

Fructan content in pasture grasses

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Introduction

In recent studies it is proposed that fructans might be responsible for pasture-induced laminitis in the horse (Pollitt and van Eps 2002). The rapid fermentation kinetics of the fructans among the hydrolyzable carbohydrates highlights the role of fructans in the aetiology of equine laminitis (Coenen et al., 2005, Vervuert et al. 2005). To calculate the daily fructan intake, it is necessary to have information on fructan concentrations in typical feedstuffs for horses. Therefore, the aim of this study was to analyse fructan concentrations in different pasture grasses and grass mixtures.

Material and methods

In the first experiment 18 pasture grasses and 2 grass-mixes were grown on proving grounds in a standardized agronomical procedure. The variants were harvested 4 to 5 times during the growing season; each harvest differentiated an early and a late stadium of blooming. Fructans were quantified enzymatically (Megazyme method AOAC/AACC, 10/2002). Further parameters (crude fibre, crude protein, water-soluble carbohydrates) were analysed by Near Infrared Spectroscopy (NIRS).

In the second experiment the fructan contents of 10 grass mixes grown on proving grounds were quantified by NIRS.

Results

Fructan contents of different pasture grasses

The highest average amounts of fructans were found in *Lolium perenne* (Perennial ryegrass) and *Lolium multiflorum* (Italian ryegrass), with an average of 5.7 % DM (early and late stadium of blooming, respectively) over all breeds and cuttings, as shown in Table 1.

The highest fructan level in a breed of *Lolium perenne* was found in 2003 in the fourth growth (14.2 % DM) and in the first growth (13.6 % DM) in "Anton" (variant 2). All other pasture grasses contain low fructan levels with an average of 3.4 % DM in the early stadium of blooming and 3.5 % DM in the late stadium of blooming respectively (Table 2).

During the season the highest fructan concentrations were found in the first growth in May and in the last growth in October. Major differences between different lines of *Lolium*

Table 1 Fructan contents of different lines of *Lolium perenne* and *Lolium multiflorum* (averaged 2002-2004).

No.	grass / line	Fructan content (% DM)									
		1. harvest		2. harvest		3. harvest		4. harvest		5. harvest	average
		early	late	early	late	early	late	early	late	early	late
1	<i>Lolium perenne</i> , Sambin (diploid)	7,4	7,3	5,2	3,9	3,1	3,0	5,5	6,0	6,7	5,6
2	<i>Lolium perenne</i> , Anton (tetraploid)	9,2	5,8	5,4	4,6	3,6	3,6	8,9	8,0	9,8	7,4
3	<i>Lolium perenne</i> , Respect (diploid)	6,0	5,6	5,1	4,7	2,7	3,3	6,3	8,1	7,7	5,6
4	<i>Lolium perenne</i> , Edda (tetraploid)	6,8	6,2	4,8	4,9	2,5	3,2	7,0	9,6	8,5	5,9
5	<i>Lolium perenne</i> , Stratos (diploid)	6,4	6,9	6,4	4,3	2,9	3,5	6,4	7,9	7,1	5,8
6	<i>Lolium perenne</i> , Gemma (tetraploid)	6,3	6,0	4,4	4,4	3,5	2,9	7,0	6,5	6,4	5,5
7	<i>Lolium multiflorum</i> , Lemtal (diploid)	7,6	9,4	4,5	6,4	2,7	3,4	5,5	9,7	6,1	5,3
8	<i>Lolium multiflorum</i> , Lipo (tetraploid)	6,3	9,1	3,4	5,0	3,1	3,4	7,6	9,2	5,7	5,2
9	grass mix Standard G I	6,3	8,3	4,3	3,0	2,8	3,6	6,2	5,4	7,0	5,3
10	grass mix Standard G III	7,3	9,1	4,6	3,9	2,9	3,1	6,7	6,6	7,2	5,7
Average		7,0	7,4	4,8	4,5	3,0	3,3	6,7	7,7	7,2	5,7

Table 2 Fructan contents of pasture grasses (averaged 2002 – 2004).

