

Effect of perennial ryegrass cultivar on intake of fresh grass and milk production

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Abstract

Efficiency in dairy systems should be improved. If grass cultivar affects intake and milk production, plant breeding could help in increasing efficiency in dairy systems. Six diploid cultivars of perennial ryegrass (*Lolium perenne* L.) were compared for total dry matter (DM) yield, grass intake and milk production. During the summers of 2000 and 2001, in three periods of two weeks each, 12 highly productive Holstein-Friesian cows were stall-fed *ad libitum* with fresh grass, harvested daily at approximately 2300 kg DM/ha. Differences were found for grass DM yield and grass leaf blade proportion. Grass intake and milk production did not differ significantly among cultivars, although some trends were present. The efficiency of conversion of ingested grass into milk was on average 1.64 kg FPCM per kg DM grass.

Introduction

Dairy systems in Western Europe are more and more under pressure to produce high quality milk at low financial and environmental costs. The use of concentrate feeds, especially of non-plant origin, has become questionable under the recent BSE-crisis. There has been a change in the public opinion in the debate on environmental issues, and EU and national policies aim to reduce the output of minerals to the environment. Concentrate feeds are expensive and forage production management should be improved to diminish negative effects of loss of excess nutrients to the environment. Therefore, future dairy production needs to increase efficiency of forage use. One way to increase efficiency is by producing high-quality forage; a significant contribution might come from grass breeding. Efficiency of grazing animals could be positively influenced by forage with a high intake and good digestibility (Wilkins, 1994). Cultivar differences in chemical composition affected animal growth in sheep and cattle (Minson, 1988). Cows fed with four perennial ryegrass cultivars, differing in lamina to sheath ratio and tiller density, showed differences in milk production (Emile et al., 2000). The objective of this study was to analyse whether intake and milk yield were different for cows fed with different *Lolium perenne* cultivars.

Materials and methods

During the summers of 2000 and 2001, fresh grass of six cultivars of perennial ryegrass was stall-fed to 12 highly productive Holstein-Friesian cows during three periods of two weeks each, during early July, early August and late August/early September. In 2000, 4.6 kg of concentrates was fed daily to each cow in two equal portions at milking, and in 2001 2.8 kg. Cultivars 1, 2 and 6 have a mid-late heading date (25-28 May) and cvs 3-5 are late (7-9 June). Grass yield (kg DM/ha at cutting), grass intake (kg DM/cow/day) and Fat and Protein Corrected Milk production (FPCM) (kg/cow/day) were recorded daily. The average DM

intake per period was calculated per cow from days 6 - 13, and the average milk production per period from days 7-14.

The DM yield was analysed by ANOVA as a randomised block design replicated in time (14 daily cuts during each period).

The intake experiment consisted of 2 Latin Square (LS) design experiments with two replicates, in which three cultivars were fed each to six cows during 3 periods. In LS1, cvs 1-3 were compared and in LS2, cvs. 4-6. In 2000, one cow in LS1 was excluded from the data set because she was much later in lactation and had a much lower yield than the other cows. In 2002, half of the cows (1 replicate in each LS) consisted of heifers.

Results and discussion

Data are presented in Table 1.

Table 1. Average cultivar performance for DM yield (kg/ha), intake (kg DM/cow/day) and milk production (kg FPCM/cow/day) during 3 x 2 weeks. Different letters within a column show a significant difference ($P < 0.05$).

Year: 2000

Cultivar	DM yield (kg/ha)	Intake (kg DM/day)	Milk production (kg FPCM/day)
Latin square 1			
1	2294 c	16.7	28.5
2	2248 c	17.8	29.0
3	2067 a	17.8	27.7
Latin square 2			
4	2250 c	16.1	26.1
5	2157 b	16.8	27.5
6	2222 bc	16.6	27.0

Year: 2001

Cultivar	DM yield (kg/ha)	Intake (kg DM/day)	Milk production (kg FPCM/day)
Latin square 1			
1	2223 a	14.7	23.7
2	2316 ab	14.9	23.7
3	2409 b	14.4	23.5
Latin square 2			
4	2602 c	13.4	21.8
5	2437 b	14.0	23.0
6	2240 a	14.6	23.4

Differences ($P < 0.05$) were found for DM yield between the grass cultivars in 2000 (Table 1). Cultivars 1, 2 and 4 were most productive, whereas cultivar 3 had the lowest yield.

