The variation in morphological fractions of perennial ryegrass cultivars throughout the grazing season and subsequent impacts on organic matter digestibility

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Keywords: *Lolium perenne L*, pseudostem, true stem, digestibility, leaf, morphology.

Introduction

The grass plant is comprised of leaf blades, leaf sheath (pseudostem), true stem and dead material each differing in digestibility and their relative proportions can impact significantly on sward quality. The objective of this study was to determine the change in the proportion and organic matter digestibility (OMD) of leaf, pseudostem, true stem and dead fractions of four perennial ryegrass cultivars throughout a grazing season.

Methods

In 2009 four paddocks were sown with *Lolium perenne* L. as monocultures with two tetraploid cultivars: Bealey and Astonenergy, with heading dates of 24 May and 31 May, respectively, and two diploid cultivars: Spelga and Abermagic, with heading dates of 22 May and 28 May, respectively. The four paddocks described were part of a larger grazing study described by Wims *et al.* (2012). The area for each cultivar was subdivided into 4 replicates, each measuring 361 m^2. Immediately prior to grazing, herbage morphological composition was determined on 10 occasions between May 2011 and March 2012.

Grass samples were cut to ground level and the vertical structure of the sward was preserved. The samples were divided into two portions: >4 cm and <4 cm stubble height. The >4 cm section was manually separated into leaf, pseudostem, true stem and dead material. The dry matter (DM) content of each fraction was determined by drying at 40^{o}C for 48 h. A whole intact sample was also retained. Due to insufficient sample quantity for OMD analysis the pseudostem, true stem and dead replicate samples were bulked by morphological fraction for the first four rotations of 2011, the last four rotations of 2011 and the two rotations in 2012. A similarly-bulked leaf sample and a whole sample that was not separated into morphological fractions were analysed for comparison. Sample OMD was analysed using the *in vitro* neutral detergent cellulase method (Morgan *et al.* 1989) (Fibertec™ Systems, FOSS, Ballymount, Dublin 12, Ireland).

Data (leaf, pseudostem, true stem and dead DM proportion and whole sample OMD) were analysed using PROC MIXED in SAS (2002) with terms for replicate, rotation number, cultivar and the interaction of cultivar and rotation number. The bulked leaf, pseudostem, true stem and dead samples were not statistically analysed.

Results

There was a cultivar × rotation interaction (P<0.001) for all four morphological fractions. At mid-May Aston-energy had a higher leaf proportion than Abermagic (P<0.05, Fig. 1) and had a lower true stem proportion than both Abermagic and Spelga (P<0.01, Fig. 3). At the start of June Astonenergy had a significantly higher leaf proportion than Bealey and Spelga (P<0.01, Fig. 1). At this time both Astonenergy and Abermagic had a lower true stem proportion than both Bealey and Spelga (P<0.01, Fig. 2).

At the end of June, Astonenergy had a higher leaf proportion, a lower pseudostem proportion and a lower true stem proportion than Bealey (P<0.05). At this time Astonenergy also had a higher leaf and lower true stem proportion than Spelga (P<0.05), and a lower true stem proportion than Abermagic (P<0.05). From mid-July onwards there were no differences between cultivars in leaf or true stem proportions. At the start of Feb Bealey had a higher pseudostem proportion than all other cultivars (P<0.001, Fig. 2). At this time Astonenergy also had a higher pseudostem proportion than Spelga (P<0.01). At the end of March Bealey had a higher pseudostem proportion than Spelga (P<0.001).

For the whole samples there was a cultivar effect on OMD. Bealey had a higher OMD (752 ± 10.4 g/kg) than Spelga (696 ± 10.4 g/kg, P<0.05). Astonenergy (724 ± 10.4 g/kg) and Abermagic (715 ± 10.4 g/kg) were intermediate. The results from the present study indicated that the OMD of the plant fractions were biologically different. Leaf had the highest OMD and the dead fraction had the lowest, following the order leaf > pseudostem > true stem > dead agreeing with previous literature. There were no true stem samples from the start of July onwards, as the plant moved out of the reproductive stage and returned to the vegetative stage.

