# FARM REPORT

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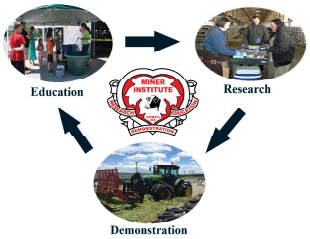


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# FROM THE PRESIDENT'S DESK: DON'T FORGET CORN SILAGE STARCH

In September many readers of the *Farm Report* will be in the midst of corn silage harvest. And most will be wondering how this year's crop will feed. Some areas have been wet, some dry, with few just right! Regardless, we typically focus on NDF content and its digestibility as a key metric of quality. Increasingly, nutritionists key on measures of fiber indigestibility that are sensitive to growing environment and maturity such as uNDF240. The uNDF240 value telegraphs the dry matter intake that can be expected from the growing season's combination of temperature, moisture, maturity at chopping, and so forth.

That is all critical to understanding how to feed the year's corn silage, but I want to focus on the other main carbohydrate in corn silage – starch. For the average corn silage, about 65% of digested nutrients comes from starch and other non-fiber components of the crop. Dave Mertens, retired from the US Dairy-Forage Research Center in Madison, WI, summarized data from a range of corn hybrids. When considering hybrids containing very low grain to those very high, he found that starch and non-fiber fractions contributed between 58 and 72% of the digested nutrients of corn silage. We must focus on starch, as we focus on fiber digestibility, when we're considering the nutritional value of the silage.

Starch may also affect rumen digestion of fiber. When starch in the ration is either too high and(or) too fermentable, excessive rumen fermentable starch can lower rumen pH and substantially reduce NDF digestion. Years ago we assessed how various starch sources affected in vitro NDF digestion rate for alfalfa, brome grass, and corn silage. The digestion rate of the alfalfa NDF, for example, under ideal fermentation conditions was about 7% per hour. When we added a slow-fermenting starch source such as ground sorghum, the NDF digestion was unaffected. But when we added a fast-fermenting starch source such as finely ground corn meal (which we commonly feed to dairy cows), NDF digestion rate was reduced by about 16%.

Here's something to ruminate on: As you begin to interpret the forage tests that will soon be arriving, will your cows "see" all of the energy predicted from the feed analysis? Laboratory analysis measures the potential digestibility of a forage, but too much fermentable starch in the ration or other poor formulation approaches will limit the energy actually derived. Also, remember that poor feed bunk management also will affect how the cow responds to the silage. We've found that the combination of overcrowding stalls/feed bunks plus feeding to a slick bunk causes subacute rumen acidosis. Bottom line: think about the difference in pH

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# LISTEN TO THE LAWN EXPERTS

*Farm Report* readers may wonder why we discuss grass management as often as we do. In part this is because the national farm press generally ignores grass as a harvested forage since a large majority of the alfalfa in the U.S. is grown without a grass companion crop. Another reason is that proper grass harvest management is somewhat different than for alfalfa and other forage legumes.

We could do worse than to listen to the experts at the Scott's lawn company, the nation's leading supplier of lawn grass seed and other lawn care products. Scott's agronomists have long known that proper mowing height (a form of harvest management) is critical in maintaining a healthy lawn. They recommend a mowing height of 2" to 3½", 2" being shorter than recommended for forage grasses, but they note that mowing should remove no more than one-third of the height of the grass. Although there are differences between lawn species and forage grasses, this guideline generally agrees with how farmers should be managing forage grasses: Research at Michigan State University found that when 50% or less of leaf weight was harvested there was little or no root damage, but when at least 70% of leaf weight was removed about 80% of root growth stopped. The reason: The nutrients for the following harvest are in the bottom of the grass stems. Mowing grass too low reduces the nutrients needed for fast regrowth. For straight grass leave a 3-4" stubble height, while for alfalfa-grass leave at least 3" of stubble.

This isn't a theoretical discussion: Years ago, after I gave a presentation on grass management to a group of Virginia farmers, a farmer came up to me at the end of the meeting and said that he now understood why he and his neighbor had such different results with their orchardgrass fields. There was only a barbed wire fence separating the farms and both mowed at about the same time, but the farmer said that after each harvest his grass always recovered much faster than his neighbor's grass. He said that he now realized the reason for the difference: His neighbor mowed to about a 2" stubble height while he left 3-4" of stubble. You can't fool Mother Nature.

