

Managing Forage for Single Digit Shrink Loss in Bunker Silos and Drive-over Piles

**2012 Corn Silage and Forage Field Day
Citra, FL
May 24, 2012**



**Keith Bolsen Ph.D.
& Associates**



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Dairy / Feedlot

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**Silage
Triangle**

Crop Grower

Silage Contractor

Corn Silage Production (NASS 2012)

2007

2008

2009

2010

2011

----- Million tons per year -----

106.3

111.6

108.2

107.3

108.9

5-yr avg. = 108.5

FL

0.63

0.51

0.54

0.45

0.54

5-yr avg. = 0.53 (33rd)

GA

0.72

0.81

0.51

0.72

0.95

5-yr avg. = 0.74 (30th)



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What is the “Market Value” of Corn Silage based just on Shrink Loss?

- **\$62.50 / ton ÷ 95.0% = \$65.79**
- **\$62.50 / ton ÷ 90.0% = \$69.44**
- **\$62.50 / ton ÷ 85.0% = \$73.53**
- **\$62.50 / ton ÷ 80.0% = \$78.12**
- **\$62.50 / ton ÷ 75.0% = \$83.33**
- **\$62.50 / ton ÷ 70.0% = \$89.29**

Forage In vs. Silage Out

How much is Shrink Loss going to cost our Corn Silage Industry in 2011-2012?

About \$1.29 billion!

Could be only 600 million!



BR A Bruno Rimini Brand
SILOSTOP

KSTATE
Kansas State University

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What can we learn from these PRODUCERS?

They had a MEETING!



Three Important Silage-making Goals

- 1. Inoculate at the forage chopper**
- 2. Reach a higher silage density**
- 3. Apply the best seal**



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Economics of Inoculated Corn Silage for Dairy Cows. ^a

1. 80 lbs of milk/cow/day
 2. 53 lb DMI/cow/day*
 3. Milk price = **\$16** per cwt
-
- ^a 48 lbs of corn silage





Bottom Line

Corn Silage

Inoculant cost/cow/day

2.1¢

↑ net income/cow/day

15.6¢

↑ net income/cow/year

\$47.54

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Dry Matter Loss as Influenced by Silage Density: Adapted from Ruppel et al. (1995)

Density, lbs of DM per ft ³	DM loss at 180 days, % of the DM ensiled
10	20
12	18
14	16
16	14
18	12
20	10

Avg. = 14.5

Targets:
16 lbs of DM
48 lbs of fresh weight

Case Study Dairy

7,000-ton pile of corn silage the 1st yr

11.5 lbs of DM/ft³ = 22.5% shrink 1st yr corn silage @ **\$60/ton**



Spreadsheet Calculations of the Average Silage Densities in Drive-over Piles of Corn Silage at a *Case Study Dairy*.^{1,2}

Component	Keith Bolsen Ph.D. & Associates	KSTATE Kansas State University	A Bruno Rimini Brand SILOSTOP	Actual: 1 st yr. corn silage	Predicted: 2 nd yr. corn silage
Bunker silo wall height, ft (0 for silage pile)				0	0
Bunker silo maximum silage height, ft				16	14
Forage delivery rate to bunker, fresh tons/hr				75	90
Forage DM content, %				0.32	0.34
Est. forage packing layer thickness, inches				8	5
Tractor #1				35,000 (80) ³	35,000 (80) ³
Tractor #2				0	35,000 (85) ³
<hr/> <hr/>					
Estimated DM density, lbs/ft ³				11.4	15.6
Estimated bulk density, lbs/ft ³				35.7	45.8

¹ Values in above the double line are user inputs.

² Adapted from Holmes and Muck (2007).

³ Estimated packing time as a percent of filling time is shown in parenthesis.

11.4 lbs of DM/ft³ = 22.5% shrink in 1st year.

15.8 lbs of DM/ft³ = 15.0% shrink target in 2nd year.

An est. 525 tons of silage “saved” x \$60/ton = \$31,500

Cost to the dairy: 2nd pack tractor (\$1.75/ton) = \$12,250

Estimated net benefit to the dairy: \$19,250 (market value)



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Achieving higher DM densities ...

↓ forage delivery rate (not likely to happen).

↑ packing tractor weight (yes, always possible).

↑ number of tractors (yes, usually possible).

↓ forage layer thickness (not always possible).

Fill silos to greater depths (not a good idea).

