

Hay Storage Alternatives - Barns

Farm Business Management Update, October/November 2003

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Decisions to invest capital in a structure should be made in light of its potential to lower costs or increase returns to the overall farm business. Building a barn for hay storage is an example. Once it has been determined that a hay storage structure will improve the farm business, what type should you build? Over the last few years hoop-barns have been showing up on farms as an alternative to pole-barns or multi-purpose barns (Figure 1). Hoop-barns use hoop-shaped support structures as the superstructure on which a fabric (tarp) is stretched completing a cover that will shed rain, ice, and snow. The structure must be properly constructed and the tarp must be properly tensioned to insure that it will stand up to wind and the elements. Hoop-barns are offered as a cost effective alternative to pole-barns constructed on site by a contractor. Given the differences in materials, shape, and costs between a pole-barn and hoop-barn which one is most cost effective?

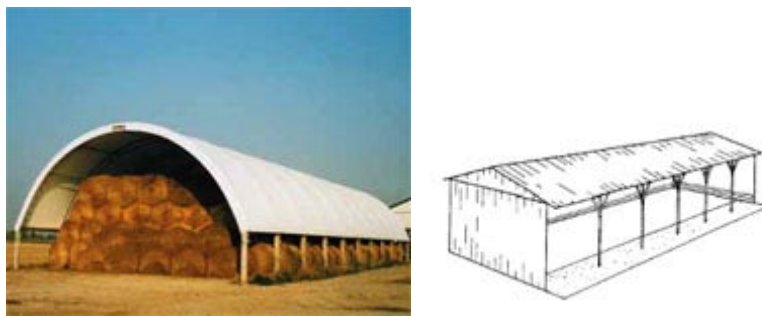


Figure 1: Example Hoop and Pole Barns

Hoop barns: Estimates in Tables 1 and 2 are based on conversations with a regional contact for a hoop-barn dealer about costs and construction methods for a comparable pole-barn. The 40' x 80' hoop-barn is constructed by the local dealer after the farmer has set eighteen 8" x 8" x 8' posts to attach the structure to the ground. Labor was not included for setting the posts and concrete work. Hoop barns can be installed directly on the ground or with poured concrete or wooden walls. Hoop barns carry a limited 15-year warranty, and when the fabric is kept tight, they require little maintenance. The fabric can be patched following a puncture/rip from the inevitable running-through with a bale spear.

Assumptions for hoop-barn

- Owner installs/sets eighteen 8" x 8"x 8' posts (four feet in the ground) in concrete.
- A filter fabric and a rock base cover the footprint of both building at \$0.60/ft2.
- Materials cost \$8,000 with the farmer paying \$700 in freight to ship materials to Virginia
- Labor to construct the hoop-barn on the posts is \$1.50/ft2

Pole barns: Estimates in Tables 1 and 2 are based on the Mid-West Plan Service Plan Number 73110, a pole-barn with metal on two sides based on estimates from a regional contractor for a turn-key operation. The turn-key costs were estimated to be \$11.00/ft2. The contractor said that the price could vary widely based on local conditions, material costs, and size of the structure.

Table 1: Assumptions for Cost Estimate	Hoop Barn		Pole Barn (MWPS 73110)	
	Unit/price	Totals	Unit/price	Totals
1. Size W - L - H & ft2	40' x 80' x 25'	3,200	24' x 72' x 17'	1,728
2. Costs per ft2 - materials	\$2.50	\$8,000	\$11.00	\$19,008
3. Freight to Virginia	\$700	\$700	-	-
4. Labor costs per ft2	\$1.50	\$4,800	-	-
5. Rock/fabric base \$/ ft2	\$0.60	\$1,920	\$0.60	\$1,037
6. Post 18 - 8"x 8"x 8'	\$55	\$990	-	-
7. Concrete \$70/yd	8.38	\$587	-	-
8. Total Costs or Investment (Sum of lines 1-6)	\$16,997		\$20,045	
9. Turn-key costs ¹ per ft2 (line 8 ÷ line 1)	\$5.31		\$11.60	
10. Range of storage (tons)	100 - 300		100 - 200	
11. Tons of storage for comparison	120		120	
1Cost per ft2 can vary greatly based on size of the buildings, e.g. MWPS-73112 (48' x 96'x 17") 330-480 tons storage capacity could cost \$9.00/ft2				

