The Blade

Monthly Newsletter of the

Grey Wooded Forage Association

SEPTEMBER 2020

Save the Dates!

EVENT	DATE	LOCATION/CONTACT
GWFA Soil carbon field school	Oct. 14 & 15	Tentative, contact field@greywoodedforageassociation.com
CFGA Annual conference	Nov. 18 & 19	Virtual Conference Visit canadianfga.com/2020/programs
BCRC Webinar Series	Oct. 28 to Mar. 24	Visit beefresearch.ca
Red-Bow Ranching Conference	Feb. 2 & 4, 2020	Virtual conference Visit redbowag.com

BCRC BEEF CATTLE RESEARCH COUNCIL

RED BOW AGRICULTURAL PARTNERSHIP

CFGA Canadian Forage & Grassland Association
Association canadienne pour les plantes fourragères

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Cover Photo: Tiny Livestock,
Brenda Kossowan photo

In This Issue:

The Grey Wooded Forage Association is a member of the Agricultural Research and Extension Council of Alberta

ARECA

This publication is made possible in part through funding from The Province of Alberta

Alberta

September Roundup

By Brenda Kossowan, Business Manager

Yikes. Small animals bearing butt knives make me nervous. Very nervous. I've suffered far more injury working with large ungulates than through the odd encounters with wasps and bees—yet I never seem to want to quit riding, feeding, grooming, hauling, stacking hay, . . .

Plus, I really like honey, and pretty well everything else that these armadas of flying livestock produce for us. It seems appropriate, therefore, that a photo featuring fall colours should focus on the tiny creatures at the centre of it all: The pollinators on which all of agriculture dearly depends. With Thanksgiving just around the corner, this may be a good time to pay homage to the assortment of bees and butterflies whose quest for nectar ensures there will be food on the hoof and in the freezer well into next summer.

This latest issue of *The Blade* continues with a couple of series introduced earlier this year, including Inside ARECA, an update from the Agricultural Research and Extension Council of Alberta as well as the fourth installment in a six-part series about water systems for beef cattle, reprinted with permission from the Beef Cattle Research Council's blog.

New this month is the first in a series of articles by Karin Lindquist, who contributed numerous articles to *The Blade* during her tenure as a beef and forage specialist with Alberta Agriculture and Forestry. Like so many others who we leaned on for information and support, Karin was let go early this year in the provincial government's bid to pare down costs and stabilize the budget. Karin and her colleagues at the Stettler-based Ag Info Centre as well as specialists from other parts of the province provided high quality, independent information to producers. Associations like the Grey Wooded Forage Association and the producers we serve relied on the AAF specialists to dig up new research and present those findings at our workshops and field days.

Losing the specialists has put more pressure on groups like the GWFA to help producers find the information they need to take best possible of care of their soil and the animals they raise as well as the environment within which everything grows. There is some benefit from this, for associations like ours, in ensuring that provincial officials see the value we

bring to the agricultural community. Provincial officials recently circulated a survey exploring the impact the downsizing within AAF has had on our operations. There has been no word on how that information will be used. Perhaps it will demonstrate to the province that our associations provide valuable service to the agricultural community as well as a benefit to taxpayers through a continually high level of care for the environment in which we all live.

Further on the environment, some of you may have had a chance to view the new Netflix documentary, *Kiss the Ground*, narrated by celebrity vegan, Woody Harrelson. The documentary attempts to bridge the information gap between rural and urban through its exploration of regenerative agriculture as a vehicle that will save the Earth. Some people may be a feel somewhat skeptical about a documentary in which a Hollywood vegan knits together the various discussions of how carbon is sequestered in the soil and the role of ruminants in that cycle. While geared to an urban audience, the documentary gives credence to soil health leaders whom many of us have come to know, including Kris Nichols, Gabe Brown, Allan Savory and others. They dedicate a great deal of their time and talent to promote grazing ruminants as a vital factor in stimulating soil health and reversing the effects of desertification.

Netflix's new documentary can be simplistic at times and perhaps does not fully explore the workings of a healthy soil biome, but it does open the discussion and may lead urban consumers to a different view of farting cows and their role in creating a healthier planet.

