

FARM REPORT



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FROM THE PRESIDENT'S DESK: COWS CRAVE CONSISTENCY

Total mixed rations (TMR) arrived on the U.S. dairy scene in the 1970s and 80s and quickly became a common approach for feeding dairy cattle. Compared with more traditional component feeding systems, TMR provided a more uniform supply of nutrients to the rumen and enhanced digestive efficiency.

But in the real world of commercial dairy farms, variation in TMR nutrient composition is inescapable, and this unavoidable variability in ration makeup affects cow performance and health. Specifically, greater variation in TMR composition may be related to more metabolic disorders like abomasal displacement and fluctuating milk yields. Delivering a TMR that is consistent in chemical and physical composition translates into higher lactation performance.

Many factors contribute to inconsistent ration composition and nutrient intake including feed sorting, daily variation in feed ingredients and forages, feed mixing equipment, order of ingredient mixing, and how long the ration is mixed. This incomplete list could be lengthened considerably. Because of this daily variability in TMR composition, nutritionists take feed samples for analysis. There should be an on-going emphasis on accurate feed mixing on all dairies.

on every farm to a greater or lesser degree. An important question is what impact day-to-day variation has on cow performance response. A paper published several years ago (J. Dairy Sci. 97:562-571) by University of Guelph researchers answers this question – and the impact they observed will astound you!

They collected information on 22 commercial dairy farms in eastern Ontario that were primarily Holstein, larger than 50 cows, and had free-stall housing. The farms were visited for seven consecutive days in summer and winter. The relationship between daily variation in composition and particle size of TMR and dry matter intake and milk production was measured. To assess variation from day-to-day, the researchers used a common statistical measure termed the coefficient of variation (CV). The CV is simply calculated as the standard deviation divided by the mean and is a common measure of variation around a mean. The larger the number, the greater the variation.

There's a lot of great information in this paper, but here are just a few take-homes that really got my attention. Every 0.5-unit increase in variability (i.e., CV) translated into a decrease of 2.2 pounds per day in dry matter intake and a 7 pound per day reduction in milk yield! Overall, efficiency

Still, variation in TMR composition exists

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ROLE MODELS: WHAT COWS CAN TEACH US ABOUT COVID

As scientists begin to take a closer look at the immune response and public health impact of SARS-CoV-2 (COVID-19) on the human population as a means to develop effective treatments, animal models pave the way to learning about this particular virus' behavior. Animal models are the basis of many pharmaceutical and biologic treatments. Not only are they a crucial part of the pre-clinical stages of drug development (where immune response as well as drug safety, efficacy and dosage are evaluated), animals also can be excellent host models in which to explore immune responses and antibody development. The previous knowledge of animal Coronaviruses (CoV) in veterinary medicine has provided a foundation for scientists to begin to understand the pathogenesis and transmission of this novel strain. As if cows weren't amazing enough, it turns out that they may be the ideal model for antibody development. Never fear, cows are here!

A recent article featured in *Science* magazine describes how one biotherapeutic company in South Dakota is using genetically engineered cows to explore antibody development against COVID-19. While manufacture of antibodies is a typical practice in the pharmaceutical industry through use of a bioreactor or other simulated environment, use of a living model is ideal as it allows for observation of a natural response to infection. Many antibodies,

especially manufactured ones, are monoclonal -- which means that they only recognize and bind to one part of an invading virus. Cows create polyclonal antibodies, which allow them to recognize and bind to multiple parts of a virus. The advantage of polyclonal antibodies is not only in their increased ability to protect against infection, but also their prolonged effectiveness even if the virus mutates by being able to recognize more than just one binding site. After injecting cows with the therapeutic candidate, the researchers discovered that the antibodies produced were four times as effective at preventing the virus from entering cells as those antibodies found in the serum of surviving COVID-19 patients. The antibodies produced by the cows are fully able to be used by humans and show promise in terms of potency and sustainable production. While more information regarding viability and efficacy of using these antibodies as a treatment means is still forthcoming, this approach shows promise toward treating or preventing the novel Coronavirus in humans.

