

# Bedded Hoop Barns *for beef cattle*

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An alternative to open feedlots where runoff and manure management are a growing concern, hoop barns are considered a more environmentally friendly option to traditional open feedlot arrangements. Recent research has compared the hoop barn to open feedlots, as well as other housing options, in an attempt to determine its advantages. Hoop barn cattle feeding often confines the cattle inside the hoop barn and relies on bedding to maintain the animal environment.

## layout and construction

Although a hoop barn's specific layout and construction differs with each building, there are four basic common features: a floor, walls, hoop frame, and cover.

*Floor:* A hoop barn's floor is generally made of compacted soil, crushed limestone, or concrete, with a concrete floor allowing for the easiest cleanout. From 40-50 sq. per animal is suggested.

*Walls:* Wood and concrete sidewalls are common for the structure. Concrete sidewalls will hold up better, but are more expensive, and make the hoop building a more permanent structure. The north and south ends are usually open to increase airflow, although winter windbreaks of bales or end panels can be used.

*Hoop frame:* Hoop frames are constructed primarily from 2- to 3-inch round tubular steel to form a roof truss system. This frame supports the tarp roof, which is attached to the sidewall of the building. A variety of frame widths are available depending on particular needs. Wider hoop barns will have arched steel bridgework for the arches or hoops.

*Cover:* The tarp covers are generally made of woven polyethylene fabric and come in a variety of weights and colors. The nature of the fabric cover makes the tarp resistant to runs when a puncture occurs.

## budget

Beef cattle feedlots can be built for a wide range of prices. Depending on the type of feedlot, a bedded hoop barn would cost slightly more per head of capacity than an open-front shelter with earthen lot. According to a 2007 study on the feasibility of hoop barns (Honeyman, et al. [A]) construction of these structures in Iowa costs about 10% more than a conventional feedlot with shelter. Of course, the cost of an individual hoop barn varies depending on the quality of materials used. Cattle performance is similar in the two systems, thus the slightly higher building cost and bedding costs of a hoop barn system must be offset by other factors, such as minimal nutrient runoff, personal preference, or an improved cattle environment.

## bedding use

When considering the budget needed for hoop barn construction, it's also important to understand the costs associated with utilizing the structure. These buildings require enough bedding to keep the floor under the bedding pack relatively dry if it is not completely concrete. Average corn stover bedding was 5.18 lbs/head/day. Producers have used corn stalks, soybean stubble, straw, prairie hay and wood shavings. A 2007 study on the feasibility of hoop barns for beef cattle (Honeyman, et al.) showed that the bedded hoop system used three times more bedding than open-front feedlots. In a hoop barn, bedding

is used all year-round, although use increases during winter and wet periods.

## cattle environment

The environment in a livestock building is determined by numerous factors, including ambient temperature, air speed, temperature of surfaces, and relative humidity. Because a stressful environment can have a negative impact on the cattle performance, it's important to understand the environment in a hoop barn compared to traditional feedlot housing. A 2006 study (Harmon, et al.) was conducted in southwest Iowa comparing the environment in a bedded hoop barn to that in an open-front feedlot building during both winter and summer.

In the summer trial, the summer temperature-humidity index (THI)

**Table 1: THI of the environmental conditions (summer trial)**

Location	Weather THI (percent of hours) <sup>1</sup>			
	Normal	Alert	Danger	Emergency
Hoop south	89.0	8.6	1.6	0
Hoop north	88.7	8.2	3.0	0
Open-front east	86.4	10.8	2.8	0
Open-front west	86.8	10.5	2.7	0
Ambient/outdoor	88.8	9.7	1.5	0

<sup>1</sup> Based on 2,160 hours; THI = Temperature-Humidity Index

showed that the hoop barn had fewer hours in the “alert” category than either the open-front building or ambient conditions (Table 1). In winter, a cold stress index showed that the open-front barn provided the most shelter for the cattle with the highest percentage of hours with “no impact” to the cattle. This study suggests hoop barns offer a viable environment for feeding cattle in confinement.

## cattle behavior

Cattle behavior and temperament in hoop barns has been compared with that of cattle in an open-shelter facility to determine if any negative alterations developed in hoop barn confinement (Baker, et al. 2007a and 2007b). Summer (2006) and winter (2007) trials were conducted with behaviors, postures, and temperaments monitored.

