FARM REPORT

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FROM THE PRESIDENT'S DESK – MANAGING OVERCROWDING

Recently I was asked a question about how to best manage cattle in an overcrowded facility. Many U.S. dairy farms operate at greater than 100% stall stocking density, whether they have 4- or 6-row barns. A simple answer would be that every management and housing factor becomes ever more important as stocking density increases above 100% of stalls. Lower stocking densities surely enhance animal well-being, but if a herd or pen of cattle is overcrowded, here are my priority management concerns.

A fundamental consideration is that an overcrowded herd is experiencing chronic, subclinical stress and the cow is expending her biological reserves every day to cope with that stress. With excellent facilities and management, overcrowded herds may seem to perform well as assessed by milk yield, reproduction, and health. But we need to remember that the reserves are being drained by overcrowding which leaves the cow less able to cope with additional stressors such heat stress, disease, poor feed, etc. Overcrowded pens typically respond more quickly and severely to additional stresses. In my experience, there is no magical stocking density that results in observable negative consequences, but it varies as a function of housing and management quality.

From the cow's perspective, I sometimes wonder if she has a desired stall and manger stocking density. We would be quick to think that 100% or less would be her answer. But in her world, it likely boils down to whether or not she can access key resources (feed, water, stalls…) when she wants, in the quantity and quality she needs. We all know there are numerous ways to make that happen on farm.

With these basic concepts in mind, I think research and on-farm experience indicate that the following are priority factors for managing overcrowded pens:

1. Keep time outside the pen to a minimum; certainly, less than 3.5 hours per day, but even less than that if possible. Limiting the cow's access to feed, water, and stalls can only exacerbate the negative effects of overcrowding and excessive competition.
2. Group first-calf heifers separately. We know they are not entirely competitive with mature cows even at 100% stocking density. Ditto for lame cows.
3. Feed more physically effective fiber (peNDF) and less rumen fermentable starch (RFS). Work we did several years ago found that cows overstocked at 142% in 2-row pens had higher rumen pH when fed 22% versus 19% peNDF. We also have found that when

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HIGH N PRICES: THE LIGHT AT THE END OF THE TUNNEL ISN'T ALWAYS AN ONCOMING TRAIN

"This too shall pass." Inspired by 2nd Corinthians, this proverb can be applied to the current fertilizer situation. The obscenely high fertilizer prices farmers are facing in spring 2022 are unlikely to be the "new normal", a result of a combination of high natural gas prices, global strife, weather woes, and the worst supply situation in memory. The nutrient most in the news has been nitrogen since it's the only major nutrient that non-legume crops can't do without, each and every year. However, Russia and Belarus are huge global suppliers of potash (though not to the U.S.), the war in Ukraine has caused potash prices also soar as well. Farmers can skip a year of phosphorus and potassium application on grain crops, but if a crop needs nitrogen and none is applied then both yield and crop quality suffer.

To make the best (or at least avoid the worst) of the current situation, use manure to supply nutrients to your lowest fertility fields, but if nitrogen is needed for corn or grass you should use it even at current prices. Think you're paying the highest prices ever for nitrogen? Think again! Commercial nitrogen fertilizers weren't available until the early 20th century. Prior to this, animal manures were a primary source of N fertilizer, and farmers used much shorter crop rotations to supply N from incorporated crop residues and root systems. Farms that didn't have livestock had to buy animal manure to supply nutrients, including guano (bat and bird poop) which is a product high in nitrogen. Guano was mined, dried and bagged in South America and marketed in the U.S. In 1850 guano was in such short supply that at $76 per pound it was one-quarter the price of gold! At a typical nutrient analysis for seabird guano, after it was collected, dried, and bagged the cost per pound of N was about **$2000**. (This is not a misprint.)