Wetaskiwin-Leduc ALUS: Planning ahead for 2021

Delivered to farmers and ranchers in the County of Wetaskiwin No. 10 & Leduc County through the Sustainable Agriculture Program

Fall and winter are the perfect time to start planning and preparing for an ALUS project. Sometimes, a project will qualify for other funding support. Having all the grants and pre-requisites in place early allows farmers and ranchers to hit the ground running in spring once their project is approved by the ALUS participant advisory committee (PAC). The Wetaskiwin-Leduc ALUS PAC likes to review the bulk of projects at their April meeting. Projects are approved throughout the year; however, less funding is available as the season progresses.

What is the first step? Contact your community ALUS Coordinator to see if your project idea fits the program. If it fits with ALUS, they will lead you through the process. Even if your project does not fit the ALUS program, they may be able to direct you to other supports. Contact the Wetaskiwin-Leduc ALUS coordinator at 780-387-6182 or kbarkwell@county10.ca

When Preparation meets Opportunity

By Greg Paranich, Ag Field Specialist

We often single out those individuals or operations that seem to have good luck with a number of things from crop production, livestock marketing, or getting that great deal! Well, being at the right place at the right time might have something to do with that, but I like to think there's a few more pieces to the puzzle.

It has been said "Good luck is when preparation meets opportunity". Having good luck in farming and ranching may be more of being prepared to act on a plan when the opportunity presents itself, giving good fortune.

It is this time of the year when we overlap with the results and harvest of the past year are evaluated and we plan into next year. Do we do more of the same to get those good results, can we improve on good results, or do we need to change things up to move the dial forward on some management? There are no silver bullets. Getting the advantage of timing of opportunities outside of our control (weather, economy, prices, unexpected offerins) depends on our planning. It takes information, focus, and considering options that fit your operation. Let's take a look at what planning can be done this fall within your farm or ranch.

Soil fertility is key to anything we do with the land. There can be many evaluations of soil and soil health, but the initial starting point should be a regular soil testing plan.

Annual cropland should have annual soil testing to reflect what was used and what we may need going into next year's cropping plan. Perennial hay or pasture may not require an annual soil test but should have one every three to five years to set a baseline and note any trends in your soil condition. You can alternate fields to manage the number of samples you take in any given year.

The Four R's of nutrient stewardship should be kept in mind for your soil fertility decisions.

- Right Source matches the fertilizer type to your crop needs (manure, compost, granular).
- Right Rate matches the right amount of fertilizer/nutrients your crop requires.
- Right Time of application makes the nutrients available to the crop when it needs it, and when it is most practical and environmentally stable for your operation.
- Right Place of nutrient placement for your crops to use them effectively.

The goal is to manage fertility in a cropping system for economic and environmental benefits. Choices will depend on local soil, climate, topography, management conditions, and site-specific factors that can make it unique to many agriculture operations.

Feed, especially winter feed, is the single most expensive item in the cost of livestock operations. Considering that in this part of the world we have about seven months of "winter feeding" before we have grass again, we need to be as efficient as possible with our stored feed. Regardless of whether we conventionally feed bales, swath graze, stockpile or chaff pile graze, feed baleage or silage, we need to know what is in the "package" to address nutrition deficiency or costly excess nutrition. Think for a moment how we will check the tag on the content of any feed bag or pet food to ensure we are getting what we need for that feed. Our forage stocks should be no different.

The cost of a feed test is small considering the information we get to keep our herd properly fed at the right stage of their production cycle.

A feed test starts with a proper sample. The more a sample represents the feed you are testing the better value of the information will be to manage your herd nutrition. Ideally, we should take 15-20 cores from the lot of feed being tested. Mix them thoroughly in a container to get a homogenous "representative" sample for submission to the lab. Have your sample bags and paperwork done ahead of time so the samples can be handled without delay.

We should process our samples and bag them as soon as possible from time of collection and keep in a cool dark place to preserve their proper nutritional levels. If you can't ship them right away, then keep them in a refrigerator until you can. I try to plan sampling so that same day or next day shipping is a Monday or Tuesday. This ensures samples get into the hands at the lab as soon as possible. I don't want it sitting in a shipping depot over the weekend and allowing my work and investment to degrade unnecessarily.

When our feed analysis arrives, the amount of information can be a bit overwhelming. How can we tell what aspects are good, bad, or otherwise? For a first step, I recommend going to the Beef Cattle Research Council web site (beefresearch.ca/research/feed-value-estimator.cfm).

