

Fenceline Feeder Systems for Beef Cattle Production and Resource Conservation

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Fenceline Feeding System demonstration site at Eden Shale Farm. Photo by Dan Miller.

Introduction

One of the most challenging and costly aspects of beef cattle production in Kentucky is winter-feeding. Many producers complain about the time required to feed stored forages, the mud, the drudgery that it creates for the operator, and the decline in production. The intense traffic associated with winter-feeding on unimproved surfaces causes mud, compaction, erosion, and loss of desirable vegetation, often resulting in

annual pasture renovations to address areas impacted by winter-feeding practices. Fenceline feeding systems offer an alternative to traditional in-field bale feeding during the wet winter conditions that Kentucky often experiences. These structures can be utilized to reduce the impact of winter-feeding on pastures and improve the operational efficiency of a winter-feeding area. The volume of wasted hay can also be reduced, compared to traditional practices. These structures are

designed so that the tractor never has to enter the field to load hay bales into the structure. Eliminating the tractor traffic in a field greatly reduces issues with mud, rutting up the field, and the frustration of feeding hay in the mud. Fenceline feeder systems are also excellent options for mobility limited or disabled producers.

The major advantage of this practice is the savings in time, but it also prevents compaction of soils and having to interact with cattle/calves while trying to feed.

These structures are also designed to reduce runoff and erosion associated with traditional heavily compacted, muddy winter-feeding areas by incorporating heavy traffic pads around the structure. Placing the fenceline feeder along a lane ensures access for feeding even during wet, muddy conditions. Locating the feeders in close proximity to hay storage barns improves the functionality and the overall efficiency of the winter-feeding process, as well. An additional benefit of this design is that feed panels can be placed between the hay feeding structures to utilize the same heavy traffic pad for feeding concentrated diets (Figure 1).

The fenceline feeding system demonstration site at Eden Shale Farm was completed in 2016 and has already begun to impact producers throughout the state. This demonstration site is an opportunity to evaluate five different designs of hay feeding structures that are integrated

into a fenceline near the hay storage barns. The siting, design, installation, and maintenance of these five structures and the associated options for heavy traffic pads will be presented below.

Site Selection Considerations

Site selection for winter-feeding is one of the most critical steps of the planning process. In order to create a functional design, the location must save the producer time and create a better environment for cattle. Evaluation of the soils based on hydrologic and engineering properties can aid in determining the best location. Soils should be well drained and capable of supporting shallow excavations with light structural improvements. Sites should always be located away from water bodies, steep slopes, sink holes, or other sensitive features on the farm. Avoiding these areas can prevent excess creation of mud, ero-

sion, and manure laden runoff. Sites on ridges or flat ground, away from sensitive features are favored. Choosing an area with a natural or man-made windbreak can also be beneficial to animal welfare and overall productivity. When siting a fenceline feeding system, it is also important to consider the location of hay storage. To maximize efficiency, feeding structures should be located near hay storage (see time distance evaluation in Figure 2), while still following the previously presented guidelines. It is also important to install the structure along a well maintained lane that can stand up to heavy winter traffic. Savings in time, fuel, and wear on equipment can offset part of the expense of infrastructure upgrades.

One of the activities that impacts time distance values is the number of gates that must be opened and closed to access a winter feeding area. While the gates located on the entrances of the feed-



Figure 1. Incorporating feed trough panels into the fenceline allows for additional space to feed concentrated diets and supplements from portable troughs. Photo by Dan Barton and Ciara Pickering.

ing structure are needed to keep calves contained, the gates can be opened to add hay and closed when hay addition is complete, rather than opened and closed when entering and leaving the field. If calves are not present, the entrances can be left open, further increasing the efficiency of the design. Omitting the entrance gates all together, because they are not needed, would also reduce cost of these systems.

When selecting a winter feeding location, it is also important to consider

where you will store the manure that is generated, until it is time to apply it to fields. Utilizing a covered or uncovered stack area for composting and storage provides an option for managing the manure from winter feeding. An uncovered stack can be windrowed on the ground or on a heavy traffic pad, if available. While more expensive, a covered stack pad can reduce the exposure of the pile to precipitation, thus improving the composting process, nutrient retention, and the handling characteristics of the manure.