Pack longer at the end of the day (waste of time
& diesel fuel).



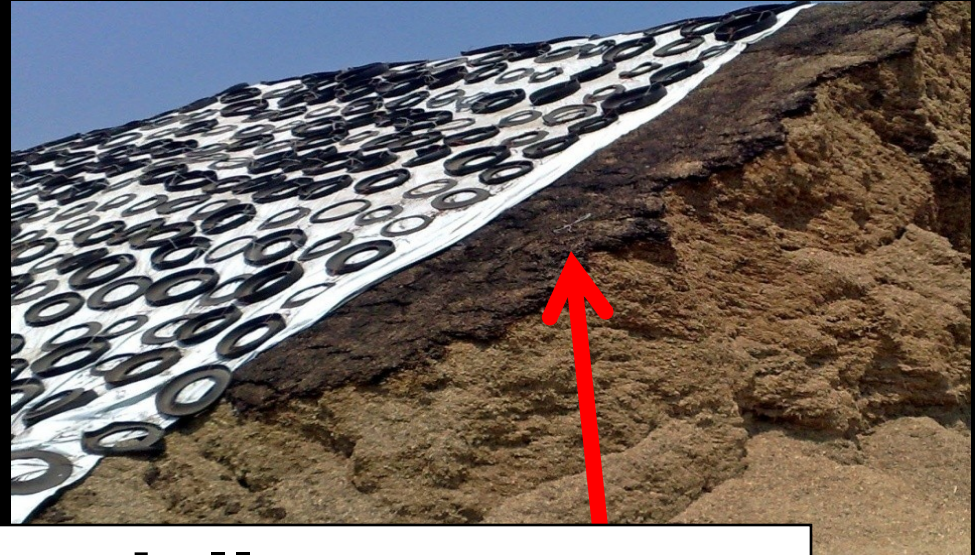
Three Important Silage-making Goals

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Poorly SEALED bunker silos and drive-over piles are a HUGE problem!!



250 to 350 million dollars per year



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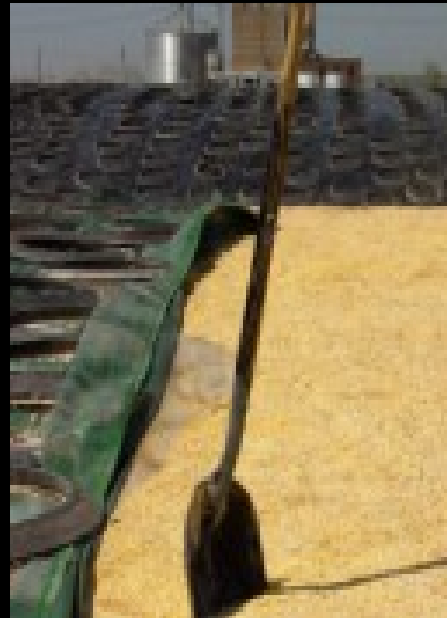
Research with **Silostop**



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Oxygen Transmission Rate (OTR)

Sample	Thickness, mil	OTR ASTM D3985 100% O₂ cm³/m²/24 h
Silostop	1.8	29
Regular silage cover	5.0	1,811
Cover B	7.0	710
Cover C	1.6	5,293
Cover D	1.6	5,982

Source: School of Packaging, Michigan State University



Comparison of 6-mil black plastic & Silostop on pH, fermentation profile, estimated spoilage loss of OM, and ash content in corn silage at 0 to 36 inches and HM corn at 0 to 18 inches from the surface at 240 days post-filling.




Item	---- Corn silage ----		---- HM corn ----	
	Std plastic	Silostop	Std plastic	Silostop
DM content, %	29.2	31.6	72.3	73.2
pH	4.28	3.78	4.70	4.09
Est. OM loss ^{1,2}	34.8	17.8	12.1	6.7
	----- % of the silage DM -----			
Lactic acid	2.7	6.8	0.86	1.08
Acetic acid	2.6	2.2	0.25	0.31
Ash	11.2	9.1	2.13	1.98



¹ Values are estimated additional spoilage loss of OM, which were calculated from ash content using the equations described by Dickerson et al. (1992a).

² Ash content of the pre-ensiled samples was 7.6% for corn silage & 1.8% for HM corn.

Economics of sealing corn silage w/ standard plastic or Silostop in bunker silos with average management practices (Numbers above the red line are user inputs).