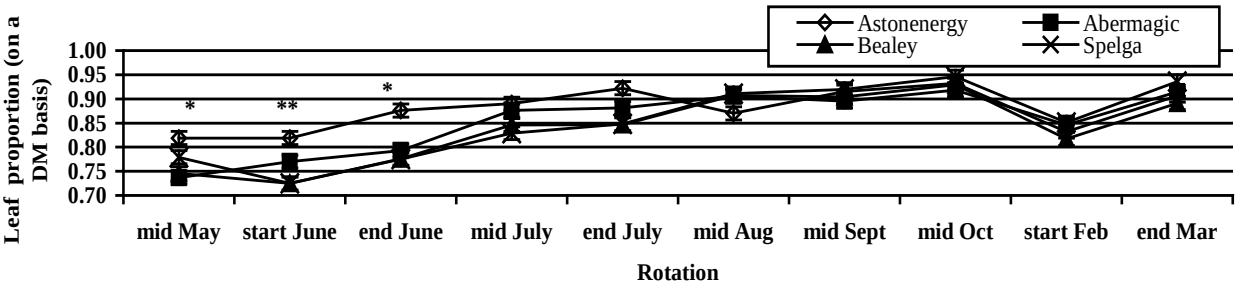

Figure 1. Leaf proportion (expressed on a DM basis) for four perennial ryegrass cultivars during 10 grazing rotations (mean±SEM).

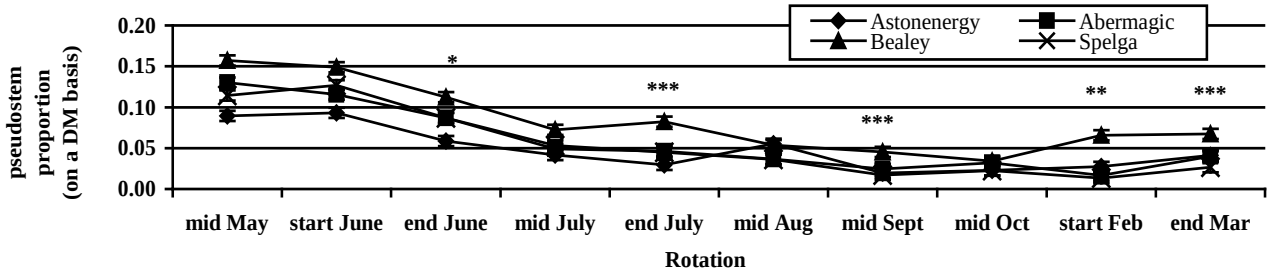

Figure 2. Pseudostem proportion (expressed on a DM basis) for four perennial ryegrass cultivars during 10 grazing rotations (mean±SEM).

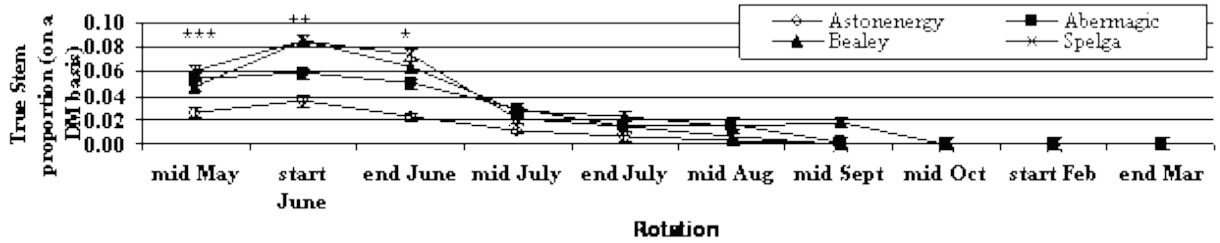

Figure 3. True stem proportion (expressed on a DM basis) for four perennial ryegrass cultivars during 10 grazing rotations (mean±SEM).

Conclusion

In the present study the two tetraploid cultivars had the highest leaf + pseudostem proportion and the highest OMD. Bealey had the highest leaf + pseudostem proportion, explaining it having the highest OMD. Astonenergy had the highest leaf and lowest true stem proportion agreeing with the Northern Ireland DARD recommended list which reports it as being highly digestible (DARD, 2010).

Differences in the proportions of plant fractions between cultivars are evident predominantly during the reproductive period implying that grass cultivar evaluation programmes should record cultivar characteristics such as leaf, pseudostem, true stem and dead proportions and their OMD at this time.

References

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