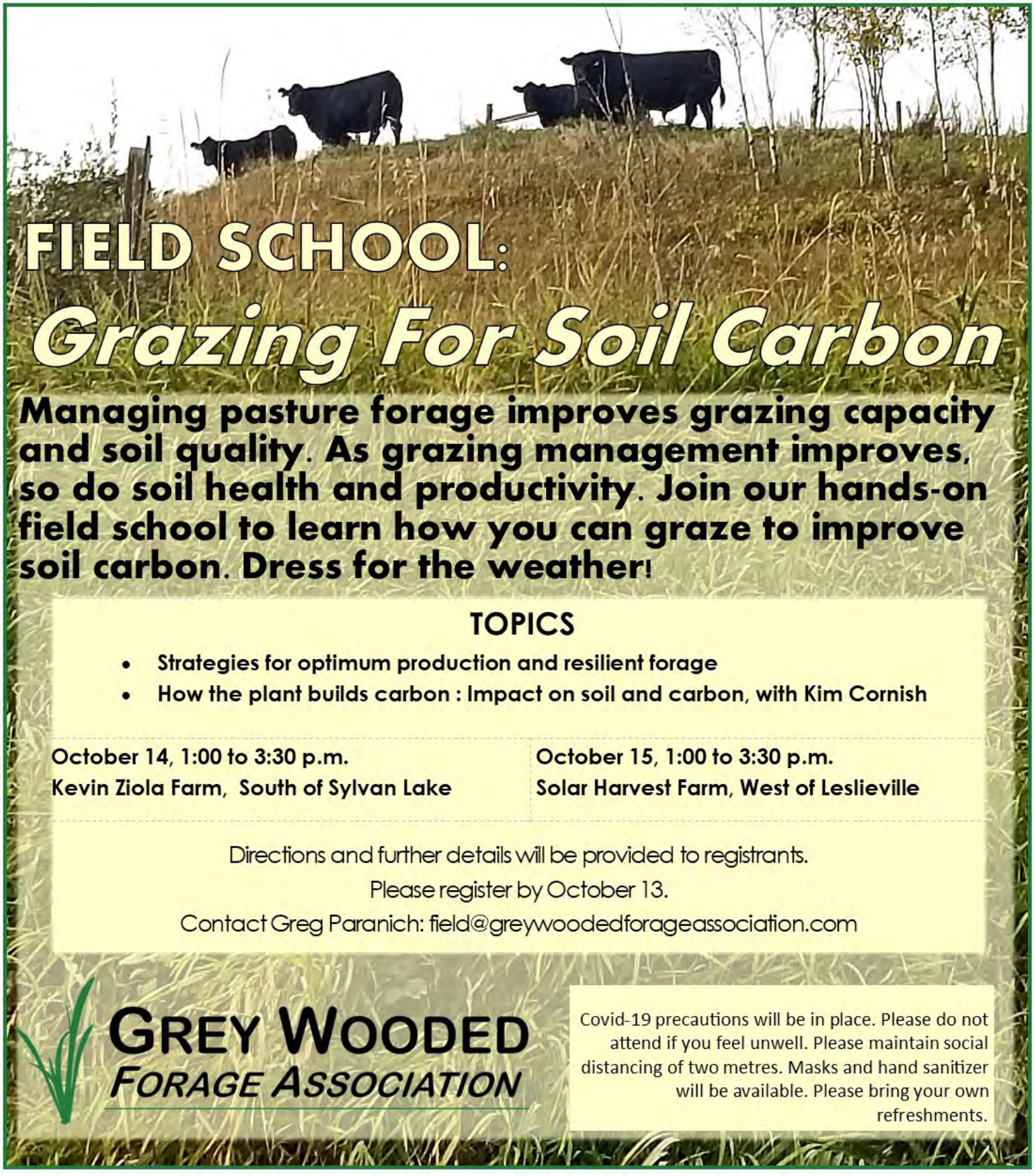
You can download an excel version of "A Tool for Evaluating Feed Results". It is very user friendly and allows you to enter your basic feed test results along with what class andweight of animals you intend to feed. While it does not give you a balance ration it will flag a color code response which nutrients in that feed are adequate (green), within a manageable range (yellow), or does not meet that animal's nutrient requirements (red). This is the starting point for us to take this "rule of thumb" information to a nutritionist to see how we can fill the gaps (protein, TDN, minerals).

Sampling and analysis information on our own agricultural assets (soil and feed) helps us prepare for the next operational cycle.

We can measure, manage and evaluate production goals to allow us to make better decisions and plans. Having a more informed plan on some of our key production expenses will keep us prepared for the opportunities that could bring us better fortune.

