A Realities Check: Working With Starch in Your Ration

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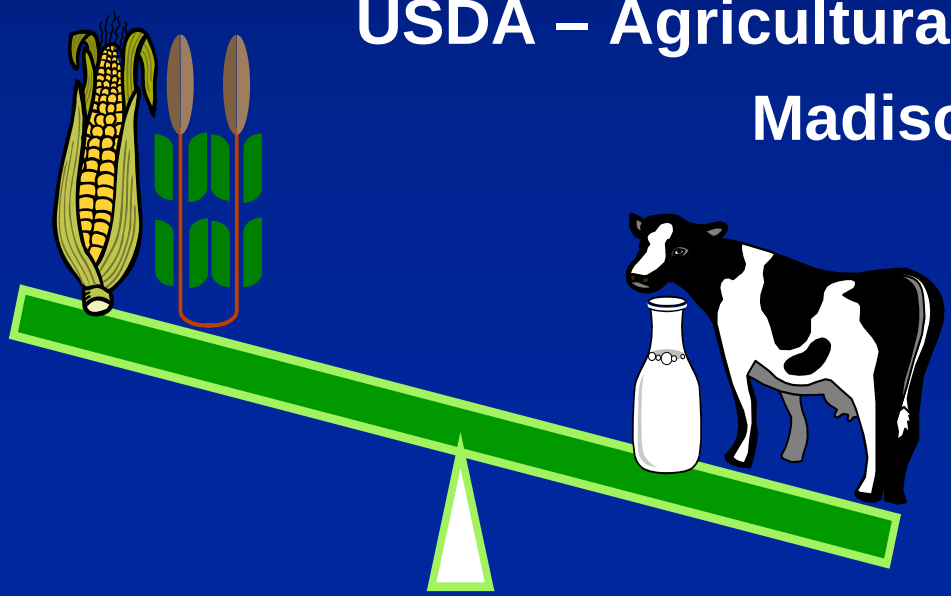
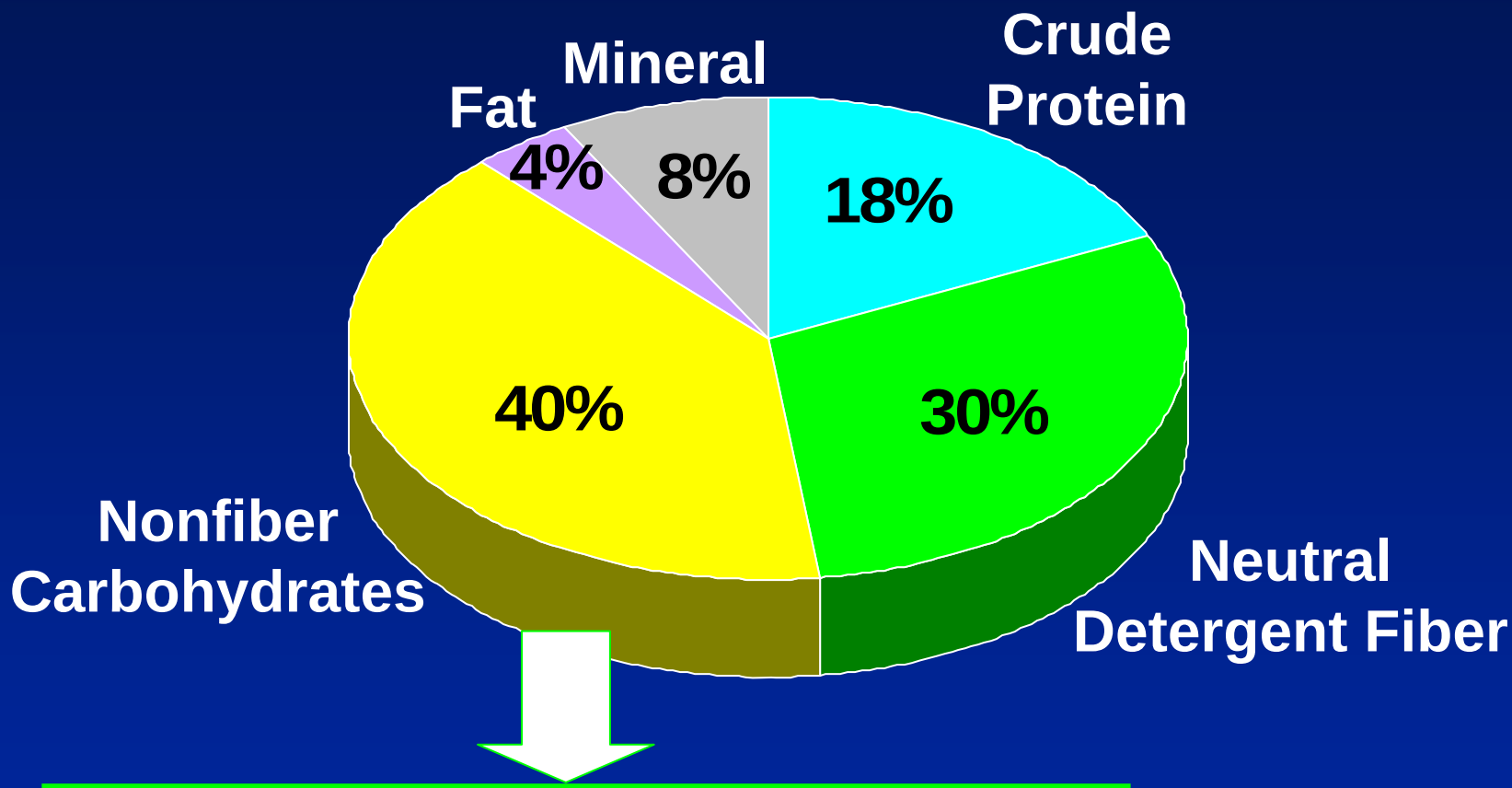