Comparing costs: These barns are assumed to last for 20 years and the owners must pay taxes, insurance, and cover repairs based on the initial investment costs. Comparisons of costs over the 20 years of life are based on recovering the initial investment plus interest (5%) so that the owner will have sufficient funds at the end of the life to replace the building with a comparable structure. Estimates of repairs, taxes, and insurance are assumed to be the same for both buildings at annualized costs based on 3% of new costs. Table 2 illustrates these step-by-step calculations indicating that annual storage costs for a hoop-barn are \$1,874 or \$15.61 per ton and \$2,210 or \$18.41/ton for a pole barn. Under the assumptions of this analysis, the hoop-barn is a more cost effective investment. Saving a farmer \$336 in annualized cost or \$2.80 per tone of hay stored.

Table 2: Per ton costs	Hoop Barn	Pole Barn
1. Total investment (Table 1, Line 8)	\$16,997	\$20,045

2. Interest rate (i)	0.05	0.05
3. Number of periods (n) years	20	20
4. Capital recovery factor =	0.0802	
5. Annual cost recovery = Line 1 * Line 4	\$1,364	
6. Ins, Taxes, & Repairs = Line 1 * 3%	\$510	\$601
7. Annual costs = Line 5 + Line 6	\$1,874	\$2,210
Costs per ton (Line 7 ÷ Table 1, Line 11)	\$15.61	\$18.41

Additional Questions and Considerations

Question: Will this analysis hold for all farm situations? Answer: NO! Farmers with construction skills can build their own barns thus lowering costs. Trading labor and resources between farmers can reduce costs, i.e., a neighbor with a portable saw mill can custom saw lumber for the barn reducing material costs. Clearly, farmers have many opportunities to build some or all of a pole-barn and reduce total costs. However, hoop-barns afford limited opportunities for using farm-based resources thus limiting ways to reduce costs.

Question: What determines the costs per ton of hay stored in a barn? Answer: how much hay you can stuff in the barn. Storage capacity is the most critical issue to figure out before you sign a contract to build a structure. In addition, the tons of storage depend on the type of hay stored - round and square bales have different density - round bales are 12 lbs/ft³ and small square bales are 15 lbs/ft³. For example, the standard size round bales have the following estimated weights: 4' x 4' bales weigh 603 lbs; 5' x 5' bales weigh 1,178 lbs; and 6' x 6' bales weigh 2,036 lbs. So the larger the round bale package, the more hay can be stored - a function of $\frac{1}{2} * r^2 * H$. Therefore, per ton costs are dependent on the type of bales, the equipment used to handle bales, design of the building, and operator skills in stacking hay.

Question: How high can hay be safely stacked? Answer: Height is the limiting factor for a flat barn and safety is a limiting factor in stacking hay in any barn. Operator skills, proper equipment, type of bale, and barn size should all be used to determine the safe height of stacked hay

Question: Is it easier to put hay in a flat barn or a hoop barn? Answer: Depends on operators' skills and personal preferences.

Question: Will a pole-barn offer greater access to hay of different quality? Answer: Yes. With multiple bays, hay of different qualities can be segregated. Hoop-barns only provide access from each end of the barn.

Hoop-barns provide a cost effective, multipurpose structure to store hay as compared to traditional pole barns. Yet, they offer few opportunities for on-farm construction and used farm based resources to reduce costs. Ultimately, the choice becomes more than just summing costs. Managers need to consider how the structured will be used, ease of access, on farm resources, constructions savings, and so on before starting the construction process.

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