



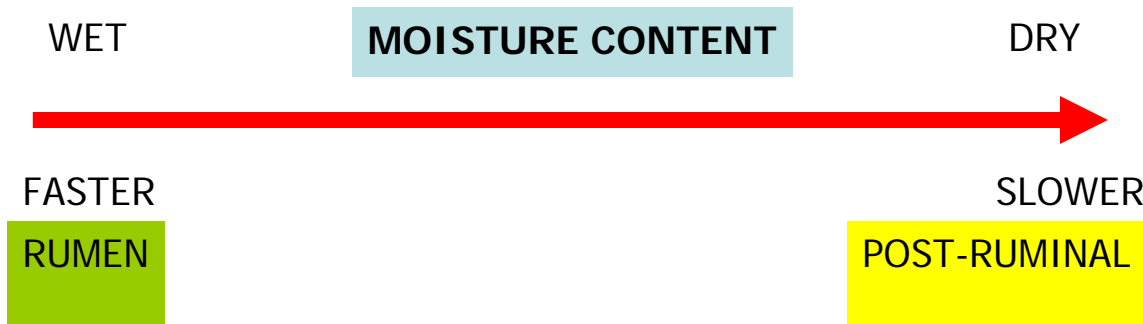
Corn is the predominant grain that is fed to lactating dairy cows in North America. Understanding how corn changes with moisture content, fermentation, drying and processing is critical when formulating diets.

One of the key concepts to grasp is the influence of the degradation rate and the site of digestion for the corn. The speed of degradation in conjunction with flow rate and DMI, will determine where the corn will be digested. High levels of rumen available carbohydrates that are rapidly degradable (within first 5 hours after consumption) could be disruptive to rumen function and microflora population. This is aptly illustrated by research from Oba and Allen who demonstrated that in a high starch diet, feeding HM Corn caused changes in meal length and chewing as compared to dry corn (Table 1). The dairy cows on the **HM Corn diet** had lower milk fat %, lower DMI and less cud chewing than the **dry corn diet**.

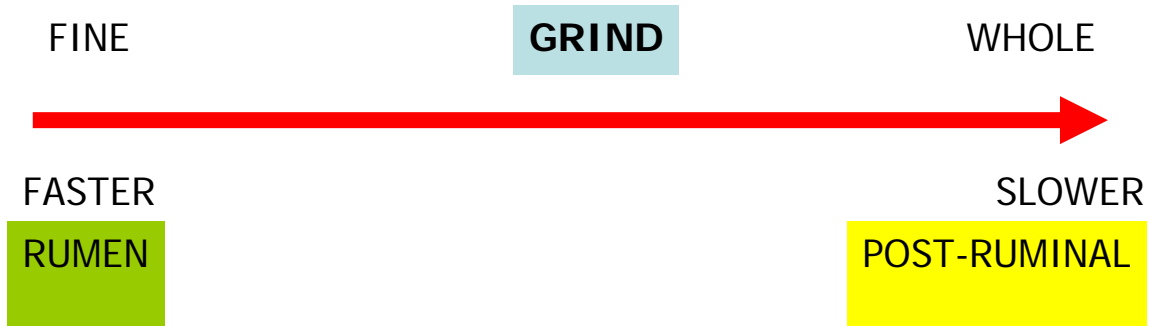
	Milk	Milk Fat	Milk Fat	DMI	Meal Length	Chewing Time	Chews
	kg	kg	%	kg	minutes	minutes	Total
HM Corn (63.2%)	38.8	1.17	3.05	20.8	28.0	680.2	42941
Dry Corn (89.7%)	38.4	1.35	3.59	22.5	31.1	697.0	44632

Understanding what factors affect the **rapidity** of the degradation rate is important when making recommendations on-farm.

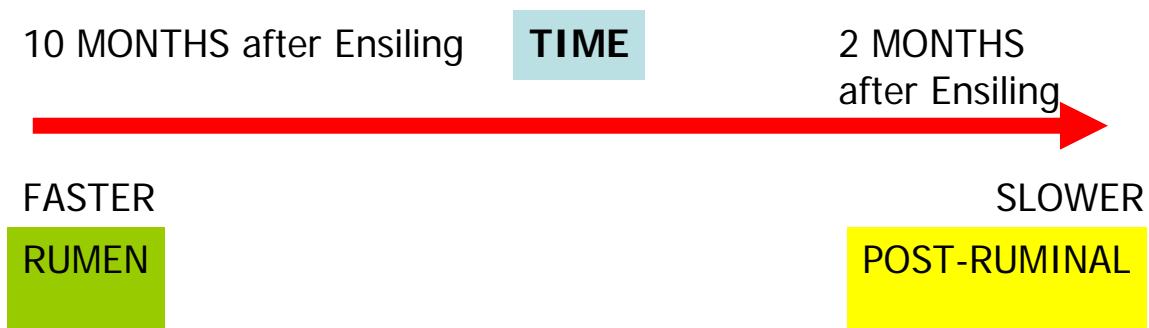
1. **Moisture Level** – as corn dries, the starch forms a crystalline structure that is more difficult for the rumen microbes to degrade. Wet HM Corn (>30%) is rapidly degraded in the rumen while dry corn (<24%) will be slower with some of the carbohydrate escaping rumen fermentation. This provides a more “even” rumen fermentation pattern and shifts some of the digestion away from the rumen.