*— Ev Thomas*
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# SAVE THE DATE!
# DAIRY DAY IS NOV. 30, 2023!!
## 10 am - 3pm

**Speakers include:**
**Dr. Joao Costa, University of Vermont**
**Dr. Rick Grant, Miner Institute**
**Katie Ballard, Miner Institute**
**Dr. Heather Dann, Miner Institute**
**Dr. Sarah Morrison, Miner Institute**

# HOW LONG DO COWS NEED IN THE FRESH PEN?

The use of a fresh cow pen is becoming a more common management practice that dairy farmers use to closely monitor health problems and provide cows with a diet formulated specifically for their unique needs after calving. Having a designated fresh pen has benefits, but the number of days that cows stay in the fresh pen is where there's potential to limit some cows' success and prolong negative energy balance (NEB). The length at which cows stay in a fresh pen varies by farm but can range from 10 to 30+ DIM.

Fresh cow diets are typically formulated for lower dry matter intake (DMI), higher fiber, and less rumen fermentable carbohydrates such as starch and sugar. Cows that have a smooth transition into lactation will be ready to consume a more fermentable diet that can promote increased DMI by 10 to 14 days in milk (DIM). If these healthy cows are left in the fresh pen for too long they'll be consuming a diet formulated for lower DMI while milk production is increasing and will be at higher risk for ketosis since the fresh diet limits intake by gut fill.

A transition cow study from Michigan State University led by R. J. Rockwell and M. S. Allen fed treatment diets to fresh cows from calving to 28 DIM and then fed a common lactating diet which was more fermentable, from 29 to 84 DIM during the carryover period. On the fresh treatment diets (27% forage neutral detergent fiber (NDF); 31% NDF; 26% starch), cows' DMI was around 45 lb/d or less. Dry matter intake increased to at least 50 lb/d once cows were offered the common lactation diet, (20% forage NDF; 32% NDF; 28% starch). In this study, DMI was likely limited by forage NDF for cows between 10 and 28 DIM. Forage NDF is very filling, and when cows are consuming a diet that's higher in forage NDF they are likely eating to gut fill (NDF intake of ~1.2% of body weight). In other words, the cows eat until they physically cannot fit anymore in their rumen. When this occurs during the fresh period the rate of increase of DMI will be slow compared to the rate of increase of milk production. We know that cows experience a period of NEB during the transition period, and this gut filling effect from the higher forage NDF in typical fresh cow diets can serve to limit DMI and cause a prolonged period of NEB as milk production is rapidly increasing. This puts cows at higher risk for losing excessive amounts of body weight and condition (i.e., fat reserves) and developing ketosis. For example, a study published in the Journal of Dairy Science in 2020 looked at the effects of adding straw to early lactation diets and found that those cows fed the early lactation diet with straw had lower DMI and higher beta-hydroxybutyrate concentrations in the blood after calving, and this difference was significant on days 14 and 17 after calving. The researchers on this study concluded that cows fed the diet with straw inclusion, which was more rumen filling, had a higher risk of developing by 3 weeks after calving compared to those fed the early lactation diet without straw.

A study published this year in the Journal of Veterinary Medicine and Science examined the effects of fresh cow grouping strategies. Cows that spent 14 vs. 21 days on the fresh cow diet tended to produce 5 lb/day more milk at 15 DIM, 10 lb/day more at 30 DIM, and 8 lb/day more at 60 DIM. This greater milk production early in lactation for cows that only spent 14 days on the fresh diet is likely due to them having a quicker transition to a diet that was more fermentable, less gut filling, and higher in starch than the fresh diet. Cows that spent 14 days on the fresh diet also produced more fat-corrected milk and milk fat at 30 and 60 DIM. Another study published in the Journal of Agricultural Science similarly looked at the effects of time spent in fresh cow pen on lactational performance. In this study cows were assigned to either spend 10 or 21 days in the fresh pen. The researchers observed that cows that spent only 10 days in the fresh pen tended to produce more milk in early lactation which resulted in them also tending to have higher milk production throughout a 305-day lactation. While there is limited research on the effects on shorter stays in the fresh pen, the research that has been published is presenting with similar performance results.

