ADVANCED AG SYSTEMS'S

Crop Soil News

http://www.advancedagsys.com/

October 2010

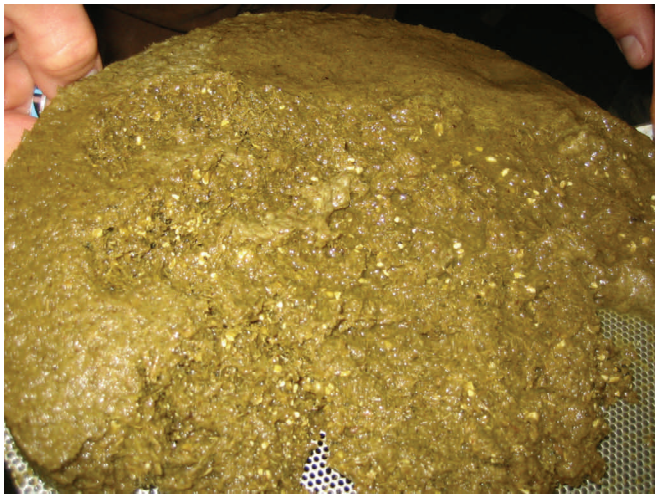
"It is the crops that feed the cows that make the milk which creates the money."

Advanced Ag Systems
Research, Education, Consulting

No Processor?
Have to Feed Shortly After Harvest?
Time to Rethink Your Corn Silage Variety Selection

Corn silage is the premier high energy feed on most dairy farms. In corn silage, 55 – 60% is true forage and so fiber digestibility is a key factor in selection for your farm. Normal corn varieties will range 5 – 6 units of NDFd while BMR types add another 5 – 6 units of variability. For every 1 unit increase in NDFd, you gain .55 lbs of 4.0 fat corrected milk. Thus many farms have selected for high digestible fiber and a large number are planting Brown Mid Rib even where they have a greater chance of taking a significant yield hit.

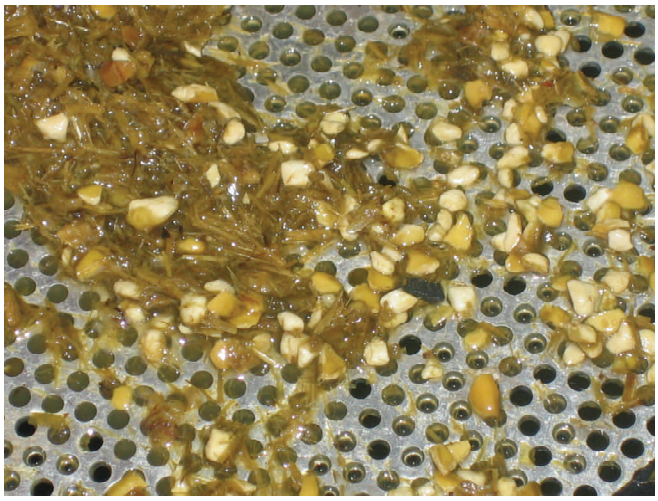
Unfortunately, the grain portion is always assumed as a given – the same as corn grain you purchase. Corn silage dry matter is 40 – 45% actual grain. Grain was assumed to be grain. The corn grain you purchase has been finely ground for maximum digestion – not so with corn silage. So in the early 1990's kernel processors came on the scene where you got to spend more money to break the hard kernels (like grinding corn but not as fine) with the anticipation that you will get more energy from the corn silage. Research showed an increase in milk from properly processed corn silage. This was because more of the kernel was exposed to bacteria. Unfortunately this was more of a Band-Aid for a more critical underlying issue of vitreous starch. Vitreous starch is a genetic line in corn that forms the component **prolamin-proteins**; also called zein. They are closely related in structure to some plastics. They increase the hardness (vitreous) of the starch by coating it in a locked matrix. This allows corn grain to be combined, dumped in trucks, run through a drier, dumped in storage, unloaded back to trucks, driven to an elevator where it goes up and drops in storage, then loaded to rail cars etc. etc.; all without breaking the kernel and producing a lot of fines. It has been critical to the US corn grain industry, enabling it to take advantage of distant markets.



The fine yellow dots are vitreous starch that was processed, fermented, digested, and came out in the manure with its energy content still intact. This represents an unacceptable energy loss in profitable high forage diets.

Unfortunately, vitreous starch is a handicap to starch availability in ruminant nutrition so it can have a huge impact on the availability of corn silage energy for your

dairy cow. High forage diets (greater than 60% forage up past 70% forage) where a lot of profitable farms have moved to; means **ALL the forage quality needs to be utilized, including more of the starch in the corn silage** from the time you start feeding. Many of the silage types were developed out of grain types. In the late 1980's when varieties bred for silage came on the scene, the focus was on fiber digestibility. Grain was assumed to be grain. If you look at the pictures on the previous page you can see from screened manure that the bottom screen has yellow dots the size of coarse sand. These are fine cracked processed vitreous corn kernels that passed through the cow undigested. As can be seen in the picture at right, even cracked and shattered kernels are still not digested. The greater the flint type genetics, the greater the vitreous or protection of the starch from digestion by bacteria. (Rémond et al.,2004), ground a semiflint corn grain to mean particle sizes (0.7, 1.8, and 3.7 mm). With larger particle size, the apparent digestibility of starch in the rumen decreased from 58.6 to 49.8 to 35.5%., but there was no compensation in the intestines because total tract digestibility still decreased from 91.4 to 86.0 to 69.5%. With varieties of lower vitreous, there is more digestion in the rumen.