Cows aren't the only animals lending a hand--er, hoof--to scientific progress. The outbreak of COVID-19 has considerably highlighted the importance of a OneHealth approach to controlling the virus. Another article published in *Research in Veterinary Science* points out that the breadth of knowledge surrounding animal CoV has helped researchers fill in

the knowledge gaps when it comes to understanding human CoV. As a result, the veterinary medical sector can be imperative in advancing human research as scientists try to better understand this family of viruses. Diseases such as infectious bronchitis virus (IBV) in poultry, feline infectious peritonitis virus (FIPV) and swine CoVs have all provided information on viral mutation, evolution and transmission between species. Vaccines that are currently available for animal use, their response, and their efficacy can also aid scientists in designing vaccines for human use. Licensed vaccines for animals do not prevent infection, but can lessen the severity of the respiratory response as well as mitigate involvement of the kidneys and reproductive tract. It's anticipated that a vaccine for human CoV would initiate a similar effect. As the immune response and subsequent protective effect after infection with COVID-19 is not yet understood, information regarding how animal vaccines infer protection will be imperative to design robust and accurate vaccines for addressing the disease in humans. Knowing what has worked and what has not worked in veterinary medicine to address and control CoV can be incredibly valuable to human health research as control and treatment efforts continue. Animal models continue to be the role "model" for how new treatments are developed.

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MANURE AND SOIL MANAGEMENT FOR IMPROVED NITROGEN EFFICIENCY

As I write this, the time for sidedress nitrogen (N) applications is just around the corner. So what better time to think about how to make the most of the N supplies that already exist on the farm to reduce the costs of purchased fertilizer and have a positive impact on water quality? While there are always new and emerging practices and technological advances that are being researched and developed that will further optimize the system, there are also those that are tried and true. This month I'll review some of the fundamental practices for sound N management.

While managing dairy cow manure is often frustrating at the best of times, when well-managed it provides an excellent supply of nutrients for crop growth and helps retain or increase organic matter in the soil, imparting many beneficial properties that are much harder to come by in crop production systems that lack livestock integration. If you look at a manure analysis you'll notice that the N in the sample comes in two forms, ammonium and organic N. The ammonium fraction comes from the urine that is combined with feces in the barn and in storage, and it's this N form that makes the timing and method of manure application so important. When manure is applied in the fall, virtually all of the ammonium will be lost and unavailable by the following spring. In the spring, injecting or immediately incorporating manure is critical to make the most of your manure N. As the table from Cornell University's Nitrogen Recommendations for Field Crops in New York illustrates, the transformation of ammonium in manure to gaseous ammonia that is lost to the atmosphere happens rapidly, with particularly high rates of losses occurring within the first 6-8 hours following application. Therefore, injection or immediate incorporation is the best way to capitalize on this "free" source of N.

As the solids content of the manure source increases, the organic N proportion of the sample will increase from approximately 50% in a liquid dairy manure (~5% dry matter), to comprising the majority in manure with a high dry matter content. The organic N will act as a slow-release fertilizer as microbes in the soil must convert it first to ammonia and then into the plant-available N forms of ammonium and nitrate, with these transformations occurring most rapidly when soils are warm, moist, and well-aerated. While the timeliness of the incorporation of high solids content manure isn't as critical as liquid manure due to the stability of the organic N fraction, incorporating the manure into the soil will ensure that as the organic N is converted into ammonia, it will be retained in the root zone

Impact of manure application method on percent of ammonium remaining in the field.

Manure Application Method	% remaining
Injected during growing season	100
Incorporated within 1 day	65
Incorporated within 2 days	53
Incorporated within 3 days	41
Incorporated within 4 days	29
Incorporated within 5 days	17
No conservation or injected in fall	0

and complete the conversion process into the plant available N forms of ammonium and nitrate. The above-mentioned Cornell University recommendations estimate that 25-35% (depending on dry matter content) of the organic N will be used by the crop in the first year following application, followed by 12% and 5% in the second and third years post-application.