Remember, soil and feed tests don't cost, they pay.

Test, don't guess!


FIELD SCHOOL:
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Managing pasture forage improves grazing capacity and soil quality. As grazing management improves, so do soil health and productivity. Join our hands-on field school to learn how you can graze to improve soil carbon. Dress for the weather!
TOPICS
• Strategies for optimum production and resilient forage
• How the plant builds carbon : Impact on soil and carbon, with Kim Cornish
October 14, 1:00 to 3:30 p.m.
Kevin Ziola Farm, South of Sylvan Lake
October 15, 1:00 to 3:30 p.m.
Solar Harvest Farm, West of Leslieville
Directions and further details will be provided to registrants.
Please register by October 13.
Contact Greg Paranich: field@greywoodedforageassociation.com
GREY WOODED
FORAGE ASSOCIATION
Covid-19 precautions will be in place. Please do not attend if you feel unwell. Please maintain social distancing of two metres. Masks and hand sanitizer will be available. Please bring your own refreshments.

Water Systems For Beef Cattle: Sources

This is the fourth installment from an online information page published by the Beef Cattle Research Council and reprinted here with permission. This month, we take a closer look at sources of water for beef cattle. The October edition will cover power options and the series will conclude in November with a discussion of costs. The blog article is being published as a series in *The Blade.* It can be viewed in its entirety at beefresearch.ca

Groundwater Sources

Wells can be bored or drilled, depending on depth to aquifers. Bored wells are usually constructed where the groundwater is less than 30 metres from the surface and are often large-diameter installations. Drilled wells are constructed to reach much greater depths and are smaller in diameter. Bored wells are more likely to be affected by variations in precipitation and recharge than drilled wells. Both types will require a pump to extract the water[12].

Springs occur where groundwater emerges naturally on or near the ground surface. The surface point of the spring may be a small part of the water-bearing area. Excavation parallel to the land at, or below the surface point, and installing drainage pipe or cribbing can increase the flow and protect the spring. To ensure that the spring keeps flowing, several steps should be taken when developing springs as a water source for livestock. 1) Ensure that the spring does not get contaminated by surface runoff. 2) Fence livestock out to prevent trampling by animals and pipe the water to a remote site. 3) Avoid altering the spring by building dams or embankments. In some instances, this construction causes the spring to stop flowing due to the rise in water level where the spring discharges.

Spring fed ponds are naturally occurring water bodies that can be used for livestock watering. While allowing direct access by livestock is cost effective and easy in the short term, this can damage banks, reduce water quality and shorten the life and capacity of the water source. In spring fed ponds, where shallow aquifers exist, surface water can mix with groundwater. Groundwater is usually highly mineralized and surface water is susceptible to microbial contamination. To ensure continued flow and water quality, fence cattle out of the water body and use remote systems like nose pumps or troughs. Avoid introducing contaminants into aquifer.

Surface Water Sources

Dugouts are the most common water source for grazing cattle and are recharged by surface water such as snow and field drainage. Dugouts are man-made water sources and generally provide adequate quality water for livestock. Site selection is important to ensure a long-lasting source of quality water. Low lying areas that appear to be suitable for dugout construction may have salinity issues, runoff challenges, or high Total Dissolved Solids (TDS).

During sustained periods of hot weather, evaporation can also increase levels of TDS and salts, which can result in reduced water consumption, poor performance and even death. As dugout water is usually stagnant (non-moving), algal blooms may be a concern at certain times of year. Conduct water tests to ensure that water is within safe levels of salinity, TDS, nitrates and sulphates.

To avoid entrapment or drowning by cattle breaking through ice in the winter, fence cattle out of dugouts and use a pump or remote system to pump water into a trough. Pumping to a trough and restricting access to the dugout will also preserve the dugout banks from damage and erosion and prevent cattle from contaminating the water with feces. Research that examined improving water quality through aeration and pumping to a trough showed increased weight gains of approximately 10 per cent over 90 days.

As with spring fed ponds, dugouts that hit shallow aquifers are best fenced to restrict direct access by cattle. Water levels may rise during high water recharge; however during droughts when groundwater levels fall, water in the dugout may drain into the aquifer. This can introduce contaminants into the aquifer.

