Minimize Bunker/Bag Silage Losses with a Tight Plastic Seal And Frequent Inspections

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Cover  Quickly & Tightly

Shape Surface to Drain Water
Cover With Plastic Within 24 Hours
Consider Oxygen Barrier Film
Line Walls with Plastic
Overlap Joints by 3-6 ft.
Weight Uniformly
Gravel Bags or Soil at Sides & Ends
Inspect & Repair Holes w Plastic Tape
Slopes too Steep

- Too steep to hold tires in place
- >3:1 slope for safe packing

Compliments of Rich Muck, USDFRC
Too Steep
To Pack & Hold
Plastic Down

Correct Shape
(max. 3:1 slope)

Incorrect Shape

Complements of Keith Bolsen
Too Steep To Pack & Hold Plastic Down

Complements of Keith Bolsen
Do You Need A Cover?

Isn’t there a decent alternative to plastic and tires?
Dry Matter Recovery (%) vs Time

Bunker Silo - Plastic Cover Immediately

DRY MATTER RECOVERY vs TIME

Bolsen, 1993

TIME (days)

Dry Matter Recovery (%)

Top 0-13 In

Mid. 13-26 In

Bot. 26-39 In
DRY MATTER RECOVERY vs TIME
Bunker Silo - No Cover

TIME (days)
Dry Matter Recovery (%)
Top 0-13 In
Mid. 13-26 In
Bot. 26-39 In

Bolsen (1993)
Visible Losses due to no cover = Spoilage

Less Visible Losses due to no cover
Plastic vs No Cover

Sealed = 12% loss

Unsealed = 65% loss

KSU, 1990
Why Should You Be Concerned About Bunker Covers?

- Quality of the cover substantially affects the quality of the silage.
  - Dry matter losses
  - Spoiled silage
Oxygen Barrier Film: Silostop

- Introduced at the 12th ISC in 1999.
- Oxygen permeability is 1/20 of standard polyethylene.

Compliments of Rich Muck, USDFRC
Plastic With Reduced Oxygen Permeability - Silostop System

- Tarp anchored with gravel bags
  - At wall
  - At seams in plastic, tarps

Compliments of Rich Muck, USDFRC
Some Oxygen Barrier Findings

No Visible Spoilage
# Standard Plastic Film vs Oxygen Barrier Film

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Single Layer Standard</th>
<th>Double Layer Standard</th>
<th>Single OB Film</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM Loss (%)</td>
<td>14.4</td>
<td>12.5</td>
<td>7.4</td>
</tr>
<tr>
<td>Depth of Visible Surface Mold (inches)</td>
<td>6.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.1&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Inedible Silage (%)</td>
<td>20.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> Means with different superscripts differ (P<0.05)

Std film= 5 mil, 175 days, 36.6 lbs AF/cu ft density

Wilkinson & Rimini (2002)
Equal Prevention of Spoilage?

- Left: two layers of white plastic and still pitching about 6” of spoiled silage
- Right: one layer of white plastic; no visible mold
- Moral: securing the plastic well is equally as important as choosing a good film.

Compliments of Rich Muck, USDFRC
Tires Not Touching

Double Layer of Plastic and Still Spoilage
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Corn Silage</th>
<th>HMC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OB</td>
<td>Std</td>
</tr>
<tr>
<td>DM (%)</td>
<td>31.6</td>
<td>29.2</td>
</tr>
<tr>
<td>Est. OM Loss* (%)</td>
<td>8.4</td>
<td><strong>27.3</strong></td>
</tr>
<tr>
<td>pH</td>
<td>3.78</td>
<td>4.28</td>
</tr>
<tr>
<td>Lactic Acid (% DM)</td>
<td>6.8</td>
<td><strong>2.7</strong></td>
</tr>
<tr>
<td>Acetic Acid (% DM)</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Ash* (% of DM)</td>
<td>9.1</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Top 18 inches, **6 mil plastic, *Ash content of CS face = 8.4%,
*Ash content of HMC face = 1.85%, 240 days post filling

Bolsen (2004, unpublished)
Estimated % DM Losses under the Middle of a Sheet - 2 Alfalfa Bunkers

No significant difference between plastics

Compliments of Rich Muck, USDFRC
Estimated % DM Losses at the Wall - 2 Alfalfa Bunkers

Reduced spoilage near the wall in top 6 in. with Silostop.