Whichever option is selected, size your stack area to accommodate the volume of manure that is expected to be generated by your winter feeding herd. You will need to be able to provide enough storage to hold manure until the beginning of the growing season, when plants can most effectively utilize nutrients from land applied manure. A representative from your county Cooperative Extension Office or Conservation District should be able to provide options and guidance on manure management and storage structures.



Figure 2. The map above shows the time required to make a round trip to various winter feeding locations on a tractor traveling at about 4.5 mph with two round bales of hay. Times includes loading and unloading time. Figure by Lee Moser.

Materials, Plans, and Specifications

Five designs were developed and installed at the fenceline feeder demonstration site at Eden Shale Farm. Each design has pros and cons that should be considered during the planning process. The given dimensions and quantities of materials needed are for the specific designs installed at Eden Shale Farm. Each design is scalable to the size of your hay bales and the needs of your operation. The design included in this publication was built to accommodate 5½ foot diameter round bales. Specifications for each design will be presented below. **Cost estimates do not include labor or any equipment rentals that may be necessary.**



Photo by Lee Moser

Option 1. Covered structure with metal panels and concrete pad surrounding.

Materials:

- ~14 yards of 3,500 PSI concrete for elevated 6 inch center pad and surrounding heavy use area
- Heavy gauge welded wire panels for concrete reinforcement (enough to cover ~712 ft²)
- Four 6" x 6" x 12' posts rated for ground contact (set at least 36 inches in ground, anchored with concrete)
- 8 oz. nonwoven geotextile fabric (enough to cover ~712 ft²)
- Rock: (as sub-base for concrete and surrounding front of feeder) enough to cover ~712 ft² with ~4" of compacted dense graded aggregate
- Sod staples/fabric pins (as many as recommended by supplier for area of geotextile fabric coverage)
- Two 12' 1 3/4" round high tensile strength galvanized steel tubing feeder panels
- One 8' 1 3/4" round high tensile strength galvanized steel tubing feeder panel
- One 8' 1 3/4" round high tensile strength galvanized steel tubing gate
- Fourteen ½" by 8" galvanized cast eye bolts
- Four 16' by 36" metal roof panels (or enough of a comparable product to cover 196 ft²)
- Nine 2" x 8" x 12' pressure treated boards for rafters
- Metal roof screws
- Ten galvanized tie plate (twist strap)
- fasteners
- Four 2" x 6" by 8' pressure treated boards for corner braces
- Sixteen 2" x 4" x 8' pressure treated boards for purlins
- 5' of ½" galvanized all thread rod
- Twenty-eight ½" galvanized nyloc nuts
- Twenty-eight ½" galvanized washers

Specifications: Exact specifications for Option 1 are included in the plan drawings at the end of this document. Option 2-4 are just variations of this design with features modified as described within the materials section of each structure's description.

Materials Cost Estimate: \$3,853.10 (with Kentucky state sales tax)



Photo by Lee Moser

Option 2. Uncovered structure with metal panels and concrete pad surrounding.

Materials:

- ~14 yards of 3,500 PSI concrete for elevated 6 inch center pad and surrounding heavy use area
- Heavy gauge welded wire panels for concrete reinforcement (enough to cover ~712 ft²)
- Four 6" x 6" x 8' posts rated for ground contact (set one third of the post below ground, anchored by concrete).
- 8 oz. nonwoven geotextile fabric (enough to cover ~712 ft²)
- Rock: (as sub-base for concrete and surrounding front of feeder) enough

- to cover ~712 ft² with ~4" of compacted dense graded aggregate
- Sod staples/fabric pins (as many as recommended by supplier for area of geotextile fabric coverage)
- Two 12' 1 3/4" round high tensile strength galvanized steel tubing feeder panels
- One 8' 1 3/4" round high tensile strength galvanized steel tubing feeder panel
- One 8' 1 3/4" round high tensile strength galvanized steel tubing gate
- Fourteen 1/2" by 8" galvanized cast

- eye bolts
- 5' of 1/2" galvanized all thread rod
- Twenty-eight 1/2" galvanized nyloc nuts
- Twenty-eight 1/2" galvanized washers

Specifications: Option 2 is just a variation of the design of Option 1 with features modified as described within the materials section above. Option 2 is the same as Option 1 except it does not have a roof.

