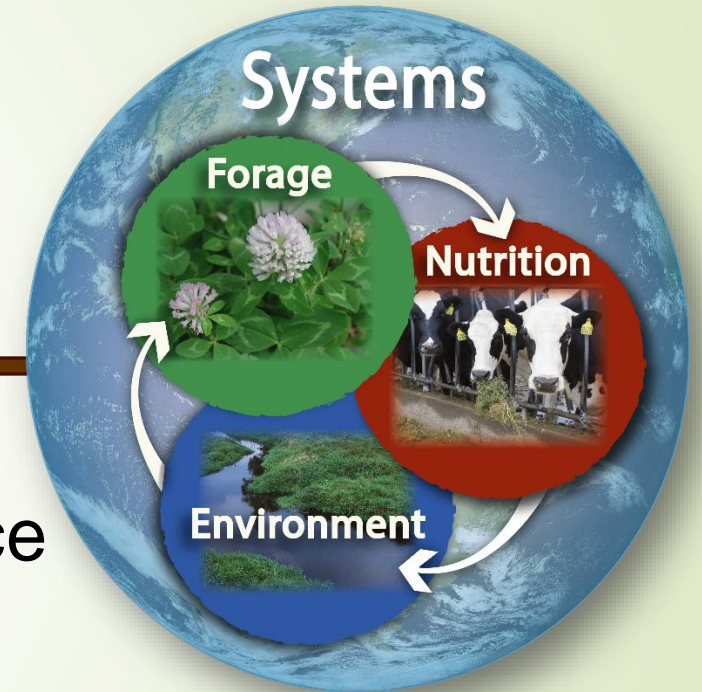


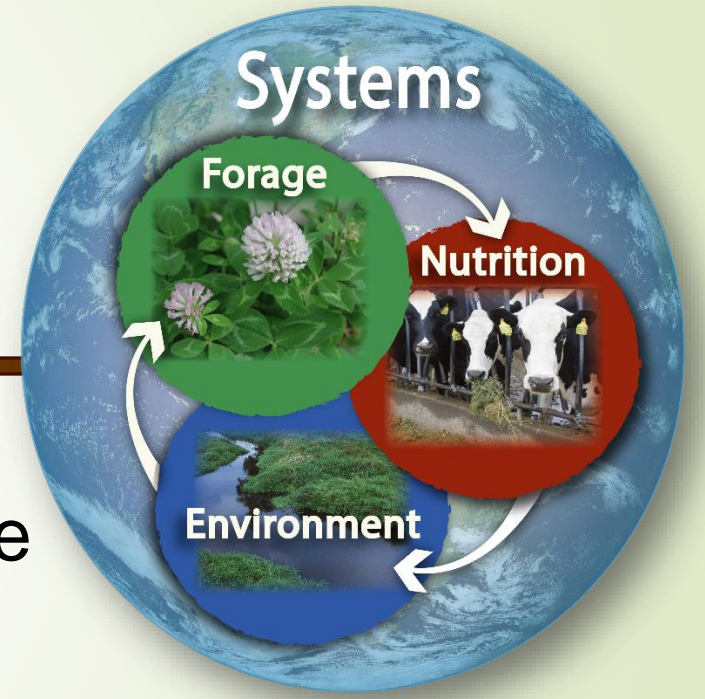
Feeding & Managing the High Performing Rumen

Mary Beth Hall, PhD
 USDA – Agricultural Research Service
 U.S. Dairy Forage Research Center
 Madison, WI

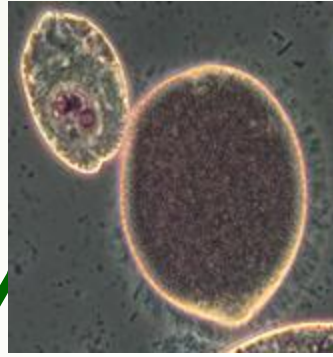


Keeping The Rumen Happy & Healthy

Mary Beth Hall, PhD
 USDA – Agricultural Research Service
 U.S. Dairy Forage Research Center
 Madison, WI



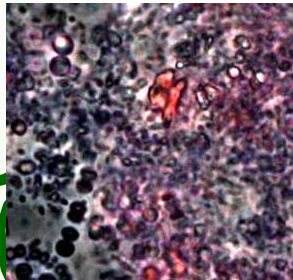
A Matter of Fermentation & The Cow



Gas

Organic acids

Microbes



What Matters In The Rumen

Fermentation

Digestibility of feed drives system.

Good: Digested to produce nutrients to support the cow.