Another major source of N during the growing season is that generated from the soil organic matter. For a simple comparison, if we assume that organic N comprises 5% of the total organic matter, and 2% of that organic N will become available in a growing season, a soil that has 2% organic matter will supply 40 lb N/A every year. For every 1% increase in organic matter, the N available for crop uptake increases by 20 lb/A. The actual level of N supplied by the soil depends on many factors, including inherent soil characteristics, drainage, and weather, but researchers at Cornell University estimate that on average, 60-80 lbs N/A of ammonium is generated from the mineralization of organic N every year in New York soils, a large proportion of the crop's annual N requirement. As is obvious from the previous discussion, adding organic matter-rich manure is a great way to increase the organic matter of the soil. However, the high nutrient levels in the manure present risks to water quality, so we need to be judicious in the rates of manure application and explore other avenues to improve organic matter content.

One option that can simultaneously achieve increased organic matter, retention of residual soil N, and improved water quality, is planting cover crops. While the extent of cover crop biomass accumulation will vary from year to year, the growing crop in the fall and early spring can utilize N that would otherwise be lost in runoff throughout the nongrowing season. Cover cropping can also contribute

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PRETTY IS AS PRETTY DOES

The title of this article typically refers to a beautiful girl with a nasty disposition. We're certainly not going there, but it reminds your writer of the difference between what may look good growing in the field vs. the quality of forage that puts milk in the tank. Two examples:

- **Multi-leaf alfalfa.** Alfalfa varieties with more than the normal three leaflets have been on the market for over 30 years. I believe the first was "Legend", which had modest multileaf expression—the percentage of multileaf vs. trifoliate plants. We planted this variety at Miner Institute soon after it's release and it was indeed "pretty". But when we compared multileaf and trifoliate plants growing in the same field there was little difference in leaf weight per plant. Most multileaf varieties have five leaflets, but each leaflet is smaller than the typical trifoliate leaf. This hasn't stopped seed companies from marketing multi-leaf alfalfa varieties since seed cost and forage quality are similar to that of conventional varieties—and it's not a genetically engineered trait.
- **Leafy corn.** These are usually silage-only hybrids, and like multi-

leaf alfalfa they've been on the market for decades. Leafy hybrids have more leaves per plant—often many more, with the extra leaves all above the ear (therefore easy to see) and some have wider leaves as well. Leafy hybrids even look good from the road, and it's been my observation that anything that looks good to a farmer (and his farming neighbors) from the seat of a pickup truck is a winner. When my son Matt was a crops consultant in Northern NY one of his clients grew a leafy hybrid in 15" rows. Matt scouted for rootworms in one of these large fields, and after getting assaulted by what seemed to be an almost impenetrable mass of leaves said that it should be illegal to plant a leafy hybrid in anything less than 30" rows! Leafy corn hybrids continue to be popular on many dairy farms. Seed cost and silage yield are similar to that of conventional hybrids, and most farmers aren't bothered by the "silage only" restriction. But corn leaves aren't the most nutritious part of the corn plant and only represent 12% or so of dry matter yield, so it's not surprising that with most leafy hybrids both milk per ton and milk per acre are similar to

that of conventional hybrids. In the previous sentence, note the word "most": Occasionally a leafy hybrid is a better-than-average performer. One year a "leafy" was one of the top-ranked hybrids in the Cornell University corn hybrid trials, and we planted a fair amount of this hybrid at Miner Institute with good results.

Leafy corn is the polar opposite of brown midrib (BMR) corn. Leafy corn looks great in the field but in most cases is an average performer in the feedbunk. BMR corn is anything but pretty, but properly managed and fed BMR corn silage increases DMI and milk production. BMR's rather shabby field appearance bothered one farmer so much that I kiddingly told him to plant BMR in most of the field but plant the guard rows to a leafy hybrid. That way the field will look good to his farming neighbors driving past in their pickup trucks while he reaps the benefit of BMR's superior forage quality. I was kidding; he was not, and that's just what he did. We need to feed our cows, but sometimes we also need to feed our egos...

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RATION, Continued from Page 1

of 4% fat-corrected milk production was reduced by greater than 4%. That is an amazing loss in milk yield due only to day-to-day variation in the TMR energy content.

