

FARM REPORT



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FROM THE PRESIDENT'S DESK: INHERIT THE RUMEN

An outstanding review of the interactions between rumen microbes and the cow was just published by researchers at the U.S. Dairy Forage Research Center in Madison, WI (J. Dairy Sci. 101:7680-7689). They focused on how we can leverage what we know about the rumen microbial population to enhance dairy cow productivity.

We all understand that the rumen is essentially a large fermentation system – about 70 to 100 liters in a mature Holstein cow – that allows the cow to thrive on otherwise indigestible fiber. There is a rich diversity of microbes that ferment the ingested feed, and these microbial communities change in response to diet, breed, and age of the animal. Importantly, and very much underappreciated, they also vary tremendously among individual animals. Over the past decades the diversity of the rumen microbial population and its presumed metabolic activity have been measured using genetic approaches.

Recent research indicates that the rumen microbial populations are heritable and sustainable within an individual cow. For example, when rumen contents from one cow are placed into the rumen of another cow, rumen pH and volatile fatty acid production returned to “normal” for that cow within a day. Exactly how and why this happens remains unknown, but it could be related to re-seeding with

microbes that persist within a cow, or animal-specific salivary buffering or passage rates. Either way, this type of research indicates that the cow’s genetics play a substantial role in establishing and maintaining the rumen microbial population.

Research also illustrates the resiliency of the rumen microbes to external factors. Consequently, the rumen contents may not vary all that much except for the case of significant dietary changes. This suggests that probiotics designed with a single non-native strain to enhance milk production are not too likely to result in permanent changes in a mature rumen environment.

Looking to the future, we will need to measure the microbial population across a wide range of rumen conditions – healthy and unhealthy, low and high efficiency – and we’ll need to figure out which factors most greatly affect rumen populations. As a result, the authors of the review predict that in the future we will have genetic selection for cows that in turn select for optimal rumen microbes as the cows naturally develop. With this advanced knowledge, we will also be able to develop probiotic approaches to predictably enhance output from the rumen microbial fermentation.

See **MICROBIOME**, Page 3

DON'T MESS WITH MOTHER NATURE

Field horsetail (*Equisetum arvense*) is a perennial weed that's been around for 300 million years. When farmers used to ask how to control it I'd say "Four inches of asphalt." Then I saw horsetail emerging from a recently-installed asphalt sidewalk. And as the accompanying photo shows, horsetail isn't the only weed with the ability to break through a layer of asphalt.



Some plants will do almost anything to survive, including breaking through a layer of asphalt.



Field horsetail, *Equisetum arvense*. One you get it, you've got it.

Sumac plants growing in a grassy area across from our house get mowed to a height of no more than 3", usually weekly from spring through fall, year after year, yet the sumac roots continue to push out new growth, undaunted by their regular trim. Since as soon as a few leaves appear on the plants they're chopped off, how do they get the nutrients needed to continue to produce new growth? Beats me!

Back to horsetail: In looking on-line

for any new control options (previous searches were fruitless), I came upon this brief Q&A from the Ontario Ministry of Agriculture, Food and Rural Affairs: "Is it possible to control field horsetail? The quick answer is NO. Sorry." (Oh well, OMAF at least gets points for honesty.) You can burn the tops off with any of several herbicides but they don't translocate far enough into the rhizomes to kill it. If you have horsetail in a field try to

keep cultivation to a minimum (easier said than done) to prevent spreading rhizomes and tubers throughout the field. And make sure you thoroughly clean tillage equipment when moving from a horsetail-infested field to a field that isn't infested. Prevention is critical since control is essentially impossible.

— Ev Thomas
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FORAGE ANALYSIS VS. TISSUE ANALYSIS

Fall is usually when you're having forage analyses on your 2018 crops, both summer-harvested hay crops and the corn you're chopping for silage. Following are a few comments about using forage and tissue analyses:

- Don't make ration decisions based on NIR mineral analysis, especially for micronutrients. Research 30 years ago with a forage grass found that NIR analysis was reliable for P, K, Ca and Mg, but not for micronutrients including Zn, Mn, and Cu.
- Proper sampling of crops for tissue analysis involves specific parts of the plant at a specific time of development. For instance, the flag leaf of corn at tasseling, and

the top 6" of alfalfa at the bud stage. Don't use forage analyses (which is based on most of the aerial part of the plant) to make final determinations of plant nutrient status. If a nutrient is low on a forage analysis, discuss this with your crop consultant and *perhaps* follow up with a tissue analysis.

