Welcome Back!

2006 Winter Dairy Management Series

“Enhance Dairy Profitability:
Achieve Balance Between Crops and Cows”

Agenda

- ✓✧**Forage Management System -- *Paving* the Road to Profitability (+Case Farm)**
  Jason Karszes and Cathy Wickswat

- ✓✧**What Does Your Forage Customer Want? (+Case Farm)**
  Larry Chase and Dave Balbian

- ✓✧**Agronomy 101 Refresher (+Case Farm)**
  Ev Thomas and Karl Czymmek

- ✧**Innovations in Effective Harvest Management (+Case Farm)**
  Tom Kilcer

- ✧**Conserving all the Goodness and Hard Work – Storage Management (+Case Farm)**
  Bill Stone, John Conway and Jerry Bertoldo

- ✧**Forage Management System -- *Building* the Road to Profitability**
  Jason Karszes and Cathy Wickswat



Silage Storage Management:
Conserving all the Goodness and Hard Work

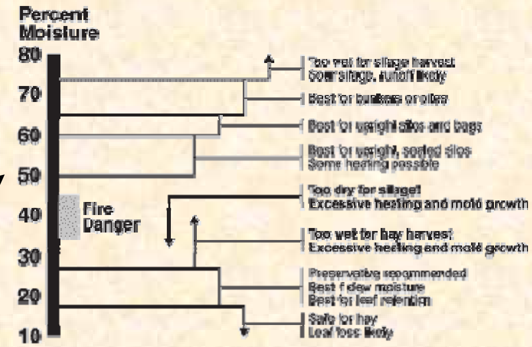
Bill Stone & John Conway
Cornell PRO-DAIRY

Jerry Bertoldo
NWNY Dairy, Crops, FBM Team
PRO-DAIRY

Winter Dairy Management
2006

Flowchart for Evaluating Forage Storage -- Goal: Optimal Nutrient Conservation and High Palatability at Feedout

- Is feeding value of forage in windrow worth all expense involved in harvest and storage?
  - No → Limit losses, consider chopping back
  - Yes → Will you be able to feed this forage when it is most prudent option to do so?
    - No → Short-term; temporary storage.. Long-term: greater flexibility
    - Yes → Will you be able to chop or bale at the optimal moisture content for your mode of storage?
      - No → Proven inoculant in cooler weather or preservative when it's freezing.
      - Yes → Will you be able to exclude oxygen rapidly/continually at filling?
        - No → Reorganize machinery/labor to affect packing or look at preservative
        - Yes → Will you be able to prevent oxygen infiltration as you are feeding out?
          - No → Cover! Consider defacer and/or L. Buchneri containing inoculant
          - Yes → Will silage remain stable (fresh) throughout feeding period?
            - No → Consider L. Buchneri inoculant (at fill) or preservative



Listing of Storage Related Resources (CD) on Other Side →

The Bottom Line

1. Harvest at the proper moisture (DM) content.

2. Chop at the correct particle length.

3. Fill rapidly to avoid excessive respiration and minimize exposure to oxygen.

4. Distribute evenly and in thin layers and pack firmly to exclude oxygen.

5. Seal to prevent exposure to oxygen.

6. Careful feedout to minimize waste and variation

"**Oxygen** is to **Silage** as **Kryptonite** is to **Superman**“ (DairyOne).

Silage Storage Related Articles and Spreadsheets

Comprehensive and General Reference

PSU From Harvest to Feed: Understanding Silage Management (silage2004.pdf)

UW Harvest and Storage of High-Quality Corn Silage for Dairy Cows (cornsilhvst.pdf)

UW Management of Bunker Silos and Silage Piles (mgmt-bunkers-piles-bjh-2.pdf)

UW Managing Forage in Tower Silos (ManagingTowerSilos.pdf)

UW Choosing Forage Storage Facilities (Choosingstorag.pdf)

UW Deciding on a Forage Storage Type (DecidingSilo.pdf)

Crop Production Budgets

OSU 2003 Alfalfa Haylage Production Budget (OSU Alfalfa Hayl. Budget.pdf)

OSU 2003 Corn Silage Production Budget (OSU Corn Silage Budget.pdf)

OSU 2003 Grass Hay Production Budget (OSU Grass Budget.pdf)

Storage Costs

UW Investment and Annual Costs of Forage Storage (CSTFORST5-1-03.xls)

UW Spreadsheet to Compare Round Bale Storage Costs (BaleStorage5-7-04.xls)

UW Silage Pile Capacity & Capital Cost Calculator (Pile_Volume1-16-05.xls)

UW Capital Cost of Pads for Bunkers, Piles, and Bag Silos (CapCostPads.pdf)

Storage Losses

UW Preventing Silage Storage Losses (prevent-silage-storage7.pdf)

UW Forage Feedout Losses for Various Storage Systems (FeedoutLossFOF.pdf) ...

A key to examining the Forage Storage System is to place reasonable values on crop costs of production (COP) and storage costs to get good estimates of costs of forage DM as delivered to the Feeding System.

Farm specific enterprise budgets are the gold standard for calculating COP.

- They are difficult to come by.
- We will be using Crop Production Budgets from Ohio State University to put a range of values for legume and grass haylage and corn silage.
- The following links will take you to the budgets used.
- Yields cited are post harvest loss. Cost of putting forage into storage structures is included in storage costs.

The Bottom Line

Your Farm's Cost of Production (including Storage Costs) are the best possible numbers to use in evaluating current performance or potential effect of improvements.

http://aede.osu.edu/Programs/FarmManagement/Budgets/crops%2D2003/grass.htm

http://aede.osu.edu/Programs/FarmManagement/Budgets/crops%2D2003/alfhaylage.htm

http://aede.osu.edu/Programs/FarmManagement/Budgets/crops%2D2003/cornsilage.htm





Estimated Cost of Production in $/Ton of Dry Matter (DM) for:

		Storage Cost*	Approx. Cost to Feeding System
Grass			
@1.8 T DM -- $116.67			
@2.7 T DM -- $95.55	+	$41.00	$136.55
@4.5 T DM -- $68.90			
Alfalfa			
@3.2 T DM -- $98.68			
@4.1 T DM -- $84.30	+	$41.00	$125.30
@5.2 T DM -- $75.80			($43.86 @ 35%DM)
Corn Silage			
@4.4 T (12.5 T 35% DM) -- $63.71			
@5.8 T (16.5 T 35% DM) -- $55.58	+	$41.00	$96.58
@7.2 T (20.5 T 35% DM) -- $51.15			($33.80 @ 35% DM)

*From Brian Holmes spreadsheet

Controlling Performance I – Overall Goals…

Goal: Optimal Nutrient Conservation and High Palatability at Feedout

Best Measure: Storage Losses as % of Dry Matter

TABLE 1. Estimate of silage losses during filling, storage and feed out							
Silo Type	**Moisture (%)**	**Filling**	**Seepage**	**Gaseous**	**Top Surface**	**Feed Out**	**Total**
		---------------- **DM Loss (%)** ----------------					
Conventional Tower	80**	1-2	7*	9*	3*	1-5	21-26
	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	0*	6*	3*	1-5	11-17
	50	2-4	0*	5*	3*	1-5	11-17
Gas-tight Tower	70**	0-1	1*	7*	0*	0-3	8-12
	60	1-2	0*	5*	0*	0-3	6-11
	50	2-3	0*	4*	0*	0-3	6-12
	40	2-4	0*	4*	0*	0-3	6-13
Trench or Bunker, no cover	80**	2-5	6*	10*	6*	3+-10	27-37
	70**	2-5	1*	9*	9*	3+-10	24-34
	60	3-6	0	10	12	5+-15	30-43
Trench or Bunker, covered	80**	2-5	4*	9*	2*	3+-10	20-30
	70**	2-5	1*	7*	3*	3+-10	16-23
	60	3-6	0	6	4	5+-15	18-31
Stack, no cover	80**	3-6	7*	10*	11*	3+-10	34-44
	70**	3-6	1*	11*	19*	3+-10	37-47
	60	4-7	0	12	24	5+-15	45-58
Stack, covered	80**	3-6	5*	8*	2*	3+-10	21-31
	70**	3-6	0*	7*	4*	3+-10	17-27
	60	4-7	0	6	6	5+-15	21-34
Silage Bags	80**	1-2	2	6	2	1-5	12-17
	60-70**	1-2	0	5	2	1-5	9-14
Wrapped Silage Bales	60**-70**	1-2	0	8	5	1-5	15-20
	50-60**	2-3	0	6	6	1-5	15-20

*Based on *Forages: The Science of Grassland Agriculture*, 4th ed. See Bickert et al (1997).

+Feed out loss is 3-5% with good management on concrete floor. Use 4-6% for asphalt, 6-8% for macadam, and 8-20% with earth floor assuming good face management. With less than good management, add up to 7% additional loss.

**Avoid ensiling hay crop above 70% moisture in structures and above 60% moisture in wrapped bales to prevent clostridial fermentation.

Numbers are "achievable estimates" based on measured observations, not an "industry average". You may be able to do better than the tabled values.

…and the bad news is; a robust search of industry resources yielded no practical way to measure storage losses on the farm.

TABLE 1. Estimate of silage losses during filling, storage and feed out

Silo Type	Moisture (%)	Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
		----	----	DM Loss (%)	----	----	----
Conventional Tower	80**	1-2	7*	9*	3*	1-5	21-26
	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]-17
	50	2-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]-17
Trench or Bunker, covered	80**	2-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]-30
	70**	2-5	1*	7*	3*	3^{+}-10	16-23
	60	3-6	0	6	4	5^{+}-15	18-31
Silage Bags	80**	1-2	2	6	2	1-5	12-17
	60-70**	1-2	0	5	2	1-5	9-14
Wrapped Silage Bales	60**-70**	1-2	0	8	5	1-5	15-20
	50-60**	2-3	0	6	6	1-5	15-20

Dryer – More leaves blowing around

**The "Clostridial Fermentation" Warning

TABLE 1. Estimate of silage losses during filling, storage and feed out

Silo Type	Moisture (%)	Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
		----------------		DM Loss (%)	----------------		
Conventional Tower	80**	1-2	7*	9*	3*	1-5	21-26
	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	0*	6*	3*	1-5	11-17
	50	2-4	0*				
Trench or Bunker, covered	80**	2-5	4*				
	70**	2-5	1*				
	60	3-6	0				
Silage Bags	80**	1-2	2	6	2	1-5	12-17
	60-70**	1-2	0	5	2	1-5	9-14
Wrapped Silage Bales	60**-70**	1-2	0	8	5	1-5	15-20
	50-60**	2-3	0	6	6	1-5	15-20

Wetter – More free water/solubles leaking away

**The "Clostridial Fermentation" Warning

TABLE 1. Estimate of silage losses during filling, storage and feed out

Silo Type	Moisture (%)	Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
		----------------	----------------	DM Loss (%)	----------------	----------------	
Conventional Tower	80**	1-2	7*	9*	3*	1-5	21-26
	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	0*	6*			
	50	2-4	0*	5*			
Trench or Bunker, covered	80**	2-5	4*	9*			
	70**	2-5	1*	7*			
	60	3-6	0	6	4	5^{+}-15	18-31
Silage Bags	80**	1-2	2	6	2	1-5	12-17
	60-70**	1-2	0	5	2	1-5	9-14
Wrapped Silage Bales	60**-70**	1-2	0	8	5	1-5	15-20
	50-60**	2-3	0	6	6	1-5	15-20

Dryer – stabilizes with lower total VFA production.

**The "Clostridial Fermentation" Warning

TABLE 1. Estimate of silage losses during filling, storage and feed out

Silo Type	Moisture (%)	Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
		----------------	DM Loss (%)			----------------	
Conventional Tower	80**	1-2	7*	9*	3*	1-5	21-26
	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	0*	6*	3*	1-5	11-17
	50	2-4	0*	5*	3*	1-5	11-17
Trench or Bunker, covered	80**	2-5	4*	9*	2*	3^{+}-10	20-30
	70**	2-5	1*	7*	3*	3^{+}-10	16-23
	60	3-6	0	6	4	5^{+}-15	18-31
Silage Bags					2	1-5	12-17
					2	1-5	9-14
Wrapped Silage Bales	60**-70**	1-2	0	8	5	1-5	15-20
	50-60**	2-3	0	6	6	1-5	15-20

Dryer – Less packing density at top

**The "Clostridial Fermentation" Warning

TABLE 1. Estimate of silage losses during filling, storage and feed out

Silo Type	Moisture (%)	Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
		---------------- DM Loss (%) ----------------					
Conventional	80**	1-2	7*	9*	3*	1-5	21-26
Tower	70**	1-2	1*	8*	4*	1-5	15-20
	65	1-3	0*	8*	3*	1-5	13-19
	60	1-3	0*	6*	3*	1-5	11-17
	50	2-4	0*	5*	3*	1-5	11-17
	80**	2-5	4*	9*	2*	3^{+}-10	20-30
Trench or Bunker,	70**	2-5	1*	7*	3*	3^{+}-10	16-23
covered	60	3-6	0	6	4	5^{+}-15	18-31
Silage Bags					2	1-5	12-17
					2	1-5	9-14
Wrapped Sil					5	1-5	15-20
Bales					6	1-5	15-20

Dryer – while lessened with defacer, more oxygen infiltration the dryer you get. Bucket "misses" greater on different surfaces

'arning

Why We're Taking a Decision Tree (Best Management Principles) Approach

TABLE 1. Estimate of silage losses during filling, storage and feed out

Filling	Seepage	Gaseous	Top Surface	Feed Out	Total
- - - - - - - - - - - - - - - - -		DM Loss (%)		- - - - - - - - - - - - - - - - -	

… and for every 100 Cows and their Youngstock

Best Bunker Management Losses: $18,795

Worst Bunker Management Losses: $58,891

Differential Value Forage Conserved: **$40,096**

Controlling Performance I – Overall Goals...

