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Reprogramming a Tobacco Barn to Hay Storage and Self-Feeding: An Eden Shale Case Study

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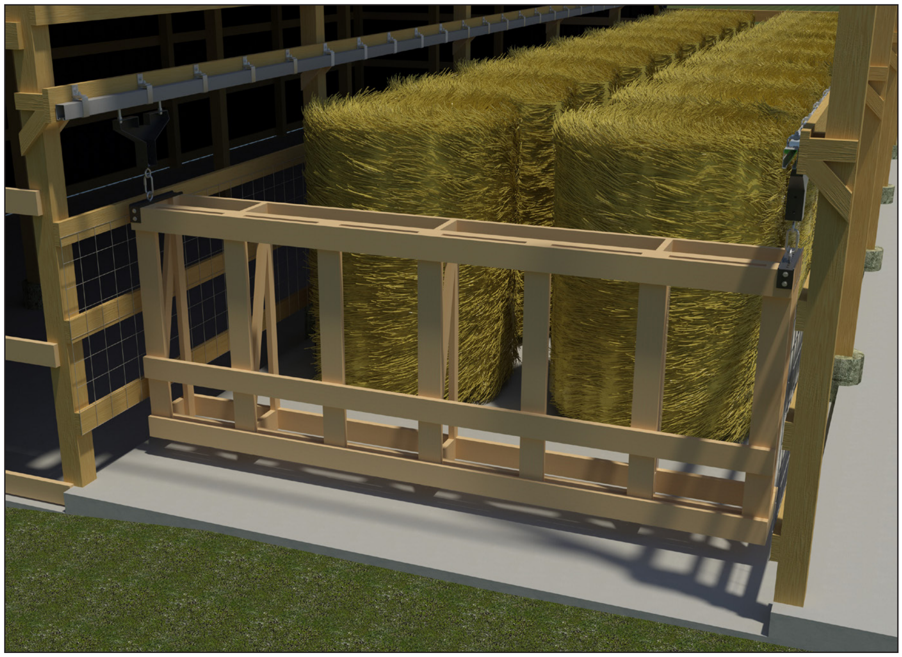

Many farms contain buildings that were productive long ago but contribute little to the farming operation today. A good example is a tobacco barn on a farm that no longer grows the crop. However, the application of land-use planning concepts allows these barns to be repurposed or reprogrammed to contribute significantly to the farming operation. Once repurposed, these old barns can reduce labor and waste while saving time and money, thus improving efficiency and profits.

The very nature of livestock operations, in which the main chores are feeding and tending to livestock, would benefit from labor-saving innovations. Reducing the time needed for feeding, for example, would increase the efficiency of the producer. The best labor-saving systems combine multiple processes. Self-feeding and work simplification are labor-saving techniques that can increase efficiency and income. This, in effect, combines two practices, creating an integrated system.

Reprogramming is the process of repurposing a building when it can no longer be used for the purpose for which it was originally intended. Repurposing becomes necessary because the structural life of a building can be at least 100 years. However, the intended use of the facility may change two or three times during its lifespan.

For example, tobacco barns were specifically designed to house, cure, and in some cases process tobacco. The design was developed to serve that particular function and nothing else. The side doors were designed to regulate the drying of tobacco so that it cures and handles properly. The columns and rails were installed for hanging tobacco. If tobacco production ceases, these buildings would be better used for other functions, such as machinery and equipment storage. However, because of the columns and rails in the design, storage of machinery and equipment is often inefficient, height is restricted, and maneuverability is difficult.

To reprogram a tobacco barn adequately, decisions must be made and a design must be developed to repurpose the structure. Before reprogramming a tobacco barn, it is important to assess the structural stability of the barn for the new purpose. Removing rails or improperly loading the columns can cause failure. The foundation and support columns should also be sound. Ideally, a reprogrammed tobacco barn should contribute to the operation in the form of reduced machinery operation and labor savings. This case study highlights the conversion of a tobacco/livestock barn into a hay storage structure that also doubles as a self-feeder. Therefore, the design goals were to simplify the labor of the livestock producer, while creating an ideal feeder.

The direct benefits of labor-saving designs include:

- Simplifying the producer's work
- Increasing the efficiency of working hours
- Decreasing the depreciation of machinery
- Decreasing crop losses from improper storage and handling
- Increasing efficiency of livestock production

Labor-saving practices also may result in the following indirect benefits:

- Increased value of buildings, and therefore, the farm
- Increased farm profits
- A higher standard of living for the producer
- Improved working conditions

The design should embrace the following efficient hay-feeding concepts:

- Feed should be moved as little as possible from the point of production to the cow's mouth.
- Feed should be moved in bulk.
- Feed should be self-fed.
- Feed waste should be limited.

Figure 1. Southern end of tobacco/livestock barn prior to reprogramming.

Figure 2. Inside of barn, showing usage prior to reprogramming.

