heifer calves (either Holstein-Friesian or Holstein-Friesian x Jersey), blood samples were taken from the cows close to parturition to determine immune profile and exposure to common infectious pathogens. Enrolled calves received one of three treatments: maternal colostrum (MC), nonmaternal colostrum (NMC; colostrum from another dam), or pooled colostrum (PC) from several cows at equal ratios. Colostrum was tested with a Brix refractometer to ensure that quality across all three treatment groups remained similar, and any colostrum with a Brix reading below 22% was not used. Calves in each treatment group received colostrum within 2 hours of birth at 8.5% of body weight, and either received subsequent feedings of milk replacer (calves enrolled in 2016) or transition milk from the same source as their treatment assignment (calves enrolled in 2018).

Despite variability in mean colostrum IgG between 2016 and 2018 (71.2 and 97.0 mg/mL, respectively), colostrum quality across both study years remained extremely high (mean 84.2 mg/mL). There were no differences in IgG concentrations between the pooled colostrum and the sources used for pooling, and colostrum IgG concentrations were highest in the NMC treatment group (mean 94.2 mg/mL). However, 24-hour serum IgG concentrations were greater in those calves fed colostrum from a single dam (either maternal or nonmaternal). Apparent efficiency of absorption (AEA), or the amount of IgG absorbed into the calf's system relative to the amount of IgG that was ingested, was lower in those calves receiving pooled colostrum. This may be attributable to IgG in the gut binding to the variety of pathogens present in pooled colostrum, leaving less to be absorbed into the bloodstream. At 1 month of age, calves in the MC treatment group had the highest number of antibodies to bovine viral diarrhea (BVD), but no treatment effect was observed for other common diseases. Regardless of treatment, maternal antibody survival rates in the calves ranged from 4-7 months for a range of diseases, including BVD, *Salmonella, Leptospirosis*, parainfluenza virus (PI-3), bovine respiratory syncytial virus (BRSV), Rotavirus, and Coronavirus. These results suggest that high-quality colostrum, whether pooled or single-dam, provided calves with cross-protection against different strains of bacteria and viruses and explains the similar immunity across groups. However, more work is necessary to determine the exact relationship between colostrum and disease-specific immunity. It's also important to note that the colostrum in this study was not subjected to heat treatment, which may have resulted in more immunoglobulins available for absorption. Higher colostrum IgG concentration, as well as feeding of transition milk to those calves enrolled in 2018, may also have

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INTERN INTRODUCTION

My name is Lianara Morciglio Matías and I started as the dairy management intern here at Miner Institute in October. I am from sunny Puerto Rico where it's basically summer all year long, so this is my first time experiencing winter and seeing snow. As for my background, I spent most of my teenage years volunteering at my local vet clinic and for The Association of Therapy Dogs. My experience with companion animals influenced my curiosity in agriculture, which led me to pursue by Bachelor of Science degree in Animal Science at the University of Puerto Rico (UPR) – Mayagüez Campus. After two months of interning here while completing my degree I graduated in December, and am looking forward to walking at my commencement ceremony this summer!

Throughout college I was always interested in dairy management and research, which led me to attend the 2019 U.S. Dairy Education and Training Consortium. This event provided me with the opportunity to learn about larger and more technologically advanced dairy practices than what I've seen back home. The following year after a brief internship, I became the calf manager at a dairy farm in Lajas, Puerto Rico. In this position I ran the calf health protocols, monitored basic herd health, and made sure all the animals got fed on time. I also oversaw the training of new interns and employees. I was able to take knowledge from this job to my position here at Miner Institute where I rotate between monitoring herd health, checking fresh cows, giving vaccinations, and feeding calves. I help around the farm wherever I'm needed!

During my time at UPR I had the opportunity to get involved with an island-wide animal welfare research project which focused on creating a profile on the status of our milking herds and calves. This project is what spiked my passion for Animal Behavior and Welfare. My goal for after this internship is to attend graduate school and continue to progress in my career in animal science, focusing on animal behavior!

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influenced antibody survival rates.

This study suggests that adequate levels of IgG could be maintained if best practices are followed when pooling colostrum (only using good quality from healthy cows, equal portions across cows, and proper storage). Rigorous criteria and management is very important to be able to successfully use pooled colostrum, and feeding individual sources is still highly encouraged as much more information is still needed to fully understand if there could be additional benefit. So whether you keep it single or choose to mingle, ensuring colostrum quality is still the best way to set calves up for success.

