

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

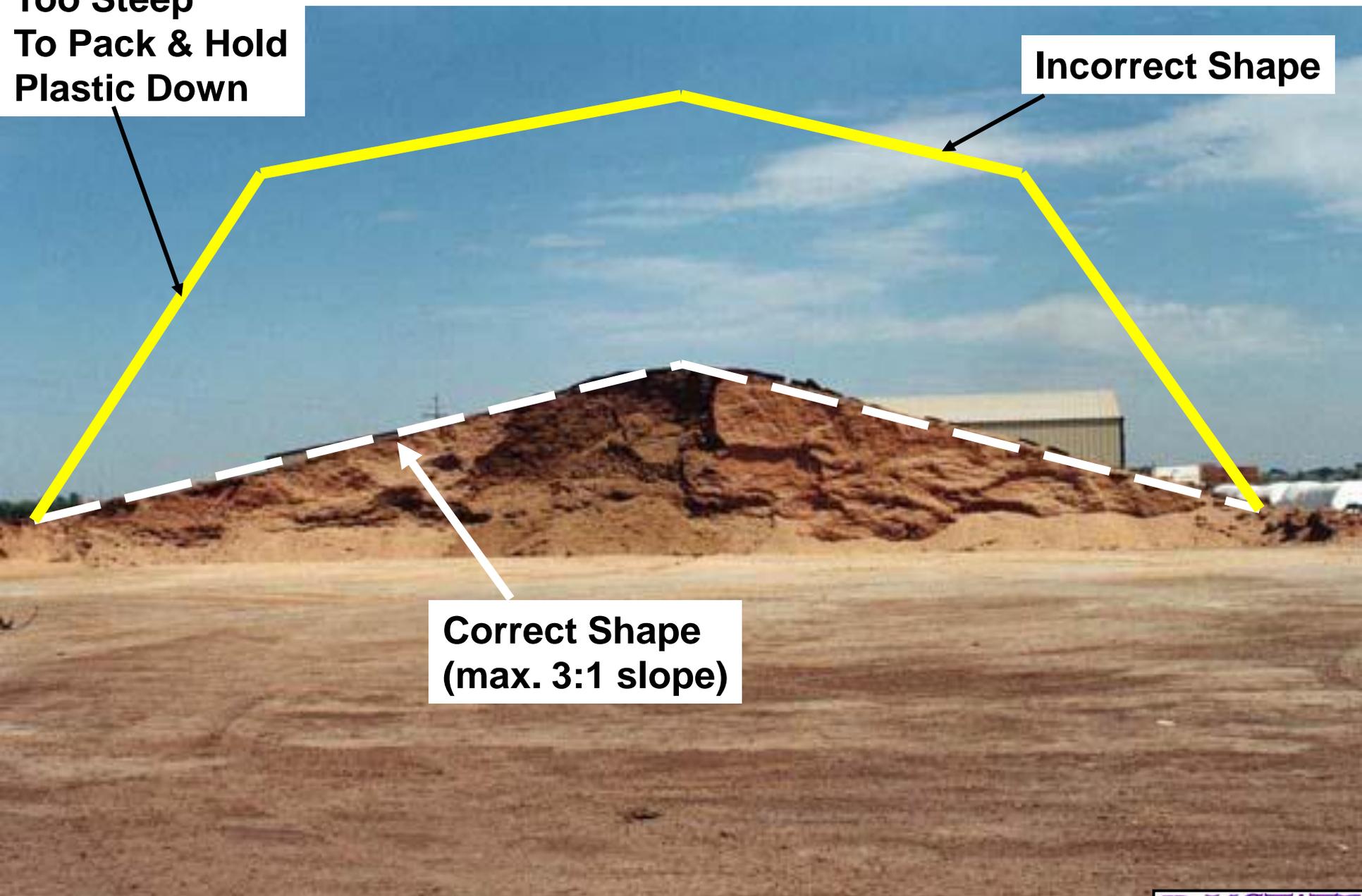
- Too steep to hold tires in place
- $>3:1$ slope for safe packing



Compliments of Rich Muck, USDFRC

**Too Steep
To Pack & Hold
Plastic Down**

Incorrect Shape



**Correct Shape
(max. 3:1 slope)**



Too Steep
To Pack & Hold
Plastic Down

Do You Need A Cover?

Isn't there a decent alternative to plastic and tires?