2. **Form** – grinding corn finer will increase the rate of degradation due to an increase in surface area and a physical destruction of some of the crystalline structure. Wet HM Corn (>30%) should be rolled while drier corn (<24% moisture) should be ground (<1000 microns). The **Newton Program** accounts for **form** when calculating RACHO levels in the diet. As the form increases from 1-5 (the grind becomes finer), the **K₇** (rate of degradation of the D fraction) and the **K₈** (rate of degradation of the E fraction) increases by up to **40%** and **80%** respectively. The **Newton Program** will also take into account passage rate – as the grain becomes finer, rumen degradability increases but so does the passage rate.

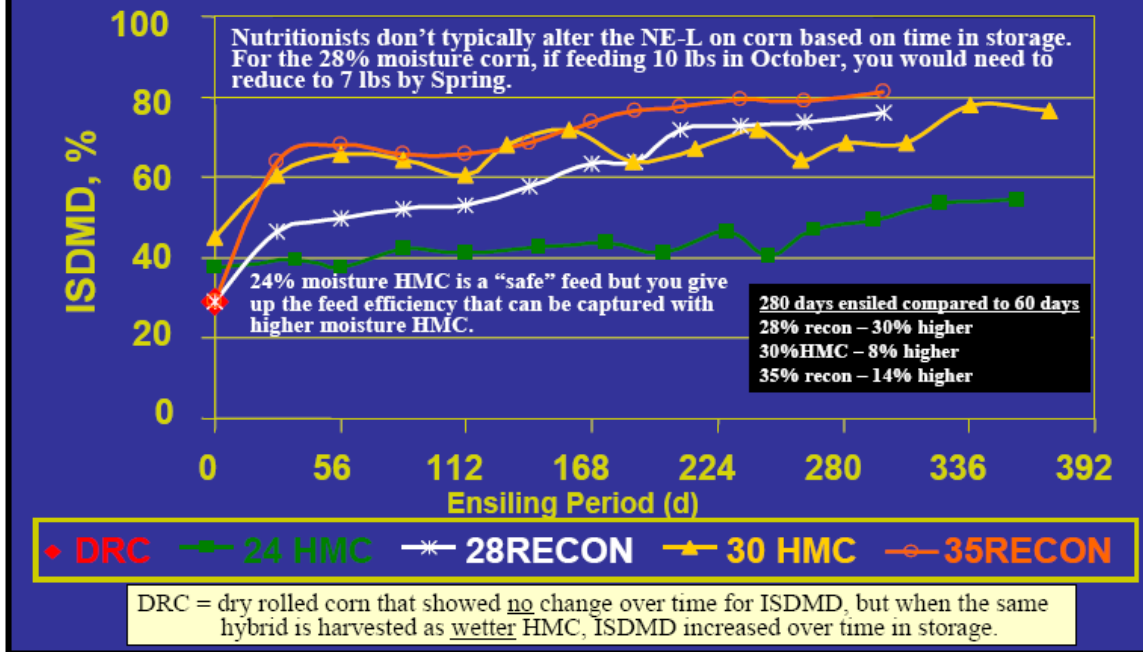


3. **Fermentation and Time** – at the conclusion of the fermentation process (both HM Corn and Corn Silage), the corn becomes more degradable. This process will likely take from **30-60 days**. After this period, the rumen degradation rate of the corn increases due to the disruption of the protein matrix that surrounds the starch molecule. The role of these proteins is to repel water to prevent premature starch hydration that could interfere with germination. The attached Nebraska study (from Dr. Bill Mahanna, Pioneer Hi-Bred International) indicates that the rate of starch digestion is influenced by both moisture content and time in storage. This has a lower influence on drier material such as dry HM Corn (<24% moisture) than wetter material.

