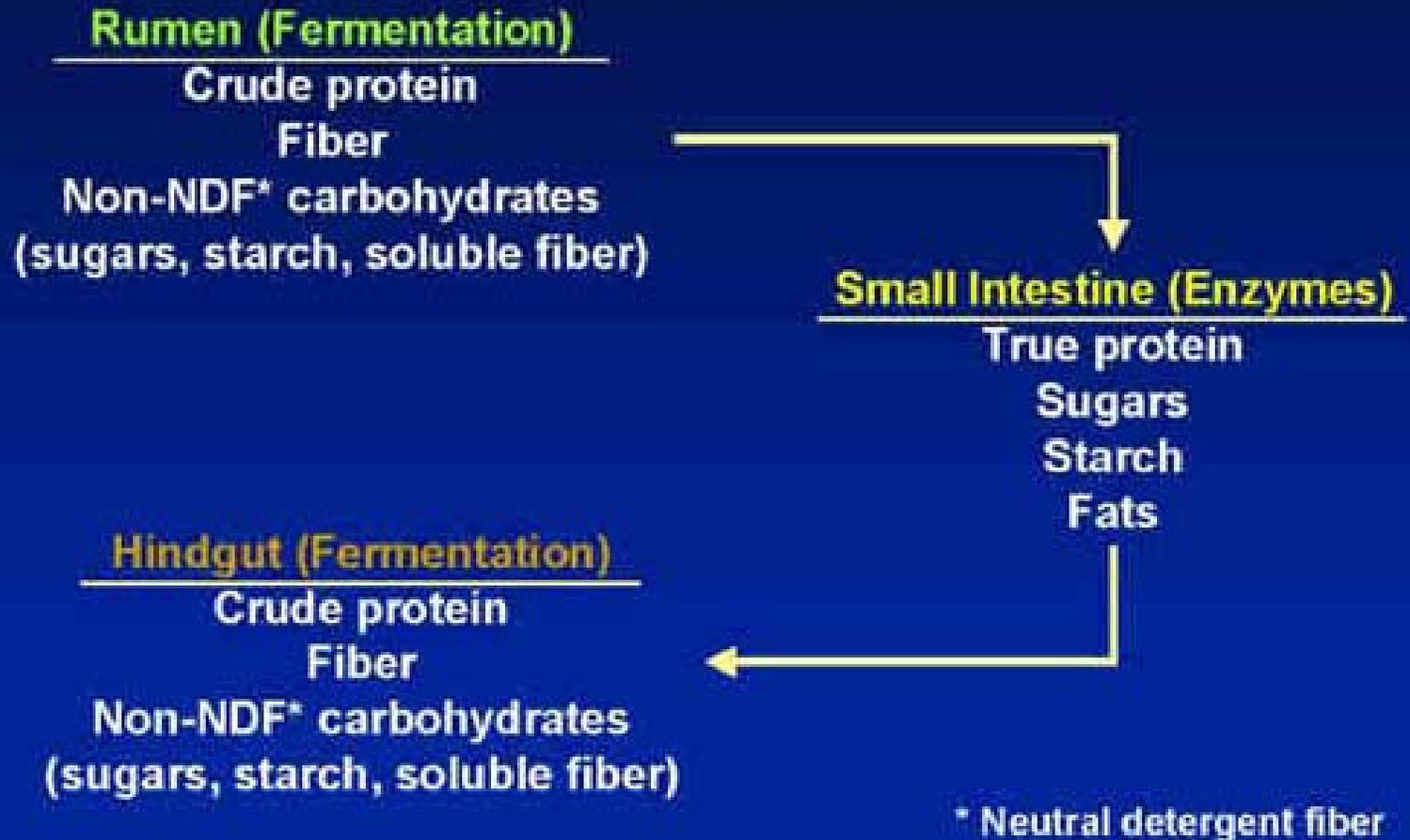


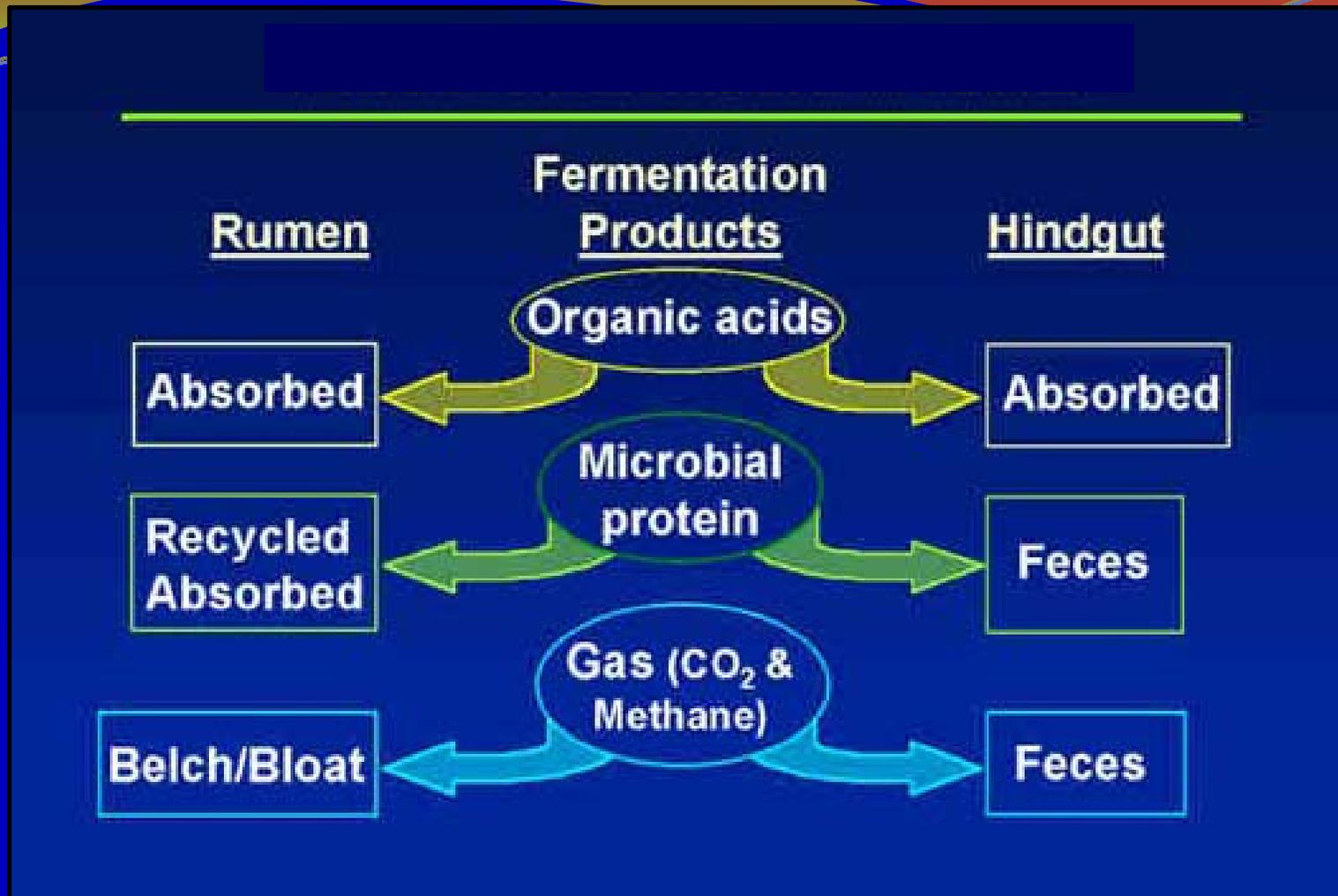


Evaluation of manure can provide information on rumen function and digestion of the ration. By understanding the factors that cause changes in appearance, consistency and particle size, we can interpret what is happening in the gut. In context with other cow observations, manure evaluation can help to diagnose areas for improvement in both ration formulation and management.