Goal: Optimal Nutrient Conservation and High Palatability at Feedout

Best Measure: Group dry matter intakes relative to model predictions.

Accounting for environmental factors also affecting intake, (such as poor ventilation or pitted feeding surface) silage can be considered palatable if intakes meet or exceed those predicted in a diet evaluation models such as CNCPS or CPM-Dairy.

Less Direct Indicator of Quality/Palatability

Dairy One

FORAGE TESTING LABORATORY
DAIRY ONE, INC.
730 WARREN ROAD
ITHACA, NEW YORK 14850
607-257-1272 (fax 607-257-1350)

Sampled	Recvd	Printed	ST	CO
	09/22/05	09/23/05		

GRASS
MCMAHON, MICHAEL (BILLING) kq
MCMAHON'S E Z ACRES
5005 CREAL ROAD
HOMER, NY 13077

ENERGY TABLE - NRC 2001
BW = 1350 Fat% = 3.7 Tprot% = 3.1

Milk, Lb	NEL Mcal/Lb	NEL Mcal/Kg	Milk, Kg
Dry	0.72	1.59	Dry
40	0.69	1.52	18
60	0.66	1.46	27
80	0.63	1.39	36
100	0.59	1.30	45
120+	0.55	1.21	54+
NEM3X	0.69	1.52	
NEG3X	0.42	0.93	
ME1X	1.14	2.52	

Sample Description	Farm	Code	Sample
GRASS SILAGE		303	9144890

Analysis Results

Components	As Fed	DM
% Moisture	70.2	
% Dry Matter	29.8	
% Crude Protein	5.6	18.9
% Available Protein	5.3	17.8
% ADICP	.3	1.0
% Adjusted Crude Protein	5.6	18.9
Soluble Protein % CP		57
Degradable Protein %CP		74
% NDICP	.8	2.8
% Acid Detergent Fiber	9.4	31.4
% Neutral Detergent Fiber	14.8	49.6
% Lignin	1.6	5.2
% NFC	6.0	20.2
% NSC	3.7	12.4
% Starch	1.1	3.6
% Sugar	2.6	8.8
% Crude Fat	1.6	5.3
% Ash	2.62	8.79
% TDN	21	69
NEL, Mcal/Lb	.21	.70
NEM, Mcal/Lb	.21	.72
NEG, Mcal/Lb	.13	.45
Relative Feed Value		121

Less Direct Indicator of Quality/Palatability

1. VFA SCORE <6, RECOMMEND SUBMITTING A NEW SAMPLE FOR COMPLETE FERMENTATION PROFILE.
2. LAG TIME EQUALS 4.90 HR.
3. NRC ENERGIES - SMALL BREEDS - DO NOT USE ENERGIES BEYOND 80 LBS. MILK. LARGE BREEDS - USE 120 LB. ENERGY WITH EXTREME CAUTION.

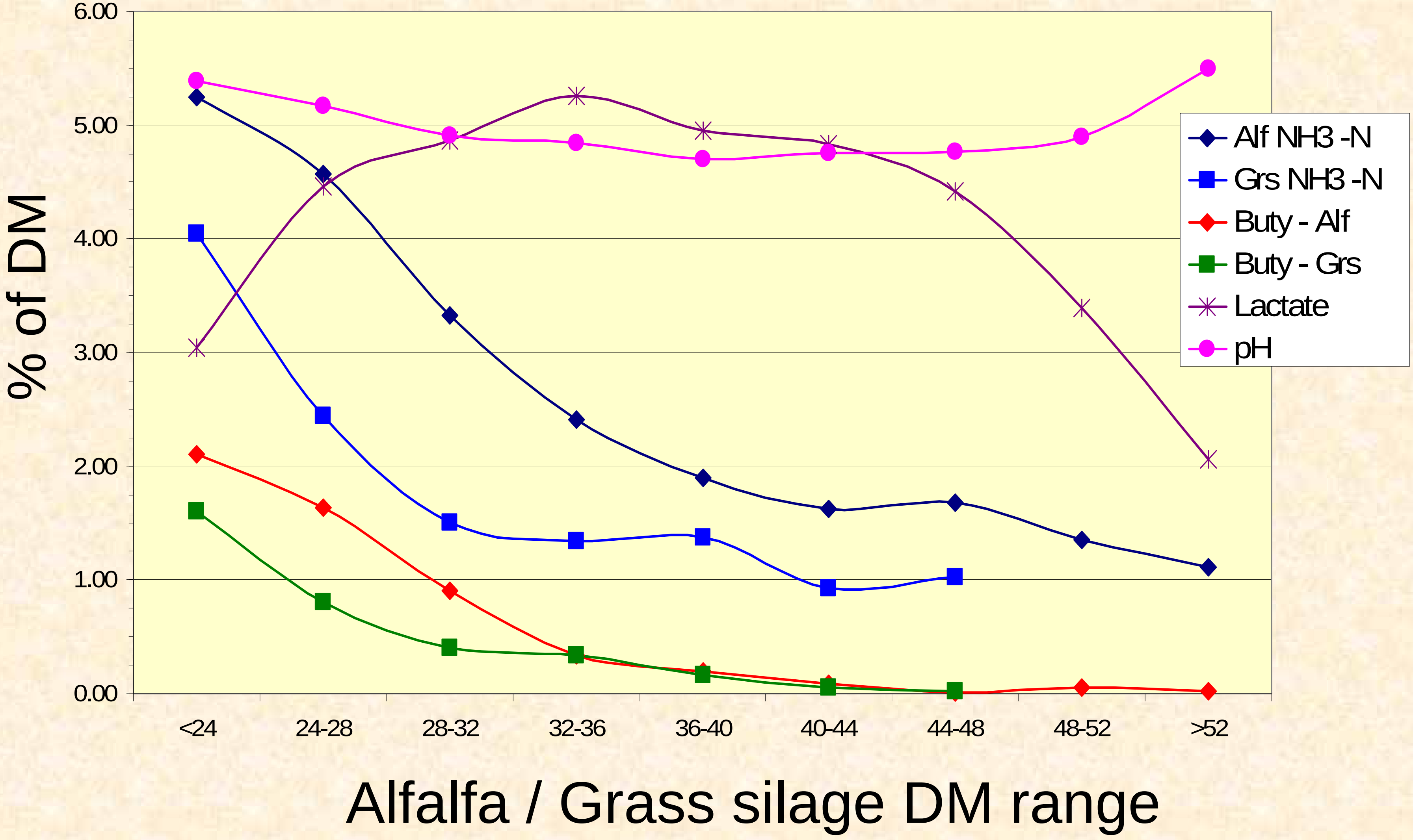
*** HOLIDAY LAB CLOSINGS ***
MONDAY DECEMBER 26TH
MONDAY JANUARY 2ND

pH	4.5		< 5
% Ammonia (Protein Equiv)	.48	1.60	
Lactic Acid, %	1.53	5.13	> 3
Acetic Acid, %	.65	2.17	< 3
Lactic/Acetic Ratio		2.36	2 - 3
Propionic Acid, %	.04	.13	< 1
Butyric Acid, %	.01	.03	< 0.1
Iso-Butyric Acid, %	.04	.14	
Total Acids, %		7.59	5 - 10
Amm-N, % of Total N		8	8 - 15
VFA Score		7.83	6 - 10
IVTD 24hr, % of DM		77	
IVTD 48hr, % of DM		83	
NDFD 24hr, % of NDF		53	
NDFD 48hr, % of NDF		66	←
Relative Forage Quality		172	←
MORE ->			

Page 1

Bottom Line:
In spite of going in slightly wet this grass silage appears to be pretty good “on paper”.

The Relationship Between Silage DM and the Resultant Fermentation



Controlling Performance II – the “Big Rocks” of Storage

Considering the cost to get the crop into the silo and properly store it…

Is the forage in the windrow (or corn row) worth the storage expense and silo space consumed?

Controlling Performance II – the "Big Rocks" of Storage

What does it cost me to ensile and store forage?

INVESTMENT AND ANNUAL COSTS OF FORAGE STORAGE

Brian J. Holmes, Professor and Extension Specialist
Biological Systems Engineering Department
University of Wisconsin-Madison
460 Henry Mall
Madison, WI 53706
(608) 262-0096
BJHOLMES@FACSTAFF.WISC.EDU

Gary G. Frank
Agricultural Economist, Center for Dairy Profitability, UW-Madison
FRANK@aae.wisc.edu

5/1/2003 Revisions

Print Inputs

This spreadsheet was developed to calculate the investment and annual costs of owning and operating several types of forage storages. A documentation publication exists for this spreadsheet and should be consulted before using the spreadsheet.

Red values are calculated from other input values. These cells are not user changeable so equations in the cells are protected.

INPUT ------------------------------ INVESTMENT COST COMPONENTS ------------ =========== INVESTMENT COST OUTPUT==========

Quantity to be Stored (TDM)	400
Forage Value ($85/TDM)	$ 85
Storage Period (days)	360

Storage Type	Structure Cost ($)	Unloader/ Unloader Tractor Cost ($)	Blade / Bagger/ Blower/ Wrapper Cost ($)	Proportion of Time <-- Used (%)	Loading Tractor Cost ($)	Proportion of Forage Dry Matter Loss (%)	TOTAL INVESTMENT COST ($)	Investment Cost per Ton DM ($/T DM)
Steel/Glass Tower	$-	$-	$-	-	$-	6.00	$-	$ -
Cast in Place Tower	$-	$-	$-	-	$-	13.00	$-	$ -
Stave Tower	$-	$-	$-	-	$-	13.00	$-	$ -
Above Ground Bunker	$48,379	$-	$-	-	$-	16.00	$48,379	$ 121
Packed Pile	$10,065	$-	$-	-	$-	17.50	$10,065	$ 25
Bagger	$7,392	$-	$-	-	$-	11.00	$7,392	$ 18
Silage Bale Wrap	$13,200	$-	$-	-	$-	14.00	$13,200	$ 33
Dry Baled Hay	$40,480	$-	$ -	-	$-	7.00	$40,480	$ 101
			Proportion of	Proportion				

On your CD or http://www.uwex.edu/ces/crops/uwforage/dec_soft.htm

Controlling Performance II – the "Big Rocks" of Storage

What does it cost me to ensile and store forage?

OUTPUT ANNUAL COSTS

Silo Type	Silo/ Storage Pad ($/YR)	Unloader/ Tractor ($/YR)	Blower/ Bagger/ Wrapper ($/YR)	Loading Tractor ($/YR)	Labor ($/YR)	Fuel & Lubrication &Electricity ($/YR)	Plastic/ Bags ($/YR)	Dry Matter Loss ($/YR)	TOTAL ANNUAL COST ($/YR)
Steel/Glass Tower (OL)	16407	9387	751	1056	1440	428	0	1958	31428
Cast in Place Tower(OL)	10707	6008	751	1056	1440	428	0	1958	22349
Stave Tower	7747	2816	751	1056	1440	428	0	3264	17502
Above Ground Bunker	7338	1183	0	1056	2580	690	200	4243	17290
Packed Pile	1927	1183	0	1056	2850	690	469	5875	14051
Bagger	1074	1183	3267	634	2300	622	2360	3264	14703
Wrapper	1059	595	1877	884	1830	225	3291	4243	14005

Costs not included are: : Snow removal, Access road, Multiple silo fills/yr, Plastic disposal.
d:\lotus\holmes\case21.wq1

Output from older version of spreadsheet with reasonable/current values entered as inputs.

Controlling Performance II – the “Big Rocks” of Storage

What does it cost me to ensile and store forage?