Materials Cost Estimate: \$3,412.14 (with Kentucky state sales tax)

Materials:



Photo by Lee Moser

Option 3. Uncovered structure with wood panels and geotextile fabric, grid, and gravel pad surrounding.

- Four 6" x 6" x 8' posts rated for ground contact (set one third of the post below ground, anchored in concrete)
- 2.5 yards of 3,500 PSI concrete for 6 inch elevated center pad
- ~96 ft² heavy gauge welded wire panels for concrete reinforcement
- 8 oz. nonwoven geotextile fabric (enough to cover ~712 ft²)
- Rock: (as sub-base for concrete and surrounding front of feeder) enough to cover ~712 ft² with ~8"- 10" of compacted dense graded aggregate (Can use a sub-base of 4" of #2 rock and 4"-6" of dense graded aggregate compacted on top)
- Sod staples/fabric pins (as many as

recommended by supplier for area of geotextile fabric coverage)

- ~712 ft² of gravel paver plastic interlocking grid
- Two 12' 1 3/4" round high tensile strength galvanized steel tubing feeder panels
- One 8' 1 3/4" round high tensile strength galvanized steel tubing feeder panel
- One 8' 1 3/4" round high tensile strength galvanized steel tubing gate
- Fourteen 1/2" by 8" galvanized cast eye bolts
- 5' of 1/2" galvanized all thread rod
- Twenty-eight 1/2" galvanized nyloc nuts

- Twenty-eight 1/2" galvanized washers

Specifications: Option 3 is just a variation of the design of Option 1 with features modified as described within the materials section above. Option 3 uses wood panels instead of the pre-fabricated feeder panels. It also has gravel paver grid/gravel as the footing surface for the cattle instead of concrete. The integrated layer of gravel paver grid reduces the impact of heavy hoof traffic on the gravel pad. The formation of depressions in the pad should be reduced.

Materials Cost Estimate: \$ 4,289.82 (with Kentucky state sales tax)

Materials:



Photo by Lee Moser

Option 4. Uncovered structure with wood panels and geotextile fabric and gravel pad surrounding.

- Four 6" x 6" x 8' posts rated for ground contact (set one third of the post below ground, anchored in concrete)
- 8 oz. nonwoven geotextile fabric (enough to cover ~712 ft²)
- Rock: enough to cover ~808 ft² with ~6" - 8" of compacted dense graded aggregate. Can use a sub-base of 4" of No. 2 rock and 4" - 6" of dense graded aggregate compacted on top. An additional 6 inches of dense graded aggregate will be used for the 8 foot by 12 foot elevated center pad
- Sod staples/fabric pins (as many as recommended by supplier for area of geotextile fabric coverage)

- Two 12' 1 3/4" round high tensile strength galvanized steel tubing feeder panels
 - One 8' 1 3/4" round high tensile strength galvanized steel tubing feeder panel
 - One 8' 1 3/4" round high tensile strength galvanized steel tubing gate
 - Fourteen 1/2" by 8" galvanized cast eye bolts
 - 5' of 1/2" galvanized all thread rod
 - Twenty-eight 1/2" galvanized nyloc nuts
 - Twenty-eight 1/2" galvanized washers
- Specifications:** Option 4 is just a variation of the design of Option 1 with

features modified as described within the materials section above. Option 4 has geotextile fabric and gravel as footing for the cattle. Option 4 also uses gravel inside the feeder where the hay sits. Options 1, 2, and 3 all have concrete in the center of the feeder. Structures with gravel pads surrounding the hay rack will need routine top-dressing with gravel to repair depressions that will form from heavy hoof traffic. Posts should be set in concrete to improve resistance to animal pressure.

Materials Cost Estimate: \$2,298.08 (with Kentucky state sales tax)

Materials:



Photo by Lee Moser

Option 5. Uncovered two-thirds of a ring feeder with geotextile fabric and gravel pad surrounding.