There hasn't been a specific number of days determined to be the optimal time for cows to stay in a fresh pen; however, based on results from current research and field observations, cows will benefit from being moved to a high diet after 10 DIM if they are healthy and aggressively eating when feed in offered to them. We feed fresh cows a gut-filling diet to maintain rumen fill and limit the risk of acidosis or a displaced abomasum, but the research on this topic has shown that some cows require that diet longer than others. Cows that are aggressively eating when feed is dropped and are otherwise considered healthy will benefit from an earlier move to a high diet. On the other hand, there will be sick and sluggish cows that will benefit from being on a fresh cow diet longer. Farmers can work with their nutritionist to find what strategies work best for their farm. Routinely checking blood or urine ketones of the fresh pen is a smart practice. In addition to checking ketones during those first 7 DIM or when cows are sick, farmers may consider checking ketones before moving cows out of the fresh pen. If farmers are finding otherwise healthy cows with elevated ketones in the fresh pen, it may be beneficial to try moving cows to a high group sooner.

*— Emily Bourdeau*
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# CAN SPREADING CRUSHED ROCK ON CROP FIELDS HELP FARMS AND THE ENVIRONMENT?

Newly published research from a team of researchers at the University of Illinois (Kantola et al., 2023) suggests the answer may be yes. While more research is needed to confirm these findings, the experiment is one of the first to take what had been promising small-scale/greenhouse studies out into crop fields. The practice itself is relatively simple, apply crushed basalt rock to farm fields similar to a lime application. In fact, the researchers used a conventional lime spreader to apply the basalt and a chisel plow (row crops only) to incorporate the material. After four years of application to fields plots (corn/soy rotation and giant miscanthus, a popular biofuel crop) the researchers saw significant greenhouse gas (GHG) reductions (carbon dioxide aka $CO_2$ in this case), increased soil pH in the acidic soils, and crop yield and quality that was either similar or better than the conventionally managed plots.

At this point you might be asking the very reasonable question, how could mixing in more rock with my soil that is already full of rocks and minerals have much of an impact on anything? The first key factor is the particle size of the basalt. Rather than applying actual rocks, the basalt rock is crushed to roughly the size of sand grains, which greatly increases the amount of surface area that is exposed to the soil and water it will eventually react with. The second factor is the chemical makeup of the rock, which is high in calcium (Ca) and magnesium (Mg). When rock is repeatedly exposed to wind and water, freezing and thawing, the rocks crumble into smaller and smaller pieces, but as they undergo this "weathering" process, their internal makeup changes as well. This means, as those Ca and Mg-rich minerals are weathered, the Ca and Mg are released from the mineral structure and enter the soil water where they can be used by plants for growth, or interact with other components of the soil water.

This is where the rubber really meets the road, and those small Ca and Mg-rich particles will react with $CO_2$, our GHG, which is also naturally found in the soil water. When this happens, much of that $CO_2$ is transformed into bicarbonate ($HCO_3^-$) which takes that carbon particle and carries it down deep into groundwater and ultimately, deep into the ocean where it can settle and remain unchanged for millions of years. This long-term storage has a major benefit over trying to store captured carbon in our cultivated soils, as carbon nearer the soil surface will be much more likely to be transformed back into $CO_2$ and reintroduced into the atmosphere. The natural process of rock weathering across the planet offsets about 3% of current fossil fuel emissions already but these early results demonstrate we may be able to greatly increase that number through this "enhanced weathering" process.

The U. of Illinois team found that adding 20 ton/acre of crushed basalt increased soil closer to optimal levels (without becoming too alkaline) and increased the amount of available Ca and Mg to the crops. These soil quality improvements were reflected in significantly greater biomass harvested from the plots that received the basalt treatment (corn/soybean and miscanthus).