Link to U.S. DFRC Home

Ration Composition



Starch = 40 to 65% of NFC

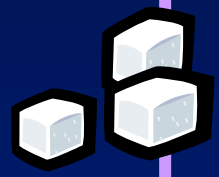
= 16 to 30% of the ration

Starch

- Where is it?
- How does it affect performance?
- What characteristics affect how much we should feed?

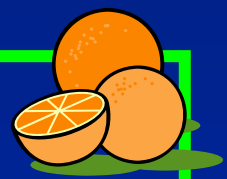
Nonfiber Carbohydrate Sources

Sugars



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

Soluble Fiber



Legume forages
Beet & citrus pulps
Soybean meal

Starch

Grain silages
Corn, sorghum
Small grains
Bakery waste
Wheat midds
Hominy feed
Potatoes cull/waste

What Does Starch Do?

- Major energy source
  - Digested in the rumen or small intestine
- Grows rumen microbes ➔ provides protein
- Changes milk composition (?)
- Can affect cow health

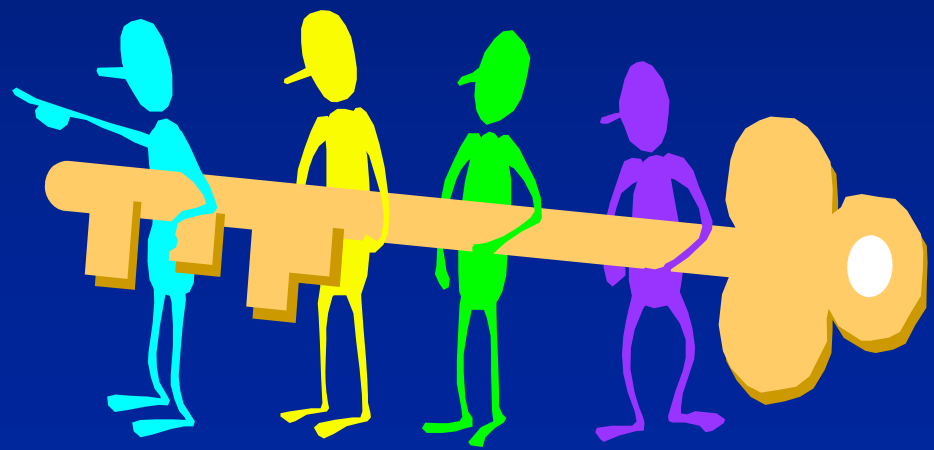
Starch vs. Soluble Fiber + Sugar

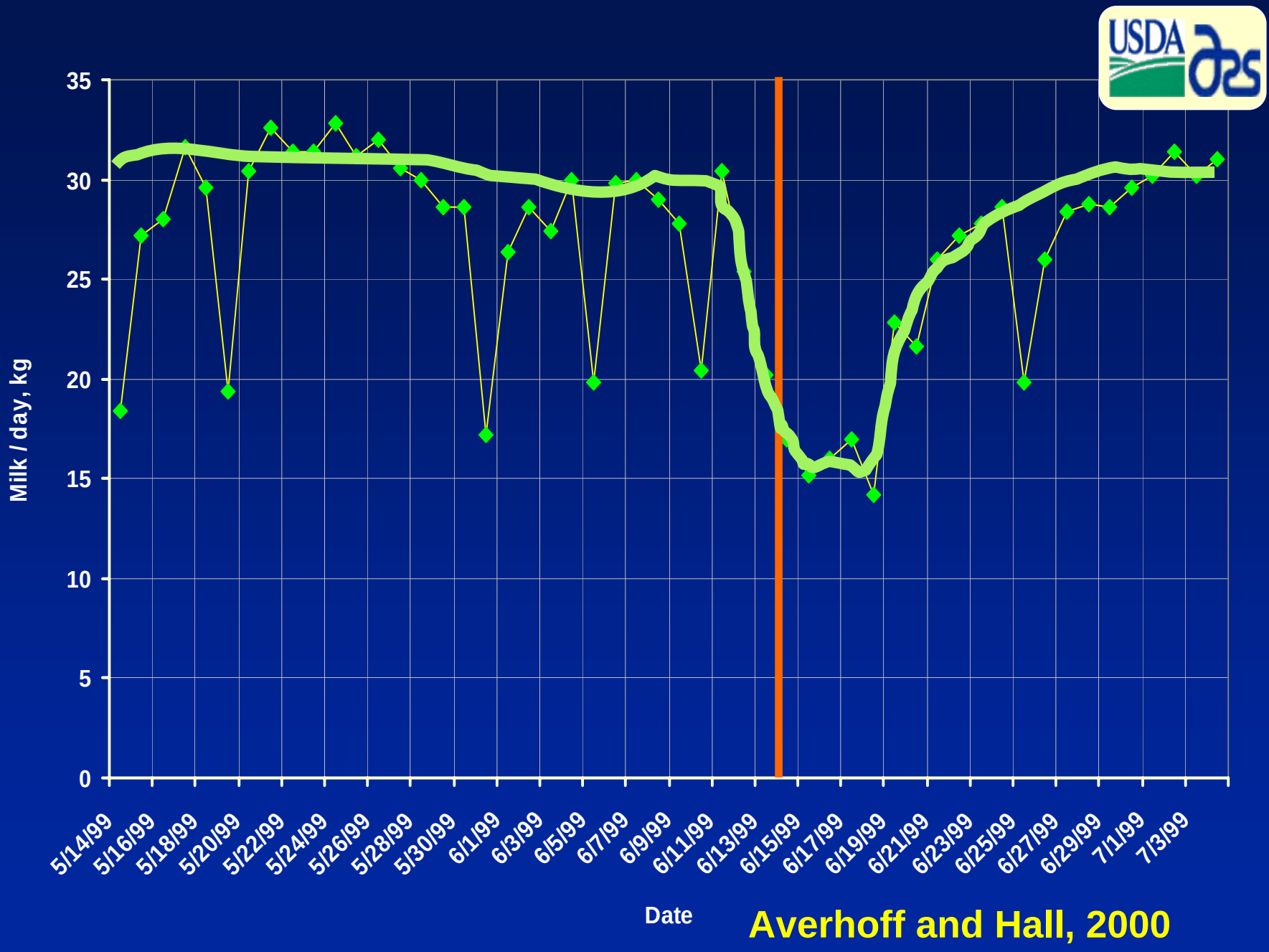
	1	2	3
Starch:	Corn vs	Corn vs	Hominy vs
Sugar + soluble fiber:	Beet Pulp	Citrus Pulp	Citrus Pulp
DM Intake, lb	+2.6*	+1.2*	+1.1
Milk, lb	+0.7	+2.0	+3.3
Fat, %	-0.18	-0.05	-0.11
Fat, lb	-0.07	+0.04	+0.02
Protein, %	+0.09*	+0.07*	+0.12*
Protein, lb	+0.11*	+0.08‡	+0.18‡

