



United States Department of Agriculture

Making or Breaking Rations With Forage Digestibility & Quality

**Mary Beth Hall
Research Animal Scientist
U. S. Dairy Forage Research Center
USDA-Agricultural Research Service
Madison, WI**

World Dairy Expo 10/2/15

U.S. Dairy Forage Research Center

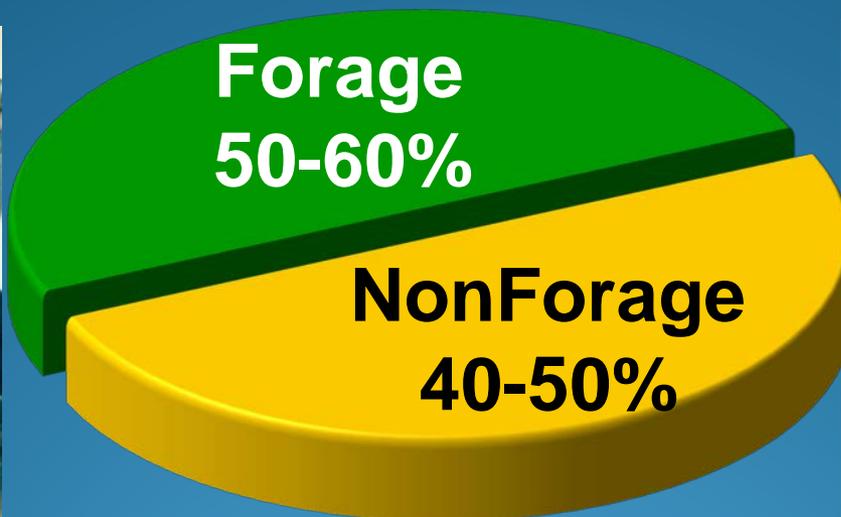




To do anything well (and repeatably), we need to understand what we are dealing with.

How do we work with forages to make rather than break rations?

Forage In Dairy Cow Rations

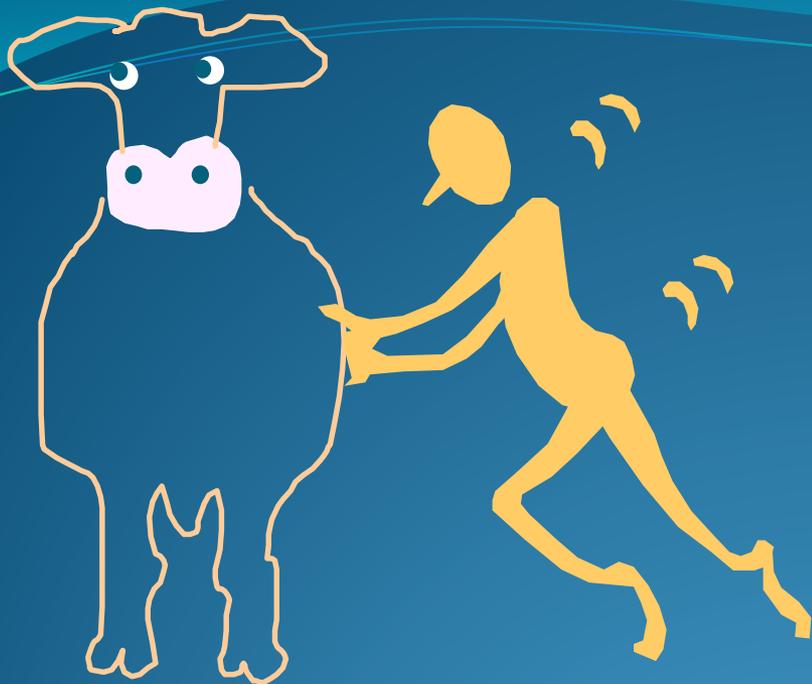


- ☀ What cows are designed to use
- ☀ Include as much forage as possible
- ☀ Meet requirements



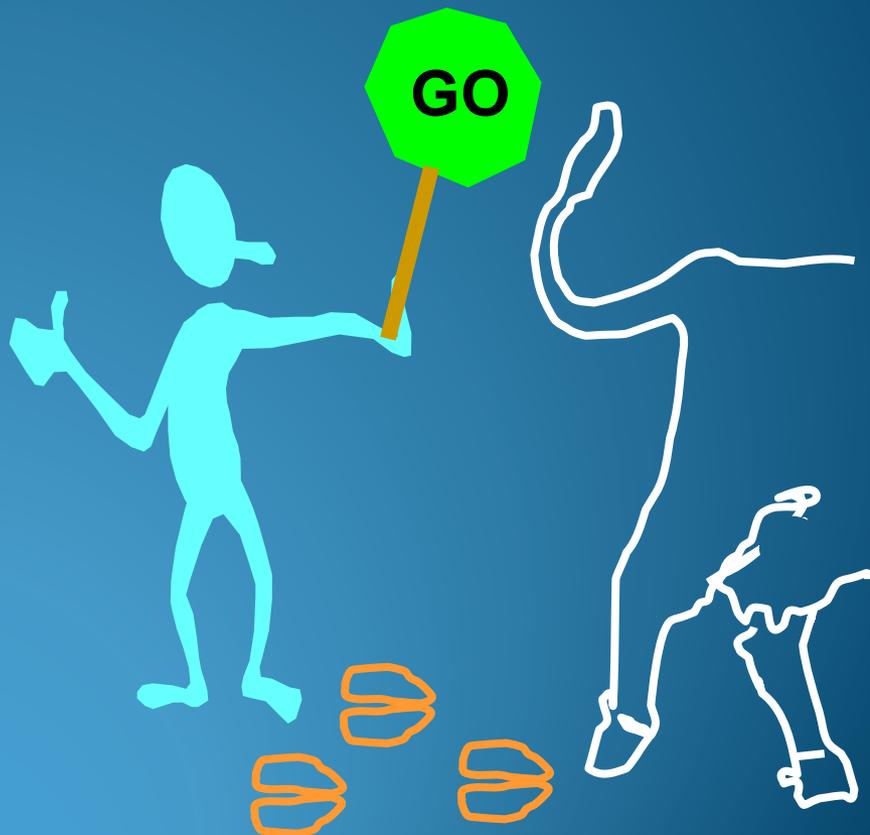
Forage quality sets limits for amount of forage fed and production.

