

## Low Sugar Hay and Pasture for Horses

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Sugars supply forages with energy required for regrowth and are a nutritional component needed by both forages and horses. However, some horses, like some humans, are sensitive to the sugar content of hay and pasture forages, which can lead to potential health problems. These problems include: laminitis (founder), equine metabolic syndrome, equine Cushing's syndrome, or forms of tying-up such as recurrent exertional rhabdomyolysis, polysaccharide storage myopathy (PSSM), equine polysaccharide storage myopathy, and others. In general, horses with obesity and metabolic syndrome, Cushing's disease, and pasture-associated laminitis are unable to take up sugar in the form of glucose into their tissues because they have developed a diminished response to the hormone insulin ("insulin resistance"). Obese or fat horses and horses over 15 years of age are more predisposed to insulin resistance. In contrast, horses with PSSM have increased sensitivity to insulin and take up too much glucose into their muscle tissues. Because some forages can contain high sugar content, whether hay or pasture, they may be problematic for horses with these specific conditions.

Many of the forage crops available today were researched and developed for cows with calves at their sides. Most are cool-season grasses that are commonly found in horse pastures and hay fields around the upper Midwest and may be high in sugar. These sugars are in the form of fructans as well as simple sugars like glucose, which posed no problem for cows. When techniques were developed to analyze forages for "sugar," they did not distinguish between the proportions of fructan and simple sugar. The difference may be important for horses because glucose is absorbed in the small intestine and triggers an insulin response, whereas fructans are passed to the horses' hindgut and fermented without triggering insulin. Diets high in simple sugars and the type of starch found in grain are not good for horses with insulin resistance as they result in very persistently high blood sugar. Horses with a predisposition to laminitis should not be fed forages high in fructans. This is because fermentation of fructans in the large intestines by microbes can upset the microbial balance and makes the gut environment more acidic, which releases toxins into the bloodstream that exacerbate laminitis.

Unfortunately, there are no "silver bullet" grasses that are consistently low in sugar. Most cool-season grasses, like orchardgrass and fescue, can have high sugar content. Timothy and crested wheatgrass tend to be medium in sugar content, as are most warm season grasses. However, warm season grasses are usually not winter hardy for the upper Midwest and cannot compete with cool season grasses in the spring and fall. This creates a dilemma for horse owners with horses who are sensitive to high sugar content or have been diagnosed with one or more of the above problems.

Alfalfa hay/pasture is not the solution for horses sensitive to sugar content. Alfalfa tends to be higher in digestible energy, calories, and protein content than grass. More calories can result in weight gain, and high levels of protein can lead to liver glucose production.

Currently, it is thought that a safe sugar content for sensitive horses is 10% or less. Testing is a good starting point for determining sugar content in hay, but caution should be used to ensure that a representative sample is taken. Just looking at a forage sample or knowing the species will not give you an estimate of sugar content. As a last resort, up to 30% of the sugar content can be flushed from most grasses by soaking in water (60 minutes in cold water and 30 minutes in hot water). Care should be taken to ensure all soaked hay is eaten, as unconsumed damp hay will eventually mold.

Determining sugar levels in pastures is extremely difficult because of the many factors that must be considered. Sugar content is highest when grass is in the vegetative state (early spring and during re-growth); during periods of cool nights and warm sunny days (fall or early spring); after a hard freeze; and during drought conditions. Sugar is usually stored in the top two inches of forage growth, and even brown grass found during a drought or winter months can contain high amounts of sugar. Until more cool-season grasses with low sugar content become available, careful pasture management and forage testing by horse owners with sensitive horses is essential. Good pasture management entails not overgrazing, limiting grazing time, and/or using a grazing muzzle.

A research project at the University of Minnesota is underway to better understand the role sugars play in sensitive horses.

# Nitrate Concerns with Horses

*by Mike Murphy, University of Minnesota*

There have been recent concerns regarding nitrates and the possibility of horses being poisoned from forage containing high levels of nitrates. Nitrates are normally found in forages, however, some forages can accumulate large nitrate concentrations during dry or drought conditions. Nitrates can be converted to nitrites in the rumen of cattle, and possibly by other GI tract flora. If nitrite is absorbed in blood in sufficient quantities it may convert hemoglobin to methemoglobin, giving the blood a chocolate brown color. Methemoglobin does not release oxygen to tissues like the normal hemoglobin does, and thus interferes with the animal's ability to use oxygen. Ruminant animals, like cattle and sheep, are reported to be about 10 times more susceptible to nitrate poisoning than horses because their rumen converts nitrate to nitrite. The same reaction may take place in the cecum (hindgut) of horses to a lesser extent. Thus, horses are generally tolerant of higher concentrations of nitrate in forage than cattle. Symptoms of nitrate poisoning in horses are similar to cattle and include: difficulty breathing, weakness, tremors, bluish-colored mucous membranes, and possibly death. Research has shown that feeding hay containing 1.5-2% nitrate to pregnant and non-pregnant mares resulted in clinically normal animals, even though higher than normal levels of nitrate were detected in blood samples. As a general rule, most horses should not be fed hay containing more than 1.5% nitrate. DHIA, Dairyland and the Minnesota Veterinary Diagnostic Laboratory can test hay for nitrate concentrations. If forage contains between 1.5-2% nitrate, it should not be fed without diluting the forage with other feedstuffs (i.e. forages/grains lower in nitrate). If the forage is over 2% nitrate, it should not be fed at all. Nitrate exposure has also been associated with goiter (or hypothyroidism) because of the potential for nitrate to interfere with iodine. Offering iodized salt is the most practical prevention for goiter.