- Don't make too much of tissue analysis, and don't knee-jerk based on the results. Some sellers of micronutrients may recommend that you apply micronutrients to correct each (apparent) deficiency, and some would even have you apply them on a routine (preventative) basis. Focus on macronutrients (N-P-K) first since a micronutrient "deficiency"

may disappear after you correct a macronutrient deficiency.

- Agricultural testing labs can accurately test samples for nutrient content, but the recommendations based on these analyses should be reviewed by your crop consultant or Extension educator **before** spending money on an alphabet soup of secondary and micronutrients.
- Dairy (and other livestock) farms usually have far fewer nutrient deficiencies (particularly micronutrients) because of manure application. I've said it many times before: Manure is a multivitamin for crops!

— E.T.

A TALE OF TWO FIBERS: PART II

Ruminants have a four-compartment stomach capable of utilizing human inedible foods such as forage fiber to produce meat and milk. Fiber is quantified as neutral detergent fiber (NDF) which is composed of cellulose, hemicellulose, and lignin (total cell wall) and is related to intake and chewing activity. A relatively new term is undigested neutral detergent fiber (uNDF) which is the remaining fiber fraction after an in vitro fermentation for a designated number of hours (usually 0, 30, 120, and 240). The uNDF at 240 hours (uNDF240) is the measure of the indigestible fraction and has been related to physical effectiveness and gut fill. The potentially digestible NDF (pdNDF) is calculated by subtracting uNDF240 from NDF and this is the fiber that has the opportunity to be digested. The uNDF240 can only be passed once it enters the rumen where the pdNDF can be digested or passed. This is important because the uNDF240 becomes the limiter of intake due to the gut fill. These measures allow nutritionists to understand the heterogeneity of fiber and be able to maximize intake. With the low milk prices there is need to reduce feed costs and one way is to feed more home-grown forages. To feed a higher inclusion rate of forages they need to be highly digestible.

In a case study at Miner Institute, forage quality changed from high (October 2014) to low digestibility (February 2015) and the cow's response was monitored with

	Date	DMI lb/d	Milk lb/d	uNDF240 % of TMR DM	uNDF240 lb/d DMI
High producing cows	Oct 2014	67	120	8.5	5.7
	Feb 2015	62	105	12.0	7.5
Low producing cows	Oct 2014	53	60	8.7	4.6
	Feb 2015	48	55	12.1	5.7

Table 1. Case study at Miner Institute of intake and milk production response of forage change from high digestibility forage to low digestibility forage.

pen dry matter intakes and milk production (Table 1.). The high-producing cows on the high-digestibility forages consumed 67 lbs. of dry matter and produced 120 lbs. of milk with uNDF240 being 8.5% of total mixed ration (TMR) dry matter (DM). The low-producing cows on the high-digestibility forages consumed 53 lbs. of dry matter and produced 60 lbs. of milk with uNDF240 being 8.7% of TMR DM. When the low-digestibility forages were being fed both the high- and low-producing cows dropped 5 lbs. of intake, but the high-producing cows lost 15 lbs. of milk while the low-producing cows only lost 5 lbs. Both groups had a similar increase of uNDF240 content in the diet. The high-producing cows were more sensitive to the forage change than were the low-producing cows. This was also reported in a Journal of Dairy Science article: Researchers at the University of Nebraska reported that high-producing dairy cows had a greater response to high

NDF digestibility corn silage than low-producing dairy cows. Using uNDF240 as indicator of rumen fill can be useful as forage quality changes throughout the year.

As milk prices remain low farmers need to be more efficient in feeding their cows to reduce feed costs. Home-grown forages offer an option to reduce purchased feed but need to be highly digestible to maximize intake and maintain production. One measure that can help track forage quality is uNDF240, which is a good indicator of rumen fill. High-producing cows are more sensitive to forage changes and should be fed the highest quality forages on the farm. Forage fiber is multifaceted with digestible and indigestible fractions; understanding this will allow full utilization for intake and production.

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MICROBIOME, Continued from Page 1

The authors conclude that the rumen microbial profile might well be a new phenotypic trait in cattle. And going forward, it may be possible to expand the standard “genotype x environment” model for predicting milk production into a more accurate “genotype x environment x microbe” interaction model. Complicated, certainly, but imagine the possibilities if we could someday account for known and inherited rumen differences among cows. It would revolutionize ruminant nutrition and how we feed and manage dairy cattle.