We must balance rations without breaking rules.



You can't push a cow to produce.....

....But you can get the obstacles out of her way so she can.





**Not good. Not normal.
We broke the rules.**



Body Condition Changes



Too Thin.

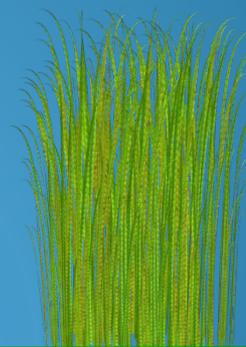
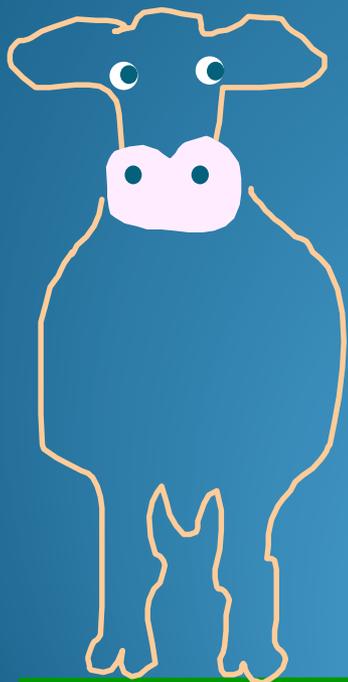


OK?

Depending on
days in milk....

What Does Forage Do?

- ☀ Nutrients to meet requirements
- ☀ Physical form for healthy gut function
- ☀ It is and makes good use of farm resources
- ☀ Recycles manure, reduces erosion



What Is “Quality”?

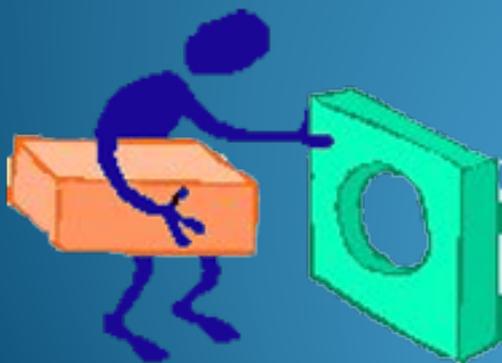
- ☀ “Quality”: how a feed complements the rest of the ration to meet cow needs.
- ☀ Not High or Low, but Right Quality
- ☀ What fits the need?

Digestibility

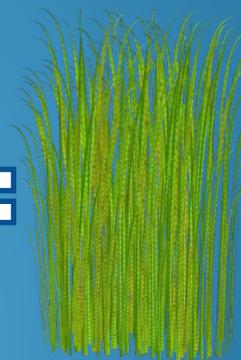
Composition

Form

Amount



≠



≠



Physically Effective Fiber

- Enhances rumen function
- Increases rumination
- Reduces rumen acidosis
- Rumen retention & passage
- Allows rations to work

Affected by particle size,
digestion, density, hydration,
“softness”