In the summer trial, steers in the hoop barn spent more time at the waterer than the open shelter steers and were more likely to be less active (greater incidences of lying down as well as fewer incidences of walking recorded). In the winter trial, cattle in the hoop barn spent more time at the feedbunk, but an equal amount of time at the waterer. As with the summer trial, the steers in the hoop barn were less active, spending more time lying down and less time walking. Neither trial indicated an adverse behavioral or temperament shift among the cattle.

### Cited:

Baker, R.G., A.K. Johnson, K.J. Stalder, and M.S. Honeyman. 2007a. Finishing steers in a deep-bedded hoop barn and a conventional feedlot: Effects on behavior and temperament during summer in Iowa. Animal Science Leaflet. Ames, IA: Department of Animal Science, Iowa State University.

Baker, R.G., A.K. Johnson, K.J. Stalder, and M.S. Honeyman. 2007b. Finishing steers in a deep-bedded hoop barn and a conventional feedlot: Effects on behavior and temperament during winter in Iowa. Animal Science Leaflet. Ames, IA: Department of Animal Science, Iowa State University.

Harmon, J.D., S.C. Shouse, and M.S. Honeyman. 2008. Environmental conditions in a bedded hoop barn with market beef cattle. A.S. Leaflet R2326. Ames, IA: Iowa State University.

## cattle performance

The performance of beef cattle has also been evaluated in an attempt to understand any effects of this new housing option. A three-year Iowa study (Honeyman, et al. 2009) evaluating the performance of yearling steers fed and confined in a bedded hoop barn versus an open feedlot showed no difference in cattle performance, with the exception of higher mud scores for the steers in the open-shelter lot. Carcass characteristics were also similar for the cattle in both types of housing.

## manure management

Hoop barns, thought to be a better housing option for nutrient runoff, still need proper equipment and, if necessary, storage available for manure management. Management of the manure in a hoop barn is either done by selectively cleaning portions of the barn periodically or waiting until the cattle are sold and hauling out the built up manure pack. If not spreading the manure immediately, there must be an appropriate storage area available. State and federal regulations may also require control of rainfall runoff from the storage area or cover of the storage area. Manure may compost during stockpiling which can reduce mass and volume.

## nutrient losses

With partial concrete floor hoop barns being increasingly adopted by beef producers, in part for runoff concerns with traditional feedlots, initial studies have attempted to determine the nutrient loss in the soil beneath hoop barns. In a 2008 study at the ISU Armstrong Research and Demonstration Farm (Shouse, et al.), soil tests were taken before a hoop barn was built (in 2005) and three years later in 2008. Shallow and deep soil samples underneath the packed limestone floor indicated that phosphorus, calcium and magnesium levels did not show consistent or major changes with time (Table 2). Soil organic matter content increased in both shallow and deep samples. These results show measurable, but very slow migration of moisture and nutrients into the soil profile.

**Table 2: Impact of hoop barn on soil nutrient levels**

Parameter	Units	December 2005		April 2008	
		Shallow <sup>1</sup>	Deep <sup>2</sup>	Shallow <sup>1</sup>	Deep <sup>3</sup>
pH		6.3	6.5	6.0	6.4
Phosphorus	ppm	4	10	11	6
Potassium	ppm	143	114	267	147
Calcium	ppm	2127	1951	2252	2164
Magnesium	ppm	507	648	437	658
Organic Matter	%	2.5	1.4	3.6	2.8
Nitrate Nitrogen	ppm	1.51	2.26	11.47	1.70

<sup>1</sup> Samples from 1 foot depth; <sup>2</sup> Samples from 4 to 5 foot depth; <sup>3</sup> Samples from 3 foot depth

Honeyman, M.S., J.D. Harmon, S. C. Shouse, W.D. Busby, and D.L. Maxwell. 2008. Feasibility of bedded hoop barns for market beef cattle in Iowa: Cattle performance, bedding use, and environment. ASABE Paper No. 08838542. St. Joseph, Mich.: ASABE.

Honeyman, M.S., J.D. Harmon, A.K. Johnson, D.L. Maxwell, W.D. Busby, and S.C. Shouse. 2009. Beef cattle feeding in a bedded hoop barn: Three year summary. A.S. Leaflet R2403. Ames, IA: Iowa State University.

Shouse, S.C., M.S. Honeyman, D.L. Maxwell, and W.D. Busby. 2008. Nutrient retention performance of a crushed limestone floor surface in a bedded hoop barn with confined beef cattle. Ames, IA: Iowa State University.