The William H. Miner Agricultural Research Institute July 2021

FARM REPORT

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FROM THE PRESIDENT'S DESK: SILAGE STABILITY STUDIES SUMMARIZED

In the most recent issue of *Journal of Dairy Science*, University of Florida researchers reported on a meta-analysis of how *L. buchneri*-based inoculants affect silage quality and dairy cow performance (104:7653-7670). Their analysis included data from 158 peer-reviewed articles and so the results should be very robust. The strength of well-done meta-analyses is that they combine data from many studies and so the conclusions ought to be stronger than from any single study.

Lactobacillus buchneri is the most studied group of so-called obligate heterolactic lactic acid bacteria. What this mouthful means is that these bacteria must produce lactic and acetic acids during silage fermentation. These inoculants have been used mainly to improve the aerobic stability of silage.

What did the meta-analysis find? Across a range of forage types (including corn, sorghum, temperate and tropical grasses, alfalfa, other legumes, and sugarcane) *L. buchneri*-based inoculants reduced silage lactate content by 7.2%; enhanced acetate (62%), propionate (30%), and 1,2 propanediol concentrations (364%); and slightly increased pH (1.4%) and dry matter losses (less than 1%). Adding obligate homolactic or facultative heterolactic bacteria to *L. buchneri*-based inoculants seemed to prevent the small increases in dry matter loss observed when *L. buchneri* was used alone. Readers interested in the specific organisms and combinations can find the details in the *Journal* article.

Importantly, aerobic stability was increased by about 74%. Greater aerobic stability reflected higher concentrations of acetate and propionate with the *L. buchneri*-inoculated silages that inhibit spoilage yeast and molds. Yeast counts were depressed 7-fold and mold counts by 3-fold in inoculated silage. The only silage type that did not have greater aerobic stability was tropical grasses, but there were very few data and large variability in responses among the tropical grasses such as bermudagrass or elephant grass.

This meta-analysis also assessed the various inoculant rates that had been used in the various studies. The researchers concluded that application rates of 10^5 and 10^6 cfu/g were the most effective at minimizing losses in silage dry matter. Aerobic stability was enhanced with application rates of 10^5, 10^6, and $\geq 10^7$ cfu/g. The authors noted that the high dose would likely be too expensive for routine use on-farm, and their overall conclusion was that 10^5 or 10^6 cfu/g are the recommended application rates based on all the published work to-date.

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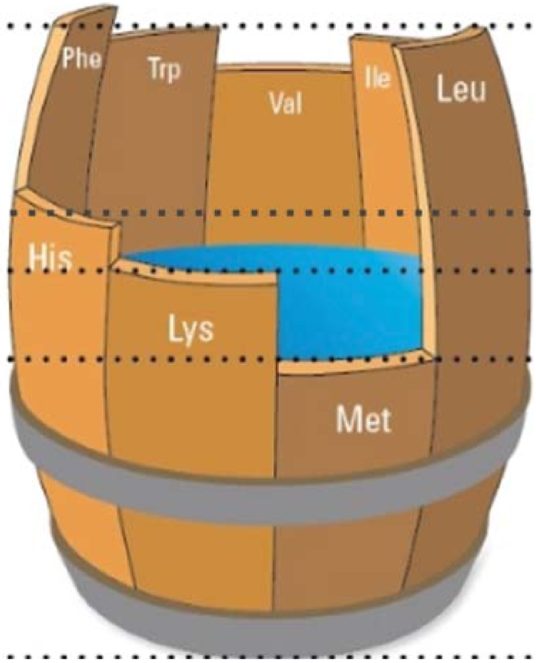
SUPPLEMENTING LOWER PROTEIN DIETS WITH RUMEN-PROTECTED HISTIDINE

Histidine as a Limiting Amino Acid

Methionine and lysine are the first two limiting amino acids in typical U.S. diets that are based on corn silage and soybean meal. It's a common practice to include rumen-protected (RP) methionine and lysine in dairy rations. Nowadays, lower-protein diets have received increasing attention in the dairy industry due to reduced feed costs and improved nitrogen use. However, when feeding cows lower-protein diets, histidine may become the third limiting amino acid, which in turn could limit production performance. To address this issue, several studies have been done to evaluate production responses of lactating cows to RP-histidine.



