Overview

A hoop barn is a Quonset™-shaped structure with sidewalls 10 to 12 feet high made of treated wood posts and wood sides. Tubular steel arches fastened to the tops or sides of the posts form a hooped roof, which is covered with an UV-resistant, polyvinyl tarp.

Figure 1 shows the common components of a hoop barn, and Figure 2 shows a hoop barn.

Hoop barns are naturally ventilated and are sited to take advantage of prevailing winds. In the Midwest, most buildings are oriented in a north-south direction when used for livestock housing to take advantage of summer winds, which generally come from the south.

Hoop barns may offer an alternative to producing beef in open feedlots where concerns exist about runoff and lot manure management. The biggest question is can the pollution potential be reduced without suffering losses in productivity and production costs.
When to Consider Hoop Barns

Hoop barns appear to be most beneficial when producers have one or more of the following goals:

- Want to provide weather protection at a low cost
- Desire livestock housing for cold weather that can double as economical hay storage during summer
- Desire to relocate the building in the near future
- Want to utilize a solid floor, bedded-housing system

- Want protection from sun and rain without full environmental control
- Want to eliminate outdoor lots and runoff concerns
- Want full control of manure at low capital cost
- Willing to trade management for capital outlay

Table 1 shows a comparison of various facility options for calving, finishing beef cattle, and housing bulls. Hoop barns may provide needed weather protection for cattle in outside lots or pasture. Producers who want seasonal protection for calving along with winter storage for hay may find hoop barns advantageous. Producers wanting to eliminate the liability and environmental risk from open lot runoff may find total confinement in hoop barns to be a cost-effective alternative. Confinement operators may choose hoop barns for a solid manure alternative to liquid manure in pits or lagoons.

If the producer is seeking a facility that has alternative uses, investing in a hoop barn becomes even more attractive. The high ceiling, low cost, and quick construction make hoop barns a logical choice for a number of uses including livestock housing, hay storage, machine storage, feed storage, and working facilities' protection.
Hoop Barn Management

Equipment selection, material handling, and animal handling techniques are important factors that affect both the longevity of the structure and animal comfort.

Structure management issues include:
• Managing the structure as a cold barn.
• Providing frost-free or no-freeze waterers.
• Handling rainfall runoff in an environmentally satisfactory way.
• Providing lights if checking is performed after dark.
• Providing one watering space for every 25 calves, 20 market cattle, or 18 cows.
• Developing a maintenance schedule that includes checking the entire structure every 12 months and checking the tarp for tears and tautness every 6 months.
• Designing the floor plan to make cleaning easy.

Using Hoop Barns for Beef Operations

So far the most common applications of hoop barns for beef operations have been as calving and open front barns. Even though these two phases of beef operations have been used successfully, other potential uses for hoop barns exist for beef operations.

Calving barns

One advantage of hoop barns is their low initial cash cost if built with on-farm labor, which makes them suitable for short-term or seasonal uses. Another attribute of hoop barns is their versatility and potential for disassembly and relocation. In beef cattle production, calving is usually seasonal and occurs for a short duration.

Some producers have capitalized on the versatility of hoops and pursued dual utilizations. Dual utilization is defined as a single facility with two or more different purposes. An example of dual utilization is a 36- x 108-feet hoop barn used for a calving barn that could be converted to hay storage (Figure 3). The barn was used for calving in late February through mid-April and for hay storage from June through January. Portable calving pens made from tubular steel panels were set up along the hoop barn walls. The hoop barn sidewalls were on 6 feet high posts lined with rough 2-inch oak lumber with some cracks. The floor was earthen. The hoop barn was oriented east to west. The east end opened into an alley to a calving pasture. The east end wall was oak lumber with sheet steel above it and a large sliding door. The west end had a permanent intensive obstetrics room with a concrete floor, heat, electricity, water, and a headgate.

The room was located inside the hoop and had a flat top that was used for storage. After the calving season was over, the calving pen gating was dismantled and the hoop barn could be used for large bale hay storage until feeding during the winter. The hay was fed before calving season when the calving pens were reassembled. Natural ventilation was used for the structure. Lights were positioned inside the hoop barn and on the exterior ends to aid in nighttime observation.

Cows were kept in calving pens for a short time, usually 1 or 2 days. Feed and water was provided by hand or by letting cows out to an adjacent grass-covered nursery lot. The purpose of the hoop barn was to provide for short-term intensive shelter and supervision for new calves, not for long-term stabling.

