Reducing dry matter and nutrient loss in high moisture forage

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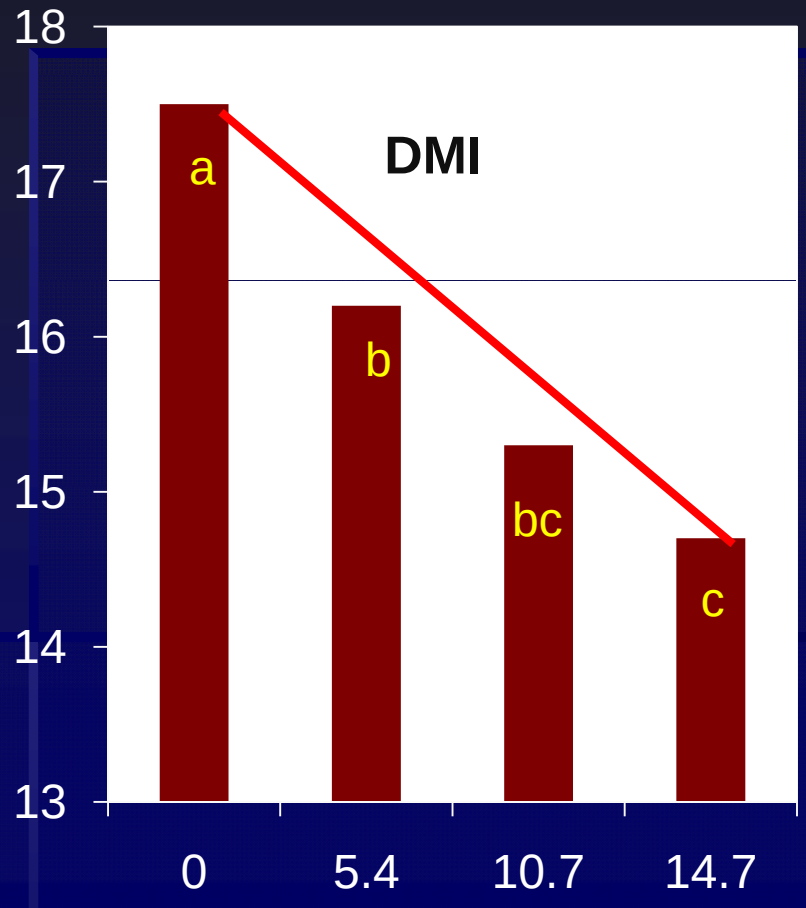
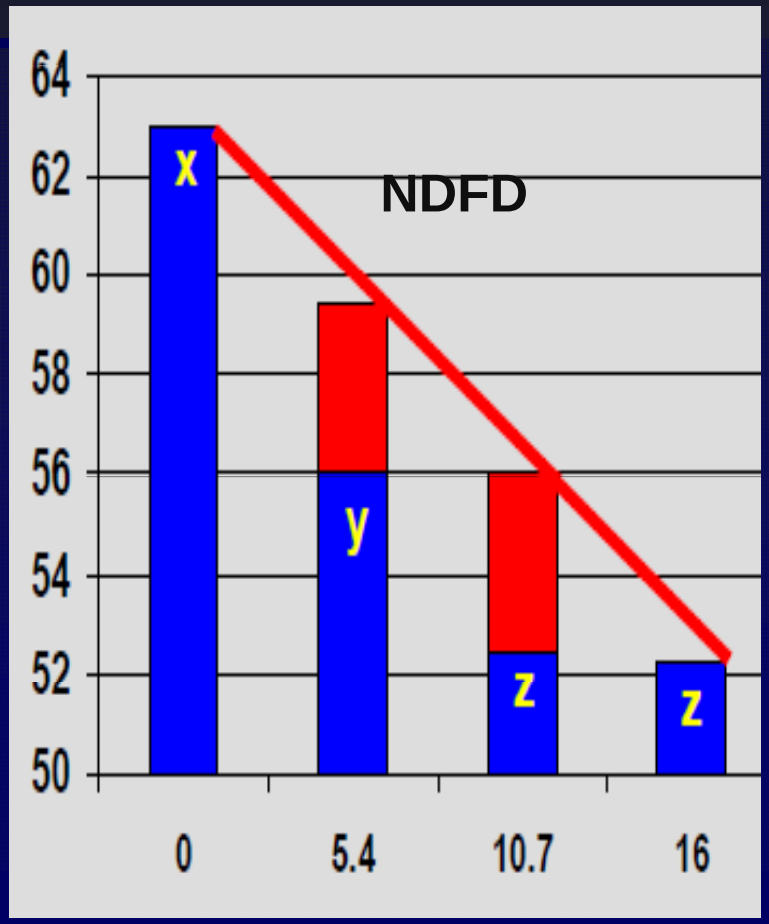
Introduction