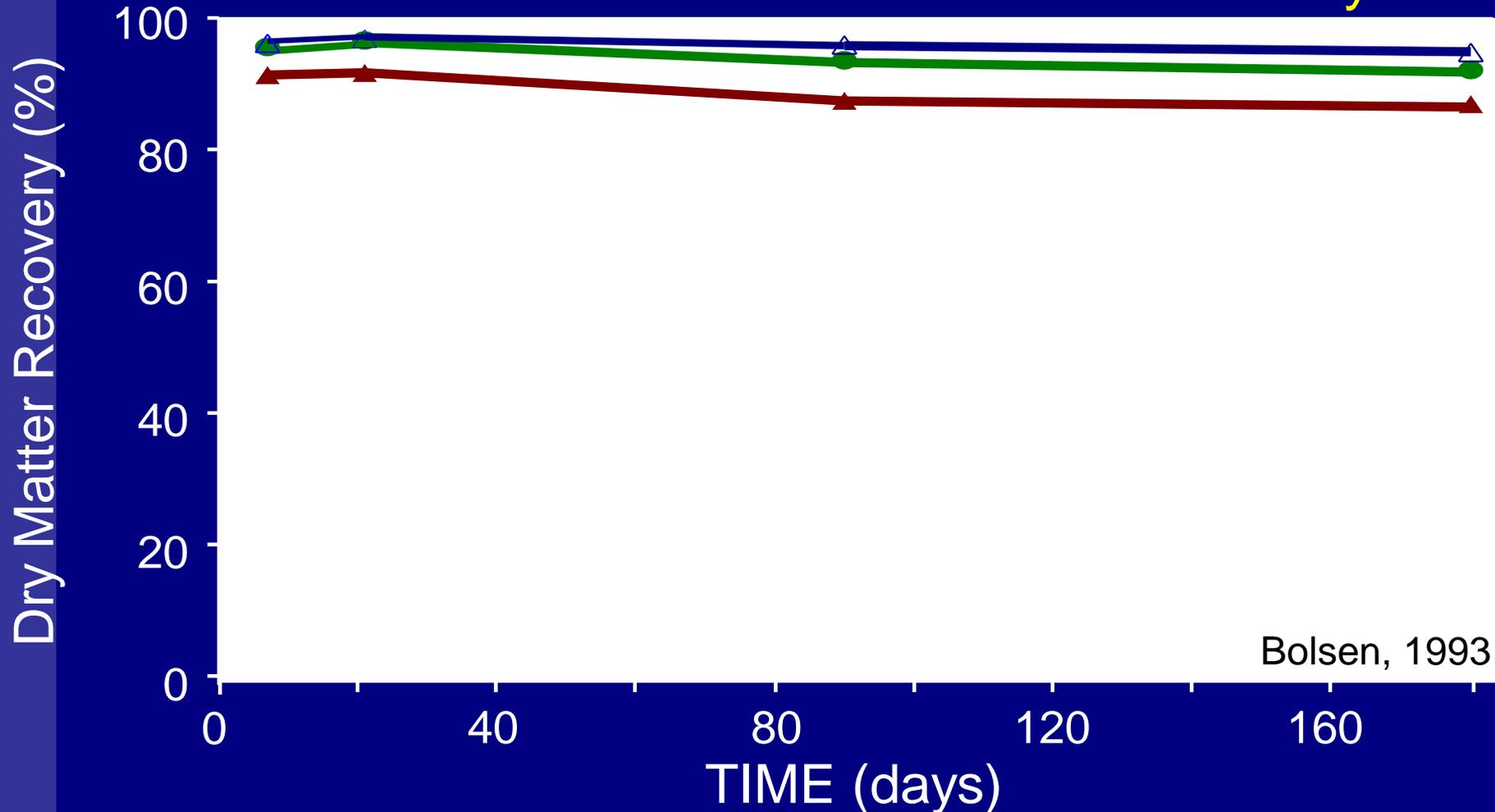
**U.S. Dairy Forage
Research Center**



Compliments of Rich Muck, USDFRC

DRY MATTER RECOVERY vs TIME

Bunker Silo - Plastic Cover Immediately



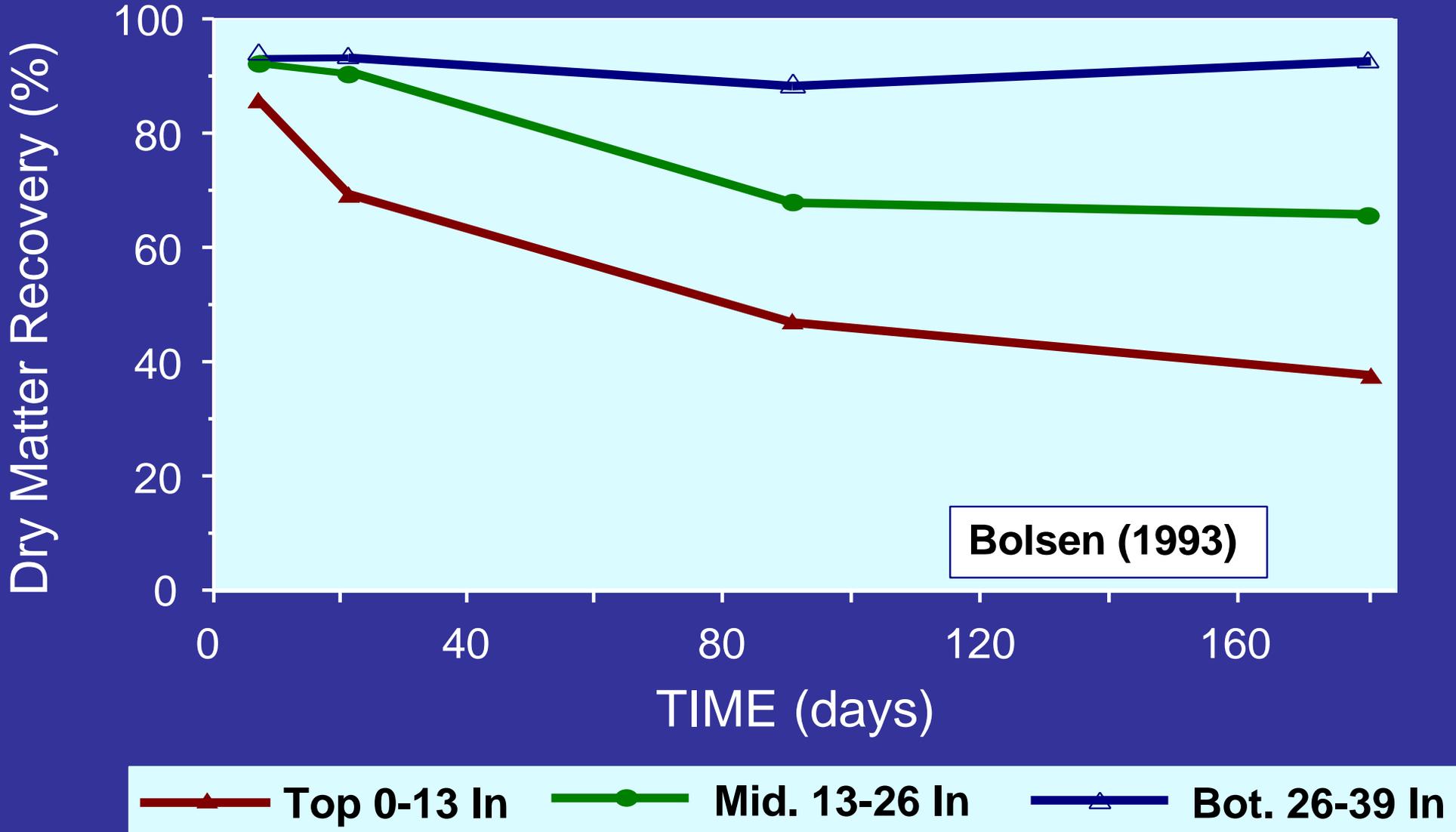
Top 0-13 In

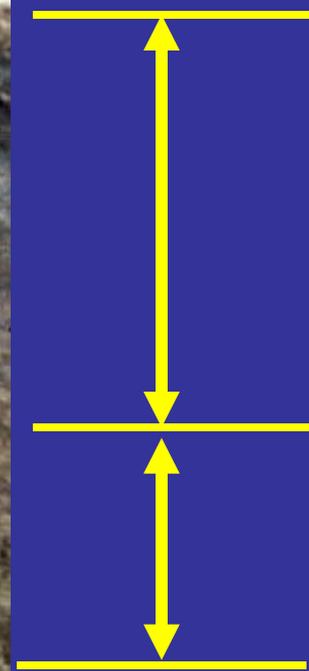
Mid. 13-26 In

Bot. 26-39 In

DRY MATTER RECOVERY vs TIME

Bunker Silo - No Cover





**Visible
Losses due
to no cover =
Spoilage**

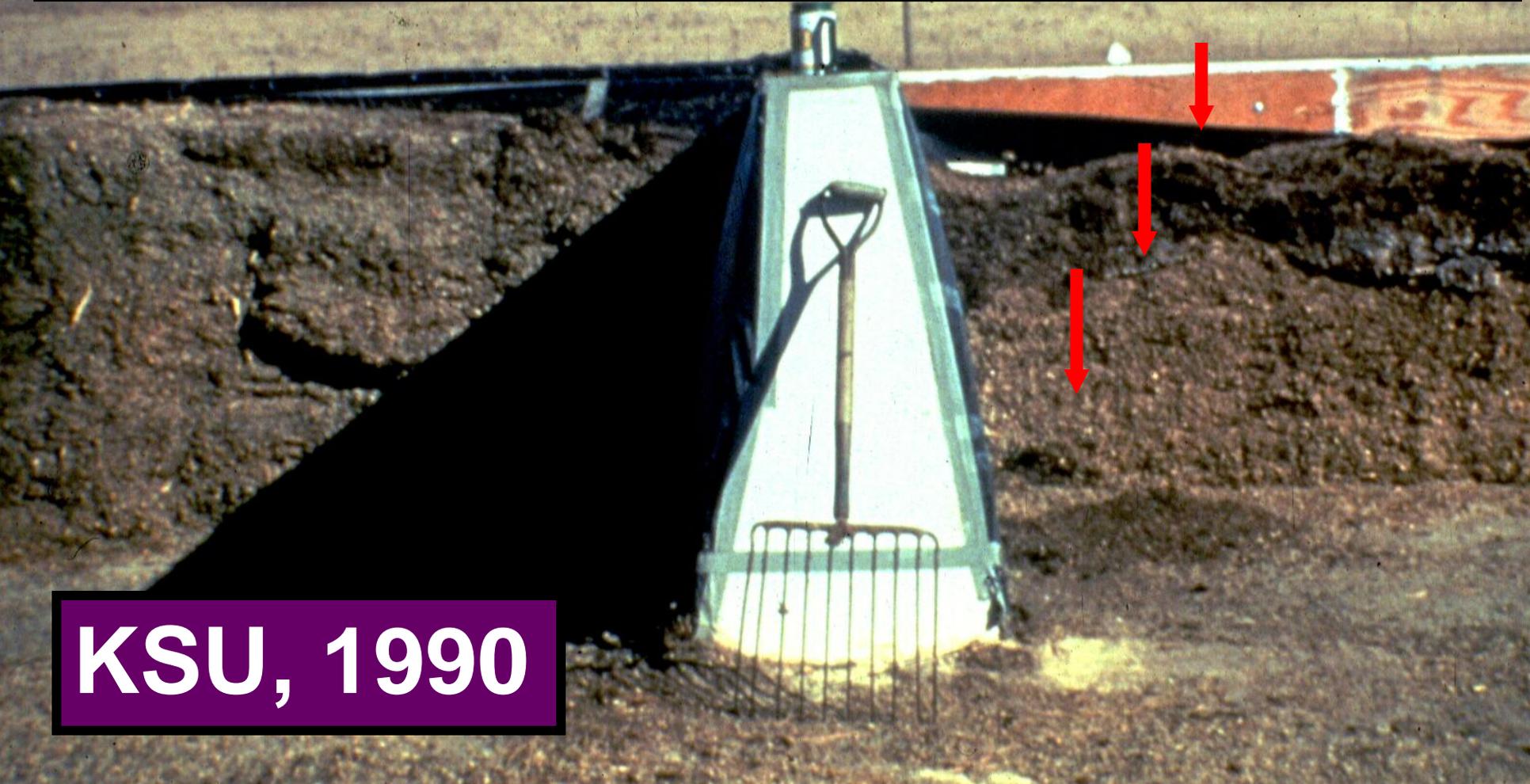
**Less Visible
Losses due
to no cover**

Plastic vs No Cover

Sealed =
12% loss

vs

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

Oxygen Barrier Film