Sloughs are naturally occurring surface water sources which generally occur in low-lying areas that collect snow and rain runoff. They can provide adequate water quality to most cattle. As with dugouts, hot, dry weather conditions can create increase salinity and TDS to dangerous levels. Shallow sloughs with salt rings can be an early indicator of potential salinity issues. Testing with an electrical conductivity meter (EC) will provide information on salt levels. Sloughs are also at risk for the formation of blue-green algae, which is bacteria that proliferates during warm weather in stagnant water. It produces toxins which are dangerous to cattle.

Rivers, streams, lakes can provide good quality water to livestock, but allowing cattle direct access to these sources can damage riparian areas, banks and habitat for other wildlife. As with dugouts and sloughs, cattle will walk into the body of water to drink and cool off during summer months, urinating and defecating in the water. Cattle may be at risk of drowning or entrapment, depending upon the banks and water current. Where possible, fence cattle out of rivers, streams and lakes, using troughs, nose pumps, or other systems to keep cattle out of the water source. This will preserve riparian health, reduce contamination of water, and extend the lifespan of the water source.

Some Extra Cash Coming from Grazing?

By Allan Hall, Executive Director

We are in some interesting times. I grew up on a dairy farm and my uncle across the road ran beef cows. We were used to our farm income being sale of milk or beef and did OK at it. Both farms are now entering their fourth generation and still going strong.

Now it looks like there will be a new revenue stream developing. Canadian Forage and Grassland Association (CFGA) is a national industry organization whose members are various interests in the livestock and forage circles across the country. They have significant membership here in Alberta among livestock organizations, forage associations, forage exporters, etc.

Over the past three years, CFGA has been working hard at developing a grassland carbon credit trading protocol. Essentially when completed and approved for use, it will be available for ranchers and farmers to use in earning extra income from their grazing and forage operations. It looks like it may become available in the next couple of years.

The way it works is we know that good grazing and forage production practices leads to continuous improvement of our soil over time. This in turn leads to higher productivity of forages that leads to more beef and other livestock products off an acre of land. Forages, like other plants, uses carbon dioxide from the air – kind of like a scrubber. This helps the crop to grow both better forage production and better root systems.

Through this process, the forage crops sequester carbon into the soil, largely through increasing organic matter content of the soil. This in turn makes the soil more productive, more resilient to drought and wet times, and improves productivity of our forages. And the cycle continues through the years. I was talking to a cattleman a few months ago and he showed me how he has increased his soil organic matter by nearly four per cent over the past 15 years or so.

What has this to do with earning extra income from our forage lands? That is where the carbon trading protocol comes in. Research has shown that high productivity forage lands in the black and grey wooded soil zones can sequester upwards of one tonne of carbon per year. On the open dryland prairies, research has shown this to be around a quarter to a third of a tonne per year. Depending on the price carbon is trading at, this can add up.

Ranchers and farmers will be using this new carbon credit trading protocol to essentially "sell" the carbon they are sequestering in their forage lands. The buyers of these credits are manufacturing companies in oil and gas production and

refining, electricity generation from coal and gas and other industries who emit carbon dioxide.

With both a buyer and seller, there is a market established. In agriculture there is already a reduced tillage carbon trading protocol that has been used over the past decade to earn income from the carbon sequestration that happens under reduced and zero till cropping systems. The new kid on the horizon will be this upcoming grassland carbon credit trading protocol.

The Forage and Applied Research Associations throughout Alberta, including Grey Wooded Forage Association, are working with CFGA on this project. Be on the lookout for more information becoming available soon, and for this to be talked about in farm media, tours, field days, webinars and at seminars and workshops.

One of the beauties of this, is that through forage management systems to improve carbon sequestration, comes increased forage productivity. Back to my family's farm – they will soon be earning additional income from selling carbon credits and earning additional income from further improvements in their forage production – a win:win by all accounts.

I encourage you to keep an eye on this one. Get in touch with Greg or Brenda, they will be pleased to fill you in more on the details of this new development that is underway.

Nitrates in Forage: It's All in the Timing

By Karin Linquist, The Bovine Practicum

Publisher's note: Karin's article is abridged and reprinted with her permission. It will be continued in the October edition of The Blade. *Can't wait? See the unabridged article in its entirety on Karin's website, bovinepracticum.com*

THE BOVINE PRACTICUM

Karin Lindquist, creator of the Bovine Practicum, is an independent consultant seeking to share her knowledge and experience gained as a producer, a research assistant, a customer service rep and a forage and beef specialist with Alberta Agriculture and Forestry.

