Silage Storage Costs

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There are many choices for silage storage. One should consider how the current storage system can be used while evolving into a different system. The evolutionary process of modernization needs to use a storage system that is flexible and expandable. It should allow for feed inventory management, labor efficiency, and feed value protection while minimizing capital and annual costs.

This analysis was developed using the *Cost of Forage Storage* spreadsheet from the UW Extension Team Forage-Harvest and Storage website at **www.uwex.edu/ces/crops/uwforage/storage.htm**

Three types of commonly used silage storage systems were considered. Three herd sizes were looked at to show the effect of increasing herd size.

Results

In Figure 1, it is apparent that initial capital costs increase with herd size (quantity of feed stored). The hay portion is larger than the corn silage portion because there is about 2/3 hay and 1/3 corn silage stored. The initial capital investment is generally lowest for silage piles and highest for silo bags. The unusually high initial capital investment for silo bags on the 400-cow herd is due to the selection of a bagging machine capable of receiving forage into a tray from dump trucks and capable of using a 150-hp tractor at an initial cost of about four times that of the bagging machine used for the 100- and 200-cow herds.

Figure 2 shows the results of converting capital investments to annual costs as well as accounting for other expenses such as plastic, fuel, labor, and dry matter loss. Here the bunker silos tend to have the lowest annual cost while the lowest investment system (silage piles) tends to be a higher annual cost system. The main reason for this reversal is the assumption that dry matter loss is highest for the silage pile (due to larger top surface area). The significance of this dry matter loss is seen in Figure 4. The higher annual cost attributed to hay vs. corn silage is due to the larger quantity of hay stored and the high value ($85/T DM vs. $70/T DM) assigned to the hay.

Various cost components are presented in Figure 4 which shows that the largest component in total annual cost of each system is assumed dry matter loss. The analysis presumes good management with these systems. If less than good management were used, the dry matter loss would be higher and the total annual cost of the other components could be dwarfed by this one cost component.

Forage Storage Used	Herd Size (cows w/replacements)								
	100			200			400		
Bag Silos									
Number		11		13		8		39	
Diameter(ft)		10		10		10		10	
Length(ft)		250		250		200		250	
Piles									
Number	2	2	2	2	2	2	3	2	3
Top width(ft)	0	1	0	17	0	9	19	24	18
Bottom width(ft)	60	49	54	77	60	69	85	84	78
Length(ft)	107	106	107	135	135	135	150	150	145
Height(ft)	10	8	9	10	10	10	11	10	10
Bunker Silos									
Number	4		2	3	3	3	3	3	3
Average width(ft)	24		20	32	30	20	64	60	40
Length(ft)	136		112	135	135	135	135	135	135
Wall height(ft)	10		10	10	10	10	10	10	10

Bag Silos - Common Characteristics
Dry matter density: 13 lbs DM/ft^3
Distance between bags: 9 ft
Plastic bag cost: $505/250 ft
$410/200 ft
Asphalt storage pad with base: $1.54/ft^2

Silage Piles - Common Characteristics
Dry matter density: 14 lbs DM/ft^3
Distance between piles: 6 ft
Plastic cost: $0.037/ft^2
Pile side slope - 3 horizontal:1 vertical
Asphalt storage pad with base: $1.54/ft^2

Bunker Silos - Common Characteristics
Dry matter density: 14 lbs DM/ft^3
Walls: T-panels loaded two sides
Plastic cost: $0.037/ft^2
Excavation/fill cost: $0.40/ft^2
Wall cost: $75/ft
Asphalt floor with base: $1.32/ft^2

An economic analysis is only as good as its assumptions. Some of the assumptions used in this forage analysis are listed as follows.

Common values for all systems.

