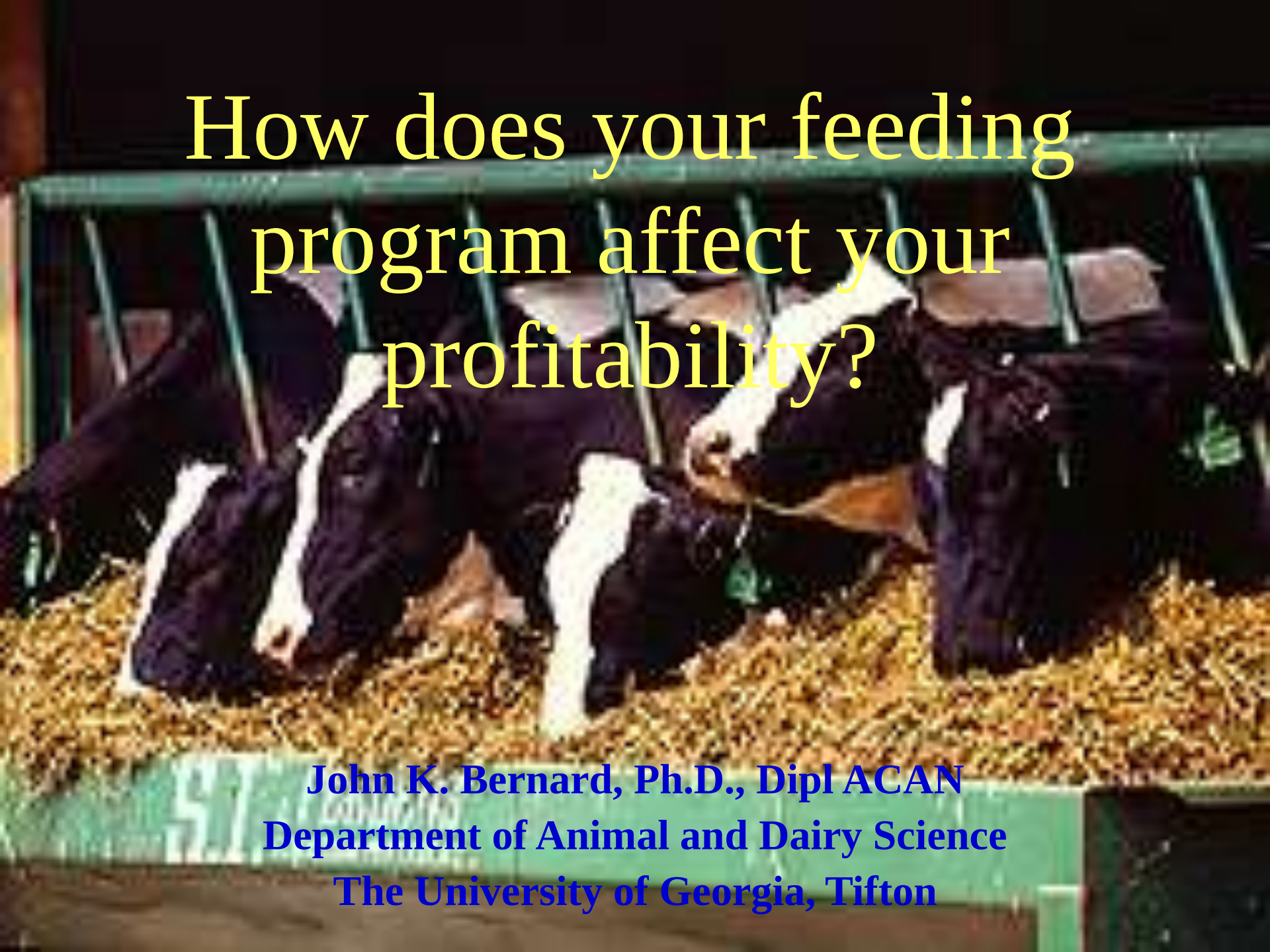


How does your feeding program affect your profitability?

John K. Bernard, Ph.D., Dipl ACAN
Department of Animal and Dairy Science
The University of Georgia, Tifton

CAT FOUND!!!

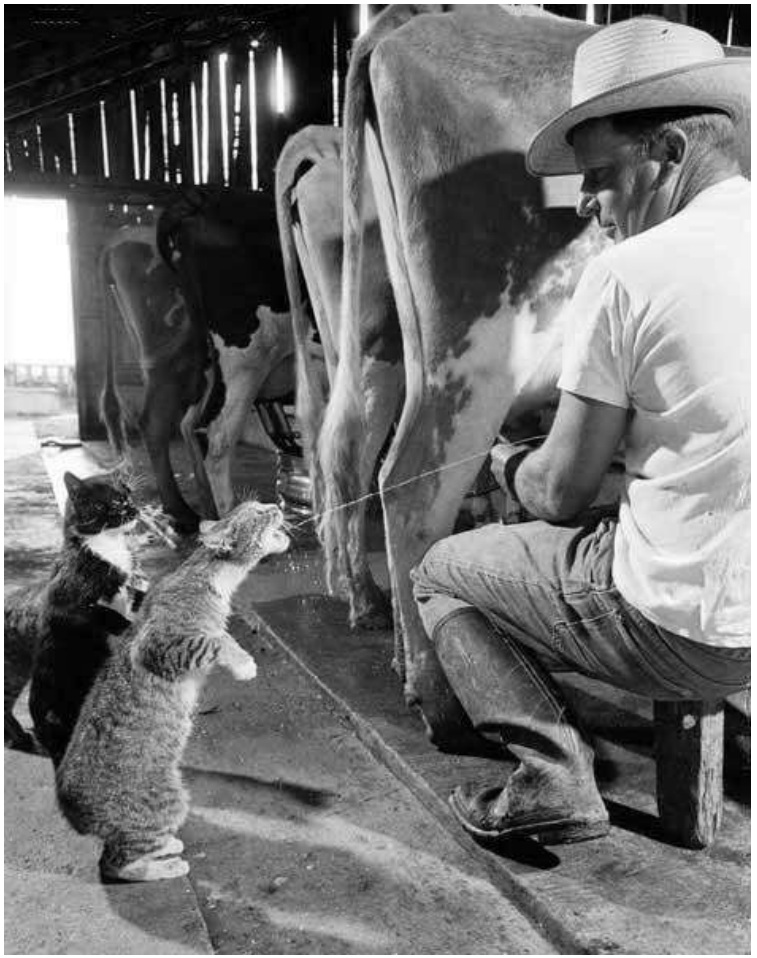
BLACK + TAN WITH GREY

- MALE — NO COLLAR
- Not VERY FRIENDLY, I think he might be SCARED.
- Not HOUSE BROKEN EITHER ☹
- Found on SUNSET BLVD.
- If HE is yours Please call

[redacted]

Times have changed

- ✓ Milk prices are volatile and subject to large swings.
- ✓ Exports have a significant influence on US dairy markets.
- ✓ World markets and politics affect prices and sales.
- ✓ Movement of milk within US has changed significantly.
- ✓ Consumer buying patterns have changed.

