Influence of Seasonal Changes and Variety on the Water-Soluble Carbohydrate (WSC) Content of Varieties of *Lolium perenne* in Sweden

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Introduction Grasses with high levels of WSC have been shown to enhance livestock production (Miller *et al*., 1999). This has led to the development of perennial ryegrass (*Lolium perenne* L.) cultivars that can accumulate high levels of WSC. The appeal of the high WSC grasses lies in their potential to make protein synthesis in the rumen more efficient through matching protein and energy supply more closely, and so help reduce nitrogen losses to the environment. The objective of the paper was to determine the influence of seasonal changes in temperature and radiance on water soluble carbohydrates (WSC) in first growth of varieties of perennial ryegrass.

Materials and methods A small-plot field experiments with a three-cut system was established in 2001 in Uppsala (59°49′N 17°39′E, altitude 5 m), Sweden. The experiment was of a single-factor randomised block design with four replicates and eight varieties of perennial ryegrass, but only three are reported here. These are: AberDart (diploid), bred for high WSC accumulation, Fennema (diploid) and Helmer (tetraploid). Plots were fertilised in spring with 100 N ha^{-1}. P and K were applied according to the plant available levels in the soil.

Pre-harvest samples were taken by hand during first growth every week three times before first harvest. All plots were harvested at 5 cm stubble height when Fennema had reached the early boot stage by a plot harvester. First cut was taken 5th June 2002 and 10th June 2003. All sampling and harvesting were done around 1400h and analysed for WSC content. Immediately upon cutting, samples were placed on ice and transported to the laboratory whereupon the samples were dried at 60 °C. Dried samples were milled through a 1 mm steel mesh and analysed for dry matter (DM) and WSC. NIRS (Near infrared spectroscopy) was used for determination of WSC with a common equation. The SAS procedure Mixed was used (SAS, 1997) for the statistical analysis of data with variety as fixed factor and replication as random factor.

Results and discussion Temperature is similar for both years, but radiation sum is higher in the first year. The results in Table 1 shows that on most sampling occasions during the first growth period, the WSC content of AberDart was significant higher than that of Fennema and Helmer. At most occasions Fennema and Helmer were equal in WSC content. There is generally an increase in the WSC content from the start of the sampling until two week before the first harvest in first year and until one week before the first harvest in the second year. Thereafter the WSC content declined. The levels of the WSC contents were rather similar between the years and a higher radiation level in first year has not influenced the WSC levels.

Table 1 *WSC (g kg^{-1} DM) in first growth period up to first harvest (FH).*

	First growth in the first year				First growth in the second year			
Site and variety	3 w before FH	2 w before FH	1 w before FH	FH	3 w before FH	2 w before FH	1 w before FH	FH
AberDart	181	221	208	182	189	194	213	204
Fennema	162	192	184	139	165	157	176	160
Helmer	173	213	186	159	185	174	181	155
CV %	5.5	6.7	4.8	5.6	7.3	5.7	6.7	4.4
P	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LSD	15	22	14	14	20	15	19	11

w = weeks, *CV* = coefficient of variation, *LSD* = least significant difference at $P < 0.05$

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