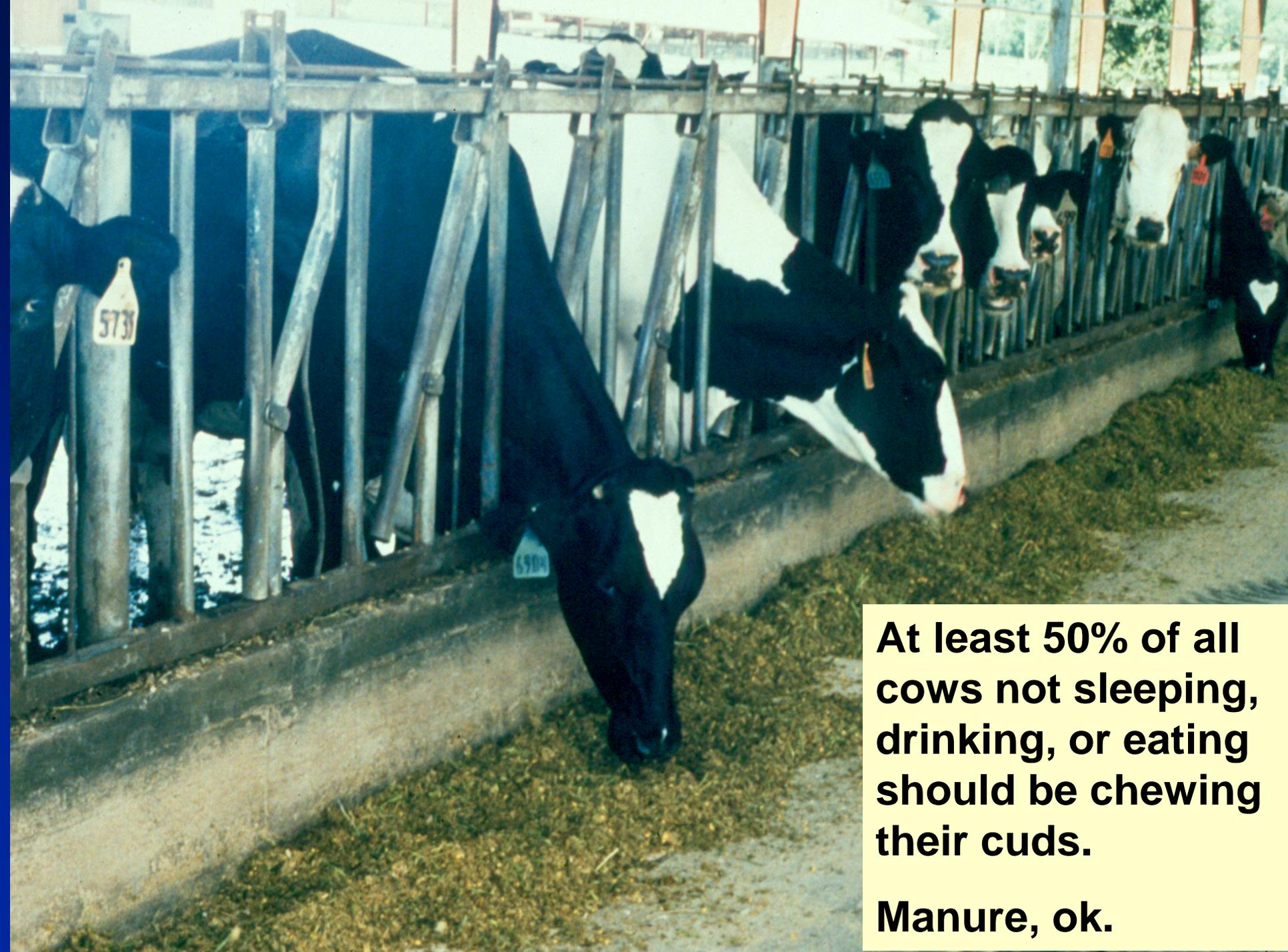
Fine



Medium



Coarse



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

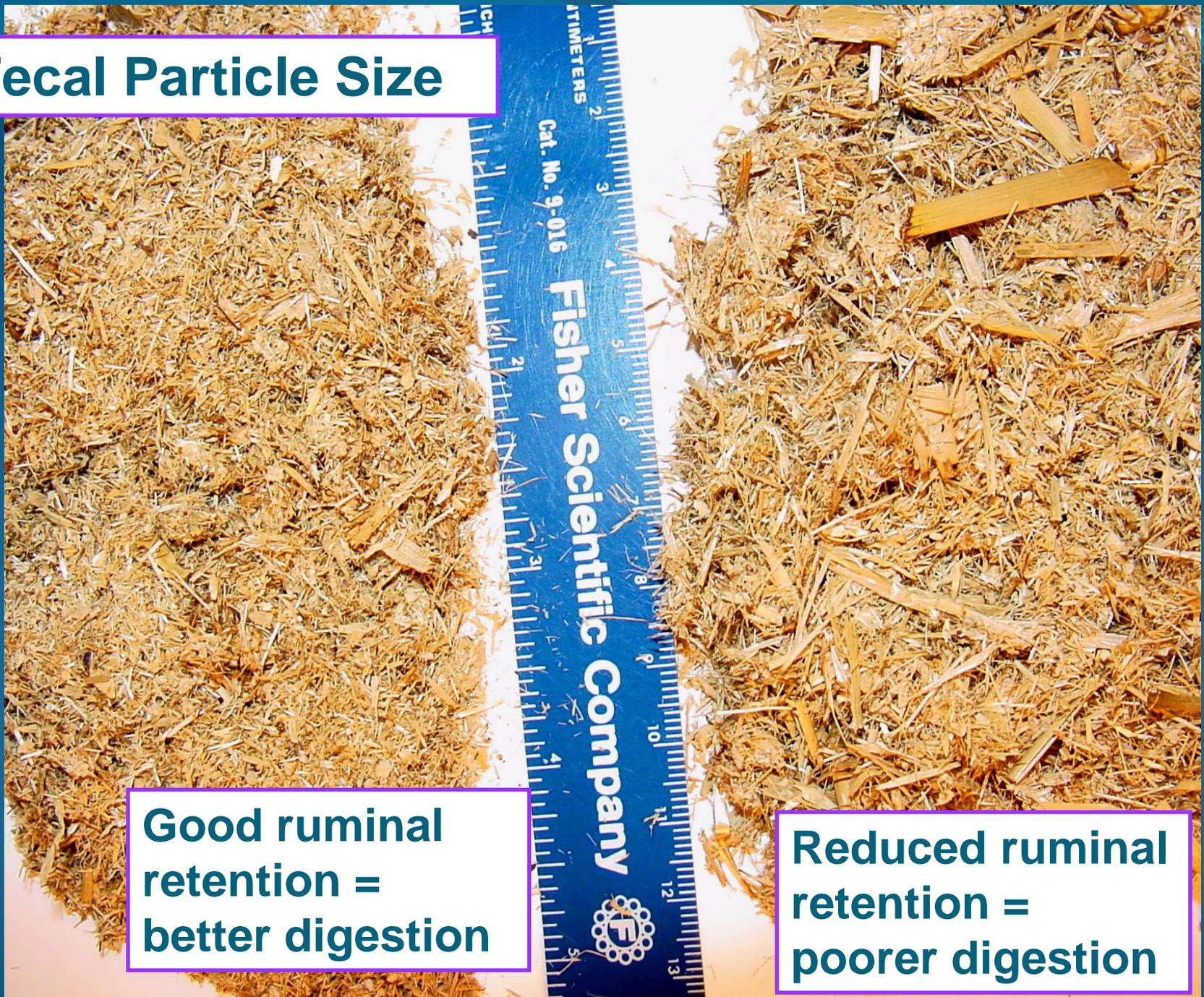
Manure, ok.