The new program created for the building should also incorporate the characteristics of an ideal hay feeder, which include:

- Suitable for use with any type of hay packages
- Accommodating for flexible limit feeding
- Adequately sized to allow for filling with hay only once per week
- Unhindered by snow or mud
- Able to pay for itself with hay and time savings in less than five years
- Convenient to use without requiring the producer to enter the lot/field/pasture

Hay Feeder Design

To demonstrate these concepts, a tobacco/livestock barn that was being inefficiently used was redeveloped for hay storage and feeding (Fig. 1). This barn is located at the Eden Shale Farm in Owenton, Kentucky. Eden Shale Farm is a commercial cow-calf operation managed jointly by the University of Kentucky College of Agriculture, Food and Environment and the Kentucky Beef Network. Since tobacco was no longer raised on the farm, the barn was used for storage prior to its redesign (Fig. 2).

A self-feeding hay feeder design was created using the center alley and existing support columns (Fig. 3). The feeder design utilizes an underhung crane concept. This design suspends the wooden feed panel and allows the panel to travel from one end of the barn to the other using a track system.

Orientation is a critical component of a design. Cattle will access the hay in the feeder from the southern end of the barn. In this case, the southern exposure will provide sunshine into the barn, helping to create a drier, firmer surface while also warming the exposed bales. The southern exposure approach also provides a warmer environment for the cattle. The barn alley already had a concrete surface, which became the feeding floor. To date, there is no more cleanable, more durable, or cheaper impermeable surface option than concrete.

The northern approach to the barn was protected with a heavy use traffic pad surface, using geotextile fabric and rock. On the southern side, where the cattle would approach the feeder, the heavy traffic pad was reinforced with semi-truck tread cylinders, also known as Mechanical Concrete. The northern end of the barn was established as the driveway for loading the hay into the barn. The design does not require the opening of any gates to reach the barn, which saves both time and steps and lessens the drudgery of hay feeding.

Creating a New Hub

The barn is in a 25-acre endophyte-free fescue hay field (Fig. 4). The barn was separated from the hay field by installing two sections of fence (approximately 300 feet) from the corners of the barn to two corners of an adjacent wooded area and a pasture (Figs. 4 and 5). This fenced area created a hub that provides access to multiple fields. Cattle use the wooded area (Field 67 in Fig. 4) in winter as a shelterbelt, lessening the cold-weather stress on the heavy pregnant cattle. The hub also provides access to field 44 (Fig. 4).

Figure 3. Illustration of hay storage and self-feeder. (Illustration by James Ash)

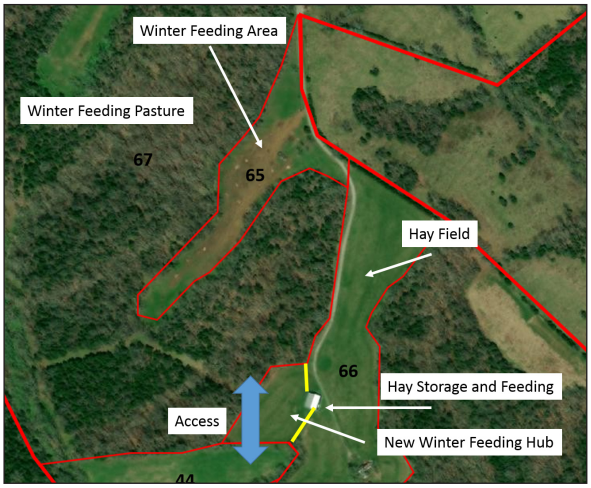

Figure 4. Layout of the reprogrammed barn in relation to the existing operation. The illustration demonstrates how the reprogrammed barn complements the existing winter-feeding area and the flow of the herd.

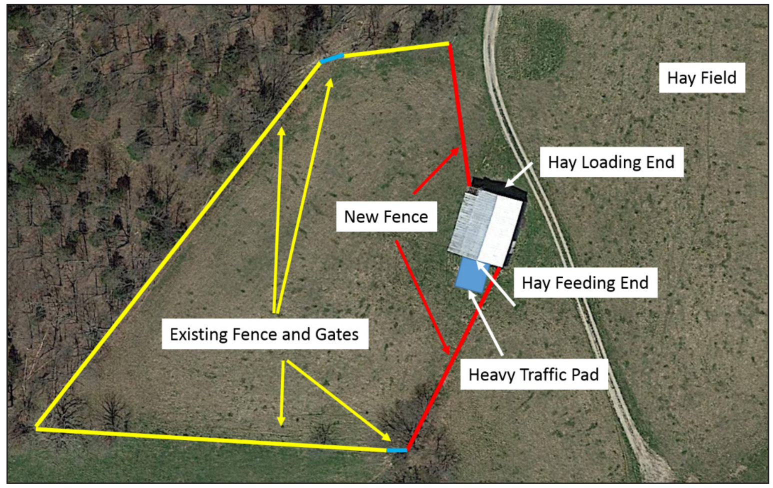

Figure 5. Illustrated view of the created hub around the reprogrammed barn adjacent to the existing hay field.