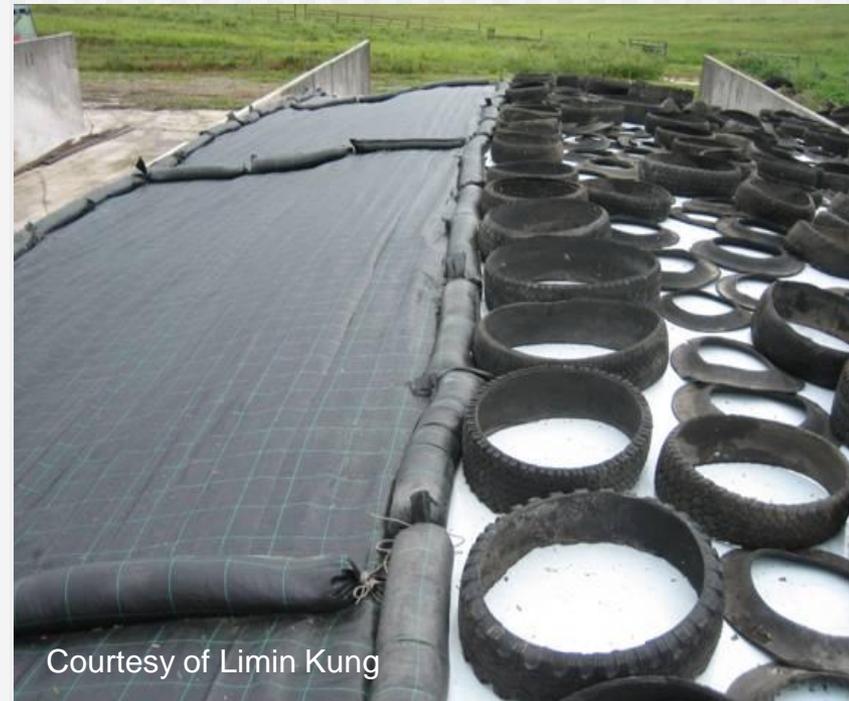


- Introduced at the 12th ISC in 1999.
- Oxygen permeability is 1/20 of standard polyethylene.

Compliments of Rich Muck, USDFRC

Plastic With Reduced Oxygen Permeability - Silostop System

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



Some Oxygen Barrier Findings



No Visible Spoilage

Standard Plastic Film vs Oxygen Barrier Film

Characteristic	Single Layer Standard	Double Layer Standard	Single OB Film
DM Loss (%)	14.4	12.5	7.4
Depth of Visible Surface Mold (inches)	6.0 ^a	3.7 ^a	<0.1 ^b
Inedible Silage (%)	20.1 ^a	14.0 ^a	3.5 ^b

^{a, b} 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.