- ✓ Silage heating and DM losses (shrinkage)
  - Waste feed and $$$
  - Decrease nutrients in feed
  - Reduce forage availability
  - Reduce animal performance
  - Reduce profit.

Effect of feeding spoiled silage on DMI and NDF digestibility

(Whitlock et al., 2000)

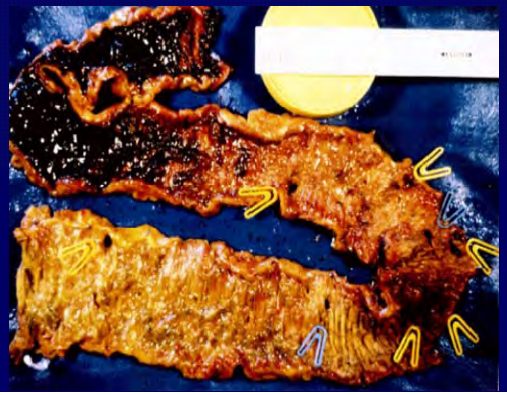




Loss of $100 per cow per year if milk yield decreases by 2-3 lb/d;
$100,000 per year in a 1000-cow dairy

Spoiled silage issues

- ✓ Increase DM loss - $$$$
- ✓ Mold & yeasts – Decreased quality
- ✓ Reduced intake and milk yield
- ✓ Diseases (bloody gut, aspergillosis etc)
- ✓ Mycotoxins
- ✓ Pathogens (Listeria, Clostridia, etc)



Approaches to reducing DM losses and spoilage

1. Using additives and inoculants

2. Keeping oxygen out / sealing well

Silo seal integrity

- ✓ The quality of the plastic seal is important to minimize losses in bunker, pile, and bag silos and round bale haylages

No good alternatives to plastic for covering bunkers/piles exist

Muck, 2006

Types of covers

- ✓ Typical covers are 6 to 8 mil polyethylene sheets held in place by tires.
- ✓ A new Silostop film with 1/20 oxygen permeability of normal plastic has been developed

Silostop cover options

2 –step

(Silostop film + plastic)

1 –step

(Silostop gold film is incorporated into)