- Two 6" x 6" x 8' posts or standard wooden fence posts (set one third of the post below ground, anchored in concrete)
- 8 oz. nonwoven geotextile fabric (enough to cover ~712 ft²)
- Rock: enough to cover ~712 ft² with ~8"-10" of compacted dense graded aggregate. Can use a sub-base of 4" of #2 rock and 4"-6" of dense graded aggregate compacted on top.
- Sod staples/fabric pins (as many as recommended by supplier for area of geotextile fabric coverage)
- Two-thirds of a standard 3-piece ring feeder
- 8' gate
- Six ½" Heavy-duty galvanized lag bolts

Specifications: To install this structure, mount two-thirds of a standard ring feeder to posts set on 8' center with

heavy-duty galvanized lag bolts. Add an 8' gate on the lane side of the structure. Structures with gravel pads surrounding the hay rack will need routine top-dressing with gravel to repair depressions that will form from heavy hoof traffic. Posts should be set in concrete to improve resistance to animal pressure.

Materials Cost Estimate: \$2,068.06 (with Kentucky state sales tax)

Installation

Site preparation is the first step to installing a fenceline feeding system. Site preparation includes removing the top soil and compacting a solid sub-base for installing the geotextile fabric and gravel pad (heavy traffic pad) for each design. The dimensions of the area to be prepared is dictated by the size of the structure(s) to be installed. After excavation and compaction, the site should be covered with overlapping layers of 8 oz. nonwoven geotextile fabric. Overlap sheets of fabric away from the direction that gravel will be pushed onto the pad to avoid buckling in fabric. Pin fabric in place with sod staples or fabric pins at the spacing recommended by geotextile fabric supplier. Cover the geotextile fabric with about 8" to 10" of compacted dense graded aggregate, or alternately, a sub-base of 4" of No. 2 rock and 4" to 6" of dense graded aggregate compacted on top. Even if a concrete pad or plastic grid product is to be used, a base of geotextile fabric and 4 to 6 inches of rock is recommended before placing the concrete or grid. Detailed instructions on installing a heavy traffic pad for livestock can be obtained from "All Weather Surfaces for Livestock" (AEN-115) or NRCS's Heavy Use Area Protection Practice Standard (561).

After completion of the heavy traffic pad, the fenceline feeding structure can be constructed on top, based on the specifications provided and the general plan drawings provided at the end of this document. For the roofed structure, ensure that posts are set at least 36 inches deep and anchored in concrete. The center pad of the hay rack should be elevated six inches to ensure positive drainage and reduce contamination with manure. Modify the design of the structure based on scale and desired options for your operation.

Materials and Hardware

Critical aspects of the functionality of these designs are dictated by the specific materials that are recommended (and associated construction techniques). The last thing you want to see in the field is a board that has been removed by cattle with the nails/hardware facing up. All feeder panels and gates should be constructed, at a minimum, of one 3/4"

round high tensile strength galvanized steel tubing. 2" diameter round high tensile strength galvanized steel tubing heavy duty (bull gates) panels and gates can be used to improve the strength and durability of the structure. All feeder panels should be mounted with heavy duty, 1/2" cast galvanized eye bolts, all-thread (cut to appropriate length to pass through mounting brackets on panels and accommodate hardware), washers, and nyloc nuts that are fastened through the feeder panel mounting tab as indicated in Figure 3. With the use of heavy duty panels and mounting hardware it is acceptable to mount feeder panels on the inside of the six by six inch posts to

improve the reach of livestock into the feeder, in turn increasing hay utilization. Gates should be mounted with galvanized through bolt gate hangers. An additional hanger mounted at the bottom of the swinging side of the gate to allow for the gate to be lifted up and set on the "thumb" to provide an additional closure mechanism besides a chain. Grind all bolts flush to wood to prevent injury to livestock. The number and size of nails in various parts of the structure should comply with the recommendations provided in the Uniform Building Code and applicable state building codes.