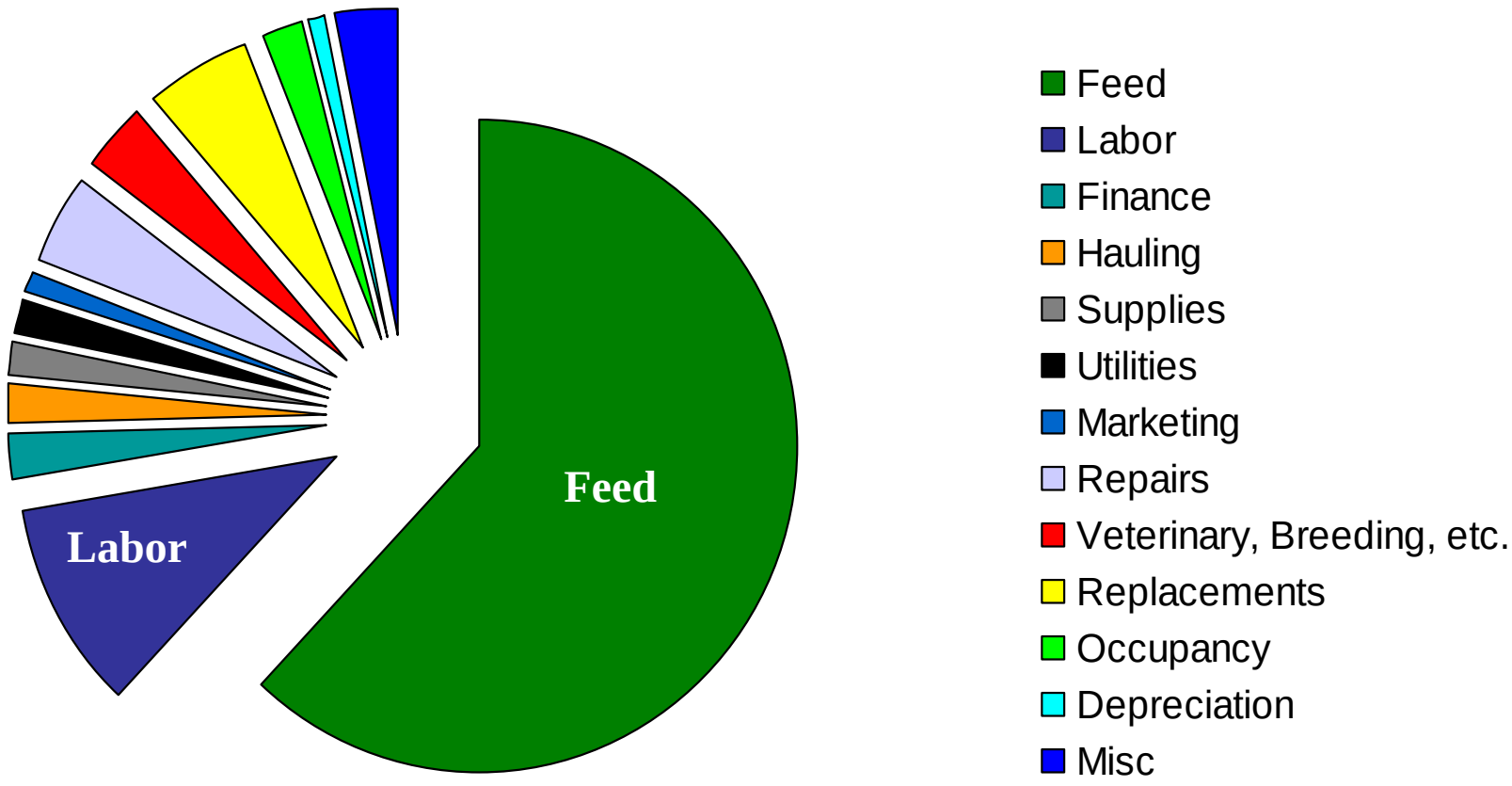


Current Situation

- ✓ Milk prices are depressed
  - Excess production (worldwide)
    - High prices stimulated increased production
    - Quotes in EU are not longer limiting production
  - Increasing product inventory (worldwide)
    - Change in purchasing by China and Russia
    - Excess production
  - Stagnant or declining fluid usage


American Composite
New York Composite
Negative impact on cash flow and finances!

Operating Cost



Total feed cost (purchased and grown for all animals on the dairy) is the largest expense associated with producing milk!

Cost of Producing Milk, 1989 - 2010

Item	Average	Top	Bottom	Difference, %
Milk yield, lb	20,326	22,788	20,455	+28
Cull rate, %	26.00	24.27	25.53	-5
Feed	9.49	8.61	10.37	-17
Labor	3.40	2.44	4.60	-47
Vet	0.53	0.57	0.51	+12
Dairy supplies	1.44	1.40	1.62	-14
Marketing – breeding	0.44	0.50	0.42	+19
Machinery	1.72	1.44	1.89	-24
Utilities & Fuel	0.88	0.67	1.18	-43
Interest	1.68	1.41	1.99	-29
Other	0.42	0.36	0.56	-36
Total	20.00	17.40	23.13	-25

Dhuyvetter, 2011

Do you know where you cost are?

Performance of lactating dairy cows fed Tifton 85 or Alfalfa hay

		Tifton 85		Alfalfa	
Item	Cont	15	30	15	30
NDF, % of DM	33.5	39.5	46.6	35.5	33.5
DMI, lb/d	50.4	48.7	48.5	49.6	49.6
Milk, lb/d	75.1	72.7	70.7	75.1	71.8
Fat, %	3.33	3.73	3.72	3.54	3.99
3.5% FCM, lb/d	74.0	74.7	73.8	75.6	74.9

45% of the dietary DM was provided by forage.
West et al., 1997. JDS. 80:1656-1665.

Performance of lactating dairy cows fed Tifton 85 or Alfalfa hay

		Tifton 85		Alfalfa	
Item	Cont	15	30	15	30
Milk value, $/d	14.82	14.95	14.77	15.13	14.99
Feed cost, $/d	7.41	3.72	6.29	7.87	8.50
IOFC, $/d	7.41	8.23	8.48	7.25	6.49
Change in IOFC		0.82	1.07	-0.16	-0.92

West et al., 1997. JDS. 80:1656-1665.