* $P<0.05$, ‡ $P<0.15$

Mansfield et al., 1994; Solomon et al., 2000; Leiva et al., 2000

Starch can support excellent performance from lactating dairy cows.




USDA
ars
35
30
25
20
15
10
5
0
Milk / day, kg
5/14/99
5/16/99
5/18/99
5/20/99
5/22/99
5/24/99
5/26/99
5/28/99
5/30/99
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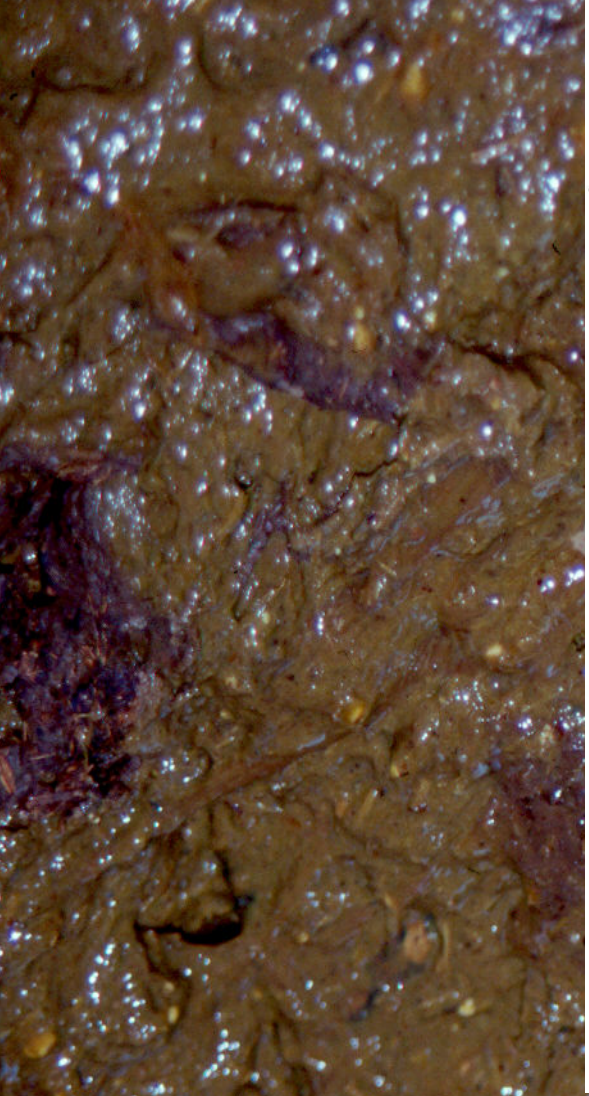
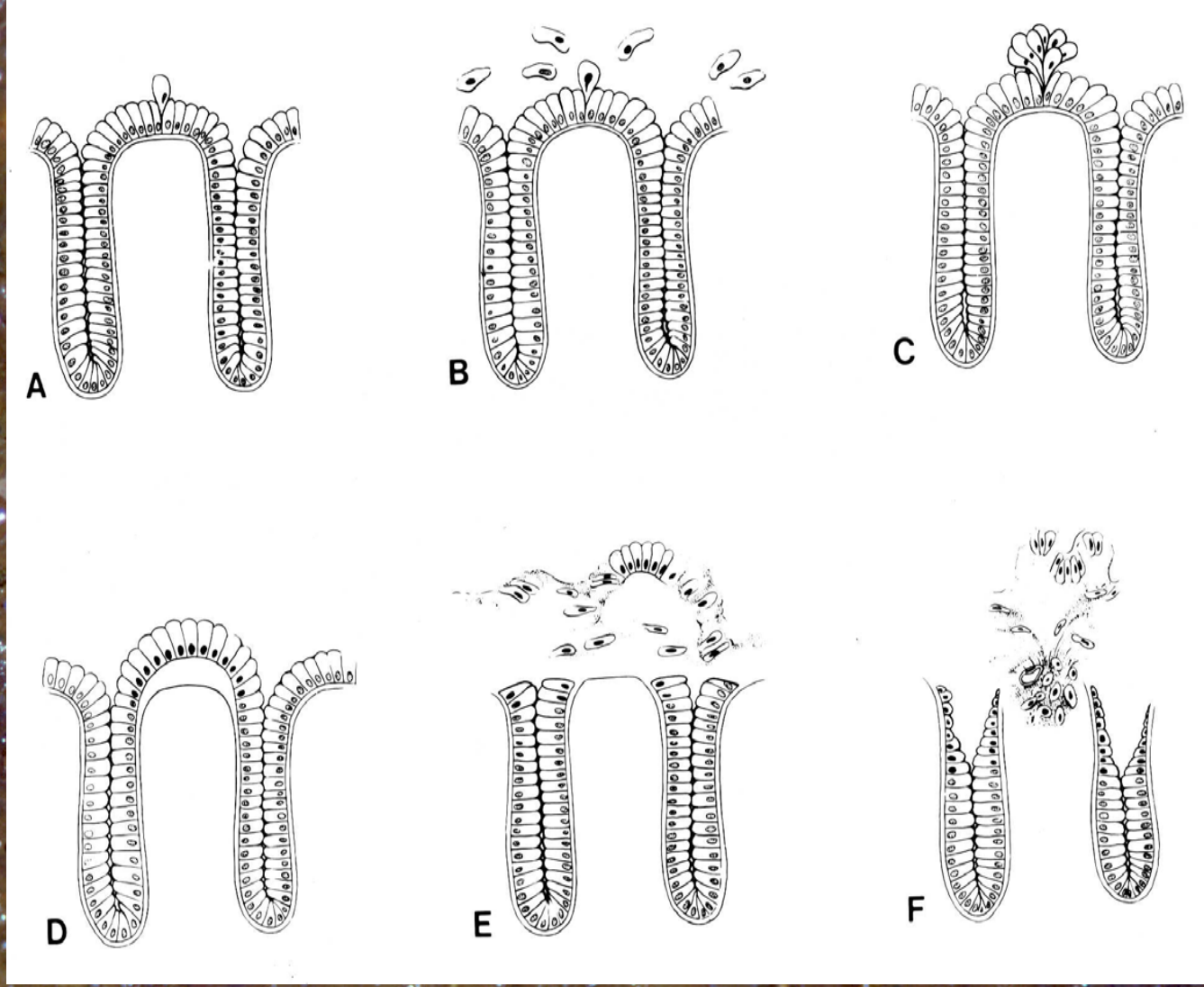
7/3/99
Date
Averhoff and Hall, 2000


Foamy manure with ground grain


Diarrhea





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

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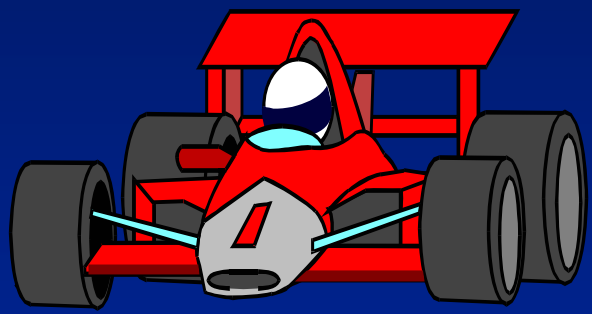
Mucin casts in dairy cow feces

In the same way that cars need both fuel and oil to run well….