If we consider TMR particle size we see that a 5%-unit increase in CV for long TMR particles (i.e., the particles retained on the top screen of the Penn State Particle Separator) was related

to a loss of 2.6 pounds per day in milk and over a 2.5% loss in efficiency of fat-corrected milk production. So, just like chemical composition, we see that day-to-day variation in TMR particle size contributed to a sizeable loss in milk and milk production efficiency.

The take-home from this study is that cows certainly thrive on consistency – in their management and in their rations.

This study clearly demonstrates the magnitude of the feed intake and milk loss that a farm will experience when the TMR is not uniform from day to day. It pays to ensure that ration variation is minimized with a well-managed feeding program. Remember that cows crave consistency, and they'll reward you when you provide it!

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RAISING THE BAR ON TRANSFER OF PASSIVE IMMUNITY

A much-needed facelift on passive immunity standards has been set by a group of calf experts based on information gathered from the USDA National Animal Health Monitoring System's Dairy 2014. The work of the panel and the analysis completed helped to determine these new standards, which were recently published in the *Journal of Dairy Science*.

For over 35 years the dairy industry has held the dichotomous standard that if a calf has a serum immunoglobulin G (IgG) >10 g/L it had successful transfer of passive immunity (TPI). The rationale behind this benchmark was based on higher risk of mortality with a serum IgG <10 g/L. With this benchmark the dairy industry has made improvements in mortality rate since 1991, but has made very little improvement in morbidity or sickness rate in preweaning heifer calves.

If you consider the example the authors presented, in which they compared a calf that has a 9.8 g/L serum IgG versus a calf with a 10.2 g/L are there any differences in risk for morbidity or mortality? Likely not. Alternatively, if you compare a calf with a value of 10.5 g/L versus a calf with a serum IgG of 20 g/L there likely would be a difference in risk of morbidity

Transfer Passive Immunity Category	Serum IgG category (g/L)	Equivalent TP (g/dL)	Equivalent Brix %	Target for herd (% of calves)
Excellent	≥25.0	≥6.2	≥9.4	>40
Good	18-24.9	5.8-6.1	8.9-9.3	~30
Fair	10.0-17.9	5.1-5.7	8.1-8.8	~20
Poor	<10.0	<5.1	<8.1	<10

Table recreated from Lombard et al., 2020.

or mortality. Observations from the field indicate that when serum IgG levels are above 10 g/L there are reduced incidences of morbidity.

With this in mind, a dichotomous classification scheme is likely too simplistic to give a good estimation of risk to the calf. Therefore, the new standard has four categories of IgG, with corresponding thresholds for total protein and Brix %, which are shown in the table. The inclusion of total protein and Brix % allows for more practical on-farm application relative to measuring serum IgG. Additionally, benchmarks for the percentage of calves within a herd have been set to help identify success of colostrum programs within a farm and to provide guidance for the opportunity to improve morbidity rates.

This included data from 103 operations and 2,360 heifer calves. The data included colostrum quality and feeding, serum IgG, total protein, and Brix %, morbidity

and mortality in the preweaning period, and weaning data. From this information there were distinctive cut points for risk of mortality and morbidity that helped the authors refine the categories for TPI. Of the farms included in the dataset, 32% were meeting the proposed targets within a herd, indicating that these standards are achievable on-farm.

Measuring transfer of passive immunity should ideally be measured between 24 and 48 hours of age. To achieve high levels of transfer of passive immunity the authors of this work recommend feeding colostrum within 2 hours of birth. Furthermore, if a single feeding of colostrum is to be fed, provide 300 g of IgG in the first feeding if multiple feedings of colostrum are to be fed within the first 24 h of life. Overall, these updated recommendations of TPI should help refine our targets and help reduce morbidity and treatments of calves.

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to improved organic matter levels by reducing the erosion of the organic matter-enriched topsoil. In the spring, whether the cover crop is chemically or mechanically terminated, the organic matter and N from the cover crop will return to the soil where it can contribute to soil health and crop growth. No-till and reduced tillage practices have also demonstrated the ability to increase soil organic matter content, and when combined with cover crops and the manure management principles above, there is even greater potential to maximize soil quality, crop production, water quality, and overall profitability.

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WHEN IS THE BEST TIME TO MOW?