Compliments of Rich Muck, USDFRC
SiloStop System  Normal Plastic/Tires

McDonell and Kung, 2006
Unpublished, Univ. of Delaware
Effect of Silostop on pH

McDonell and Kung, 2006

Compliments of Rich Muck, USDFRC
### 30 h NDF-D, %

<table>
<thead>
<tr>
<th>Distance To Wall</th>
<th>Top 6” Silage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4”</td>
</tr>
<tr>
<td>Standard</td>
<td>43</td>
</tr>
<tr>
<td>Silostop</td>
<td>57</td>
</tr>
</tbody>
</table>
Summary of Our Experience with Silostop

- Virtual elimination of visible spoilage
  - Biggest difference at the shoulders (wall)
- More homofermentative fermentation across the top, indicating a better seal.
- Evidence of better dry matter recovery, especially near the wall.

Compliments of Rich Muck, USDFRC
Thoughts on Using Silostop

- Make sure side sheets lap at least 3 ft. onto the top.
- Use pea gravel instead of sand in the bags so rain drains out better.
- But gravel filled bags touching each other end-to-end.
- Gravel filled bags can freeze into low spots; slope the sides to drain rainwater forward.

Compliments of Rich Muck, USDFRC
6 mil Black vs. 8.5 mil White

- Thicker white better by 5% points in 2 tests in top 6 inches
- Field crew liked working with the thicker white
  - Better in wind
  - Easier to walk on

Compliments of Rich Muck, USDFRC
White Plastic But Different Sides Up

- No significant differences in losses between black or white side up
- But more heat damage in top 1” when black side up

Compliments of Rich Muck, USDFRC
Approaches to Shoulder Spoilage

- **Side wall sheet**
  - Lapped on top 4+’ with the top sheet over it.
  - Sealed with tires or gravel bags
  - Excludes air from passing through walls, wall cracks
  - Keeps water from silage
  - Also prolongs life of walls

Compliments of Rich Muck, USDFRC
Runoff Management

Runoff between wall and silage carries away nutrients and acids.
Other Problems

- Shoulder spoilage
- For a 100’ long, 8’ bunker wall: 11 tons dry matter within 1’ of both walls

Compliments of Rich Muck, USDFRC
Bunker Silo Plastic Drains to Wall

8’ x 100’ x 2 sides x 2’/sides = 1,600 ft³ = 5.3% = 11.6 T DM
Plastic With Reduced Oxygen Permeability - Silostop System

- Side-wall plastic
- Top sheet

Compliments of Rich Muck, USDFRC
Bunker Silo Lined with Plastic

- Stored Plastic
- Silage
- Drain Tile Under Plastic for Clean Water

3'
Bunker Silo Fold Wall Plastic onto Silage

4’+ Overlap
Bunker Silo - Place Cover to Overlap Wall Plastic
Bunker Silo - Weighted with Tires
Use Silostop Approach With Regular Polyethylene?
Joint Taped
How Many Tires Are Enough?

Enough to keep the plastic from billowing in the wind.

Photos courtesy Brian Holmes, Chuck Grimes
Billowing plastic sucks in air
Temporary Cover in Anticipation of Rain
Is A Good Plastic All You Need?

- No
- Securing is important
  - Tires touching tires
  - Gravel bags and tarp
- Shoulder spoilage
  - Best bet is side wall plastic
- Scout for and patch holes

Compliments of Rich Muck, USDFRC
The Plastic’s Secure. Can’t I Relax?

- A major contributor to losses are holes in plastic
- Scout routinely
- Patch holes with tape made for the plastic

Compliments of Rich Muck, USDFRC
Check Bags Regularly for Holes and Patch
Clean Area with Alcohol Before Applying Tape
Seal Edges and Seams to Exclude Air

Kung 2008
Edge Sealed with Soil
Edge Sealed with Gravel Filled Bags
Feedout Management

Move weighting behind cut edge
Expose no more than 3 days feed
Rain exposure
Air exposure
Remove visible spoilage
Plastic Cut Edge Sealed
Too Much Plastic Removed?
What To Do With Spoilage?

- Take the time and safety risks to remove it?
- Feed it and assume it does not make much difference?
The Pitchfork
... Use It!!

Complements of Keith Bolsen
Figure 9. Silage overhangs create dangerous situations.
Silage Safety

- Overhangs, under cutting of face
- Have access to equipment to dig out
- Avalanches
- Stay away from the face
  - Not a gathering place
- Never alone
- 3X Rule

Compliments of Paul Craig, PSU
What’s Wrong in This Picture?

- Rough Feedout Face
- Tires could fall on someone
- Billowing Plastic
- Child at risk of avalanche
Questions?