Can you answer these questions?

- ✓ What are your actual costs of producing forage versus market prices in your area?
  - Cost of production
  - Harvest and storage cost
  - Handling or processing cost
  - Shrinkage

- ✓ How do your forages affect your cost of producing milk ($/cwt)?
  - Forage quality and amount fed
  - Supplements needed to balance the diet
  - Actual milk yield and composition
  - Income over feed cost

- ❖ Are there other forages that you should consider that would improve your bottom line or reduce risk associated with weather or cost of production?


Forage is the foundation of feeding program

Feeding Program

- ✓ Maximize use of home grown forages
  - Quantity
  - Quality

- ✓ Corn silage is the King of forages, but other forages can work as well when feeding lactating cows.
  - Alfalfa
  - Forage sorghum
  - Orchardgrass, fescue, and other cool season grasses
  - Bermudagrass
  - Winter annuals
  - Summer annuals
  - Etc.

Effect of increasing proportion of ryegrass silage

	Proportion of RG:CS					
	25:75	50:50	75:25	100:0	SE	*P*
DMI, lb/d	48.7	47.8	47.8	45.6	0.7	0.05
Milk, lb/d	69.7	67.9	71.2	66.8	1.8	0.21
Fat, %	3.90	3.63	3.91	4.01	0.14	0.30
Protein, %	3.00	2.92	2.85	2.85	0.03	0.01
ECM, lb/d	72.1	66.8	71.9	69.9	3.1	0.46
Efficiency	1.46	1.39	1.51	1.51	0.06	0.46

Bernard et al., 2009. J. Dairy Sci. 92:1117-1123.

Alfalfa or Tifton 85 Bermudagrass with or without enzyme treatment

Forage	Alfalfa		Tifton 85		
Enzyme	0	+	0	+	SE
DMI, lb/d	53.5	53.3	54.8	54.2	0.7
Milk, lb/d	91.1	89.1	92.8	91.7	2.0
Fat, %	3.76	3.70	3.63	3.68	0.12
Protein, %	2.81	2.81	2.75	2.81	0.03
ECM, lb/d	91.6	88.9	91.4	91.3	2.4
Efficiency	1.71	1.67	1.67	1.68	0.05

Alfalfa and Tifton 85 bermudagrass provided 12% of dietary DM.
Bernard et al. 2010. J. Dairy Sci. 93 :5280–5285


Brachytic dwarf forage sorghum

Production response of lactating cows to diets based on corn (CS) or forage (FS) sorghum harvested in the summer (S) or fall (F) – Year 2

	CSS	CSF	FSS	FSF	SE	P
DMI, kg/d	55.1	49.6	51.6	51.1	2.2	0.30
Milk, kg/d	78.5	76.1	74.5	78.7	2.4	0.56
Fat, %	3.61[d]	3.26[c]	3.70[d]	3.67[d]	0.12	0.06
Protein, %	2.55	2.62	2.57	2.63	0.03	0.13
Lactose, %	4.68	4.67	4.74	4.72	0.02	0.14
SNF, %	8.07	8.09	8.13	8.15	0.04	0.68
ECM, kg/d	75.0	78.0	72.1	80.0	2.2	0.15
Efficiency	1.37	1.48	1.46	1.48	0.04	0.26
MUN, mg/dl	8.21[a]	8.84[a]	11.53[b]	11.44[b]	0.31	<0.0001

[ab]Means with unlike superscripts in the same row differ ($P < 0.01$)

[cd]Means with unlike superscripts in the same row differ ($P < 0.01$)

BMR sorghum-sudangrass compared with corn silage

	35SS	45SS	35CS	45CS	SE
DMI, lb/d	44.3^{b}	38.8^{c}	51.6^{a}	51.2^{a}	1.3
Milk, lb/d	69.0^{ab}	63.7^{b}	72.1^{a}	68.1^{ab}	2.0
Fat, %	3.43	3.43	3.15	3.15	0.11
Fat, lb/d	2.29	2.16	2.21	2.15	0.11
Protein, %	2.95^{a}	2.81^{b}	3.00^{a}	3.00^{a}	0.03
Protein, lb/d	1.94^{b}	1.74^{c}	2.14^{a}	1.98^{ab}	0.04
MUN, mg/dl	11.96^{ab}	12.81^{a}	10.59^{b}	9.53^{b}	0.50
FCM, lb/d	67.0	62.6	67.0	64.2	2.4
Efficiency	1.52^{a}	1.62^{a}	1.32^{b}	1.26^{b}	0.05

^{ab}Means in the same row with different superscripts differ ($P < 0.05$).

Dann et al., 2008. J. Dairy Sci. 91:663-672.


Different forage programs can be used successfully to support profitable milk yield when managed properly!

Forage Quality

- ✓ **Increasing NDF digestibility reduces fill and increases passage rates that allows higher dry matter intake.**

- ✓ **1 unit increase in NDF digestibility**
  - **0.37 lbs DMI**
  - **0.50 lbs milk yield**
  - **0.55 lbs 4% FCM**

Oba and Allen. 1999. JDS 82:589-596

Forage Quality

	High	Low
Forage NDFd, %	62.9	54.5
DMI, kg/d	51.1	48.1
Milk, kg/d	70.1	65.9
Fat, %	3.43	3.38
Efficiency	1.37	1.35
IOFC, $/d	2.30	2.08

Equals $8,030 extra for a 100 cow herd each year!