- Even intake
- Not too acid / enough fiber

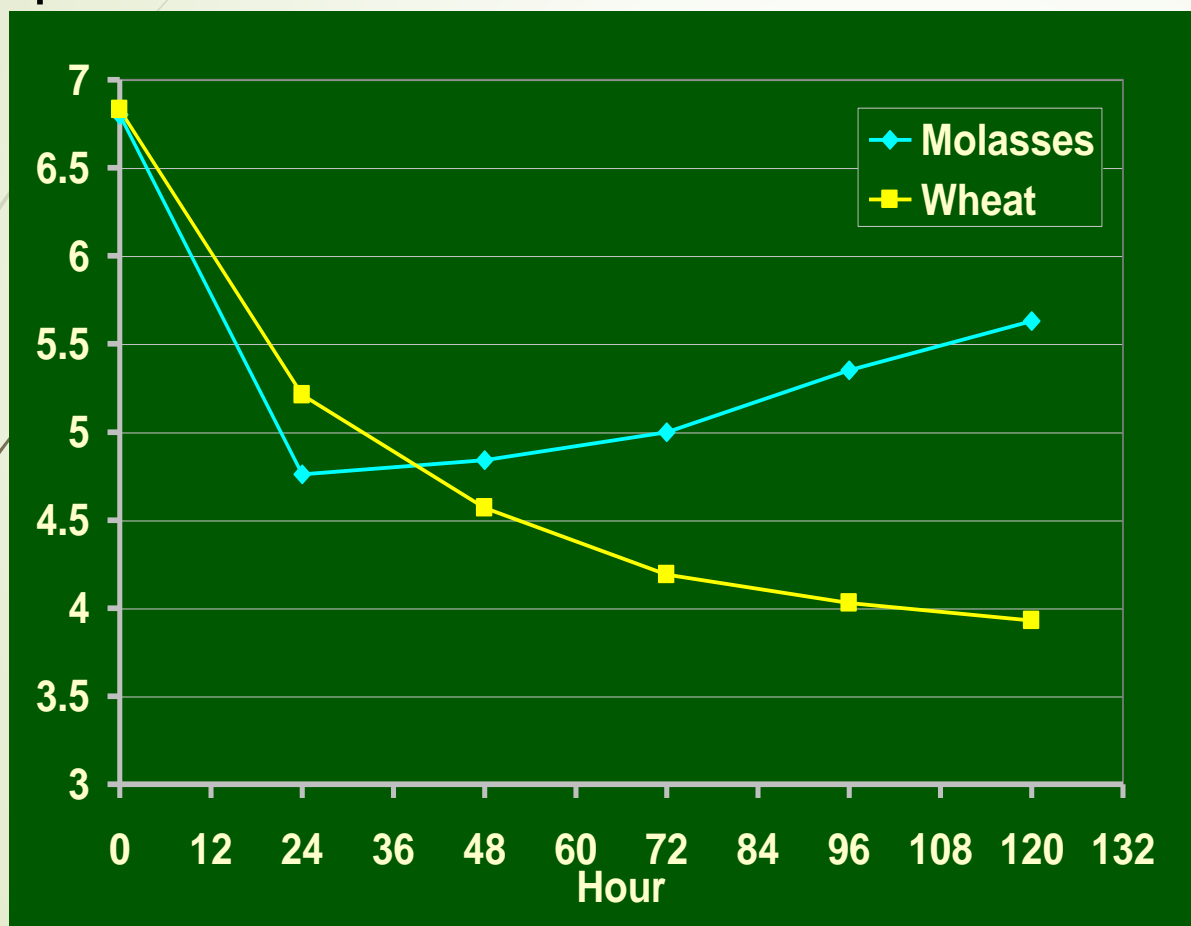
Bad: Too much (?) fermentation/acid

- Low rumen pH
- Depresses fiber digestion
- Makes cows sick: acidosis, laminitis
- A matter of timing?



Rumen Acid: Sources, Management

Rumen pH: dose with crushed wheat or molasses



- ★ We measured intake of a day's ration post-feeding:
 - By 3 hour: 30%
 - By 9 hour: 60%
- ★ Feeding pattern matters: Slug feeding? Sorting?
- ★ How fast is the starch?
- ★ Fiber dilutes the NFC.

Timing and what feed doses the rumen matter for keeping pH in line.

What Matters In The Rumen

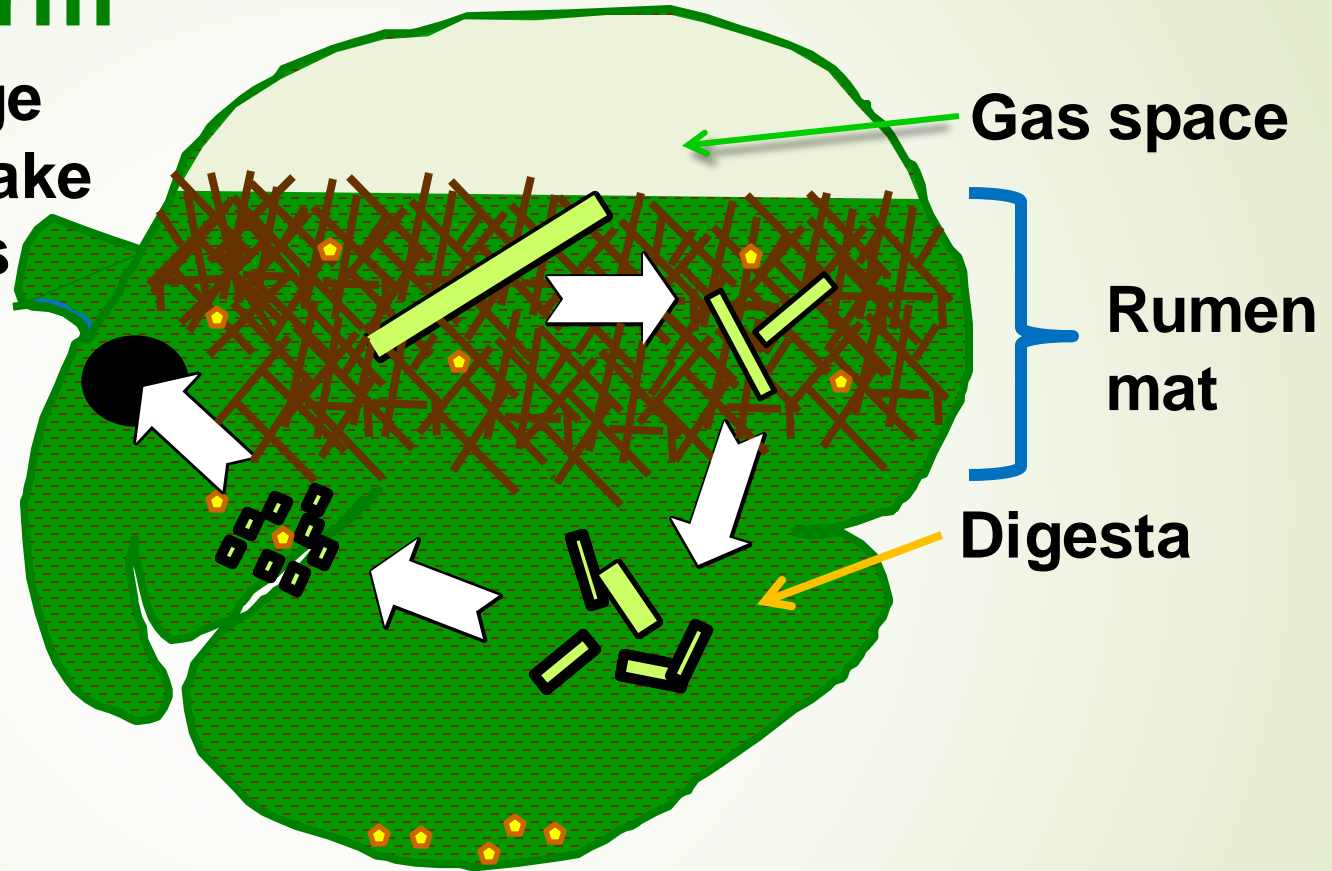
Particle Size

- “Large” particle size encourages rumination and rumen buffering.
- Large particles hold other feeds in the rumen to be fermented, fiber helps particles leave the rumen, too.
- Forage is the main source of large particles / “effective fiber”.