Dairy Studies Investigating Rumen-Protected Histidine

Dr. Alexander N. Hristov, a distinguished professor of dairy nutrition at Penn State, has published many papers on RP-histidine since 2012. Specifically, in a study published in June 2021, yields of energy-corrected milk and milk true protein increased linearly from 74.7 to 77.6 lbs/d and from 2.3 to 2.5 lbs/d, respectively, with increasing amounts of RP-histidine (up to ~166 g/d), in cows fed diets with approximately 87% metabolizable protein requirements, based on the NRC (2001) model. Feed efficiency calculated as energy-corrected milk yield ÷ dry matter intake averaged 3.7 lbs/lb and was not changed by supplemental RP-His. The Hristov lab also tested the effects of incremental amounts of RP-His (up to ~70 g/d) on milk production, in cows receiving diets with about 102% metabolizable protein requirements, according to the NRC (2001) model. Dry matter intake (mean = 51.5 lbs/d), milk yield (mean = 93.0 lbs/d), and feed efficiency (4.0 lbs/lb) did not change with RP-histidine. However, milk fat yield increased by 8% (+0.28 lbs/d) for ~35 g/d of RP-histidine compared with no supplementation or ~70 g/d of RP-histidine. Dr. André F. Brito, an associate professor at the University of New Hampshire, has also studied RP-histidine in dairy cows. In a study published in 2019, dry matter intake (mean = 48.4 lbs/d) and milk yield (mean = 70.0 lbs/d) were not changed with incremental amounts of RP-histidine (up to ~246 g/d). However, feed efficiency calculated as milk yield ÷ dry matter intake and milk true protein yield increased linearly from 3.1 to 3.3 lbs/lb and 2.1 to 2.2 lbs/d in response to RP-histidine. The basal diet fed in Dr. Brito's study provided ~99% metabolizable protein requirements, based on the NRC (2001) model. Taken together, RP-histidine is more likely to improve lactation performance in lactating dairy cows fed lower-protein diets.

According to the studies discussed above, supplementation of RP-histidine has limited effect on changing nutrient digestibility, including crude protein, neutral and acid detergent fiber, and starch. Moreover, fecal nitrogen and total manure nitrogen excretion, as a proportion of nitrogen intake, were reduced from 35.4 to 31.7% and from 67.5 to 61.5%, respectively, when adding increasing amounts of RP-histidine to the diets providing 87% metabolizable protein requirements. However, RP-histidine was unable to change urinary, fecal, and total manure nitrogen excretion as a proportion of nitrogen intake, in cows fed the diets containing 99 or 102% metabolizable protein requirements. Thus, from an environmental perspective, supplementation of lower protein diets with RP-histidine appears to be an effective way to reduce manure nitrogen excretion at dairy farms. Needless to say, the use of RP-histidine is mainly dependent on the income over feed cost at the end.

— Patrick Zang
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NEW BARN FOR YOUNG CALVES

As the calf manager here at Miner Institute for the past 17 years, I am so pleased to see the new calf barn get started. (Construction officially began in early May). We've had a great success raising our own heifers out of hutches. During that time we have had some struggles, but this new barn will affect our calves now and into the future. The calf-raising facility will be a benefit to the calves and to staff, and will be able to maintain a stable environment for such things as:

- RAIN - No wet conditions for calves or feeders; less wet bedding; no wet grain; and no wet clothes. This will also decrease the need for an abundance of supplies.
- SNOW - The snow will stay outside, allowing feeders and the calves to get around more freely. This will also allow more time to be spent on calves rather than on shoveling snow out of the hutches.
- SUN - Heat has a negative impact on calf health. During the hottest parts of the summer calves undergo a lot of stress. Their grain and milk intakes decrease, which affects their average daily gains (A.D.G.).
- WIND - The temperature can range from 5 to 10 degrees colder with a wind chill. With new air systems, benefits like plenty of air exchange, less chance of pneumonia and less need for treatments arise.
- HANDLING - The new barn will allow us to have an easier method of handling our calves. Administering vaccines can become more difficult as the calf gets older and larger. The barn will provide an ideal way for staff to administer treatment to animals that's much safer for staff and the animals, with far less likelihood that someone gets hurt. The facility allows us to attempt to use a buddy system, improving our calves' social skills at a younger age. In the future there will be lower stress levels on a calf when moving it into larger groups.