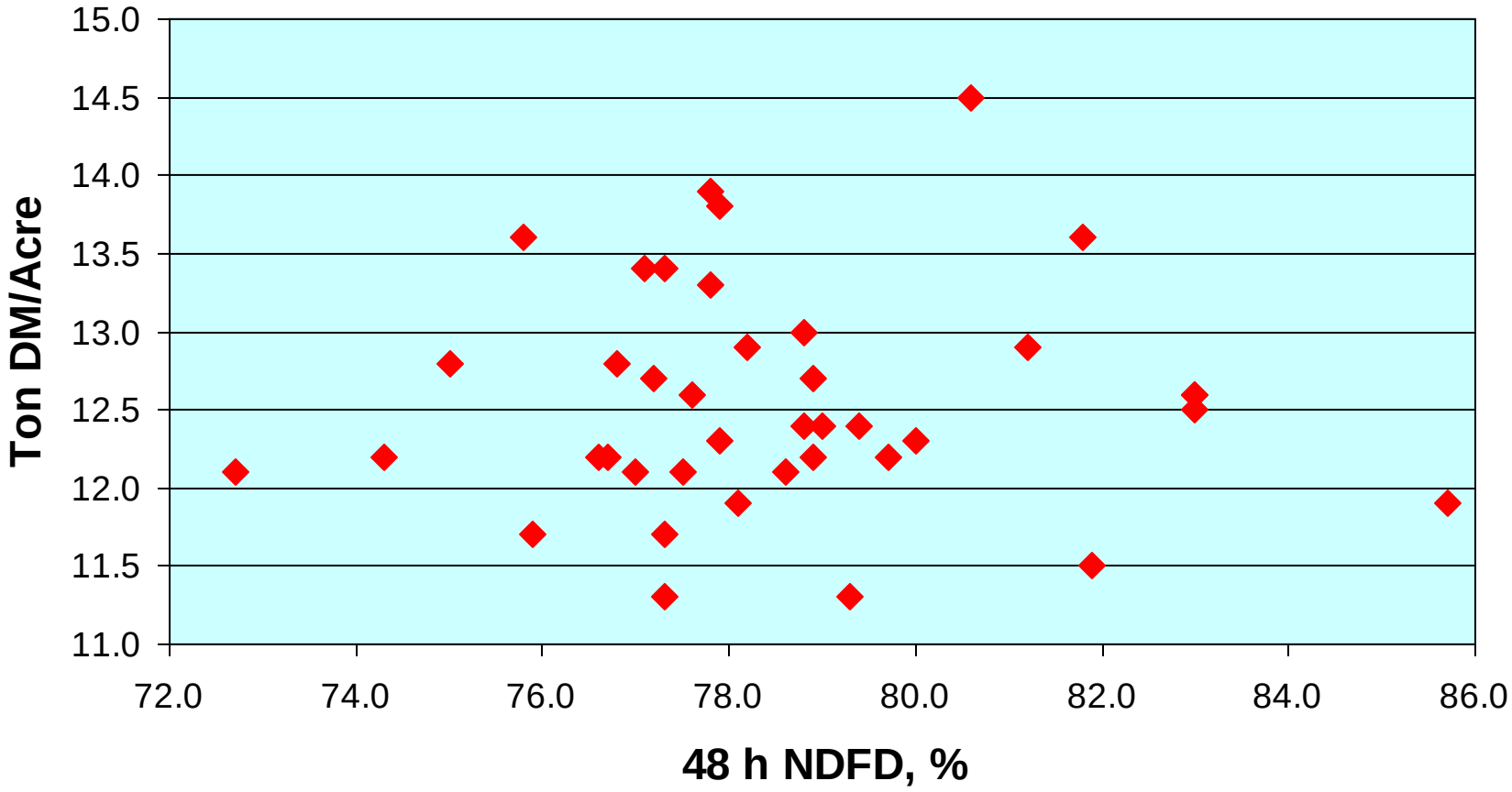
Oba and Allen. 1999. J. Dairy Sci. 5889-596.

Factors that affect forage yield and quality and resulting animal performance

- ~~Soil type~~
- Fertility
- Hybrid/variety/cultivar
- ~~Weather~~
- Irrigation
- Disease and pest control
- Timeliness of harvest
- Chop length and processing
- Proper storage
- Silo management during feedout
- Other

How do we influence forage quality?

Select varieties/hybrids shown to produce high quality forage



Georgia 2015 Corn Performance Test

How do we influence forage quality?

- ✓ Use good agronomic practices
  - Fertility management
    - Soil pH
    - Fertilization
  - Weed control
  - Pest and disease management
  - Timely irrigation

Harvest at the optimum stage of maturity

- ✓ Yield and nutrient content changes with advancing maturity
  - DM yield increases
  - CP decreases
  - Fiber (NDF) increases
  - Fiber digestibility (energy) decreases

- ✓ Harvest at stage of maturity that provides nutrients needed for the production level you expect from your cattle.

Total Dry Matter Yield

	Barley	Oats	Rye	Wheat
	---------- Ton/acre ----------			
Vegetative	1.30	1.12	1.02	1.41
Boot	3.06	1.92	2.32	2.96
Heading	4.42	2.75	3.59	3.42
Milk	4.77	3.34	3.61	4.48
Soft Dough	5.10	3.90	3.79	4.61
Hard Dough	5.64	3.42	3.91	4.58

Adapted from Edmisten. 1985. NCSU MS Thesis.
Multiple cuttings were made from vegetative through heading.

In Vitro Dry Matter Digestibility

	Barley	Oats	Rye	Wheat
	---------- % ----------			
Vegetative	80.80	83.35	79.40	80.20
Boot	77.75	80.30	77.35	75.50
Heading	72.70	71.55	63.15	69.85
Milk	63.70	63.60	53.60	62.50
Soft Dough	62.55	54.30	53.15	59.15
Hard Dough	60.75	51.50	46.40	51.65

Adapted from Edmisten. 1985. NCSU MS Thesis.