Even properly processed corn will pass through the digestive system with much of its energy intact if it is encapsulated in prolimins—creating a very vitreous starch kernel.

As Dr. Sniffin of Fencrest, LLC, points out, there are two pools of starch: a fast and a slow pool. The fast is the starch in the more floury part and the slow the more vitreous or made of limited availability by the prolamins in the kernel. Even with some of the vitreous types, there is considerable digestion in the hindgut to increase the total starch degradation – giving you nice looking numbers. Having a lot of the escaped starch digested in the hindgut although can be a real decrease in efficiency and adversely affect microbial protein synthesis – even though the lab said you had good total starch digestion. Adding insult to injury, there is some data to suggest that the greater vitreous starch the greater the rate of passage due to the greater density.

The vast majority of corn silage today has significant amounts of vitreous starch. Pop corn has the highest levels of prolamin. BMR types may have superior fiber digestibility (and superior seed price) but most are based on a flint type grain that has very high vitreous starch. This means you either need to leave it in a pile for 8 – 10 months before feeding it, or accept a significant amount of starch energy is going out the back of the cow and feeding the birds. Most corn silage hybrids planted in the Northeast are also moderately high in prolamins. Fortunately, there is an increasing number of lines becoming available that have a floury gene. These floury type are missing the zein gene and so are low in prolamin. The kernel has very low vitreous starch (see photo at right) and so crumbles easier when chopped and/or processed. Thus it is available to the dairy cow in higher amounts and shorter time frame. There is some data comparing some varieties that indicates floury types un processed have the same starch availability as processed vitreous corn.

The principle that the higher the vitreous the less the starch digestibility, is well founded but for farmers comparing one study to another to select varieties; it is very problematic.

Kernels of vitreous starch on the bottom. A significant portion of the dark yellow can pass through undigested. Long storage (8 –10 months) allow silage lactic acid to dissolve the prolamin and allow the rumen bacteria to digest it. The top kernel is a floury type that is more readily available after ensiling, and crumbles easier making starch available for farms without processors.

The dry matter of the corn at harvest plays a huge role in the degree of expression of the genetic zein content. The higher the dry matter of the silage is, the higher the vitreous expression. Adding to this genetic issue is the fact that "the dry matter percentage remains a key diagnostic indicator, even with kernel processed silages" (Johnson et al.,2002). Moreover, increasing dry matter of the silage was highly correlated with vitreousness of the corn kernel in the silage (Filkins et al 2006). So kernel processors have their greatest impact on drier corn, yet in spite of increasing energy from more exposed surface area, the harder kernel particles can still go through the cow undigested (see photos). Adding to the greater vitreous expression, is the factor that as we get to a higher DM there is lower silage acids and it results in taking a longer time to make the starch available. So when comparing two studies did they harvest at the same moisture level? Do you normally harvest on time or do you get behind and the silage gets dry?

Another question for any of these studies is how long was the silage stored before the analysis was completed? **Prolamin is NOT soluble in water or in rumen fluid.** The only compound that breaks it down is **lactic acid**; which is present in proper ensiled silos in large amounts. The prolamins slowly solubilize over time as a result of the silage acids. That is why storing silage for 8 – 10 months increases the energy because of increased starch digestibility. This opens the huge question: can you afford to invest a pile of money and let it sit for 8 – 10 months at 0% interest before you get your money back. For some farms already in this system, it is no problem. For farms that have more limited storage and have to start feeding immediately after ensiling, this is a critical problem. In today's economy can you afford to wait until March until your cows start milking well (or worse, have the cows milking well on higher grain ration and then have a stealth acidotic crash from too much starch in March when the lactic acid has finally broken down much of the prolamin)? For these farms, switching to a floury endosperm kernel type on a highly digestible stalk will make much more sense and money. Floury are front loaded in that they have more starch in the fast pool that has greater availability immediately after harvest and more steady throughout the year. Adding to the confusion, measuring starch availability in the lab opens another can of worms as some do the digestion over one time frame. They can present nice starch digestibility numbers to the second decimal point, but what do the cows say? The more accurate tests break the starch availability into fast and slow pools to represent the rumen and hind gut digestion.

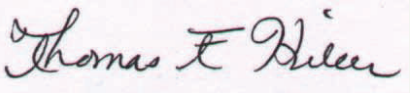
What can you do about all this confusion?

First and foremost purchase highly digestible silage varieties that are at or shorter than your harvest season. In a normal year or a wet fall year you have properly matured corn. There is little yield advantage in a full season vs a shorter season (eg. 105 vs 95) if both are grown properly and at proper populations (this will be discussed more in the November news letter). Farms with extensive wet soils have dramatically increased their silage supply by growing length of season corn that can be harvested before the fields turn to a quagmire.

Second: You don't have and can't afford a kernel processor, or you have to start feeding corn silage shortly after harvest because of limited storage resources. Plant floury corn that produces high yield but is very low in Prolamins. There are several companies out there with floury endosperm corn with high stalk digestibility that have done well in the Cornell corn silage trials.

Third, if you always harvest on time or early, have a kernel processor AND can allow your silage to sit for 8 – 10 months, then you have wider latitude of varieties that will be the best for your dairy production.

Sincerely,



Thomas Kilcer,
Certified Crop Advisor

172 Sunnyside Rd
Kinderhook, NY
12106

Tel: 518-421-2132

tfk1@cornell.edu

The Helping Hand to Better Agriculture