Forage Storage Options, What’s Right for You?

Central Wisconsin Dairy Series

2005

Craig Saxe
UW-Extension, Juneau Co.
211 Hickory Street
Mauston WI 53948
(608) 847-9329
E-mail: craig.saxe@ces.uwex.edu
Forage Storage Options, What’s Right for You?

A. Wooden-hoop Silo
B. Tile Block Silo
C. Welded-steel Fence Silo
D. Bunker Silo

“Farm Silos”
Pub. # 810
Oct. 1964
Forage Storage Options, What’s Right for You?

A. Horizontal Silo
B. Tower Silo
C. Silo Bag
D. Silage Pile
E. Wrapped Bale
Silage Storage Costs

“How many miles do you get per payment?”
Annual Costs Vs Storage Type
3072 T DM Stored - Good Management

- Tower
- Bunker
- Pile
- Bag

Holmes, 1997
Annual Costs Vs Storage Type

3072 T DM-Bunker & Pile Not Covered

- Tower
- Bunker
- Pile
- Bag

Annual Cost ($ / yr-T DM)

DM Loss
Plastic
Fuel & Lube
Labor
Equipment
Structure

Holmes, 1997
Annual Costs VS Storage Type
384 T DM Stored

Holmes, 1998
WARNING

An Economic Analysis is Only as Good as Its Assumptions

This Analysis Does NOT Apply to your Farm
## Common Characteristics – All Systems

<table>
<thead>
<tr>
<th>Herd Size (Cows)</th>
<th>Hay Forage (T DM/yr)</th>
<th>Corn Forage (T DM/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>741.0</td>
<td>364.4</td>
</tr>
<tr>
<td>200</td>
<td>1448.4</td>
<td>721.9</td>
</tr>
<tr>
<td>400</td>
<td>2896.8</td>
<td>1443.8</td>
</tr>
</tbody>
</table>
Bag Silos – Common Characteristics

- Dry matter density: 13 lbs DM/ft$^3$
- Plastic bag cost: $505 / 250$ ft long bag
- Bag Diameter: 10 ft.
- Distance between bags: 9 ft
- Asphalt storage pad with base: $1.54/ft^2$
- Bagger Cost: $30,700 - 100, 200$ Cow
  $111,480 - 400$ Cow
Total Capital Cost  =  

Structure Cost + 

Equipment Cost Allocated to Storage Activity
Annual Cost = Sum of:

Annualized Structure Cost
Annualized Equipment Cost
Labor Cost
Plastic Cost
Fuel & Lube/Electricity Cost
Dry Matter Loss Cost
## Causes of Dry Matter Loss - Bunkers & Piles

<table>
<thead>
<tr>
<th>Cause/Location</th>
<th>Practice Contributing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seepage/Leachate</td>
<td>Harvest too wet for storage type</td>
</tr>
<tr>
<td></td>
<td>Inadequate protection from precipitation</td>
</tr>
<tr>
<td>Surface Decomposition</td>
<td>Inadequate exclusion of precipitation &amp; air</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Cause/Location</th>
<th>Practice Contributing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Out Face</td>
<td>Inadequate packing</td>
</tr>
<tr>
<td></td>
<td>High porosity</td>
</tr>
<tr>
<td></td>
<td>Slow feed out rate</td>
</tr>
<tr>
<td></td>
<td>Too much feed removed</td>
</tr>
<tr>
<td></td>
<td>Inadequate fermentation</td>
</tr>
<tr>
<td></td>
<td>Rough feed out face</td>
</tr>
<tr>
<td></td>
<td>High forage temperature</td>
</tr>
<tr>
<td></td>
<td>Feed spilled while feeding</td>
</tr>
</tbody>
</table>
## Causes of Dry Matter Loss - Bunkers & Piles

<table>
<thead>
<tr>
<th>Cause/Location</th>
<th>Practice Contributing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Bunk</td>
<td>Feed exposed to air too long</td>
</tr>
<tr>
<td></td>
<td>Inadequate fermentation</td>
</tr>
<tr>
<td></td>
<td>High forage temperature</td>
</tr>
<tr>
<td></td>
<td>High levels of sugars remain after fermentation</td>
</tr>
<tr>
<td></td>
<td>Sorting of feed by animals</td>
</tr>
</tbody>
</table>
## Common Characteristics – All Systems

<table>
<thead>
<tr>
<th>Storage Type</th>
<th>Dry Matter Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bags</td>
<td>13</td>
</tr>
<tr>
<td>Piles</td>
<td>23.5</td>
</tr>
<tr>
<td>Bunkers</td>
<td>18</td>
</tr>
<tr>
<td>Baglage / Tbllage</td>
<td>5</td>
</tr>
</tbody>
</table>
Base Storage System Investment Decision on Annual Costs Incurred as Operated, Not On:

- Lowest Initial Capital Cost
- Lowest Achievable Annual Cost
TEAM FORAGE Web Page

Mission  Team Members  Work Groups
Focus on Forage  UW Forage Resources
Member Information

WHAT ARE YOUR THOUGHTS ABOUT THIS WEB SITE? click here

You are the 10916th to access this page since 10/18/1999.

© 1999-2001 Board of Regents of the University of Wisconsin System, doing business as the Division of Cooperative Extension of the University of Wisconsin-Extension.
Storage Economics

Bunker Silo Facers - worth the investment?
A "Focus on Forage" fact sheet written by Dr. Brian Holmes, UW-Extension Ag Engineer

Facer Cost Analysis Spreadsheet - download as an Excel (*.xls) file
This spreadsheet, developed by Dr. Brian Holmes, will help analyze the economics of owning and operating a facer for removing silage from horizontal silos.

