Making Hay While the Sun Doesn't Shine

(Additives Used to Preserve Hay)

Yes, chemicals can be added to your hay. It could affect the performance of your herd, even cause veterinary problems since the USDA and extension services are not conducting feeding trials with chinchillas. While these chemical preservative are considered GRAS (generally recognized as safe), all the feeding trials have been conducted on dairy cattle, beef cattle, sheep and perhaps ponies. So ask your hayman if your hay has been chemical treated and what was the chemical? You have the right to ask questions.

Nutrient losses in hay starts at the moment it is cut. The dry matter losses can be 35-40% of the cutting. Nutrient potential loss can be 20-60%. This is major economic loss for the haygrower as the hay crop will be graded lower. Good haygrowers and good consumers should have laboratory analysis done on the hay. Bad hay must be compensated with more concentrates.

Hay losses in yield and quality start in the field. Just because the "hay" has been cut doesn't mean plant respiration stops. (Tulip stem cells continue to grow after they have been cut. That is why tulip stems keep getting longer.)The second cause of nutrient loss is mechanical. Leaf shatter and grain shatter occurs during cutting, raking, windrowing, tedding or baling. Every time the plant material is handled, a little more falls off or apart. The third cause of hay loss is weather. I don't think I need to explain what happens in wet weather to plant material.

It takes about 30 sunshine hours (in the Midwest) or 3-6 hours of sunshine in the Imperial or Sacramento Valley to cure non-conditioned hay. It depends on daytime temperatures, relative humidity, density of the stand(how close the plants were growing), age of the stand(woody stems or succulent stems), the type of equipment used to cut, rake and windrow the plant material and other factors as to when the hay will be dry enough to be baled.

Plant cells of cut forages are alive and functioning until the moisture content reaches about 47-48% at which point the cells die.(Remember the cells start at 100% moisture content..) The longer the cells live, the more carbohydrates will be lost. Under ideal conditions, 2-8% nutrient loss occurs. Under poor conditions, 16% or more losses may occur. It is best to cut hay under the right condition- cut early in the morning to allow the longest solar drying period; cutting when the relative humidity is low; use mechanical means or chemicals to condition the cut hay or maximize hay exposure by having very wide and thin layered windrows for drying.

So cut hay while the sun shines. Sounds like a good idea-right? Maybe yes, maybe no. Excessive sunlight can bleach the carotene compounds in hay. RAIN on the other hand guarantees leaching losses of the water soluble vitamins, minerals and sugars. The crude protein in hay may actually increase in mildly rain damaged hay. However you should include a protein analysis as well as a fiber analysis to accurately determine the value of the hay when purchasing.

So excessive daylight can damage hay. Rain, floods and other excessive amounts of water will cause damage. Now you say the equipment can mash, mangle, shred and shatter what could have been decent hay into damaged hay. What doesn't damage hay?

Mechanical Losses:

Leaf shatter and grain shatter are the two main causes of hay loss by machinery. Alfalfa is always made up of stems and leaf, perhaps prebloom and bloom flowers. Stems take longer to dry than the leaves. So when the leaf is drying 2.5 to 5 times faster than the stem, you will have a problem when you bring the equipment through. Major quality losses occurs when the leaves shatter or fall off. Alfalfa leaves are 50% of the dry matter, have more than 70% of the digestible protein, 65% of the digestible energy and 90% of the plant carotene. So every little leaf counts!

Grain shatter occurs on barley, oat and other grain hays. Unless the haygrower cuts and bales the grain hay while the grain head is in the tight sheath (soft dough), the consumer is the loser. Grain shatters or falls off the stem when it is handled as a mature or dry plant (hard dough). Anybody who has picked wild oats or tried to "flower arrange" dried wheat, barley or oats knows that grain heads like to fall apart or break into many pieces. Since the grain part is the only nutritious part of the grass/grain hay, any grain loss is a nutrient loss. The grass stems and leaves are only fiber.

So to increase drying rates on thick or very moisture fields, you need to rake and windrow or "ted" the plant materials. Tedding is a European process developed for their generally wet damp hay fields. However the general rule of thumb is don't handle the cut hay if it's moisture content drops below 40%. Just bale it!

There are different types of balers and bales. You have the tiny haycube balers, small rectangular bales (horse market) and the huge (1l50 lbs) rectangular bales (feedlot market) and the huge round bales(pasture or feedlot). Every type of baler causes some level of nutrient loss. And if your final hay product is re-baled from a larger bale, even more nutrient loss will occur. Yes, they "chainsaw" those monster size bales apart and run the loose hay through haycube machines, pellet machines, or small rectangular (horse size) balers. Since the hay market depends on demand, the haygrower has no way of estimating the need for one particular type of haybale at the time of harvest. So if the horse market demands small hay bales in late winter/early spring and the hay dealer has monster bales, he will re-bale and lose more nutrients each time.