Bottom Line:

If you subtract out capital costs and account for the variable costs of putting material in and feeding it out, you’re annualized cost is ~$26.60 per ton DM. Three scenarios exist – 1. Chop it back, it’s terrible, 3. Slam it in, it’s gorgeous and 2. We need the feed, it’s of questionable quality and we’re dryer than normal…

Cast in Place Tower(OL)	~~58~~
Stave Tower	46
Above Ground Bunker	45
Packed Pile	37
Bagger	38
Wrapper	36

You’ll have (at least) between $36 and $46 per Ton of Dry Matter cost sitting there taking up valuable space!

Controlling Performance II – the "Big Rocks" of Storage

What does it cost me to ensile and store forage?

Optimal Maturity in 1st Crop:

Bottom Line how many strikes against it:

- ☒It's mature (>10% NDF above ideal)
- ☒It's been rained on in a way solubles have been leached
- ☒Doubtful any sugars left to ferment
- ☒It's slimy and/or moldy
- ☒There is no place to isolate it for selective feeding

Can this be diverted for bedding if it dries? Will waiting hold back the growth of the next crop?

With seasonably warm weather figure NDF gain is about 1% per day (less if unseasonably cool). Windrows seeing significant rain lose soluble nutrients through leaching (lowering quality) and may ultimately present a mold problem somewhere along the line.

Controlling Performance II – the "Big Rocks" of Storage

Is the forage in the windrow (or row) worth the storage expense and silo space consumed?

Bottom Line how many strikes against it:

- ☒It's mature (>10% NDF above ideal)
- ☒It's been rained on in a way solubles have been leached
- ☒Doubtful any sugars left to ferment
- ☒It's slimy and/or moldy
- ☒There is no place to isolate it for selective feeding

Can this be diverted for bedding if it dries? Will waiting hold back the growth of the next crop?

Controlling Performance II – the "Big Rocks" of Storage

Will we be able to feed this windrowed (or standing) forage to the animals we'd like to at the time we need to?

,,, A *Very* Dynamic Issue that boils down to:

Forage Dry Matter Conservation &/or Enhancing Value by Selective Feeding

Forage Dry Matter Conservation

- Animal Needs/Acreage/Yields Tight
- Need Every Morsel in Good Year
- *Really* Critical in Bad Year
- Argument for More Internal Walls or Flexible, Temporary Storage (ability to segregate, selectively feed)

Enhancing Value by Selective Feeding

- Diversity in Forage Type
- Typically Broad Harvest Window
- Minimized Harvest Equipment Expense
- Argument for More Internal Walls or Flexible, Temporary Storage (ability to segregate, selectively feed)

Is this windrowed forage within the ideal moisture range for the mode of storage?

Controlling Performance II – the "Big Rocks" of Storage

Is this windrowed forage within the ideal moisture range for the mode of storage?

Maturity and Moisture Guidelines for Silage Harvest and Storage

	Alfalfa	Grass	Corn Silage
Stage of Maturity	32" (mid-bud) in 1st cut	Boot	1/2 to 2/3 milk line
Theoretical cut length (inch)	3/8 to 1/2		Unprocessed 3/8 Processed 3/4
Moisture *(DM)* by storage structure			
Bunker Silo	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	65 – 70% *(30 – 35%)*
Conventional upright	60 – 65% *(35 – 40%)*	60 – 65% *(35 – 40%)*	63 – 68% *(32 – 37%)*
Oxygen-limiting upright	40 – 55% *(45 – 60%)*	40 – 55% *(45 – 60%)*	55 – 60% *(40 – 45%)*
Bag	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	60 – 70% *(30 – 40%*
Baleage	50 – 60% *(40 – 50%)*	50 – 60% *(40 – 50%*	---- ----
Pile or Stack	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	65 – 70% *(30 – 35%)*

Controlling Performance II – the “Big Rocks” of Storage

Is this windrowed forage within the ideal moisture range for the mode of storage?

Table 1. Hand method for estimating forage moisture concentration for silage.

Characteristic of forage squeezed in hand	**Moisture (%)**
Water is easily squeezed out and material holds shape	> 80
Water can just be squeezed out and material holds shape	75 - 80
Little or no water can be squeezed out but material holds shape	70 - 75
No water can be squeezed out and material falls apart slowly	60 - 70
No water can be squeezed out and material falls apart rapidly	< 60

Take a handful of chopped forage, squeeze it into a ball, and release. Chopped forage is too wet to ensile if the ball stays together and too dry if it quickly falls apart. Forage that slowly falls apart is ready to be ensiled.

Controlling Performance II – the "Big Rocks" of Storage

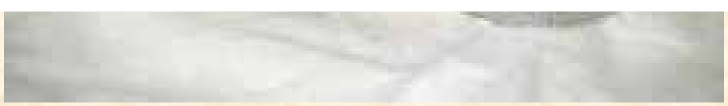
Is this windrowed forage within the ideal moisture range for the mode of storage?

nfo.php?products_id=346

.95 delivered)

A 36% DM haylage sample (64% moisture) took between 20 and 25 minutes to fully dry down in the "Vortex". The same sample through the Koster took 65 minutes to dry down.

10 min. – 51% DM
15 min. – 41% DM
20 min. – 38% DM
25 min. – 36% DM
30 min. – 36% DM



http://www.kostercroptester.bigstep.com/

(~$289.99 includes electronic scale)

http://abe.psu.edu/vortex/

(~$85.00 delivered)

Will we have adequate packing?

Major influencers of silage density

- Tractor weight
- Packing time per ton
- Layer thickness
- Crop DM

- Particle length
- Height of silo

Controlling Performance II – the "Big Rocks" of Storage

Will we have adequate packing? Real time estimates/options

Minimum Recommended Packing Density:

15 Lbs DM/ft.^{3}

Controlling Performance II – the “Big Rocks” of Storage

Will we have adequate packing? Real time estimates/options

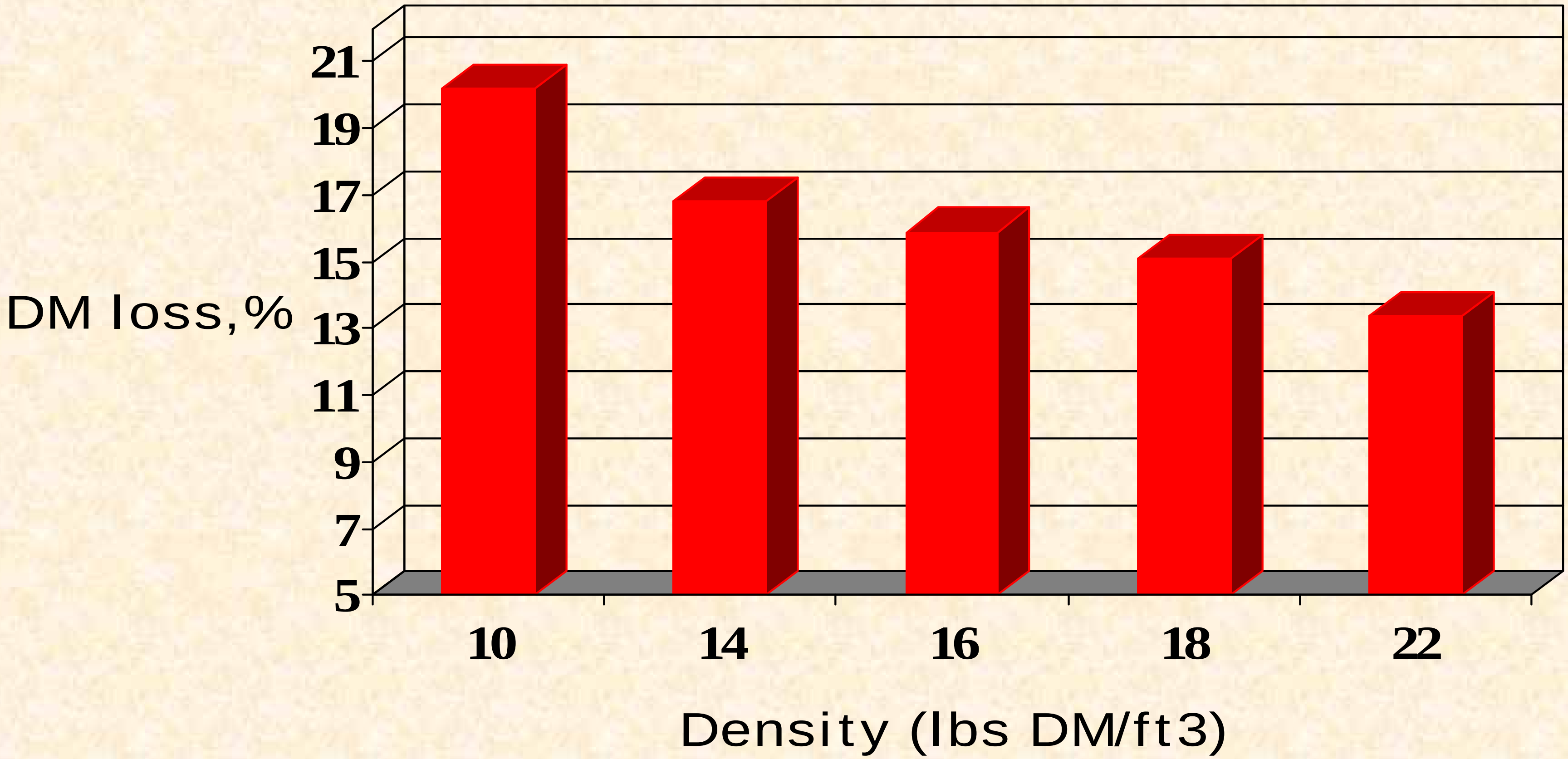
packing thumb rule:

1 ton chopped forage/hr. (as fed) *requires* 800 lbs. tractor

Example:

- 100 ton forage per hour
- 80,000 lbs. of tractor weight for the hour

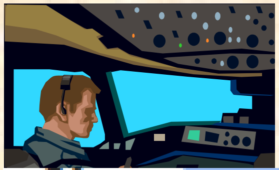
Packing Density & DM Loss -
Ruppel, 1992



Bunker Silo Densities - Holmes, 1999

- Hay crop silage (87 silos)
- Average = 14.8 lbs/cu ft (6.6 - 27.1)

- Corn silage (81 silos)
- Average = 14.5 lbs/cu ft (7.8 - 23.6)



Controlling Performance II – the "Big Rocks" of Storage

Will we have adequate packing? Real time estimates/options

http://www.uwex.edu/ces/crops/uwforage/dec_soft.htm

Also on your CD

Spreadsheet to Calculate Average Silage Density in a Bunker Silo(English Units)

Brian Holmes(1) and Richard Muck(2)
(1) Biological Systems Engineering Dept. and
(2) US Dairy Forage Research Center

Bunker Silo Wall

Do you only want to be average?

Bunker Silo Maximum Silage Height (feet) =	14	Values in yellow cells are user changeable
Silage Delivery Rate to Bunker (T AF/Hr) =	80	Typical values 15-200 T AF/hr
Silage Dry Matter Content (decimal ie 0.35) =	0.33	Recommended range of DM content = 0.3-0.4
Silage Packing Layer Thickness (inches) =	6	Recommended value is 6 inches or less

Packing Tractor - Each Tractor		Tractor Weight (lbs)	Tractor Packing Time (% of Filling Time)
Tractor # 1	Typical tractor weight is 10,000-60,000 lbs	40000	100
Tractor # 2	Typical tractor weight is 10,000-60,000 lbs	25000	75
Tractor # 3	Typical tractor weight is 10,000-60,000 lbs	0	0
Tractor # 4	Typical tractor weight is 10,000-60,000 lbs	0	0
Proportioned Total Tractor Weight (lbs) =		58750	
Average Silage Height (feet) =		12.0	Values in green cells are intermediate calculations

Packing Factor =	475.4	Values in pink cells are results of calculations
Est. Average Dry Matter Density (lbs DM/cu ft) =	15.6	Density greater than 14 lbs DM/cu ft is recommended Density greater than 28 lbs DM/cu ft is unrealistic
Maximum Achievable DM Density (lbs DM/cu ft)=	24.0	

3" layer – 22.8 lbs./ ft^3
6" layer – 15.6 lbs./ ft^3
9" layer – 13.2 lbs./ ft^3

Custom Fill – Delivery Rate Dramatically Increases…

Spreadsheet to Calculate Average Silage Density in a Bunker Silo(English

Brian Holmes(1) and Richard Muck(2)
(1) Biological Systems Engineering Dept. and
(2) US Dairy Forage Research Center
University of Wisconsin-Madison

23-Apr-01

12" layer
10.7 lbs DM/ft^3

Bunker Silo Wall Height (feet) (zero for silage pile) =	10	
Bunker Silo Maximum Silage Height (feet) =	14	Values in y…
Silage Delivery Rate to Bunker (T AF/Hr) =	80→200	Typical values 15-200 T AF/hr
Silage Dry Matter Content (decimal ie 0.35) =	0.33	Recommended range of DM content = 0.3-0.4
Silage Packing Layer Thickness (inches) =	6	Recommended value is 6 inches or less