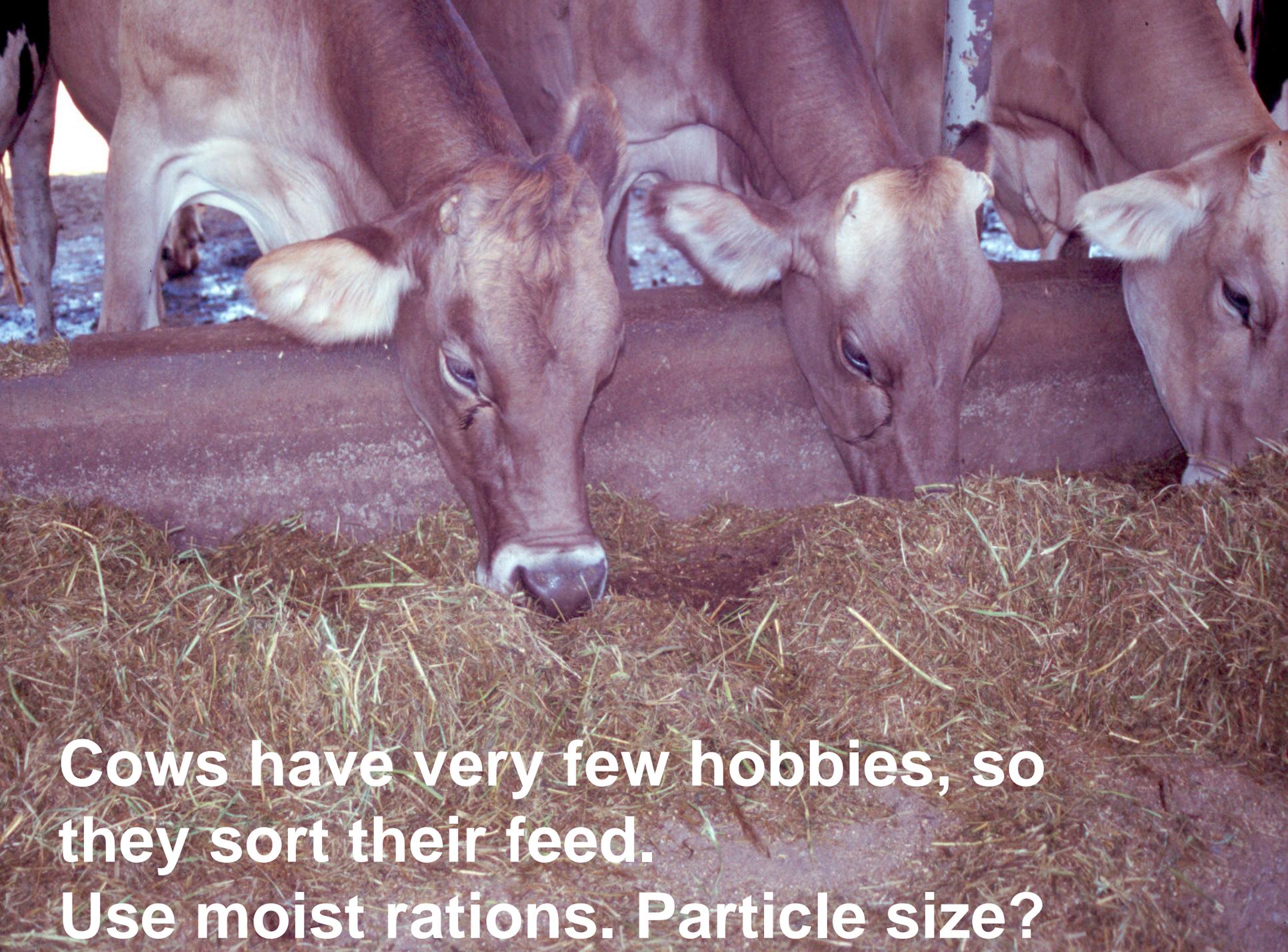


Fecal Particle Size

**Good ruminal retention =
better digestion**

**Reduced ruminal retention =
poorer digestion**





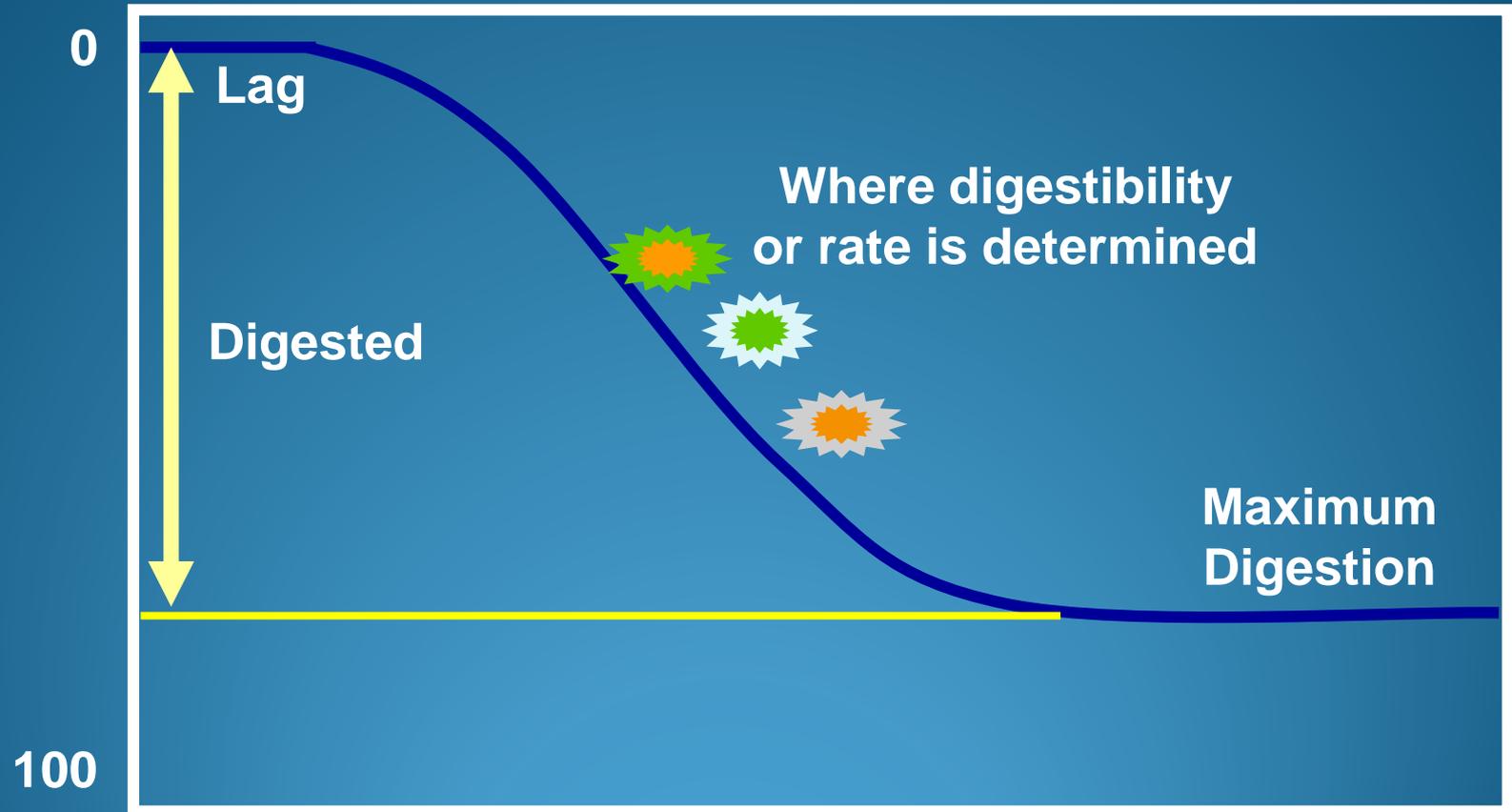
Cows have very few hobbies, so they sort their feed. Use moist rations. Particle size?