Therefore, my hopes are that our calves will be healthier, happier, and increase their A.D.G. Looking into the future, this will improve our overall herd health and the environment for staff.

THANK YOU to all involved in the barn construction process!

— *Bethann Buskey, Alexis Seymour, Andrew Guerin*

Bethann Buskey poses with a calf amid the barn construction on May 24, 2021.

Images above and below show calf barn construction progress on June 28, 2021.

Is there something you would like to know more about? Email article suggestions to Rachel at dutil@whminer.com

CORN STAND COUNTS

When I managed the Miner Institute crop enterprise we measured corn plant population when the corn was a foot or so high. With 30" rows, 17'4" = .001 acre. Tying a 17'4" length of string between two nails makes counting corn plants quick and easy, and can be a one-person job. We'd make ten plant counts in a number of fields, averaging the ten and adding three zeros to get plants per acre. We'd also note any variation between individual counts, since widely varying counts can indicate a problem: Corn planted too deep? A wireworm or cutworm problem? Disease? Birds pulling seedlings? By now it's too late to correct any problems detected, but the results of counting plants might influence your future planting procedures and/or pest control.

Most bags of seed corn contain 80,000 kernels, so multiplying the bags of corn (actually planted, not simply purchased) by 80,000, then dividing by the acres planted you can calculate seeds planted per acre. (This only works if you don't intentionally vary planting rate between fields.) Many corn planters have acreage meters, making acreage determination easy. How does this compare with the results of your plant counts? The old rule-of-thumb was to overplant by 15%, so for a final stand of 30,000 plants/acre you'd drop 34,500 kernels. But even 20+ years ago we found that that a 15% loss was too pessimistic, probably due to a combination of better handling by seed companies and more effective seed pretreatments (Poncho, Cruiser, etc.). At Miner Institute we seldom found more than a 10% difference between seeds dropped and final stand. Most seed corn has a germination of at least 95%, and may be higher than the % printed on the seed tag. Cornell University recommends a harvest population of 26,000-28,000 for grain production, 31,000-33,000 for fields harvested for silage. So for silage, if you want to harvest 33,000 plants per acre this fall and assuming a 10% loss, you'd need to drop just over 36,000 kernels. (The exception would be notill planting into cold soils or other adverse conditions, when you should assume a 15% loss and increase the planting rate accordingly.)

So get out there and do your plant counts on at least several fields — more is better! How close are your counts to your intended plant population, and to Cornell University recommendations? To know is better than not to know.

— Ev Thomas
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DIVERSITY IN THE HAYFIELD

We've often mentioned the numerous advantages of alfalfa-grass vs. pure grass stands. But if including one cool-season grass species with alfalfa is good, are two species better? I don't know, and I can't find any research on the subject, but some farms — including Miner Institute — seed two or more grass species with alfalfa. The only time we did anything similar during the 30 years or so that I managed the Institute crop enterprise was to include several pounds of "annual" Italian ryegrass in an alfalfa-tall fescue mixture. The quotation marks are because some Italian ryegrass plants often survive the first winter. But the ryegrass was included primarily to suppress annual grasses since the field had been in notill corn for five years and some patches of smooth crabgrass had escaped our weed control program.

I'll stick with my long-term recommendation to seed a single perennial grass species with alfalfa—this assuming good soil K status. Jerry Cherney's research at Cornell University has shown meadow fescue to be much higher in quality than any of the other grasses commonly used in the Northeast – enough higher to make a difference in milk production. The grass species most often seeded with alfalfa are timothy, tall and meadow fescue, and orchardgrass (which I hate), and less commonly reed canarygrass, bromegrass and perennial ryegrass. Until I see research to the contrary, I'll continue to be a Doubting Thomas on mixing two or more grass species in alfalfa-grass seedings.

— E.T.