Inputs and calculations	Keith Bolsen Ph.D. & Associates			Bunker1 std. plastic	Bunker 2 Silostop
Silage value, \$ per ton 'as-fed'				60.00	60.00
Density of silage in top 3 ft, lb 'as-fed' per ft ³				36	36
Silage density below top 3 ft, lb per ft ³				44	44
Bunker/pile depth, ft				14	14
Bunker/pile width, ft				60	60
Bunker/pile length, ft				240	240
Silage lost in original top 3 feet % of crop ensiled ²				30.0	15.0
Silage lost below original top 3 ft, % of crop ensiled				12.0	12.0
Cost of covering sheets, ¢ per sq. ft				4.5	12.5
Bunker/pile capacity, tons				4,262	4,262
Total value of silage in the bunker/pile, \$				255,744	255,744
Silage in the original top 3 ft, tons				778	778
Silage below the original top 3 ft, tons				3,484	3,484
Total silage lost in bunker/pile, % of the crop ensiled				15.29	12.55
Silage saved by sealing, \$				9,331	16,330
Sealing cost, \$				2,250	→ 4,050
Net silage saved by sealing, \$				7,081	12,280
Net benefit from Silostop, \$				---	5,198

1



2



4



3



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Surface-spoilage

Feed it? or Prevent it?



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Surface-spoiled Corn Silage Research at Kansas State

'Slime' in the ration,
% on a DM basis:

0, 5.4, 10.7, and 16.0

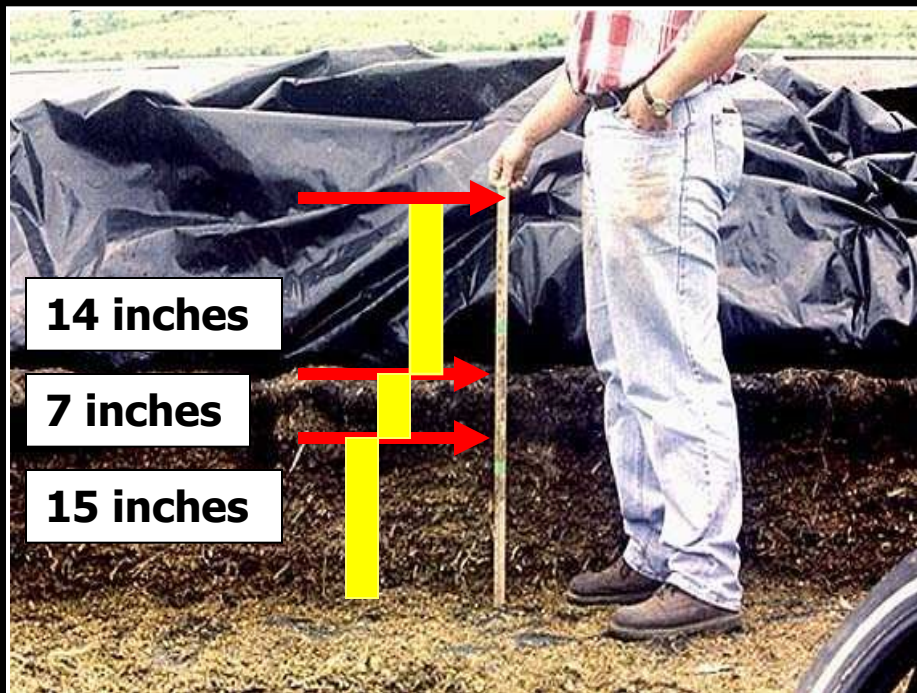
Whitlock et al. (2000)

