

# Bale Grazing: Feeding Hay the Rotational Grazing Way

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Imagine a hay feeding system where you did not have to use a tractor for months at a time and that allowed you to build up pasture fertility without applying commercial fertilizer. Would this be of interest to you? What if this same system also kept your cattle clean during the winter without coats caked in mud and manure, allowed you to creep graze fall-born calves, and built up the organic matter levels in your pasture soils. Would you be even more interested? As far-fetched as this may sound, all these benefits are possible with an innovative winter-feeding technique called Bale Grazing.

Bale grazing is a winter-feeding method where bales are set out on pasture and fed in a planned, controlled manner, somewhat like rotational grazing. Temporary electric fencing limits cattle access to those bales that you want fed in the current move. With each move a fence is set up to expose new bales, usually 50-75 feet in front of the previous fence, which is then taken down to allow the cattle access to the new bales. Where hay rings are used, they are rolled from the old bales to the new bales and flipped over into place. The process is typically repeated every 1-7 days. Properly planned, you will not need to use a tractor for weeks or months at a time (possibly the entire winter) and nutrients will be deposited where they are needed. Simple, cheap, and effective. The main requirements to making it work are an open mind, advanced planning, and cattle trained to electric fence.

## Planning

Ideally, hay is set out on pastures in late fall or early winter, right where you want it fed. In the Upper South, we almost always have good conditions for driving out on pasture through Thanksgiving and usually into mid-December. These drier conditions are ideal for setting out bales without causing any damage, and doing it efficiently. On most pastures with reasonable slope, you can pull a loaded hay wagon or trailer with a pickup truck in dry conditions, and move a lot of hay quickly. With smaller bales (I like 4x5's), you can even roll them off the trailer by hand, right into place without using a tractor to unload (use a hay hook to help in this process). We have moved all our winter hay onto pasture in less than half a day using this method. Moving wagonloads of hay in dry conditions is much more efficient than hauling 1-2 bales at a time by tractor. Properly planned, your winter machinery costs will be a fraction of what they would be feeding hay conventionally.

As a practical matter when starting out, I would recommend setting out 1/4 to 1/3 of your hay at a time. This will give you most of the efficiencies of moving large amounts of hay at a time and allow you to re-calibrate your bale grazing plan as you gain experience. After a

couple of winters you will be able to better estimate your hay needs and feeding densities, and this will allow you to set out more hay at one time, reducing your machinery costs even further.

Bale grazing combines very well with stockpiled pasture. With this system, cattle get both hay and a strip of stockpiled pasture with each move. Since stockpiled pasture is typically better in both energy and protein compared to typical hay, the stockpile can effectively serve as both an energy and protein supplement. This is my favorite way to bale graze and cattle performance with good quality hay in late fall and early winter can be incredible. Thus this system is ideally suited for a fall-calving herd in terms of nutritional requirements.

### **Executing**

As a general rule of thumb, I like to move the fence 2-3 times per week but I have worked with farms that have done well with weekly moves. Most of the cattle farmers I know that do not use hay rings stress you should only put out enough hay for two days or you will have excessive waste. I know of one farmer in Missouri that has had good luck without rings by feeding every two days and tipping bales onto their flat side. He claims this method significantly reduces hay waste. I have experimented with his technique but have typically used hay rings, and roll them across my pastures, usually 50-75 feet at a time to the next set of bales.

Always start from a water source and move away from it. You do not need to use a back-fence during the dormant season, but it is a good idea when practical, to set up two forward fences. One for the current move and another for the next move. In case something happens to your first fence (e.g. wind, ice, or deer knocks the wire off posts), you will still have an additional fence that will protect the bulk of the hay bales. If cattle have access to a 10 acre pasture with 50 unprotected bales they can do a lot of damage in a couple days. It goes almost without saying that your fence needs to stay hot, and cattle need to respect it. Find and correct any shorts or problems before the cattle do.

### **Fertilizer Value of Hay Feeding**

Each bale of hay contains mineral nutrients that either come from soil reserves or from applied fertilizer. When fed to livestock, most of these nutrients will pass through the animals and can be recycled for future forage growth. As an example, a 5x5 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 pre-2021 fertilizer prices 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 that are 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 nutrients flow, but that is essentially what it is. You are exporting nutrients 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, Biermann et al 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, woodchips) 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.

Thus, even if you scrape every last bit of manure from the drylot, feeding pad, or feeding barn 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. For more information see:

<https://www.progressiveforage.com/forage-types/grasses-and-grazing/compost-bedded-pack-barns-a-solution-or-an-added-cost>

### **Retaining Nutrients through Bale Grazing**

Very little research has compared retained nutrients from bale grazing with traditional hay feeding methods. The best and most comprehensive study was a Master's thesis by Paul

Jungnitsch 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 an equivalent amount of 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 dry-lot applied pastures (recall that almost all of the P is in the poop, which is more stable in confined feeding areas). 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.

In most regions in the U.S. you probably do not want to feed at the high bale densities used in this Saskatchewan study, as they have frozen soils for almost half the year. They likely fed all their winter hay on 5 to 10 percent of the pasture acres, while I typically recommend feeding on 30 to 50 percent of your pasture acres in the Upper South. At these lower densities, you 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 that the manure from the dry-lot would be spread back onto pastures. That may be a dubious assumption in most real-farm situations. I have been on few beef cattle farms in Kentucky and other nearby states that actually have a manure spreader, and 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 that I don't like about unrolling hay the traditional way: 1) You generally need to use a tractor every 1 to 2 days, and 2) 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 unrolling systems that get around these two problems.