IVDMD Yield

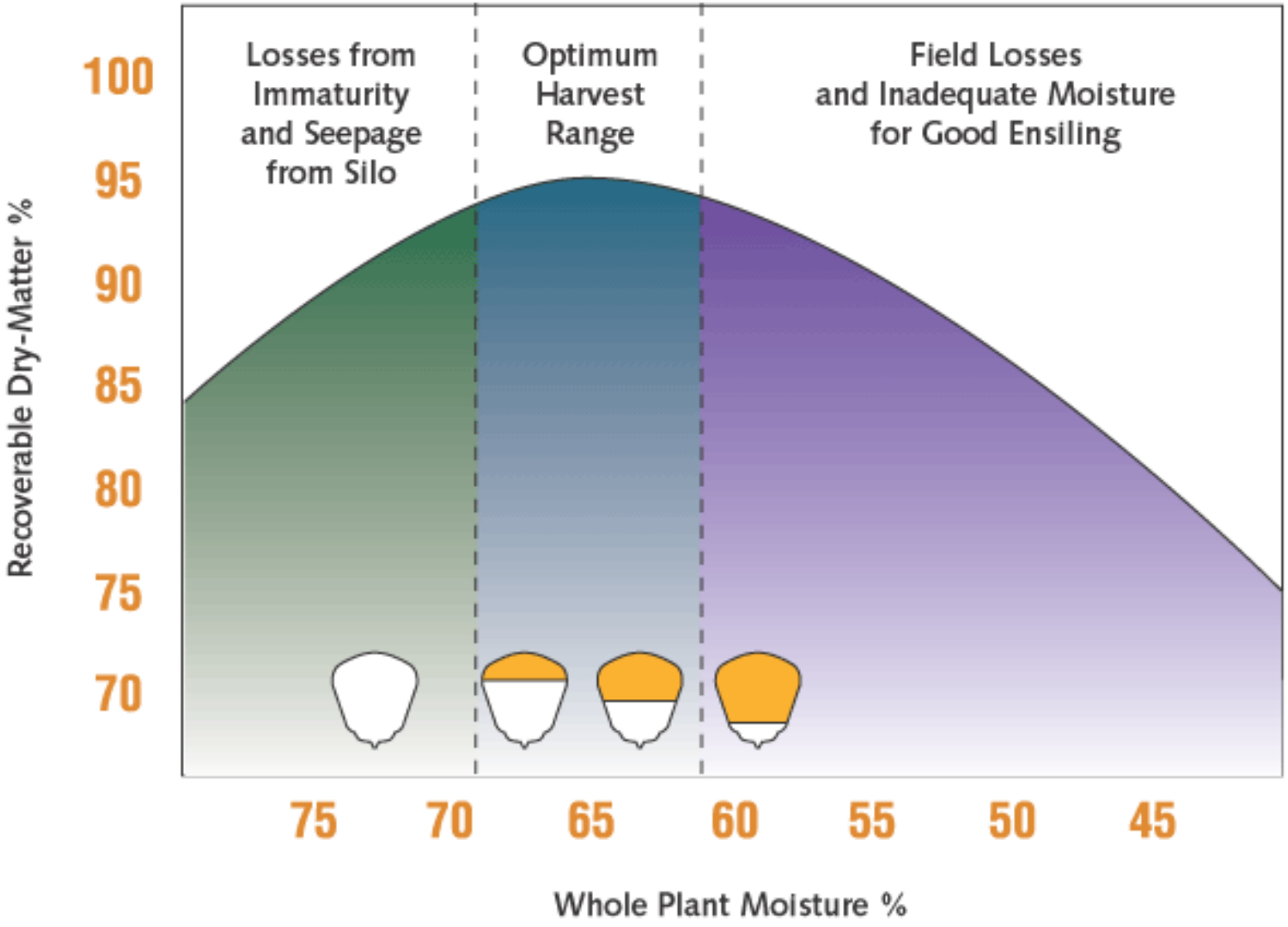
	Barley	Oats	Rye	Wheat
	---------- Ton/acre ----------			
Vegetative	1.1	0.9	0.8	1.1
Boot	2.4	1.5	1.8	2.2
Heading	3.2	2.0	2.3	2.4
Milk	3.0	2.1	1.9	2.8
Soft Dough	3.2	2.1	2.0	2.7
Hard Dough	3.4	1.8	1.8	2.4

Adapted from Edmisten. 1985. NCSU MS Thesis.
Multiple cuttings were made from vegetative through heading.

How do we influence forage quality?

- ✓ Use best management practices to preserve nutrients
  - Wilt forages to reduce seepage
  - Chop at recommended length of chop and sharp knives
  - Adequate kernel processing
  - Use a proven inoculate to facility proper fermentation
  - Fill, pack, and seal quickly
  - Store in area that minimized losses

Optimum range is 30 to 40% DM, depending on storage structure



Effect of stage of maturity of wheat silage on milk production

Item	Early	Late	P
NDFD, %	29.4	23.7	
DMI, lb/d	48.3	48.5	NS
Milk, lb/d	79.4	72.3	<0.001
Fat, %	2.45	2.79	<0.001
Protein, %	2.97	2.98	NS

Early = mid-flowering
Late = end of milk stage

Arieli and Adin. 1994. JDS 77:237-243.

Forage quality of ryegrass harvested as silage, baleage, or hay

	Storage Method		
	Silage	**Baleage**	**Hay**
DM, %	**36.2**	**33.5**	**87.5**
	-------- % of DM --------		
CP	**19.2**	**19.8**	**13.1**
NDF	**58.1**	**56.2**	**70.5**
IVDMD	**79.2**	**78.7**	**71.1**
NE_l, Mcal/lb	**0.64**	**0.64**	**0.56**

McCormick et al., 2002

Performance of lactating cows fed annual ryegrass silage, baleage, or hay

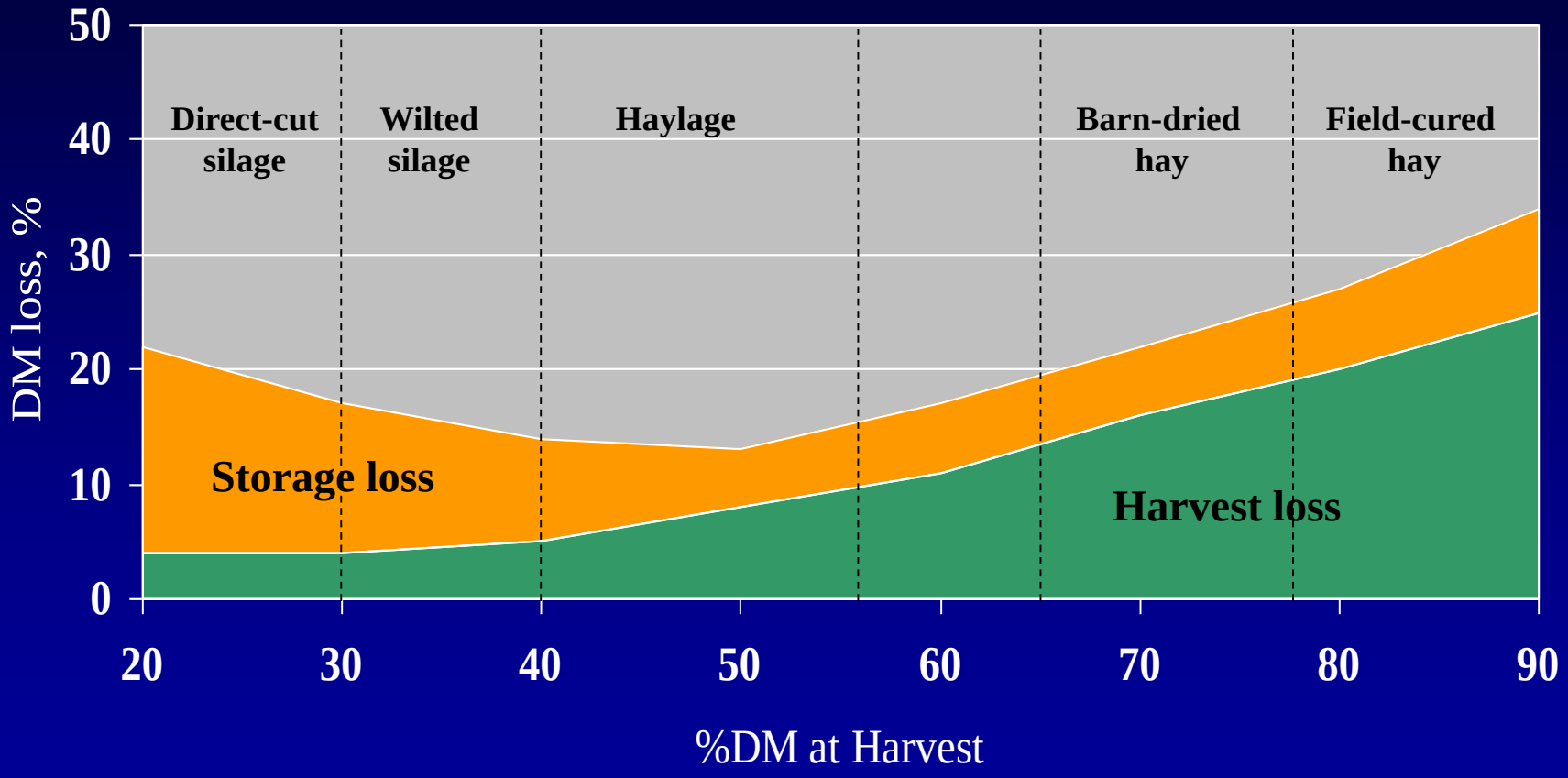
	Storage Method		
	Silage	**Baleage**	**Hay**
DMI, lb/d	**40.1**	**37.5**	**40.6**
3.5% FCM, lb/d	**63.5**	**60.3**	**58.3**
Fat, %	**3.50**	**3.55**	**3.43**
Protein, %	**3.37**	**3.31**	**3.26**