Sites of Digestion



Changes in how manure looks can be caused by some diseases, but mostly, it is related to the ration. Where, what, how, and to what extent feed is digested affect manure consistency and appearance. To begin with, different nutrients are digested or fermented in different portions of the gut.



Microbial fermentations in the rumen or hindgut produce the same products. These products influence how manure looks. If a great deal of fermentable material, usually mostly carbohydrate, reaches the hindgut, then...



Diarrhea may occur due to an extensive hindgut fermentation (acid production?).



Manure may be very bubbly or foamy (gas production).

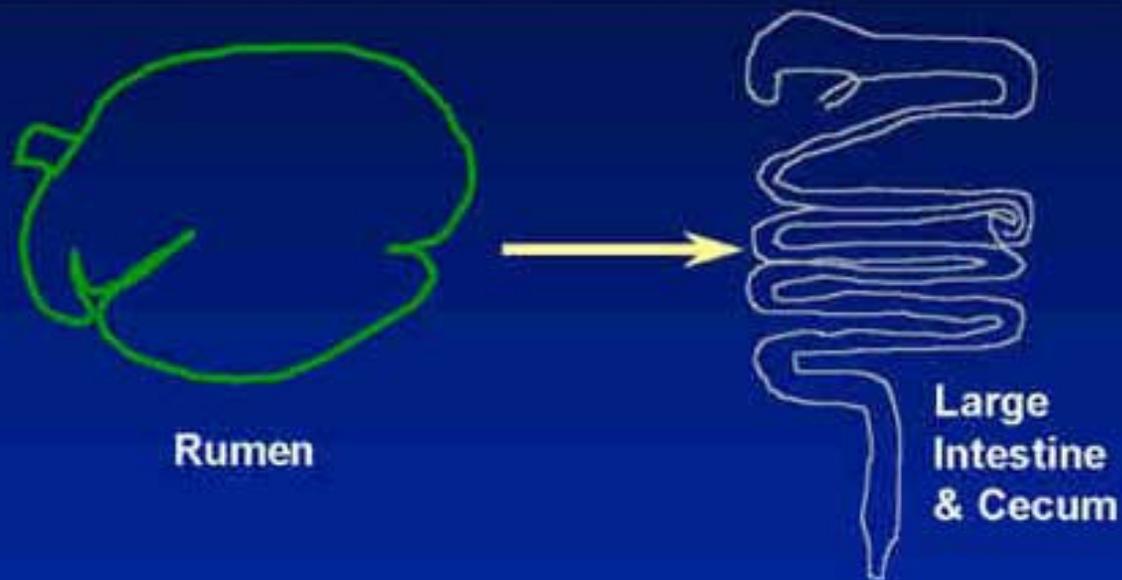


Mucin casts may be found in the manure. These represent damage to the walls of the hindgut, possibly caused by low pH from an extensive hindgut fermentation. If the gut is damaged, the cow secretes mucin or fibrin to cover the area. Intact casts resemble tubes. These casts may be found in manure of any consistency.