Measuring Digestibility in the Lab



Digestion%

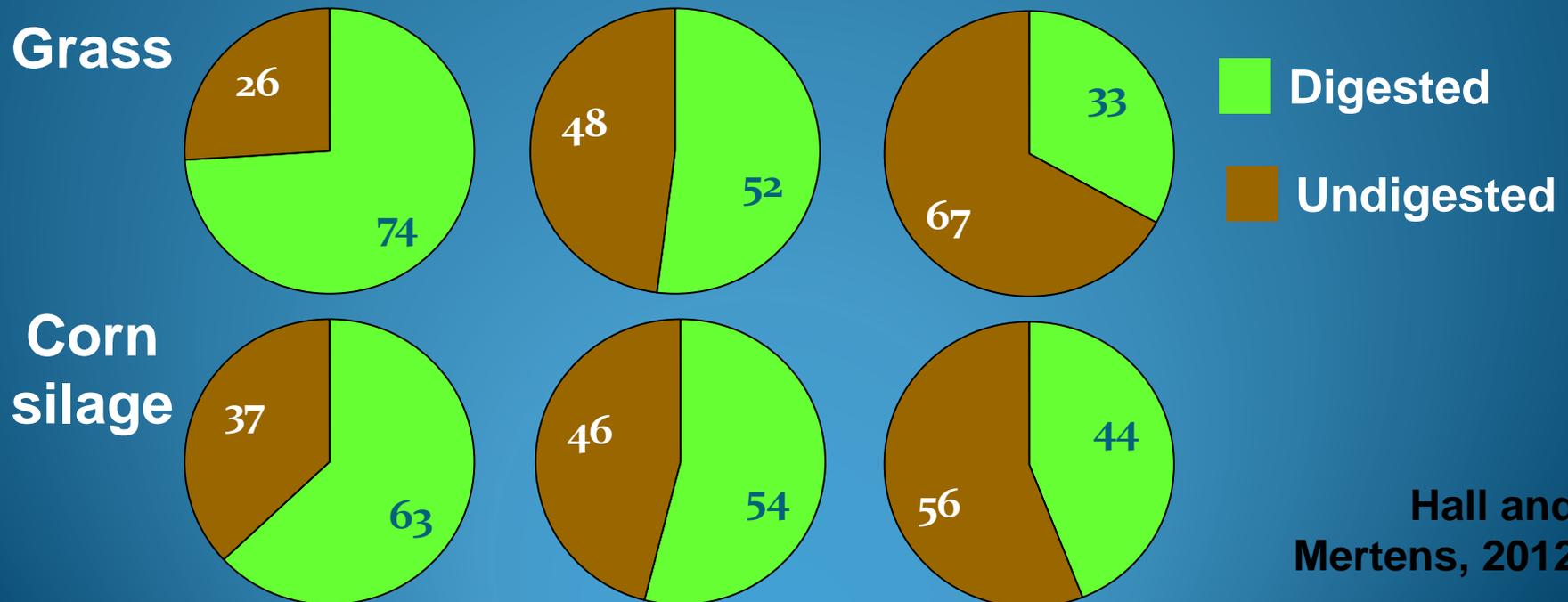


Hour of Fermentation

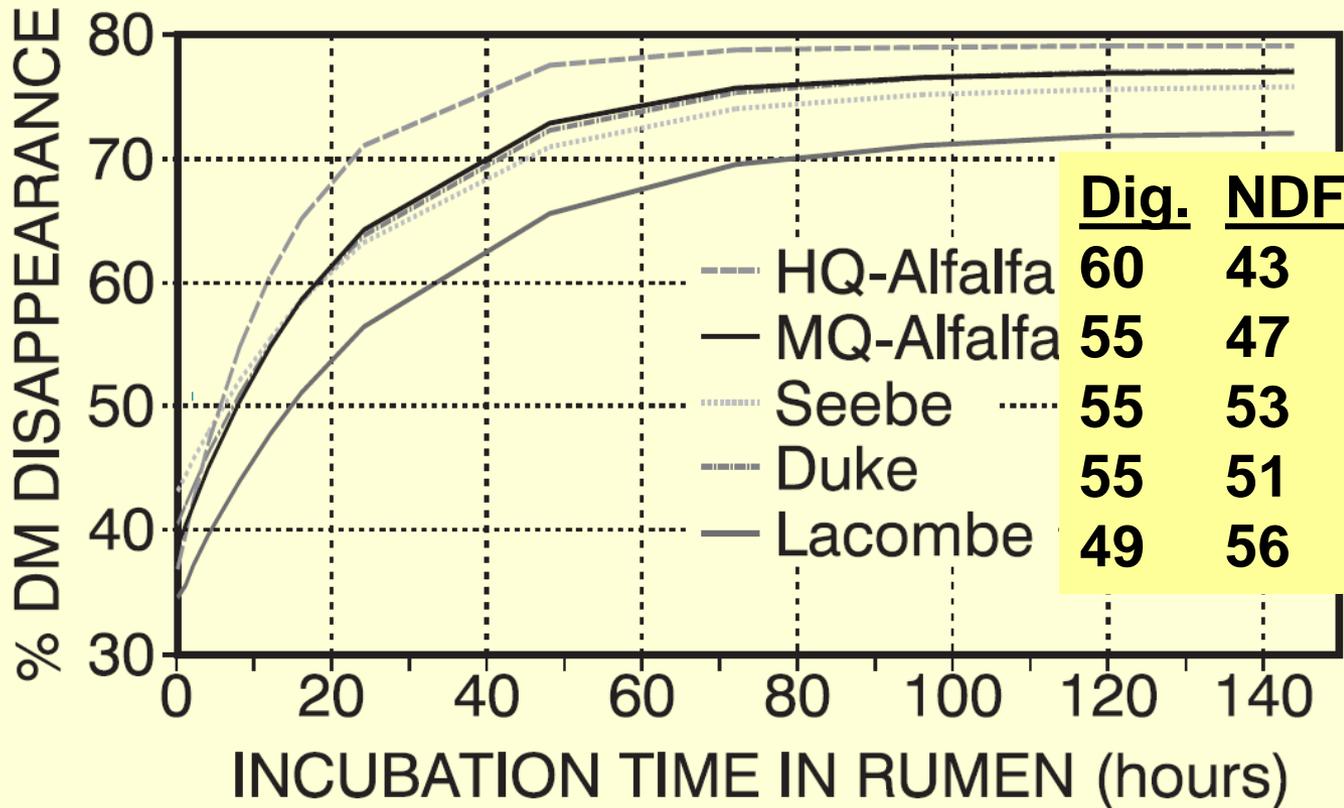
Fiber Digestibility

- ✦ Highly variable
- ✦ Crop variety, maturity, growing conditions, ...
- ✦ Determines available nutrients

30 hour NDF digestibility



Alfalfa and Barley Silages



☀ How quickly they digest to give nutrients

