FARM REPORT

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FROM THE PRESIDENT'S DESK: LIGNIN OR LINKAGES?

In the most recent issue of the *Journal of Dairy Science* (2021. 104:5391-5404) I noticed an interesting article on how hydroxycinnamic acids are related to forage fiber digestibility and milk yield. The study examined the effect of harvest date and forage species on lignin and hydroxycinnamic acids, fiber degradability, and milk response of dairy cows. One of the co-authors, Ron Hatfield, now retired from the U.S. Dairy-Forage Research Center in Madison, WI., is a leading plant physiologist and expert in what explains forage digestibility.

Unlike NDF or lignin, "hydroxycinnamic acid" is not likely a phrase that is recognized by most nutritionists or producers, but these acids serve a critical role in determining rumen NDF degradability. Lignin is crosslinked with cell wall carbohydrates through hydroxycinnamic acids such as ferulate, and this crosslinking is thought to be a primary factor limiting fiber degradation in the rumen. Another important hydroxycinnamic acid, p-coumaric acid, also may reduce rumen fiber digestibility. Since the amount of these acids in a forage reflects the extent of crosslinking, the goal of the study was to determine if cow response was associated more with the hydroxycinnamic acid concentration (i.e., extent of crosslinking) or simply the lignin content itself.

Tall fescue and timothy, two common perennial grasses, were harvested at either an earlier or a later stage of maturity during the regrowth following first cut. These forages were ensiled in plastic-wrapped round bales and four diets were formulated that had a 46:54 forage-to-concentrate ratio. All diets contained between 30.5 and 33.7% NDF, 20.6 to 23.8% forage-NDF, and similar starch, fat, and crude protein.

Harvesting at the later date increased NDF and lignin for timothy only. At either harvest date, timothy had more lignin and NDF than tall fescue. But, regardless of maturity, the concentration of esterified ferulic acid and p-coumaric acid was greater for the tall fescue than the timothy. The timothy silage-based diets supported more energy-corrected milk yield, even though the NDF and forage-NDF content in the timothy and tall fescue diets were similar. Surprisingly, the timothy silage also contained more lignin than the tall fescue. This tells us that the simple fiber, lignin, and nutrient composition of the diet (or forage) does not explain the differences in performance due to type of grass.

Rather, the likely explanation is that the hydroxycinnamic acid content was greater for tall fescue than timothy. Consequently,

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THE DAIRY INDUSTRY IN CHINA

China's dairy market

In 2020, the US and China ranked the world's first and third largest dairy producers, respectively. China had 6.15 million cows and produced 33 million metric tons of milk, while the US had 9.38 million cows and produced 101 million metric tons of milk. In 2019, the per capita consumption of dairy products in China and the US was 27.6 and 653 lbs, respectively, and the total consumption was 17.5 and 97.2 million metric tons, respectively. China was the world's second largest dairy importer, following Germany and imported 5.9 billion dairy products in 2019. Mexico, Canada, and China were the top three dairy markets for the US in 2019. By 2022, China will surpass the US as the largest dairy market in the world.

The development of China's dairy industry

In 1978, Deng Xiaoping, the core of China's second-generation leadership, announced the Reform and Openness policy and decided to open up to the world. This economic reform ended the collective farming in agriculture and launched the household responsibility system, which encouraged peasants to keep a few livestock animals to improve their household income. As a result, China's milk production increased from 1.4 million metric tons in 1980 to over 30 million metric tons in 2008. This rapid increase mainly resulted from increasing numbers of cows and dairy farms.

The year 2008 became a turning point for China's dairy industry due to the melamine scandal. Melamine, an industrial compound, was added to diluted milk to increase milk's nitrogen content for a better milk price. However, melamine can lead to kidney stones and even kidney failure. In this melamine scandal, approximately 300,000 children suffered melamine-related diseases, and six babies died.

After that, the Chinese government announced stringent regulations, which indirectly promoted the dairy industry's modernization. Small dairy farms were forced out of business. In 2008, China had 2.6 million dairy farms with almost 2 million with <5 cows, but only 660,000 farms in 2018. The dairy industry's modernization is continuing, including genetic improvement, automated milking, and precision dairy farming.

Why China's dairy industry develops rapidly.

First of all, government support plays a significant role in this process. For instance, President Xi Jinping expressed that a new China man should be a milk-drinker. Official dietary guidelines recommend the public consuming more dairy products. Secondly, the growing middle class in China drives increased milk consumption. The median per capita disposable income of urban and rural residents was $6696 and $2616 in 2020, respectively, and $230 and $105 in 1990. China's urban population surpassed its rural population for the first time in 2011 and accounted for about 60% of the total population in 2020.