Currently located in Stettler, she was raised on a mixed farm northwest of Edmonton, where she and her family backgrounded calves and grew forage, cereal and oilseeds crops.

Karin has a BSc in Agriculture with an animal science major from the University of Alberta, including studies in applied beef and dairy sciences; ruminant digestive physiology and nutrition; forage, pasture and cropland management; rangeland management and ecology of Western Canadian plant communities, and wildlife and lake ecology. She is an Agrologist in Training with the Alberta Institute of Agrologists.

Karin is available for presentations and consultation in the area of beef and forage management.

Please visit her online to learn more: bovinepracticum.com

An insidious threat looms when temperatures drop below the freezing point: It's nitrate season.

Nitrates are a risk with any crop that is intended as feed to livestock.

Nitrates, in high enough levels, can kill, and quickly. The mode of action is akin to internal suffocation, where the body runs out of oxygen in the bloodstream to the point where it cannot sustain itself, so the animal dies.

Lower doses cause reduced weight gain in growing animals, decreased milk production, and lowered appetite. It can also cause abortion in cows.With this article, I would like to introduce to you the forage half of the nitrate equation.

The biggest question I was asked while serving as a forage and beef specialist was: When can I harvest?

It's important to first go into the plant physiology and morphology of why and how plants accumulate nitrates. From there, I discuss the various factors that influence nitrate levels in plants, what plant species are most susceptible, and how to test for nitrates. After this, I talk about why and how timing is very important when determining the best opportunity to start greasing up the swather and get out in the field.

What is Nitrate and How Do Plants Accumulate It?

Nitrate (NO_3^-) is a highly oxidized, inorganic nitrogenous compound.

Nitrate is the form of nitrogen that plants need for healthy plant nutrition, particularly as they form plant protein and other important physiological functions.

Plants take up most of their nitrogen as nitrate. However, nitrate cannot be used immediately by plants; first, it needs to be reduced to ammonia (NH_3) before anything further can be done, such as forming amino acids.

Once in the plant, nitrate is reduced to nitrite (NO_2^-) by an enzyme called "nitrate reductase;" this reduction takes place in the cytoplasm of plant cells in the roots or leaves or both, depending on the plant species. The nitrite molecule moves into the chloroplasts of leaf cells (or plastids of root cells) where another enzyme called "nitrite reductase" reduces nitrite to ammonia. Ammonia is quickly used up by the plant cell (since it is toxic to plant tissues if left floating free) to form amino acids and amides for protein synthesis.

Under normal conditions, the nitrate that plants take up in their roots is being regularly converted and used for protein synthesis. Any nitrates that get into the animal's system are quickly converted by the rumen microbes into ammonia, which is then used as a source of microbial protein.

It's a much different story when growing conditions change and thereby affect regular plant metabolism of N. When conditions shift to where plants become stressed, growth slows or stops altogether because the plant is now more interested in sheer survival rather than putting energy into extraneous efforts such as a lot of growth (over reproduction; stressed plants feel a greater need to reproduce as fast as possible before they die to ensure the next future generation continues after the parent plants die). However, the roots just can't help but keep up taking nitrate.

The problem, therefore, is where protein synthesis occurs, which is usually higher up in the leaves. Photosynthesis and a major portion of protein metabolism occur in the leaves, thus when environmental conditions slow or inhibit these normal plant processes, protein synthesis slows down; yet, root nitrate accumulation does not. The situation becomes akin to a dog chasing its tail, or the basic economics of supply exceeding demand, where the conversion into plant protein is unable to keep up with soil nitrate uptake.

(Continued on next page)

Forage Nitrates *(continued from Page 9)*

Plants need a shock to their system to slow down or stop normal nitrogen metabolism. These conditions are largely going to be such that slow plant growth:

- Cool temperatures
- Hot temperatures
- Cloudy weather
- Drought
- Frost
- Hail damage

What Conditions and Factors Affect Nitrate Levels in Plants?

Multiple factors come into play that directly affect the nitrate-accumulation potential of plants. Environmentally speaking, temperature fluctuations, moisture availability, and the availability of sunlight are three of the most major influencers; hail damage and frost fall into this category, as well as herbicides. With regards to plant nutrition, high amounts of nitrogen fertilizer–both synthetic inorganic fertilizers, and animal manure–that exceed plant needs also play a role. Finally, plant maturity is a compounding factor in plant nitrate levels.

