

Perennial ryegrass variety differences in nutritive value characteristics

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Introduction Animal grazing performance at grass is predominately determined by herbage intake rates, with high yielding dairy cows requiring up to 20 kg/d DM within a limited grazing time (Gibb, 1998). Grass nutritional factors such as seasonal patterns in digestibility and water-soluble carbohydrate levels have been linked to animal productivity (Davies *et al.*, 1991), while sward surface height, herbage mass, bulk density and green leaf mass have been shown to promote high grazing intake (Barrett *et al.*, 2001). Furthermore, fatty acid profiles have been shown to improve the unsaturated fatty acid composition of milk, with potential human health benefits (Parodi, 1997). Recent CAP funding changes are expected to intensify the drive to optimise margin over costs. Given that grazed grass is the cheapest ruminant feed, it is expected that nutritive value characteristics of grass varieties will become increasingly important relative to total productivity, both as a breeding objective and as an evaluation criteria by variety testers and by farmers. This study examined the genetic diversity in such parameters among a wide range of perennial ryegrass (*Lolium perenne* L.) varieties, as an indicator of the heterogeneity among current varieties and the prospects for improvement by selective breeding.

Materials and methods A range of UK recommended perennial ryegrass diploid and tetraploid varieties of widely differing maturities were managed over four growing seasons, under a nine-cut simulated grazing system. In addition to yield parameters, at each cut, water-soluble carbohydrate (WSC) concentration was assessed on herbage dried within one hour of cutting (60°C). Further 350g dry samples were subjected to modified acid detergent fibre (MADF) analysis and 350g fresh herbage samples were stored at -20°C and then tested for lipid composition, including the linoleic acid (C18:2, *cis*-9, *cis*-12) and α -linolenic acid (C18:3, *cis*-9, *cis*-12, *cis*-15) fractions of total fatty acid content. Sward surface height (SSH), extended tiller height (ETH), bulk density (BD_{>6}) and herbage mass (HM_{>6}) characteristics of sward geometry were measured on a subset of varieties.

Results In overview, this study showed that existing registered perennial ryegrass varieties differ significantly in a range of nutritive value and sward structural parameters and would, therefore, differ in the output performances they could support in a grazing herd. Water-soluble carbohydrate concentration differed significantly (P<0.001) between varieties with tetraploids higher than all diploid varieties, except those selectively bred for this trait. Significant differences were also recorded between varieties of different maturity type and stage of physiological development (P<0.001). Similarly, differences in herbage digestibility were observed between varieties (P<0.001) and maturities (P<0.05), but only between ploidies when the very high digestibility, high WSC diploids were excluded. Significant varietal differences were also recorded in the proportion of linoleic acid (P<0.05) and of α -linolenic acid (P<0.05). These differences were not associated with either ploidy or maturity classes and were generally low in varieties with highest digestibility/WSC contents. Comparison of canopy structure characteristics among the intermediate varieties revealed significant differences (P<0.001), overlaid by temporal patterns of variation associated with maturity and season.

Conclusion The presented studies showed that overall, differences in animal value parameters were poorly associated with variety yield potential, but were strongly influenced by the physiological stage of development of the grass when harvested. It was concluded that the observed genetic diversity, indicated a good potential for achieving selective breeding improvements from within existing gene pools. However, achieving such changes without a linked yield penalty may be difficult in certain cases and precise sward management to maintain grass in its optimum physiological condition, may be vital in fully exploiting 'animal value' factors on-farm.

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