Bunkers, piles, or bags: Which is most economical?

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Because the forage component of the dairy cow ration is critical, information pertaining to silage that can be used by dairy managers to make sound decisions is plentiful. However, information specifically looking at the economics of alternative storage systems is somewhat sparse. Many factors influence which silage storage system is best for a particular dairy; thus, each manager must evaluate their unique situation.

The “most economical” manner of silage storage refers to the cost of the silage (producing, harvesting, storing, and feeding) and the impact that silage has on milk production (income). The lowest cost per ton should only be the goal if a milk-production-per-ton-adjustment has been made. Evaluation of costs per ton of feed will vary depending on the assumptions made prior to making the calculations. The objective of this article is to develop a framework for comparing the economics of three different types of silage storage structures, bunker silos, drive-over or wall-less piles, and silage bags. A companion Excel spreadsheet (SilageStorage$.xls) is available at http://www.agmanager.info/livestock/budgets/production/default.asp#Dairy. This spreadsheet can be used as an aid for making decisions regarding these systems.

When evaluating the economics of silage storage alternatives, it is important to recognize several factors. (1) Silage storage costs will vary between dairies due to forage type, herd size, facilities, and management ability. (2) Some economic inputs required for evaluating storage alternatives such as labor availability for packing or covering silage piles, feed out considerations, delivery rate of silage to the storage area, etc. may be difficult to quantify but impact the ultimate decisions. A realistic estimation of these associated costs should be made. (3) Once costs have been objectively estimated, other more subjective factors also may need to be considered in making the final decision. Table 1 lists some of the relative merits of each of the silage storage alternatives.

Costs of Silage Storage

Determining the cost of delivering silage to the herd will be complex if all of the economic components such as silage production, storage, silage removal and delivery, are included. Dairies should focus their efforts on estimating the major cost differences and not be overly concerned about assuming minor costs are similar across different alternatives. The important expense categories to consider are discussed below.

**Site and structures** — The annualized cost, as opposed to investment, of the site and structure is important and includes market-based depreciation, interest, repairs and maintenance. The land area or footprint required for the storage system is also important because the dairy may have space constraints. Although land cost may represent a small percent of the total costs, the cost of developing the land (i.e., land leveling, base material, floor/surface, etc.) can be significant and must be included.

**Cost of silage delivered to storage** — The cost of silage delivered to storage is similar to the purchase price for silage. This value reflects either the costs of production or a market value (i.e., opportunity cost) of home-grown silage.

**Packing or bagging costs** — The cost of packing or bagging represents the cost associated with getting the silage into storage. If this cost includes the cost of the

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**Table 1: Advantages and disadvantages of silage storage alternatives**

<table>
<thead>
<tr>
<th>Storage System</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concrete Bunkers</strong></td>
<td>• High capacity • Smaller footprint • Fast unloading rate • Stable forage quality if packed correctly • Relatively low “out of pocket” cost • Utilizes conventional farm equipment</td>
<td>• High initial investment • Packing influences DM losses • Cost effective for small herds • Cost availability of labor • Safety concerns</td>
</tr>
<tr>
<td><strong>Drive-over Piles</strong></td>
<td>• Low initial capital investment • Flexibility of pile quantity • Fast unloading rate • Utilizes conventional farm equipment</td>
<td>• Larger footprint than bunkers • Flooding potentially expensive • Cost availability of labor • Safety concerns</td>
</tr>
<tr>
<td><strong>Plastic Bags</strong></td>
<td>• Low initial capital investment (assuming custom bagging) • Flexible storage system • Small feedout face to manage • Low DM loss if managed properly • Feed can be inventoried easily • Fewer safety hazards</td>
<td>• High annual “out of pocket” expense • Largest footprint • Flooding potentially expensive • Need specialized equipment • Small “feed out face” • Cows may ingest plastic • Plastic bags not reusable</td>
</tr>
</tbody>
</table>

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Comparison of Economic Costs – Example Dairy

The production-adjusted cost per ton of silage delivered to cows was estimated for a hypothetical 3,000 cow dairy. The following assumptions were made for the dairy:

Assumptions used in economic analyses:
- Herd size, cows 3,000
- Silage in ration, as-fed (AF) lbs/cow/day 45.0
- Silage moisture content, % 68.0
- Maximum feeding days per storage structure interest rate, % 10.0
- Land value, $/acre $1,000
- Useful life for structures, years 30.0
- Annual repair and maint, on structures, % 1.5
- Cost of silage delivered to storage, $/AF ton $25.00
- Cost of plastic, $/sq ft $0.030
- Labor cost, $/hour $10.00
- Milk price, $/cwt $13.50

Table 2: Economic Comparisons of Alternative Silage Storage Systems

<table>
<thead>
<tr>
<th>Storage-type-specific inputs</th>
<th>bunker silo</th>
<th>drive-over pile</th>
<th>plastic bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons of silage stored, AF</td>
<td>31,597</td>
<td>32,850</td>
<td>27,683</td>
</tr>
<tr>
<td>Plastic required for covering bunkers and piles, sq ft</td>
<td>25,261</td>
<td>37,345</td>
<td>na</td>
</tr>
<tr>
<td>Estimate of DM loss, %</td>
<td>18.0%</td>
<td>20.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Estimate of feedout DM loss, %</td>
<td>5.0%</td>
<td>5.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Total DM loss, %</td>
<td>23.0%</td>
<td>25.0%</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

A. Full cost scenario

| Cost of silage into storage, $/ton AF | $74.62 | $59.24 | $29.13 |
| Total cost of silage into storage, $/ton DM | $104.55 | $91.03 | $106.68 |
| Total cost of silage out of storage, $/ton AF | $43.45 | $38.84 | $33.02 |
| Total cost of silage out of storage, $/ton DM | $135.78 | $121.37 | $103.18 |

B. Bunker silo ownership costs = 0 scenario

| Cost of silage into storage, $/ton AF | $26.22 | same as scenario A |
| Total cost of silage into storage, $/ton DM | $81.93 | same as scenario A |
| Total cost of silage out of storage, $/ton AF | $34.06 | same as scenario A |
| Total cost of silage out of storage, $/ton DM | $106.40 | same as scenario A |

Silage cost adjustments due to quality

| Milk prod. adjusted cost of silage out of storage, $/ton AF | $34.05 | same as scenario A |
| Milk prod. adjusted cost of silage out of storage, $/ton DM | $106.40 | same as scenario A |

Summary

The most important point of this analysis is how much costs per ton will vary depending on the assumptions. Costs per ton of milk-production-adjusted silage were compared for silage stored in concrete bunkers, drive-over piles, and plastic bags for an example dairy. Cost per ton was lowest for silage stored in bags if all costs were included for the bunkers. However, if fixed costs of concrete bunkers were ignored, the cost of storing silage in bags was only lower than silage stored in bunkers if milk production for cows fed bagged silage increased slightly. To aid dairy managers with evaluating their silage storage alternatives, an Excel computer spreadsheet (SilageStorage.xls) has been developed that can make this process much easier.

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