Sand bags are used to weigh down the plastic

Silostop Potential savings Bolsen, 2006

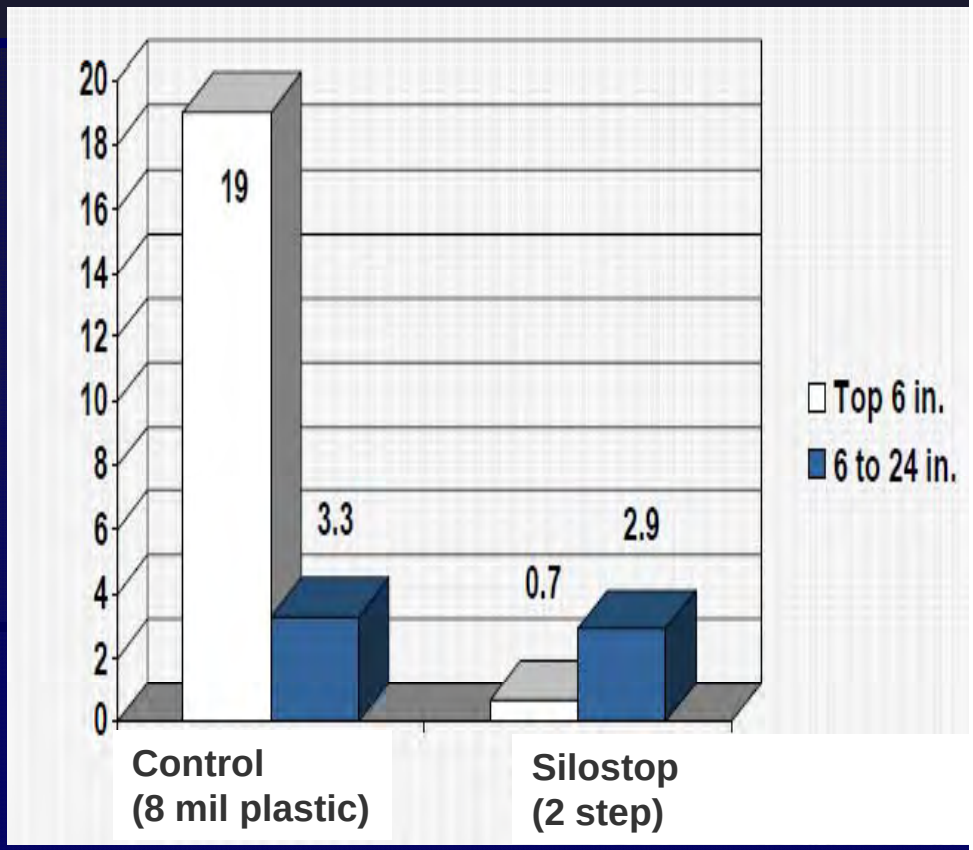
	6 mil plastic	Silostop
Silage value $/ton	32.5	32.5
Silage in original top 3 ft, tons	288	288
Silage lost in original top 3ft, % ensiled	**20**	**12**
Cost of cover ¢/sq . ft	**3.5**	**10**
Value of silage in original top 3 ft, $	9360	9360
Value of silage lost in original 3 ft	1870	1120
Sealing cost	560	800
Net silage saved, $/silo	**2270**	**2760**

(Based on a 40 x 100 ft^2 bunker silo with a wet density of 48 lb/cu ft and an assumed 8% reduction in spoiled silage in the top layer)

Silostop versus plastic

	Plastic	Silostop
Needs	Plastic & tires	Silostop, plastic, sandbags (2 step)
		Or Silostop & sand bags (1 step)
Plastic needed	Less	More with 2 step
Plastic cost	Lower	Higher
Waste	Possibly greater	Possibly less
Corrosion	More on side walls	Less on side walls
Labor	Similar,	Similar, may be less
Cover weight storage	Tires are lighter but difficult to store	Sand bags are heavy but easy to stack

Cover type effects on DM losses near the wall



Silostop reduced spoilage in the top 6 inches near the wall but had little effect on losses in the middle of the bunker

(Muck , 2007)

Results from Muck, 2007

- ✓ Virtual elimination of visible spoilage with Silostop
- ✓ Biggest differences between the two systems have been at the top layer near the wall (shoulders).
- ✓ No cover effects on mold counts
- ✓ Silostop silage had lower pH and higher Lactate:Acetate ratio (improved fermentation)

Cover type effects on fiber digestibility (30-h NDFD)

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

Silostop improved fiber digestibility at the 'shoulders'