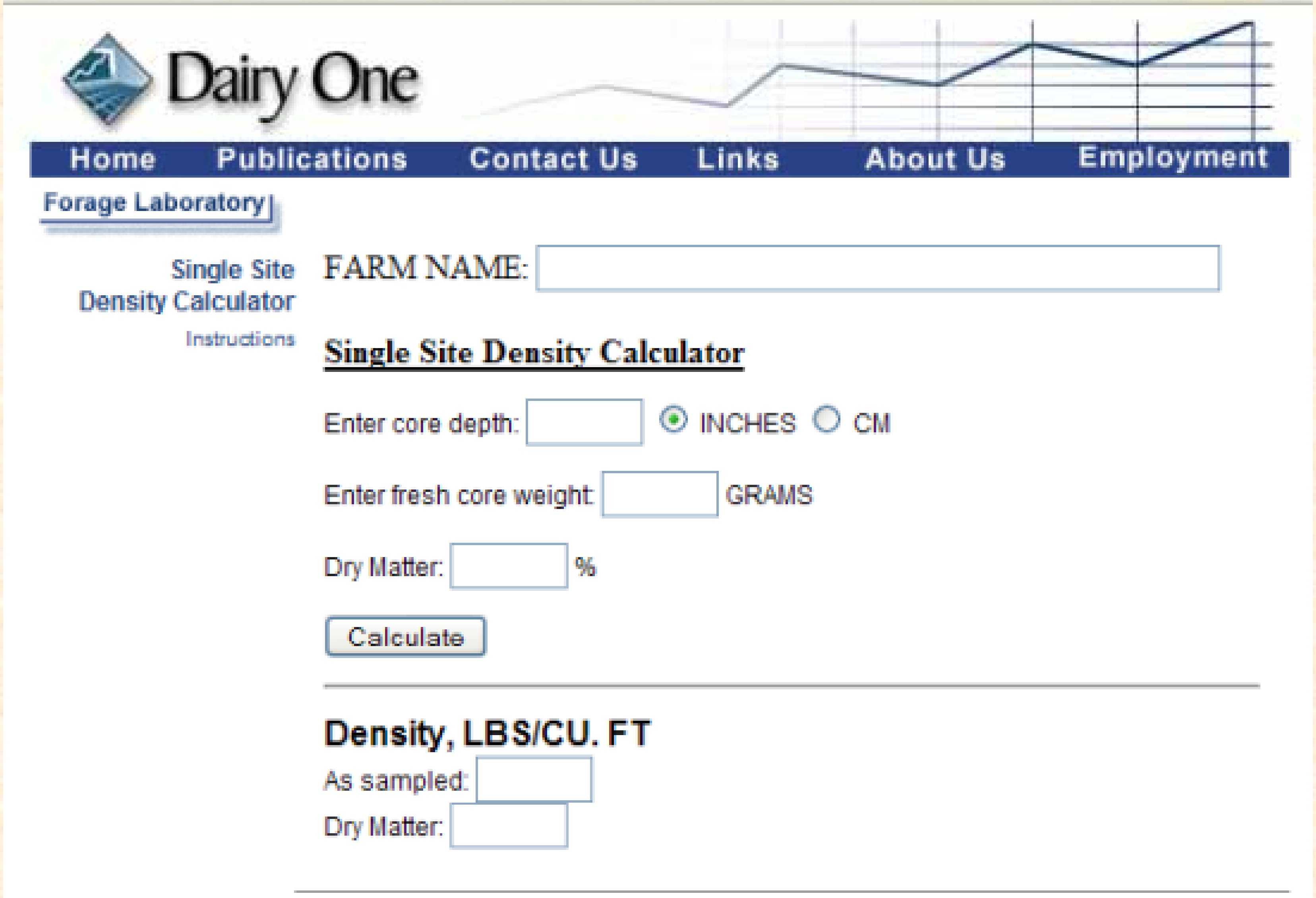
Packing Tractor - Each Tractor		Tractor Weight (lbs)	Tractor Pac…
Tractor # 1	Typical tractor weight is 10,000-60,000 lbs	40000	100
Tractor # 2	Typical tractor weight is 10,000-60,000 lbs	25000	100 ←75
Tractor # 3	Typical tractor weight is 10,000-60,000 lbs	0	0
Tractor # 4	Typical tractor weight is 10,000-60,000 lbs	0	0

Proportioned Total Tractor Weight (lbs) =	65000	
Proportioned Number of Packing Tractors =	2.00	
Proportioned Average Tractor Weight (lbs) =	32500	Green cells are intermediate calculated values
Average Silage Height (feet) =	12.0	
Packing Factor =	311.2	Values in pink cells are results of calculations
Est. Average Dry Matter Density (lbs DM/cu ft) =	13.1	Density greater than 14 lbs DM/cu ft is recommended
		Density greater than 28 lbs DM/cu ft is unrealistic
Maximum Achievable DM Density (lbs DM/cu ft)=	24.0	

Seriously consider filling/packing along entire silo length rather than wedge

Controlling Performance II – the “Big Rocks” of Storage

Did we have adequate packing? After the fact measures…



http://www.dairyone.com/Forage/DensityCalculators/SingleSite.htm

Controlling Performance II – the “Big Rocks” of Storage

Will we be able to prevent oxygen infiltration during fermentation and feedout?

Controlling Performance II – the “Big Rocks” of Storage

Will we be able to prevent oxygen infiltration during fermentation and feedout?

Edible Starch-Salt Covering For Horizontal Silos

Larry L. Berger, Jason R. Sewell, and Nathan A. Pyatt

08/09/2005

- An edible silage cover made of starch and salt can applied to bunker or pilo silos reducing dry matter losses compared to plastic or uncovered horizontal silos.
- The new cover avoids disposal of plastic and the need for tire weights.
- Commercial applications are anticipated in the near future.

http://www.traill.uiuc.edu/dairynet/paperDisplay.cfm?ContentID=7697

TEST	U.M.	SILOS TOP	STD PE
Thickness	Micron	45	45
Tensile strength at break MD	N/mm^2	38	22
Tensile strength at break TD	N/mm^2	30	20
Elongation at break MD	%	300	280
Elongation at break TD	%	310	350
Permeability to O^2 85% RH 23°C	**cm^3/m^2 /24h**	**100**	**4000**
Permeability to O^2 85% RH 50°C	cm^3/m^2/ 24h	500	12000

www.silostop.com



Controlling Performance II – the “Big Rocks” of Storage

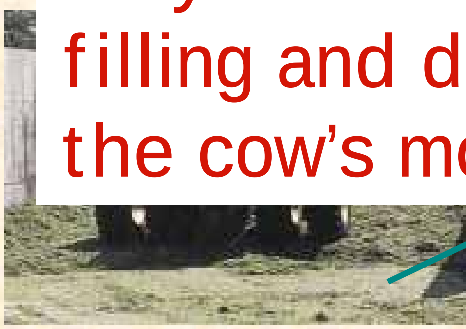
Will we be able to prevent oxygen infiltration during fermentation and feedout?

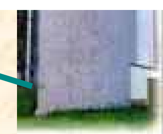
Also worth noting…

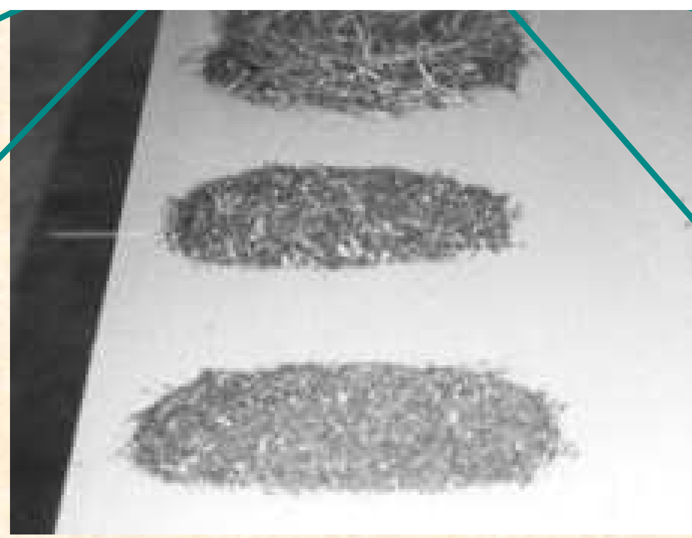
While it is actually a control or check on chopper setting in the harvest operation, chances are the place to run a forage particle separator test is at the blower or apron. Particularly with the bagger and sometimes the silo unloader, chop length needs to be gauged as to how it will *eventually* be presented to the cows.

The Bottom Line

Do you measure (as a control) particle size at filling and do you know particle size reduction to the cow's mouth?







Useful Reference – 1…

Table 19. Percentage reduction in the mass of large TMR particles in a Pennsylvania field study.[1]

Mixer type	# Batches	Percent reduced by mixing: Particles > 1 inch	Percent reduced by mixing: Particles > 0.71 inch
Auger	4	56	37
Chain and slat	7	40	2
Reel	2	70	35
Tumble	3	54	22
Overall	16	50	19

Source: Heinrichs, et al. 1999. *Journal of Animal Science.* 77:180-186.
[1]TMR were mixed according to normal farm procedures and contained no long hay.

http://www.das.psu.edu/publications/moreInfoPDA.cfm?pubID=809

Table 17. Summary of silage additives for various forages.

Additive	Useful when:	Precautions	Application rate	Reported results[1]
Lactic acid bacteria (homolactic)	Natural population is lower or less competitive than inoculant bacteria Forage is too wet Alfalfa, > 50% moisture Corn silage, > 70% moisture Forage is too dry, < 30% moisture Corn harvested immature or the day after a killing frost Alfalfa wilted for one day or less or wilted at a low temperature, < 60°F	May reduce aerobic stability Use crop-specific products	100,000 cfu/g fresh forage Liquid application preferred, especially with dry forage	Improved alfalfa fermentation in 60% of cases Improved corn silage fermentation in 31% of cases Reduced dry matter losses in 50% of cases Improved milk production in 47% of cases

Think cool conditions leading up to harvest

Bar is pretty low!

Sources of Supply
Face Cutters for Bunker and Pile Silos
April 29, 2005

(15 Sources)

Brian Holmes
Biological Systems Engineering Department
University of Wisconsin-Madison
460 Henry Mall
Madison WI 53706
608-262-0096

http://www.uwex.edu/ces/crops/uwforage/FaceCutters-SourcesofSupply4-29-05.pdf

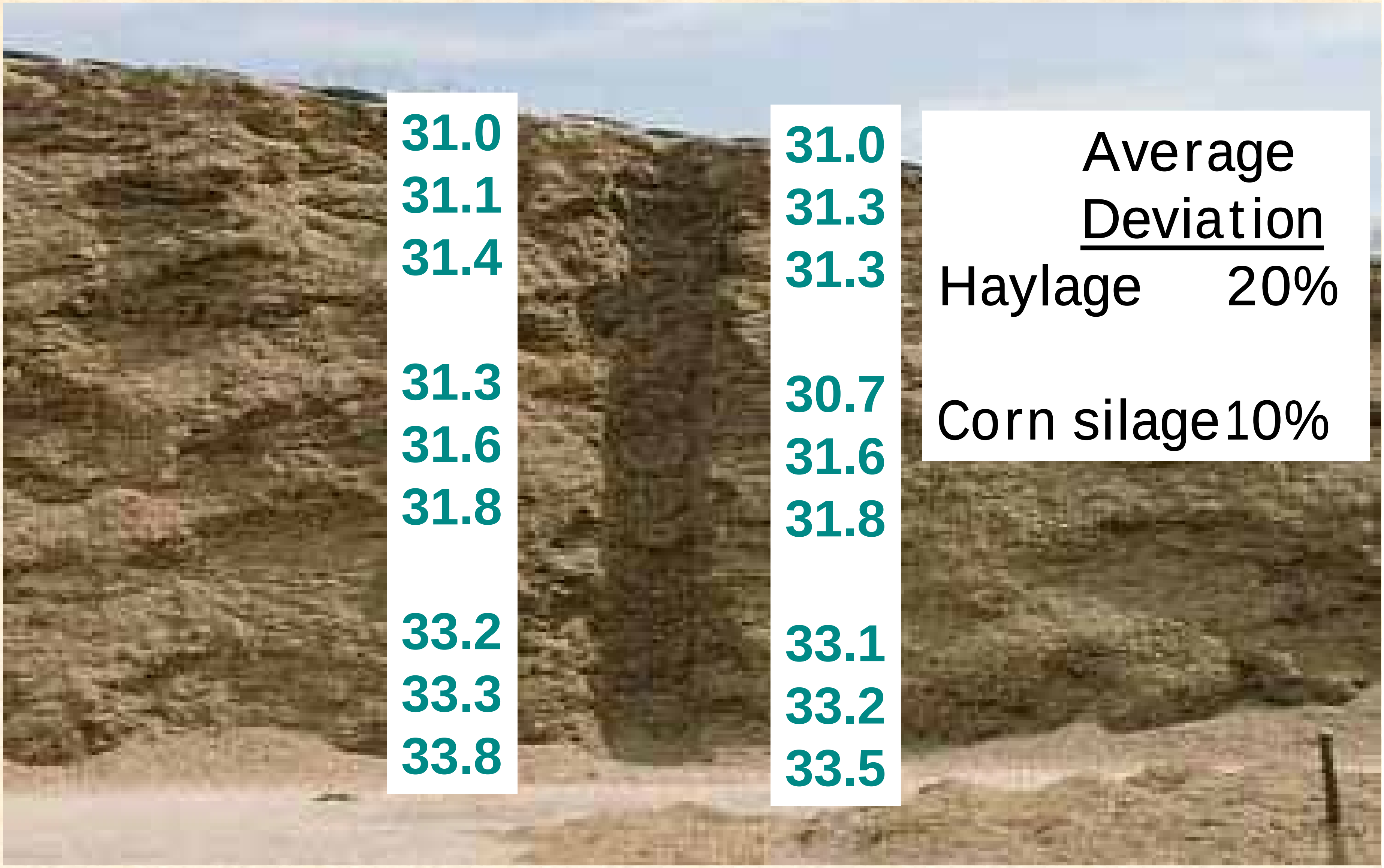
New York State

Department of Health

Teenage Farm Worker Dies during Silage Defacer Entanglement - Case Report: 05NY001