How will China's dairy industry impact the US?

Although China's dairy industry develops rapidly, dairy products' domestic production can't meet the growing demand. China heavily relies on imported dairy products (e.g., milk powder and infant formula) from other countries, including the US. Moreover, because of limited land and resources, China will also import more feeds (e.g., alfalfa, soybean, grains, etc.) from foreign countries, with the major share coming from the US. Between 2015 and 2019, the average annual values of soybeans and dairy products exported to China from the US were $9.61 billion and $457 million, respectively. It's conceivable that the US can benefit from the development of China's dairy industry; even if the tariff hurts the trade during a short period. According to the USDA, China is projected to import $27 billion of agricultural products and become the largest US agricultural market.

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WHAT'S UP WITH SEAWEED?

In recent years there's been controversy within animal agriculture over sustainability and greenhouse gas production. It's no secret that dairy and beef farmers are hit the hardest by these arguments as cattle are generally painted as methane-making machines. This stereotype may be exaggerated but isn't necessarily wrong. Cattle produce enteric (refers to occurring in the gastrointestinal tract) methane as a byproduct of ruminal fermentation which is released into the atmosphere through eructation, or burping. As of 2020, enteric fermentation is responsible for about 27% of yearly methane emissions and roughly 4% of total greenhouse gas production in the U.S. According to a 2016 article published in *Climate Change*, enteric methane production from ruminants is the most abundant source of greenhouse gas in animal agriculture.

Greenhouse gas reduction through nutritional strategies is a fairly new but important concept. There are many strategies currently being reviewed including optimizing feed concentrates, adding essential oils in TMR, introducing probiotics, incorporating seaweed into diets, etc. Of these methods, seaweed has by far received the most attention in the media. A Google search suggests that mainstream media believes seaweed to be a cure-all product. This is generally because the media tends to focus on its potential to reduce methane at the cow level without considering the possible impacts of production. Seaweed products for cattle haven't yet made it to mainstream markets, though it's been seen in some coastal operations. While seaweed does seem like a plausible solution to mitigate enteric methane production in cattle, more extensive research needs to be conducted in order to establish its overall impact on the dairy industry.

Seaweed, or marine microalgae, has shown promising results in preliminary in vitro and in vivo studies. In an effort to find sustainable methods of reducing methane production, companies such as the World Wildlife Fund, Foundation for Food and Agricultural Research, and Advanced Research Projects Agency-Energy have funded numerous studies evaluating the effects of adding different seaweed species in cattle diets. Surprisingly, seaweed has been demonstrated to reduce enteric methane production significantly, though results are highly variable (17-98% reduction reported). When introduced into the rumen, active compounds in the algae will shift hydrogen metabolism into the production of the volatile fatty acid (VFA), propionate. Increased propionate concentration in the rumen results in greater feed efficiency and nutrient utilization. One active compound in particular, bromoform, seems to be directly correlated with methane reduction ability.

Seaweed has many additional components that make it appealing for dairy cow diets. Certain species can provide significant amounts of rumen degradable protein (anywhere from 242-860 g/kg RDP after 24 hours in the rumen, depending on the species and season of harvest), omega-3 and omega-6 among other polyunsaturated fatty acids, essential and non-essential amino acids, as well as vitamins and minerals. A 2019 study performed at the Chinese Academy of Agricultural Sciences found the inclusion of kelp (a type of brown algae) powder in dairy cow diets has the potential to improve cow health as well as increase overall milk yield and milk fat. At an inclusion rate of 1-5% DM, kelp powder reduces ammonia concentration in the rumen and increases VFA production. Some compounds found in this algae have been observed to reduce oxidative stress and occurrence of ketosis. Subsequent studies have found lower somatic cell counts in the milk of animals supplemented with seaweed. Moreover, this shows that there are potential benefits in addition to enteric methane reduction associated with seaweed supplementation.

While seaweed sounds like the perfect solution to our greenhouse gas problem, there are some potentially negative impacts that need to be addressed. First, different categories of seaweed, usually grouped into red, green, and brown algae, support different amounts of enteric methane reduction. Red algae has the greatest potential to reduce enteric methane production because it contains the compound bromoform. While bromoform can be transferred into milk, a recent study conducted in the Netherlands shows the milk of cows fed red algae doesn't contain levels of bromoform that meet or exceed the EPA safety limit. Additionally, unprocessed seaweeds often contain high levels of iodine which can negatively affect milk quality. We also need to consider the economic and ecological impacts of growing, harvesting and transporting seaweeds across the world.