McCormick et al., 2002

Feed Shrinkage

- ✓ Feed shrinkage is a problem on most operations
  - ➢ Harvesting losses

Potential DM loss during harvest and storage



Hoglund, 1964

Note: Losses for hay are based on square bales

DM losses for silage

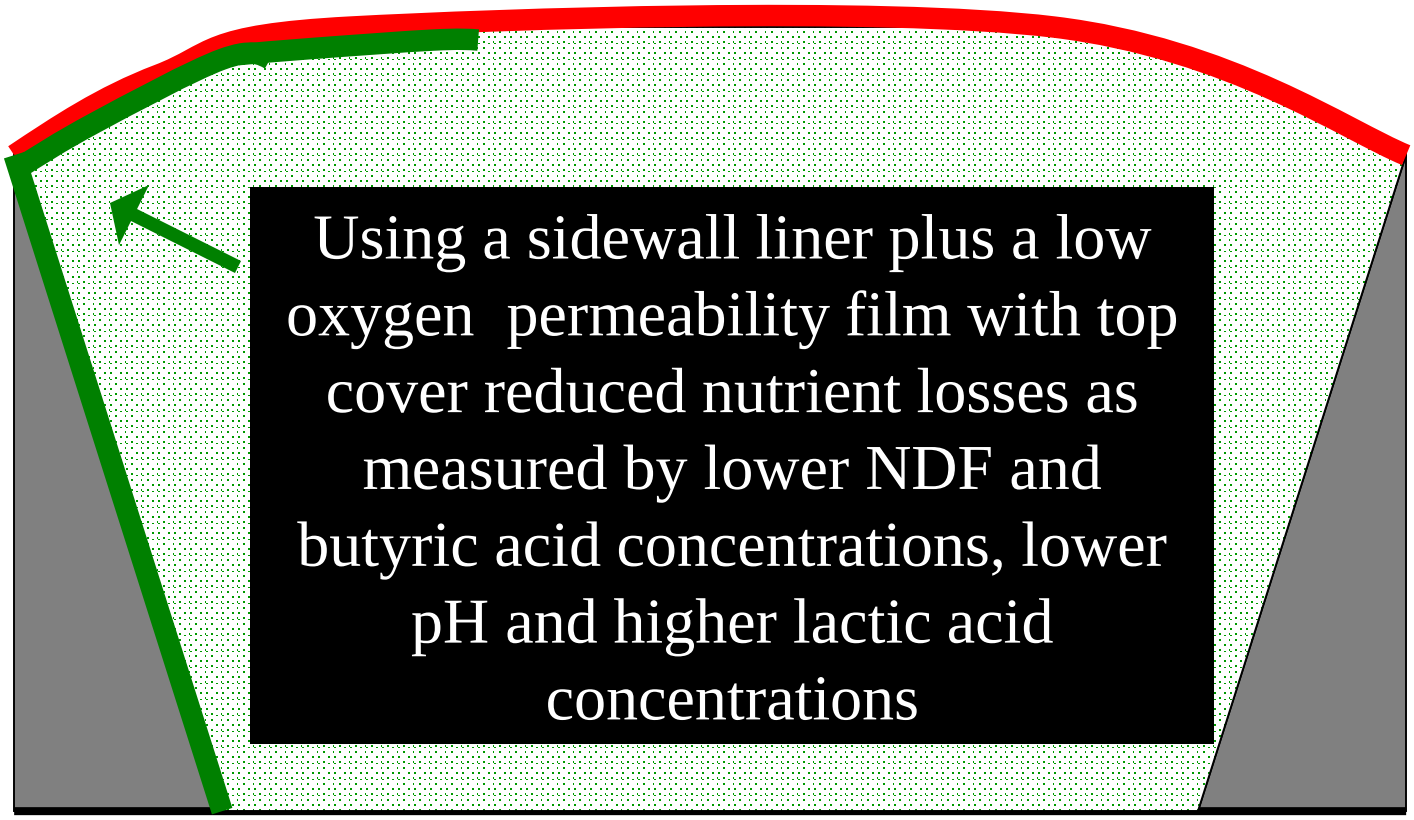
Process	Classification	Loss (%)
Respiration	Unavoidable	1-2
Effuent	**Mutually unavoidable**	**2-7**
Storage aerobic losses	**Avoidable**	**0 - >10**
Fermentation	Unavoidable	2-4
Secondary fermentation	**Avoidable**	**0 - >5**
Feedout aerobic losses	**Avoidable**	**0 - >15**
Total losses		7 - >40

Did your corn silage get processed adequately?

Feed Shrinkage

- ✓ Proper storage and feeding is key to controlling shrinkage!

Sidewall liners in trench or bunker silos



Effect of covering type on silage fermentation

	8[1]		16		24	
Item	A[2]	**B[2]**	A	**B**	A	**B**
DM, %	19.77^{e}	**29.01^{abc}**	23.52^{d}	**29.13^{ab}**	27.80^{bc}	**30.33^{a}**
NDF, %	62.29^{a}	**46.07^{cde}**	54.86^{b}	**46.44^{cd}**	47.87^{c}	**43.00^{e}**
pH	5.20^{a}	**3.97^{bc}**	4.22^{b}	**3.76^{c}**	4.04^{bc}	**3.74^{c}**
Lactic acid, %	0.39^{e}	**1.67^{cd}**	1.09^{d}	**2.21^{abc}**	2.44^{ab}	**2.76^{a}**
Butyric acid, %	0.22^{b}	**0.07^{d}**	0.39^{a}	**0.02^{d}**	0.21^{bc}	**0.08^{d}**

^{abcde}Means in rows with unlike superscripts differ ($P < 0.05$).