Nitrogen prices are expected to remain very high at least into 2023, though in the coming year the price of UAN solutions might be a better buy than that of some other N fertilizers. (That's if UAN is available, which isn't at all certain.) If you haven't used UAN and it is available, perhaps it's time to consider it. UAN is a blend of ammonium and nitrate sources of N; it volatizes less than urea and may be slightly more efficiently used by plants. It's also easy and economical to add a commercial nitrification inhibitor such as N-Serve 24 or Instinct to a tank of UAN. We expect that nitrification inhibitors haven't increased in price nearly as much as fertilizer N, so they may be an especially good buy this year.

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REGENERATIVE AGRICULTURE

The term "regenerative agriculture" threatens to replace "organic" as a buzzword, purportedly a system of farming that continuously improves soil health, increases biodiversity and transfers greenhouse gases from the atmosphere into the soil. A number of commercial food products are claiming that they were produced using regenerative agriculture, but talk is cheap since there isn't a single test to determine how a foodstuff was grown. A plant doesn't care how it gets its nutrients, whether from decaying plant organic matter or from commercial fertilizer. But farmers will go a long way to making their nutrient management regenerative by following the "Four Rs" of fertilizer use: The Right rate, the Right source, the Right placement and the Right timing. This will result in good nutrition for the crop while minimizing the loss of nutrients to the environment.

— *E.T.*

CAN ANTIBODIES *MAP* OUT A POTENTIAL WAY TO REDUCE JOHNE'S INFECTIONS?

Mycobacterium avium subsp. *paratuberculosis* (MAP), the slow-growing, resilient bacteria responsible for Johne's disease, is detrimental on many levels. Since infection occurs in stages, clinical symptoms can become increasingly more apparent in infected animals over time, and are often characterized by chronic diarrhea, emaciation, lethargy, and poor milk production. The difficulty with identifying Johne's disease lies in its ability to remain as a subclinical infection for months to years, and the infected animal will shed large amounts of MAP in feces while showing no visible symptoms. Infection with MAP lasts a lifetime, and disease progression between the different stages of infection varies between animals. A 2021 Journal of Dairy Science article examined the worldwide economic impact of Johne's disease for various dairy regions based on available prevalence estimates. Annual losses over a 10-year period in the U.S. and Canada due to Johne's infection were an estimated U.S. $53 and CA $49 per cow, respectively. At a national level, annual herd losses for the U.S. were estimated at $108 million and CA $20 million in Canada. While there are many variables that can affect comparisons of prevalence data, herd-level impact of Johne's disease is nonetheless a concern. The only licensed Johne's vaccine in the US was discontinued in 2019, and while an experimental vaccine is in the works with promising preclinical results, there is still interest in charting new territories to combat this debilitating disease. Could antibodies show us the way?

Infection of calves with MAP can either happen in utero or via the fecal-oral route through ingestion of contaminated colostrum, milk, feed, or water during the first 6 months of life. Management and biosecurity strategies are mainly used to control Johne's disease in herds and prevent youngstock from exposure. The importance of antibody transfer to calves is well-documented and can provide newborn calves with some defense against diseases. Could this also apply to reducing early-life infections with MAP? In a 2022 Veterinary Immunology and Immunopathology article, Argentinian researchers were interested in determining if antibodies from cows either positive for MAP or vaccinated with a known antigenic compound of MAP (lipoarabinomannan: LAM) had an impact on MAP infection in the calf small intestine. Serum antibodies were collected and pooled by group from either healthy cows (free of MAP infection), MAP-positive cows, or LAM-immunized cows. Pure bacterial culture of MAP was isolated from a fecal sample of a MAP-positive cow. Three 3-4 week old male Holstein calves from MAP-negative dams were anesthetized, and an 8 ml inoculum of either MAP bacteria alone, MAP + antibodies from healthy cows, MAP + antibodies from infected cows, or MAP + antibodies from immunized cows were injected into one of five loops of the ileum. The fifth loop was injected with sterile saline as a control. The loops of the intestine were replaced, the incision closed, and calves were euthanized after 3.5 hours. The ileal loops were removed and content collected to examine the interactions between MAP and antibodies in the intestinal lumen. There was significantly lower recovery of viable MAP bacteria (almost one full log reduction) in the MAP + MAP antibodies tissue sections than in the MAP + healthy antibodies and MAP + immunized cow antibodies sections, indicating that the presence of MAP antibodies inhibited the invasion of MAP; however, these two sections also demonstrated diminished bacterial counts compared to the loops inoculated with MAP alone. In vitro pre-incubation of MAP with each of the antibody groups (3.5 hours at 38.5°C) showed insignificant differences between groups, which may indicate other mechanisms in the intestinal tissue contributing to the lower recovery of MAP as opposed to a direct antibody effect. The presence of MAP antibodies also reduced early local inflammatory responses in the intestine, suggesting a protective immune response.