Summary

Corn Silage DM – Sampling and Laboratory Consistency Evaluation



Bunker Silo Facer Cost Analysis	
Brian J. Holmes	
University of Wisonsin-Madison	
April 1, 2003	
Labor Cost ($10/hr)	10
Number of Feedings per Day	2
Labor Saved by Facer over Bucket (min/feeding)	5
Extra Labor Required Facer vs Bucket (min/feeding)	0
Daily Labor -Cost /+Savings Facer vs Bucket ($/day)	1.7
Annual Labor -Cost/+ Savings Facer vs Bucket ($/yr)	**608.3**
Power Unit Ownership Cost ($5-25/hour)	8.0
Additional Power Unit -Cost /+Savings ($/yr)	**486.7**
Power Unit Size (HP)	60
Percent of Engine Capacity while Operating (75%)	75
Fuel Cost ($1.00/gal)	1
Additional Fuel -Cost/+Saving ($/yr)	**224.07**
Facer Variables	
Forage Value ($/T DM)	80
Depreciation (%)	10
Interest ($)	7
Repairs (%)	4
Taxes (%)	0
Insurance (%)	0.5
Ownership Cost (%)	18

Bunker Silo Facer Cost Analysis

Brian J. Holmes

University of Wisonsin-Madison

April 1, 2003

Labor Cost ($10/hr)	10	
Number of Feedings per Day	2	
Labor Saved by Facer over Bucket (min/feeding)	5	1
Extra Labor Required Facer vs Bucket (min/feeding)	0	0
Daily Labor -Cost /+Savings Facer vs Bucket ($/day)	1.7	
Annual Labor -Cost/+ Savings Facer vs Bucket ($/yr)	**608.3**	
Power Unit Ownership Cost ($5-25/hour)	8.0	
Additional Power Unit -Cost /+Savings ($/yr)	**486.7**	
Power Unit Size (HP)	60	
Percent of Engine Capacity while Operating (75%)	75	
Fuel Cost ($1.00/gal)	1	
Additional Fuel -Cost/+Saving ($/yr)	**224.07**	
Facer Variables		
Forage Value ($/T DM)	80	
Depreciation (%)	10	
Interest ($)	7	
Repairs (%)	4	
Taxes (%)	0	
Insurance (%)	0.5	
Ownership Cost (%)	18	

Dry Matter Loss Improvement (%)	Storage Management Characteris
1	Harvest forage in the 60-70% moisture range Short chop length Pack forage densely (>16 lbs DM/cu ft) Remove 12 inches per day from silo face Good face management with front end loader
3	Harvest forage in the 55-65% moisture range Long chop length Pack forage to average density (14-15 lbs DM/cu ft) Remove 6 inches per day from silo face Moderate face management with front end loader
5	Harvest forage in the 50-60% moisture range Long chop length Pack forage to below average density (< 14 DM/cu ft) Remove <3 inches per day from silo face Poor face management with front end loader

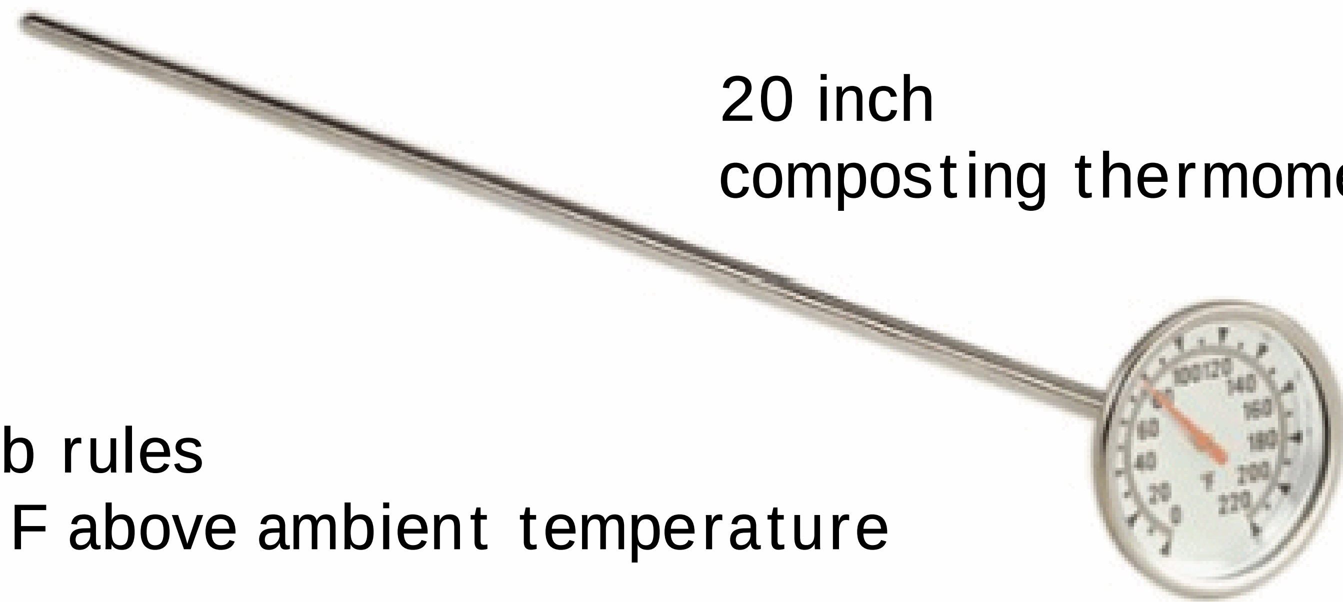
http://www.uwex.edu/ces/crops/uwforage/storage.htm

Increased DM Loss (%) By Using Front End Loader	Quantity Stored (T DM)	820	2050	4100	6150	8200
	Approx Cows	100	250	500	750	1000
==	with Heifers	Break Even Investment ($)				
0.5		$9,150	$11,884	$16,439	$20,995	$25,550
1		$10,973	$16,439	$25,550	$34,662	$43,773
2		$14,617	$25,550	$43,773	$61,995	$80,217
3		$18,262	$34,662	$61,995	$89,328	$116,662
4		$21,906	$43,773	$80,217	$116,662	$153,106
5		$25,550	$52,884	$98,439	$143,995	$189,550

Controlling Performance II – the “Big Rocks” of Storage

Were we be able to prevent oxygen infiltration during fermentation and feedout?

Is there a way of evaluating ongoing aerobic activity in the silage mass?

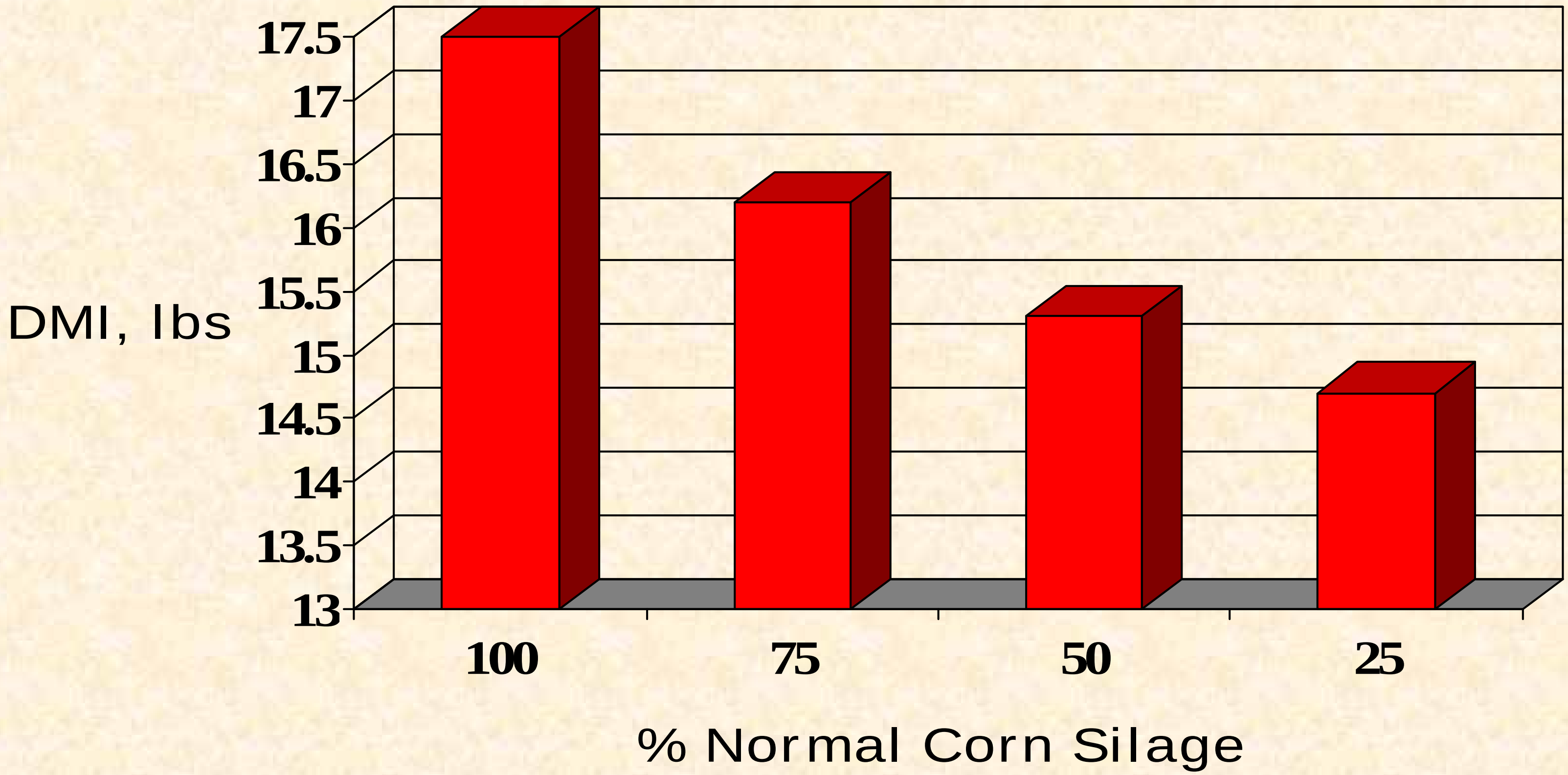


20 inch composting thermometer.

Thumb rules

- <15^0 F above ambient temperature
- Others say <10^0 - 15^0 F above the ambient temperature at the time of ensiling.
- *But always* less than 90 – 95^0 F.