☀ How quickly they break down to leave the rumen

Figure 1 : Dry matter disappearance curves for barley and alfalfa silages.

(In)Digestibility and Intake

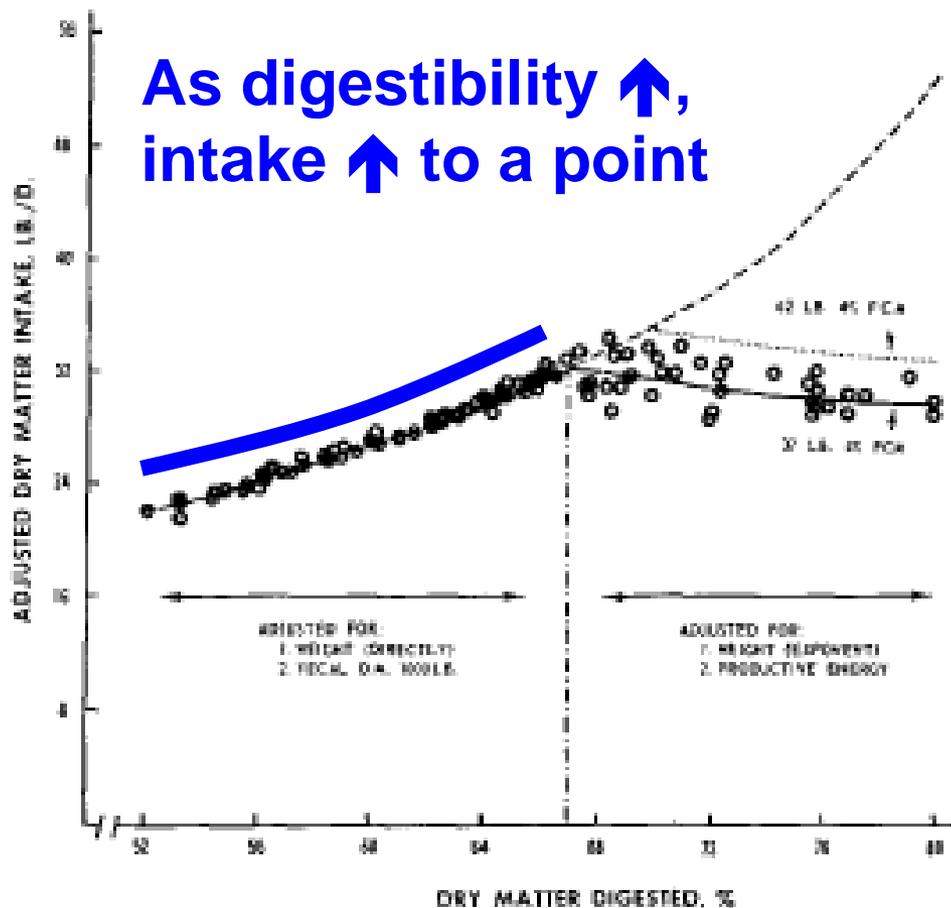
There's only so much undigestible material a cow can fit in her rumen/gut!

Undigestible feed limits intake.

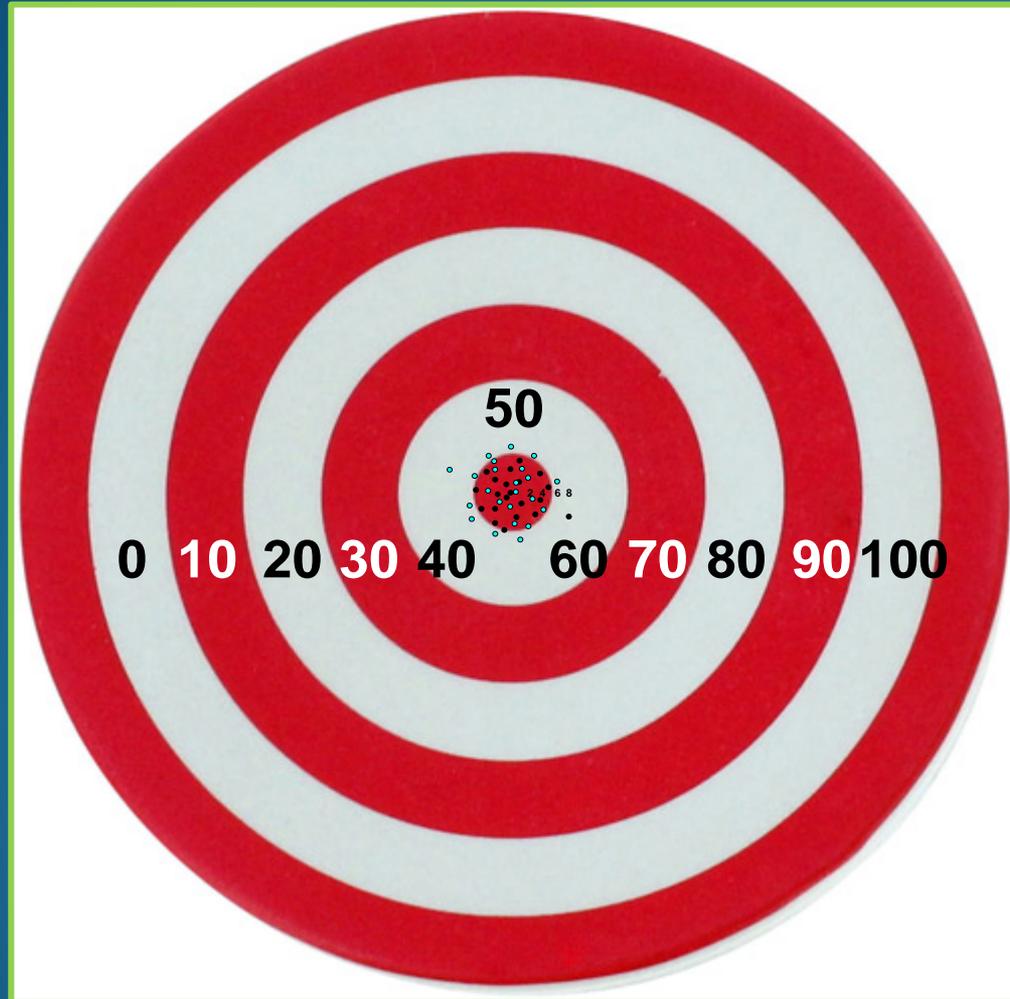
NDF is the least digestible part of the diet.