While the initial results are promising, further work is necessary and the mechanisms by which this observed protective effect are still not fully understood, especially if these results may not be similar in natural infection situations. More questions remain regarding the duration of protection that these antibodies could provide, which specific antibody types (IgG1, IgG2, IgM, IgA) contribute most to protective effect, and if antibodies from MAP-positive dams could eventually be used as a preventative MAP strategy. While colostrum from MAP-positive dams should still not be fed to calves, better understanding of MAP antibodies in colostrum and their protective mechanisms may generate more research into their potential use as prophylactics. With this research and the questions it poses, there is opportunity to further explore the role of antibodies as potential cartographers to aid in our journey to control Johne's disease.

— *Cari Reynolds*
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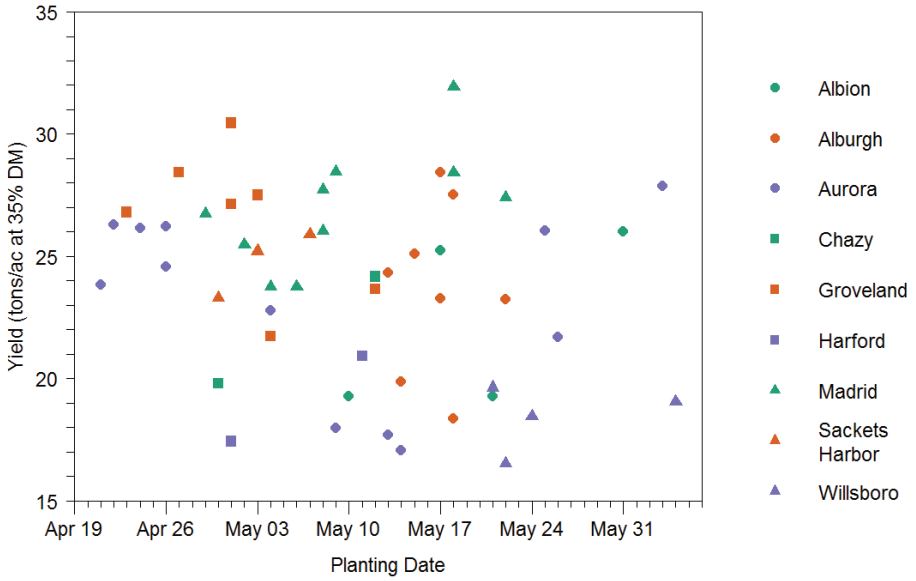
EARLY CORN PLANTING – BRIGHT IDEA OR BIG MISTAKE

Planting corn has to be one of the biggest priorities for a forage producer each spring. A single crop acre can produce six to ten tons of high-energy forage dry matter, so it's no wonder that corn silage is the predominant forage crop fed to lactating dairy cows. While we're still a few weeks away from corn planting in the North Country, planting is already well underway in southern regions. The state of Texas, for example, was already more than 50% planted by the end of March according to the USDA. While reports like that may have you itching to get your corn planter rolling, I suggest you hold your horses and consider the implications that different planting dates might have on corn silage yield and quality.