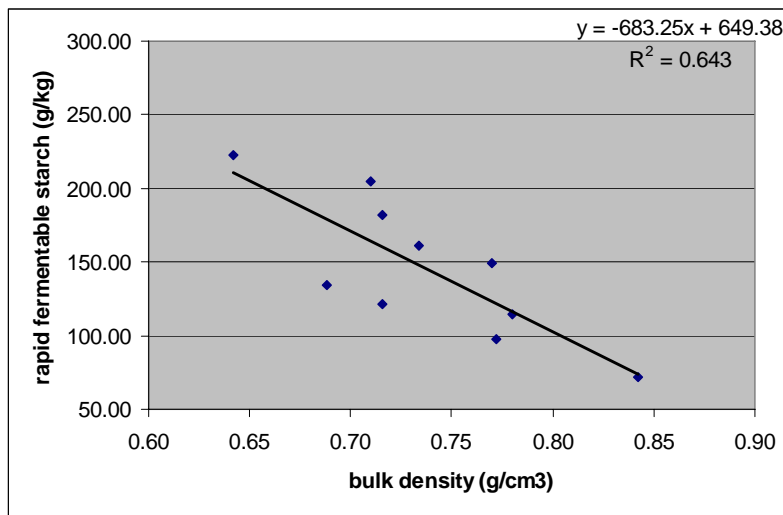


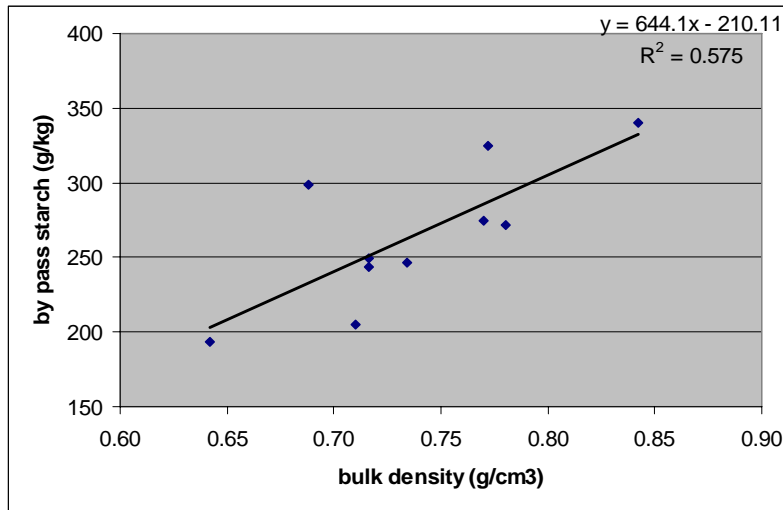
Some of our spring acidosis may be explained by this Nebraska study looking at the rate of in situ (ruminal) DM digestion of HMC of varying moistures and time in storage

Source: J.R. Benton, G.E. Erickson, and T.J. Klopfenstein U of NE, Lincoln. Abstract # 936 2004 ASAS/ADSA Sessions, St. Louis, MO



4. **Test Weight** – the Test Weight (Bushel Weight) of corn is influenced by the density of the kernel. High TW corn (>56 lbs/bushel) is favoured by grain elevators because it is denser and takes up less space than low TW corn. Low TW corn can have less endosperm and more rapid starch by weight than high TW corn. This is due to less “packing” of the starch in low TW corn. These factors will lead to faster rate of rumen degradation in low TW corn. Research from **Nutreco Ruminant Research Centre** in the Netherlands illustrates the difference in starch fermentability between corn samples with different **bulk density**. The two parameters that were measured were rapid fermentable starch (grams/kg) and bypass starch (grams/kg). The attached charts illustrate the change in starch fermentability with low TW corn.





LOW TW

GRIND

HIGH TW



FASTER
RUMEN

SLOWER
POST-RUMINAL

Conclusion

There are a myriad of factors that influence the degradation rate of corn. All of these factors should be considered when making the decision on the type and amount of corn to feed on-farm. Tempering the inclusion of "fast" corn with slower dry corn could be a sound strategy this year due to the increased tonnes of wet HM corn harvested in 2009.

The cow "signals" that would indicate the levels of "fast" corn are too high in the diet would be:

- ❑ Loose manure
- ❑ Fluctuating DMI
- ❑ Decreased rumination
- ❑ Fluctuating milk and milk components

It will be critical to "watch" the dairy cows as they transition on to this year's corn. Adding some dry corn to the ration will help reduce the risk of feeding corn that is too "fast". As the winter season progresses, it will be important to consider the effect of time on the degradation rate of the corn. Wet, finely ground HM Corn will be "fast" at this time of year but even "faster" during the winter and spring months.