There IS sugar in grass and hay

There is a myth that most of the carbs in grass are fiber and not sugars. However here are some basic plant physiology concepts. I'm a plant person, and I really do know more about this than your vet does.

· Sugars are the basic building blocks for plant growth.

Glucose and fructose are the substrates for most other carbohydrate fractions in plants. Stick one of each together and you have sucrose…common table sugar. Another name for sugar is 'saccharide'. When a molecule is formed from many sugars, we call it a 'polysaccharide'. Some common polysaccharides are starch, which is a bunch of glucose stuck together Make a longer, more structured chain and you get cellulose. Some of the more exotic flavors of sugar form together to make pectin. Fructans are polysaccharides of primarily fructose, with maybe a glucose thrown in occasionally. These can be really huge molecules, with a 3-dimensional structure, and there are many different kinds, with a complex nomenclature (frankly, it's a nightmare) based on the type and site of chemical linkages. Grass fructans are called levans or phleins, having mostly or exclusively 2-6 linkages, whereas the fructan from broad leaved plants are generally inulin, having 2-1 linkages. Each kind of grass has it's own special kind of fructan, although not all kinds of grass make fructan. [26]

· Plants make sugar by photosynthesis during daylight.

CO_2 + H_2O+ energy from the sun = sugar. This happens continually, as long as there's sun, unfrozen water and carbon dioxide. Being primarily driven by radiant energy, temperature only has a minimal affect on photosynthetic rate. There's two different kinds of photosynthesis in plants, termed C3 and C4. C4 plants grow only when it's warm, and the first product of photosynthesis is a 4 carbon acid. C3 plants predominate in northern climates, can grow when its cool, and the first intermediate product of photosynthesis has 3 carbons in it. This difference in metabolism makes each type of plant better adapted to its climate. Plants that are really well adapted to cold can actually continue a low rate of photosynthesis under a light layer of snow. Examples of C3 grasses are brome, timothy, orchard, fescue. C4, warm season grasses continue to be efficient in high temperatures that cause C3 cool season grasses to shut down. Examples of C4 grass are Bermuda, bluestem, Pangola, and many native prairie grasses.

· Plants use sugar during respiration at night.

The plant uses sugars to grow, turning the simple sugars made that day into fiber for cell walls, and energy to build other necessary components with the additional essential nutrients. This is why grass will have lower levels of sugar at dawn, IF conditions for respiration were optimum- if it's warm enough, and there's enough water, and other necessary substrates to make things with. Because enzymes are necessary for these transformations, this part of the cycle is more dependant on temperature.

· If the rate of photosynthesis is higher than respiration, sugars accumulate.

The rate of respiration/growth is reduced in cool temperatures. Photosynthesis is driven primarily by electromagnetic energy from the sun, and even though water is necessary for this process, respiration will shut down under stress before photosynthesis will.

· Stressed plants accumulate sugar.

The above process is limited by any kind of plant stress, including cool temperatures [9] [11] drought stress,[4] [5] [29] salinity [21] or lack of essential nutrients. [4] [30] Think of it as a factory that makes things that require a broad inventory of parts. If just ONE of those essential parts is missing, the factory shuts down. If more sugar keeps being produced during the day, but the factory is shut down due to a lack of water, the sugars will accumulate. This is a successful evolutionary adaptation for plants, as it allows them to continue to accumulate and save up sugar and other substrates that will then be readily available for rapid growth once the limiting factor is provided. [12] This is why we see just a big jump in growth from a light rain after an extended drought. The grass has accumulated sugars in the base of their stems and leaf sheaths while in 'hunker down' mode, and is ready to spring into action with the first rain, or warming days or application of deficient nutrient.

· Excess sugar and fructan will also be present in hay made from high sugar grass.

Some sugar will be lost in hay curing, because even after cutting, forage plants will continue to metabolize sugars until the moisture levels are below about 40%. The generation of C02 from the respiration of sugars will make dry matter content decrease until respiration ceases. That is why the length of drying time is a factor in how much sugar gets spent during curing. Cool cloudy weather, with high humidity that increases the curing period will result in lower levels of sugar in the resulting hay. A light rain may leach out a significant amount of sugars, and further slow down the drying process. This is why 'rained on' hay is not considered of dairy quality, even if conditions after the rain were good for drying, and the hay goes up without any mold. It takes a heavy rain, or extremely long term curing to damage protein. I contend that some of this hay that is considered of lesser quality may be the most appropriate for laminitic horses.

· Reducing sugar in hay.

The Animal Health Foundation funded a study where I looked at the effect of soaking on the NSC content of hay. Researchers looking at quality of hay rained on during curing find that 2.4 inches of rain on legume hays will decrease highly soluble nutrients(NSC) while protein is only slightly decreased. [13] I believe soaking hay is useful as a first aid measure for treatment of horses with acute laminitis related to intolerance of high levels of sugar and/or fructan. I have reports of chronically laminitic, insulin resistant horses responding with improved soundness within a few days. It may take up to 2 weeks to see a response, so don't give up too soon. While experimenting with soaking my horses hay, I discovered that if the rinse water is kept in a warm environment for a few days, it gets a head of foam and smells like alcohol. I made hay beer! If a horse is suspected of having metabolically induced laminitis, soak hay for at least 60 minutes in cold water, or 30 minutes in hot water, drain and feed before it has a chance to mold. Use fresh water every time, because the sugar will build up in the water. Then get your hay tested for NSC, and replace it if the levels are above 12%. For the full text article of the hay soaking study, click here.

Where I live, very sunny, and extremely dry, hay cures in a couple days, and growers bale only in the wee hours of the night in hopes of getting some dew to keep the leaves on the hay. Consequently the San Luis Valley of Colorado is well known for producing some of the highest quality dairy hay in the USA. We also have more than our fair share of laminitis and colic. An Amish horse trainer who recently moved here from Minnesota told me he's never encountered so much laminitis since he has lived here. After a year, they also started seeing EPSM in their draft horses. Data from research trials conducted at Rocky Mountain Research & Consulting, Inc., in conjunction with USDA showed that oat hay maturing in the fall at my facility contained levels of total carbs and fructan specifically that are surprisingly high, even when extremely mature. I have tested improved grasses from the research plots here that are up to 39% NSC dry matter! Surely destiny has a hand in putting me and my insulin resistant ponies in the Founder Fodder Capital of the world.