Physical Form

The larger forage particles can make a mat that holds feeds in the rumen.

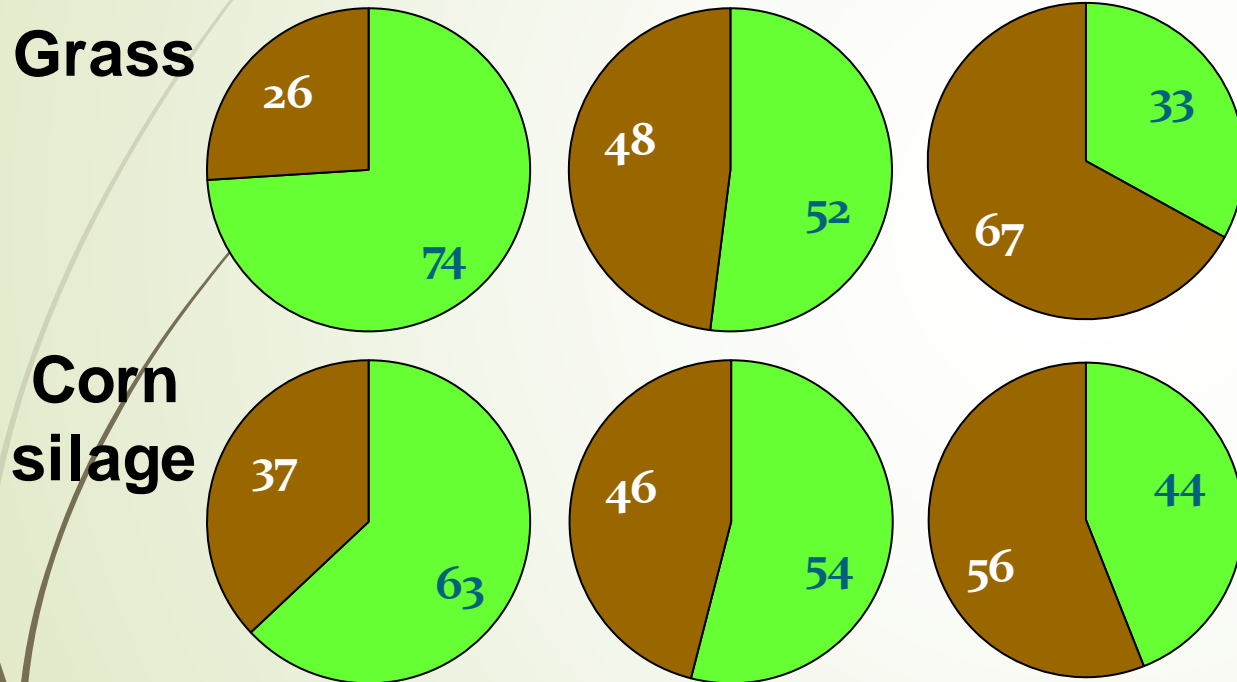


Longer time in the rumen gives more time for rumination and fermentation to digest feeds and break down particles. This affects the size of particles we see in manure. pH?

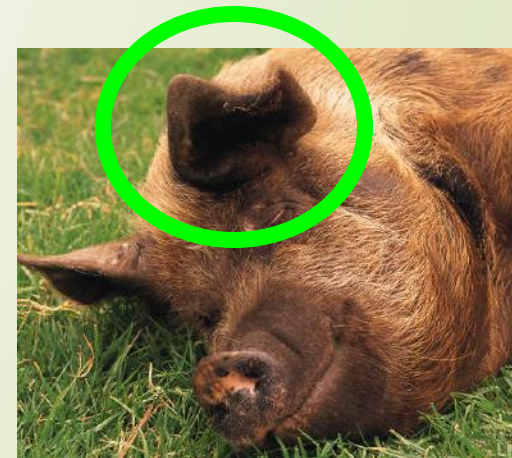
Forage Quality Sets The Limit

30 hour NDF digestibility

■ Digested
■ Undigested



- ✱ If low digestibility, can't feed as much, will limit nutrients to the cow. Rumen effect?
- ✱ You can't feed past wrong quality forage.



Particle Size + Carbohydrates +

Adjustments.

Minimum Forage NDF	Minimum Total NDF	Maximum Starch
19	25	30
18	27	28
17	29	26
16	31	24
15	33	22

What about the other carbohydrates?

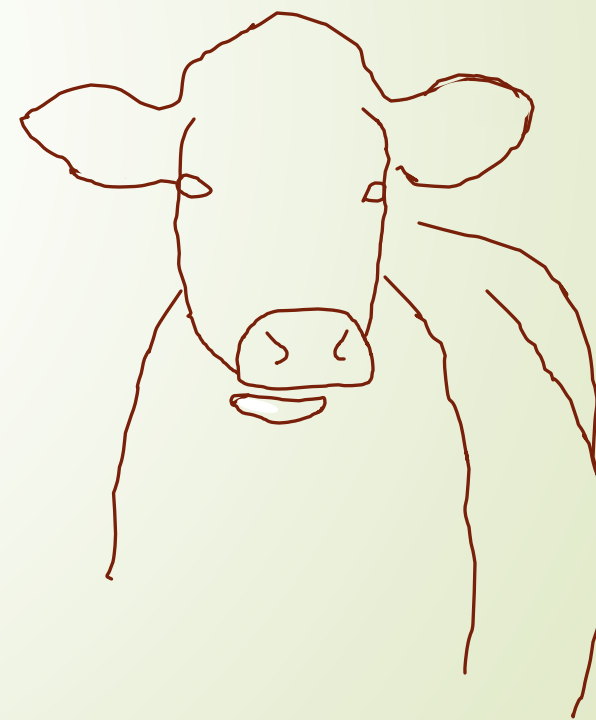
- Optimal diet forage NDF concentration
- 15% <- Higher dry matter intake
- Faster ruminal clearance rate of forage NDF >
- Finely chopped forages >
- Higher diet starch, lower NFE concentrations >
- Higher diet starch degradability >
- <- Supplemental buffers
- Grained separately, infrequently >
- Limited feed bunk space, slug feeding >
- Greater daily variation in diet composition >

Rumen: Still A Lot We Can't Measure...