DAIRY FARMING IN JAPAN

My name is Hiroyuki Uchihori; I have been working for Zen-noh, a Japanese agricultural cooperative and have been stationed at Miner Institute as a Zen-noh representative for almost two years. Miner Institute and Zen-noh have had a collaborative relationship for over 20 years to conduct various studies together. I am happy to have this opportunity to write in the *Farm Report*.

The dairy industry in Japan is much smaller than that in the U.S. In 2020 we had 1.4 million cows and 14,000 herds (9.4 million cows, 32,000 herds in the U.S.). Almost all dairy cows in Japan are Holsteins. The average herd size is 95 cows/herd, which is about one third of the average U.S. herd size. Annual milk production is about 16 billion lbs. (more than 200 billion lbs. in the U.S.), and half is processed for fluid milk.

Japan is a small country with a lot of mountains including volcanoes (that's why earthquakes often happen). Many Japanese farmers, especially in Honshu, the main island of Japan, aren't able to have enough farmland to grow their own forages. Those farmers need to purchase feed from others. We would say that the U.S. feed Japanese cows because most of the grains and forages are imported from the U.S. However, it means that feed costs are higher and fluctuate more in Japan. Although the milk price is higher (about \$50/cwt), it's not always reasonable for the feed cost.

The cost of replacement heifers has become another big issue in Japan. Farmers who have no space to keep their replacements usually buy heifers from Hokkaido, a northern island which is the primary dairy region in Japan. Currently the price is about \$7,000 per pregnant heifer! It is a huge investment! Wagyu, Japanese black beef cattle which produce wonderfully tender meat with high marbling, affects the dairy heifer market. The price of Wagyu calves has also been inflated because of decreased calf production from Wagyu cow-calf operations. Now the price of Wagyu calves, both steers and heifers, is about \$7,000 at 9 months old! Farmers could sell dairy pregnant heifers at almost the same price but need to keep them for 18-20 months. And how about dairy bulls? They are much cheaper than heifers, Wagyu, or even crossbred calves (Wagyu × Holstein). If you were a Japanese dairy farmer, which would you like to breed? Yes, many farmers have been shifting to breeding Wagyu (either insemination or embryo transfer) to their dairy cows. That is why dairy replacement heifers are also getting expensive.

Unfortunately, the numbers of dairy cows and herds in Japan are decreasing. In addition to the problems mentioned above, a labor shortage is making the dairy industry difficult. A national survey in 2014 found that 40% of Japanese dairy farmers had no successor. So, we have focused effort on improving labor efficiency as well as cow productivity and longevity. Some new technologies would be helpful for labor-saving. Good management in every aspect of dairy farming is also important to keep cows healthy and productive as mentioned in many articles in the *Farm Report*. Those efforts should be made not only for the present farmers but also for the next generations. I hope the relationship between Miner Institute and Zen-Noh can brighten the future of the dairy industry in Japan as well as in the U.S.

— *Hiroyuki Uchihori*
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SILAGE, Continued from Page 1

A smaller meta-analysis with 12 papers assessed silage inoculation with *L. buchneri*-based products on dairy cow performance. The published results so far have been inconsistent. Early concerns that *L. buchneri*-based inoculation of silage would reduce dry matter intake has not proven true, but milk response has varied among studies. The meta-analysis found that inoculated silage did not affect dry matter intake, milk production, or efficiency of milk production. Further research may demonstrate ways to enhance lactation performance with these inoculants, but to-date that has not been the case.

The bottom line is that *L. buchneri*-based inoculants greatly enhance silage stability due to greater acetate content and related lower yeast counts for all forage types except tropical forages. This consistent and positive effect on aerobic stability is important given the significance of aerobic stability to dairy silage and feed-bunk management.