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YUM

A University of California animal science professor, Frank Mitloehner, notes that the ingredients in two leading plant-based meatless burgers are almost exactly the same as the ingredients in a vegan dog kibble. The meatless burgers contain over twenty ingredients commonly used in pet foods, and the biggest difference appears to be the colors and flavorings in meatless burgers. I've never tasted vegan dog food so can't comment on the flavor difference between meatless burgers and dog kibble. However, in my youth I once munched on a "Milk Bone" dog biscuit just out of curiosity, an act which doesn't even get honorable mention in the long list of dumb things I've done. (BTW, the dog biscuit wasn't all that bad, but neither was it vegan since back then nobody would dream of feeding Fido meatless dog food.)

— E.T.

Learn more about Miner Institute's equine program, visit whminer.org/equine

WHAT EFFECT DO VIEWS OF ANIMAL & DAIRY SCIENCE STUDENTS HAVE ON THE FUTURE OF DAIRYING?

Undergraduate degrees in agriculture can lead to students pursuing a wide range of careers involving agronomy, genetics/reproduction, nutrition, animal health, consulting, research, extension, and many more. These students are the future workers and advocates for the dairy industry and therefore will be in charge of how the public perceives animal agriculture.

In recent years farming and the dairy industry as a whole has been getting a lot of attention by the general public. Our industry is sometimes portrayed in a negative way through social media, especially through videos posted by animal activist groups. The goal for the future should be to find a way to be open with the public about the many positive things our industry has to offer, without responding to perceived threats in a defensive manner. One way to accomplish this is to listen to the voices of incoming industry professionals -- in this case, undergraduate students. It's important to see where their education has led them and if anything in the curriculum should be changed to better prepare them for how to deal with the pressure of public expectations for animal agriculture in the future.

A focus-group study was conducted at the 2019 US Dairy Education and Training Consortium held in Clovis, New Mexico and was published in the July 2021 issue of the *Journal of Dairy Science*. Six group sessions were held with a total of 45 undergraduate students from different universities across the U.S. The goal was to understand student views on the future of dairying, including changes in practices affecting animal welfare and care on farms and how they perceive public expectations. The researchers stated that "a better understanding of student views may inform new curricula to help students become critical thinkers in the field."

Students were asked what they believe the "must-haves" were going to be over the next 20 years, and how they believe the interaction between the dairy industry and the public is going to change. Between all the sessions, the main "must-haves" for the future of animal care and farming included; increased use and understanding of technology, group housing of calves, and improved facilities, including enrichment. Another point discussed was welfare and overall animal care. The students indicated the need for accountability and zero-tolerance for mishandling cows. We as producers and industry representatives have the responsibility to be diligent in the hiring, training, and supervision of employees who interact with animals.

Common expectations from the public were brought up and included things we've all heard about before. The want for cows to be on pasture, farms switching over to organic, keeping the cow and calf together, and improving sustainability practices and overall use of natural resources. Producers would agree that many times, perceptions of what the public wants to see isn't always feasible. Progress has been made in many of those topics, especially in sustainability. Just last October, USDA Secretary Tom Vilsack announced an investment of more than $146 million in sustainable agricultural research projects.

The students relayed that it is our responsibility, as producers and industry representatives, to have more contact with the public and to communicate all the positive things happening in our industry, while being honest about what we currently are doing, and what we can do to improve. They believed we are going to have to force public education through social media, since that is what drives new information, especially to the younger generations who are demanding change.

The students struggled to come up with ideas of how to improve animal care practices in a way that meets public expectations. There was a lot of variation between students' ideas of the influence the public has on the future of animal agriculture. The researchers believe there is a need to include professional training that incorporates critical thinking and ethics in undergraduate curriculum of students preparing to work in the livestock sector. Additionally, they indicated that it's important to provide students with the opportunity to debate issues from different angles and learn how to become independent advisors, rather than aligning their views with the perspective of current stakeholders in the industry. In the next 20 years the public is going to demand changes, and we need new individuals entering the dairy sector to be able to push for improved communication of the positive changes happening in the dairy industry and improve the public image!

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DO CONDITIONS AT BIRTH RELATE TO LONGEVITY IN THE HERD?

Dairy cow longevity is a complex topic that reflects culling decisions throughout the life of a dairy cow. Longevity has often been defined as early initiation of lactation (first calving) and long productive life with profitable production levels. Early first calving reduces the amount of time a dairy cow spends in a nonproductive state. Longevity is related and contributes to the sustainability of dairy farms and the dairy industry. Shorter longevity in the herd results in a lost financial opportunity, increased environmental footprint and impaired animal welfare. Culling decisions related to milk production, reproduction, health issues and profitability will impact cow longevity within the herd.