Herd Size (cows w/replacements)	T Hay DM/yr	T Corn DM/yr
100	741.0	364.4
200	1448.4	721.9
400	2896.8	1443.8

Feed Value: Hay Silage $85/T DM
Corn Silage $70/T DM

Tractor	Herd Size (cows)		
	100	200	400
Bagger filling tractor	105 hp	105 hp	150 hp
Pile filling tractor	105 hp	105 hp	150 hp
Bunker filling tractor	105 hp	105 hp	150 hp
Unloading, all storages	72 hp	72 hp	72 hp

Engine Capacity	Tractor Initial Cost ($)
72 hp	55,000
105 hp	65,000
150 hp	112,700

Filling and Unloading Bucket Initial Cost: $10,000

Herd Size (cows w/replacements)	Bagger Initial Cost ($)
100	30,700
200	30,700
400	118,480

Item	Ownership Cost (% of initial cost)
Bagger	16.7
Tractor	15.7
Structures	12.0
Bucket Loader	23.8

Item	Dry Matter Losses (%)					
	Filling	Seepage	Gaseous	Spoilage	Unloading	Total
Bagger	1	0	7	2	3	13.0
Pile	2.5	0	8	10	3	23.5
Bunker	2	0	8	5	3	18.0

Labor Cost: $10/person/hour
Fuel Cost: $1.00/gallon

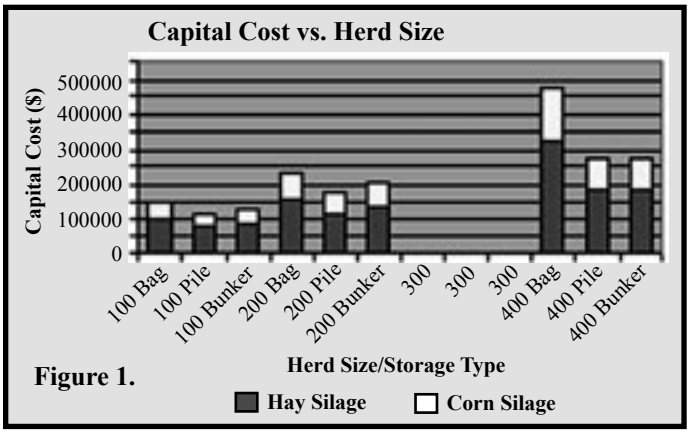

Figure 1.

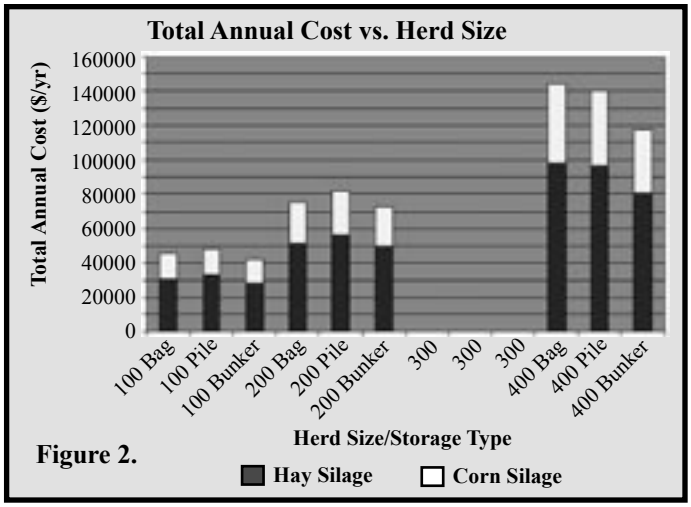

Figure 2.

Structure cost is generally the next largest cost component. This points out the need to size the storages well (not oversize) and to shop for a low initial cost. Labor is a somewhat large component in all systems. Plastic is a large component in the silo bag storage. The large investment in the bagging machine for the 400-cow herd size shows up as a large annual cost for that one system. Had the lower initial cost bagging machine been used for this herd size, bagger annual cost would have been much smaller, thus reducing the total annual cost to a value less than that of silage piles.

