Cultivar Influences Milk Production of Grazing Dairy Cows

Mary McEvoy
Teagasc, Ireland

Michael O'Donovan
Teagasc, Ireland

Emer Kennedy
Teagasc, Ireland

John Paul Murphy
Teagasc, Ireland

Luc Delaby
INRA, France

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Cultivar influences milk production of grazing dairy cows

Mary McEvoy [A], *Michael O'Donovan* [A], *Emer Kennedy* [A], *John Paul Murphy* [A] *and Luc Delaby* [B]

[A] Teagasc Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland, www.teagasc.ie
[B] Institut National de Recherche Agronomique, Unité Mixte de Recherche Production du Lait, St Gilles, France
Contact email: mary.mcevoy@teagasc.ie

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Introduction

Perennial ryegrass is considered one of the most important forage grass species used in temperate ruminant animal production systems. Maximizing milk production from grazed grass is a major objective of pastoral-based dairy systems. While DM yield is an important trait, it fails to define the ultimate value of a grass cultivar, which is its potential to improve animal performance from a pasture sward (Reed 1994). The majority of cultivar evaluation trials are conducted under cutting, so therefore inferior cultivars from an animal production perspective may not be identified until commercialisation when animals graze a pasture sward. Reed (1978) reported that ryegrass pastures of similar digestibility can have different animal production responses depending on the season. Without exposure to animal production trials, practical differences between cultivars under field conditions may not be detected.

The objective of the current study was to evaluate the effect of four perennial ryegrass cultivars with different sward characteristics on milk yield, milk composition and dry matter intake (DMI) of lactating dairy cows during the spring and mid-season period.

Methods

The experiment was conducted at the Moorepark Animal and Grassland Research and Innovation Centre, Fermoy, Co. Cork, Ireland (50°09'N; 8°16'W). In 2009, eight paddocks totalling 11.6 ha were established with four grass cultivars sown as monocultures in a randomized block design with each having four replicates. The four cultivars were as follows: two tetraploids: *Cv.1* (heading date 24 May) and *Cv.2* (31 May) and two diploids: *Cv.3* (22 May) and *Cv.4* (28 May). From March to May (spring) and June to August (summer), two Latin square grazing studies were completed. The first Latin square (spring) lasted 56 days, divided into four 14-day periods; summer lasted 84 days, divided into four 21-day periods. Twenty four cows were blocked using pre-experimental data and randomized to one of the four cultivars. An additional 16 cows were blocked and randomized for the summer period. Throughout the experiment cows were offered 17 kg DM herbage per cow per day (>4 cm). The final five days of each period was used as the measurement period. Pre-grazing herbage mass was estimated twice weekly, with only those estimates taken during the measurement period used in the analysis. Pre and post grazing extended tiller height (ETH) and pseudostem height (SH) was measured twice per measurement period on 100 tillers for each cultivar. The difference between ETH and SH can be used to calculate free leaf lamina (FLL). On two occasions per measurement week, and prior to grazing, the sward was sampled to ground level and the vertical structure was preserved. A 50 g subsample was separated into leaf, stem and dead proportions (>4cm). The grass samples were cut to ground level using scissors and the vertical structure of the sward was preserved using elastic bands. Individual cow milk yield and dry matter intake (DMI) using the n-alkane technique (Dillon and Stakelum 1989) was measured daily. Milk composition was measured twice daily from six consecutive milkings. The animal data were analysed according to a 4 × 4 Latin square design, with the mean effects of four cultivars measured over the spring and summer period. Animal variables were analyzed using Proc Mixed in SAS version 8 (SAS, 2005). Animal was treated as a random effect. Sward variables were analyzed using Proc Mixed. Sward variables were analyzed using a model which included cultivar and season.