Key results

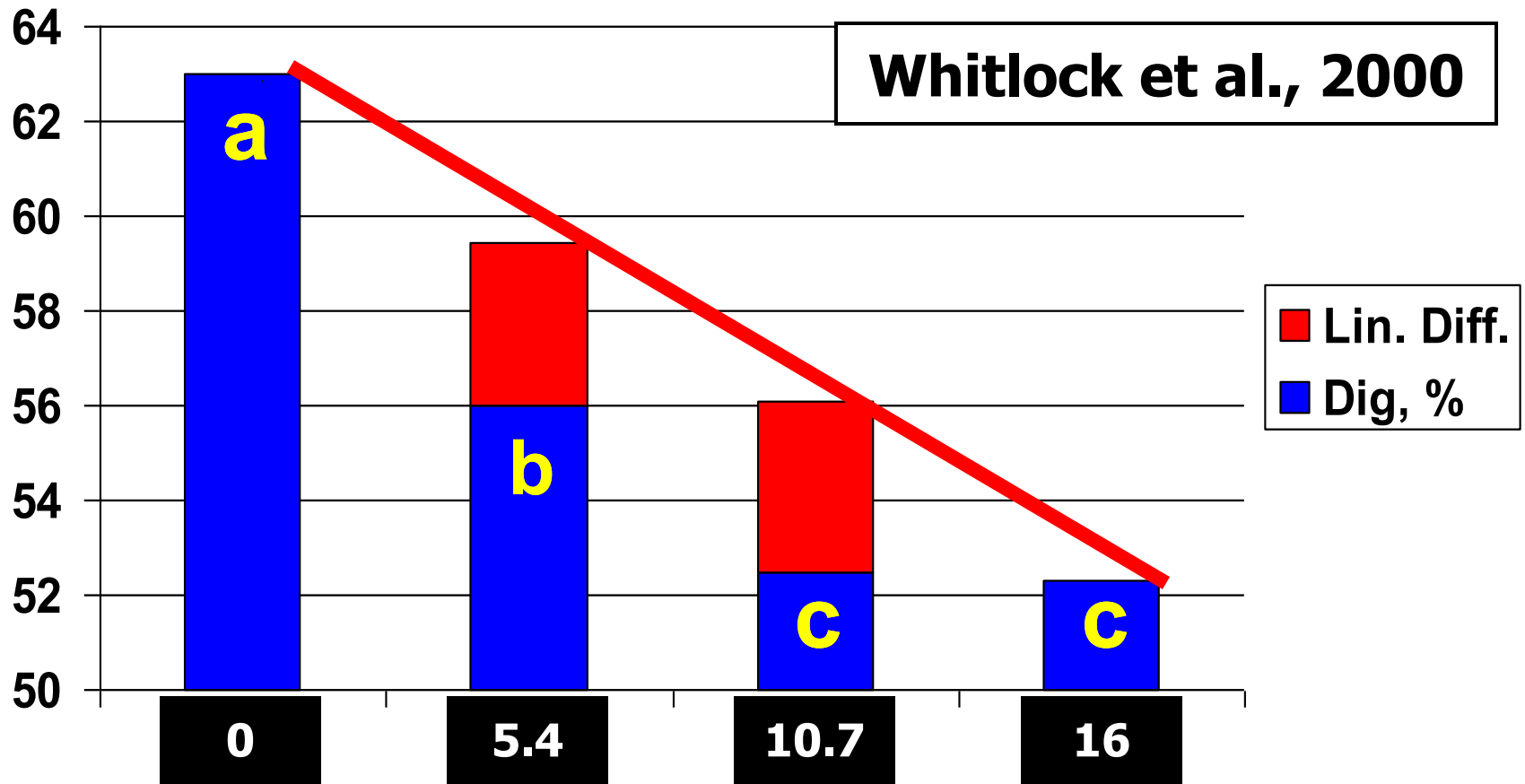
- ✓ Depressed **DM intake**.
- ✓ Destroyed the **forage mat** in the rumen.
- ✓ Reduced **fiber digestibility** dramatically.



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NDF Digestibility



How much does feeding surface-spoiled corn silage cost dairy producers?

- ✓ **0.3 to 3.0 lbs less milk /cow/day.^{1,2}**
- ✓ **\$15 to \$145 less milk /cow/year (\$16 cwt).**

¹ Assumes that 1 percentage unit of NDF digestibility equals 0.35 lbs of milk /cow/day.

² Assumes that 1% surface-spoilage in the ration decreases NDF digestibility by 1.3 percentage units.

Pitch the Spoilage?

No ... It is just too Dangerous!

But ... It can be Prevented!!



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Safety Issues in Bunker Silos and Drive-over Piles

THINK SAFETY FIRST ...

“We have nothing to lose by practicing safety; but we have everything to lose by not practicing it.”

Dennis Murphy, Ext. Safety Specialist, The Pennsylvania State University

Major Hazards:

- ✓ **Tractor or truck roll-over.**
- ✓ **Entangled in or run-over by machinery.**
- ✓ **Fall from height.**
- ✓ **Crushed by an avalanche.**
- ✓ **Complacency.**



An 11-year old boy died from injuries suffered after a feed pile collapsed on top of him at a Claremont farm (WMUR TV, 2010).