In 2001, cv 4 again was most productive, but cvs 1, 2 and 6 had the lowest yield. These are the mid-late heading cultivars. The DM content at harvest was not different among cultivars and was on average 232, 173 and 157 g DM kg⁻¹ fresh grass in periods 1, 2 and 3,

respectively. The proportion of leaf blades in the harvested material was lower in late heading cvs 3-5 than in the mid-late heading cvs 1, 2 and 6. This was due to a highly significant difference in period 1, when on average 70 % of the DM of cvs 1, 2 and 6 consisted of laminae, but only 43 % of cvs 3-5. In periods 2 and 3, on average 86 and 90 % of the DM of the offered material consisted of leaf blades.

Grass intake ranged from 16.1 to 17.8 kg DM/cow/day in 2000 and from 13.4 to 14.9 kg DM/cow/day in 2001 (Table 1). No significant differences for intake were found among the cultivars in either year. In LS1, cv 2 tended to have the highest intake in both years. In LS2, cv 4 tended to have the lowest intake in both years.

Milk production ranged from 26.1 to 29.0 kg FPCM/cow/day in 2000 and from 21.8 to 23.7 kg FPCM/cow/day in 2001. No significant differences were found among the cultivars in either year, although cows fed with cv 2 tended to have the highest milk yield in LS1 and cows fed with cv 4 tended to have the lowest milk yield.

The overall relation between intake and milk production, averaged over cows for the six cultivars, is shown in both latin squares for both years in Figure 1.

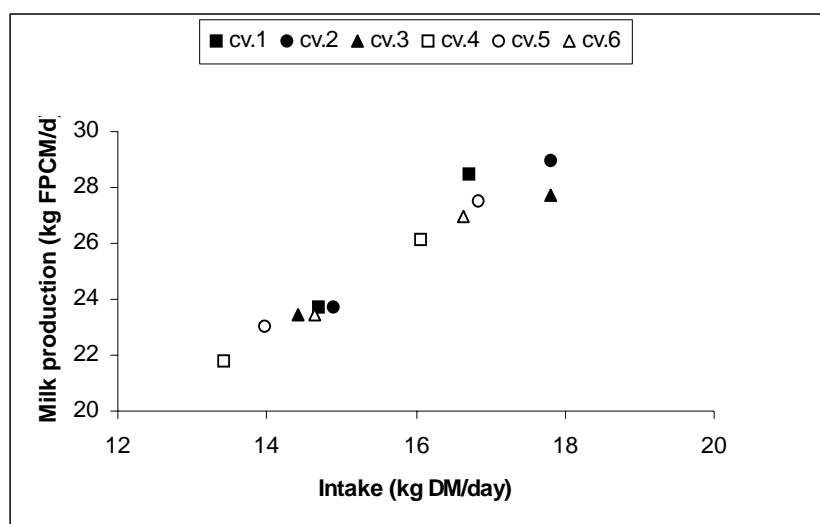


Figure 1. Average milk production and DM intake by dairy cows, stall-fed fresh grass of six *Lolium perenne* cultivars (1-6) during three periods of two weeks each in the summers of 2000 and 2001. Cvs 1-3 (filled symbols) were tested in one latin square experiment; cvs 4-6 (open symbols) in another latin square experiment with six cows each, in both years.

In both years, there was a linear relation between intake and milk yield in our experiment, except that cvs 1 and 3 showed some deviance in 2000. Our results confirm the statement of Emile *et al.* (2000), that intake of forage is an important factor for milk production. On average, 1.64 kg FCPM was produced with 1 kg DM grass in both years. The efficiency of conversion was not different among grass cultivars. The lower levels of intake and milk production in 2001 than in 2000 were probably caused by the lower amount of concentrates fed and by the fact that in 2001 half of the animals were heifers. The efficiency of conversion was lower for the heifers than for the older cows.

Although within each year the ranking order of the cultivars was not identical, cows consuming cv 2 generally had the highest intake and the highest milk production, while cows consuming cv 4, with the highest grass DM yield, had the lowest intake and the lowest milk production. As the DM content and the leaf blade proportion of cv 4 were not different from those of e.g. cv 5, which has a similar heading date and was in the same latin square experiment, it is not clear what caused the lower response of animals to cv 4. Similarly, the nature of the difference between cv 2 and cv 1 would be of interest. Further analyses of chemical parameters are being carried out.

No effects of grass cultivar on milk composition were found in 2000, but in 2001 cows fed with cv 1 had a lower milk fat content and a higher milk protein content ($P < 0.05$) than cows fed with cv 3. The urea content in the milk was significantly ($P < 0.05$) lower after feeding cv 4 than when cvs 5 and 6 were fed, in both years.

These results were obtained in a stall-feeding system, but as in practice grazing is of importance as well, the experiment will be repeated in 2003 and 2004 with cvs 1-4 under grazing. Intake will be measured by taking pre- and postgrazing cuts of the herbage, as well as by using n-alkanes.

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