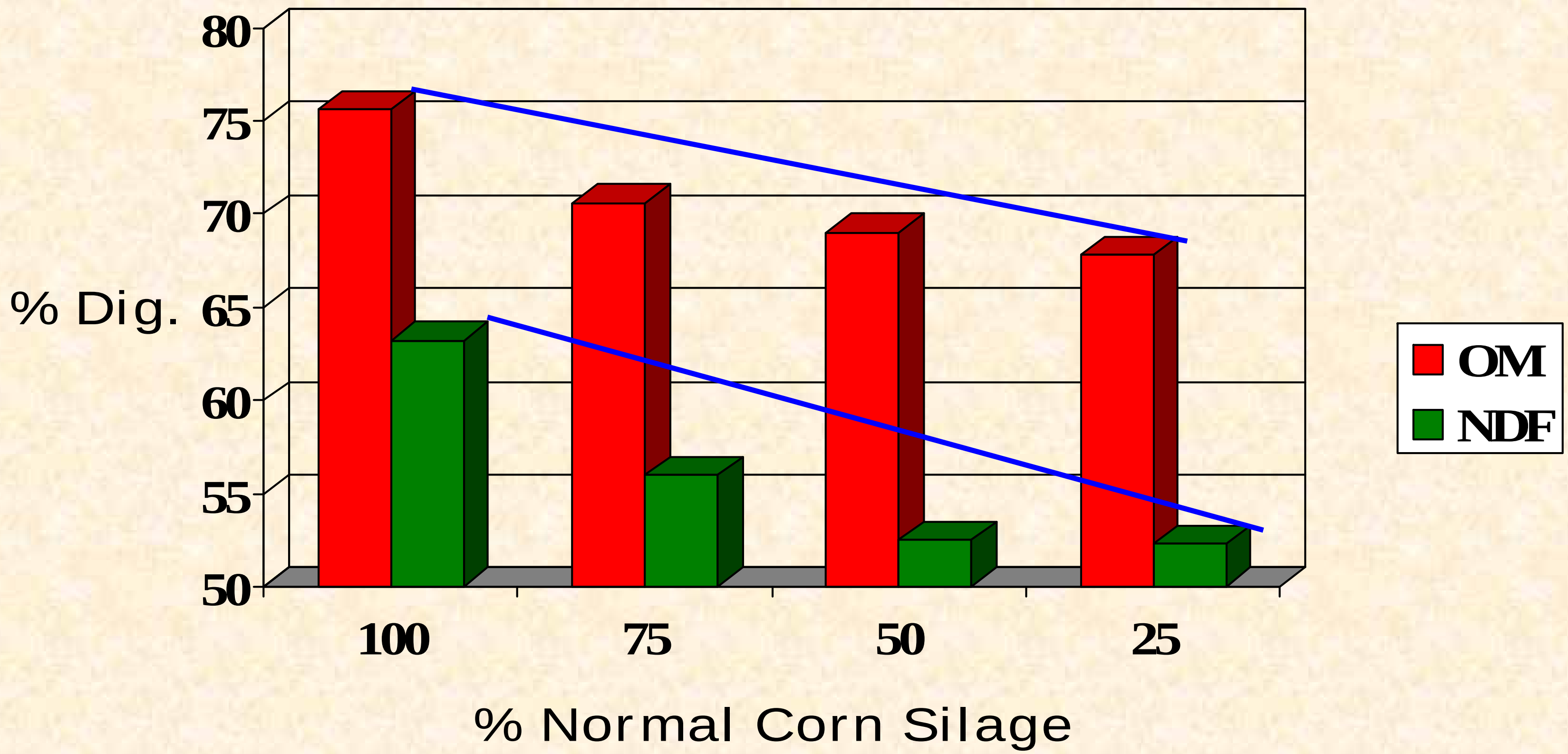
Impact of Feeding "Spoiled" Corn Silage



Spoiled = tops, sides of bunker silo

Bolsen 1999

Impact of Feeding "Spoiled" Corn Silage



Spoiled = tops, sides of bunker silo

Bolsen 1999

Controlling Performance II – the “Big Rocks” of Storage

Inoculant considerations

“Front end” inoculants - Trying to shift the fermentation in favor of the good guys

“Back end” inoculants – Make the silage more stable, less likely to have yeast/mold growth and heating

Inoculant Results

- Dr. Keith Bolsen - Kansas State Univ.
- > 200 laboratory scale trials
- 1,000 silages
- 25,000 silos
- Positive results = >90% of trials
- These were all “Front-end” inoculants
- More likely to be have positive returns with rapid dry down time, cool weather

Inoculants - other considerations

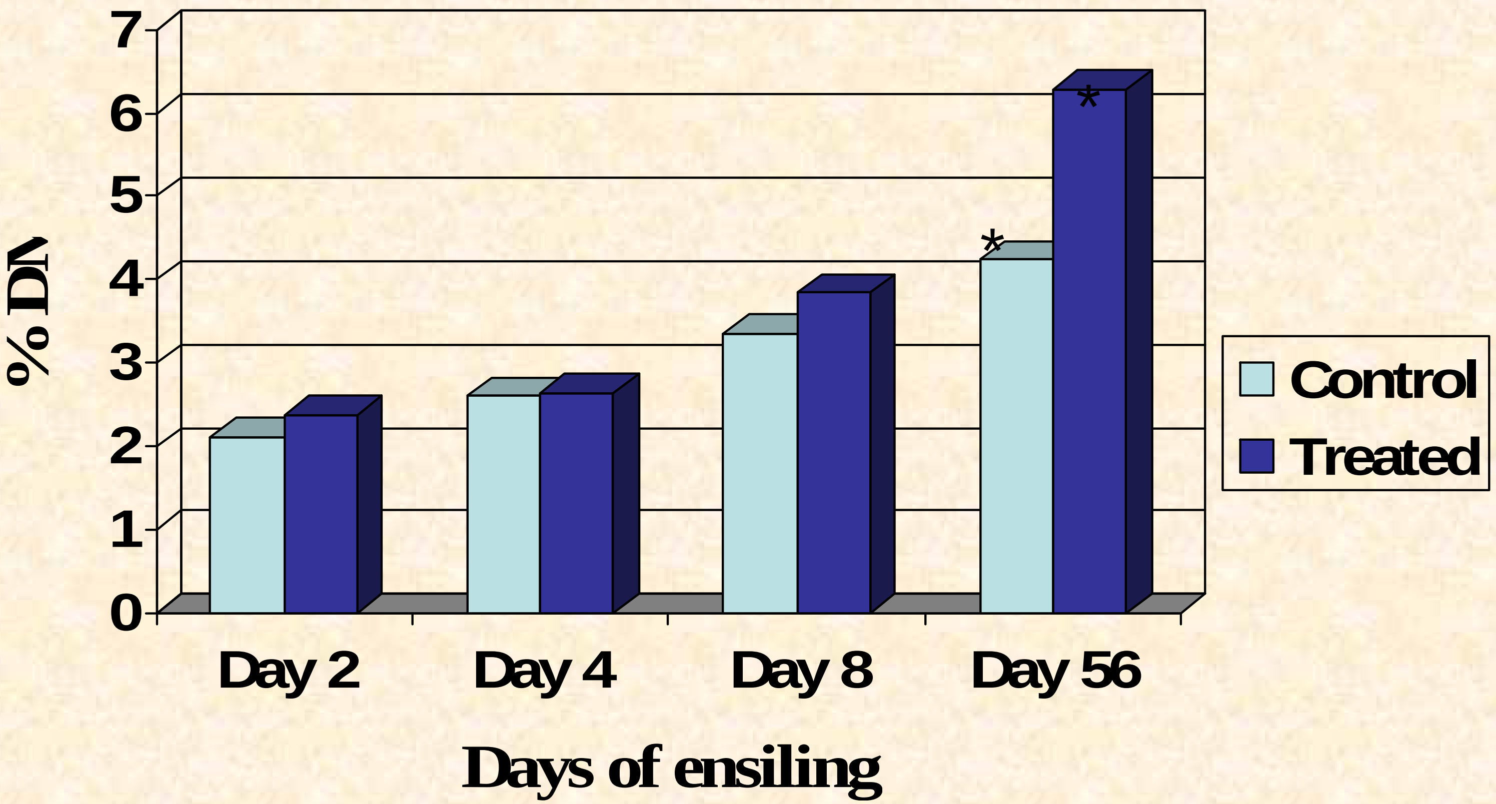
- Liquid preferable at DM > 40%
- Apply at the chopper, blower, or bag
- Ask for research and quality control procedures
- Keep the bugs alive

- Inoculants increase your chances for success, but don’t guarantee it

“Back-end” Inoculants

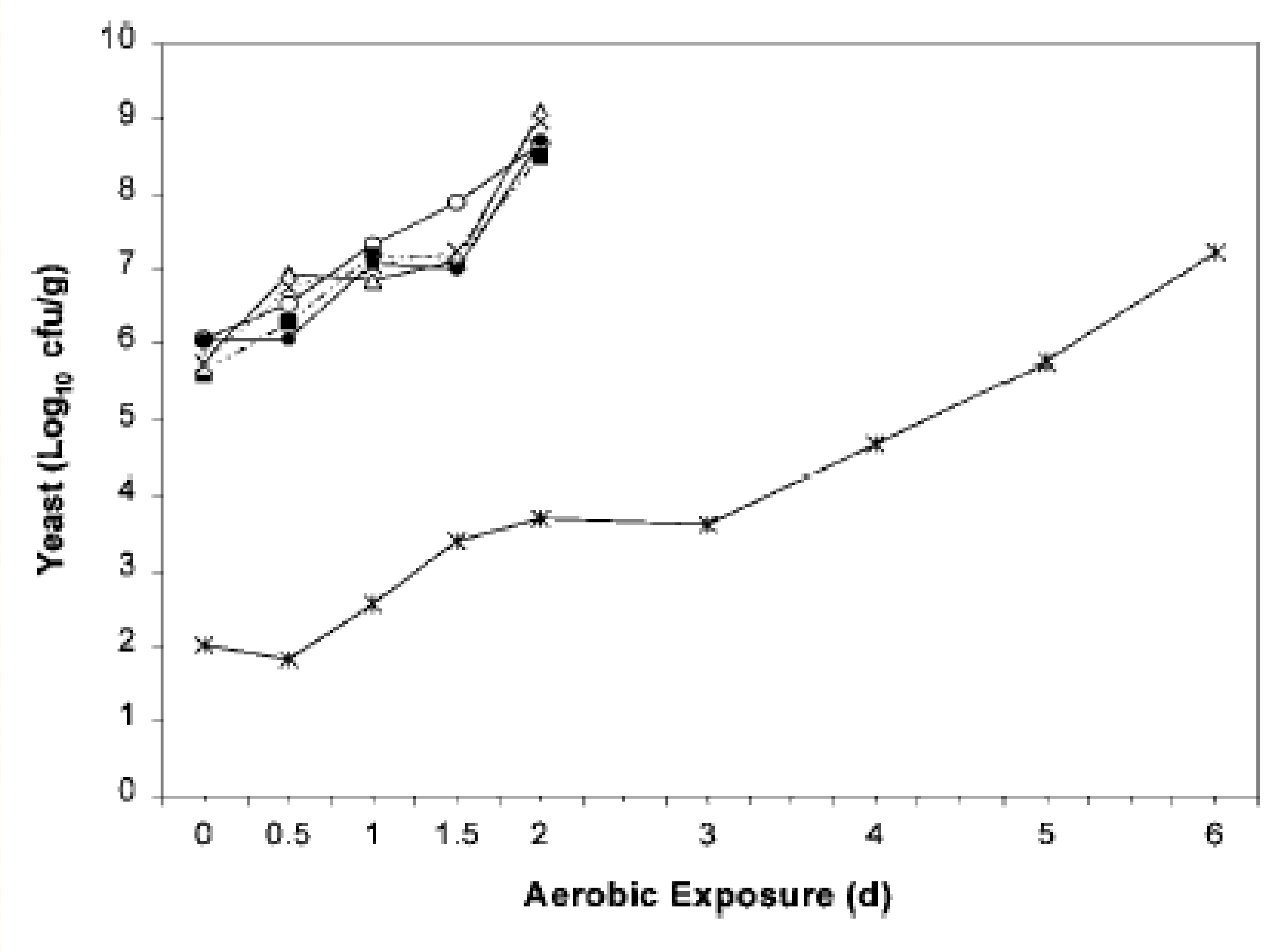
- *Lactobacillus buchneri*
  - Starts to grow after the initial fermentation
  - Converts some of the lactate to acetate (primarily), and propionate
  - Both of these acids are much stronger mold and yeast inhibitors than lactate
  - Wide or jagged bunks? Heating of the TMR?

Effect of inoculation with *L. buchneri* on acetate levels - alfalfa haylage



Kung et al., 2003

Effect of treatment on yeast growth corn silage



Kung 2000

Table 17. Summary of silage additives for various forages.