Tires Not Touching



Double Layer of Plastic and Still Spoilage

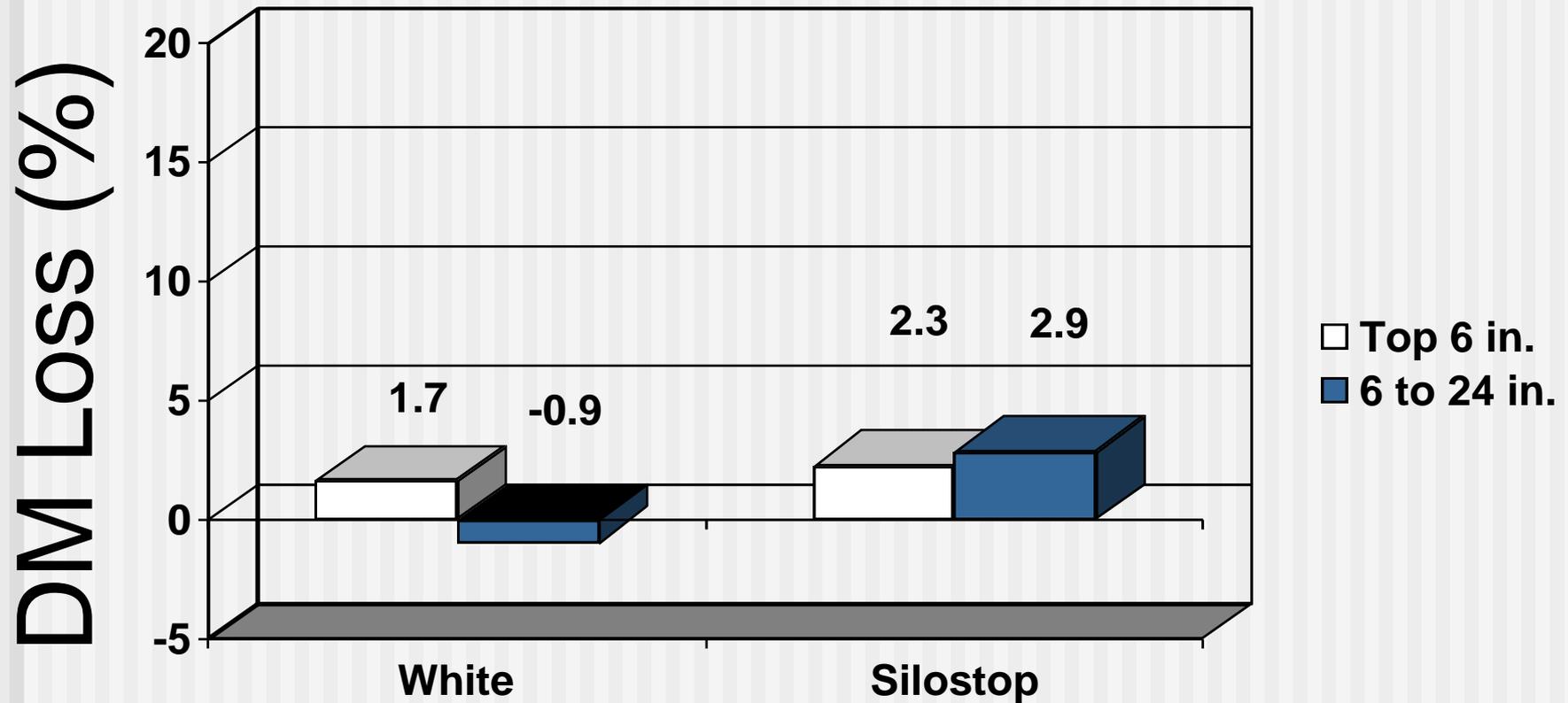
Oxygen Barrier Plastic vs Standard Plastic**

Oxygen Barrier = SiloStop -Two Step

Characteristic	Corn Silage		HMC	
	OB	Std	OB	Std
DM (%)	31.6	29.2	73.2	72.3
Est. OM Loss* (%)	8.4	27.3	7.20	12.6
pH	3.78	4.28	4.09	4.70
Lactic Acid (% DM)	6.8	2.7	1.08	0.86
Acetic Acid (% DM)	2.2	2.6	0.31	0.25
Ash* (% of DM)	9.1	11.2	1.98	2.10

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

Estimated % DM Losses under the Middle of a Sheet - 2 Alfalfa Bunkers

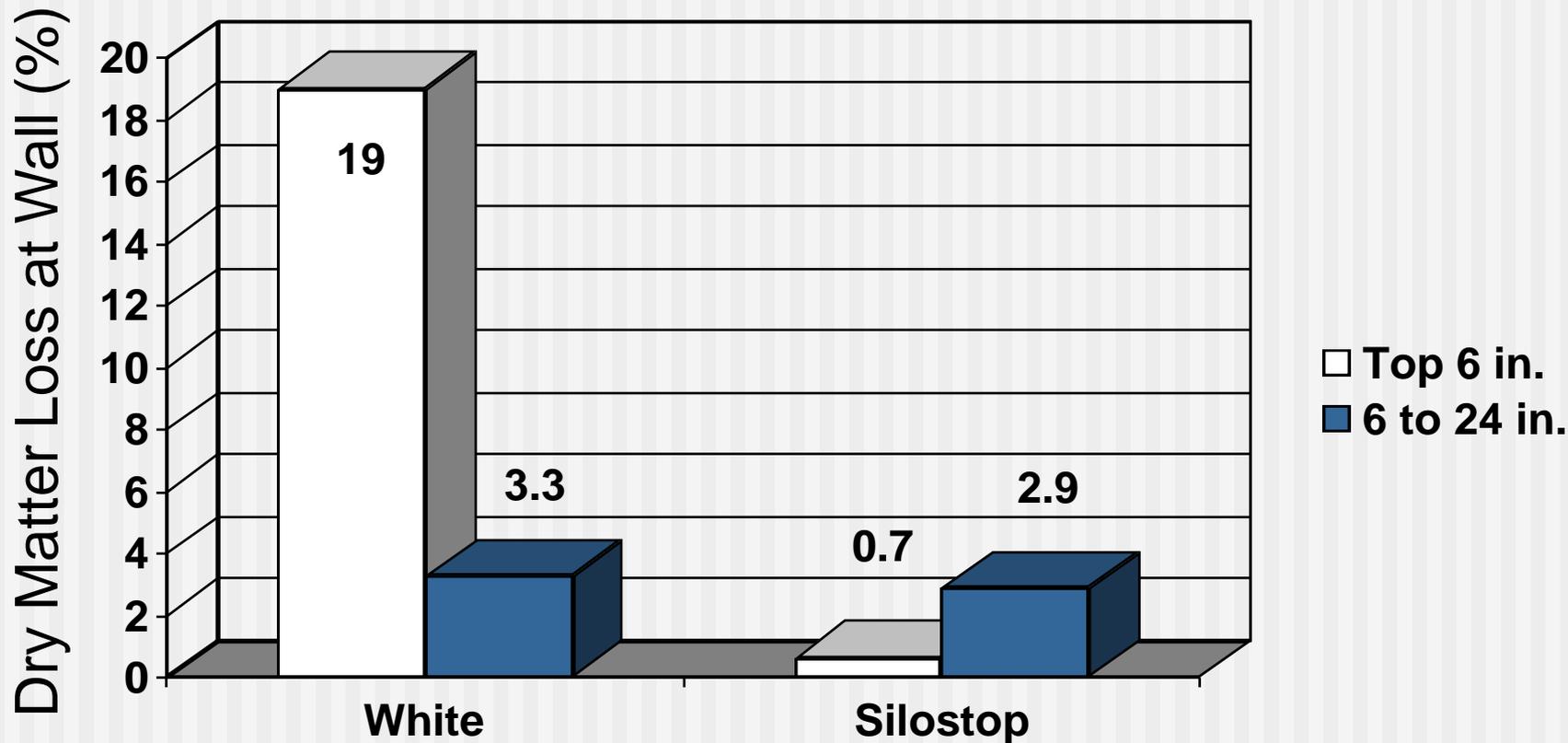


No significant difference between plastics

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.