Environmental Factors: Temperature

Optimal growing conditions for plants is between 15 to 25° C (60 to 77° F); this is especially true for cool-season plants (C3 plants). Warm-season plants (C4 plants) can tolerate warmer temperatures, where the optimum is to approximately up to 35° C (95°F).

When temperatures get higher than these optimum levels, plants begin to feel stressed and put their focus on survival. This is also true for when the mercury dips below plants' lowest optimal temperature threshold.

Especially in autumn, temperatures that dip down to 0° C or lower act as a major stressor for plants.

Environmental Factors: Frost Damage

There are some very important variances to know when it comes down to frost. We can divide frost into two main categories:

1. Damaging or light frost (temperatures reach -0.5 to -3.5°C (32 to 25.5°F) for a short time before sunrise)
2. Killing or hard frost (temperatures reach below -5°C (23°F) for one or more hours before sunrise)

It's a common myth that a killing frost brings the greatest risk for nitrate accumulation. This is not true. The greatest threat for nitrate accumulation occurs with a damaging or light frost.

Killing frosts kill the plant outright. As a result, the plant is unable to bring nitrogen (nitrate) up from the roots like it could if it were still alive, and just damaged by a light frost.

Damaging frosts only cause damage to some plant tissues, mostly at the top of the plant. Damaging frosts also create the same issue as a killing frost, where the cells burst due to the freezing water expanding as it turns into ice, but only to some parts of the plant. It doesn't stop growth, just temporarily impairs it. Tissues are still able to function, even though the stress damaging frost has put on the plant shifts its metabolism into survival mode. As a result, nitrates are free to accumulate in the cells, and move up into the still-functioning, albeit injured, leaves.

I would like to share with you a very good tip to memorize when you're out in the field checking your crops prior to harvesting it for forage (note: this only applies to cereals such as oats or barley that are headed out and at the milk to the mid -dough stage). Take a kernel and squeeze it between your thumb and forefinger until you get liquid coming out. If it comes out milky, the plant is still alive and able to still accumulate nitrates. If the liquid comes out clear, the plant is dead and therefore safe to harvest. The clear liquid indicates that the plant is no longer continuing to put its resources into further maturity of the plant, because it has died due to cell rupture.

What about the lower leaves that don't get damaged by frost? They also are stressed, but it's not because of freezing temperatures; it's much more to do with light or lack thereof. The leaves that are shaded below the frosted upper portions also accumulate nitrate, making the potential for nitrate reduction in the lower half of the plant rather limited.

Environmental Conditions: Sunlight Availability

Cloud cover, shading, or simply just surviving through the night will cause nitrate accumulation in plants. All of these are stressors on the plant because they slow down photosynthesis.

We don't notice this because of the timing of accumulated nitrates reaching peak levels, and since much of these conditions are short-lived. For example, nitrates quickly dissipate after the sun comes up and the day remains bright and sunny with optimum growing temperatures.

A couple of cloudy days where nitrates will accumulate is countered when they move off or evaporate into nothingness, exposing the sun to the slightly light-starved plants below.

It's a much different story when these cloudy days extend for a week or more. Smoke from forest fires that obscure the sun's rays for a long period acts in the same way as with cloud cover, slowing photosynthesis.

Ironically enough, plants need that cloud cover to bring them the moisture they need in the form of rain.

Environmental Conditions: Moisture or Lack Thereof

A lack of sufficient soil moisture can cause nitrate accumulation in plants. Since moisture is needed to transport nutrients up into the plant as well as maintain plant cell rigidity, as well as other important physiological processes such as protein synthesis, the lack of moisture inhibits this ability, causing plants to feel stress thus creating a nitrate-accumulation issue.

The key element here is not the lack of rainfall for an extended period that creates the nitrate-accumulation issue, but rather a soil's water-holding capacity, contributing to an effective water cycle. There must be a notable loss in soil moisture that causes plants to feel water-stressed and therefore accumulate nitrates.

(continued on next page)

It's all in the Timing *(continued from Page 10)*

It's important to understand the particular factors that create this, including a lack of litter (dead and living plant residue) armouring the soil surface (i.e. too much bare soil) plus a lack of soil organic matter to capture moisture and soil structure: Compacted, block-like or plate-like in structure instead of porous and column-like where water can trickle down deep into the soil profile. Pay attention to where the water goes in a big rain event. There's a big effective water cycle problem when much of the water runs off into adjacent water bodies instead of quickly soaking into the soil where it should remain for a long time.