[1]Distance from wall, inches

[2]A = 6 mil black/white polyethylene plastic weighted with split-tires; B = Triple co-extruded film (1.77 mm) with low permeability to oxygen, protective tarpaulin, and weighted down with reusable bags filled with pea-gravel. Also included a layer of extruded film along the length of the sidewall prior to filling.

McDonell et al. 2007. JDS 85(Suppl. 1): 180. (Abstr.)

DM Losses and packing density

Density (lb DM/ft^3)	DM loss at 180 days (% of DM ensiled)
10	20.2
14	16.8
16	15.1
18	13.4
22	10.0

Goal > 15 lb DM/ft^3

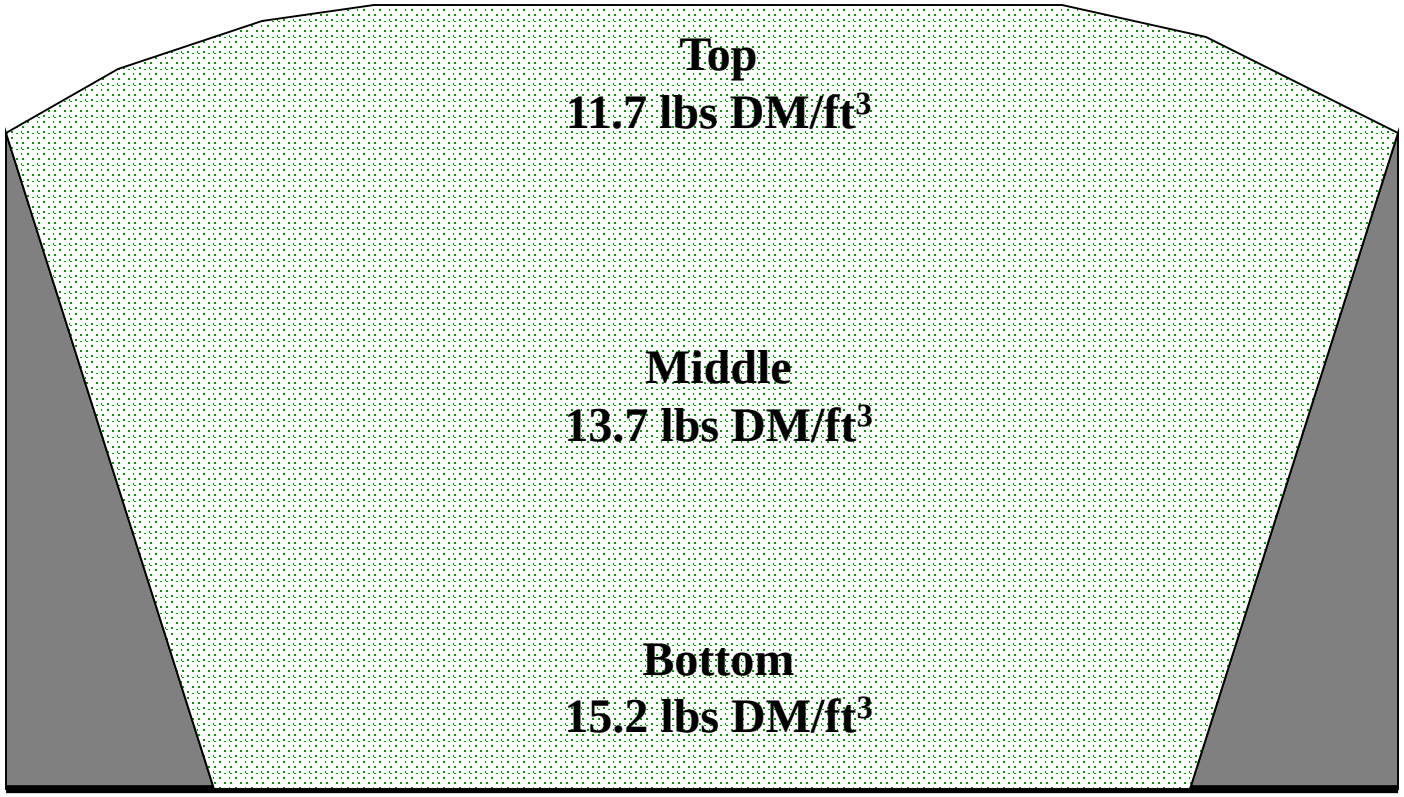
Ruppel et al. 1995.

Average packing density

Left
13.3 lbs DM/ft^3

Middle
14.3 lbs DM/ft^3

Right
13.0 lbs DM/ft^3



Goal: 15.0 lbs DM/ft^3

Maintaining a firm silo face reduces DM losses

	Days of Exposure		
	1	2	3
	-- % DM Loss --		
Firm	1.5	3.0	3.5
Loose	0.7	3.0	6.9

Are these losses acceptable??

Limited cost required to significantly reduce losses!

Cost of DM losses

	% Dry Matter Recovery					
$/ton	95	90	85	80	75	70
37.50	39.48	38.89	44.12	46.88	50.00	53.57
40.00	42.11	44.44	47.06	50.00	53.33	57.14
42.50	44.74	47.22	50.00	53.13	56.67	60.71
45.00	47.37	50.00	52.94	56.25	60.00	64.29
47.50	50.00	52.78	55.88	59.38	63.33	67.86
50.00	52.63	55.56	58.82	62.5	66.67	71.43

Calculated as $/ton ÷ % DM recovery

Feeding Program

- ✓ Operating equipment properly
  - Order ingredients are added to mixer
  - Dump or shake?
  - Adequate mixing time
  - Mixer maintenance

- ✓ Feeding management
  - Discard spoiled forage
  - Measure DM content of feeds and adjust rations as needed
  - Record amounts fed and refused
  - Calculate feed efficiency

Feeding spoiled silage

	% of spoiled layer silage in ration			
	0	5.4	10.7	16.0
DMI, lb/d	17.5[a]	16.2[b]	15.3[b,c]	14.7[c]
	---------- Digestibility, % ----------			
OM	75.6[a]	70.6[b]	69.0[b]	67.8[b]
CP	74.6[a]	70.5[b]	68.0[b]	62.8[c]
NDF	63.2[a]	56.0[b]	52.5[b]	52.3[b]
ADF	56.1[a]	46.2[b]	41.3[b]	40.5[b]

[a,b,c]Means differ ($P < 0.05$)

Whitlock, et al., 2000.