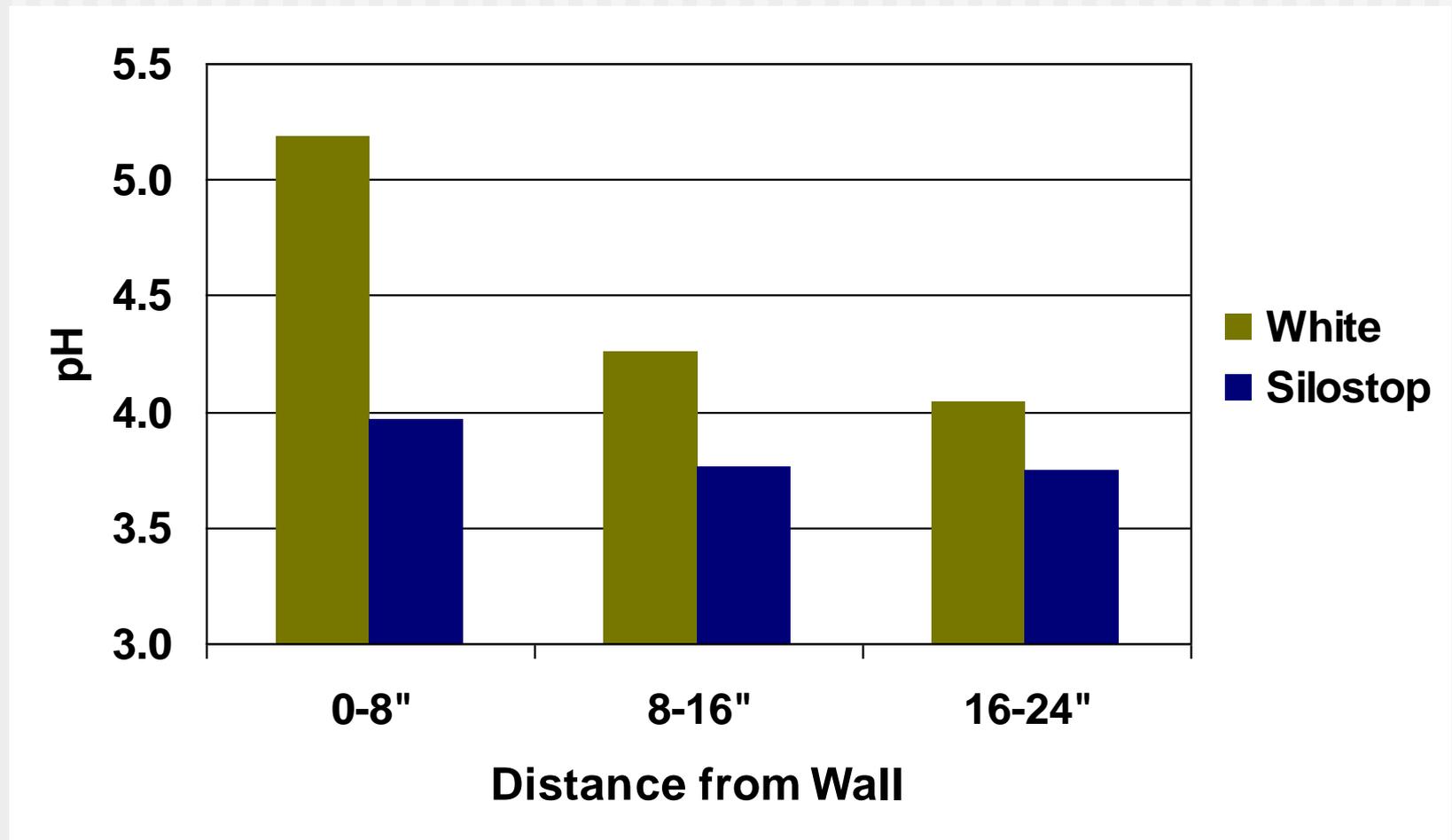


SiloStop System

Normal Plastic/Tires

McDonnell and Kung, 2006
Unpublished, Univ. of Delaware

Effect of Silostop on pH



30 h NDF-D, %

Distance To Wall	Top 6" Silage			
	4"	12"	20"	5'
Standard	43	53	58	57
Silostop	57	58	58	60



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.



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.