— *Rick Grant*
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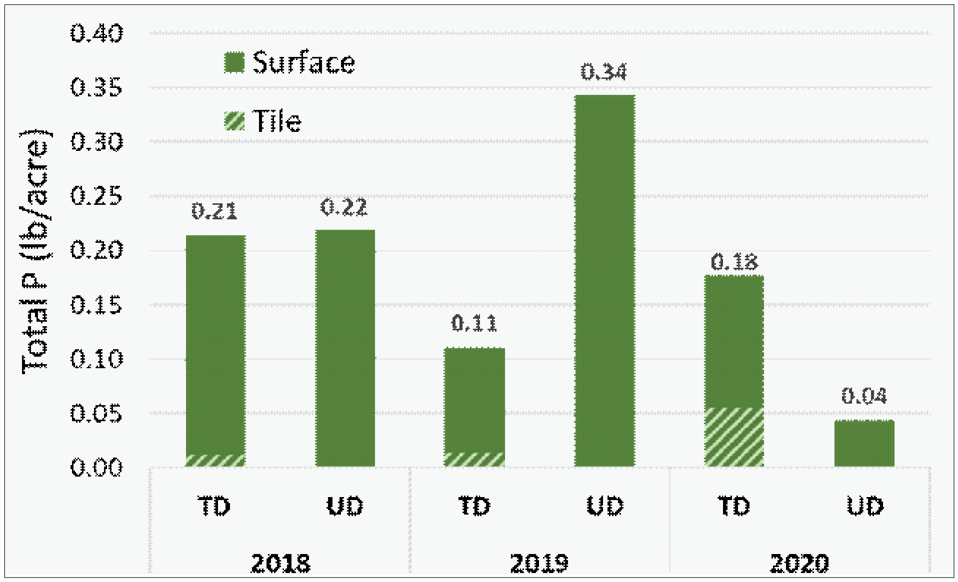
TILE DRAINAGE EFFECTS ON P LOSSES

We'll finish up the three-part review of a three-year edge-of-field monitoring study conducted by Miner Institute investigating the impacts of tile drainage on runoff, nitrogen (N), and phosphorus (P) with a discussion of the P loss dynamics. See the April issue of the Farm Report for a discussion of the project design and runoff dynamics and the June issue for a discussion of N transport. This study was funded by the Northern New York Agricultural Development Program and a full report can be found on the research section of its website (www.nnyagdev.org).



Miner Institute has been monitoring runoff from two adjacent 6-acre corn fields managed identically in Essex County, NY since 2018. One field (TD) has a pattern tile drainage system (35 ft lateral spacing; 4 ft depth) and both surface runoff and tile drainage flows are continuously monitored. The other field (UD) is not tile-drained and therefore only surface runoff is monitored. To briefly hit the highlights from the previous discussion, there was 26% greater total drainage over the three-year monitoring period from TD relative to UD. However, surface runoff was reduced by 49% in TD compared to UD and tile flows represented 60% of the total drainage from UD. The increased subsurface drainage in TD resulted in approximately 2.8 times greater total N loss than was observed in UD, with 90% of those losses occurring via tile drainage.

Despite the higher rates of total drainage from TD, it exported 22% less total P (0.17 lb/A/yr) than UD (0.21 lb/A/yr). There was considerable variation from year to year for both UD and TD, with annual total P exports from TD ranging from 0.11 lb/A in 2019 to 0.21 lb/A in 2018 (figure above). In UD, the lowest total P load was observed in 2020 with 0.04 lb/A exported while the highest losses occurred in 2019, with an annual load of 0.34 lb/A. These levels are at or below the low range of those reported in the scientific literature (Gilliam et al., 1999; King et al., 2015).

In contrast to total P, dissolved reactive P (DRP) losses were nearly two times greater from TD than UD. However, exports were very low from both fields and losses of this magnitude are unlikely to have a significant impact on surface water quality. A concern regarding the use of tile drainage is that the proportion of total P as DRP could increase, even if total P losses were similar. This could have negative water quality implications because DRP is the form of P that is immediately available for biological uptake. Although this initially appears to have occurred given the difference in export rates between the two fields, DRP comprised just 11% of total P in both surface runoff and tile drainage from TD. Additionally, tile flows from TD were only responsible for 16% of the field's DRP export.

The modest reduction in overall P loss from TD is likely a result of two factors. First, surface runoff greatly increases the risk of erosion, which can detach and transport P-enriched sediments and organic matter as it flows over the field surface. Additionally, once surface runoff is initiated, there is little opportunity for the dissolved P in the water to interact with the soil. In contrast, the soil profile, particularly the subsoil which tends to have lower P levels, can act as a filter for subsurface drainage water as it percolates downward before ultimately reaching the tile lines. While certain factors, such as preferential flow pathways and runoff events immediately following nutrient applications, can increase the risk of P loss through tile drains, overall, there have been low rates of P transport in tile flow during this study. These low rates of P loss are reflected in the field's nutrient budgets, as the percentage of applied P lost in runoff on an annual basis has ranged from 0.2 – 1.4% for UD and 0.2 – 1.3% for TD, indicating that only a tiny fraction of the applied P is ultimately leaving the field.