A lot of focus in evaluating dairy cattle longevity often looks at events within a lactation (health, milk production, reproduction) while not as much focus has looked at early life events and how it might relate to lifetime longevity. Recent research published in the Journal of Dairy Science sought to evaluate birth conditions and how they might relate to longevity.

Researchers described two ways of measuring longevity. The first is length of life, which accounts from the time from birth to culling or death, while length of productive life is the time between first calving and culling or death. To evaluate this, researchers from McGill University and Lactanet in Quebec summarized data from records collected from 712,890 offspring born on 5,425 Quebec dairy herds for evaluating length of life (LL) and 506,066 records from 5,089 Quebec herds to determine length of productive life (LPL). The time frame in which these records were collected from was Jan 1999 to November 2015 for LL and until December 2013 for LPL. This data was collected from DHI records so there's some subjectivity between farms and people recording the data (i.e. calf size is not an actual measurement of body weight) but overall this was a very extensive dataset to work from.

The information collected for each offspring (heifer but not freemartin) included in the dataset related to birth conditions was ease of calving (unassisted, pull, surgery, or abnormal presentation), size of calf (small, medium, or large), and if the calf was a twin. The researchers statistically tested different combinations of these birth conditions to identify the groups of offspring that were most likely to have long LL and LPL.

Five groups of offspring were identified to differentiate birth conditions that impacted LL. Calf size at birth was the most important variable of the birth data collected in helping to determine the groups of offspring for this longevity metric. Offspring that had the highest LL were either medium or large sized at birth and were a result of an unassisted calving (median length = 3.61 years). Offspring that were noted as small at birth and a twin had the shortest LL (median length = 2.20 years).

For LPL there were six groups of offspring identified. In this case, ease of calving (at birth) was the most important factor in determining LPL. Offspring that were born from an unassisted or surgery calving and were medium or large at birth had the highest length of productive life (median length = 2.03 years). Offspring born from an abnormal presentation or pull and were born to a twin had the lowest length of productive life (median= 1.15 years) and were 1.7 times more likely to be culled early in life.

The difference between length of life and length of productive life is the time spent waiting to reach productive life (first calving). Between the two models, size at birth was indicated as an important factor for length of life with larger calves having a greater chance at reaching productive life. Previous work has related larger size at birth to reduced calf mortality, increased growth, and lower age at first calving.

Calves that are born from a difficult calving are more likely to be culled compared to unassisted calves. These calves are also at greater risk of still birth, lower vitality, failure of passive transfer, and dying within 21 days of age. Previous research has indicated that a difficult birth results in the offspring having reduced milk yield in the first lactation, which could increase the risk of culling for low milk production. The researchers made to point that calving assistance in response to dystocia was the main driver in decreased longevity but not necessarily systematic assistance under normal calf presentation.

If the offspring was a twin that resulted in lower length of life and productive life. Previous work has identified that a calf that is a twin is at higher risk of mortality and lower body weight and average daily gain compared to singleton calves which is likely to increase the risk for culling.

Overall, if we can use birth information to make informed decisions related to culling before investing in raising animals that are likely to have lower productive life this could increase the sustainability and profitability of farms. Are there opportunities to use birth conditions recorded on your farm to maker earlier informed culling decisions?

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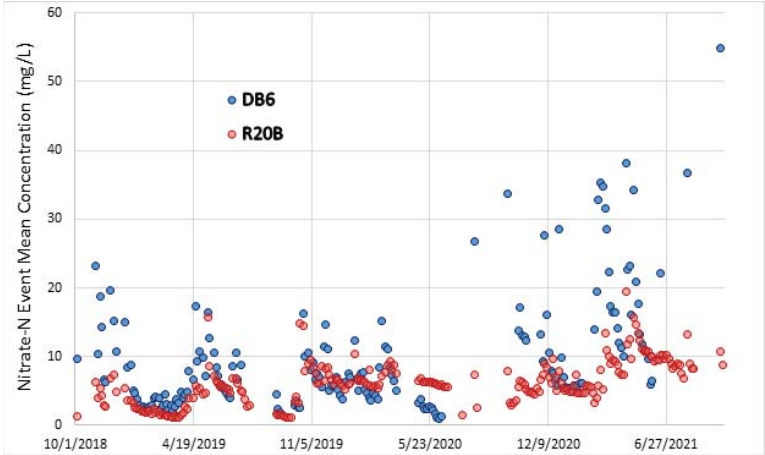
SAVE THE DATE!
Miner Institute is hosting an Open House on Aug. 6, 2022!