Results and Discussion

Table 1 presents the effect of cultivar on milk production, DM intake and some key sward characteristics. There was a significant effect of cultivar on milk yield and milk solids yield (P<0.001). Cows grazing *Cv.1* and *Cv.2* produced 28.7 kg milk per day, compared to *Cv.3* and *Cv.4* (27.3 kg per cow per day). Gowen *et al.* (2003) reported no difference in milk yield from diploid or tetraploid ryegrass cultivars. This difference was also observed in milk solids yield which was higher for *Cv.1* and *Cv2* compared to *Cv.3* and *Cv.4*. Despite the difference in milk yield, DMI was similar for *Cv.2* and *Cv.3* (17.4 kg DM), compared to *Cv.4* which was intermediate (16.9 kg/day); the lowest DMI was observed on *Cv.1* (16.6 kg DM/day). In contrast, Hageman *et al.* (1993) reported increased intake (+0.6 kg OM/cow/d) and milk solids production (+4 to 5%) with cows grazing tetraploids, compared to diploids at a high grass allowance. In the current study, there were no clear trends in terms of ploidy on DMI, despite this

Table 1. The effect of cultivar on milk production, DM intake and some key sward characteristics.

	Cultivar 1	Cultivar 2	Cultivar 3	Cultivar 4	SE	P-value
Milk yield (kg/d)	28.5 a	28.8 a	27.2 b	27.3 b	0.46	0.001
Milk fat (g/kg)	43.2 a	41.6 b	41.6 b	43.3 a	0.82	0.05
Milk Protein (g/kg)	33.3 a	33.3 a	32.8 b	33.4 a	0.32	0.01
Milk solids (g/kg)	2.18	2.15 a	2.02 b	2.08 b	0.035	0.001
DMI (kg/cow/day)	16.6 a	17.5 b	17.2 b	16.9 ab	0.25	0.05
Pre height (cm)	9.3 a	8.9 b	9.4 a	9.3 a	0.09	0.001
Post height (cm)	4.2 a	4.3 b	4.4 c	4.4 d	0.02	0.001
Herbage mass (kg DM/ha)	1235 a	1218 b	1337 c	1393 d	18.0	0.001
Leaf Proportion (>4cm)	0.71 a	0.79 b	0.71 a	0.77 b	0.008	0.001
Stem Proportion (>4)	0.22 a	0.13 b	0.17 c	0.17 c	0.007	0.001
Extended tiller height pre (cm)	23.2 a	23.4 a	21.4 b	22.1 c	0.23	0.001
Pseudostem Pre (cm)	8.5 a	7.0 b	8.7 a	8.8 a	0.12	0.001
Pseudostem Post (cm)	5.9 a	5.4 b	5.8 a	5.8 a	0.05	0.001

Values followed by different letters are significantly different ($P<0.05$); SED = standard error of the difference

milk yield on the tetraploids was 5% greater than that on the diploids and milk solids yield was 6% greater on the tetraploids than the diploids. It is likely that differences in milk performance were due to differences in the sward structure as management and allowance were similar for all cultivars. Pre-grazing sward height was lowest for *Cv.2* (8.9 cm) but similar for the other 3 cultivars (9.3 cm), this difference however, would not be biologically significant. Similarly, pre-grazing herbage mass was lowest for *Cv.2* and highest for *Cv.4*. Both *Cv.1* and *Cv.2*, had a longer ETH than *Cv.3* and *Cv.4*. In addition the pseudostem height of *Cv.2* was lower than that of the other 3 cultivars (-1.5 cm), this resulted in a greater FLL for both *Cv.1* and *Cv.2* (15.5 cm) compared to *Cv.3* and Cv.4 (-2.5 cm). This appears to have resulted in a positive effect on milk performance of the animals. Leaf is of higher quality than stem and dead material, and this is supported by the higher dry matter digestibility of *Cv.1* (877 g/kg DM) and *Cv.2* (876 g/kg DM) compared to *Cv.3* (861 g/kg DM) and *Cv.4* (868 g/kg DM), while *Cv.2* also had a higher leaf proportion than *Cv.3*. Beecher *et al.* (2013) has shown that the morphological components of perennial ryegrass differ in terms of OMD with leaf having the highest OMD content in the sward and dead material the lowest.

Conclusion

The results indicate that a difference of 5% in milk yield and milk solids yield is achievable between the cultivars used in this study. The milk performance of animals grazing cultivars *Cv.1* and *Cv.2* were higher than that of *Cv.3* and *Cv.4* across the spring and summer period. Choice of cultivar has the potential to have a large impact on the overall profitability of a system assuming good grassland management techniques are practiced. Cultivars with a high leaf proportion are desirable to ensure a sward with high nutritive value and allow greater utilization by the animal, thus achieving greater sward utilization and higher animal intakes.

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