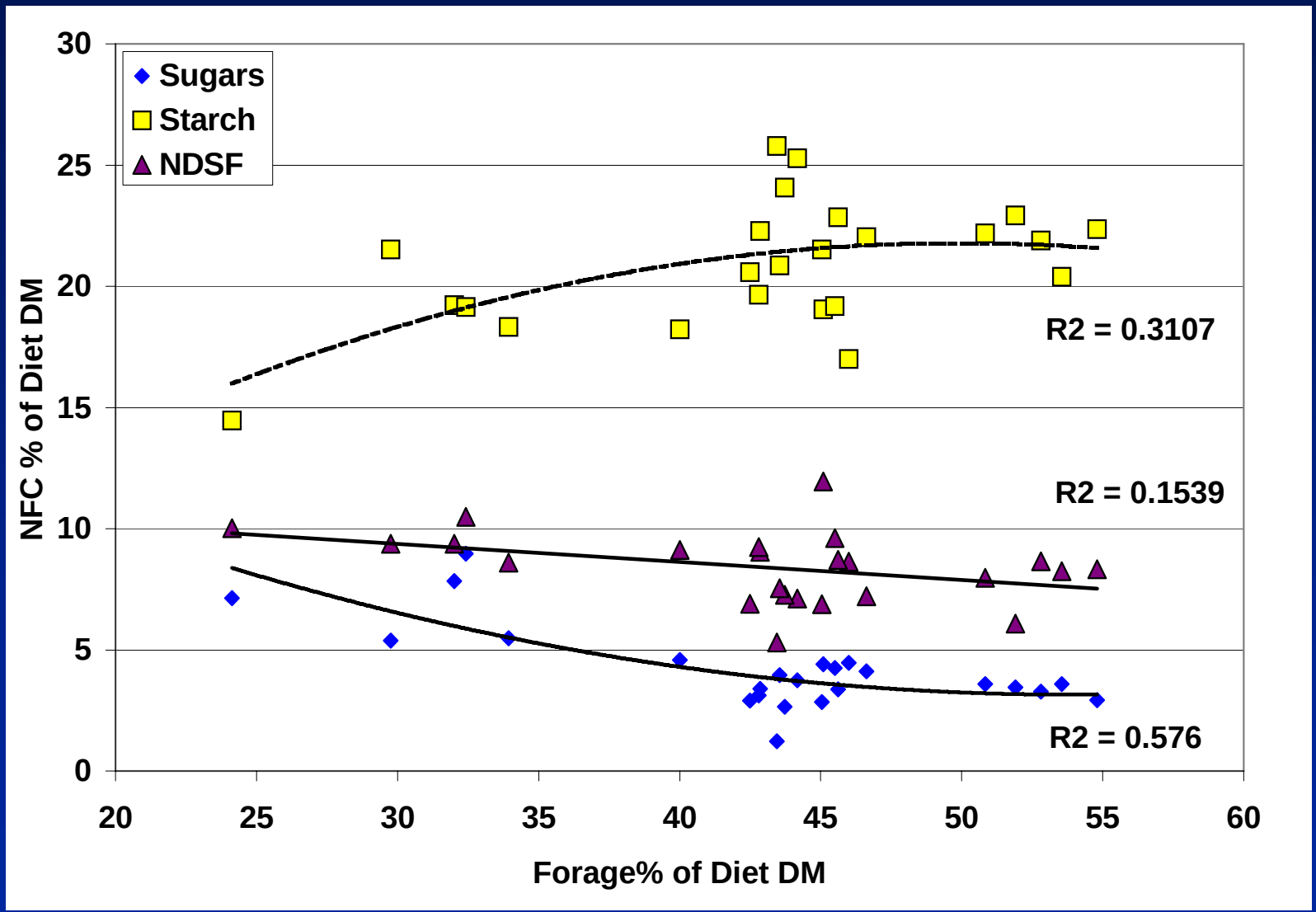
…cows need both NFC and fiber.

2001 Dairy NRC Recommendations

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

- Meal feeding
- Empty bunks
- Cows sorting
- Heat stress
- ….

NFC vs. Forage (% of ration DM)



Hall and Van Horn, 2001

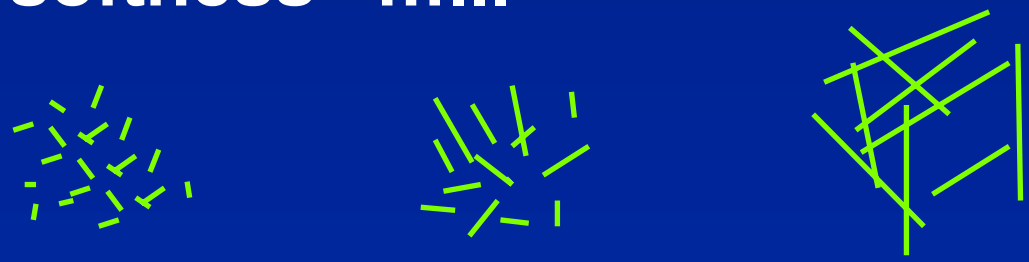

At least 40% of cows not eating, sleeping, or drinking should be ruminating.