Stay tuned for more information!

MAKING SENSE OF NITROGEN LOSSES DURING A DRY YEAR



In last month's Farm Report I introduced the experimental set-up and discussed the rates of surface runoff and tile drainage from the paired fields in a no-till corn trial at Miner Institute. Briefly, the first two years of the study (2019-2020) formed the calibration period, during which both fields were tilled according to the farm's typical management and manure was incorporated with a tillage pass. The first year of treatment occurred in 2021, during which the field that serves as our experimental control (DB6) was managed the same as the previous two years, while the treatment field (R20B) transitioned to no-till management, with manure remaining on the field surface after a broadcast application in the fall of 2020. Regardless of year and experimental phase, both fields received the same rate of nutrient inputs at the same time.

While last month's discussion will help inform the nitrogen (N) data we'll discuss here, here's a quick refresher on the major trends in runoff before we dive back into some more results. Both fields are relatively flat and the vast majority of surface runoff occurs during large snowmelt events. In contrast, during an average year the tile drains flow nearly year-round, stopping only in mid-winter or mid-summer for a month or two at a time due to the naturally shallow water table in both fields. Abnormally dry conditions at the end of the calibration period and throughout the first year of treatment resulted in 58% and 30% less total runoff (surface + tile) from DB6 and R20B, respectively. These reductions were largely due to greatly reduced tile flows as the groundwater dropped below the level of the tile laterals for much of the year.

Throughout the trial, tile drainage has been the primary transport pathway of N, delivering greater than 97% of the total N load from the two fields. The majority of the N has been in the form of nitrate, which is easily lost from the soil due to its high solubility in water. This solubility, coupled with nitrate having a negative charge, results in negligible adsorption by the soil which also has a net negative charge (like charges repel, opposites attract), rendering it at high risk for leaching to tile lines as water drains through the soil. Surface runoff is typically low in nitrate and higher in organic N and ammonium-N, and the low overall loading of ammonium-N and the high ratios of nitrate-N to total N reflects the low volumes of surface runoff observed in both fields.

It's generally assumed that as subsurface drainage increases, N losses will increase as well. Therefore, it would be reasonable to assume that with the sharp reductions in tile drainage observed with the droughty weather in 2021, we could expect to see lower nitrate and total N loading from the tiles as well. Unfortunately, this was not what we observed. In the case of R20B, the 35.7 lb/acre of total N lost was nearly identical to 2020 and 33% greater than in 2019, despite overall similar rates of N application. Even more surprising, losses from DB6 (45.2 lb/acre) were actually 35% greater than 2020, and similar to the losses observed in 2019 when a large snowmelt event occurred in late fall shortly after manure had been applied.

While this seemed somewhat counterintuitive given what we've observed in past research projects, an examination of the individual sample concentrations sheds some light on how these results came about. The graph shows the concentrations of each tile drainage sample collected over the course of the entire study. Each sample represents the average tile drainage water quality over the course of a 3-4 day period. There are some seasonal trends that are immediately obvious, with nitrate concentrations increasing after the fall manure application, dropping during the winter when most of the drainage is groundwater (rather than water moving from the surface to the tiles), and rising again as temperatures warm (waking up the soil organisms) and water begins draining once again from the surface to the tiles in large quantities in the spring. It is also clear that there tends to be higher concentrations of nitrate in the tile water from DB6 than R20B during major runoff events, but the difference is largely eliminated when groundwater dominates the tile flows. The difference in event flow concentrations is likely due in part to the higher levels of organic matter in DB6 (7% organic matter) compared to R20B (4%).

However, in late 2020 and through fall of 2021 (the graph only shows through summer 2021 due to no tile flows through the end of the most recent monitoring period on Oct. 1), the seasonally elevated concentrations from DB6 in particular, are approximately twice as high as those observed in the previous two years. We see a modest increase in R20B concentrations as well, though not to the degree in DB6. As a refresher, to quantify nutrient losses from the field, we multiply the runoff volume by the sample concentration which gives us the pounds of nutrient lost during a given period of time. Therefore, even though we saw roughly 50% less runoff volume than previous years, at the same time the concentrations increased by 50% (we're using ballpark figures here), we were left with approximately the same results.

While this was not what we hoped to see, hopefully these data will help inform our future management of similar fields with high organic matter levels that may require different N management than the majority of fields on the farm that are more in the range of 3-5%. With the high fertilizer prices, this is a great year to see whether we can cut back on inputs to our higher fertility fields without experiencing any yield penalties. Next month we'll further discuss what may be driving the differences in N loading and concentrations across the years for these two fields.

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