Courtesy of Ken Nordlund

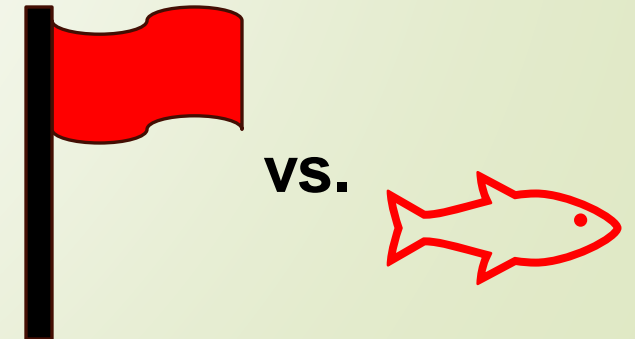
- ☀ Make sure the ration formulation, feed analyses, and mixing numbers and procedures are right....



Go See The Cows



- ★ The cows are the only ones on the farm who are always right.
- ★ See what's going on. Find out if it's what you expect, what you want, if it's fine, or needs change.
- ★ Look at the whole picture.
- ★ Non-invasive.

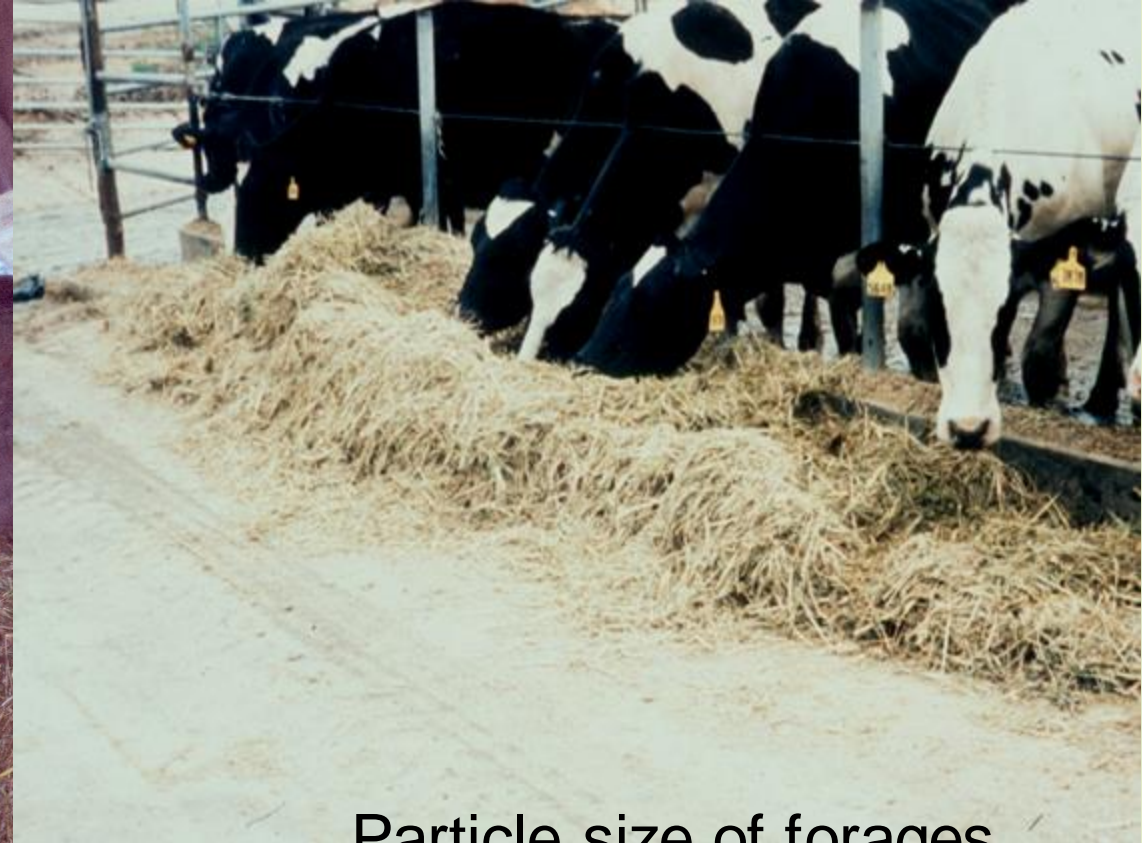
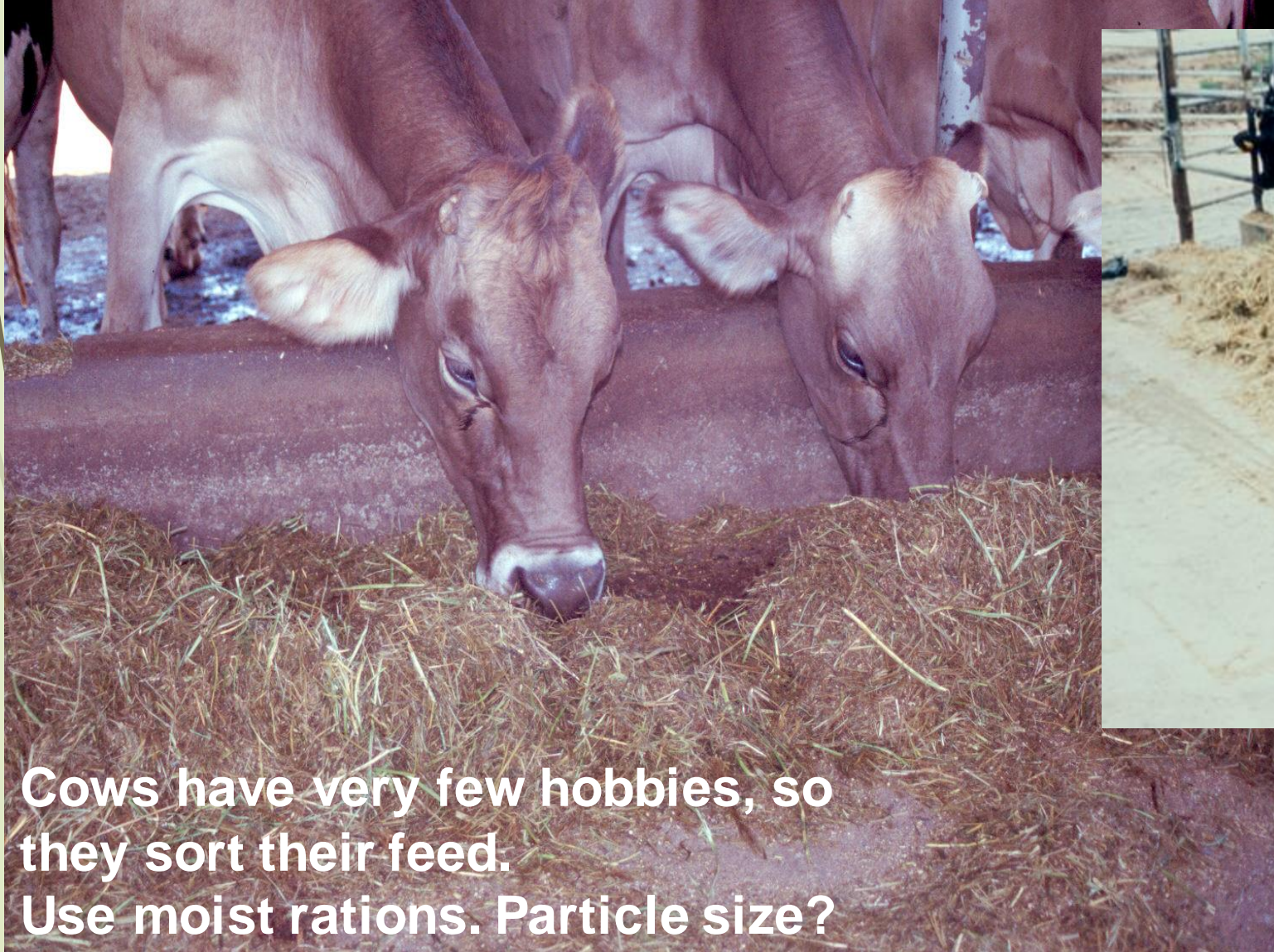