Andy Wheeler had previously been listed in critical condition at Dartmouth-Hitchcock Medical Center. Police said it took as long as 20 minutes to find and free Wheeler from the feed pile after the accident Tuesday.

Police said the boy was on vacation from Maple Avenue School which is why he was hanging out at the MacGlaflin Farm, where his father works. He was riding his bike near a silage crib, where livestock feed is stored, police said.

“The boy was in a silage crib where there was a large pile of silage, and that overhang collapsed,” said Police Chief Alexander Scott. Scott said it took some time for anyone to realize there was a problem. “It is probably a pile close to 25 feet high” he said. School officials said they are preparing for questions from students when they return from spring break.

WMUR TV. Claremont, NH. Web site accessed August 21, 2010.



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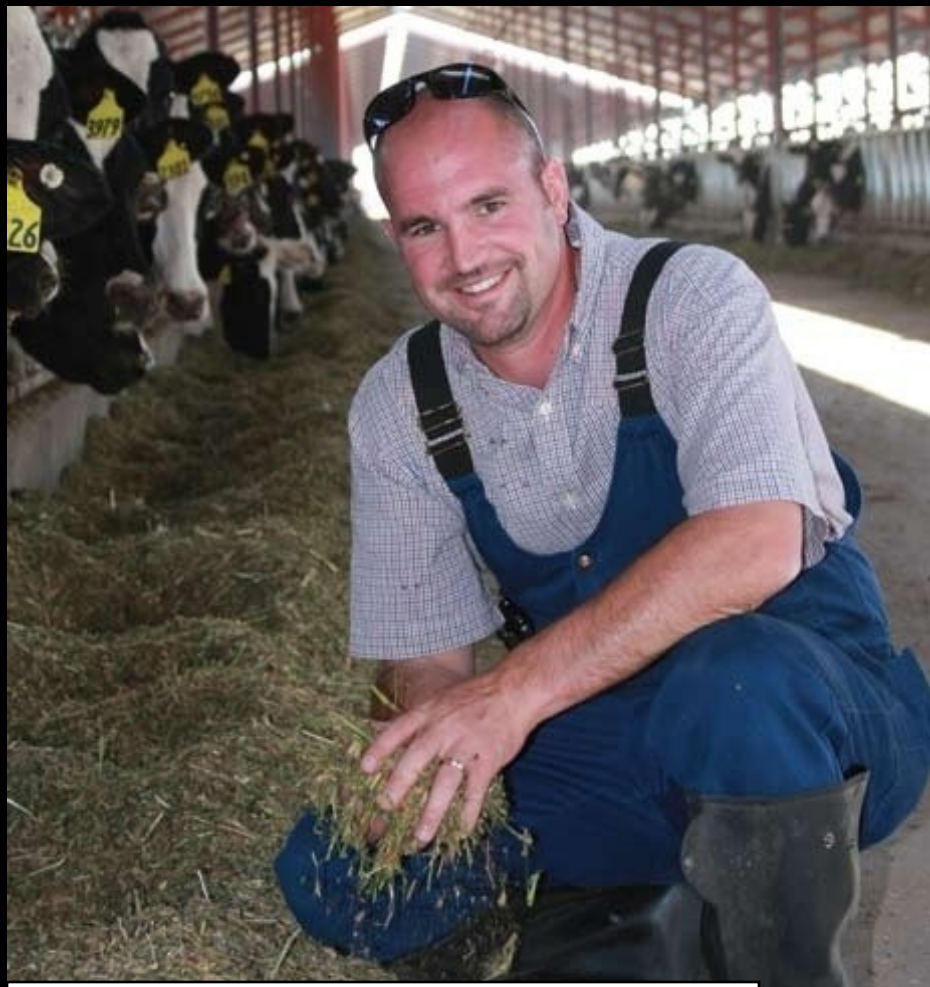


Photo: by Hay and Forage

Surviving A Silage Avalanche

By Fae Holin,
Managing Editor



Photo: by Doug DeGroff

Take home message ...

It's really not about shrink loss, feed conversion, cost of gain, a close out, or milk over feed cost.

It's about sending everyone in your silage program home to their family safe ... EVERYDAY”.

Thank You!!



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