

Is Teff grass hay always low in NSC?

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In California teff is being called the 'perfect grass for foundered horses'. But is Teff hay always safe for horses that are intolerant of high sugar forage? Teff grass (*Eragrostis teff*) is a new type of grass being introduced around the world for hay production. Originally from the highlands of Ethiopia, there are different varieties grown for grain or for hay.



Some varieties are perennial, but most farmers interested in growing teff hay are looking at using the short-lived annual varieties as a 'catch' or 'rescue' crop, which is something that can grow in a hurry and use up nutrients left over from a previous crop that failed. It's especially useful to extend the life of a stand of alfalfa that may have been damaged by worms or winter-kill until it can be replanted later on in the season. Being very shallow rooted, teff can take advantage of light rains and is very drought tolerant. Water it a lot you get a lot of forage; water it less, you get less forage. Unfortunately the same shallow root system makes it too easy for horses to uproot, so it is not suitable for grazing. The seed is extremely small, requiring a special seeder or can be broadcast by airplane.

As a C4, warm season grass, it should average lower in NSC than most C3, cool season grasses because C4's do not have the ability to form long chain fructan. C4 grasses form starch as a storage carbohydrate, and starch formation is self limiting, whereas fructan formation is not. Un-replicated hay tests provided by the seed supplier show that teff hay grown under various conditions in the United States and analyzed at Dairy One, Ithaca, NY range in NSC from 7.2 to 15.9 % NSC dm (WSC + starch). Those in the lower range are well suited for laminitic horses, while some in the upper range are

not. A study was conducted to investigate the NSC level of a forage type of teff grass grown under sunny, cool conditions and subjected to drought stress.

Methods

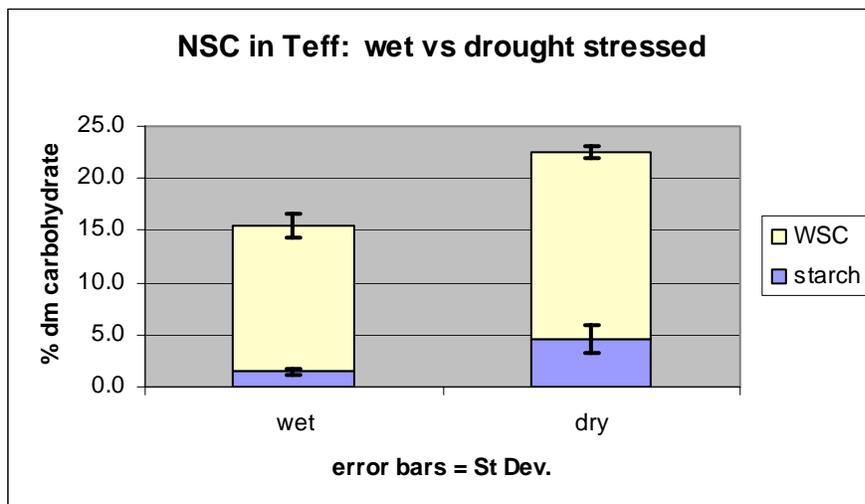
Teff grass, variety Tiffany (supplied by Target Seed, Parma, ID) was planted by hand in late June, in a planter skip in a malt barley field in a high mountain valley in Colorado, where conditions for producing high NSC forage are optimum; sunny and cool. The seed was diluted with cracker crumbs and broadcast using a jar with holes punched in the lid, and then raked lightly into the soil surface. Soil was a sandy loam with low organic matter, and a low moisture holding capacity. Irrigation was provided by overhead sprinkler. No additional fertilizer was added other than that applied previously for the malt barley. Irrigation proceeded normally for the barley crop, which was below optimum for the teff. Drought stress was probably occurring through much of the growth of the grass as it was in earlier stages of growth than the barley. The teff stand was sparse and thin, and by the time the barley was mature and irrigation stopped, the teff was just starting to head out.



