



Effective Fiber Is Essential For Reducing Rumen Acidosis

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Forages in Dairy Cattle Rations

- Higher levels of forages will be fed (60 to 70% of the total ration dry matter)
- Economics of quality forage can save 20 to 40 cents per cow per day
- High dry matter intakes depress rumen pH
- Rumen digestion is key to amino acid and energy balance
- Forage quality will increase (DDM > 70%)

Step One

**Effective NDF vs
Chemical NDF on Rumen
Function**

Physically effective fiber

- > 5 lb of feed particles over 0.75 inch
- > 550 minutes of chewing / cow / day
- > 60% of cows at rest cud-chewing
- > 50 chews per bolus of feed
- Rumen pH should be over 5.8
- > 2.2 parts acetate : one part propionate (rumen VFA)

Chemical NDF

- **28 to 34% of the total ration dry matter**
- **1.2% of the cow's body weight as total NDF (1300 lb cow x 1.2 = 15.6 lb NDF divided by 30% = 52 lb of dry matter)**

Measuring Effective Fiber

- Cud chewing per lb of DM (Georgia)
- 21% effective forage NDF (Wisconsin)
- 21% peNDF > 0.18 mm (Merten—WI)
- Penn State Particle Box (Penn State)
- USDA / Dairyland Lab / Pioneer corn silage starch availability in corn silage (Wisconsin)
- Calculate the amount of U of IL effective NDF
- Z-Box > 3.18 mm corn silage and TMR; 4.76 mm and haylage (Miner Institute and Japan)

Penn State Separator

	Top	2nd	3rd	Bottom
	>20mm	> 8mm	> 1.18mm	
	-----% (as fed)-----			
TMR	10-15	> 40	< 30	< 20
Haylage	> 40	> 40	<20	< 5
Corn silage	5-15	> 50	< 30	< 5

(3/4 TLC-Process)

Penn State Box Results

Effective NDF = % in top two boxes

Bagged haylage	60%
Unprocessed corn silage	40%
Processed corn silage	70%
Tub ground hay	50%
Chopped straw	66%

Guidelines for U of IL eNDF

- Hay 92 to 95%
- Processed hay (tub ground) 40 to 65%
- Haylage 40 to 80%
- Corn silage 30 to 70%
- By-product feeds
 - Fuzzy cottonseed 75%
 - Beet pulp, brewers 35%
 - Soy hulls, distillers 5%
- Grain
 - Ground corn 5%
 - Cracked corn 30%
 - Pelleted grain 5%

Step Two

**Impact of Forage
Digestibility on Forage
Particle Size and Rumen
Fermentation**

NDF Digestibility Impact

- Invitro lab analysis
 - 24 hour (corn silage)
 - 30 hour (normal rumen retention time)
 - 48 hour (maximum digestibility)
- Variation in NDFD values by lab
- RFV of legumes over 180
- > 35% starch in corn silage
 - Impact of processing
 - Impact of 30 or 40% dry matter content

Feeding High Digestible Forage

- If forages are too good, check indigestible NDF levels (40% indig NDF x 50 lb dry matter x 30% NDF = **6 lb** of indigestible NDF) and add a source
- If you are short of chemical fiber, replace starch with NDF by-products (such as soy hulls, beet pulp, etc)
- Lignin requirement (3 to 4% of DM)

Using Wheat Straw

- When physically effective NDF is marginal
- When digestible NDF is over 60% for legumes and grass or corn silage is over 70%
- When fecal scores are low and appear related to a lack of effective fiber
- One lb of straw equals three lb hay
- Milk cow rations:
 - Start with one half pound per cow and monitor cow response
 - Maximum of 2 pound per cow
 - Processing to < 2 inches in length

Step Three

**Impact of Grain Particle Size
on Forage Particle Size and
Rumen Fermentation**

Starch Particle Size and Processing

- Impact of fermentation rate
- Impact of rate of passage
- Dry corn vs. high moisture corn (19 to 30% dry matter) vs. steam flaking
- Corn (flinty vs. floury) vs. barley

Impact of Rumen TNC Degradation Rate

Component	Degradation Rate		
	Slow	Moderate	Fast
Milk (lb)	94.4	95.3	100.4
Milk fat (%)	3.49	3.42	3.37
4% FCM (lb)	86.5	86.2	90.8
Milk protein (%)	2.83	2.86	2.89
MUN (mg/dl)*	16.2	15.4	13.7
DM intake (lb)*	58.3	58.5	57.8

* Data represents part of the

Impact of Rumen TNC Degradation Rate

Component	Degradation Rate		
	Slow	Moderate	Fast
Percent TNC / hr	6.04	6.98	7.94
Rumen pH	6.43	6.30	6.19
Acetate:Propionate	3.12	2.90	2.60
Total VFA ($\mu\text{mol/ml}$)	133.7	134.7	138.0
BUN (mg/dl)	14.6	14.2	12.8
NEFA ($\mu\text{meq/L}$)	128.2	115.8	103.4

Grain Particle Screens



Number 4	> 4500	Whole/coarse
Number 8	> 2200	Cracked corn
Number 16	> 1100	Ground corn
Number 30	> 500	Pig feed
Pan	< 500	Powder

Particle Size Guidelines

Screen Size	#4	#8	#16	#30	Pan
H.M. Corn (>30%)	75	25	0	0	0
H.M. Corn (25-30)	25	50	25	0	0
H.M. Corn (<25%)	0	<10	30	50	<20
Dry corn	0	<10	30	50	<20
Sample Shakeout	1	20	29	44	6

Shelled Corn Energy Values

	<u>Mcal/lb DM</u>
Cracked	0.84
Ground	0.89
High moisture	0.93
Steam flaked	0.93
High lysine	0.94
Finely ground	0.96

Take Home Messages

- Chemical and effective NDF are important
- New methods of measuring effective NDF will be studied
- Forage digestibility will have impact
- Starch form and type can shift effective and chemical NDF needed