McDonell and Kung, 2006

UF Experiment

Cover type effects on silage quality

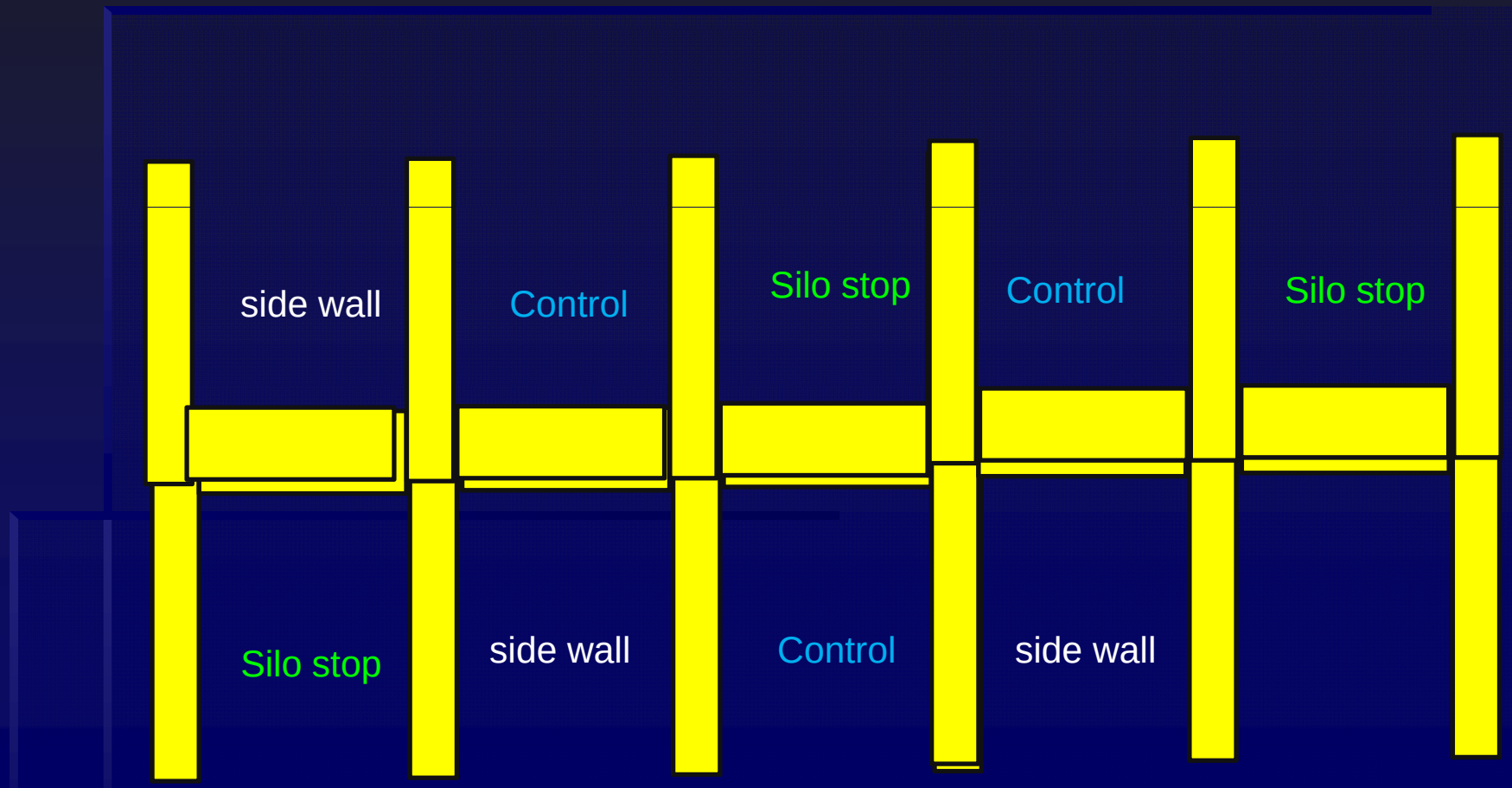
Treatments

- ✓ Normal plastic on top (6 mil) + tires
- ✓ Normal plastic on top and side walls + tires
- ✓ Silostop (2 step) + sand bags

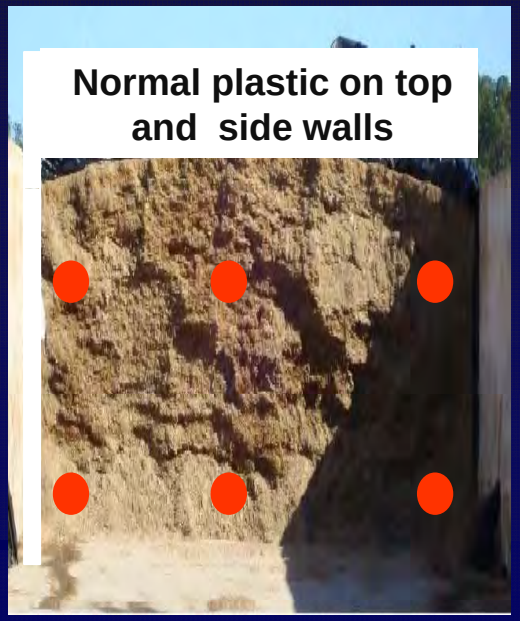
Treatment silos

(20 x 12 x 12 ft)

3 silos per treatment



Methods



3 bunkers were used for each cover type and 6 bags were placed in each bunker

Pictures are show only the bag locations; these are not the bunkers from this trial