So now that we know the crop wasn't negatively impacted, we'll move onto the environmental benefits. The basalt treatment offset 23-42% of the carbon emissions from the corn/soybean rotation plots. Row crop production, particularly when tillage is utilized, can generate substantial amounts of GHG emissions from the soil, so offsetting almost half of what would typically be produced is a major improvement. Perennial grasses, which don't get tilled (or at least much less frequently if in rotation) and typically have much more plant biomass (and therefore carbon) underground, can be a net sink (removes more than is lost) of carbon. In fact, the results from the miscanthus plots (grown for biofuel), showed that they stored (aka sequestered) much more carbon than was emitted during the experiment. Finally, that carbon that was sequestered by the miscanthus was enough to offset the remaining balance of what was produced by the corn/soybean rotation. Altogether, this means that growing these two crops side by side and on equal acreage, there was roughly a "net-zero" change in the amount of GHG produced. Becoming net-zero as an industry as a major goal of the dairy industry and while we may not be planning to incorporate miscanthus into our crop rotations, this concept has shown a lot of promise. Even better, we're utilizing equipment that's already on the farm, incorporating a by-product of other industries, seeing benefits to the crops we're already growing all while having a positive impact on the environment.

*— Laura Klaiber*
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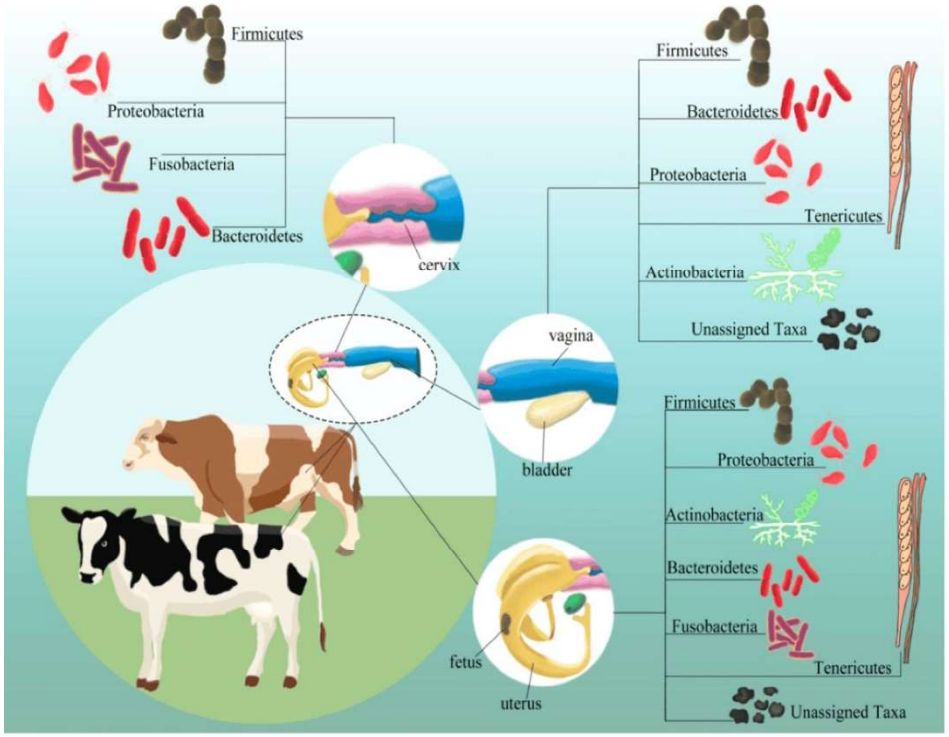
# COMMENSAL BACTERIA: A REPRODUCTIVE TALE UNTOLD

Beyond harmful bacteria, what is your knowledge on the female reproductive microbiome? I pondered this in my studies of reproduction, and it's a question that continues to mystify researchers. Within the dairy industry we're aware of the negative impacts that pathogenic bacteria (bad bugs) have upon the reproductive system and overall fertility. resulting in postpartum reproductive illnesses like endometritis and metritis. For this reason, farmers work to prevent these costly illnesses from occurring by limiting the potential harm to the reproductive tract during the transition period. They do so by reducing stress during the dry and fresh period, ensuring sterile protocols, and providing appropriate feed and attention. While we go to great lengths to limit the adverse impact of pathogenic bacteria, what role in reproductive health of the herd is played by the commensal bacteria, which are naturally-occurring, harmless microbes residing on the surface or within the body and mucosa that don't cause disease?