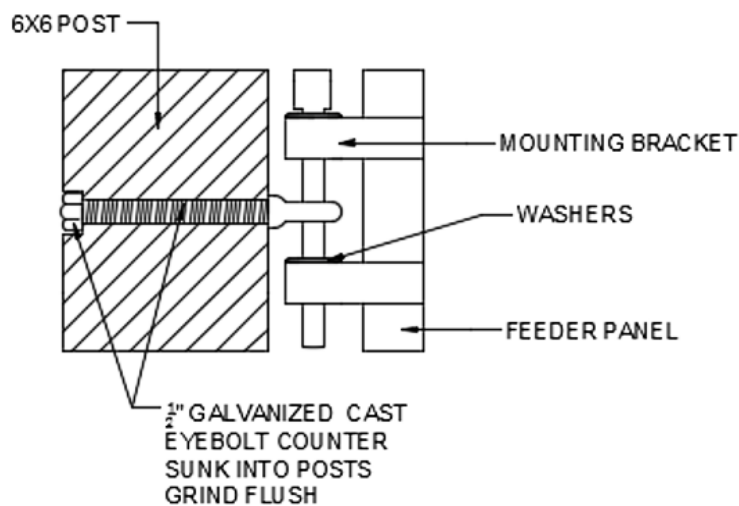
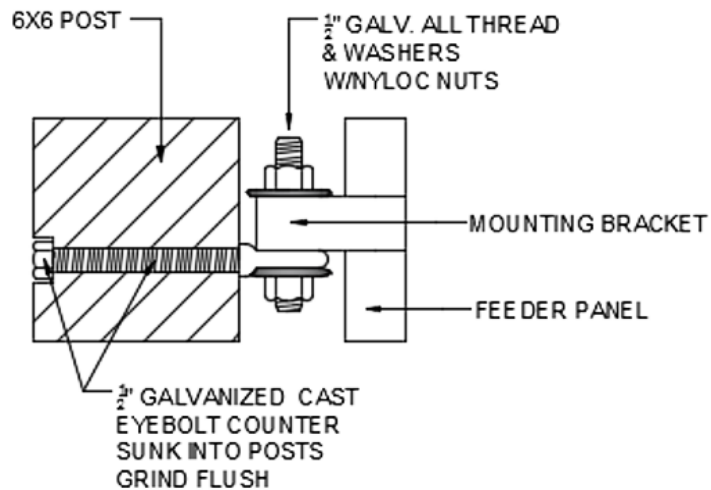


Figure 3. All feeder panels should be mounted with heavy duty, 1/2" cast galvanized eye bolts, all-thread, washers, and nyloc nuts that are fastened through the feeder panel mounting bracket. The drop-in pins that come with the feeder panels can be used as an alternative method to mount the panels to the posts. *Figure by Ciara Pickering.*

Operation and Maintenance

Adult beef cattle require approximately 24 inches of space each to utilize these structures. At any given time, ten cattle can easily utilize the structures described in Option 1-4, at once. Feeders should be loaded with roll bale hay as necessary, to accommodate the dietary needs of the winter feeding herd. Hay wastage should be minimized by structure design. Hay that is out of reach can be pushed up and moved to the back of the feeding structure, by subsequent bales, to provide access and reduce waste.

At the end of the season, the interior of the structure should be cleaned. The manure pack that is generated surrounding the structure should be scraped, stored, and applied to pastures or crop fields to take advantage of the organic matter and nutrients in the manure. All manure applications should follow a nutrient management plan. If you do not have a nutrient management plan for your operation, you should contact your county Cooperative Extension Agent or local Conservation District to arrange for a Kentucky Nutrient Management Plan (KYNMP) to be developed that follows the guidelines set forth within the Kentucky Agriculture Water Quality Act and NRCS's Nutrient Management Plan Practice Standard (590). This step in the cycle is critical to the overall functional design. It supports the efficiency goals of this design, which reduce waste (time, hay, cattle effort, etc.). It utilizes waste that's normally overlooked (manure) and creates a benefit from it (higher yields, better soil health, etc.).

Structures with gravel pads surrounding the hay rack will need routine top-dressing with gravel to repair depressions that will form from heavy hoof traffic. Concrete provides a more durable option that will aid in the collection of manure. The physical integrity of the structure should be checked on a routine basis to ensure fasteners and fixtures remain functional and safe for livestock use.

