

Varietal differences in rate of carbohydrate accumulation for tall fescue

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Introduction Total non-structural carbohydrates (TNC) accumulate during daylight because photosynthesis produces more TNC than are metabolized for plant growth and maintenance. The net balance of leaf photosynthesis, respiration, and carbohydrate export produces a diurnal variation in TNC such that minimum concentrations occur in early morning and maximum in late afternoon. The objectives were to determine variability of TNC concentrations among cultivars, and to investigate daily rates of carbohydrate accumulation in tall fescue (*Lolium arundinaceum* (Schreb.) S.J. Darbyshire = *Festuca arundinacea* Schreb.).

Materials and methods Tall fescue cultivars tested were Kenhy (*L. perenne* × *L. arundinaceum*), and Mozark. The soil was a surface-irrigated silt loam near Kimberly, ID USA (42°32' N and 114°20' W, elevation 1200 m). Herbage was sampled to 7 cm at eight times between sunrise and sunset in May, July, August and September and were analyzed by near-infrared (NIR) spectroscopy for TNC, fructans, starch, sucrose, glucose and fructose.

Results Concentrations of TNC declined with each successive cutting during the season. Vegetative tissue contained, on average across cultivars and time of day, 238, 232, 141, and 121 g TNC kg⁻¹ in May, July, August and September, respectively. Figure 1 illustrates the contrast in intercepts between the cultivars Kenhy and Mozark, while the accumulation rates (slopes) are the same. August TNC accumulation rate from 0800 to 1800 hours for Kenhy was 3.9 g TNC kg⁻¹ h⁻¹ and for Mozark was 3.6 g TNC kg⁻¹ h⁻¹. Except for May, cultivar Kenhy contained among the highest and cultivar Mozark the lowest concentration of TNC. Kenhy was the most and Mozark the least preferred cultivars in a previous study (Shewmaker *et al.*, 1997). The TNC concentrations were similar to those reported by Mayland *et al.* (2000).

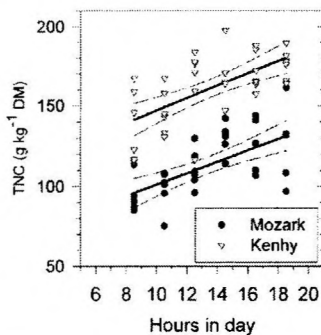


Figure 1 August herbage TNC concentration.

Conclusions Forage samples taken for animal preference or carbohydrate analyses should be taken within 1 h to control the diurnal variation of TNC proportionately within 0.02 in May or 0.05 in September. Alternatively the proper use of experimental designs such as the use of time as blocks or as a covariate in analyses may account for the effects of differences of time. Tall fescue should be cut between noon and sundown for TNC concentration to be greater than the daily mean.

References

- Shewmaker G.E., Mayland H.F. and Hansen S.B. (1997) Cattle grazing preference among eight endophyte-free tall fescue cultivars. *Agronomy Journal*, 89, 695-701.
- Mayland, H.F., G.E. Shewmaker, P.A. Harrison, and N.J. Chatterton. 2000. Nonstructural carbohydrates in tall fescue cultivars: Relationship to animal preference. *Agron. J.* 92, 1203-1206.

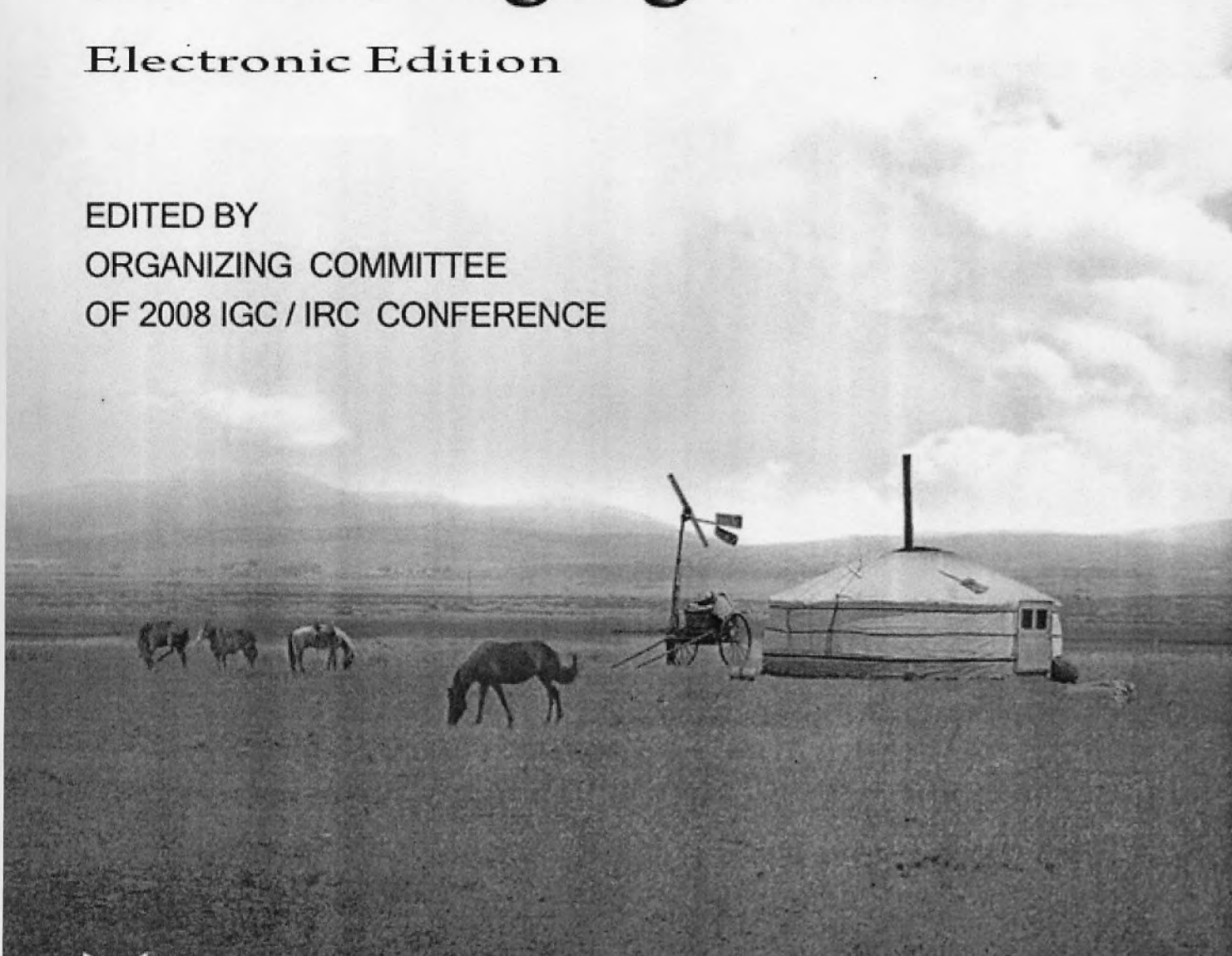


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