Graphic sourced from Appiah et al. 2020

Recent studies, specifically in human research, has provided a deeper understanding of the mammalian female reproductive tract and its vast microbiome. Technological development within microbiology enhanced by 16S rRNA sequencing has allowed for the ability to identify and compare complex and poorly described bacteria and their strains. For many decades it was believed that the uterus of the dairy cow was sterile of living bacteria until breeding, parturition and exposure of the reproductive tract to environmental bacteria (Nguyen et al., 2019). Owens et al. (2019) reported an abundant pre-existing microbiome in virgin heifers. These bacteria phylum consist of Proteobacteria, Firmicutes, Bacteroides, and Lactobacillus spp., all of which are influenced by the reproductive cycle of the dairy cow and insemination. Within the phylum Firmicutes and Bacteroides, Moore et al. (2017) found commensal bacteria within the development of the placental attachment and the endometrial lining. Lactobacillus spp. are commensal bacterium found within the human and bovine female reproductive tract and endometrial lining associated with suppressing inflammation and immune response during early embryonic development between the dam and fetus which in turn contributes to sustaining pregnancy in dairy cattle. The image displayed by Appiah et al., 2020, demonstrates the diverse types of naturally occurring bacteria found within the bovine female reproductive tract and their relationship with each structure and organs. It appears that commensal bacteria play an important role in overall reproductive health. Lots more needs to be learned including the impact of antibiotics on the microbiome balance and how to restore homeostasis and improve uterine health and reproductive performance over a cow's lifetime.

*— Jasmine Guerrero*
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# WHAT'S HAPPENING ON THE FARM?

What a busy month! We toured a large dairy, Bilow Farms in Malone, with the summer students so that they could see their newly built 100-cow rotary parlor as well as tour another well-run facility. We also toured a local sugar house and learned how to make maple syrup and got to sample some! Our students departed Miner Institute a few days later; we wish them well in their future!

We also started chopping 4th cut milk cow forage and 2nd cut grass silage and packed bunker silos. Our crop crew has been working hard to get the crop harvested at the right stage. We're expecting corn harvest to start around the 2nd week in September. The cows have handled the heat well. To help limit heat stress we have temperature-controlled sprinklers set up over the headlocks to cool the cows when they are eating, as well as in the holding pen before milking. We also have fans positioned over the stalls and in the holding pen to keep the air moving and the cows cool.

We are having a baby boom, with over 80 cows and heifers due in August! This definitely keeps us busy. We dry off cows at 227 DCC (days carried calf). They then go to a sand bedded free stall. At 3 weeks prior to calving we move them to our sawdust bedded pack. Heifers are brought over from the heifer facility at the same time. Checking the pack is a team effort: Herdsman, calf staff and milkers walk the pack several times a day to check on them, looking to see if anyone is calving or if a cow needs help. For the most part we have good calving ease and few health issues in our fresh cows. However, recently, we have noticed a spike in larger calves being born and an increase in DA's (displaced abomasum).

Enjoy the rest of summer!

*— Rebecca Sprang, Herdsman*
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# THE FARM REPORT

You are one of approximately 1700 subscribers to this newsletter, which has been published continuously for the past 42 years. In fact, since we had a couple of combined July-August issues some years ago it's likely this is the 500th issue of the Miner Institute Farm Report. Whew!

While we occasionally ask our readers if there's a topic they'd like covered in a future issue, periodically we do a more formal evaluation to make sure we're meeting the needs of our readership. We haven't done a readership survey for almost 10 years, during which time we've added a lot of subscribers. Therefore, in November you'll receive a short Farm Report survey; we'd appreciate it if you'd complete it and return it to us.

# STARCH, Continued from Page 1

between the lab analysis (i.e., 6.8) and the pH conditions in the rumens of the cows in your herd and what that may do to fiber digestion.

As we feed corn hybrids with higher NDF digestibility, more starch, and perhaps softer starch, understanding the contribution of starch to the energy value of the silage and its interaction with rumen fiber digestion is critical. Nutrition models used to formulate rations can help us properly balance NDF content and digestibility with starch content and digestibility (as well as sugars). Corn hybrids containing more rumen fermentable starch require less additional starch in the ration concentrate mix.