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 hay fields they came off. I realize that probably sounds like a radical idea to some, but I have seen it done well with good management. Ed Rayburn, forage extension specialist at West Virginia University has bale grazed for over 20 years, and has been bale grazing on his hay-ground for over ten years now.

He has not applied any commercial fertilizer during that time period and has maintained soil test nutrient levels.

### **Equipment and Labor Cost Reduction**

Some farmers envision bale grazing taking up a lot of time as you are moving cattle around the pastures all winter, including rolling hay rings and moving temporary fencing. In reality, a well-designed and executed bale grazing system will significantly reduce both labor and machinery costs. A large part of this savings comes from moving hay in bulk when the weather is dry, as previously mentioned. As an example, Dave Burge in Anderson County used to spend around 45 min per day on his tractor feeding on a sacrifice lot. With bale grazing, and pro-rating his time on a per day basis, it works out to about 22.5 min per day for labor moving portable electric fence and hay rings (he moves the fence and rings every four days), plus about 2.5 min of tractor time (he sets out all of his hay 3-4 times each winter). A total of 25 min per day on average for bale grazing compared to 45 min of tractor time per day with conventional hay feeding in the sacrifice lot. The best thing about it is that he only has to start a tractor 3-4 times with bale grazing for the entire winter vs. 100-120 times with conventional hay feeding.

I have had comments from cattle farmers that they could see bale grazing work with smaller herds but that there is no way it could be done with a 100-cow operation. This simply is not the case. A cattle farm that I've been to and that I correspond with regularly in south-central Missouri winters over 400 head each year by bale grazing and spends about an hour a day feeding, and this includes the pro-rated time of staging the hay. Before switching to bale grazing, he and his wife would spend half the day feeding cattle during the winter. Bale grazing completely transformed winter feeding on this farm.

Many cattle farmers who worry that bale grazing will take up so much time conveniently forget how long it takes them to feed cattle during the winter with conventional practices. It is not unusual for a farm with a 30-40 cow herd to spend 2-3 hours a week on a tractor, or more, feeding cattle. Many of these same farmers also conveniently forget the foot-deep mud or near-zero temperatures that they will invariably have to deal with when feeding hay in a normal Kentucky winter, and all the extra time that will be needed in these situations when feeding with a tractor.

### **Other Benefits from Bale Grazing**

I used to think the improved capture of nutrients (N, P, and K), and reduced winter-feeding machinery costs were the primary benefits of bale grazing. I'm not sure anymore. Soil organic matter will improve through manure and waste hay deposited on pasture, and the consequent stimulation of forage growth. Increases in organic matter will increase long-term soil mineralization of nutrients, particularly nitrogen, and will improve the water holding capacity of the soil. Improved animal health results through constantly moving the feeding area and having less associated mud and manure typical in conventional feeding. For fall-calving herds, you can creep graze/feed calves by adjusting the height of the electric fence. They will have access to grass and hay without competition from the cows. This works especially well when combining bale grazing with stockpiled forage.

### **Concerns with Bale Grazing**

Bale grazing originated in the High Plains in the US and Canada. While it is ideally suited for this region due to typically dry conditions and frozen soils during the winter, it can be modified for effective use in other regions. The main reason people are afraid to try bale grazing in regions with more rainfall and warmer winters is over concerns it will damage or pug their pastures. While this is a legitimate concern, I have generally found that with good management, pugging can be kept to a minimum in most years. The key is to feed at low densities. In the Upper South, I generally recommend keeping feeding densities to 2 tons of hay (roughly 4, 5x5 bales) or less per acre, particularly when starting out. If you have a stocking rate of 3 acres of pasture per cow, this would likely necessitate feeding hay on around 30-40% of your pasture acres each winter. In my opinion this is ideal. Farms that have a higher stocking rate will have a more difficult time effectively implementing bale grazing as they will have to feed more hay on fewer acres and this will by necessity be at higher densities. Stocking rates of 2.5-3.5 pasture acres per cow are the easiest to manage to minimize pasture damage.

Do not constrict cattle to small areas. When I start bale-grazing a new pasture, I continue to give them access to the previous pasture, either in full or in part. This will keep the cattle from being concentrated. Be flexible. If you are bale grazing an area that has drainage problems, move to another area when it is wet. When you have really nasty weather and mud, move to the dry lot or feeding pad if you have one and if it is convenient to get to. That said, I have worked with a farm that has an existing feeding pad, and a farm that has an existing feeding barn where neither has used their existing facility in the last two years, even during the worst of the muddy weather. That is how well bale grazing has worked for them.

Hay waste from leaving bales outside for months at a time is another concern. However, this one is almost completely unfounded, at least in the Upper South. Hay set out in pasture during the summer in this region with its high rainfall, heat, and humidity would be expected to have significant rot even after 1-2 months. But this same hay set out in late fall or early winter after temperatures have dropped will experience very little rot as the biological organisms that break down the hay are not active at this time of year. If you set out hay in late fall that is in good shape with a thatch largely intact, you will be amazed by how little rot occurs even by March.

Bale grazing is not for everyone. It takes good management, reasonable stocking rates, and cattle that respect electric fences to be successful. But it also takes the right attitude to make it work. Farmers who enjoy recreational tractor driving and playing in the mud will find excuses why it won't. But for those with the right attitude that learn how to implement it effectively, the benefits can be great. Once you figure out how to bale graze effectively, chances are good you will never go back to conventional hay feeding. I've never met anyone that did.

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