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Thermal Comfort Control</th>
<th>Runoff Control</th>
<th>Initial Investment</th>
<th>Operating Management</th>
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<td>Outside lots</td>
<td>Poor</td>
<td>Difficult</td>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Outside lots with steel loafing shed</td>
<td>Fair</td>
<td>Difficult</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td>Outside lots with hoop loafing shed</td>
<td>Fair</td>
<td>Difficult</td>
<td>Low-medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Confinement in steel building with liquid manure pit</td>
<td>Good</td>
<td>Easy</td>
<td>High</td>
<td>Medium-high</td>
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<tr>
<td>Confinement in hoop</td>
<td>Good</td>
<td>Easy</td>
<td>Medium</td>
<td>Medium-high</td>
</tr>
</tbody>
</table>

Table 1. Comparison of facility types.
Open front bull barns

At the Iowa State University McNay Research farm in Chariton, Iowa, a 30- x 108-foot hoop barn is divided into nine pens (each 12 feet wide) for individually housing mature bulls (Figure 4). The outside pens are 12 x 60 feet. The sidewalls were 10 feet high with oak posts on 6-foot centers. The north back wall has ventilation doors. An extra large and heavy-duty holding alley and chute for handling and collecting semen from the bulls for artificial insemination is along the north wall. Feeding grain is by hand. Large round bales of hay are placed in free choice racks at the ends of the pens. Waterers are located inside the south wall. Heavy traffic areas are concrete; the remainder is earthen. Penning is welded 1-inch steel sucker rod on 4-inch steel pipe posts.

The individual bull barn is connected by an alley to a 38- x 48-foot open front hoop barn that is divided into two pens for group housing young bulls. This layout could be used as an open barn with small lot facility to feed cattle or calves. The waterers are inside the south wall. Sidewalls are 10 feet high made of rough, 2-inch oak planking. Two support posts on the south wall were removed to create 12-foot openings into the outside lots. A header made of four, 2- x 6-inch lumber was used between the posts to support the hoop arch. Grain feeding is by hand. Hay feeding is with large round bale racks. High traffic areas have concrete flooring. The north wall has vent doors for ventilation, although a curtain could be used. In both barns, the end walls were 2-inch oak planks with fabric end panels above.

Other uses

Hoop barns are versatile structures and can be used for a variety of purposes on a beef cattle operation. Hoop barns with open sides can be set up as cattle shades in pastures or lots. Hoop barns can also be used as shelter for cattle-handling facilities such as crowding tubs, alleys, chutes, etc. Hoop barns can also be used for storage of hay, compost, feed, grain, forage, bulk commodities, or machinery.

Designing and Erecting Hoop Barns

Producers who decide to build a hoop barn need to treat the construction project as they would any construction project involving a new structure. Aspects to consider include what type of structure to build; site selection; and proper access to the building for moving feed, bedding, and animals. Producers thinking about building a hoop barn also should consider the building's usefulness within an existing operation, its proximity to neighbors, the availability of necessary services and utilities, and
the possibility of using the structure in conjunction with existing buildings. As hoop barn widths and sidewalls increase, the height of the peak of the arch also increases. For arch height dimension details, producers should check with their respective dealer or manufacturer.

Using engineered or non-engineered hoop barns

Although hoop barns have been used in the swine industry for many years in the United States and Canada, using hoop barns for beef housing is relatively new. Many hoop models have proven to last 10 years or more if they are well maintained. Factors influencing the life include the use of strong, tear-resistant tarps; corrosion-resistant structural members; and sidewalls that are well maintained and not abused.

One factor producers should consider is whether to purchase an engineered or a non-engineered structure. When a hoop barn is engineered, a qualified designer (typically a registered engineer) has analyzed how each component of the structure will interact with the other components of the structure. The qualified designer has analyzed how the loads applied to the roof (or tarp) will affect the design of the tubular frame and how the tubular frame will transfer forces vertically and horizontally to the sidewall frame.

In addition, the designer has considered the forces the animals themselves will exert against the sidewalls and has designed the sidewalls to withstand the outward push of the frame and animals. In an engineered building, the foundation has been specified to withstand the loads transferred from the wall, and the structure has been designed to meet snow

Figure 4. Hoop bull barn (30 x 108 feet).
Barn divided into nine pens (each 12 feet wide) for individually housing mature bulls. The outside pens are 12 x 60 feet. Large bale feeders are situated so that bales can be placed in them without entering the pens.
and wind loads for the geographic area in which it is to be erected. An important point for producers to consider is that engineered structures are more easily insured because they meet weather design conditions. Insurance agents should be consulted about insurability issues before any building is purchased and constructed.