With rations containing about 7% uNDF240 (dry basis) or less, we need to be careful with starch. Our work with corn silage-based rations tells us that when uNDF240 is 7% or less, the risk of low milk fat rises with a rumen fermentable starch content of just 19 or 20% (24 to 25% starch in the ration). One the other hand, in these corn silage rations, when uNDF240 approaches 10% or more of dry matter, we can expect less intake. Some nutritionists have started monitoring the rumen fermentable starch:uNDF240 ratio as a marker of risk for milk fat depression. They may be on to something, and a ration around 2.8 or higher may signal ideal conditions for low milk fat.

This fall, as you begin to review your farm's forage tests and how to feed this year's crop of corn silage, think about the rumen conditions in your herd and factor in both fiber and starch.

*— Rick Grant*
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# SUMMER RAINS AND NITROGEN MANAGEMENT-A BLESSING OR A CURSE?

Nitrogen is one of the most difficult nutrients to manage on the farm. Compared to phosphorus, potassium, and most of the other micronutrients, nitrogen is rather mysterious in its comings and goings from the soil. Just like every other nutrient, it can leave the field through crop removal, or through surface/subsurface flow. Yet, the loss potential doesn't stop there. Any surface-applied nitrogen that contains or turns into ammonia can quickly disappear through volatilization. This is because ammonia is a gas – a bit like propane. If you leave the propane tank valve open all that valuable fuel gets away pretty quickly!

So, go ahead and incorporate your nitrogen, use urease inhibitors, etc. However, if you think that by doing so you will completely stop nitrogen from floating off into the atmosphere, think again. As it turns out, ammonia is not the only gas that nitrogen can form to escape from your soil.

Most of the nitrogen in soil ends up converting to nitrate form. While plants can absorb nitrate just fine, nitrate and excess water don't really get along, (or perhaps they get along too well). Due to its negative charge and solubility, nitrate easily moves into soil water. So, if saturation persists, soil microbes start converting the nitrate into gaseous forms such as nitrogen gas ($N_2$), or even into nitrous oxide ($N_2O$) – a potent greenhouse gas. This is one instance where summer rains can be our enemy. If you get too much rain too fast, you stand to lose some nitrogen. Well-drained soils can favor losses through leaching, while the wetter ones risk nitrogen gas losses.

While that paints a pretty frustrating picture to those of us who keep getting hammered by showers and thunderstorms this season, there is still plenty of opportunity to count our blessings. In addition to moving surface applied nutrients into the root zone, abundant moisture in the summer can really help with the breakdown of surface residue and soil organic matter to help feed the crop. This is one reason why "healthy" soils with a manure history and reduced tillage often perform well in wet summers.

To complicate things further, some of the microbes involved in these processes actually have the ability to fix atmospheric nitrogen for themselves (similar to legumes). This is another factor that could help supply late-season nitrogen in a moist year.

Another beneficial factor is that while the numerous storms throughout the country this season have generated above average wind and large hail reports--not an ideal situation for standing crops-- the lightning that comes along with these types of storms actually fixes a little bit of nitrogen that rains down on the crop. Although it's estimated to be only 10-20 lbs. total N throughout the growing season, hey, every little bit helps.

*—Allen Wilder*
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# WHAT I THINK

- I think that nobody should be surprised at the plummeting share price of a major producer of artificial meats. As The Economist newspaper noted, the sales volume of alternative meats was "butchered" in 2022. The major reason cited (other than high prices): Artificial meat doesn't taste as good as beef. Gee, who knew?

- I think that high feed grain prices are "the new normal", in which case we can expect to see more corn and soybeans growing on our region's dairy farms.

- I think that in spite of heavy spring rains in the Southwestern U.S. and last month's Tropical Storm Hilary, "You can't fake water", and irrigation water costs and restrictions will be a major driver of livestock and cropping alternatives in that part of the country.

*— E.T.*

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Members of Adirondack Architectural Heritage recently visited Miner Institute and The Alice T. Miner Museum. Here President Rick Grant talks about the new transition heifer barn.

## Closing Comment

The reason some politicians like to stand on their record is to keep voters from examining it.

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