Getting The Whole Picture To Make Sense

- ☀ Cows: BCS, coat, lameness, and more...
- ☀ Feed: Mold/dust, analysis, consistency, mixing, existence....
- ☀ Bunk: Mold, clean, fresh, heating, mixed, weigh back...
- ☀ Water: Clean, fresh, available...
- ☀ Facilities: Comfortable, clean, ventilated, cooled....
- ☀ Employees.....



Walking The Feed Bunk



Particle size of forages matters: too short, not enough rumination, too long, cows sort.

Walking The Feed Bunk



Spoilage

- ☀ Properly mixed?
- ☀ Sorting?
- ☀ Spoilage?
- ☀ Enough bunk space?
- ☀ Slug feeding?

Among The Cows: How They Spend Time



At least 40 - 50% of all cows not sleeping, drinking, or eating should be chewing their cuds.

Manure, ok.

Among The Cows



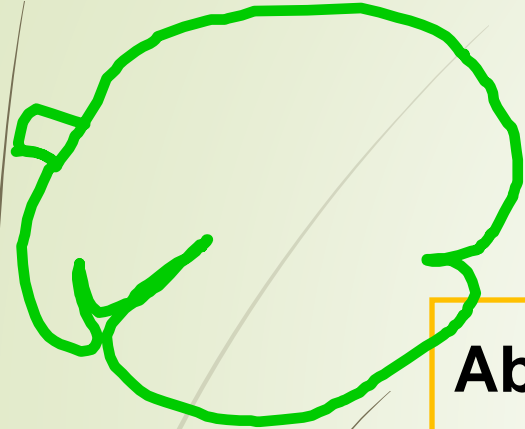
Cows will eat more “dirt”, salt, or bicarbonate when they have digestive upset.

Among The Cows: Manure



In context, manure gives insights into the interaction between the cow and her diet. Qualitative, not quantitative.

Where Feed Ferments Affects Manure



Rumen

Fermentation Products

Hindgut

Organic acids

Absorbed

Absorbed

Microbial protein

Recycled Absorbed

Feces

Gas (CO₂ & methane)

Belch/Bloat

Feces



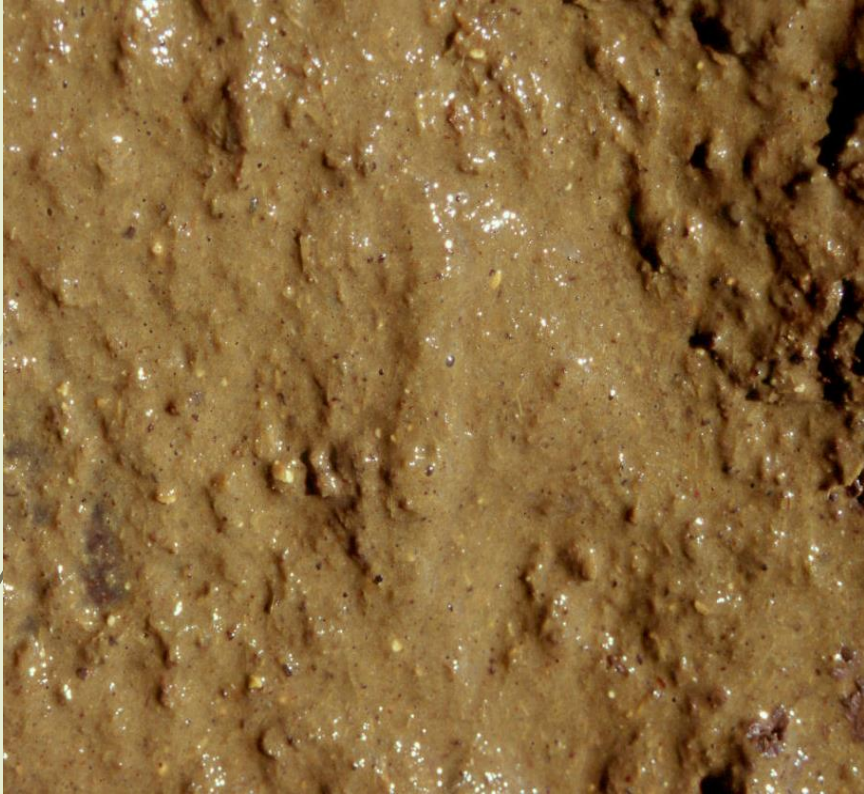
Consistency, The Good Stuff



For lactating cows, soft, but forms up.