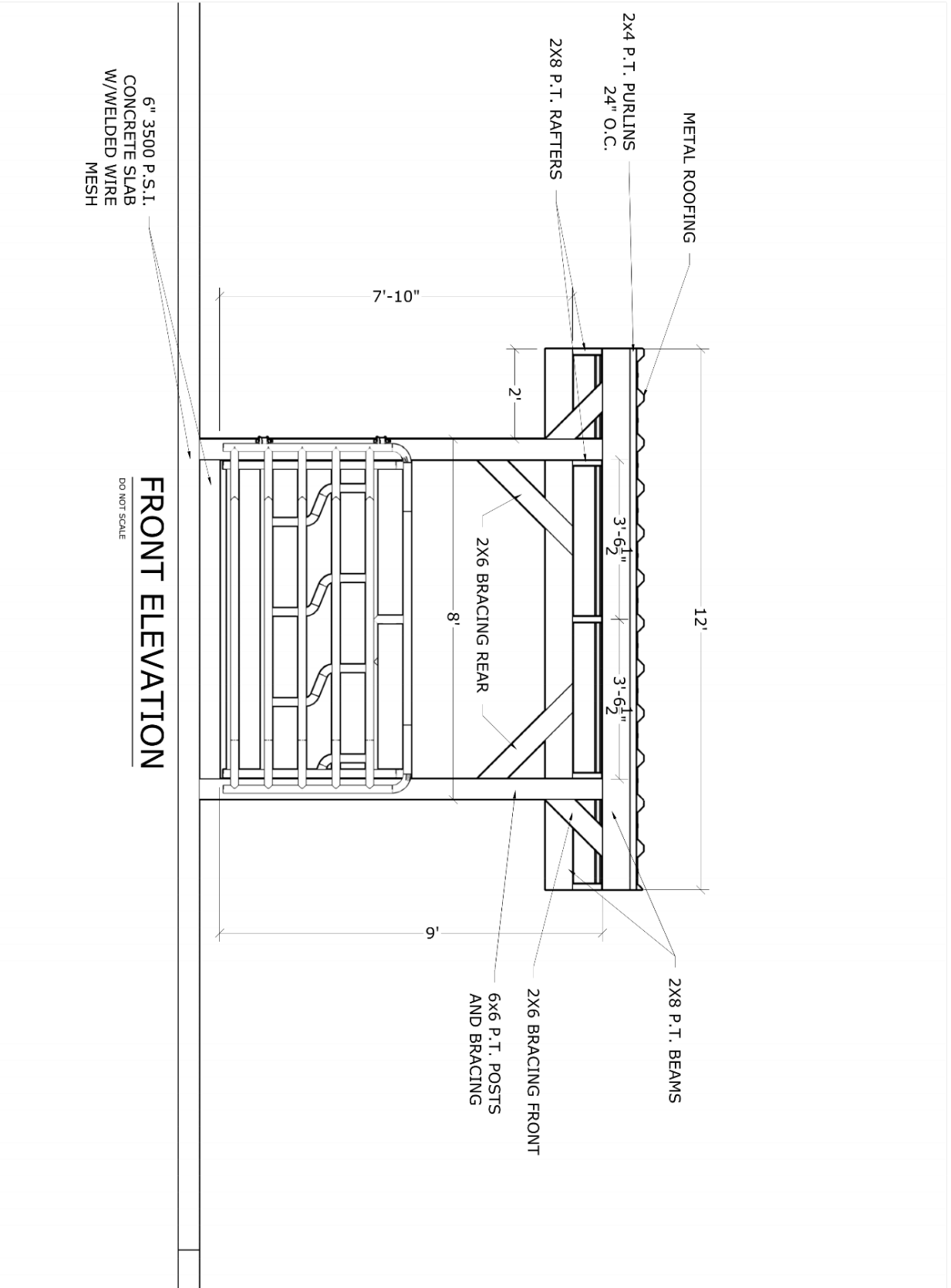
Summary

Fenceline feeding systems offer an alternative to traditional in-field bale feeding during the wet winter conditions that Kentucky experiences. These structures can be utilized to reduce the

impact of winter-feeding on pastures and improve the consumption of hay during feeding. The time management and economic benefit of these structures can also improve on-farm productivity. Utilizing a fenceline feeding system can be an important step for producers to take to improve the animal welfare, management demand, and environmental impact of beef cattle production systems. Contact a Cooperative Extension Agent or county, state, or federal resource professional to obtain further information on the use of these structures and the possibility for obtaining cost-share funding to install a fenceline feeding system at your farm.