Physically Effective Fiber

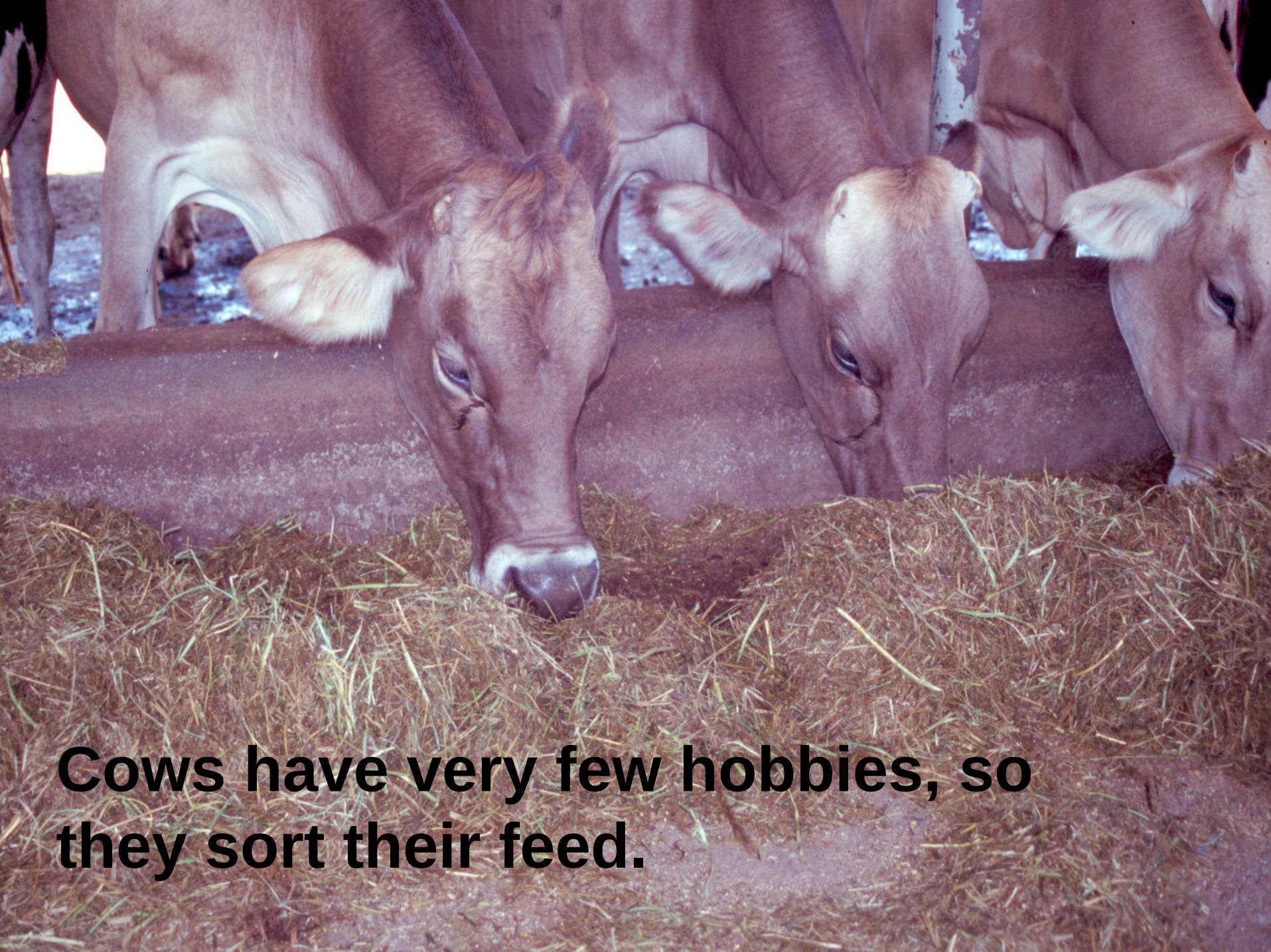
- Enhances rumen function
- Increases rumination
- Reduces rumen acidosis

Mostly from forages

– physically effective NDF is affected by particle size, digestion, density, hydration, "softness" ……



Fine Medium Coarse


Cows have very few hobbies, so they sort their feed.