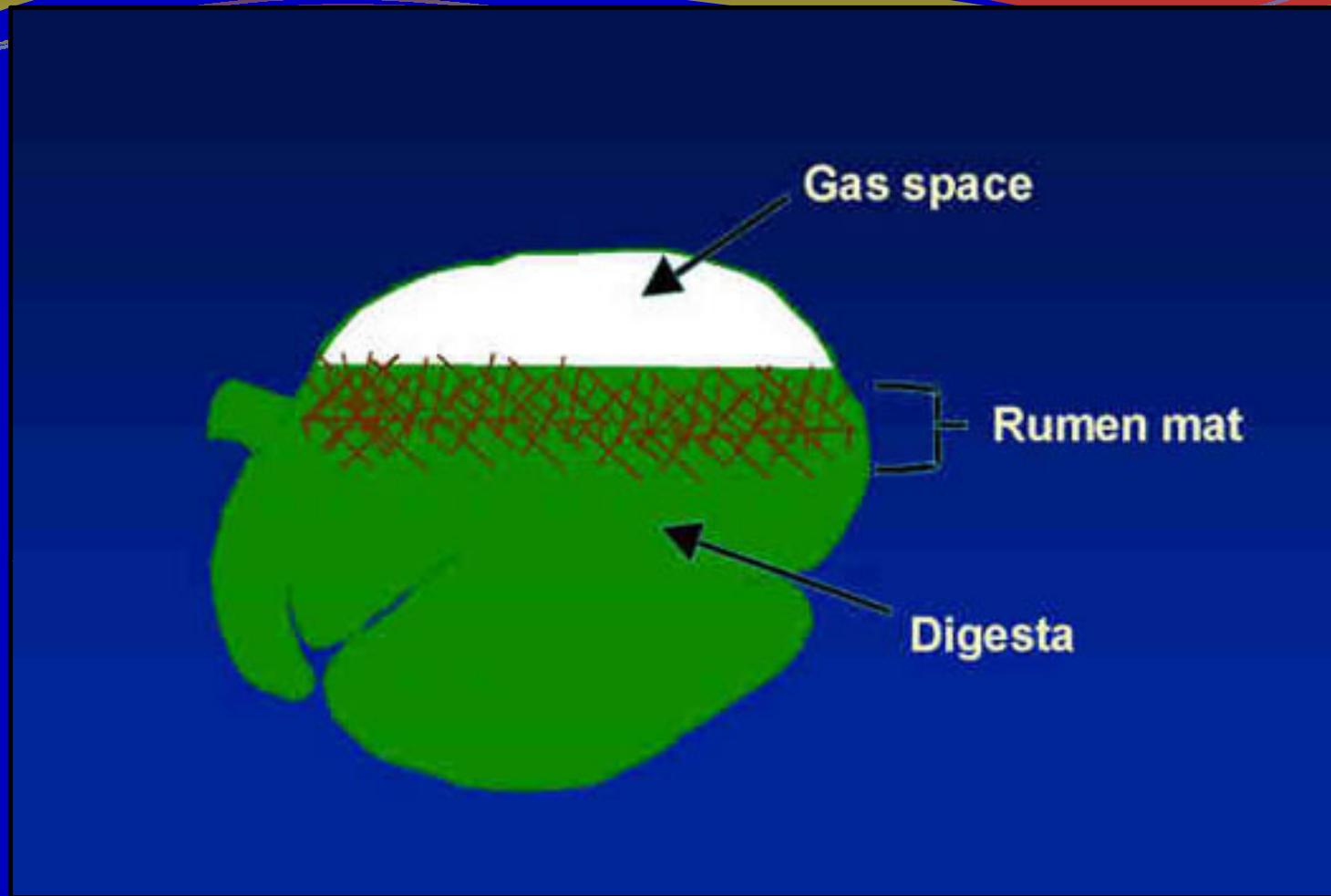
Isolated mucin casts.

Where Does The Feed Ferment?



Shifting the site of digestion is the cause of some of the symptoms of ruminal acidosis.

If you think about it, the three descriptions of extensive hindgut fermentation look like the symptoms we tend to associate with ruminal acidosis. What does rumen function have to do with the appearance of manure? If insufficient physically effective fiber is fed, if too much starch is fed, if rumen pH declines, digestion of feeds in the rumen may decrease, passage out of the rumen may increase, with undigested feed passing down the tract. When the feed reaches the hindgut, we see the changes in manure appearance described above.



The rumen will also be the main site that determines the size of particles that reach the manure. Most fiber digestion and particle reduction occurs in the rumen, if enough physically effective fiber (peNDF) has been fed. peNDF is the chewable fiber that enhances rumination and good rumen function, and helps to build the rumen mat. The rumen mat is the raft of coarser, floating feed that can help retain particles in the rumen for chewing and digestion.