Additive	Useful when:	Precautions	Application rate	Reported results[1]
✓ Lactic acid bacteria (homolactic)	Natural population is lower or less competitive than inoculant bacteria Forage is too wet Alfalfa, > 50% moisture Corn silage, > 70% moisture Forage is too dry, < 30% moisture Corn harvested immature or the day after a killing frost Alfalfa wilted for one day or less or wilted at a low temperature, < 60°F	May reduce aerobic stability Use crop-specific products	100,000 cfu/g fresh forage Liquid application preferred, especially with dry forage	Improved alfalfa fermentation in 60% of cases Improved corn silage fermentation in 31% of cases Reduced dry matter losses in 50% of cases Improved milk production in 47% of cases
✓ Lactobacillus buchneri	Potential exists for aerobic spoilage Can be used on legume, grass, corn, or small grains	Do not use if silage is historically stable at feed out	100,000–400,000 cfu/g fresh forage	Increased aerobic stability (less heat, yeast) in 60% of cases[2] Improved dry matter recovery
Enzymes	Soluble sugars are limiting Immature grass is harvested	Usually too expensive and not needed Not recommended for corn	Depends on specific product	Reduced dry matter losses in less than 30% of cases Improved dry matter digestibility in 9% of cases Increased milk production in 33% of cases
Fermentable carbohydrates	Soluble sugars are limiting Hay crop is too wet, > 75% moisture	Not necessary for corn due to high starch content	Molasses: 40–80 lb/ton fresh forage	Improved fermentation Increased dry matter intake
✓ Propionic acid	Forage is too dry, < 60% moisture	Often very expensive	2–4 lb/ton fresh forage	Increased aerobic stability of face and feed out in 50% of cases[2] Reduced yeast and mold growth
Anhydrous ammonia	Corn silage is at proper moisture level, 63–68% Corn silage is the primary forage in diet	Avoid adding to dry (< 60% moisture) or wet (> 70% moisture) silage Use for corn only Dangerous to handle	6–7 lb/ton forage (at 65% moisture)	Increased aerobic stability of face and feed out Increased silage protein content Reduced yeast and mold growth Improved dry matter recovery Increased dry matter digestibility

[1] Muck and Kung and Kung and Muck. 1997. *Silage: Field to Feedbunk.* NRAES-99.
[2] Survey of research published in the United States from 1996 through July 2003.

http://www.das.psu.edu/publications/moreInfoPDA.cfm?pubID=809

Lactobacillus buchneri	Potential exists for aerobic spoilage Can be used on legume, grass, corn, or small grains	Do not use if silage is historically stable at feed out

- Large silo face, < recommended removal rate
- Treat portion you will hit during warmer weather

100,000–400,000 cfu/g fresh forage	Increased aerobic stability (less heat, yeast) in 60% of cases[2] Improved dry matter recovery

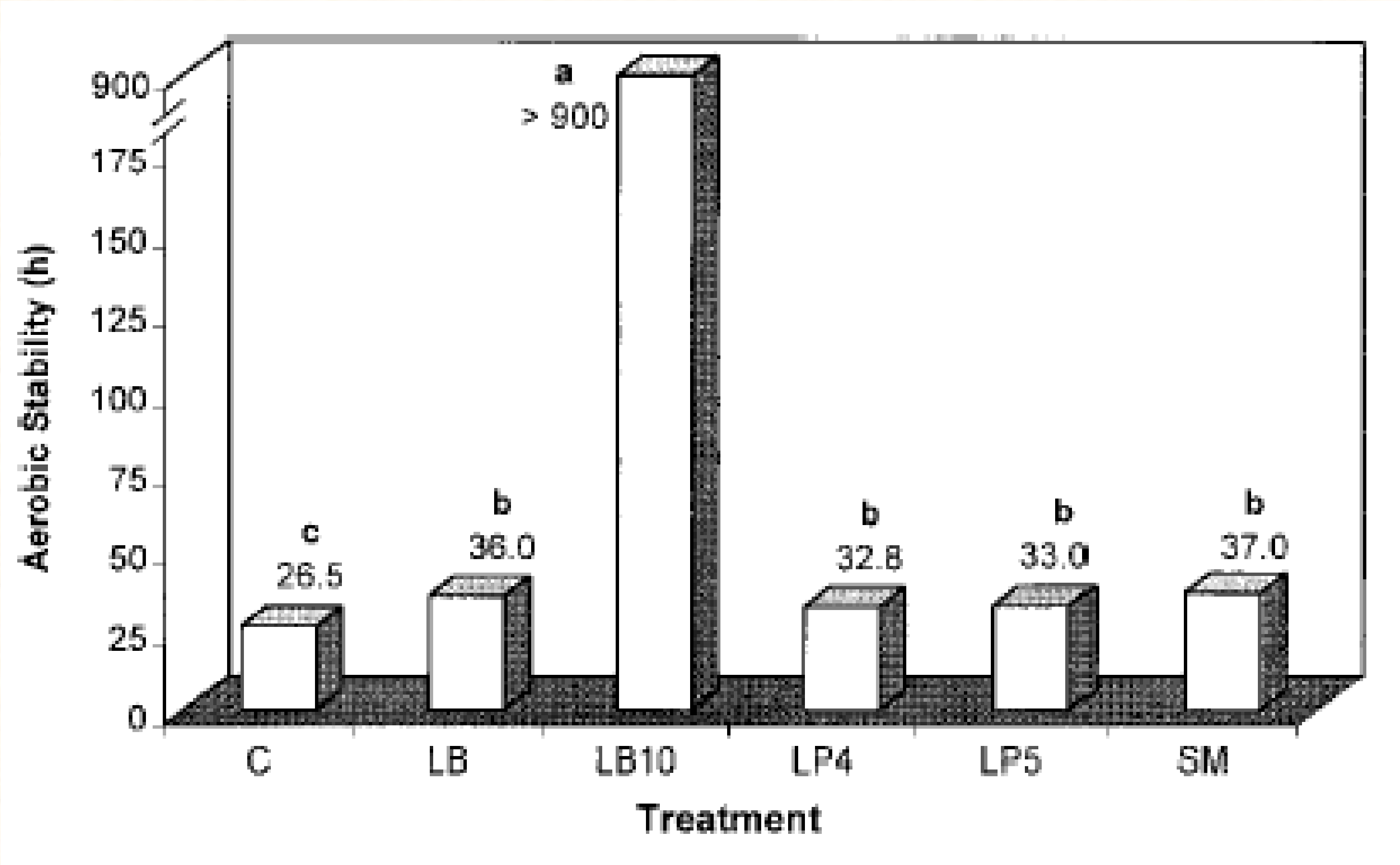
Table 18. Recommended minimum removal rate (inches per day) by storage type.

Storage type	Daily high ≤ 40°F	Daily high > 40°F
Unsealed upright	3	4
Sealed upright	3	3
Horizontal[1]	4	6
Silo bag[1]	4	6
Stack or pile[1]	4	6

[1]Increase these rates for silage with dry matter density less than 14 lb/ft^3 (bulk density less than 40 lb/ft^3).

http://www.das.psu.edu/publications/moreInfoPDA.cfm?pubID=809

Effect of treatment on time until sample heating -- corn silage



Kung 2000

Who is more likely to benefit from L. buchneri?

- Slower rate of feedout (multiple faces, growing herd)
- Lower DM density silos
- Want stable feed during the summer?

Table 18. Recommended minimum removal rate (inches per day) by storage type.

Storage type	Daily high ≤ 40°F	Daily high > 40°F
Unsealed upright	3	4
Sealed upright	3	3
Horizontal[1]	4	6
Silo bag[1]	4	6
Stack or pile[1]	4	6

[1]Increase these rates for silage with dry matter density less than 14 lb/ft³ (bulk density less than 40 lb/ft³).

L. buchneri as a risk reduction tool

TABLE 1. Dry matter loss as influenced by silage density – Ruppel (1992)

Density (lbs DM/ft^3)	**DM Loss, 180 days** (%)
10	20.2
14	16.8
15	15.9
16	15.1
18	13.4
22	10.0

TABLE 2. Summary of core samples collected from 168 bunker silos.

Characteristic	**Haycrop Silage** (87 silos)			**Corn Silage** (81 silos)		
	Average	**Range**	**SD***	**Average**	**Range**	**SD***
Dry matter, %	42	24-67	9.50	34	25-46	4.80
Wet density, lbs/ft^3	37	13-61	10.90	43	23-60	8.30
Dry density, lbs/ft^3	14.8	6.6-27.1	3.80	14.5	7.8-23.6	2.90
Avg. particle size, in	0.46	0.27-1.23	0.15	0.43	0.28-0.68	0.08

Buffered Propionic acid products and acid mixtures

- Propionic acid is a much more potent mycotic inhibitor than lactic acid
  - -bunk temps are often higher in a predominantly lactate fermentations
- Often sold as acid mixtures (prop, acetic, sorbic)
- Acetic is less expensive, and less effective, than prop
- Very limited research indicating that growth of Clostridia may also be reduced

Propionic acid based products visibly reduce spoilage on top of the bunker

Propionic acid	Forage is too dry, < 60% moisture	Often very expensive

- Consider treating top layer (18”) when Acres:Cows is tight and every pound counts (cheaper than buying hay)
- Bonus may be labor saved with far less spoilage to pitch

Price it on “pounds of active ingredient” basis

2–4 lb/ton fresh forage	Increased aerobic stability of face and feed of cases[2] Reduced yeast and mold growth

Can you do everything right and still get done in?

In a word, yes -- Mycotoxins

			Concern Level
pH	4.3		
% Ammonia (Protein Equiv)	.25	.35	
Aflatoxin, ppb	< 5	< 5	22
Vomitoxin, ppm	.54	.77	.56 (5)
Zearlenone, ppm	.08	.11	.56 (5.6)
T2, ppm	<0.025	<0.025	.25 (.7)
Ochratoxin, ppm	<0.002	<0.002	.25 (5.9)
Fumonisin, ppm	<0.5	<0.5	5 (30)
Horse TDN, %	63	89	
Horse DE, Mcal/lb	1.26	1.78	
Lactic Acid, %	.86	1.22	
Acetic Acid, %	.39	.55	
Lactic/Acetic Ratio		2.22	
Propionic Acid, %	.01	.02	
Butyric Acid, %	.00	.00	
Iso-Butyric Acid, %	.03	.04	
Total Acids, %		1.83	

And unfortunately, these appear to be synergistic with one another and effects are additive.

Above sample is HMCS – *mostly* a corn plant problem

Mycotoxin Guidelines

rev. 8/11/99

Mycotoxin	Concern Level (a)	Potentially Harmful to: (b) Cattle	Swine
Aflatoxin, ppb (c) Air dried (d) DM	 20.0 22.0	 20 – 300 22 – 333	 20 – 100 22 – 111
Vomitoxin, ppm Air dried DM	 0.50 0.56	 4.5 – 11.0 5.0 – 12.0	 0.7 – 1.3 0.8 – 1.4
Zearalenone, ppm Air dried DM	 0.50 0.56	 5.0 – 9.0 5.6 – 10.0	 1.0 – 5.0 1.1 – 5.6
T–2, ppm TRDM (e)	 0.25	 0.7 – 1.5	 0.7 – 1.5
Ochratoxin, ppm TRDM	 0.25	 5.9 – 9.0 (f)	 0.7 – 1.5 (f)
Fumonisin, ppm Air dried DM	 4.5 – 27.0 5.0 – 30.0	 27.0 – 54.0 (g) 30.0 – 60.0	 18.0 20.0

Quick Mycotoxin quiz… please hold results until "Storage"

True or False

1. Feeds that are visibly moldy are at high risk for mycotoxin contamination?

2. Feeds that contain no visible mold are seldom contaminated with mycotoxins?

3. Silage that heats during feedout has a high risk of mycotoxin contamination?

4. Knowing the species of mold is a good indicator of mycotoxin contamination potential?

5. The color of molds on crops is a good indicator of mycotoxin contamination potential?

6. Molds that do not produce mycotoxins are harmless to dairy cattle?

A real pain to deal with because:

Feed Mold/Mycotoxin Quiz…….
(True or False)

1. Feeds that are visibly moldy are at high risk for mycotoxin contamination? False

2. Feeds that contain no visible mold are seldom contaminated with mycotoxins? False

3. Silage that heats during feedout has a high risk of mycotoxin contamination? False

4. Knowing the species of mold is a good indicator of mycotoxin contamination potential? False

5. The color of molds on crops is a good indicator of mycotoxin contamination potential? False

6. Molds that do not produce mycotoxins are harmless to dairy cattle? False

http://www.wisc.edu/dysci/uwex/nutritn/presentn/mold.pdf

Mycotoxins (DON-Vomitoxin)

- Normal Corn Silage 1998,1999
- Levels = 1-4 ppm
- Excellent Growing Conditions
- Testing Labs Credible
- Presence Verified 1998, 1999

Courtesy of Nutrition Professionals, 1999

Normal Corn Silage →

Fond du Lac	1.7 ppm
Fond du Lac	13.8 ppm
Fond du Lac	5.8 ppm
Winnebago	3.0 ppm
Calumet	5.2 ppm
Brown	6.2 ppm

Why?