Capital Costs of Pads for Bunkers, Piles, and Bag Silos - .pdf
by Dr. Brian Holmes, UW Extension Ag Engineer

UPD 5.1.2003 Cost of Forage Storage Spreadsheet - download as an Excel (*.xls) file
Documentation - download as a *.pdf file (Acrobat Reader needed)
This spreadsheet, developed by Dr. Brian Holmes, will help analyze the capital and annual costs for various types of high-moisture forage storage structures.

http://www.uwex.edu/ces/crops/teamforage/index.html
Other Considerations When Selecting Silage Storage

- Ability to get financing
- Spoilage and other losses
- Volume of feed to be handled
- Potential to purchase feed
- Herd Size
- Speed of loading and unloading
Other Considerations When Selecting Silage Storage (cont.)

- Compatibility with current system
- Flexibility for future needs
- Silo longevity/obsolescence
- Convenience
- Personal Preference
## Workers Needed to Harvest Forage

<table>
<thead>
<tr>
<th>Storage Type</th>
<th>Harvest</th>
<th>Transport</th>
<th>Filling</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunker/Pile</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Tower/Bag</td>
<td>1</td>
<td>3/4</td>
<td>1/4</td>
<td>2</td>
</tr>
<tr>
<td>Bale/Balage</td>
<td>1/2</td>
<td>1/4</td>
<td>1/4</td>
<td>1</td>
</tr>
</tbody>
</table>

* High harvest rates and/or long transport distances may further increase these values.
# Fatal Silage Accidents in Wisconsin 1987-1996

<table>
<thead>
<tr>
<th>Accident Description</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tower Silo – Falls/Asphyxiation/Mold</td>
<td>18</td>
</tr>
<tr>
<td>Tower Silo – Unloader</td>
<td>6</td>
</tr>
<tr>
<td>Tower Silo – Buried under silage</td>
<td>1</td>
</tr>
<tr>
<td><strong>Tower Silo - Sub Total</strong></td>
<td><strong>25</strong></td>
</tr>
<tr>
<td>Bunker – Side Collapse/Buried in Silage</td>
<td>4</td>
</tr>
<tr>
<td>Bunker – Pinned</td>
<td>1</td>
</tr>
<tr>
<td><strong>Bunker - Sub Total</strong></td>
<td><strong>5</strong></td>
</tr>
<tr>
<td>Bagged Silage - Sub Total</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>
What’s Your Personal Preference?

A. Horizontal Silo
B. Tower Silo
C. Silo Bag
D. Silage Pile
E. Wrapped Bale
Horizontal Silo Advantages

• Holds large capacity
• Can be filled with conventional farm equipment
• Offers faster unloading rates
• Forage quality changes occur gradually if filled using the progressive wedge
Horizontal Silo
Disadvantages

• Higher initial cost
• Requires greater care in filling and packing
• Will not work for smaller herds
Horizontal Silo Recommendations

• Packing is essential for good silage preservation
• Must be covered to avoid large storage losses
• Labor must be available
• Face removal of more than 6 in/day is recommended to avoid spoilage
Tower Silo
Advantages

• Lower Storage Losses
• Requires less area for construction
• Allows greater mechanization during filling and feedout
• Convenient to unload in winter
Tower Silo
Disadvantages

• Higher initial cost
• Unloads more slowly
• Silage moisture cannot be as high as compared to other silo types
Tower Silo
Recommendations

• Face removal of more than 4 in/day is recommended to avoid spoilage
• Using an effective distributor can increase silo capacity by as much as 30%
Silo Bag
Advantages

• Lower capital investment
• Flexible storage system
• Feed is easily inventoried
• Can be used for small and large herds
• Fewer safety and health hazards
• Lower Storage Losses
Silo Bag
Disadvantages

• Specialized equipment may be needed
• Plastic disposal creates extra labor and environmental concerns
• Bags must remain intact, compromised bag can result in a complete loss
Silo Bag Recommendations

- Locate on a hard all-weather surface
- Locate away from drainage areas and low spots
- For ease of feedout locate close to existing storage
- Face removal of more than 6 in/day is recommended to avoid spoilage
Silage Pile
Advantages

• Inexpensive
• Good for short term storage needs
• Also see horizontal silo comments
Silage Pile
Disadvantages

• Large amount of exposed surface area
• Greatest loss of dry matter during storage
• More difficult to pack
• Also see horizontal silo comments
Silage Pile
Recommendations

• Packing is essential
• Must be covered
• Consider side slopes at 3 horizontal units for each vertical unit (about 18 deg)
• Also see horizontal silo comments
Wrapped Bale
Advantages

• Low initial investment
• Flexible storage system
• Feed can be inventoried
• Can be used for small herds
• Also see silo bag comments
Wrapped Bale
Disadvantages

• Damage can occur when storing and moving bales
• Specialized equipment may be needed
• Also see silo bag comments
Economics of Your Decision

• Every situation is different, do your own analysis

• Consider looking at: Investment and Annual Costs of Forage Storages Spreadsheet.

• This and other documents can be found at the Team Forage Website:
  
  http://www.uwex.edu/ces/crops/teamforage/index.html
Forage Web Page
http://www.uwex.edu/ces/crops/teamforage/index.html