To evaluate fecal particle size and undigested feed, use a screen or kitchen strainer (do not return it to the kitchen) with 1/16 inch (1.6 mm) openings. This is a qualitative, on farm evaluation, so getting very specific about mesh size is not crucial. A strainer that is 7 inches (17.8 cm) in diameter and 4 inches (10.2 cm) deep works well. Disposable coffee cups, or 8 oz (237 ml) sample cups with snap on lids work well for sample collection. In a pen of cows, collect a number of samples from individual cow pies to give a fair representation of the variety in the group -- make sure that they are not contaminated with uneaten feed. This may be 3 - 6 samples per pen of 100 cows. Identify the samples by the group they came from.



With water flowing gently but in a steady stream from a hose, rinse a single sample into/onto the screen, and rinse gently but thoroughly until the water flows clear. The remaining material gives a clear view of large particles and undigested feed in the manure.



When not enough physically effective fiber is eaten by cows, particle size in the feces INCREASES. Without the fiber to make a good mat in the rumen, larger particles pass out. You may see pieces of hay, pieces of corn stalk, etc. in the feces. As effective NDF in the diet decreases, fecal particles become coarser. Generally, you do not want to see many fiber particles greater than 1/2 inch (1.3 mm) in the feces. The small size of the particles on a 40% sorghum silage ration (% of dry matter) and the lack of apparent grain suggest that the ration was retained in the rumen long enough to be chewed and fermented.



Enlargement of manure particles from 40% roughage diet.



Whereas, very long pieces of coarse fiber in manure suggest that rumen retention time was far too short. This sample came from a herd in which cows were extensively sorting their feed to eat the grain and refuse the forage. Many of the cows were suffering digestive upset. Note the one long piece of hay (~6 inches/ 15 cm) that passed thorough.



Enlargement of manure particles from diet low in effective NDF.



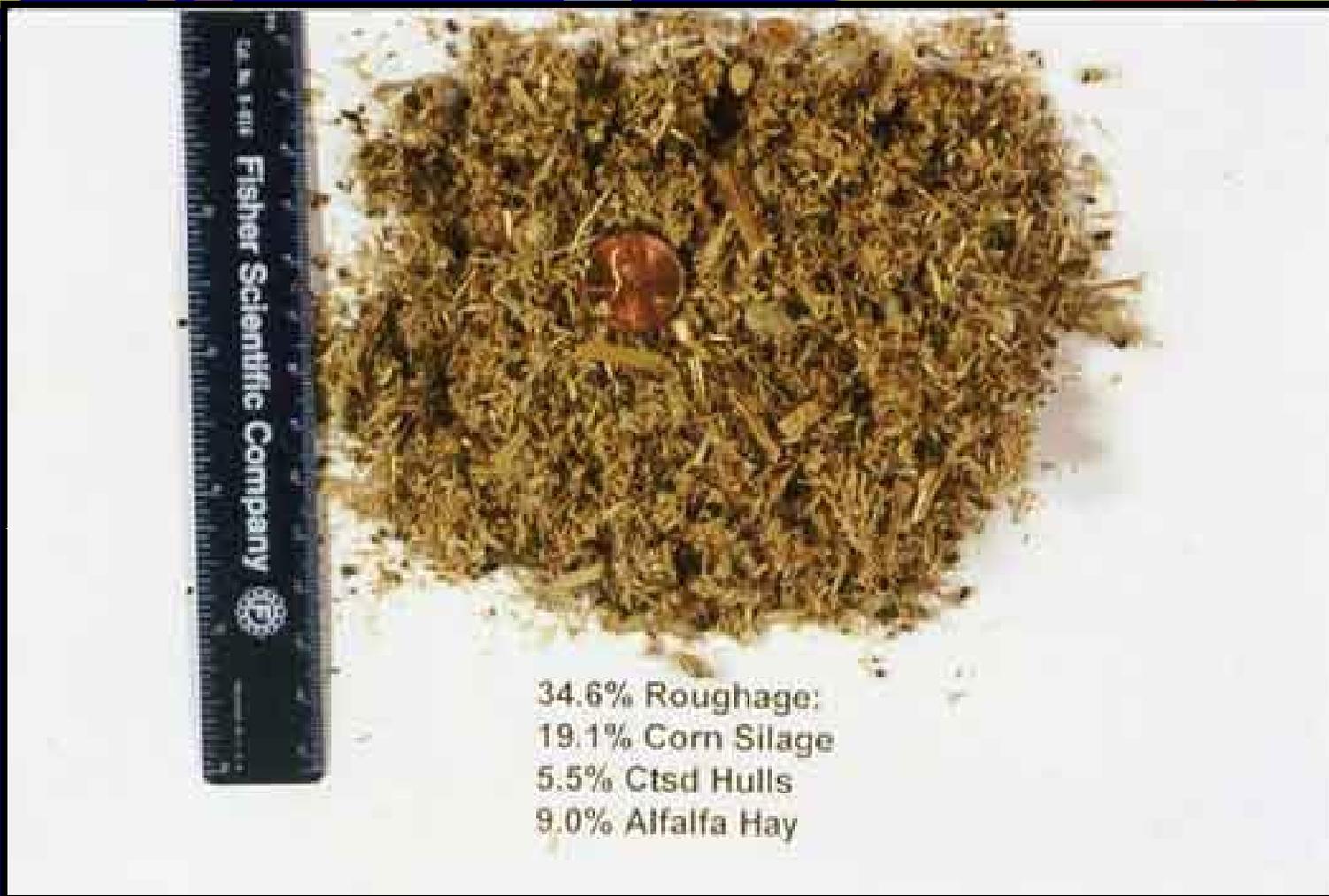
Cows can sort out fiber that is more than 2 inches (5 cm) long from a moist total mixed ration. If sorting is a problem, all hay or forage should be chopped to 1 - 2 inch lengths, and mixed into a moist total mixed ration that does not separate.