- Field History
- Insect Damage (Corn Borer)
- Leaf Disease
- Susceptible Varieties

Need to test with HPLC or TLC (unless it's dry corn)

http://www.wisc.edu/dysci/uwex/nutritn/presentn/mold.pdf

Useful Reference

Table 24. Summary of common silage problems and possible causes.

Physical characteristics	Chemical or microbial characteristics	Possible causes
Vinegar odor	Acetic acid > lactic	Low population of lactic acid bacteria, low sugar levels in crop, wet forage
Rancid, fishy, or putrid odor Yellow-green color Slimy texture	Butyric acid > 0.5%	Clostridial fermentation, wet forage, low sugar levels in crop
Alcohol odor	Ethanol > 1% for legume or grass silage or > 3% for corn silage Yeast populations > 100,000 cfu/g fresh forage	Oxygen exposure, resulting in yeast growth and fermentation
No odor detected	Propionic acid > 0.5%	Low sugar levels in crop
Caramelized or cooked odor Dark brown or black color	Energy and protein reduced	Heating due to oxygen exposure Slow fill rate, poor packing, dry forage
Musty odor, hot	Mold populations > 100,000 cfu/g fresh forage	Oxygen exposure, pH > 4.5
	Ammonia nitrogen Corn silage > 10% of total nitrogen or > 7% of crude protein Alfalfa > 5% of total nitrogen or > 10% of crude protein	Excessive protein breakdown, could be clostridial fermentation
	pH > 4.5	Dry forage, poor packing, low sugar levels in crop, low temperatures at harvest pH > 5 indicates clostridial fermentation pH > 7.5 indicates oxygen exposure

http://www.das.psu.edu/publications/moreInfoPDA.cfm?pubID=809

Useful Reference

Maturity and Moisture Guidelines for Silage Harvest and Storage

	Alfalfa	Grass	Corn Silage
Stage of Maturity	32" (mid-bud) in 1st cut	Boot	1/2 to 2/3 milk line
Theoretical cut length (inch)	3/8 to 1/2		Unprocessed 3/8 Processed 3/4
Moisture *(DM)* by storage structure			
Bunker Silo	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	65 – 68% *(32 – 35%)*
Conventional upright	60 – 65% *(35 – 40%)*	60 – 65% *(35 – 40%)*	63 – 68% *(32 – 37%)*
Oxygen-limiting upright	40 – 55% *(45 – 60%)*	40 – 55% *(45 – 60%)*	55 – 60% *(40 – 45%)*
Bag	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	60 – 68% *(32 – 40%)*
Baleage	50 – 60% *(40 – 50%)*	50 – 60% *(40 – 50%)*	---- ----
Pile or Stack	58 – 66% *(34 – 42%)*	58 – 66% *(34 – 42%)*	65 – 68% *(32 – 35%)*

Useful Reference

Recommended Practices for Harvesting and Utilizing Silage

Recommended Practice	Rationale
Seal silo walls and doors as necessary	Eliminates oxygen and water infiltration
Harvest forage at suitable maturity stage and moisture content (see table below)	Optimizes nutrient content Aids in packing and eliminates oxygen Minimizes heating Minimizes seepage Limits clostridial fermentation
Chop at correct cut length	Aids in packing and eliminates oxygen Promotes cud chewing and rumen health
Harvest, fill, and seal quickly	Reduces respiration losses Eliminates oxygen Minimizes heating Increases rate of pH decline
Pack and seal tightly	Eliminates oxygen Reduces respiration losses Prevents water from entering silage mass Minimizes heating Increases rate of pH decline
Test moisture content of forage	Ensures that moisture content at harvest is correct Enables the calculation of additive required, if necessary
Evaluate forage particle size	Monitors the accuracy of harvester settings Allows adjustment of cut length during harvest
Ensile forage 2 to 3 weeks before feeding	Allows fermentation to stabilize
Maintain a smooth feed out face	Limits oxygen penetration and aerobic spoilage
Remove 4 to 6 inches per day from each open silo	Limits aerobic spoilage at the exposed face
Discard spoiled feed	Prevents possible illness from toxins Improves silage palatability and intake

Corn silage >>

But depends…

http://www.das.psu.edu/publications/moreInfoPDA.cfm?pubID=809

Case Farm *Continued…*

PRO-DAIRY

Forage Management System
Building the Road to Profitability

Jason Karszes & Cathy Wickswat

Jason Karszes
Farm Management Specialist
PRO-DAIRY
Cornell University

Cathy Wickswat
Farm Mgt. & Dairy Educator
Cornell Cooperative Extension
Of Rensselaer County

Forage Management System

- Thinking about as a system, and how to get the most out of the system, allows the farm to maximize profitability of the business, the “road to profitability”
- There is always room for improvement
- Question becomes – where to start - and what to do first?

Series of Questions

- Every business is unique
- What may be a priority for one farm might not be the most important thing for your business
- To help determine where to start, a list of questions has been developed

Series of Questions

- These questions focus on key management concepts associated with the different areas of the forage management system
- First step – go through the questions, answering yes or no

Series of Questions

- Refer to your packet
- Take one of copies
  - A second copy provided to be used at home with all the management
- Take the next five minutes and answer the questions

Series of Questions

- With the no's highlighted, now time to start working through a decision making process to determine what to work on first

Decision Making

- What area/objective/goal do we need to work on first, second, third, etc.?
- Usually have more things to work on than have resources to provide.
  - Management
  - Capital
  - Labor
- Need to decide which ones will work on first

PRO-DAIRY

Decision Making

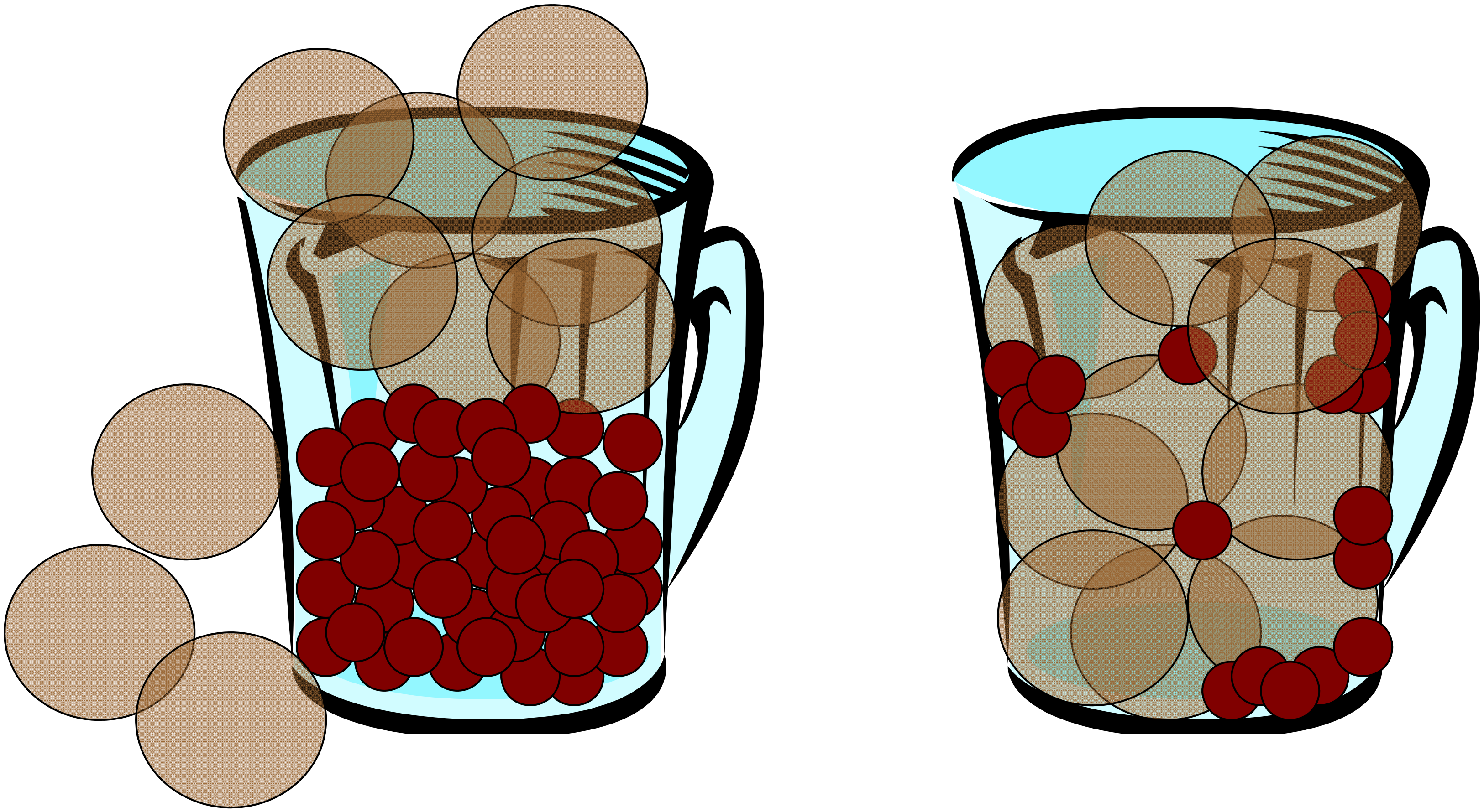
- First step in decision making is identifying the different things that could be done
- Working through the questions may help in determining what things could be worked on within the business
- The next step is to prioritize the options

Prioritize

- Comparing the different choices to determine which makes the most sense to work on first
- Assigning an order to the options so can focus management efforts on those that have the highest priority

PRO-DAIRY

Work on the Big Rocks First



Prioritize

- Need to look at each option/choice/decision in the same manner
- Follow a set of rules/guidelines/or criteria for each option
- Relying on management process to rank list, not emotions

PRO-DAIRY

How do you make "your" decisions?

- The easiest decision
- The quickest decision
- The emotional one
- What the neighbors did
- What people will think decision
- Flip of the coin decision
- Make no decision until have no choice
- Make no decision – stay the same
- The gut feeling decision
- The decision that address the issue
- The most profitable
- Generates the most cash
- Best use of resources
- Supports direction of business

Prioritize

- Partial list of criteria to utilize for prioritizing
  - Profit impact?
  - Cash impact?
  - How much labor is needed to do?
  - How much management is required?
  - How much capital is needed?
  - How fast will results be seen?
  - What other things need to be done for full impact?
  - Degree of certainty that it will work?

Decision Grids

- Matrix approach to helping decide which objective to pursue first, or which ones
- Formally evaluate the different objectives with a score assigned
- Add up the totals to determine which objectives have the highest ratings

PRO-DAIRY

Decision Making Grids

Problem: CORN YIELDS ARE LOW. NEVER ENOUGH CORN SILAGE FOR AN ENTIRE YEAR.

Ratings:

3- Good rating for criterion 2- Fair rating for criterion 1- Poor rating for criterion

	Grow more acres	Set Up & Follow Crop Rotation	Soil Test & Follow Recc.	Start Planting & Harvesting on Time	Buy a Whopper Chopper	Check Rotations vs. Ration	Improve Storage
Low Cost	1	3	2	3	1	3	1
Least Labor	1	2	3	2	3	3	3
Positive impact on yield	1	3	3	3	1	1	2
Easy	1	2	3	2	2	3	1
Fast Results	1	2	3	1	1	2	1
Total	5	11	14	11	8	12	8

Homework

- Go over the list you made up –
- Pick five of the areas that you think will have the biggest impact that you said no to.
- Think about criteria to rank
- Utilize the blank decision grids
- Assign ranks and score

Decision Making

- ⌘Prioritizing helps to decided what to do first
- ⌘Important part of decision making is implementation
- ⌘Making a decision and not implementing is the same as not making a decision
- ⌘Goal setting a critical component of implementation
- ⌘Tactical plans critical to meeting goals

Summary

- Think about the forage management system
- Look at the series of questions
- Work through a decision making process
- Make steady progress improving performance
- Take full advantage of the forage potential

PRO-DAIRY

Goals

- What are the specific things we want/need to accomplish to change no to yes
- Set goals
  - Communicate to all involved people
  - An end in sight
- “SMART” Goals

PRO-DAIRY

"SMART" Goals

S	Specific
M	Measurable
A	Attainable
R	Rewarding
T	Timed

Tactical Plans

- What needs to be done to meet goals?
- Who is going to do it?
- How will it be done?
- When will it be done?
- Why is it being done?
- Specific plan of action to accomplish different tasks

PRO-DAIRY

Tactical Plans

- Personnel Management
  - What tools does each person need?
  - What training is needed?
  - What does each person contribute?
  - What feedback can be provided?
  - What performance criteria will be used to evaluate each person's contribution?