Bigger pieces of feed cannot pass until they are digested & ruminated to reduce their size.

As digestibility ↑,
intake ↑ to a point



NDF Digestibility Precision



For good analyses done in 1 lab:
variability is + or - 5% NDFD.

For good analyses done across labs:
variability is + or - 7% NDFD.

Very good for ranking samples within lab.

Composition



Sugars

Molasses
Bakery waste
Fresh forages/hays
Beet & citrus pulps
Almond hulls



Protein

Legume forages
Soy & Canola
Corn gluten meal

Soluble Fiber



Legume forages
Beet & citrus pulps



Fiber

Forages
Nonforage fiber sources
Crop residues
Wheat middlings
Corn gluten feed
Bagasse

Starch

Grain silages
Corn, sorghum
Small grains
Bakery waste
Wheat middlings
Potatoes
cull/waste



Eaten Doesn't Mean Digested



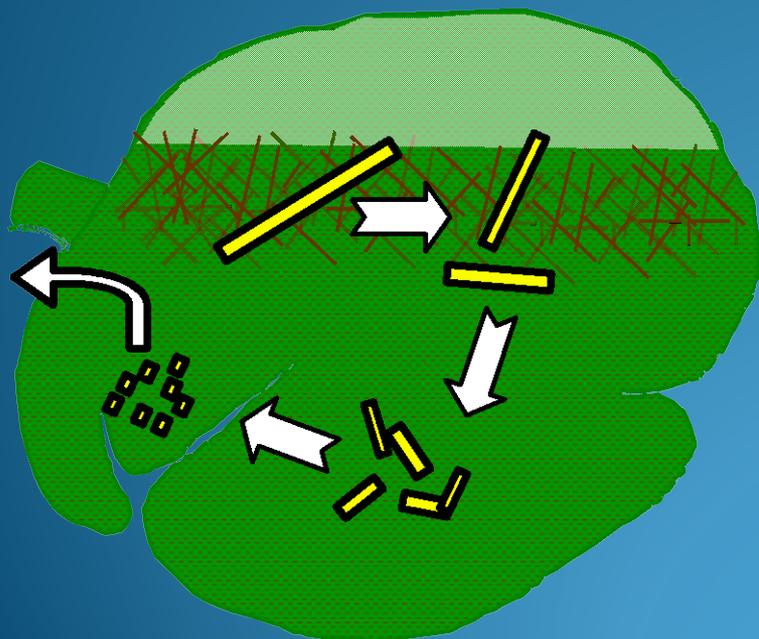
Poorly
chopped/processed
corn silage

Coarse corn meal



Forage: Current Recommendations

- ☀ Composition
- ☀ Physical form
- ☀ Digestibility



Min. Forage <u>NDF</u>	Min. Dietary <u>NDF</u>	Max. Dietary <u>NFC</u>
19	25	44
18	27	42
17	29	40
16	31	38
15	33	36

- ☀ NDF from Forage as 0.9 to 1% of body weight (Mertens)
- ☀ 75% NDF from forage

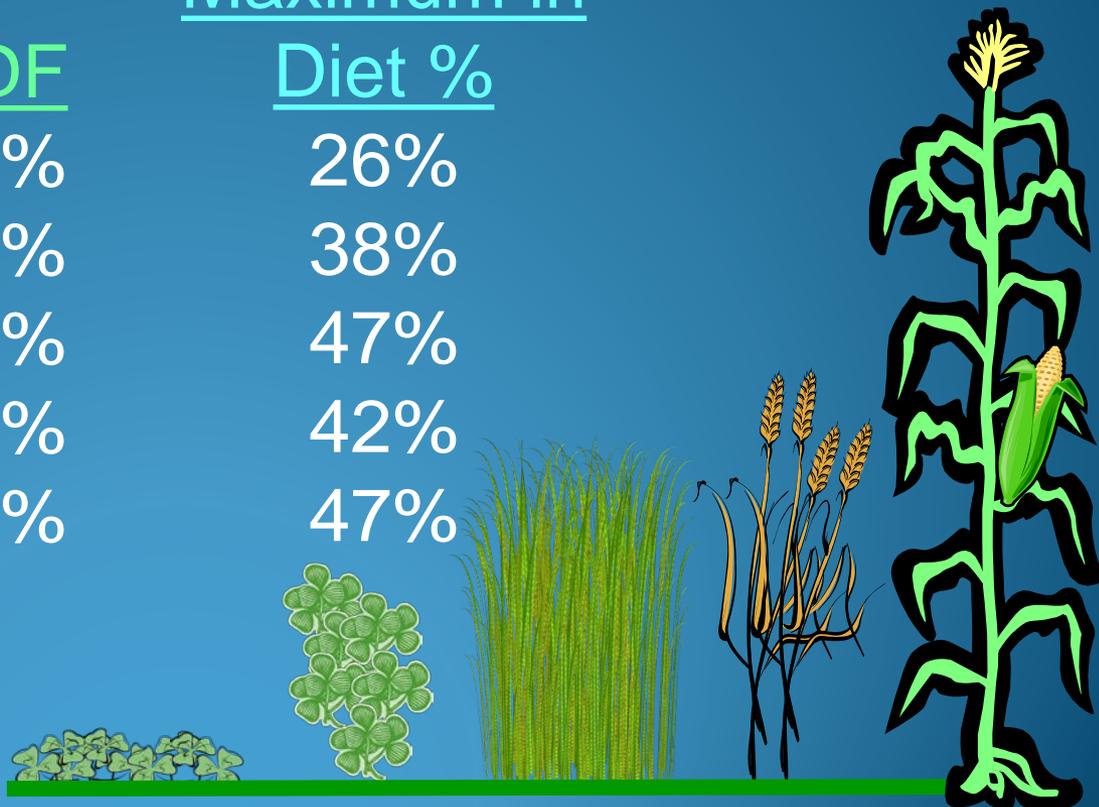
How Much Can You Feed?