A PMR (Partially Mixed Ration). The long pieces of green chopped forage make this ration impossible to mix uniformly.



A well mixed TMR (Total Mixed Ration).



Feed such as cottonseed with the lint still on, citrus pulp that is still orange, pasture grass that is still green, all indicate that the feed passed through the rumen and the whole gut too quickly. Usually because not enough physically effective fiber was eaten by the cows.



Enlargement of manure particles with undigested whole cottonseed.



Whole Corn &
Large Particles

Whole kernels of corn in the manure often mean that the grain in the corn silage was not properly processed, or there is a problem with the ground corn. A quick inspection of the concentrate and silage can decide which is the culprit. Corn in silage must at least be nicked to allow access to microbes and enzymes.



Enlargement of manure particles with undigested whole corn.



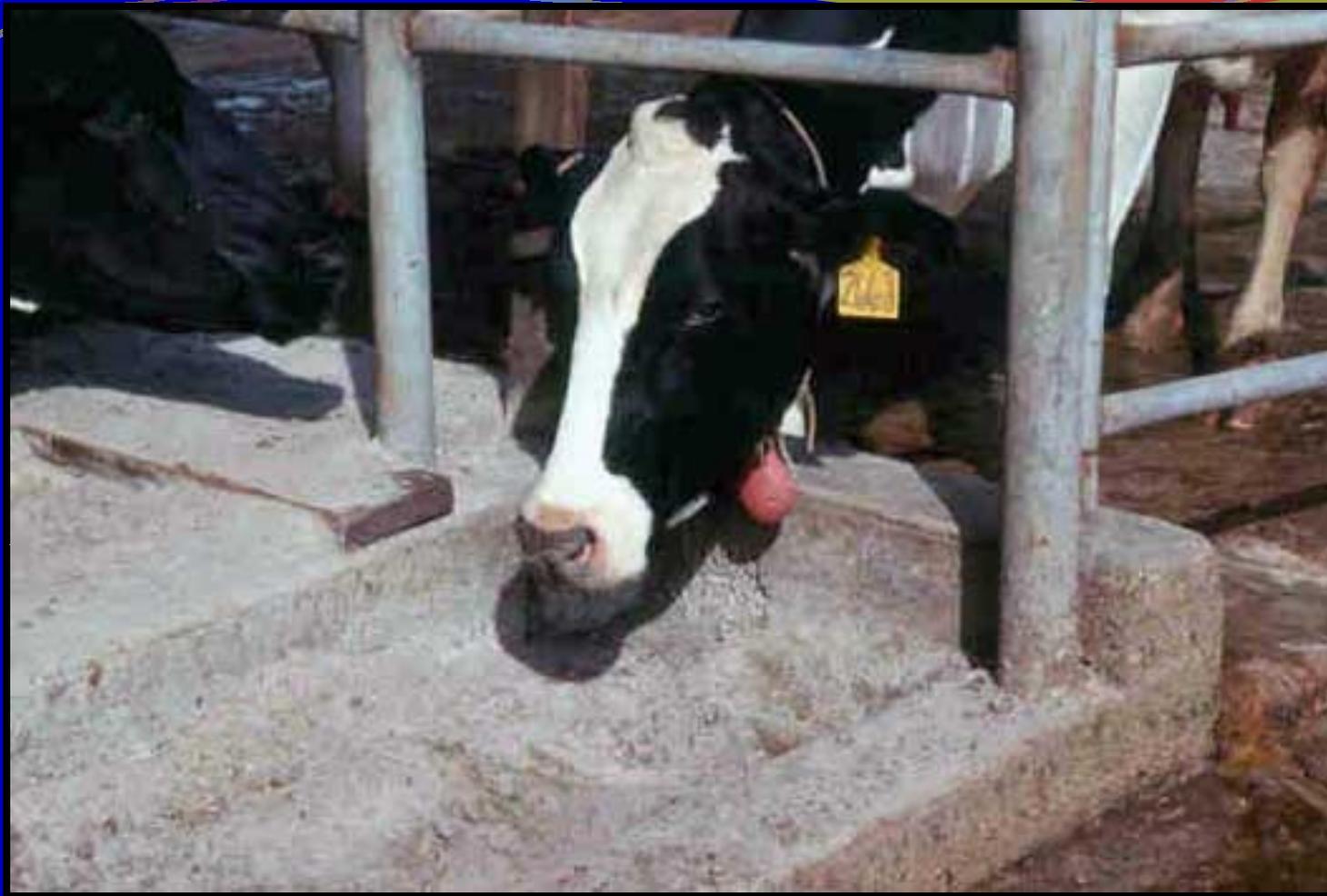
Finely ground grain in the manure can indicate corn that is ground too coarsely, or insufficient consumption of physically effective fiber. More peNDF can hold the grain in the rumen for more extensive digestion. Grinding the corn more finely can also increase its digestibility. Make sure that enough fiber is fed so that the finer grind does not lead to ruminal acidosis.



Manure consistency, good or bad, should be consistent within a group of cows that are receiving the same ration. If it is not, it suggests that the cows are sorting their feed, either aided by poor mixing, or by deliberate efforts on the cows' parts. Watch them eat. If you see them push the feed from side to side, and then dive to the bottom of the bunk for a mouthful, they are usually pushing the forage out of the way, and eating grain that falls to the bottom. If bunk space is limited, and the group is sorting, the timid cows may eat the most forage, but may not get enough energy or protein. The boss cows may get acidosis.



Heat stress can also change manure consistency. Cows drink more water, and their rumen pH decreases (due to less cud chewing, more slug feeding, changes in their acid-base balance, etc.). Their manure will be loose.



Sometimes, a large amount of sand/soil may be found in manure. When cows consume a great deal of soil, it may be a non-specific indication of digestive upset, ruminal acidosis, etc.