— Rick Grant
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NEW RESEARCH SCIENTIST AT MINER INSTITUTE

My name is Sarah Morrison, and it's been a few years since I wrote my last Farm Report article. I was hired in mid-August as a Research Scientist at Miner Institute, and would like to share a bit about myself and how I ended up in the North Country.

I've been involved in the dairy industry my whole life. Both of my parents grew up on Vermont dairy farms; my mom's family is from Franklin County and my dad's family is from Addison County. I grew up on my dad's family farm where we milked 120 Jersey cows until 2011. I was involved in 4-H growing up and was always interested in what was going on at the farm. As a result I enrolled in the University of Vermont for a degree in Animal Science and graduated in 2012. During my time at UVM I participated in the C.R.E.A.M (Cooperative for the Real Education in Agricultural Management) program where we collectively managed a herd of 30 milking cows.

As indicated, this is not my first time at Miner Institute. In my last semester

at UVM I decided to come across the lake and enroll in the Advanced Dairy Management Program at the Institute. During that semester I was exposed to different aspects of dairy management. We had classes and hands-on learning on management of the dairy, nutrition, crops, and research. Through my research project that semester I took became interested in the nutrition and behavioral research that was being conducted there.

Before that time, I hadn't been involved in any research conducted at the University of Vermont while I was enrolled as a student. Luckily, at the end of that semester at the Institute I accepted a position as the research intern for the next year. With the experience from that year, I was able to solidify a passion for dairy nutrition and research and decided I wanted to go to graduate school.

I recently finished my doctorate degree from the University of Illinois Urbana-Champaign under the direction of Dr. Jim Drackley. I've been in his lab for the past five years working toward first

my Master's and then my Doctorate in Animal Science. Much of the work I did at the University of Illinois was related to dairy calf health and nutrition. For my Master's work we evaluated alternative protein sources (plasma protein) and amino acid supplementation in calf milk replacers. In the work done for my doctorate we evaluated a plant bioactive as a way to promote intestinal health of calves.

As I enter this new position I look forward to working and interacting with people from industry, universities, and farms within the region. With the focus of research done in my graduate program I hope to incorporate more research on dairy calf nutrition, management, and behavior at Miner Institute while also supporting the research already being conducted here. I am excited about this position and the plans for the future as I get settled into my new role at the Institute! If you have any questions, please feel free to contact me!

— Sarah Morrison
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80th ANNUAL CORNELL NUTRITION CONFERENCE

October 16-18, 2018

Doubletree Hotel Syracuse

6301 State Route 298, East Syracuse, New York 13057

The annual Cornell Nutrition Conference is designed to provide industry leading research and information to feed industry professionals and nutritional consultants.

The 2018 event will begin with a pre-conference symposium sponsored by Diamond V, entitled "Leading the Way in Responsible and Sustainable Food Production" The main conference program will feature a mini-symposium honoring Dr. Ron Butler's contributions to the field of animal source. Breakfast presentations sponsored by Alltech and Arm and Hammer Animal Nutrition start the day on Wednesday and Thursday. The conference will conclude with a post-conference symposium sponsored by AB

Vista, "Unlocking the Energy Potential of Fiber."

On line registration is available at:
<https://www.cvent.com/events/2018-cornell-nutrition-conference/registration-b859247a1bea45dfbc207158fce5e689.aspx?fqp=true>

For Conference information contact:
Heather Darrow, Conference Coordinator
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ALFALFA VERSUS HAY CROP

Personally, I am a very visual learner. It is easy for me to “grasp” a concept when I can physically “grasp” it. With this in mind, I sought to create a visual aid to help explain the difference between pure alfalfa silage and hay crop (alfalfa grass mix) silage using a method from Kurt Cotanch. With the help of John Kjolhaug, I was able to get my hands on a pure alfalfa silage sample from the Midwest. Using both the alfalfa sample as well as a hay crop silage (HCS) sample from the Miner farm, I conducted a small in situ project to illustrate how the two samples breakdown differently in the rumen.

The samples were placed inside in situ bags and then in the rumen of a cannulated cow for 48 hours. When the samples were removed they were paired with their corresponding 0 hour (no ruminal fermentation) sample and washed and rinsed. The samples were dried and then removed from the in situ bags. The results can be seen in the corresponding photos.