An engineered structure typically will include the frame, tarp, sidewall materials, and materials to anchor the building to the foundation. Warranties for engineered structures range from 10 to 15 years on materials and workmanship. Engineered structures often are more insurable than non-engineered structures, and engineered structures often cost less to insure.

Some hoop barns on the market have not been engineered. Hoop barn dealers often sell a roofing system instead of a complete structure. Included in most packages are the tubular frame, tarp, and material to attach the tarp to the sidewalls. The buyer must purchase the wood posts and tongue and groove boards to construct the sidewalls. Many times, non-engineered structures will have less than a three-year warranty on products and workmanship. Non-engineered structures may have little if any resale value after five years.

Producers must ask themselves questions like the following when considering the purchase of a hoop barn:

- How long do I want the structure to last?
- Do I want to have the opportunity to resell the structure in the future?
- Will the extra cost of buying an engineered structure outweigh the savings of buying a less expensive, non-engineered structure?
- How does having an engineered structure affect my ability to get insurance on the structure?

**Design and construction details**

Hoop barns for beef housing are naturally ventilated and are sited to take advantage of the summer prevailing winds. For much of the Midwest, the building is oriented in a north-south direction to take advantage of the summer prevailing winds from the south. Prevailing summer winds should blow into the end of the building. A concrete apron should be located along the bunk. Slope the apron 1 inch per foot away from the bunk.

The remaining deep-bedded area of the structure can have either a dirt or concrete floor, with many producers preferring concrete for ease of cleanout. A complete concrete floor will make cleaning much easier. In some states, regulations require concrete floors to prevent nutrients from leaching into the underlying soil and groundwater.

If the bedding area is to be concreted, the soil should be compacted to prevent differential settling. A 5-inch slab with woven wire, placed in the center (vertically) of the slab, should be sufficient for most applications. The concrete floor should have a compressive strength of 4,000 psi. Thicken the edges of the slab, particularly at the end where vehicles will drive into the bedding area for cleaning. Place the concrete flat.

When building multiple hoop barns, provide at least 10 feet of space between buildings to allow for equipment to travel between buildings and for snow removal and moisture drainage. This separation distance may need to be increased to allow feeding in bunks along the side. If sidewall curtains are used for ventilation, locate hoop barns 75 feet apart. Obstructions should also be kept 75 feet from open ends.

Both wood and concrete sidewalls are relatively common, with increasing interest in using concrete. For wood sidewalls, the steel frames are fastened to the tops or sides of the posts that support the outside wall. Commonly, pressure-treated 6- x 6-inch posts are used. Pressure-treated tongue and groove 2- x 6-inch lumber is used on the animal side of the posts to form the sidewalls of the animal space.

Concrete walls can be used for hoop barns but must be designed to support the design loads caused by the hoops. See the following section on Foundations for more information on wall design criteria. Concrete for the sidewalls is more durable than wood but may be more expensive. Building concrete sidewalls would make the hoop barn a more permanent structure. If concrete sidewalls are used, they must be designed to accommodate the fastening requirements of the selected brand of hoop barn.

Typically the sidewalls are at least 6 feet high. High sidewalls are recommended to prevent animals from damaging the tarp when a great deal of bedding has accumulated. Figure 5 shows the inside details of a typical hoop barn.

Livestock panels or gates form the north and south endwalls at animal level. In the winter, these
gates are covered with sheets of galvanized steel, recycled plastic, or plywood to reduce drafts. In all instances, the north wall can be closed relatively tightly to reduce winter winds using commercially available tarps or plywood sheeting. In the summer, both the north and south ends are totally open, with the steel, plastic, or plywood panels removed from the end gating to increase airflow in the animal zone.

Endwall construction should include posts that will be close enough to fasten the end gates adequately but far enough apart to allow room for feeding and manure-handling equipment. If the posts extend to the height of the hoops, do not fasten the posts to the end hoop. Hoops can deform during winds and will rub against the posts, which may damage the tarp material. Commercially available end tarps will reduce the potential for damage. Figures 6, 7, and 8 show typical endwall configurations for various weather conditions.