There's been a recent push for earlier planting of both corn and soybeans around the country. Farmers and agronomists alike point to contest-winning crops that were planted so early that it would send chills down a veteran farmer's spine. While timely planting is naturally a consideration for maximizing corn yields, pushing the envelope with early planting dates may actually reduce productivity. That was Bill Cox's conclusion in 2015 when his Cornell research program confirmed that mid-May is still the optimum planting time for maximum corn yields in New York. To further investigate the optimal corn planting date, we turned to the historical yield and planting data from the New York and Vermont Corn Silage Hybrid Evaluation Program headed up by Joe Lawrence.

The program evaluates corn hybrids at several locations each year, most of which don't end up planting corn on exactly the same date every growing season. For example, corn has been planted at the Aurora, NY location anywhere from April 20th to June 3rd. This variation in planting date gives us a sense of how early or late planting might translate into silage yield. The figure above shows the average corn yield for each planting date at all participatory locations associated with the hybrid evaluation program from 2007 to 2020. Each shape/color combination represents a location; any pattern formed by the points is indicative of a relationship between planting date and yield.

The obvious conclusion from this dataset is that corn actually has quite a large planting window: Planting earlier in the spring isn't consistently associated with higher yields. Interestingly, the highest average yields at the Aurora location were from June-planted corn. Nevertheless, excellent yields have also been obtained in cases where the corn planting occurred in late April for that location. To be fair this isn't a perfect dataset, and it doesn't account for the fact that earlier planting may allow for higher-yielding full-season varieties to be used. It's also important to note that later planting generally means later harvest which shortens the fall fieldwork window and could potentially put the crop at risk of frost before it reaches optimal maturity.

The matter of corn silage quality as it relates to planting date hasn't been well researched in the Northeast region. However, the general consensus seems to be that silage quality is optimized by timely planting. If late-planted corn is harvested prior to peak maturity due to frost, it will certainly suffer from a starch standpoint. On the other hand, my observation is that some hybrids grow a bit shorter when planted later, a phenomenon which could effectively boost the starch content if the plant still puts on a good ear. Regardless, it's unreasonable to believe that biomass yield would not be reduced in these cases.

The best time to plant corn is always when the soil is fit for the task: It needs

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ADDING NEW LIFE TO WINTER-DAMAGED ALFALFA FIELDS

By now any winter damage to your alfalfa fields should be painfully evident. Hopefully your alfalfa and alfalfa-grass fields came through the winter in good shape, but if they didn't here are a few comments which may help in your decision-making.

- Alfalfa-grass fields are more resistant to winter damage than is clear alfalfa, plus the presence of grass gives you an option of applying manure or N fertilizer to these fields. Applying N to clear alfalfa is a waste of money, but is an option if there's enough grass in the stand.
- **Do not** attempt to rejuvenate a winter-killed alfalfa field by drilling alfalfa seed. Autotoxicity makes this a losing proposition. Red clover is a better choice because it won't be affected by the plant toxins that will affect alfalfa seedlings. If the soil surface is moist you might get enough soil cover with a conventional (vs. a notill) drill, but you won't know this until you try drilling a test strip.
- While red clover may be an option for winter-damaged alfalfa fields, the more grass in a field of alfalfa-grass, the less likely that drilling red clover will amount to much. Asking a red clover seedling to compete with established grass plants is simply asking too much — it's simply the survival of the fittest. Even if the red clover seed germinates it may die within a few weeks due to competition by the grass for light and moisture. Years ago I won a gentleman's bet with a farmer who insisted on no-till drilling alfalfa seed into one of his grass fields. I told him that it wouldn't work, a waste of time and seed. He called me out there after the alfalfa seed germinated, delighted to show me lots of tiny alfalfa seedlings. I agreed that there were a lot of seedlings, then said that I'd be back in a few weeks. When I showed up again (there was no call inviting me this time), for some reason the farmer wasn't interested in going out to the field with me...

— *E.T.*

OVERCROWDING, Continued from Page 1

undegraded NDF240 is approximately 7% of ration dry matter, RFS at a moderate 19% will reduce milk fat. Overcrowding reduces time spent ruminating in stalls and encourages slug feeding, and that appears to reduce rumen pH as well as lowering dry matter intake and milk fat and protein percentage.