It is important to point out that the change between the 0 and 48-h samples is strictly due to the rumen microbes and that the dairy cow was unable to masticate the sample. The first thing that you may notice is that the forages lose their green color. When taking a closer look, it can be observed that portions of each sample have begun to fray apart. It is primarily the leaves in the alfalfa sample that have separated into stringy portions, while the stems



appear to retain their original shape. On the other hand, both the leaves and stems of the HCS exhibit this fraying action. The difference between the alfalfa and HCS 48-h samples is subtle but important. This is critical because it illustrates a portion of why legumes and grasses have different passage rates. The differences between legumes and grasses has been previously examined and one study that explains this well is Kammes and Allen, 2012 (J Dairy Sci. 95:3288-3297). They utilized alfalfa silage and orchard grass silage to compare passage rates as well as the rumen dynamics. They found that the diet containing orchard grass silage had a slower passage rate for smaller

fiber particles. They found that over 55% of the particles within the rumen were less than 2.36 mm for both silages, meaning that particle size was most likely not the limiting factor of passage. Kammes and Allen, attribute the difference in passage to the selective retention of particles in the rumen. This can also be described as the entanglement of particles in the rumen mat. Now with this in mind, refer back to the pictures of the 48-h in situ samples. The HCS sample appears to contain a greater amount of particles frayed apart. Not to say that the alfalfa sample lacks this but it is not to the same degree.

The difference between legume and grass is largely due to their structural makeup. The difference between the two often being described as building blocks for legumes and cords running together, similar to a rope, for grasses. The in situ samples help illustrate this difference and I believe this is an important concept to keep in mind when feeding different forages to ruminants. Grass particles will fray apart to a greater degree than legume particles, increasing the probability of entanglement in the rumen mat and in turn slowing passage. We need to recognize that although they can be similar, legumes and grasses are still very different.

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FALL ALFALFA HARVEST

Should you take a fall harvest of alfalfa this year? In general, if you need the feed, harvest it. If you don't, leave it. This summer was dry in many areas in the Northeast, with little rain from early June until late July when some timely rains (hopefully) saved the corn crop and improved prospects for hay crops. Early summer hay crop yields in these areas were very low, especially where there was a fair amount of grass in the stand. They call it cool season grass for a reason, and the combination of dry conditions and 90-degree temperatures really hammered grass yields.

If you're considering a fall harvest of alfalfa, keep in mind the following:

- Fall harvest of alfalfa will usually reduce first cut yield the following spring. This is based on old Michigan research, but I can't see that anything's happened to change this.
- The younger the alfalfa stand, the better it should withstand the challenges of a fall harvest. The damage from field traffic takes more of a toll on older, larger alfalfa crowns.
- According to Cornell University's Jerry Cherney, "Winter damage to alfalfa is an accumulation of insults." Harvesting alfalfa at 30-day intervals is an "insult". If you've been aggressive in your summer harvest management, give the alfalfa a chance to rest and recover this fall.
- If you do take a fall harvest, the best situation is to allow at least 7 weeks between the fall harvest and the prior one, get a killing frost the night before you mow, and leave a 6" high stubble.
- The worst situation is to take a fall harvest, the alfalfa then regrows 6" or so and then you get a killing frost. That's because the first 6" or so of regrowth comes from root carbohydrates. I've seen complete wipeouts under those conditions.
- If you leave a fall crop of alfalfa don't worry about it causing problems. The plant usually "freeze dries" after frost and the leaflets fall to the ground, leaving just the stems standing. Those bleached-out stems may still be standing next spring depending on winter weather conditions, but they have very little impact on first cut quality. A few old stems in next year's first cut baled hay may look a bit unsightly, but that probably matters only to horse owners (and we all know about them).

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WE HAVE MET THE ENEMY...

(With apologies to Walt Kelly & Pogo.) Editorial comment

There's an old story about a guy who buys apples for ten cents and sells them for five cents. A friend asks him how he expects to make any money that way, and the fellow replies "Volume."

This resembles the current situation in the dairy industry. U.S. dairy farmers are producing more milk than is needed by dairy markets and milk prices have been low for several years, so as an industry their response is: Make even more milk! On January 1st, 2018, U.S. dairy cow numbers were the highest since 1996. According to USDA's mid-year (July 20th) cattle inventory, dairy cow numbers were unchanged from one year ago at 9.4 million head. Similarly, dairy heifer numbers were unchanged at 4.2 million. The only light at the end of the tunnel (hopefully not an oncoming train) is that replacement heifer numbers have decreased since Jan. 1st.