Starting Point:

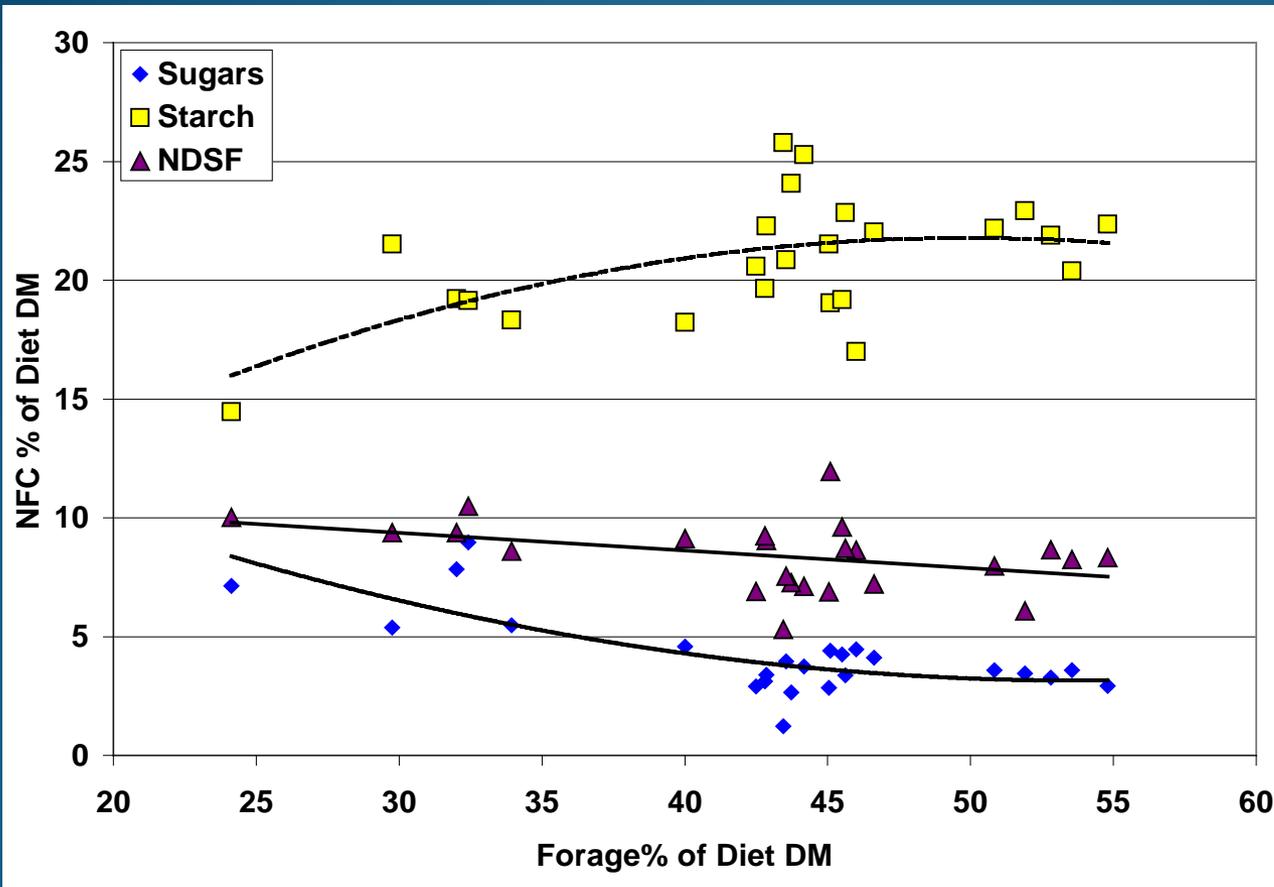
Allowable NDF = 28% x 75% from forage = 21%

Allowable Forage = Allowable NDF% / Forage NDF%

	<u>Forage NDF</u>	<u>Maximum in Diet %</u>
Straw	80%	26%
Barley Silage	55%	38%
Alfalfa Silage	45%	47%
50:50 Barley:Alf	50%	42%
Corn Silage	45%	47%



Formulating For NFC



5% sugars
 25% starch
 7% soluble fiber
 Allowable starch
 relative to amount
 of forage/effective
 fiber?

Moldy Feed / Mycotoxins

What is the costs of preventably sick cows?



Spoilage

Sorting This Out On The Farm

- ✨ Balance first with forages. They dictate the ration's base.
- ✨ Aim to meet cow fiber & energy needs within bounds of present recommendations.
- ✨ ...Then work with the cows to figure out the details.



Sorting This Out On The Farm

- ☀ Things you can evaluate
 - Digestibility and composition
 - Particle size & sorting
 - Rumination and manure evaluation
 - Intake, performance, and feed efficiency
 - Body condition score change





Questions?

