

**NITROGEN DEFICIENT GRASS IS HIGHER IN
NON STRUCTURAL CARBOHYDRATES
THAN GRASS FERTILIZED WITH AMMONIUM NITRATE**

Kathryn Watts

Rocky Mountain Research & Consulting, Inc. Center, CO 81125

Excess Non Structural Carbohydrates (NSC) have been linked to laminitis, OCD, EPSM, Equine Metabolic Syndrome and colic. Improved grasses can contain excessive amounts of NSC under certain conditions. Horse caretakers of at-risk animals desire pasture management techniques that minimize accumulation of excess NSC.

A study was conducted to investigate the response of grass NSC concentration to nitrogen fertilization. Data was collected from an established paddock of irrigated pasture at Rocky Mountain Research & Consulting, Inc., Center, Colorado. The test site is at 7,600 elevation, and the sunny, cool climate is very conducive to accumulation of NSC in forage. The study design was a randomized complete block with 4 replications. Previous soil analysis and fertilization brought other required nutrients into optimum range, therefore nitrogen was the only limiting nutrient. The species represented are mostly Paddock meadow brome (*Bromus riparius*) and Garrison meadow foxtail (*Alopecurus arundinaceus*), which are well-adapted, commercial standard varieties in the area. Ammonia nitrate was applied by a ground driven broadcast spreader in March, and irrigation was applied as needed for optimum growth to all plots. Sampling for NSC was conducted on May 30, as the grass was starting to head. The average day/night temperatures for the 5 days preceding sampling were 22/3°C, with a light frost occurring the morning before sampling. Whole plant samples were collected at 4 PM, frozen immediately, and shipped frozen to Dairy One, Ithaca, NY for NSC analysis. The next day, 2 sq yards of plant material was hand clipped to ground level from each plot, and dried in an oven to obtain dry matter yield. The grass in the fertilized plots was noticeably taller, denser, and more vigorous than the unfertilized plots. The plots fertilized with ammonia nitrate yielded 3 times more dry matter, and were significantly lower (29%, P=.05) in NSC concentration.

NSC Content of Fertilized vs. Non fertilized pasture

	NSC % * Dry matter	Yield Tons Dm/ ha
31 kg/ha nitrogen as AmNO ₃	17.88 b	.8 a
No nitrogen	23.10 a	.27b

P= .05, mean of 4 reps

*Analysis by Dairy One, Ithaca, NY to include sugar, starch and fructan

The relationship between nitrogen and NSC is complex and affected by many other variables including growth rate, variety, and environmental conditions. Generally, forage grown under nitrogen deficiency is higher in NSC than forage grown with optimum amounts of nitrogen fertilizer (1)(2)(3). Fructan content was found to be inversely proportional to nitrogen content in wheat (4). Production of fructan is triggered by excess amounts of sugar in C3 grasses. If nitrogen deficiency is a limiting factor for growth, NSC accumulate in grass, which would otherwise be utilized for production of fiber, protein and energy. Nitrogen stimulates optimum growth, thereby fully utilizing sugar produced during photosynthesis. Since excess nitrogen can delay senescence, thereby allowing grass to continue to photosynthesize longer into the fall when excess NSC accumulation is likely, over fertilization with nitrogen should be avoided as well.

Horse owners concerned about excess NSC in pasture and hay should be advised to provide forage crops with the amount of nitrogen deemed necessary for optimum growth by soil analysis.

Keywords: carbohydrate, fructan, grass, fertilizer

- (1) Smith, D. 1973. The Nonstructural Carbohydrates. Page 143 in Chemistry and Biochemistry of Herbage, G.W. Butler and R.W Bailey, ed., Academic Press, London.
- (2) Belesky, D.P., S.R. Wilkinson, and J.A. Stuedemann. 1991. The influence of nitrogen fertilizer and *Acremonium coenophialum* on soluble carbohydrate content of grazed and non-grazed *Festuca arundinace*. *Grass Forage Sci.* 46:159-166.
- (3) Wilman, D., Y. Gao, and A. Altimimi. 1996. Differences between related grasses, time of year and plant parts in digestibility and chemical composition. *J. Agric. Sci.* 127:311-318.
- (4) McGrath, V. B., A. B. Blakeney, and G. D. Batten. 1997. Fructan to nitrogen ratio as an indicator of nutrient stress in wheat crops. *New Phytol.* 136:145-152.