There are at least two reasons explaining this seemingly contradictory situation — steady to increasing milk production

in spite of low milk prices: **First**, when milk prices are low many farmers can temporarily keep their heads above water by postponing capital purchases and other non-essential expenses: You see a lot fewer new pickup trucks on dairy farms these days, and I expect that some dairy farmers are relying more than usual on topdressed manure vs. purchased fertilizer. **Second**, farmers make decisions based on what's good for their farm operation, even if this means shipping more milk into a market that is already flooded with the stuff. Many dairy farmers have obviously decided that having at least one cow in every stall is still a good economic decision *for their farm*. ("Think globally, act locally.") That's why past government programs that were aimed at reducing milk production, including the Dairy Diversion Program (1984-85) and the Dairy Termination Program (1996-97), were abysmal failures.

— E.T.

WHAT'S HAPPENING ON THE FARM

Summer is quickly coming to an end. The county fair is over, the corn is tasseled, and our summer students have headed back to college. We're looking ahead to the fourth cutting of alfalfa and harvesting corn silage.

Before the students left for the summer we took them on some farm tours. We visited two farms in Clinton County and saw their calf facilities – one farm had robotic calf feeders and another had individual hutches underneath a roof with shade cloth side-walls for some protection from the sun and snow. These are two very different ways of raising calves, each with its advantages and challenges. Then we took a drive down to Valley Falls, NY to visit a 700-cow robotic dairy farm. Some of the students had never seen a robotic milking system – even though I've been to several robotic dairies, I still am fascinated to watch the whole process! We learned about the importance of cow flow and barn design in a robotic milking system. Our four students spent the summer working on our farm; they were good help and we hope they gained a lot of hands-on experience. But we also wanted them to see other dairy operations because there are

many different ways to successfully dairy farm!

The county fair is always a fun but exhausting week. For me the best part of the fair is being able to show off the genetics we've worked hard to produce. And every year we seem to bring a better and better group of animals...even if they don't win first place against other farms, we know that we've improved the herd over the last year and that is very satisfying! But we did win some first place ribbons this year – our Meridian (200H2770) fall yearling and our GW Atwood (7H10506) senior 3 year old both won first place. We came home with some first and second place ribbons for the group classes – Produce of Dam, Senior Best 3 and Exhibitor's Herd. We were pretty excited about placing well in these group classes - we may not have a superstar cow, but we do have a lot of cows with good conformation. Our goal at the farm is to have good-looking cows that work hard and last a long time - and slowly but surely we're getting there!

It's been a dry growing season. The corn plants in some of the fields are very tall and green and in other fields they're very short. Yield is really going to vary

field to field this year. We're estimating overall yields and deciding where to put the 288 acres of conventional corn and the 150 acres of BMR. Corn harvest will probably begin earlier than usual this year because it's been so dry.

Usually our second cut grass haylage is heifer/dry cow feed because it's higher in fiber and lower in protein. But this year because of the lack of rain the grass didn't grow very tall after the first cutting, so the grass was short and tender and relatively high in protein...it will be good milk cow haylage although there's not much of it! We still have to take a fourth cutting of alfalfa for milk cows and a third cutting of grass...that will be heifer and dry cow feed.

We have a new herdsman intern, Alexandra Banks. She has been here for the past several months as a summer student and although the other students have left for another year of college, Alexandra has already graduated and will continue to work alongside our farm team, learning about all aspects of dairy management. Next month she will introduce herself and begin writing for the *Farm Report*.

— Anna Pape
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CHECK YOUR EARS

Corn hybrid selection can have some impact on the development of molds on corn ears, and of mycotoxins in your corn silage. It's too late to do anything about it this year, but a careful evaluation of every corn hybrid on your farm can help in hybrid selection for 2019.

Any openings in the ear husk are an invitation for mold development. Avoid hybrids with ears that are erect, since this can let rain run between husk and kernels. This is especially important along corridors where migrating birds may travel. Blackbirds are notorious for sitting on top of an erect ear and pecking open the husk to eat the tip kernels. This slightly reduces yield but more importantly opens the ear for molds as well as corn rootworm beetles and picnic beetles which can be found munching away on damaged ear tips. Look for hybrids with ears that tip down, shedding water and providing a less convenient perch for birds. This is a genetic trait that you can select for, often the result of a longer shank length. By doing so you can eliminate the worst offenders, replacing them with hybrids that are more resistant to mold development. Also avoid any hybrids that have had standability problems due to stalk rot. Work with your seed dealer(s) as you select hybrids for 2019. Prevention is easier than a cure.

— E.T.

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