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A comparison between simulated grazing, 2-cut and 3-cut silage management on the performance of *Lolium perenne* L.

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Introduction

Internationally, the majority of grass cultivar evaluation protocols test the performance of cultivars under cutting managements with little or no exposure to animal stresses such as treading and plant pulling. In addition, the majority of these protocols test cultivars under 2 or 3 cut silage systems. Gilliland and Mann (2000) reported a difference in cultivar ranking between years and also between management systems when a severe (simulated grazing to 3 cm height) or lax (6 cm height) defoliation was applied to perennial ryegrass (*Lolium perenne* L.) cultivars in plot trials. Internationally, many evaluation protocols use only one management system within the protocol, whereby defoliation height is constant. If the protocol applied is not similar to the grazing management imposed at farm level, then it is unclear if the protocol can identify the cultivars which are most suitable to a particular production system.

Methods

The experiment was conducted at the Teagasc Animal and Grassland Research and Innovation Centre, Fermoy, Co. Cork (52°16 N, 08°26 W). One-hundred and eight plots (1.5 m × 5 m) were sown in August 2006 on a free-draining, brown earth soil with a sandy loam texture. The experimental design consisted of 12 cultivars (4 diploid and 8 tetraploid) of perennial ryegrass, with 3 management systems in a 3-replicate, randomised block design. Management treatments were imposed for 3 years (Y1, Y2 and Y3) and included: (1) a 10-cut simulated grazing management (SG), designed to simulate a frequent rotational system at the farm level; (2) a 2-cut silage management (2C) with 4 simulated grazings; and (3) a 3-cut silage management (3C) with 2 simulated grazings. Both 2C and 3C were designed to simulate an intensive silage harvesting system.

Defoliation height across all harvests was 4 cm, with the difference between the management treatments being the frequency of harvesting. First harvest for the SG management was taken on 20th March, with subsequent harvests taken at 3-4 weekly intervals until 5th November. The first harvest for the 2C management was on 31st March (a simulated grazing cut), with the 2 silage harvests taken at intervals of 7 and 6 weeks, respectively, and the remaining simulated grazings at intervals of 4, 5 and 6 weeks. The final harvest was taken in mid-October. The 3C management had no spring harvest; the first 3 harvests were silage cuts, with cut 1 taken on May 26, cuts 2 and 3 taken after 6 week intervals and harvests 4 and 5 taken after 5 week intervals, with the final cut taken in early November. Total N fertiliser levels were 350 kg N/ha for each management. To determine dry matter (DM) yield plots were harvested to 4 cm within 3 days of the targeted harvest date using an Agria mechanical mower.

Sward measurements were analysed by ANOVA in Proc Mixed (SAS, 2009). The variables included in the model were block, plot, year, cultivar and management, with the interactions between year, management and cultivar tested. Year was included as a repeated measure.

Results

Year and management both had a significant effect (*P* <0.001) on total DM yield (Table 1). The SG management had the lowest mean DM yield across the

Table 1. Total dry matter (kg DM/ha) and the relative ranking (in parentheses) of 12 perennial ryegrass cultivars under 3 different management systems, averaged over three harvest years

	Simulated grazing		3-cut silage		2-cut silage	
Cultivar 1	12581	(4)	16157	(3)	14751	(10)
Cultivar 2	12654	(3)	15434	(8)	15974	(2)
Cultivar 3	13172	(1)	15204	(12)	15018	(8)
Cultivar 4	12045	(7)	15366	(10)	14490	(12)
Cultivar 5	12368	(5)	15225	(11)	16195	(1)
Cultivar 6	12091	(6)	15441	(7)	15358	(7)
Cultivar 7	11739	(10)	16072	(4)	15376	(6)
Cultivar 8	11625	(12)	16037	(5)	15525	(3)
Cultivar 9	11781	(9)	17012	(1)	15429	(4)
Cultivar 10	11852	(8)	15681	(6)	15422	(5)
Cultivar 11	11738	(11)	16365	(2)	14615	(11)
Cultivar 12	12819	(2)	15378	(9)	14821	(9)
Significance		*P value*	*s.e.*			
Year		0.001	78.1			
Management		0.001	92.9			
Cultivar		NS	185.8			
Management × year		0.001	135.3			
Management × cultivar		0.01	300.67			

s.e. = standard error

total experimental period (12.2 t DM/ha), compared to 2C (15.2 t DM/ha) and 3C (15.8 t DM/ha). There was an interaction between management and cultivar (*P*<0.01) on total DM yield. Cultivars 3 and 12 were the 2 highest yielding in the SG treatment, while they were ranked 9th and 12th, respectively, in the 3C, and 8th and 9th, respectively, in the 2C treatments. Cultivars 9 and 11 were the highest yielding cultivars in the 3C treatment, compared to cultivars 5 and 2, which performed best in the 2C treatment. This indicates that some cultivars are more suited to frequent defoliation at lower herbage mass, while others are more suited to less frequent defoliation (as in a conservation type management system).

There was a significant interaction between year and management on total DM yield (*P*<0.001). The simulated grazing management always had the lowest total DM yield in Y1, Y2 and Y3 (11.3, 11.7 and 13.6 t DM/ha, respectively). In Y1 the 2C management had the highest yield (15.3 t DM/ha), but was intermediate in Y2 and Y3 (13.6 and 16.8 t DM/ha, respectively), while the 3C treatment yielded 14.8, 15.2 and 17.3 t DM/ha in Y1, Y2 and Y3, respectively. There was also a significant interaction between year and cultivar (*P*<0.01).

Dillon *et al.* (2002) have shown that inclusion of grazed grass in the diet of spring-calving dairy cows can increase intake and milk yield and improve milk composition, compared to silage-based diets. Differences in total DM yield, and more specifically in the rank order of cultivars between management systems, are important from an industry perspective. The use of one protocol within National evaluation trials increases the risk of not identifying the most suitable cultivars for different management systems. In many temperate countries, grazed grass is an important feedstuff for ruminants, with grass silage used to balance the feed budget and provide quality feed during periods when grass supply is in deficit. If only one evaluation protocol is in place, the risk of failing to identify superior cultivars for the individual requirements increases greatly; the evidence of re-ranking in the current study supports this.

Conclusion

Results of this study show that cultivars rank differently depending on the management imposed. This indicates that some perennial ryegrass cultivars are suited to intensive grazing systems, while others are better suited to intensive conservation systems. This has highlighted the need to ensure cultivars are evaluated using the protocol which best represents farm requirements. If there is a high use of separate grazing and silage areas within the farming industry, then it is recommended that both a simulated grazing and a conservation evaluation protocol are applied to identify the best cultivars for each management system. This will ensure farmers will use the cultivars which are most suited to their individual paddock requirements to improve the yield output of cultivars under different management systems.

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