As with any new idea, seaweed supplementation has pros and cons that need to be considered. Because research on this topic is somewhat new, the focus has generally been on how seaweed affects the animal. However, this is only one part of the production chain. All aspects of seaweed collection and use need to be evaluated for environmental impact, and the resulting milk products need to be tested for safety and taste. Before we implement adding seaweed to our feed, we need to answer these important questions: Will the resulting dairy products be fit for human consumption? Is adding seaweed to diets cost effective? Will the methane emissions from harvesting, processing, and transportation offset the reduction in emissions at the animal level?

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RYE COVER CROP AS SPRING FORAGE – BRIGHT IDEA OR BIG MISTAKE?

Short on forage? You're not alone. Many farmers in the North Country were underwhelmed, shall we say, with the quantity of haylage they put up thanks to the anomalous drought that hit most of the region during the 2020 growing season. With plenty of heat units, corn came off the fields relatively early, and farms that use cover crops had plenty of time to get something growing before the really cold weather hit. As a result, there are a lot of decent winter rye stands around that have taken full advantage of the warm April sunshine. But is there a way to capture some of this lush growth as a forage crop?

The alternative is to terminate the crop with repeated tillage, herbicide application, or both in many cases. This prevents the rye from depleting water and nutrients that the subsequent corn crop will need. And yet it never feels quite right to kill off a solid stand of lush winter rye as your haylage inventories dwindle. Here are some things to consider if you want to use your rye cover crop as a forage:

Winter rye can be very high in forage quality, but quality declines rapidly with increasing maturity (particularly after head emergence). Data from Cumberland Valley Analytical Services suggests that rye has comparatively high fiber digestibility as compared to other cereals (like oats or wheat). However, it matures earlier in most cases. Rye for lactating animals must be carefully monitored for stage of maturity as it can go from the flag leaf stage to head emergence in just a few days. In the reproductive stage, rye will likely only be suitable for heifers or dry cows.

Field conditions can pose a big challenge when it comes to harvesting cover crops. Unless the field was intentionally smoothed and leveled, there will likely be exposed rocks and ruts that could make mowing and merging difficult. Cutting height might have to be adjusted at the cost of yield to prevent equipment damage. The best option for utilizing immature rye on rocky fields would probably be grazing if possible. This would allow the best sections of the field to be taken advantage of prior to a timely herbicide application. Alternatively, if the field is uniform and in good condition, rye could also be harvested with first-cut perennial grasses. We plan to attempt this method on a field of winter rye at Miner Institute this spring if all goes as planned. If you plan ahead, it probably makes sense to hit the rye with a little nitrogen and sulfur if you can. This will maximize yield and crude protein at whatever stage the rye is in when it gets cut.

Be careful about letting your rye become overly mature. Not only will quality decline, but wilting may become very difficult as the biomass increases. Furthermore, merging and chopping equipment will have more difficulty handling the longer material. Another factor to consider is the impact that your maturing rye will have on a subsequent corn crop. Recent research at the University of Wisconsin Arlington Agricultural Research Station showed that over five growing seasons, a rye cover crop does not negatively affect corn silage yields if it is terminated in the early vegetative stages (West et al., 2020). However, when the cover crop was allowed to progress to the boot stage, there was a 13% reduction in corn silage yields. While this drop is substantial, the additional rye harvest more than made up for it – resulting in slightly higher total forage production overall. There is clearly a tradeoff between rye and corn biomass when grown in the same season, but, if you're short on haylage, your corn fields might be a good place to look this spring.

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DIVERSITY IN THE GRAIN DRILL — AND CORN PLANTER

A recent article by Daniel Olson in the *Dairy Herd Management* "Nutritionist e-Network" discussed the benefits of planting several forage species by mixing the seed in the grain drill small seed box, also seeding a blend of several alfalfa varieties. Planting two or more species in a field is a well-accepted practice, most notably the multiple advantages of alfalfa-grass vs. straight alfalfa. And research has found that planting several or more species in a pasture will result in more uniform yields. In fact, one university trial found that planting up to 10 species (or varieties within a species) gave the best (most consistent) results. Some species did better during hot weather while others thrived during cool, moist conditions.

However, Olson's recommendation — *suggestion* may be a better word at this point — to mix several alfalfa varieties in the seed box is more controversial. In all the years I've been an agronomist this is the first time I can remember anyone recommending mixing two or more alfalfa varieties in the seedbox. (Or perhaps the second time since last month a farmer emailed me, asking for my opinion because his seed dealer had recommended mixing two alfalfa varieties in the seed box.) Alfalfa breeders state that there's already plenty of diversity in a bag of alfalfa seed, and a respected forage agronomist told me that mixing two or more alfalfa varieties in the seed box might even result in a yield *decrease* vs. planting a single elite variety. So there's definitely some difference of opinion. Until we have university research proving otherwise, consider me a "Doubting Thomas" on the advantages of blending alfalfa varieties. In the meantime I'll continue to recommend a single variety of alfalfa, in most situations seeded with a forage grass such as meadow fescue.