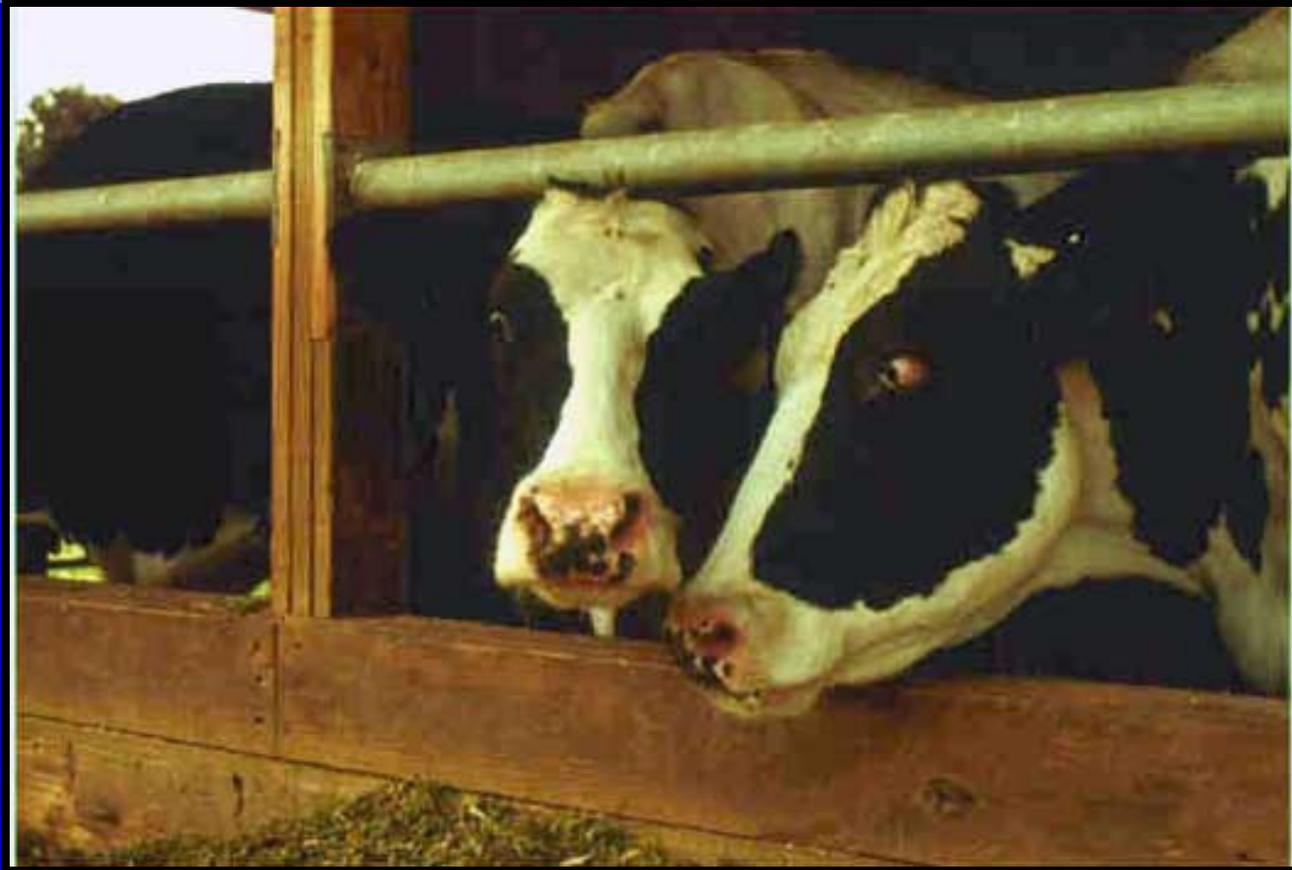


Many of the undesirable changes in manure are related to underfeeding physically effective fiber, or overfeeding the non-NDF carbohydrates, notably starch. What matters is what the cows actually eat, not what we think we are feeding. Unlike the hay in this rack, sources of effective NDF must be available....

**Effective fiber must
be eaten to be
effective.**



... And the cow must actually eat it.



Manure can tell us a variety of things about how and where feeds are being digested in the gut. It is important to put that information in context with how well the cows are ruminating, incidence of digestive upset or laminitis in the herd, information on milk yield and composition, and other observations to decide 1) Is there a ration problem? 2) Have we diagnosed it correctly? Used with the other tools at our disposal, manure evaluation can help to interpret how cows are eating and digesting their rations.