Foundations
The foundations of hoop frames must be able to transfer the loads applied to the frame to the earth. Wind applies horizontal and uplift loads to the sidewall frame, while snow, rain, and the weight of the frame apply vertical loads downward and horizontal loads outward to the sidewalls. The foundation anchors the building to the earth and must resist corrosion from contact with manure, moisture, and the soil.

The most common method of anchoring the frame to the foundation is to build a post frame wall
with the posts extended below the frost level and then construct a 6-foot high wall along the sides of the frame. The pipe frame is attached to the tops or sides of the posts. Figure 9 shows the construction details of the frame and walls. Posts must be set properly. If posts are set improperly, they can move out of plumb and affect the structural integrity of the building. Posts should be set below the frost line and on top of concrete footings. The soil around the posts must be tamped properly. Do not set posts in areas that have a high water table. Precast concrete sidewalls can be placed on a crushed rock layer or on concrete. The weight must be adequate for the hoop barn to resist wind uplift forces. Follow engineered designs from the hoop barn supplier. If concrete walls are to be used, contact the hoop barn supplier or a licensed engineer to obtain a concrete wall design that can resist the lateral hoop loads.

Frames

Hoop frames are constructed primarily from 2- to 3-inch O.D. (Outside Diameter) round tubular steel to form a roof truss system. Steel purlins connect the trusses to each other to act as a unit (Figure 10). The thickness of the tubing used in frames ranges from 16 to 12 gauge. (The lower the gauge number, the thicker the tubing.) Frame sizes depend on building width and frame spacing. Some narrower hoops use tubing only, without forming a truss.

Frames are spaced at variety of widths. These frames support the tarp roof and the trap is attached to the sidewall construction of the building. See Figure 11 for an illustration of how the tarp is fastened to the sidewall and frame. Galvanized steel tubing 1-3/8 inch O.D. is used for purlins and bracing to span and brace between the frames along the length of the building.

While frame widths for single-span structures usually range from 18 to 36 feet, many hoop barns span 40 feet or more with engineered truss arches to allow more flexibility for interior layout. Some manufacturers span 150 feet or more with engineered truss arches such as the one shown in Figure 10. Truss arches also are used if high snow or wind loads are a concern or if a lower roof height is desired. Wide hoop barns longer than 75 feet should have an open ridge located in the middle of the arch to facilitate good moisture removal.

Because of the corrosive nature of an animal housing environment, high-quality galvanizing is crucial. Some manufacturers use hot dipped galvanizing, which produces excellent results. Other types of galvanizing, however, may not be suitable for use in animal environments. Check the quality and amount of galvanizing in the frame tubing and determine what type of warranty is available from the supplier. Aluminum frames are an option with some suppliers. Aluminum frames used with the appropriate fasteners should experience less corrosion than steel in the conditions that exist in typical animal housing.
Covers

Tarp coverings for hoop barns come with various options, but evaluating what type of tarp to get should be an integral part of the overall design and decision-making process. Generally, tarps are made of woven polyethylene fabric that is produced from low-density polyethylene extruded over high-density woven polyethylene. Due to the woven nature of the tarps, punctures do not tend to run. When punctures occur, they may be patched with a kit the company provides. The better tarps are those that have been treated with UV stabilizers and a fire-resistant substance to provide safety and longevity. Producers should consult their insurance company about which treatments are required for insurability.

Tarps generally come in different weights, which may include 10.0-, 12.5-, and 14.9-ounce fabric. Many colors are available, including clear and opaque fabric. Fabrics that have a white underside or are white and allow some light through tend to make a building brighter and make the animals easier to see. Clear fabrics are not a good choice because they allow a high degree of solar penetration, which will overheat animals on most sunny days. Reflective tarps that are light colored are best because they do not soak up solar radiation. Pro-rated warranties for tarps are generally 10 to 15 years. Rub points, such as purlin connections and end wall connections, tend to wear first. Such rub points can be minimized by keeping the tarp tight.

Snow and wind loading

In general, the structure must be able to meet snow and wind load requirements. Structures that do not meet snow and wind load requirements may not be insurable.

The snow load design should be similar to snow loads for other agricultural building loads for the area in which the building is being constructed. The effect of snow on the structure can vary. Snow may slide off the roof, or it may accumulate and create the design snow loads on the tarp and hoops. Generally, snow loads are not seen as a big concern because the curvature of the structure minimizes snow buildup.