A much older practice is to mix a small amount of a different corn hybrid in the seed units (or by planting two hybrids in paired rows) with the objective of extending the pollination period. USDA research in 1997-98 found a small (4 bu./acre) yield advantage to doing this, but most research since then hasn't found any yield advantage. Part of the difficulty is pairing the right two hybrids, and lots of luck in getting any advice on how to do this. Most seed companies recommend against the practice. There's also the challenge of thoroughly mixing the seed. My opinion: Farmers have enough to do during corn planting without adding one more chore, especially one that's unlikely to do any good.

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LIGNIN, Continued from Page 1

there was more crosslinking of lignin with cell wall carbohydrates, a slower rate of rumen fiber digestion, and overall less energy available to the cow when they ate the tall fescue-based diets. We need to move beyond simply measuring lignin.

For several years we've thought that the extent of crosslinking was at least as important, if not more important, than lignin concentration itself in determining fiber digestion in the rumen. This research confirms that lignin crosslinking (as measured by hydroxycinnamic acid content) is the primary factor that limits NDF degradability and energy availability for the milk production.

This research provides strong evidence that, in fact, the content of hydroxycinnamic acids, notably ferulic acid, is the primary factor that determines milk production response to grass forages such as timothy and tall fescue. This work sheds new light on exactly how plant chemistry affects fiber degradability and energy value. In the future, we may well be hearing more about these hydroxycinnamic acids as we try to better understand and predict how cows will respond to dietary forage.

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OCCUPATIONS

- Occupations that people look down on: Truck driver. Electrician. Mechanic. Oil worker. Carpenter. Farmer.
- Occupations that people look up to: Social media "influencer". Professional athlete. Actor. Model.
- Occupations that keep society running: Truck driver. Electrician. Mechanic. Oil worker. Carpenter. Farmer.

KEEP YOUR EYES ON THE BALL

Golfers are told to keep their eyes on the ball; the same holds for managing corn for silage, although in this case the "ball" is hybrid selection. There's a lot of chatter in farm magazines and ag e-newsletters about corn silage quality including kernel texture, also a lot of disagreement among seed companies as to the importance of this characteristic. Some farmers pore over seed corn catalogs in search of hybrids combining high yield and top silage quality, then buy corn hybrids that are too late in Relative Maturity for their area. Or they buy well-adapted hybrids but plant them much too late and wind up with immature corn silage and the resulting silage effluent.

My good friend Dutch Rovers, taken from us far too soon, used to plant hybrids that were about 10 days RM later than most farmers in the region should be planting. But Dutch planted in early May on tile-drained fields, his crop management was excellent and the cropland was near the lake so not as apt to be hit by an early fall frost. And because of good drainage he was able to wait until these 100+ RM hybrids matured to 33-35% DM for silage harvest. Some of his friends and neighbors found out what hybrids he was planting and bought the same ones, planted them a couple weeks later, then wondered why their results were so different. Much of the advantage of superior genetics — for silage yield as well as quality — is wasted if the corn is chopped before it's at the correct maturity. There's no need to spend money for elite genetics if you're going to chop your corn at less than 30% DM.

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BASIC DAIRY NUTRITION SHORT COURSE

Presented as a partnership of Cornell University and Miner Institute, the Basic Dairy Nutrition Short Course will cover basic principles of dairy cattle nutrition and their application within dairy herd management. It has been taught in-person every other year at Miner Institute since 1997 and fills to capacity every time. In 2021, the course is being offered for the first time in an online, virtual format with weekly opportunities for live interaction with the speakers for the week.

The course runs from the week of May 14 through the week of June 18. Topics include forage production and silage management; carbohydrates, protein and amino acids and fat and fatty acids; calf and heifer nutrition; environmental aspects of dairy nutrition; nutrition and milk components; and transition cow nutrition and management.

To learn more or register, visit https://cals.cornell.edu/animal-science/events/basic-dairy-nutrition-shortcourse/course-registration

For event specific questions, contact Heather Darrow, Conference Coordinator by phone at 607-255-4478 or via email at hh96@cornell.edu.