The first sampling was made Aug. 25, 2008 after the last irrigation and a light rainfall such that the teff was well watered. Day/night temperatures during the sampling period ranged from 82-76/ 49-42°F. Minimum relative humidity ranged from 16-42% and it was mostly sunny. The strip of teff was sectioned into 3 reps, and grass was cut approx. 3 inches from ground level with hand clippers randomly within each section. No irrigation or rain occurred after the first sampling. By the second sampling, made 8 days later, the soil in the rooting zone was completely dried out. The teff grass was severely drought stressed, and fully headed out at the second sampling. After cutting, all samples were cured in full sun for 3 days in screen pouches to simulate hay production. All were analyzed at Dairy One, Ithaca, NY for Ethanol Soluble Carbs (ESC), Water Soluble Carbs (WSC), and starch.

Results

After 8 days of severe drought stress, the mean NSC (WSC + starch) concentration in Tiffany teff hay increased from 15.5 to 22.5 % of dry matter; a 45% increase. Both Water Soluble Carbs and starch increased significantly; from 14.0 to 17.9 and 1.4 to 4.6 dm, respectively. ESC increased from 9.2 to 10.4 % of dm.



A composite, complete analysis of the later, drought stressed sample showed crude protein at 5.7, NDF at 62.8, ADF at 35.0, Ca .23, P .25, Mg .09, K 1.17, Na .024, all at % of dry matter, and Fe 67, Zn 28, Cu 5, Mn 88, Mo.6, all at PPM on dm basis. Horse DE calculates to .97 Mcal/lb.

Discussion

Successful grasses accumulate carbohydrates under stress so they are more competitive after the stress has ended. It has been noted previously that carbohydrates increase in C4, warm season grasses under both drought and cold stress. While two C4 grasses were lower in NSC than C3 grass at day/night temperatures of 60°F/ 50°F, they increased dramatically in starch content (as defined as carbohydrates soluble in 100°C water) to 16 and 13 % of dry matter when grown at 90/80° F (Wilson and Ford, 1971). While C4 grasses are not capable of producing long chain fructan, they can make shorter chain fructo-oligosaccharides (FOS) under cold and drought stress (Chatterton, 1991). FOS has been shown to elicit a glycemic response in insulin resistant ponies.

Nitrogen deficiency is another stress that can increase carbohydrate levels in both C3 and C4 grasses (Gallaher, 1977). In the current study, the low level of crude protein, 5.7% dm, indicates that this teff was deficient in nitrogen. This additional nutrient stress probably contributed to the higher carbohydrate concentrations.

There are many factors that interact to determine carbohydrate content of grass. It is extremely difficult to control every factor such that the effect of a single factor can be studied. The grass stand in the current study was very sparse, allowing every leaf to receive maximum sunshine throughout the day. This may have been significant to the fairly high levels of NSC attained. We must consider that if the grass were thicker, the lower portions of the plant would have received far less solar radiation, and may have been considerably lower in NSC. The later sampling was made when more of the

grass was headed out, which may also have contributed to increased NSC concentration.

While C4 grasses may average lower in NSC than C3 grasses, individual lots of hay from C4 grasses may still fall within ranges too high for horses with insulin resistance. Given that choices of hay in California are few, teff grass may still be a better choice in that region than hay made from oat, barley, rye or wheat forage or straight dairy quality alfalfa. Choosing hay that is grown with proper fertilization and irrigation, and well adapted to the growing region may improve the chances that teff hay is low enough in sugar and starch for horses prone to laminitis.

Summary

As with all varieties of grass, the carbohydrate concentration of teff grass varies depending on environmental conditions during growth. Under cool, sunny conditions, drought stress and nitrogen deficiency, the NSC content of teff may still be too high for carbohydrate intolerant horses.

References

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For more information on carbohydrates in forage and management of carbohydrate intolerant horses please go to www.safergrass.org