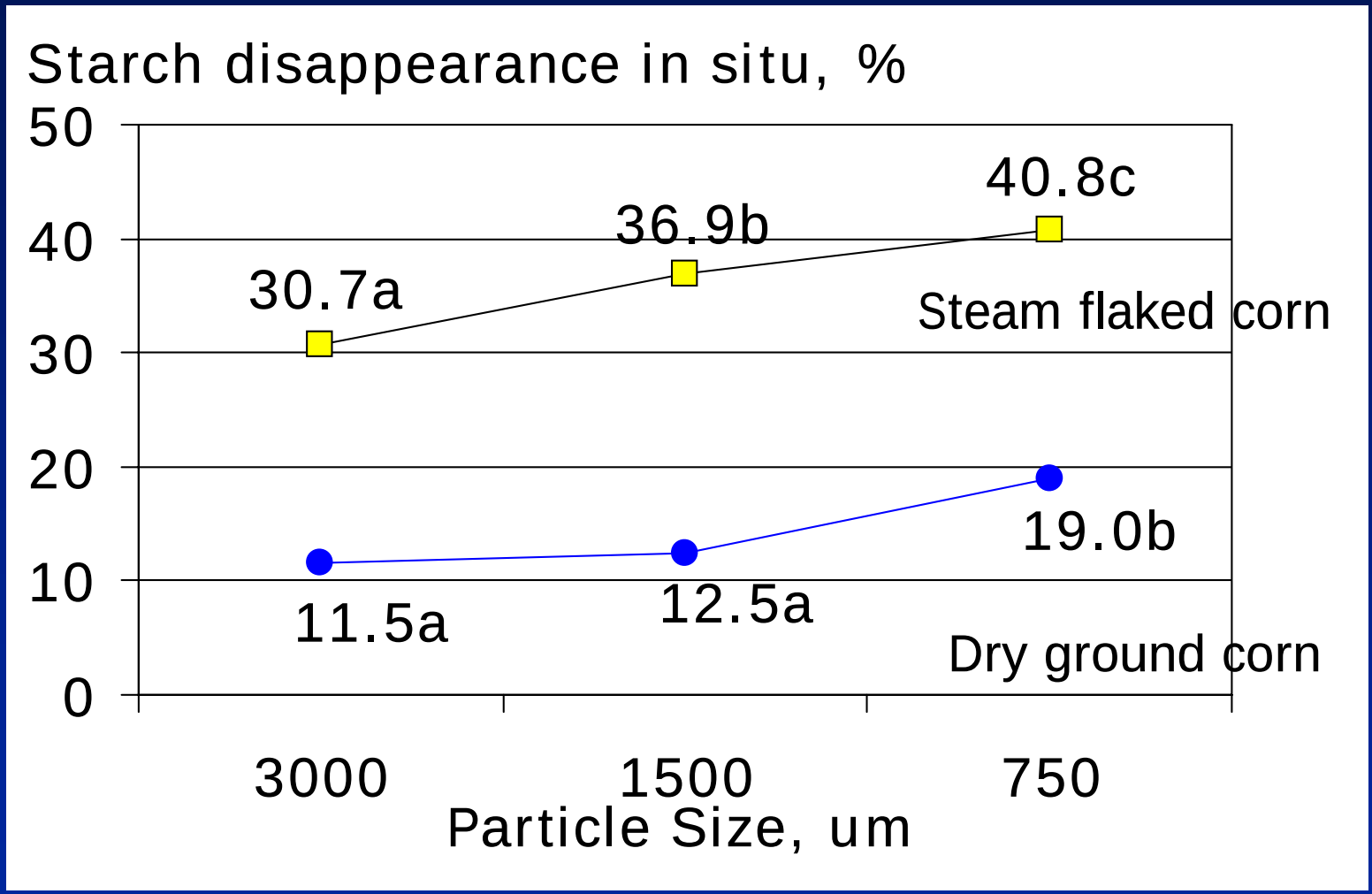
Starch In The Ration

- How much vs forage?
- How much do cows consume in a meal?
- How rapidly does it ferment?
  - Finely ground more rapid than coarse
  - Moist faster than dry
  - More rapid the longer its ensiled
  - Small grains faster than corn or sorhum