Drought is a situation where plants get a double-whammy of environmental stressors: Hot weather and lack of soil moisture (the latter caused by insufficient plant residue that cannot protect the soil, thereby encouraging greater evaporation and heating of the soil surface which quickly dries out the soil). Plants stop growing because conditions are all-around unfavourable for growth.

We already understand that stressed plants who stall growth will accumulate nitrates. However, there is some empirical evidence out there to show that plants–especially those that are immature–pose a very dangerous risk of nitrate accumulation when they receive rainfall after a lengthy period of drought. It's wise to note that much of this evidence was noted in warmer climates, such as in India, New Zealand, Australia, and the southern United States. Little, if any, is applicable to more northern areas that have shorter growing seasons, such as here in Canada.

While rains spell a marked reprieve from drought, hail is a whole different matter, and certainly not the type of reprieve anybody would be looking forward to!

Environmental Conditions: Hail Damage

Let's assume that the weather has been highly favourable for growing forages (as opposed to a drought situation discussed above) until a wicked hail storm arrives.

Hail damage acts much in the same way that frost does: it reduces the capacity for the plant to photosynthesize. The bottom half of the plant (roots) is unaffected and continues pumping nitrates into the plant as normal. However, the upper part of the plant cannot make use of the nitrate because of the damage the hail caused to the very important green photosynthetic solar panels. How much this capacity is diminished depends on how significant the hail damage is.

Light hail damage where some of the leaves got stripped but plants didn't get completely annihilated means that there's going to be a period of time where nitrates accumulate as the plants heal themselves and regrow after the weather-related injury.

If there's a total crop loss, however, nitrates are still going to accumulate in those plants that will eventually die by a completely eliminated ability to continue photosynthesis. Nitrates will remain in this plant material for a very long time.

Frost, as Mother Nature's all-natural organic herbicide, and The Great White Combine (hail), all act in the same way as a more man-made chemical intended to selectively kill certain plants: herbicide.

Herbicides can be a nitrate-accumulation nightmare, depending largely on the chemical mode of action.

Not all herbicides are created equal; there are well over a dozen classified groups of herbicides, separated by their different modes of action.

With regards to nitrates, most attention must be paid to the groups that specifically target growing points of a plant, as well as those that affect the photosynthetic capacity of a plant yet do little to affect the roots. This is because the non-systemic (foliar) mode of action actively kills the top growth, rather than systemic herbicides that translocate down into the roots and interrupt the plant's system from the bottom up.

Top-growth-killing herbicides interrupt the photosynthetic activity and do it quite quickly. Some may move down into the roots but usually not enough to affect them. This leaves the roots able to continue normal processes of collecting nitrates to send up into the rest of the plant. But just like with the impacts of hail and frost, the herbicide has damaged the upper portion of the plant so much that it can't use the nitrate for protein synthesis. Thus, nitrates accumulate.

The most notable herbicides to keep in mind that will do this are 2,4-D, MCPA, Basagran, Pardner, Vanquish, Grazon, Tordon 22K, Curtail M, Lontrel, and potentially (though less likely than the aforementioned herbicides), Restore II and Reclaim II.

Reglone is another herbicide – used as a desiccant rather than a means to target weeds – that carries a significant risk of encouraging nitrate accumulation in forages. Reglone is used to terminate the growth of plants by quickly killing the top growth, acting very much like frost or hail.

The general consensus among crops specialists of whether glyphosate also creates issues with nitrate accumulation is that no, it does not. Glyphosate basically acts systemically, where it targets the whole plant, starting at the roots and working its way upward. When it does this, it basically slowly shuts down the physiological processes from the roots upwards, which also inhibits the plant's ability to take up excessive nitrates. Thus, when the plant finally dies, it dies due to the slow progression of the effects of the herbicide, and results in zero locked-up nitrates.

However, caution needs to be expressed when choosing what herbicide to use on which plants. It's best to talk with a local agricultural extension person for more information if have any detailed questions about herbicidal use. Also, always read the label before using. There are certain restrictions to adhere to when it comes to knowing when it's safe to graze or feed the treated crop.

With all of these environmental variations, one has to wonder if all plants are inclined to accumulate nitrates, or are only certain plants more predisposed to be nitrate-accumulators than others?

Let's talk about that next time.

THE BOVINE PRACTICUM

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