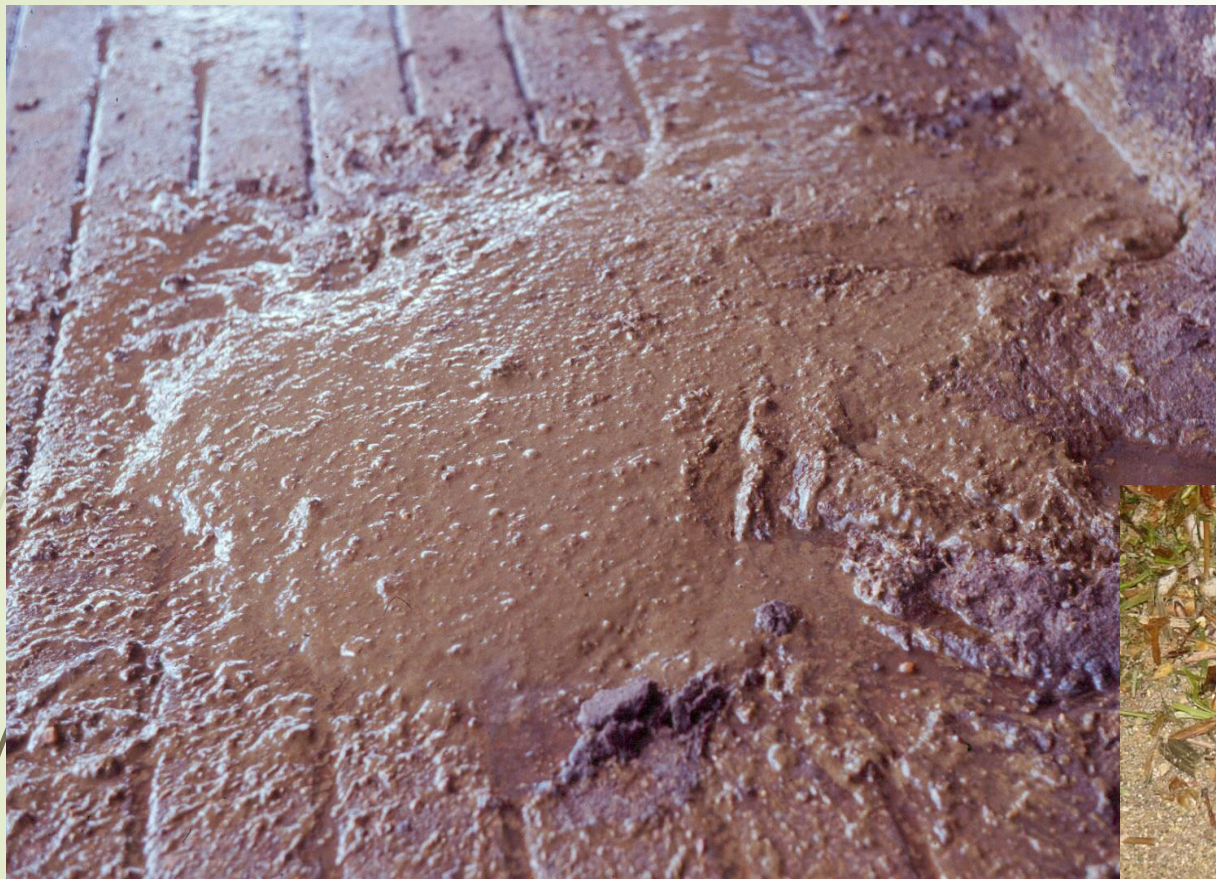
Suggests the rumen is healthy.

Not Normal, Foamy



Excess fermentation in the hindgut created acid & gas. Feed didn't digest in the rumen and small intestine where it should have.

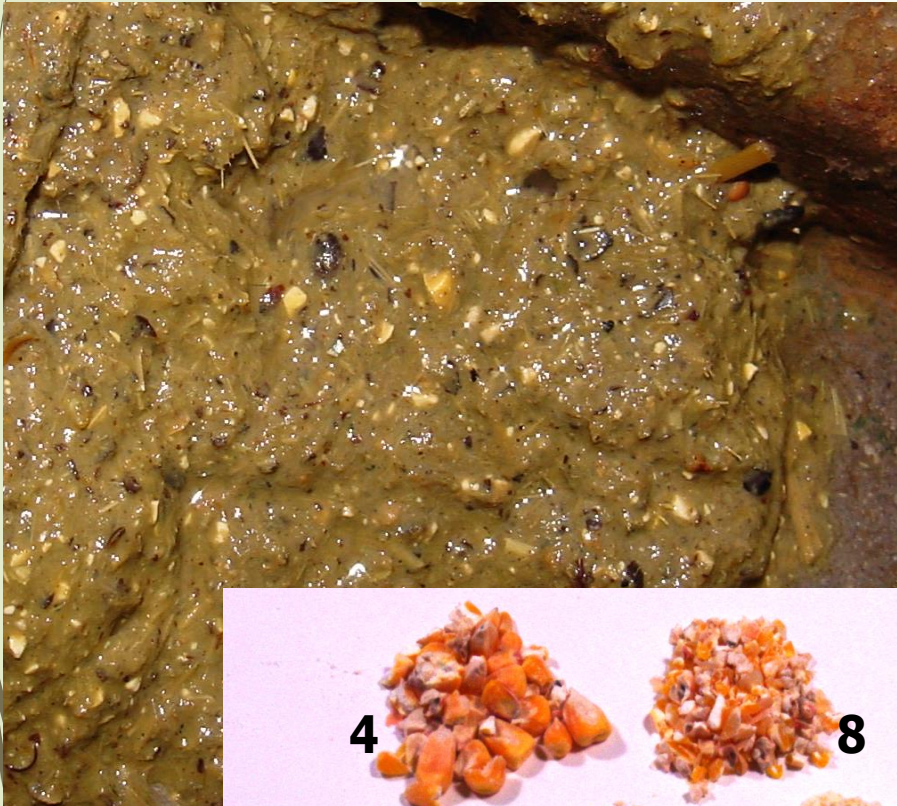
Not Normal, Diarrhea



A sign of ruminal acidosis/digestive upset or eating spoiled feed. Can be caused by disease, as well.