References

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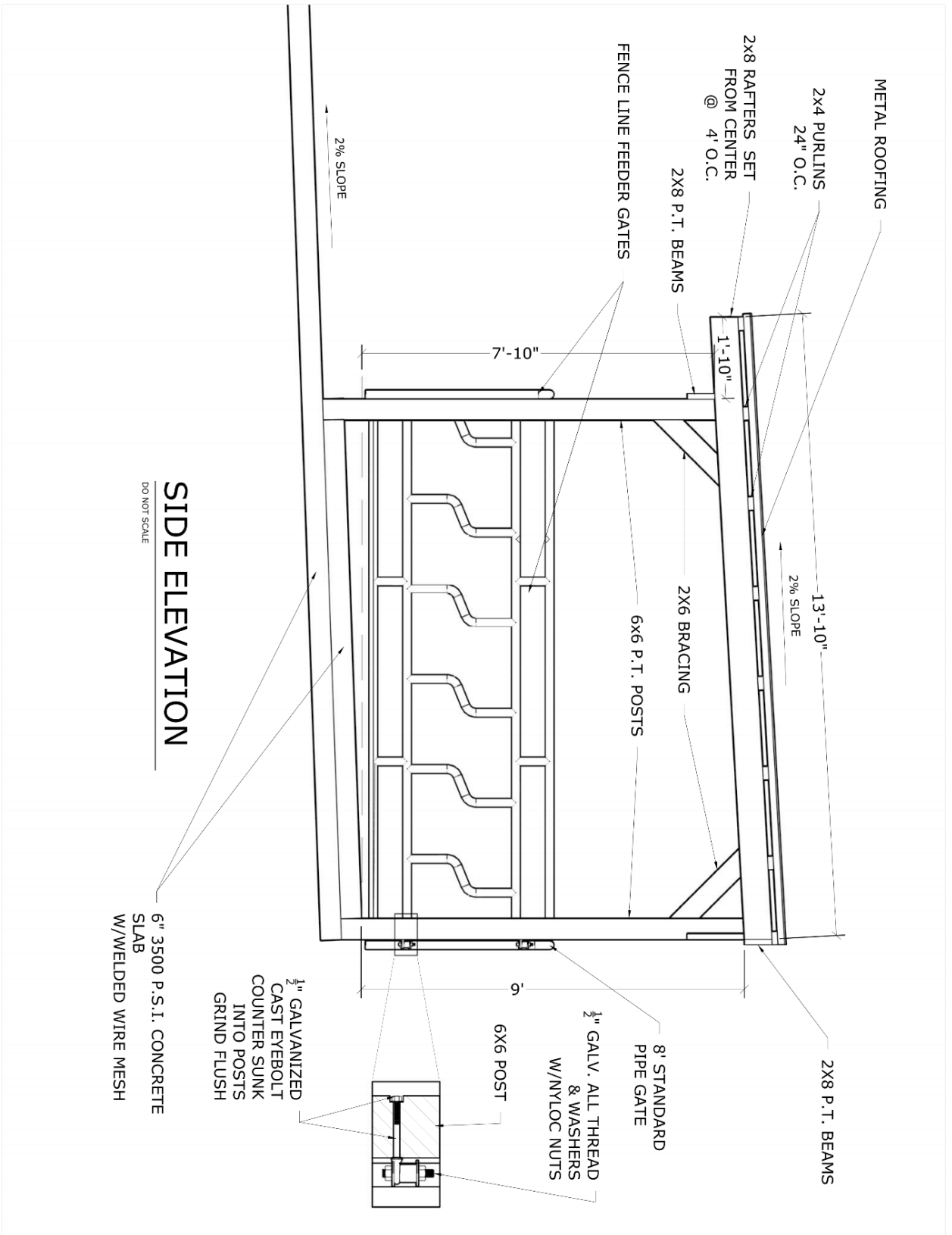