The best time of day to mow is one of the most argued subjects in the hay business. When “hay in a day” became the recommendation, mowing was shifted earlier to ensure that there would be adequate time for everything to dry sufficiently before dark. This was to ensure that carbohydrates would not be lost from plant respiration during the night. But some are now advocating for evening mowing. Research out of Canada found that cutting alfalfa at sundown improved the digestible dry matter intake of the resulting forage as compared to morning-mowed alfalfa. This was attributed to an increased proportion of total nonstructural

carbohydrates in the evening-cut alfalfa. Similar results were observed with timothy haylage. The theory is that since plants absorb energy from the sun, the forage energy content will be greatest in the evening.

So what is the best time to mow? Both the “hay in a day” and the evening-cut methods represent strategies for targeting high-energy forage. The best method for each circumstance is likely dependent on the weather, the amount of wilting required, and how thick the stand is. If you time things just right, a superior product could be produced; it’s just easier said than done sometimes. Often, there is so

much mowing to be done, that time cannot be wasted waiting around for the perfect time to mow. Waiting for the perfect time to mow could also set things back far enough so that any benefit is offset by progressing forage maturity. So perhaps it would be easier to focus on avoiding the “bad” times to mow. These are primarily during or before wet conditions. I have never been a proponent of mowing before the dew burns off in the morning. Plant energy will be low and surface water dries faster on a standing crop than in a windrow.

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FARMING IS EASY

"I could teach anybody to be a farmer... You dig a hole, you put the seed in, you put dirt on top, add water, up comes the corn."

The above quote from former Democratic presidential primary candidate (and former New York City mayor) Michael Bloomberg probably raised farmers’ eyebrows and elicited some unprintable responses. But Bloomberg is a city kid born in a suburb of Boston, so it’s not surprising that his knowledge of farming is superficial at best. But even if he’ll remain blissfully ignorant, one result of the Covid-19 pandemic is that a number of people have gained a newfound respect for farming. I smiled when reading that many suburbanites were buying some chickens so that they could raise their own hot wings and McNuggets, so to speak. Chicks are cheap, and the cost of feeding them is “chickenfeed”. Except that when buying poultry chow they discovered that it’s not cheap at all.

What was probably more entertaining was when these folks decided to “process” their chickens. Converting a chicken running around the yard into anything resembling what you’d find in the supermarket is a labor-intensive, messy process. Unfortunately, I have first-hand experience of this: One year the president of Miner Institute, for reasons unknown to anyone but himself, decided to buy about 100 chicks and raise them in the Horse Barn. (Actually the Institute’s farm workers raised them.) Eventually he had 100 chickens — now what? He offered them to employees, and being rather — ah, frugal — I decided that free chicken was too good to turn down. I arrived home with a crate of live cluckers in the trunk of my car and proudly showed them to The Bride. T.B. was not impressed, said that the next time she saw them they were to resemble what she’d find in the supermarket. Nooo problem: After all, I’d had a course in Poultry Science in college. I dispatched the chickens (the course taught me that much), but I had no idea that chicken plucking was such a chore. I wound up skinning the birds and presented the results to T.B., who was even less impressed. After figuring out the investment in labor (including cleaning the garden shed which was the site of the carnage) I concluded that free chicken was much too expensive. By now I probably have a lot of suburbanites and city folks in agreement...

— E.T.

WHAT'S HAPPENING ON THE FARM

As I write this article, we just experienced five days of ninety plus degrees, and the weatherman is calling for another stretch of ninety plus the first full week of July. Overall, the cows have survived the first heat spell pretty well, in fact our Bulk Tank Somatic Cell Count (BTSCC) has been the lowest since I arrived the end of October of last year. As stated in previous articles, our BTSCC had been fluctuating on a monthly basis between 150,000 and 175,000 cells/ml of milk (for non-farm readers, a BTSCC less than 200,000 cells/ml is very good and less than 100,000 cells/ml is excellent). My goal was to have the monthly average BTSCC less than 150,000 cells/ml by the middle of the year, and the over-reaching goal of less than 100,000 cells/ml by the fall. With two days left in June our average BTSCC for the month of June is sitting at 110,000 cells/ml and the last four days the average has been less than 100,000 cells/ml. In my mind, this reduction in our BTSCC can be contributed to three things. First and most importantly, the milking crew has been doing an excellent job prepping cows for