Not Normal, Undigested Feed



Eaten does not mean digested.
 Need a finer grind?
 Is forage feeding / particle size adequate?
 Slug feeding? Sorting?
 Why is it escaping the rumen?

Not Normal, Lots of Variation



Except for maybe 5% of the cows, cows eating the same diet should have similar manure. If not, are they sorting their feed?
Go look.

Not Normal



Pasty

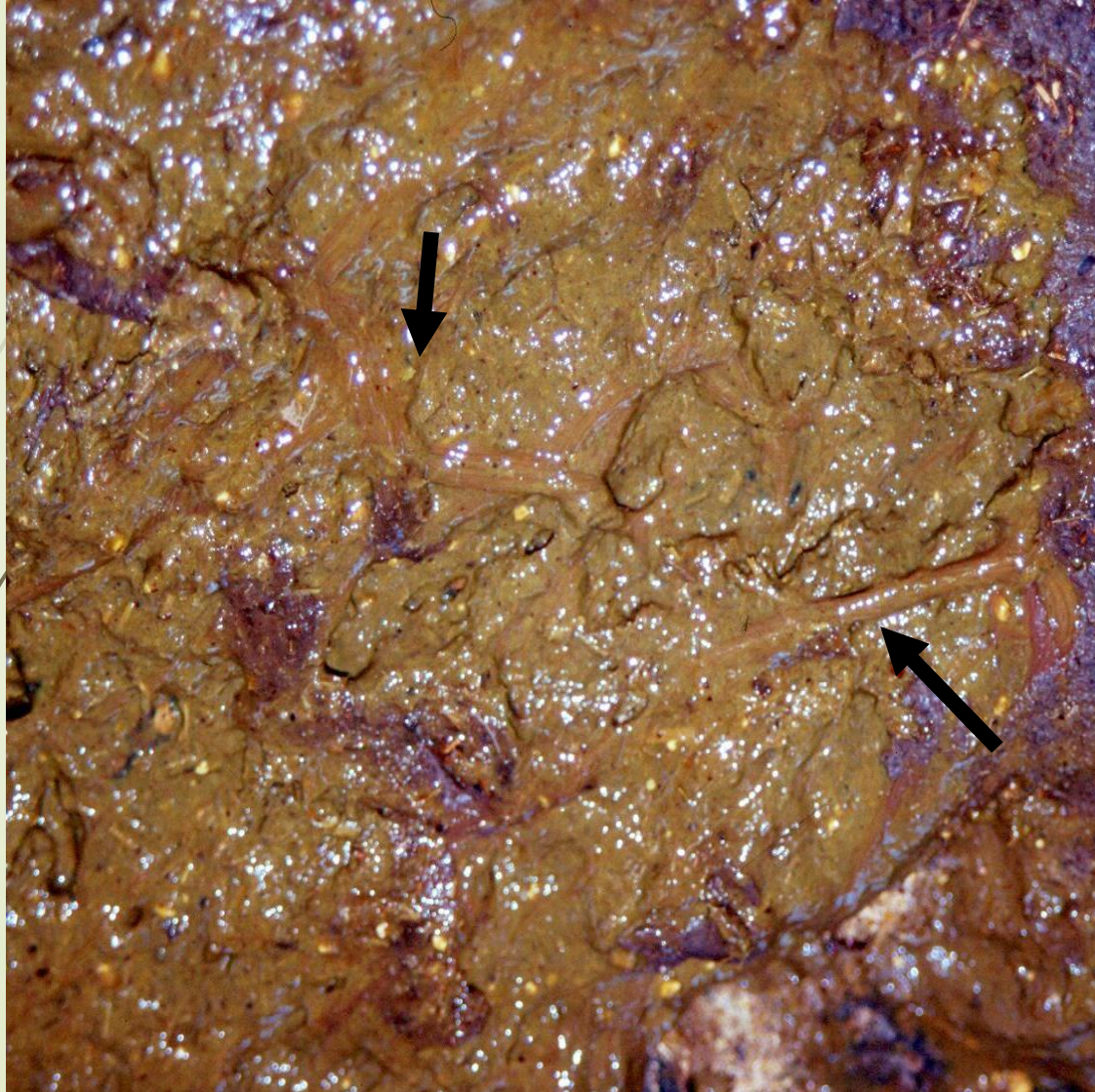


Splattered



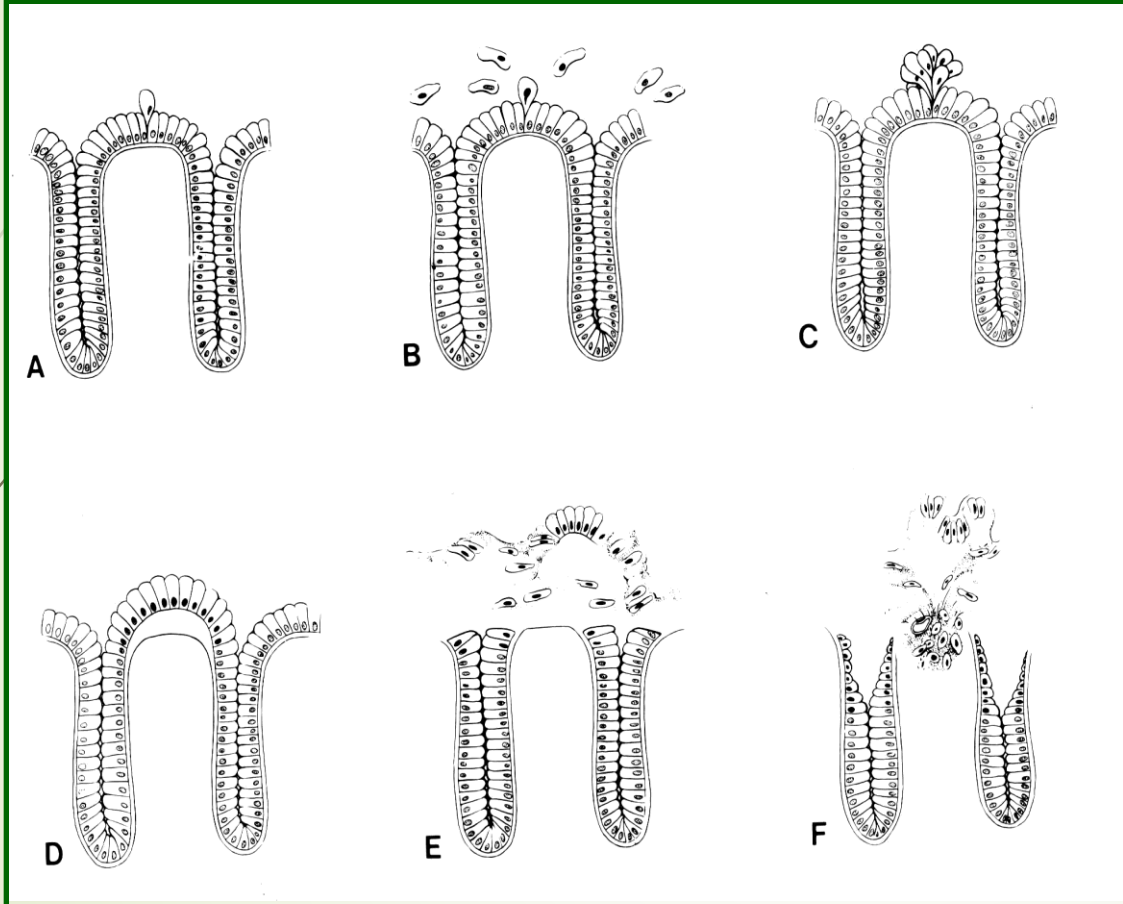
Dry

Not Normal, Mucin Casts



Sign of past damage to the large intestine.
Can be brown, gray, or almost black.

Not Normal, Mucin Casts



Damaging the lining of the large intestine creates mucin casts.

This can happen due to too much fermentation in the hindgut.

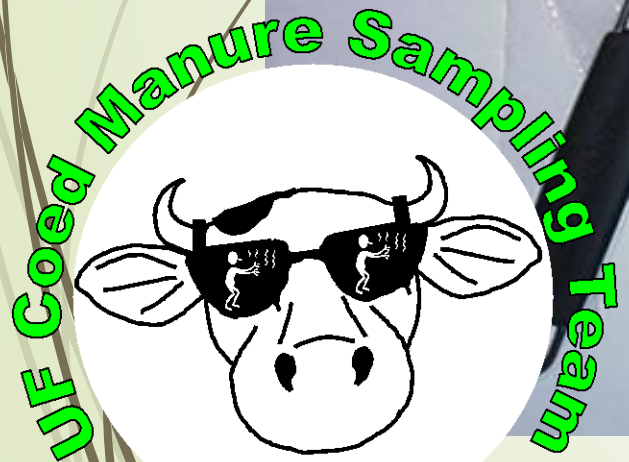
Rumen is better buffered.

Henrikson et al., 1989. Laboratory Investigation 60:72-87

Figure reproduced with permission, ©Nature, <http://www.nature.com/>

Georgia Dairy Conference 1/16/24

1/16 inch (1.6 mm) openings



"We know our stuff."