4. Overcrowding and restricting feed access substantially increases incidence of subacute rumen acidosis. So be sure to have feed available 24/7, pushed up, and in good condition. Cows will likely be eating at all hours at high feed-bunk stocking densities, and so the ration needs to be high quality all the time.
5. Likewise, every stall should be as comfortable as possible since the cows' ability to choose a stall is restricted, especially subordinate animals. For the stalls and the feed bunk, you are essentially trying to counteract the negative effects of slug feeding and lost recumbent (lying down) rumination.
6. Make sure that water is not limiting so that cows can readily access it despite overcrowding.

This would be my priority list – you could no doubt add to it. But these are the absolute essentials in my opinion if you must manage overcrowded pens.

— *Rick Grant*
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FOLLOWING UP ON RICK GRANT'S MARCH *FARM REPORT* ARTICLE

Regular readers of this newsletter may have been encouraged by the results of recent Miner Research showing that feeding a wide range of ratios of alfalfa hay to corn silage, from 10-90 to 90-10, resulted in very similar milk production. While the corn silage was produced on the Institute farm, the alfalfa hay used in the trial was purchased, which is significant as will soon be explained. After considering milk components, Rick noted that a ratio of 70-30 or 50-50 corn silage-to-alfalfa resulted in the highest milk protein and slightly higher fatty acid content. Milk urea nitrogen (MUN) was lowest in the 70-30 corn silage-alfalfa hay ration, another plus.

As an agronomist, and as the one who managed the Institute crop enterprise for about 30 years, the superiority of the 70-30 and 50-50 rations pleases me greatly, especially the diet with 70% corn silage. Our long-term average yield of corn silage at Miner Institute was about 18 tons per acre or 6 tons of DM. In all those years our alfalfa-grass yields never even came close to 6 tons of DM. In fact, I don't think we ever hit 5 tons DM/acre, even with a 4-cut schedule. Therefore, it's a lot easier to grow the crops for a 70-30 corn silage-hay crop silage ration than it is one with a higher ratio of hay crops. And all the corn silage comes from one harvest, not several. Forage quality is more consistent with corn silage than with hay crops, particularly alfalfa-grass which varies in quality depending on both cutting and stand composition. Uniformly high quality is a reason why Miner Institute purchased the alfalfa hay used in this trial.

— E.T.

PLANTING, Continued from Page 4

to be dry enough for the planting equipment to work properly and also warm enough for the seeds to germinate consistently. The other factor to consider is first-cut haylage timing. If you're managing orchardgrass or a similar crop for lactating cows, there is a good chance that the time you harvest it and the corn planting window will overlap. When push comes to shove, it's better to prioritize taking first cut on time to maximize digestible dry matter. Planting your corn by a certain date doesn't guarantee yield or quality at harvest, but grass gone by is heifer feed every time. The corn planting window lasts for weeks, but maximum grass yield and quality only lasts a few days: It's a time period you cannot afford to miss.

Ultimately, you can't predict how a corn crop will turn out based on the date that you plant – provided you plant within a couple weeks of the optimal planting time for your region. A late-planted corn crop may not be a record breaker, but you can still raise a heck of a crop if the temperature and rainfall patterns allow. It's therefore more important to plan your planting around environmental and soil conditions and to ensure that you will not postpone critical harvest times for other essential crops. When it comes to corn planting, the early bird doesn't always get the worm, so don't get too excited about corn planting yet.

— Allen Wilder
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SAVE THE DATE!
Miner Institute is hosting an Open House on Aug. 6, 2022!
Stay tuned for more information!

HEY! THAT IS MY STALL!

Have you ever been walking through a pen of cows and noticed that a particular cow is always in the same stall or section of stalls? Do cows prefer specific stalls in a free-stall barn? Have you ever asked yourself what may be motivating cows to choose a particular stall within a pen?