There was not enough feeding space at the field 65 hay feeder to accommodate the entire herd. Reprogramming the tobacco/livestock barn in field 66 to hay storage with a self-feeder provided an additional feeding site. This allows the herd to be split to an adjoining field. Splitting the herd between adjacent fields aids the producer by providing access to the two herds with minimal travel distance. It also facilitates field rotations. Providing a shared fence between the herds also helps maintain social hierarchies within the herd.

From Field to Self-Feeder

The benefit of this layout is that the distance between the hay field and hay storage has been significantly reduced as compared to the previous hay storage and feeding practices. Storing the hay inside reduces the degradation of the nutritional quality of the hay as compared to outside storage. The reprogrammed barn is also a self-feeder, with a capacity of approximately 30 bales based on the original length of the barn (Fig. 6).

Hay bales can and should be placed in the self-feeder at the time of harvest to reduce hauling. Once filled (Fig. 7), the hay feeder is loaded and ready to feed cattle the following winter. This saves time and labor by eliminating the need to relocate the bales from the previous storage location to the feeding location.

Prior to this implementation, hay bales would have been moved from the hay field to storage and then moved again—in this case, two bales at a time every other day. The new practice significantly reduces travel distances. It also reduces hay waste that can occur when moving the bales from one location to another. In addition, time and labor savings are created, as there are no gates to be opened and closed every time feeding occurs.

Figure 6. Reprogrammed barn loaded with hay at the time of harvest.

Figure 7. The southern end of the barn provides cattle access to the self-feeder with a Mechanical Concrete approach. The flooring in the barn was existing concrete.

Structures and mechanization should complement each other, which means the tractor should ideally clear the structure and be able to maneuver. Unfortunately, the main barn alley was the only alley the tractor could access. In addition, the spacing of the columns controlled the width of the alley and limited maneuverability and flexibility of the structure for reprogramming.

In this case, the width of the alley is approximately 13 feet. Since each animal should have approximately two feet of feeder access, this only allows about six or seven animals to eat at one time. However, the hay is available 24/7, allowing animals to eat in shifts or by social groups. A factor of three can be used to determine the number of animals a feeder can actually serve; in this case, approximately seven spots will provide access to about 21 animals.

Experience Using the Feeder

The design included changing the size of the created bales from five-by-five feet to five-by-six feet. This change increased the volume of the stored and fed hay between the columns. Cattle have difficulty feeding above six feet; therefore, stacking the hay above this height is not recommended.

Removing the strings or net wrapping from the bales at the time of storage is preferred for this design. Benefits include easier access of the cattle to loose hay. Any waste is typically not attributed to cattle but to the design of the feeder. The design of the panel creates a separation distance between the cattle and the hay of approximately 19 inches (Fig. 7). This feature reduces hay waste by forcing the cattle to reach for the hay and helps prevent them from pulling the hay out and stepping on it. What we observed from feeding the cows was that the separation feature allowed approaching cattle to feed off the loose hay that dropped between the hay bales and the feed barrier, without needing to pull hay from the bales.

Summary

This design of the reprogrammed barn incorporates best practices for hay feeding and feeder fundamentals. On this farm, it also creates an accessible hub to allow the cattle to reach multiple pastures. Combining these features creates a system that leads to improved efficiency. Not every farm is such that livestock producers can take advantage of the techniques that are available in this example. The location of existing facilities and other variables may not allow it.

In this case, the project was successful for several reasons:

- The existing tobacco barn was structurally sound, and no work was required to shore up the structure.
- The barn flooring already had an existing concrete pad.
- Fencing the barn out of the field required very little fencing (300 feet).
- Establishing the endophyte-free hay field had been an expensive project, but only 1.5 acres of the 25-acre hay field were taken out of hay production.
- The management of the farm already had cattle in the adjoining wooded field during winter.
- Reprogramming the barn allows the cattle herd to be split between an existing self-feeder and the reprogrammed barn.
- Cattle will access the barn from a gravel all-weather surface.
- The producer will not need to open a gate to reach the barn.
- Storing the hay in the barn will allow the hay to be conserved better as compared to outdoor storage.
- The proximity of the hay field to the barn will reduce travel time.
- The capacity of the barn and the size of the herd will enable the cattle to self-feed for approximately 25 to 30 days.
- Reprogramming the barn provides additional indoor hay storage, which was needed.

This barn redesign represents a significant savings in equipment, time, and labor while providing the cattle with a better feeding experience. Reprogramming the barn is also a more productive use as compared to storage. From a whole-farm perspective, this project leverages a structure and an area of land into an organized hub. It creates a permanent feeding location using a fixed structure, as opposed to using portable hay ring feeders that can only be filled by entering the field. This is an intelligent design that integrates two practices (hay storage and feeding), reincorporating an existing barn into the operation at minimal cost.

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