Georgia Dairy Conference 1/16/24



Manure: Particles



Manure: Fecal Particle Size



**Good ruminal retention
= better digestion,
smaller particles**

**Reduced ruminal
retention = less digestion,
larger particles**

Fecal Particles: Coarse, Undigested Feed



33.5% roughage:
19% corn silage
5.5% ctsd hulls
9% alfalfa hay



Found in a pool of
bubbly diarrhea.

Fecal Particles: Coarse, Undigested Feed



Before corn processors were popular.....
Milk production increased when ground corn was added to the ration.

Among The Cows



Uterine infection or gut irritation?



In Context

- ★ Get an idea of the variation
 - In groups
 - Between groups
 - Between rations

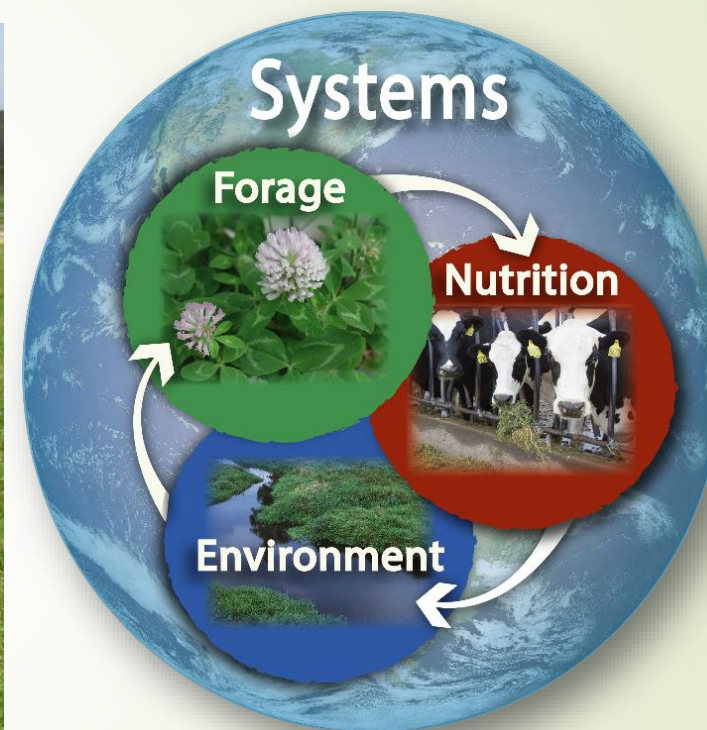
- ★ Manure appearance
- ★ Fecal particle size
- ★ Undigested feed
- ★ % Rumination
- ★ Eating behavior

- ★ Animal health
- ★ Production
- ★ Environment
- ★ Management
- ★

Use these together to build a case as to whether rumen health is being supported.



Questions?



Forage & Nonfiber Carbohydrates