NOBODY ASKED MY OPINION, BUT…

…it's an ill wind that blows no good: Due to the pandemic I've finally been able to go an entire year without wearing a tie. One of the rare times I had to wear a tie was on "Formal Night" during what until this year was our annual Caribbean cruise, but Covid-19 dealt with that.

…you may think that the "Forever" printed on postage stamps refers to the price of the stamp, but it's a prediction of how long it can take for first-class mail (or any class of mail for that matter) to be delivered. I'm still waiting for a check that was mailed in February.

…before the Internet people thought that stupidity was because of the lack of information. It wasn't that.

— E.T.

YOU ARE NOT ALONE

Dairy farmers are full of resilience, perseverance, and strength. However, they are also human, and humans are susceptible to mental illness. If you struggle with mental health concerns such as anxiety or depression you are not alone. As the saying goes, "It's okay to not be okay." Farming is influenced by factors out of your control; it is understandable to feel stressed, overwhelmed, or helpless. Adverse life events and genetic predisposition to mental illness only exacerbate these feelings. Fortunately, conversations about mental health are becoming increasingly common and normalized throughout agriculture, and strategies exist that you can use to help yourself and others.

How to Help Yourself.

Anxiety and depression look and feel different to different people. Anxiety usually includes excessive apprehension and worrying thoughts, while depression is typically a constant feeling of sadness or loss of interest. Anxiety and depression are not the only forms of mental illness; post-traumatic stress disorder, eating disorders, and bipolar disorders are a few other examples.

If you are struggling, the first step is to be kind to yourself as you acknowledge you need help. The second step is to talk with others. It can feel uncomfortable to open up, especially when there is a stigma around mental health. However, verbalizing your issues can provide clarity, help you feel less alone in your struggles, and lead you towards a path of feeling better. Sharing your story also helps others acknowledge their own struggles and feel less alone.

How to Help Others.

If a loved one is struggling with mental illness, the most powerful way to help them is by providing a judgment-free space to talk through issues. Focus on reflecting what they are feeling rather than trying to fix or make light of the situation. Regular visitors on farms can also be on the lookout for signs that a farmer may be struggling. Below are signs of depression and suicide to help you identify when someone is struggling.

Signs of Depression

- Deterioration in personal or farm appearance
- Decreased care of livestock
- Increase in farm accidents
- Change in routines or not showing up for usually attended events
- Decreased interest in activities

Signs of Suicidal Thoughts

- Feels hopeless
- Feels like a burden
- Withdrawal or isolation
- Giving away cherished belongings

If you are concerned that someone close to you is considering suicide, below are some steps to take that come from the National Institute of Mental Health.

1. ASK: "Are you considering killing yourself?" You won't put the thought into their head or increase their risk of suicide by asking.
2. KEEP THEM SAFE: Although difficult, you should ask if they have a plan and prevent access to the lethal means.
3. BE THERE: Research has shown that talking through issues can decrease suicidal thoughts.
4. HELP THEM CONNECT: Help connect them with a mental health professional or call the suicide prevention lifeline (1-800-273-8255).
5. STAY CONNECTED: Follow up after a crisis.

Additional Resources.

In addition to talking with close friends and family members, it's okay to need professional help, and you should be able to do so without feeling ashamed. Seeking help shows more strength than weakness. Below are some confidential resources that you can turn to for support; some are specific to farmers and understand the unique challenges that come with agriculture. You can also ask one of the resources to help you find local support. Your primary care doctor is another resource that can prescribe medication or refer you to services.

- National Suicide Prevention Lifeline: 1-800-273-8255 (24/7)
- Crisis Text Line: Text "START" or "HELLO" to 741-741
- Substance Abuse & Mental Health Services Administration: 1-800-662-4357
- Farm Aid Hotline: 1-800-327-6243 (Mon-Fri 9:00am-5:00pm ET)
- Lifeline via TTY (for deaf and hard of hearing): 1-800-799-4889
- Farmer Resource Network finds resources within your region https://farmerresourcenetwork.force.com/FRN/s/

If living in NY:

- NY FarmNet provides support (at no cost) in well-being, familial concerns, business planning, financial analysis, and retirement and estate planning : 1-800-547-3276 www.nyfarmnet.org
- NYS Agricultural Mediation Program is free or low cost and geared towards conflict resolution: 1-866-669-7267 www.nysamp.com

Look out for yourself and others, and don't hesitate to ask for professional help. You are not alone in how you are feeling or in your healing process.

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Mark Gonyo (driving the backhoe) and Adam LaCount work together to safely move the storage building on our calf hill in preparation for site work and construction of a new calf barn.

Closing Comment

A positive attitude may not solve all your problems
but it will annoy enough people to make it worth the effort.

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