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



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

White up



Black up

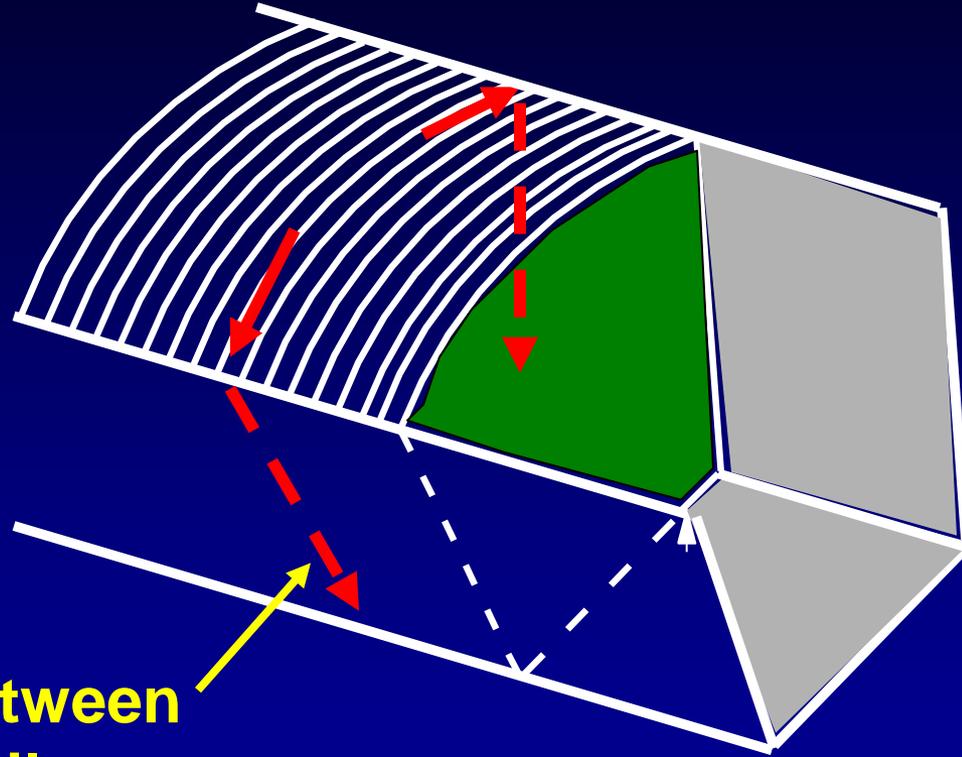


Approaches to Shoulder Spoilage



- 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

Runoff Management



Runoff between
wall and silage
carries away nutrients
and acids

Other Problems

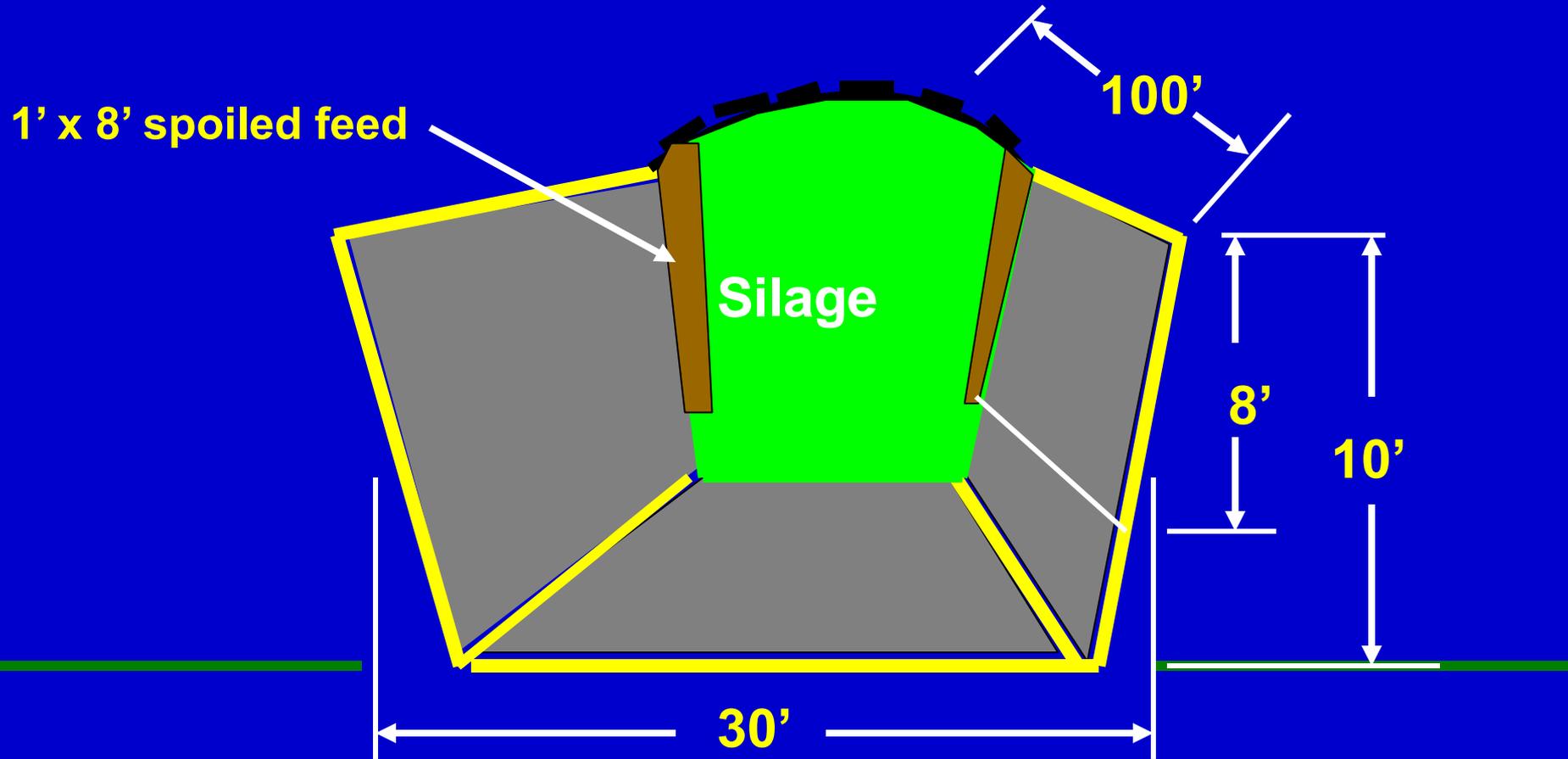
- Shoulder spoilage
- For a 100' long, 8' bunker wall: 11 tons dry matter within 1' of both walls



Courtesy of Chuck Grimes



Bunker Silo Plastic Drains to Wall



$$8' \times 100' \times 2 \text{ sides} \times 2' / \text{sides} = 1,600 \text{ ft}^3 = 5.3\% = 11.6 \text{ T DM}$$