Wind loads also should be calculated as they would for other agricultural structures in the area. Additionally, uplift of the frame under wind loads needs to be considered in the design of the frame and the foundation anchoring. In some designs, diagonal bracing of the sidewalls from the endwalls and along the roofline should be incorporated. Outside guy wires can be important to keep the frame from racking or deforming out of plumb. Frames that have shifted off center are likely to be loaded unevenly and are subject to premature failure. Some reports of wind damage have indicated that hoops sometimes deform without failing.

Environment and Ventilation

Perhaps the top priorities for hoop barns used as beef housing are the issue of animal environment and the related issue of proper ventilation. Realistic expectations for these structures are that they reduce exposure to wind and snow in winter and to sun and rain in summer. Hoop barns are unheated barns and should be managed as such. Although the bedded-manure pack generates considerable heat and enhances animal comfort in the winter, hoops require special design and management for hot weather comfort.

The primary goal of hoop barns is to protect the animals from the weather. In the summer, the...
building should provide shade and allow cross-ventilation by wind pressure. In the winter, the housing should allow for moisture removal and draft control. In the winter, a cold barn with dry bedding allows cattle to create a suitable, comfortable microenvironment.

To reduce risks to animal health from poor air quality, hoop barns must be well ventilated, and the ventilation must be well managed. A hoop barn must be managed just as any cold, naturally ventilated structure. Do not close the structure too tightly. Do not attempt to manage the structure as a warm barn; it is primarily a shelter. Properly managed, air temperature in the hoop barn 6 feet or more above the bedding pack is often within 5°F of the outside air temperature.

At night a hoop barn loses heat to the cold surroundings and the cold, clear, black sky. This cools the air in the structure, lowering its moisture-holding capacity substantially and causing relative humidity to rise. The result is cold, damp air and, most likely, excessive condensation on the underside of the tarp. If ventilation is inadequate, animals will be subjected to wide, day-to-night variations in air temperature and humidity, which could adversely affect animal health.

Because wind is a major force in ventilating any naturally ventilated structure, orient hoop barns to intercept the prevailing summer wind through the end opening. Do not construct hoop barns where buildings, trees, or other large obstructions block the prevailing summer winds. For most structures, the minimum separation distance from obstructions to the end of the building is 75 feet.

**Ventilation openings**

Natural ventilation uses openings at different heights to achieve ventilation in the winter. Building a structure with an open ridge will allow the moist air that builds up to escape through the opening at the top of the structure. Ideally, a ridge opening would be provided (Figure 12). However, some hoop barns used for beef housing do not have ridge openings. In these buildings, ventilation air enters through a continuous space along the sidewall where the tarp is attached and exits through the ends of the hoop, depending on wind direction. Air exchange, and therefore air quality, will likely be poorer for structures without ridge vents, especially for long buildings.

**Endwall ventilation**

Hoop barns without ridge vents are difficult to ventilate naturally if they are too long. Typically, a hoop barn longer than 75 feet, without ridge vents, and filled with animals will present ventilation challenges. Hoop barns up to 100 feet long can be used in high-wind areas. In all areas, hoop barns rely on endwall openings to aid airflow through the structure. The ends are open most of the year. Figure 13 shows an example of how a 3- to 6-inch gap between the top of the endwall and the frame and tarp acts to aid natural ventilation when the ends are closed. These gaps in the end are very important when no ridge is present since it is the only high opening with which to

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*Figure 12. Ridge outlet opening.*

*Figure 13. Hoop frame connected to endwall.*

A gap at the top serves as a continuous air opening for ventilation.
remove moisture. The south end, or end away from
the predominant winter winds, should remain open
during cold weather.

Where such devices as hovers or wind baffles on
gating are used to reduce drafts, the draft prevention
devices must still allow ventilation and moisture
removal to occur.

Sidewall Curtains

Hoop barns may be constructed with sidewall
curtains to promote cross-ventilation during
summer. This is essential in barns positioned
perpendicular to predominate summer winds.
Provide one foot of curtain height for each 10 foot of
width (minimum of 4 feet). Take care to ensure
animals cannot chew the curtain as the bedding pack
gets deeper. Sidewall curtains are likely not
necessary if the hoop is positioned to receive the
predominate summer wind and if animals are free
to move throughout the building. Sidewall curtains
may also allow solar penetration if improperly
positioned, adding to heat stress.