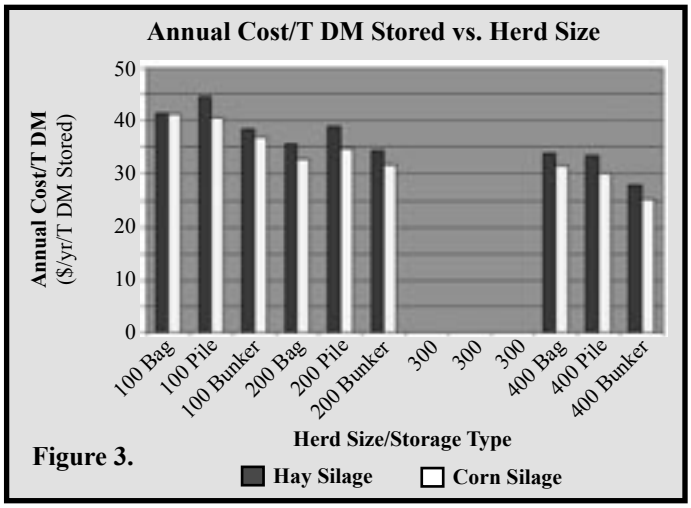

Figure 3.

Conclusions

Of the storage types studied and assumptions used, bunker silos have an intermediate initial cost but the lowest annual cost and the lowest annual cost per ton of dry matter, suggesting that a bunker silo should be given careful consideration as a storage system. If one is limited on capital to invest and/or needs a system that is flexible, consider the silage pile system. This system could be adapted to the addition of walls in the future as it is converted to bunker silos. If a bagging machine could be rented out to neighbors, one might justify the higher initial investment to help reduce the annual costs by producing income. Similarily, if bagging can be contracted and investment cost eliminated, bagging can be more cost effective. The bag pad could also be converted to bunker silos in the future. However, a 200-250 ft long storage pad will not make for a good bunker silo length. Consider a pad one half to two-thirds as long.

Figure 3 shows a decreasing cost per ton of dry matter stored as herd size increases. This reflects the economies of scale with increasing quantity of feed stored. Values range between $25-45/T DM. The bunker silo tends to be the lowest cost per ton system with silage piles being the highest except in the case of the 400-cow herd size. The cost for corn silage is lower than that of hay silage, probably due to the lower value assigned to corn and thus the lower cost of feed loss for the same percentage of dry matter loss.

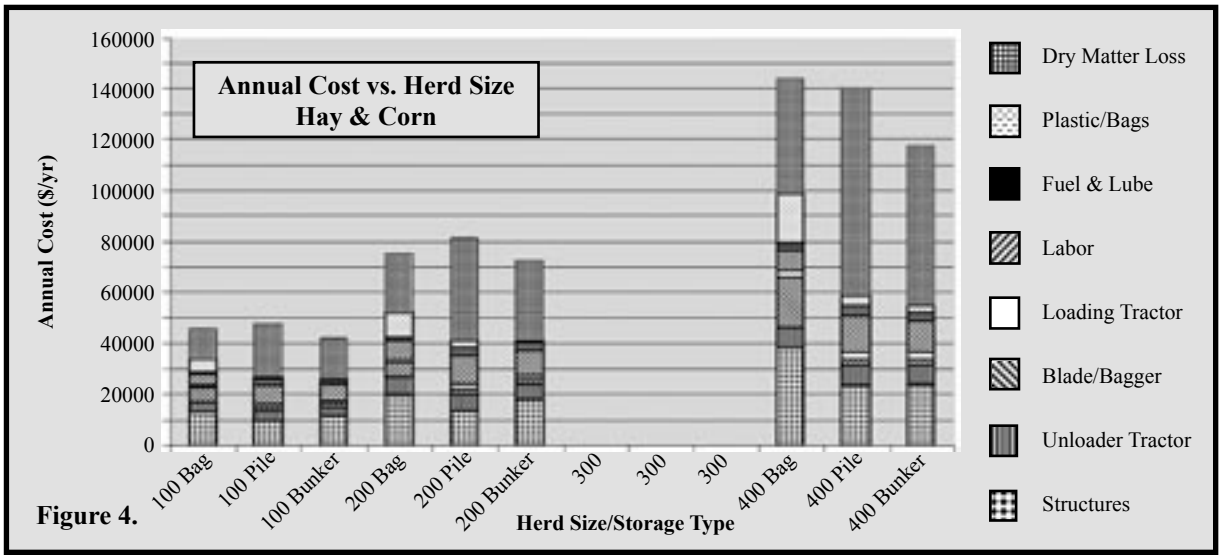

Figure 4.