It is easier for the haygrower to bale the monster bales and store them. You use a fork lift to move them around rather than muscles. Most small rectangular haybales are stacked by hand (called bucking bales- hard work!). Feed lots and dairies are equipped with heavy machinery to move feed by the ton. Horse stables buy in small amounts(from 1-2 bales to 1-3 tons at a time). The bread and butter business for the haygrower is feed lots and dairies, the horse industry is the high end product but low volume compared to dairies and feedlots. The small ruminants(sheep, goats, llamas, alpacas, etc.) and the tiny nonruminants(rabbits, guines pigs, chinchillas, etc.) are a mere drop in the bucket for the feed and hay industries. So haydealers cater to the largest market- feed lots and dairies.

Storage Losses:

So, every time the hay is handled, some more nutrition is lost. So stop moving it for a while. Now it is stacked in one place and not moving, so there isn't any nutrient loss-right? Wrong! More things can go wrong at this point than you want to know about. The worst can be a hayfire from too wet hay. That could cost you the barn! Ever wonder why a hay bale smelled and perhaps looked at bit burned? Had that singed look to the edges? It probably burned during the "sweating" period.

Once hay is baled, it must go through a period of heating or sweating (think composting). You usually do it outside- NOT IN A BARN. You don't want to burn the barn down. You usually let the haystack sweat for 21 days. During that time and depending on the moisture content, density and size of bale, rate of bale dry-down and the local microbial population on the hay, the hay will generate heat up to 130-140F in the first couple of days. Sometimes the bales can reach 448˚-527˚F and spontaneous combustion will occur.

Excessive heat damage will reduce protein and energy digestibility of the hay. But moldy hay isn't much better. Moldy hay as in "improperly cured hay " has reduced palatability,feed intake and off flavors (a problem in milk). However less than 5% of the molds commonly found on hay produce mycotoxins. So 95% of molds on hay are "friendly" or at least don't kill. But some animals don't like to eat moldy hay. There can be significantly lower dry matter intake, reduced weight gain, and poorer feed conversions with moldy hay feedings.

So now that your hay has "sweated" and cured safely- how to store it to prevent losing even more nutrients? Obviously inside is the best choice with good air circulation and off the floor. You can do that at your place but what is the haydealer doing at his place? A good question- take a look at their facilities and ask them questions about their hay storage facilities.

Hay Additives:

So, what are the chemicals used on hay? There are drying agents or dessicants- potassium or sodium carbonate (baking soda), sodium silicate(water glass) and citric acid(acidulants in soft/fruit drinks). They are all chemicals commonly consumed by people, pets and livestock. They are considered GRAS -generally recognized as safe.

They act on the waxy-cutin layer on alfalfa, clover, and trefoils but are useless on orchardgrass, bromegrass and timothy. If these products are used on legumes that get rained on afterwards, the water damage and nutrient loss is even greater. Timing is important!

Propionic and propionic/acetic acid(vinegar) blends are good for preventing molds and heating damage in high-moisture hays. How effective the organic acids are depends on the rate of application and moisture content of the hay. Even the type of microbes can change the effectiveness of propionic acid. There are species of microbes that can utilize the propionic acid for its nutrition. Unfortunately the hay can develop a vinegar odor and sometimes livestock just doesn't like the flavor !

The next chemical used is the "acid-salt" or sodium diacetate (food preservative). It acts by raising the acetic acid (vinegar) levels in the moist material. The main problem in using this product is the vinegar taste and smell. Not every species appreciates the taste of vinegar on their" salad" material. Speaking of salt(table salt,NaCl), it is also used to preserve hay. However there is a fine line between too much salt and not enough to do any good, and not all species like salty food.

Anhydrous ammonia can be used to treat very wet hay. Again there is a catch to this chemical. It is difficult and dangerous for the user and it may or may not cause toxicity and death in ruminants. It is the case of "dose = poison". Ammoniated hay is dangerous for nonruminants as they can't use the non-protein nitrogen sources (ammonia and urea can be utilized by the bacteria in the rumen). Which leads us to urea. Yes, it can be used on hay. Yes, it can be fed to ruminants but not to nonruminants. It is safer to handle. But it can still cause toxicity and death, if the urea treated hay exceeds 4% of the total ration. That is still a narrow margin for safety.

So people have tried fermentation products-bacteria, yeasts and enzymes. The success rate was rather limited. The products were only tested on a dairy feeding trial. So the next group of product tried was the anaerobic bacterial inoculants. They were originally developed for silage products not hay. But wet hay isn't too far from becoming silage, so why not try the products. The problem with anaerobic bacterial inoculants was the tremendous variation in bacterial strains, type of hays, weather conditions,and many other conditions that couldn't be controlled. So they were judged to be not cost effective.

The aerobic bacterial inoculants fared slightly better in trials. They did make it to feeding trials with lambs. Again the trials were done with ruminants, so there is no way to judge its results with nonruminants.

Summary:

Be informed! Knowledge is your best defense against bad hay. Know your consumer rights too. Getting a good education in the different types of hay can range from going to visit a local agriculture school (college, junior college or university) and talking to the animal science or agronomy departments to visiting local horse farms and dairies. Horse farms/stables and dairies have to be very familiar with good and bad quality hay. You can also visit hay co-opperatives and haydealers. They handle thousands of tons of hay per year and they can give you a very practical hands- on education about the local types of hay. «•»

References:

http://www.pioneer.com/consult/research/hayaddit.htm