Bedding

Bedding is one of the keys to successful production
in hoop barns, especially in the winter. The producer
must determine how many acres are available to
provide residue for bedding and then decide how many
of those acres must be harvested to meet bedding
needs. Enough bedding must be provided to keep the
soil under the bedding pack relatively dry if it is not
completely concreted.

Several materials have been used successfully
for bedding swine, but there is limited experience
with these same materials for beef. A starting point
for estimating minimum bedding requirements is
30 pounds of bedding per day per 1,000 pounds of
animal weight.

A 1,200-pound bale of cornstalks costs $10 to $20
for baling, transportation and storage. Besides corn
stalks, some producers have used soybean stubble
bales successfully. However, soybean bales tend to
be dustier than corn stalks. Other producers use
barley straw, wheat straw, oat straw, prairie hay and
wood shavings. Bedding used should be free of molds.
Wood products should be used with caution.

While the selection of bedding is based mostly
on what is readily available, many other concerns
should enter into the decision. These concerns vary
from region to region and include the following:

Soil conservation: In regions where residue
cover is required on highly erodible lands, the
harvesting of cornstalks or beanstalks may not be a
good option. The producer must consider how much
residue can be removed per acre while still complying
with existing conservation plans.

Custom baling: Custom baling of stalks may
cost between $10 and $15 per ton. Additional costs
are incurred in transporting bales. On-farm baling,
while requiring less out-of-pocket expense, is not a
low-cost option. Additionally, stalk baling results in
more wear on round balers than does normal hay
baling.

Bedding availability: During years in which
a wet fall or early snow prevents stalks from being
baled in a timely manner, they may become less
available and more costly. A situation of this type
could require a shift in priorities from doing all of
the grain harvesting first to a system of harvesting
and baling stalks. A variety of bedding sources can
minimize the risk of not having enough bedding due
to inclement weather in the fall.

Bedding storage: Bedding baled in the fall
and used before the spring generally does not
deteriorate if stored outside. However, if stored into
the spring and summer, bedding must be protected
to prevent reduction in quality. Bales that will be
used during spring and summer should be stored
under cover on a well-drained area. Bales stored
outdoors will lose bedding quality, thereby
increasing costs. Bedding quality will influence the
amount needed.

Manure Handling

Before considering a hoop barn, producers must
carefully plan on how to handle the bedded pack.
The proper equipment to remove the manure
resulting from the bedded pack must be available.
If direct application to a field is not possible, then
space to stockpile the manure must be available.
Depending on the operation, federal or state
regulations may require this manure stockpile to
be covered.

Knowing the nutrient content of manure is
essential for those who have developed a manure
management plan for their fields. Bedding from hoop
barns may be drier and have a higher carbon/lower
nitrogen status than manure from facilities with
semisolid or liquid manure systems. Manure with a
high-carbon/low-nitrogen status may lead to
nitrogen immobilization and crop stress if applied during or immediately prior to the growing season.

**Removing solid manure**

Management of the manure in the hoop can either be done by selectively cleaning portions of the barn or by allowing the bedding pack to build up, hauling it after cattle are sold. If selective cleaning is done throughout the hoop barn or exterior feedlot, you must have a place to stockpile if it will not be spread immediately. This location must be free of runoff and have an all-weather surface. Federal and state regulations may require the manure to be covered and runoff from the pile to be controlled.

The manure/bedding mixture removed from the hoop barn is either directly spread on fields or stored for later use. Typically, only a few custom haulers are available that will handle solid manure. If a custom hauler cannot be located, a manure spreader, loader, and tractor must be available for on-farm usage. Cornstalks are often used in the Midwest for bedding. Cornstalk bedding is not easily handled due to the potential for wrapping on manure spreader beaters. An ordinary skid loader will probably not be sufficient to tear apart the pack during loading.

Total labor to clean the hoop barn and spread the material on nearby cropland is not currently known. The best equipment to remove the bedding pack is a mechanical, front-wheel assist tractor with a grapple fork attachment on the front-end loader. One producer reported using a chisel plow to disrupt the bedding pack before cleaning.

**Storing solid manure**

If manure is applied directly to the fields, storage requirements are minimal. If solid manure is not applied directly to a field after cleaning, then designing a space to safely stockpile the manure must be determined. To properly design the storage area the amount of manure to be stockpiled is necessary. Federal and state regulations may require rainfall runoff from the storage area to be controlled or this storage area to be covered, either permanently or temporarily with a tarp during the storage period.