milking and identifying problem cows much sooner. Secondly, back in March we made some minor adjustments to the milking system which has improved overall udder health in the herd. Last but not least, with the imposed reduction in milk production as a result of COVID 19, we have selectively culled some of the problem cows from the herd. I can't thank our milking crew enough because as the herd SCC drops the overall health of the herd improves which inevitably makes my job that much easier.

The cows can't wait to move into their new home. We can actually see the light at the end of the tunnel: The floors have all been poured and the insulation in the ceiling is just about complete. The construction crew is busy assembling the numerous gates and free stall dividers. With the primary focus of the addition being geared toward research, there is a lot of railings and gates to allow the pens to be broken down to pens of 12 stalls each (for reference the pens in our main milking barn have 72 stalls per pen). The last big hurdle is to get final approval on

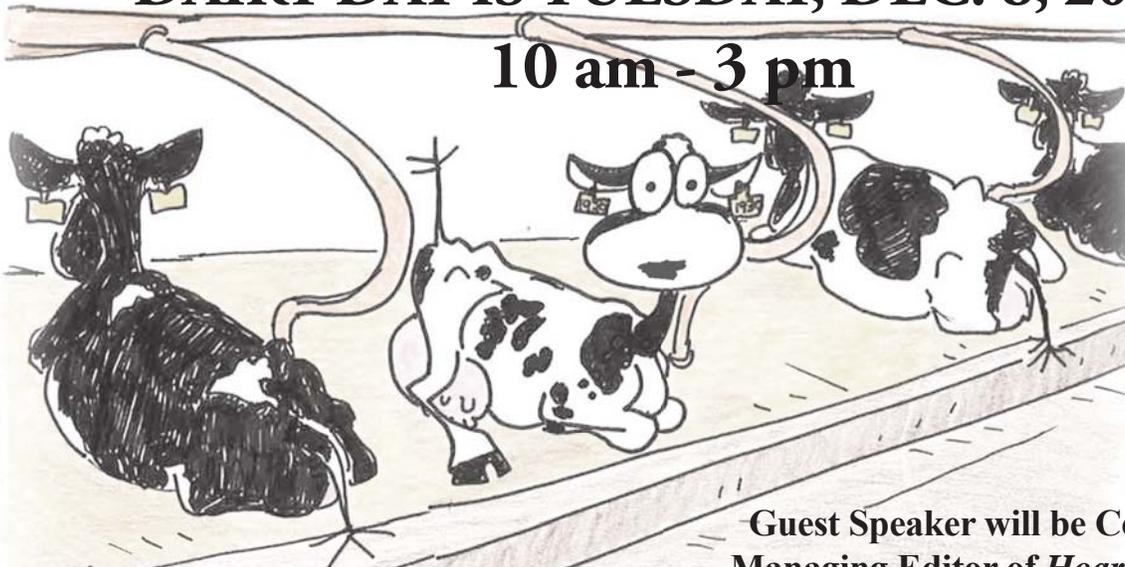
the manure storage and we should be good to go by the end of the summer or the very beginning of fall.

Select members of the research crew returned to work between the end of May and the beginning of June to start their next research project. The Institute is slowly getting back to the norm, but this year will never be completely normal without the summer intern students. One doesn't realize how much the students help reduce the workload until they're not around to lend a helping hand. Educating young minds on managing a dairy operation is one of the primary reasons I accepted this position. Having said that, we are still in search for a year-long farm management intern. so if you know of anyone interested in dairy management please have them forward a resume and cover letter to Dairy Farm Manager Steve Couture at couture@whminer.com or Dairy Outreach Coordinator Wanda Emerich at emerich@whminer.com.

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SAVE THE DATE: DAIRY DAY IS TUESDAY, DEC. 8, 2020!

10 am - 3 pm



Guest Speaker will be Corey Geiger,
Managing Editor of *Hoard's Dairyman*

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