Plastic With Reduced Oxygen Permeability - Silostop System

- Side-wall plastic
- Top sheet

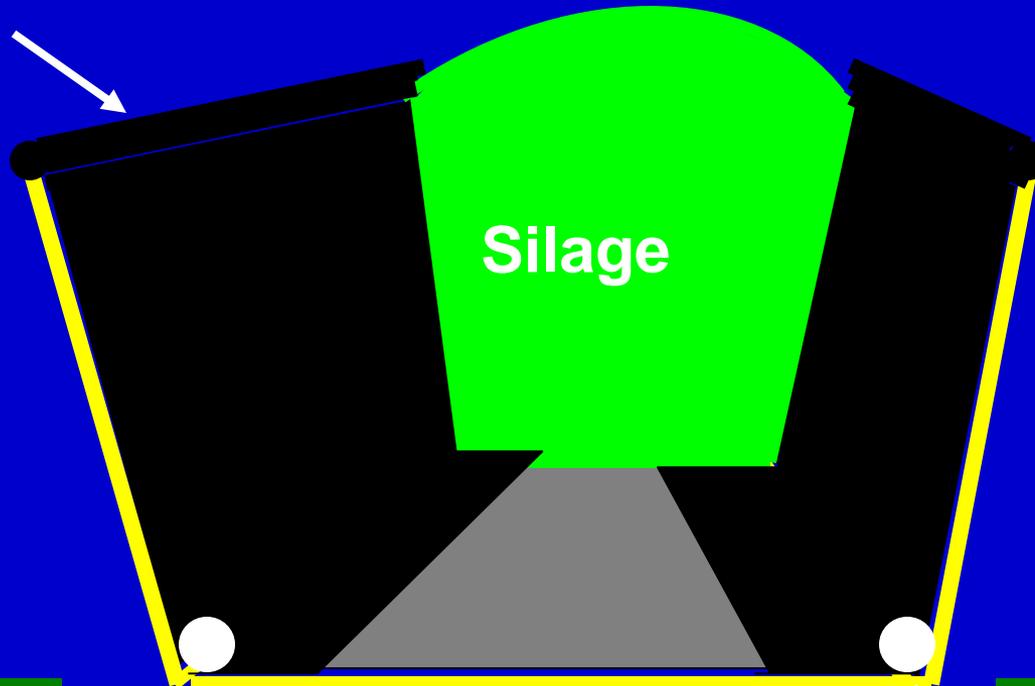


Silostop

Compliments of Rich Muck, USDFRC

Bunker Silo Lined with Plastic

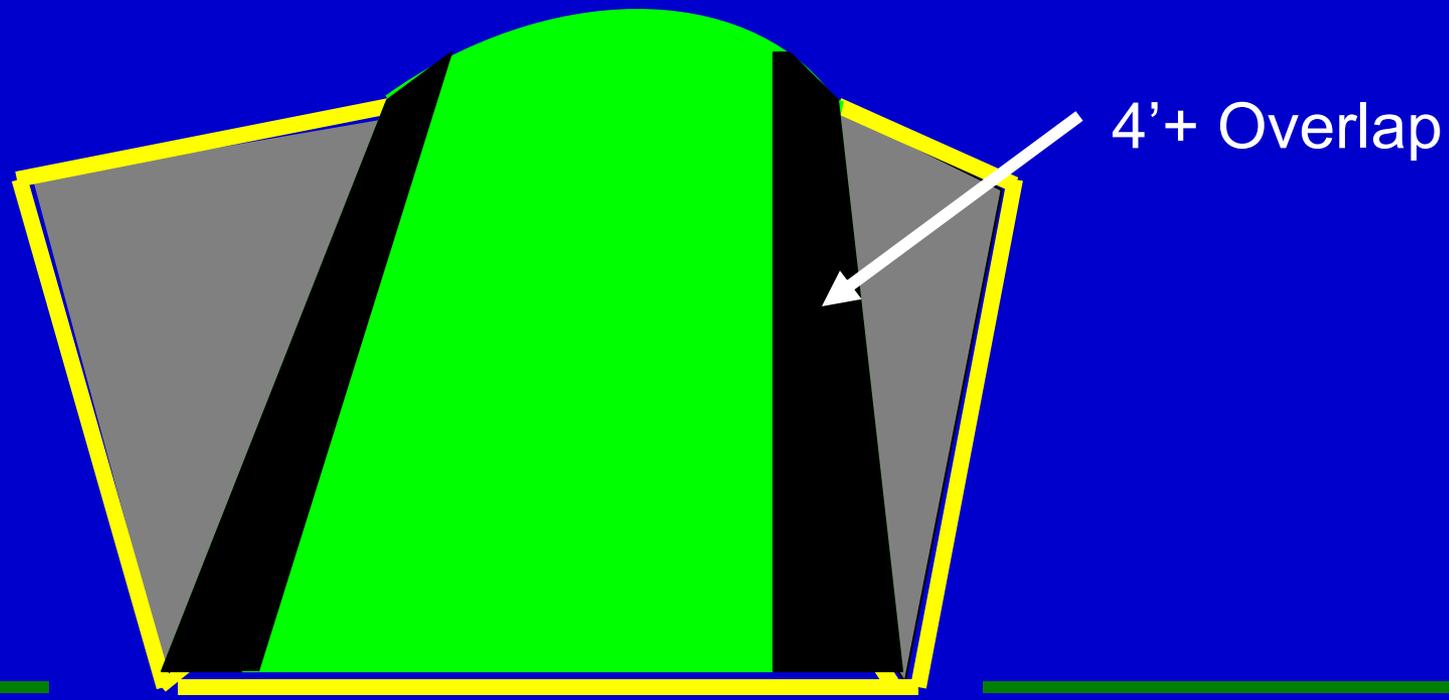
Stored Plastic



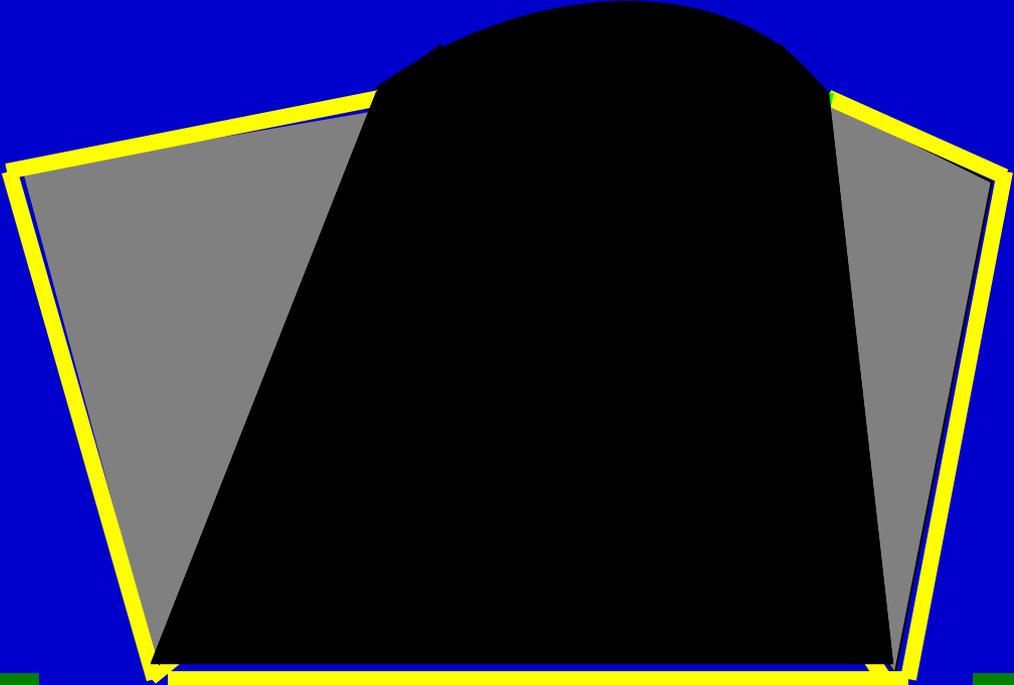
3'