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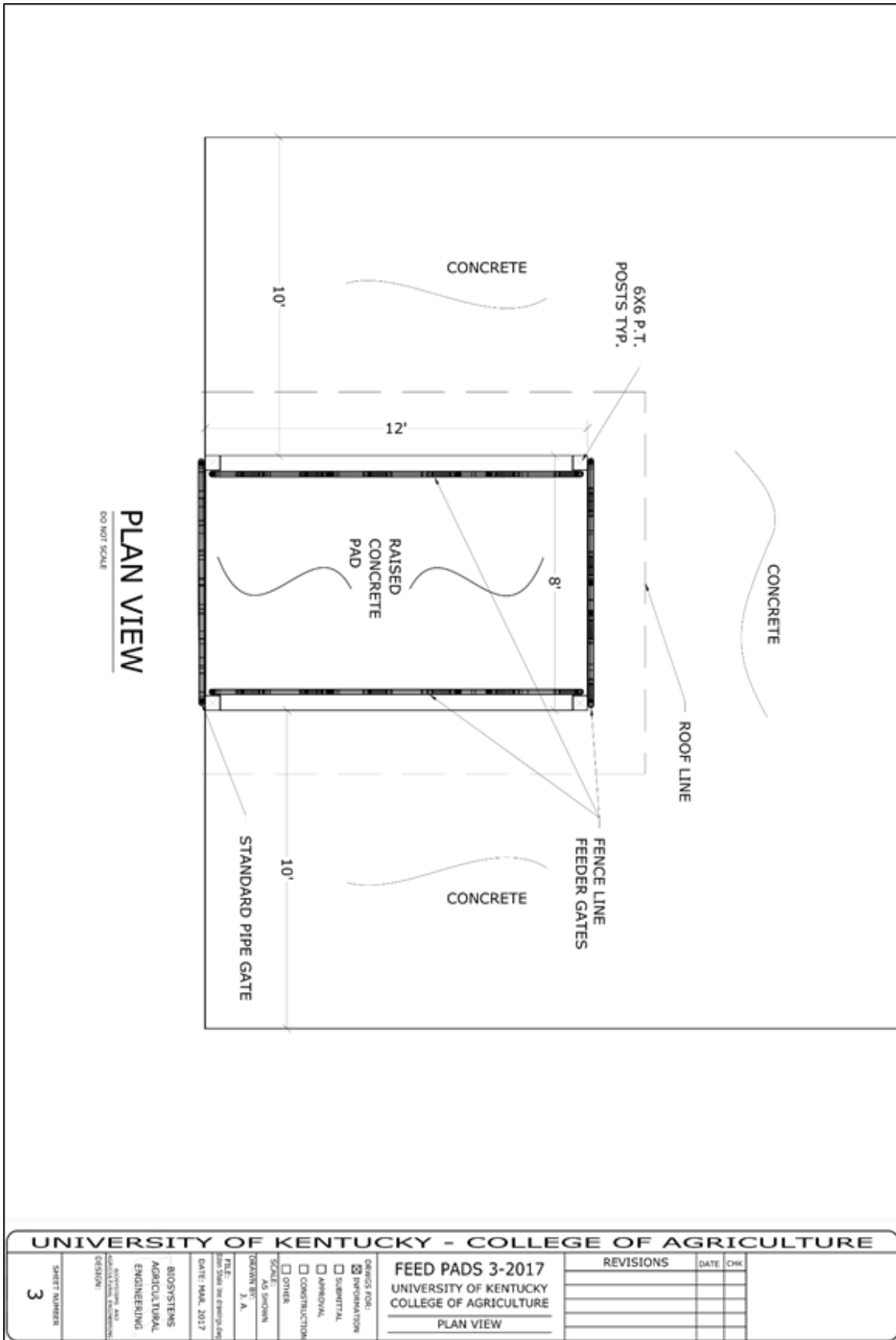
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