Generally, we characterize an animal's preference as the amount of time spent in a particular place, like a stall. Preference can be hard to capture because it takes a lot of time to follow animals throughout the day and observe their time in a particular area of the pen. However, new technologies can help us capture the location of animals in a pen on a more continuous basis. From a management standpoint, we may be able to identify cow preference to determine areas that need improvement on the farm. For example, if a certain portion of the feed bunk continuously gets neglected during feed push-ups, it could have negative consequence on dry matter intake for cows that prefer to eat in that area of the bunk. You may also observe an empty section of the feed-bunk, with cows jostling for feed-bunk positions at other areas of the pen. If the empty section of the pen had adequate feed, more cows could eat at one time in a more efficient manner.

In terms of stalls, cows prefer stalls that have higher levels of bedding and are free of manure and urine. Therefore, it's important to maintain the cleanliness of stalls throughout the week and in between days when new bedding is added. To accomplish this, the bedding could be redistributed within the stalls on days when new bedding isn't added. Cows have a strong behavioral need to rest, and should spend 12-14 hours per day lying down. Increased lying time in stalls can lead to an increase in milk production: For every extra hour a cow spends lying down, an additional 2-4 pounds of milk can be produced. This is why it's important to find out why cows prefer certain stalls to lie in. In order to try to get an idea of stall preference at your farm, take a walk through the free-stall pens and look for any stalls that cows seem to avoid. If there is a stall that has bedding piled up and looks unused, spread the bedding out to make a more even lying surface. If any of the stalls are bent or have broken rails, and cows seem to avoid them, try to make it a priority to fix them. Some cases may not be an easy fix, such as end stalls that are smaller than the rest in the row, so it is recommended to focus on the easy fixes.

Another consideration is the distance a stall is from the feed-bunk and if this determines cow preference. A recent case study was done by Marek Gaworski at the Warsaw University of Life Sciences, Poland on the differences in occupation of lying stalls by cows. The idea behind the research was to identify different features of a stall that might drive a cow to spend more time in a particular stall. In this study, cows were housed in two pens, with 6 cows per pen. There was single row of 6 stalls available for the cows to lie in, allowing 1 stall per cow. The row of stalls in front of the feed bunk were chained off, forcing the cows to walk around to the row of stalls on the other side of the stall alley, further away from the feed-bunk. The researchers did this to determine if distance to stalls from the feed bunk affected preference. When cows were forced to travel a further distance to stalls from the feed alley the amount of time cows spent lying decreased. The three closest stalls had a greater stall occupation (lying or standing) compared to the three furthest stalls, indicating that these stalls were more preferred by cows based on their proximity to the feed-bunk. Potentially, there could be other factors such as proximity to fans and air flow, or light that may have influenced this, but the researchers did this on two different pens and there were no differences between the pens. This indicates that it was likely the distance to feed that was driving this preference. Gaworski concluded that the difference in stall occupation confirmed that cows and their activity in the pen may be guided by the distance of stalls from the feed-bunk. He also stated that further research needs to be done to discover accurate recognition of preference for stalls in pens with different numbers of rows and the relation to feed alley and water troughs. This information could be beneficial for designing a dairy barn.

In conclusion, we can see that cows do show preference for particular stalls for a variety of reasons including clean and adequate bedding and stalls located closer to the feed-bunk or water troughs. Doing occasional walk-throughs of your free-stall pens can allow you to view if there are any broken/bent stalls or stalls with too much or not enough bedding, and make management changes. When designing a new barn, be sure to look at current industry standards for stall sizes, install multiple crossover alleys for easy access to the back-alley, which creates a shorter distance to those stalls, and lastly, try to avoid end-stalls being smaller than the rest of the row. This is an intriguing topic that will continue to be studied in the future with new technologies.

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Students from our Advanced Dairy Management program representing the University of Vermont took part in the North American Intercollegiate Dairy Challenge event in Green Bay, WI. From L to R: Emily Sorrell, Chelsey Patch, Kate Rowley, and Hannah Roberts.

Closing Comment

Survival tip: If you get lost in the woods start talking about politics; someone will soon show up to argue with you.

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