Drain Tile
Under Plastic
for Clean Water

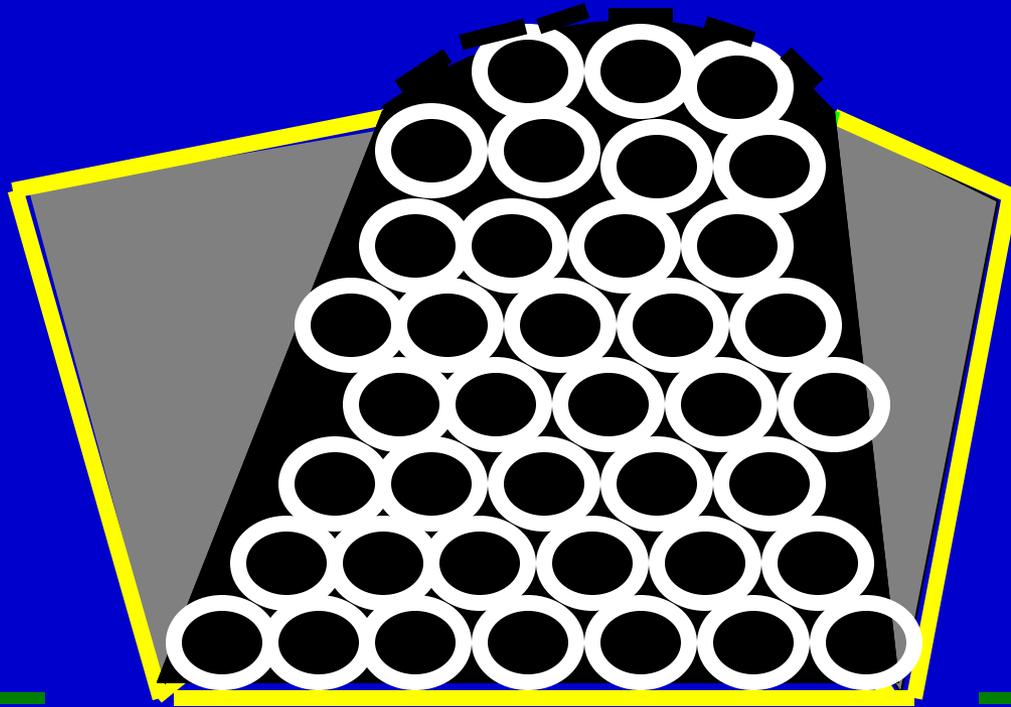
Bunker Silo Fold Wall Plastic onto Silage



Bunker Silo - Place Cover to Overlap Wall Plastic



Bunker Silo - Weighted with Tires



Use Silostop Approach With Regular Polyethylene?

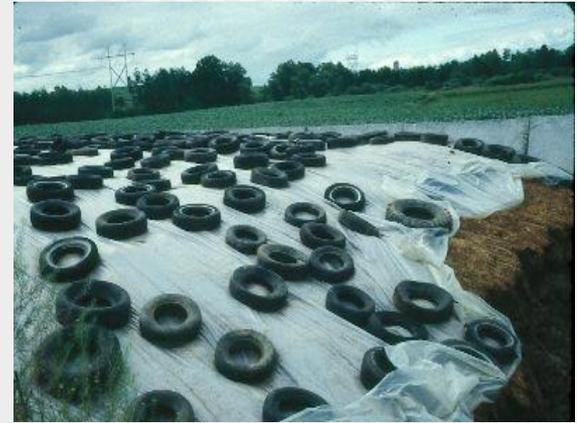


Joint Taped



10025443

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



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

Holes

**Mushrooms Growing
Through Holes**



Check Bags Regularly for Holes and Patch
Clean Area with Alcohol Before Applying Tape



Kung

06.30.2004



Seal Edges and Seams to Exclude Air

Kung 2008



Edge Sealed with Soil



Edge Sealed with Gravel Filled Bags



Edge Not Sealed

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

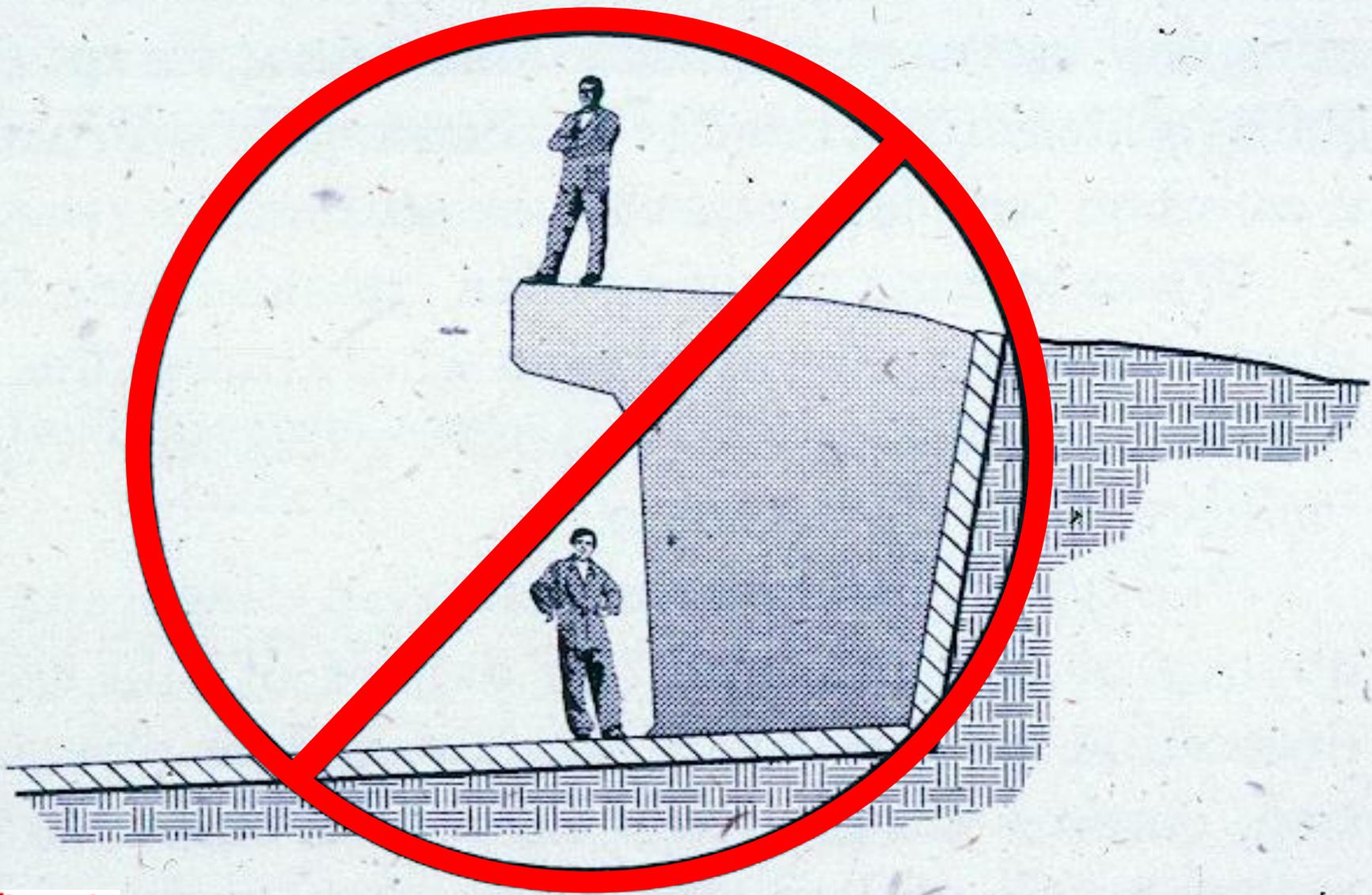


Figure 9. Silage overhangs create dangerous situations.

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

Billowing
Plastic

Tires could
fall on someone

Child at risk
of avalanche



Questions?