Dairy Efficiency

- ✓ Simplest form of measurement
  - Efficiency = Milk yield / Dry matter intake (DMI)

- ✓ Easy to measure on farm
  - Milk shipped / no of cows milked
  - (Amount of feed offered – refused) x % DM

How much is 1 unit of efficiency worth?

Assumptions:

- 100 cow herd
- 75 lb/d ECM
- Feed = $0.13/ lb DM

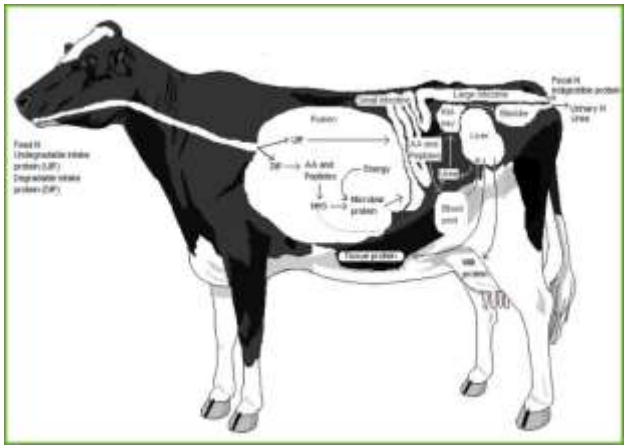
	Efficiency		
	1.4	1.5	1.6
DMI, lb/d	53.6	50.0	46.9
Feed cost, $/d	6.97	6.50	6.10
Savings/loss			
$/d	**-47**	-	40
$/year	**-17,155**	-	14,600

Factors that influence efficiency

- ✓ Genetic
- ✓ Age
- ✓ Maintenance requirements
- ✓ Health (disease, lameness, etc.)
- ✓ Stage of lactation
- ✓ Production level and composition
- ✓ Cow comfort
- ✓ Environment
- ✓ Forage quality
- ✓ Nutrient balance of diet

Ruminal Fermentation

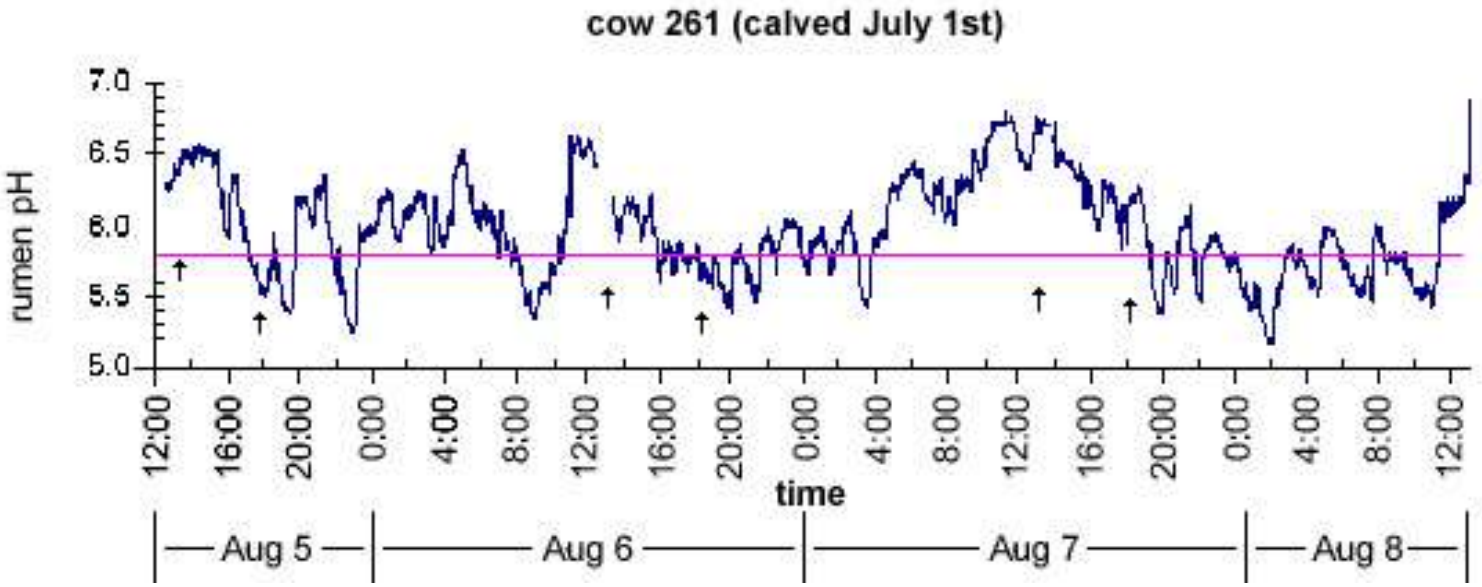
- ✓ Optimizing ruminal fermentation will improve efficiency
  - Maintain desirable pH of 6.0 to 6.4
  - Reduce methane production
  - Improve DM – NDF digestion
  - Improve conversion of dietary N to milk protein (or muscle)
  - Reduce metabolic losses



Sub-Acute Ruminal acidosis (SARA)

Ruminal pH drops below 5.5 – 5.6 for extended periods

- Rapidly fermentable carbohydrates or highly digestible forage without adequate fiber causes an accumulation of VFA in rumen
- Depresses activity of micro-organisms, especially fibrolytic
- Reduced rumination and DMI



Factors Affecting Herd Performance

- 47 herds in Spain fed the same TMR
  - Cows had similar genetics
  - Average milk yield was 64.6 lb/d with a range of 45.4 to 74.5 lb/d (29.1 lb/d difference)
  - Amount of feed offered ranged from 35.7 to 54.7 lb DM/d (19 lb DM/d difference)
- Non-dietary factors accounted for more than 50% of the difference in milk yield among herds
  - Age at first calving (negatively)
  - Feeding for refusals (positive)
  - Pushing up feed (positive)
  - Free stall maintenance (positive)

Bach et al. 2008. J. Dairy Sci. 91:3259-3267.

Summary

- ✓ Evaluate your feeding (forage) program to identify are opportunities for improvements
  - Calculate the cost of producing forages
  - Compared actual forage quality with desired

Summary

- ✓ Measure feed shrinkage (and spoilage) and feed efficiency
  - Identify areas that can be improved
  - Work with employees so they understand the importance of measuring shrinkage and feed efficiency and how they can help improve values
  - Work to remove barriers that increase shrinkage or decrease feed efficiency

Questions


DAIRY RESEARCH CENTER
UGA-TIFTON CAMPUS


DAIRY RESEARCH CENTER
UGA-TIFTON CAMPUS