As the material comes directly out of the hoop barn, some variability in the bedded pack makes it difficult to predict manure nutrient contributions to crop fertilization needs. Composting is likely to occur if the manure is stored for any length of time. Composting will provide a volume reduction of one-third to one-half and cause nutrient stabilization prior to field application. Such composting will occur with minimal management if the material is piled in windrows about 6 feet high and 12 feet wide.

Moisture content will influence the ability to compost. If the material mixture is too wet, the pile will not allow adequate air exchange and may give off offensive odors. Bedding and manure that is too dry will not be actively composted. Mixing the material to achieve a higher degree of uniformity would improve this situation. Mixing currently occurs to some degree if the bedded pack is piled for storage or composting prior to field application. Additional mixing, as would occur during turned windrow composting, may offer a benefit with this material. Contact your local Cooperative Extension service for recommendations on composting manure.

Some concern exists about nitrogen leaching from storage, especially during high rainfall. Environmental control agencies are concerned about runoff and will inspect areas of stockpiled manure. Storing manure on a concrete pad can be an effective management tool that will provide a solid base to make manure removal easier and can be designed to safely control runoff from the area. Runoff control structures may be necessary. Contact state environmental control agencies to determine proper procedures and requirements for stockpiling manure.

**Applying solid manure**

In some places in the Midwest, much of the agricultural land base is highly erodible. As part of their conservation plan, many producers have signed an agreement with the federal government to maintain 30% residue coverage after planting. Using large amounts of residue in hoop barns has raised the following concerns:

- The properties of the manure may vary throughout the structure. Some areas will have a high concentration of manure while others will be mostly bedding; therefore, the fertilizer value of the manure and residue mixture cannot be estimated accurately and credited for nutrient content.
- If they are not chopped first, cornstalks spread on fields may interfere with minimum tillage operations.
- If the farming operation plans on using no-till, will the producer be able to land apply...
the residue in a thin enough and uniform pattern with existing manure spreaders to minimize planting problems?
- Substantial organic matter will be returned to the cropland, but will a high carbon-to-nitrogen ratio prevent the nitrogen from being fully available for crop use the first year following land application?

**Example Layouts**

Hoops used in conjunction with outside lots can be built in many different configurations. One popular layout is shown in Figure 14. This configuration places the feed bunk and feed drive alley inside the building along with 20 to 25 square feet of space for each animal. The south sidewall of the building is open for cattle movement while the north sidewall is partially enclosed with a ventilation curtain. The east and west end walls are closed. Overhead or roll-up doors allow feed alley access.

One possible total confinement layout is shown in Figure 15. The building is placed with the open south end toward the prevailing summer breeze. The feed bunk and drive alley are located outside the

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**Figure 14.** Hoop barn with interior drive alley and outside lot.

**Figure 15.** Hoop barn total confinement with exterior feeding.
sidewall of the building on the side least affected by winter winds. The building provides 40 to 50 square feet of space per animal. Bedding is provided in the back end of the pen away from the feed bunk.

This facility was designed as shown for several reasons. The building utilizes an interior drive for feeding. The interior drive is an easily implemented design but is more expensive per animal housed because of space for the drive alley. If an interior drive alley is not used, the bunk should be protected from rain and wind using an overhang as shown in Figure 16. Feeding market cattle with the facility shown is being studied at the Iowa State University Armstrong Research Farm located near Lewis, Iowa. No final results were available at press time. Initial indications show that this approach appears to be feasible.

Summary

Hoop barns may be part of an environmentally sound beef production unit. While this system will reduce runoff potential and provide a good environment for cattle, management of bedding and the physical structure must be addressed.

Figure 16. Cross-section and design details of total confinement hoop barn with exterior feeding.
When the curtain is down during the summer, sunlight can penetrate and increase the heat in the building.
References and Resources
Available from MPWS, 122 Davidson Hall,
Iowa State University, Ames Iowa 50011-3080
or Fax: 515-294-9589 or www.mwps.org:
• Beef Housing and Equipment Handbook, MWPS-6
• Modern Corral Design, OKE-938
• Corrals for Handling Beef Cattle, CAN-723
• Beef Cattle Handbook CD-ROM, MWPS-CD-1
• Beef Cattle Handbook, MWPS-CD-1P