No.	grass / line	Fructan content (% DM)									
		1. harvest		2. harvest		3. harvest		4. harvest		5. harvest	average
		early	late	early	late	early	late	early	late	early	late
11	<i>Phleum pratense</i> , Comer	2,7	1,9	1,5	2,1	1,6	1,9	4,0	4,5	4,6	2,9
12	<i>Festuca pratensis</i> , Pradel	4,0	5,7	3,1	3,0	1,6	3,4	4,5	5,0	4,3	3,5
13	<i>Poa pratensis</i> , Lato	2,6	4,1	4,3	4,5	4,5	5,2	4,3	5,7	5,0	4,1
14	<i>Festuca rubra</i> , Gondolin	1,9	2,5	2,8	2,4	2,5	2,0	3,8	3,7	5,3	3,3
15	<i>Dactylis glomerata</i> , Lidaglo	3,7	4,3	2,7	3,1	2,2	2,3	4,2	4,6	3,6	3,3
16	<i>Festuca arundinacea</i>	3,0	5,2	3,4	4,6	1,8	2,5	3,2	3,7	1,9	2,7
17	<i>Alopecurus pratensis</i>	1,3	2,9	1,8	1,7	1,0	1,6	1,8	2,6	4,3	2,1
18	<i>Poa annua</i>	6,1	4,0	7,3	7,5	4,6	2,8	8,5			6,6
19	<i>Agropyron repens</i>	1,4	3,0	1,8	1,6	1,7	3,4	4,2	4,2	5,5	2,9
20	<i>Holcus lanatus</i>	2,2	2,5	3,0	3,0	1,0	1,4	1,9	4,6	3,8	2,4
Average		2,9	3,6	3,2	3,4	2,2	2,6	4,0	4,3	4,3	3,4

perenne of different stadiums of blooming (early, mean, late) and as well between diploid and tetraploid varieties could not be found.

Fructan contents in grass mixes

During the growing season an increase of fructan levels from the early first harvest in May to the early third harvest in June was measured (1.9 % DM up to 11.4 % DM in average). After a decrease of fructans in August (4.6-5.2 % DM) the grass mixes harvested in October are again characterized by high amounts of fructan (10.3 % DM). The fructan contents are presented in a large variation depending on the contents of *Lolium perenne* in the grass mixes. The highest amounts were measured in grass mixes exclusively composed of *Lolium perenne* with a maximum of 15.2 % DM. The results are given in Figure 1. Fructan levels of two grass mixes examined in the first experiment (Table 1) are similar to the pasture grasses, with highest amounts in May and October.

Discussion

Pasture grasses are characterized by a large variation in fructan contents, *Lolium perenne* and *Lolium multiflorum* contain highest fructan concentrations. This was also confirmed in experiments by Meister and Lehmann (1984) and McGrath

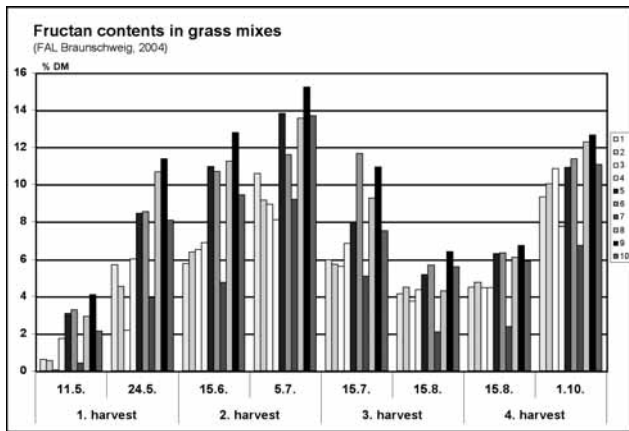


Fig 1 Fructan contents (% DM) in grass mixes, 2004.

(1988). According to these results, grass mixes with high amounts of *Lolium perenne* show high fructan concentrations. In contrast grass mixes with low amounts of *Lolium perenne* contain low fructan levels. Beyond that it could be shown, that the breeds of *Lolium perenne* differ in their fructan contents in a wide range. Highest amounts of fructans are accumulated at the beginning and at the end of the growing season, low fructan concentrations occur during the summer. This is in accordance with experiments of Kühbauch (1977) and Schubiger et al. (1998), who proved a decrease of fructan contents in summer.

Conclusions

As a result of this work, grass mixes with a reduced quantity of *Lolium perenne* should be preferred to minimize the risk for grazing horses affected by laminitis. Pastures with forage grasses *Alopecurus pratensis* (meadow foxtail) and as well *Phleum pratense* (timothy) as main components can be seen as suitable to produce low fructan concentrations. Grass

mixes with high amounts of *Lolium perenne* may contain high fructan contents especially in spring and autumn and are less suited for feeding of horses predisposed by laminitis.

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