  - More starch in ration, more rapid?

Poorly chopped/processed corn silage

Coarse corn meal

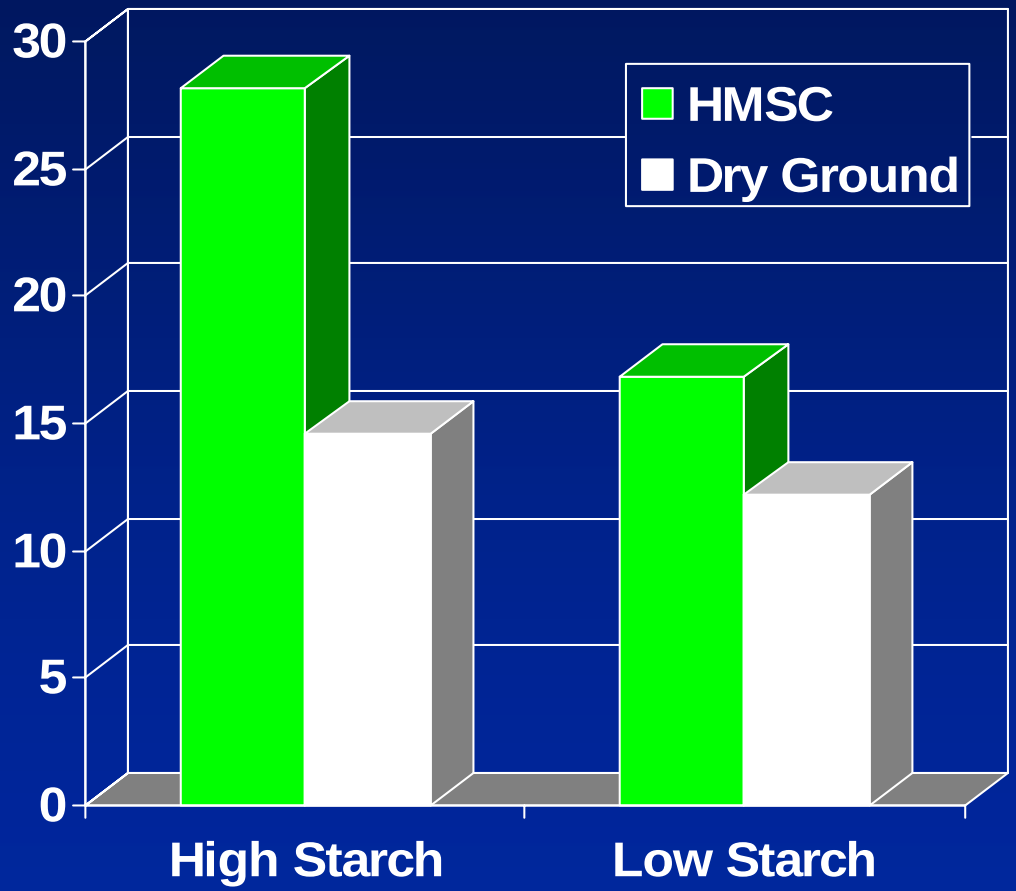
Starch Fermentation Rates



Galyean et al., 1981 **105 μm pore size** **Avg:2,4,6,8 h** a,b,c $P < 0.05$

Starch: Rates Subject to Change?