Positions of bags in bunkers

Depths

Top (1 foot below surface)

Bottom (5 feet below surface)

Distance from side wall

RESULTS

Control treatment,

The top layer of all 3 replicate silos for this treatment looked bad with a distinct spoilage crust on the top layer

Side wall treatment,

The top layer of all 3 replicate silos for this treatment looked bad with a distinct spoilage crust on the top layer

Silostop treatment,

The top layer of 1 replicate silo looked excellent with no spoilage crust, 1 was average and 1 was bad

Effect of cover

	Control	side wall	Silostop	P value
DM, %	30.3	31.0	31.2	0.71
pH	3.84	3.88	3.81	0.65
Lactic acid, %	5.64	4.85	4.60	0.09
Acetic acid, %	2.96	3.16	3.25	0.78
Ammonia, % of Total N	0.58	0.63	0.55	0.25

No effect on the fermentation

Effect of cover

	Control	Side Wall	Silostop	P value
DM loss, %	13.1	12.8	12.0	0.92
Yeasts, log cfu/g	3.14	3.22	3.24	0.87
Molds, log cfu/g	3.24	3.40	3.19	0.66
Density, lb /ft^3	22.3	23.8	21.7	0.56
Aerobic stability, h	79.6	98.7	71.6	0.66
Thickness of top spoilage layer, inches	3.2	3.6	1.1	0.03

Silostop reduced top spoilage layer thickness;
No other effect cover effects detected

Effect of distance from side wall

	5 feet	2 feet	P value
DM, %	31.6	30.1	0.11
pH	3.83	3.86	0.66
Lactic acid, %	4.93	5.14	0.60
Acetic acid, %	2.91	3.34	0.20
Ammonia, % of total N	0.58	0.59	0.79

No effect on fermentation indicators

Effect of distance from side wall

	5 feet	2 feet	P value
Aerobic stability, h	66.3	100.3	0.18
DM loss, %	11.7	13.6	0.38
Yeast, cfu/g	3.16	3.24	0.65
Mold, cfu/g	3.20	3.35	0.46
Density, kg/m^3	354.8	369.4	0.57

No effect on spoilage indicators

Effect of depth

	Bottom	Top	P value
DM loss, %	8.9[a]	16.4[b]	0.001
Yeasts, log cfu/g	3.17	3.23	0.72
Molds, log cfu/g	3.22	3.33	0.57
Aerobic stability, h	95.1	71.4	0.35

Greater shrinkage at the top; No effect on the spoilage indicators

Effect of depth

	Bottom	Top	P value
DM, %	32.0[a]	29.7[b]	0.019
pH	3.69[a]	3.99[b]	<.0001
Lactic acid, %	6.32[a]	3.75[b]	<.0001
Acetic acid, %	2.29[a]	3.95[b]	<.0001
Ammonia, % of total N	0.52[a]	0.65[b]	0.002

Poorer fermentation at the top

Conclusions

- ✓ *Silostop reduced the thickness of the top spoilage layer; Cover type had no other effects*
- ✓ No differences due to distance from the side wall were detected.
- ✓ Dry matter loss, pH, acetic acid, and ammonia production were lower at the ‘bottom’, but lactic acid was greater at the bottom.
- ✓ Therefore, bottom samples had better fermentation and less shrinkage than top samples.

Cover type effects

- ✓ Proper covering is essential to optimize silage storage
- ✓ Silostop film reduced thickness of the top spoilage layer but did not affect the fermentation or bunk life
- ✓ In other studies, silostop was more effective at preserving silage at the ‘shoulders’ of ‘large’ bunkers

Silage distance from side wall: Summary

Silos where the width is over 2 times the tractor width)

- ✓ Silage near side walls is not as well packed and fermented as silage in the middle
- ✓ Cover side walls with plastic

Silos where the width is Width is less than 1.5 times the tractor width)

- ✓ Silage near side walls or in the middle of narrow silos are similarly packed and fermented
- ✓ Covering side walls is optional

Silage depth: summary

- ✓ Silage in the top layer is wetter and is poorly fermented compared to silage in lower layers
- ✓ Therefore pack the top layer more than lower layers and cover immediately

Acknowledgements

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