Overall, tile drainage continues to have mixed water quality impacts. The reductions in surface runoff, exported P, and erosion are promising and can have important implications for the P reduction efforts ongoing in the Lake Champlain Basin. However, the improved P retention comes at the cost of an increased risk for N mobilization and future research is needed to identify practices, or, more likely, suites of practices, that can improve these water quality parameters simultaneously under a range of conditions.

— Laura Klaiber
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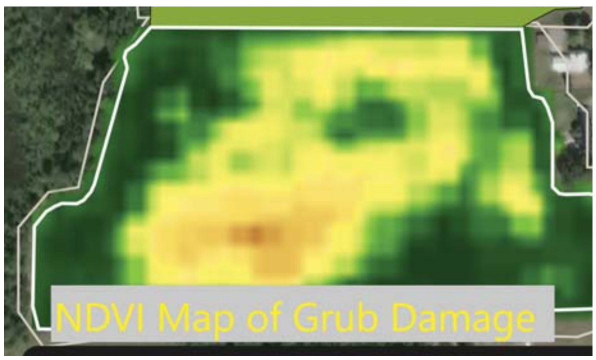
MAKING THE BEST OF A GRUBBY SITUATION

Chafer Beetle and larvae.



If you take pride in your lawn, chances are high that you've battled white grubs at one point or another in your top-notch turf. The skunks are usually the first to identify the problem, and they make it known to the world by systematically excavating the infested areas. Some angry landowners proceed to slander the skunks for this disturbance, but the true fault belongs to the creepy crawlies below. In severe cases of grub feeding, dead spots in the lawn will appear when conditions turn hot and dry. This is because the grubs eat away the roots and prevent the grass from accessing water and other nutrients. Whole sections of turf may even become dislodged as the insects tunnel around and clip the roots just under the soil surface.

As nasty as a grub infested lawn looks, the trouble doesn't always end there – as grubs can do serious damage to pasture and hayfields as well. Earlier this spring I noticed a series of fields where the grass was beginning to brown in certain areas. Further investigation revealed multiple white grubs in each shovel full of soil that I turned over in those areas. I identified the majority of them as European chafer beetle larvae (Amphimallon majale), as well as a few Japanese beetle larvae (Popillia japonica). The European chafer is a medium-sized beetle that is brown or tan in color. Unlike the Japanese beetle, the adult chafer beetle doesn't cause significant feeding damage on crops. In NY, the adult beetles emerge in June/July and congregate on trees and other objects at night to mate. Once they have laid eggs in suitable soil their life cycle is over.

Short cool-season grass stands with adequate moisture are generally the most attractive egg laying sites for European chafer. Alfalfa and red clover are reported to be resistant to feeding damage, but I observed lots of damaged alfalfa crowns in our infested fields at Miner Institute. It appears that the grubs will eat the grass first, but pretty much anything else could be at risk when food becomes scarce. As a result, we were left with some very large dead spots in three alfalfa/grass fields in May (with one field being almost a total loss). Our solution was to take whatever we got for first cut and follow it up with some late-planted corn. While European chafer can survive and reproduce on corn, by the time we were planting, the grubs were getting ready to pupate and thus posed little risk to the corn. Furthermore, the seed treatments could have some activity against the grubs if they made any feeding attempts early on. To save time on field preparation, we ended up no-tilling the corn in the three fields that were the most affected by the grubs. As it turns out, the feeding activity of the grubs made for a very nice no-till seedbed and the corn came up very well in the hardest hit areas. Soil moisture is the main concern now as even the meager hay harvest dried out the soil considerably.

It's unlikely that large numbers of beetles will return to lay eggs in the growing corn, so we hope that the problem will be eliminated by the time we rotate the fields back into perennial forages.

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Closing Comment

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