Rates of Total Starch Fermentation, %/h

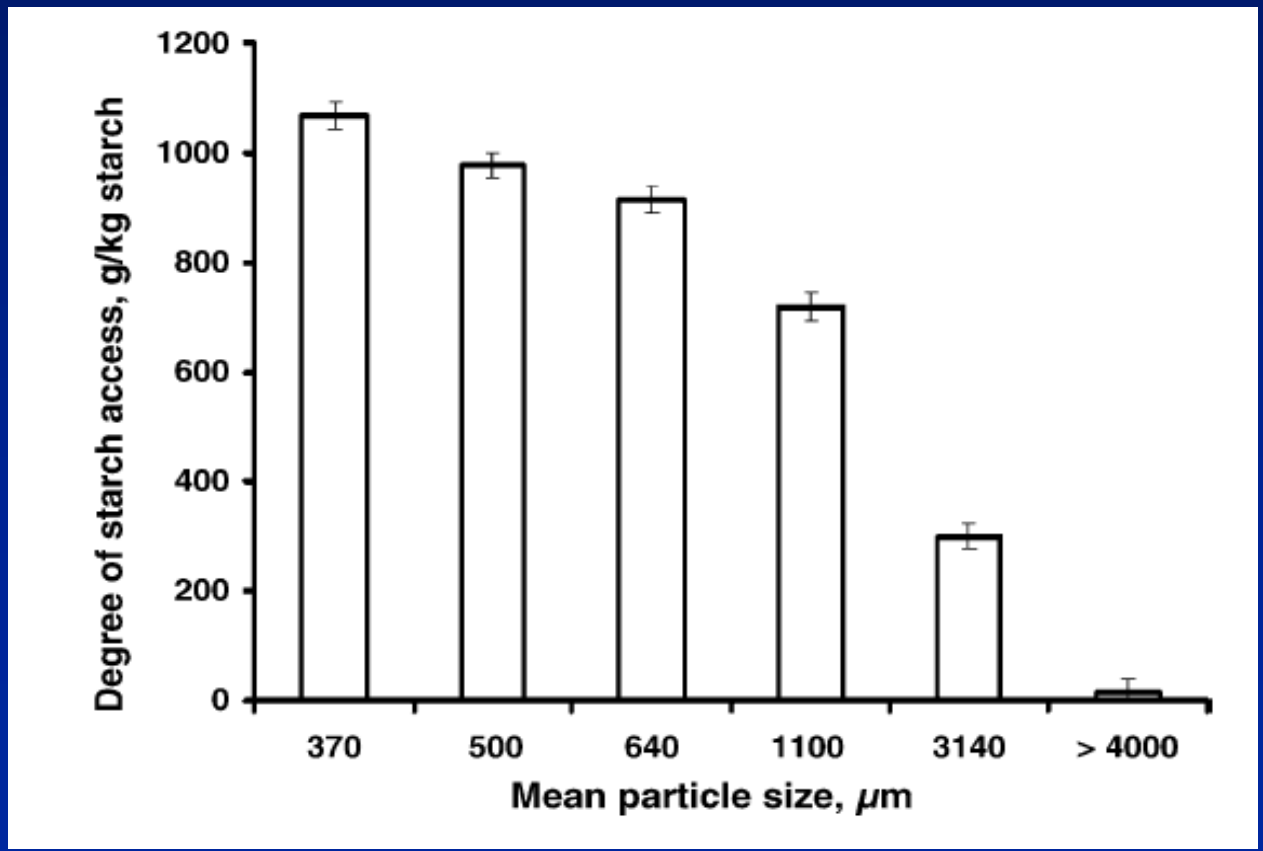


- The more starch included in the ration, the more rapidly it fermented.
- Greater change for high moisture corn than for dry.

Oba and Allen, 2003 Starch $P<0.001$, Corn $P<0.001$,Starch x Corn $P<0.01$

Measuring Digestibility

- Starch digestibility/degradation
  - Enzymatic and fermentation methods
- Measurement affected by particle size



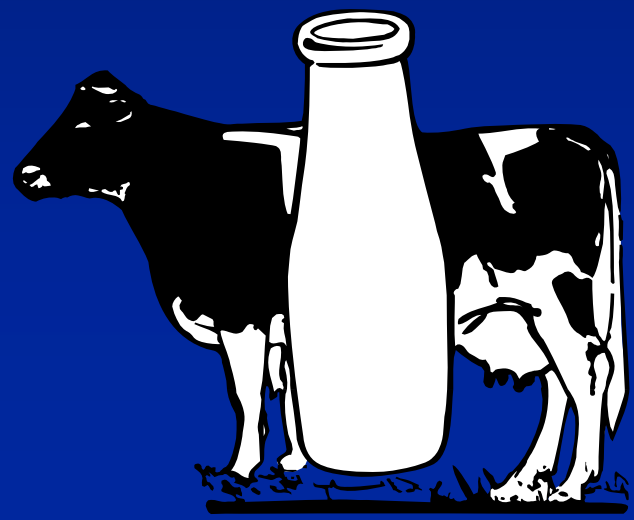
Each 100 μm increase in particle size decreased "degree of starch access" by 26.8 g/kg starch.

Numeric and qualitative?

Blasel et al., 2005.

Starch in Herd Rations

- Feed to limit allowed by forage intake & ration management, and cow sorting.
- At least 40 to 50% of all cows ruminating – watch for signs of ruminal acidosis.
- Consider characteristics of starch source, possibly test starch degradability for relative starch rates.

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