Fertilizer value of hay feeding

Greg Halich for *Progressive Forage*

AT A GLANCE

When feeding hay, producers might not consider the value of nutrients returned back to the hayfields and pastures for future forage growth, but the numbers are substantial.

Photo by Greg Halich.

How and where hay is fed makes all the difference in the recovery of nutrients.

Each bale of hay contains mineral nutrients that come from soil reserves or from applied fertilizer. When fed to livestock, most of these nutrients will pass through the animals and can by recycled for future forage growth.

As an example, a 5-by-5 mixed grass bale, weighing 1,000 pounds, will contain around 18 pounds of nitrogen, 6 pounds of phosphorus and 26 pounds potassium. (The exact amount will depend on the quality and species composition of the hay.) At current fertilizer prices in early 2019, and assuming 75 percent of these nutrients are effectively recycled for plant growth, this would amount to around $14 in fertilizer value. If that hay sold for $35 per bale ($70 per ton), the fertilizer value would be 40 percent of the overall value of the hay.

How and where you feed this hay will make all the difference in the recovery of these nutrients. To be effective, nutrients need to be returned to areas on the farm that can effectively use them. If nutrients are lost before this occurs (leaching, volatilization, etc.), or if nutrients are spread on areas already high in these nutrients, much or most of the potential will be lost.

We don't always think about the overall process of feeding hay in terms of nutrient flow, but that is essentially what it is. You are exporting nutrients

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from your hayfields and importing nutrients wherever you are feeding the hay. If you are making your own hay, feeding it during the winter and spreading commercial fertilizer back onto the hayfields and pastures every spring, you have broken a nutrient cycle. If you are buying your hay and you still fertilize your pasture year after year, you have broken a nutrient cycle. This is one of the biggest avoidable costs on a livestock operation and, in my opinion, one of the lowest-hanging fruits to improve profitability.

Nutrients lost in confinement

In a 1999 study on nutrient retention in feedlots, it was found that out of all the nitrogen that passed through the cattle, 57 to 67 percent was lost to volatilization, 5 to 19 percent was lost to surface runoff, and 10 to 15 percent leached into the soil below the feeding area. Only 9 to 19 percent of the nitrogen was left in the manure by the time it was ready to be spread.

This was in commercial feedlots. Can we expect anything better from our on-farm drylots and other confined winter feeding options? The answer is doubtful, and to help understand why, we must dig into the details of dung and urine.

Roughly 33 percent of the nitrogen, 98 percent of the phosphorus and 10 percent of the potassium excreted by cattle is in the dung. Dung has a high organic matter content, and nutrients tied up with organic matter tend to be stable and not easily lost to the environment. Urine, on the other hand, is mostly water and has almost no organic matter. Roughly 67 percent of the nitrogen (almost all of the inorganic N which is readily plant-available) and 90 percent of the potassium excreted by cattle is in the urine. Unless you have a high-carbon source (e.g., sawdust, straw, wood chips) that can tie up these nutrients (think of this as a carbon diaper), it will be almost impossible to keep them from volatilizing, running off with surface water or leaching into the soil when fed in a concentrated feeding area.

My point being, even if you scrape every last bit of manure from the drylot and spread it back to the fields or pastures, you have lost a large portion of the nutrient value. The only way you could capture most of these nutrients would be if the manure was mixed with a high-carbon source and protected from the elements until it is ready to spread. This may be practical and cost-effective with dairy cattle and some beef cattle backgrounding operations but highly doubtful for a cow-calf operation, even if the needed infrastructure is subsidized.

Methods to retain nutrients

Potentially the most effective and efficient way to retain hay feeding nutrients is by bale grazing. Bale

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grazing is a winter feeding technique where bales are set out on pasture before winter and fed in a planned, controlled manner, somewhat like rotational grazing.

Very little research has compared retained nutrients from bale grazing with traditional hay feeding methods. The best and most comprehensive study was in 2008 and a subsequent journal article based on this thesis three years later. In this research, nutrient capture and subsequent forage growth with bale grazing was compared to conventional drylot feeding, where manure was spread back onto pasture. Soil inorganic N (easily available to plants) was 187 percent higher in the bale-grazed pastures. Extractable potassium was 185 percent higher in the bale-grazed pastures. Phosphorus levels, however, were nearly identical in the bale-grazed and drylot-applied pastures. (Recall that almost all of the P is in the poop, which is more stable.) Subsequent forage growth over the next two years was 127 percent higher in the bale-grazed pastures, and protein levels of this forage were 74 percent higher in the bale-grazed pastures. Bale grazing was the clear winner over drylot feeding when it came to retained nutrients and subsequent forage growth. It wasn't even close.

To read more about bale grazing as mentioned in the article, visit www.progressiveforage.com/forage-types/grasses-and-grazing/winter-bale-grazing

I would point out that, in most regions in the U.S., you probably do not want to feed at the high bale densities used in this Saskatchewan study. They likely fed all their winter hay on 5 to 10 percent of the pasture acres, while I typically recommend feeding on 33 to 75 percent of your pasture acres in the Upper South. At these lower densities, I would expect a much smaller forage production increase on a per-acre basis. However, you will be getting that increase on more acres, so the net production increase should be similar.

The Saskatchewan research assumed the manure from the drylot would be spread back onto pastures. That may be a dubious assumption. I have been on few beef cattle farms in Kentucky and other nearby states that actually have a manure spreader. I can count on one hand the number of times I've seen a manure spreader in use on a cow-calf operation. That isn't to say manure isn't spread on these farms, but I know for a fact a lot of it, and possibly most of it, isn't. Even if a spreader is used, the manure doesn't always get spread where it needs to go. It often gets spread where it is easiest and convenient.

Unrolling hay is another method that gives good nutrient distribution and is currently used with much greater frequency than bale grazing, at least in the eastern U.S. There are two things I don't like about unrolling hay the traditional way: You generally need to use a tractor every one to two days, and you will inevitably be unrolling hay in conditions when you shouldn't have a tractor out on pasture, with the associated impacts. Those concerns aside, you can get great nutrient dispersion with this method. I would encourage farmers and researchers to experiment with alternative hay feeding systems that work similarly to bale grazing and hay unrolling.

Regardless of whether you are bale grazing, unrolling hay or using another effective method to distribute nutrients, ultimately you will build up the nutrient levels of your pastures to the point where you are getting little benefit from continued hay feeding on them. At this point, and it may be years or decades before that point is reached on a particular farm, the only place left to feed hay to get the full benefits of the nutrients will be on the hayfields they came off. I realize that probably sounds like a radical idea to some, but I have seen it done well with good management. By learning to feed on your pastures first, you will develop the skill and management needed to take it to the next level when that time comes. Ultimately, both the bottom line on your Schedule F and the environment will be better off for it.