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`STAY-GREEN` AND NON-`STAY-GREEN` PERENNIAL RYEGRASS IN FIELD SWARDS WITH DIFFERENT INTERVALS BETWEEN CUTS

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Abstract

The purpose of this study was to investigate the effect of the `stay-green` character, originally introduced into perennial ryegrass (*Lolium perenne* L.) for amenity purposes, on herbage yield, N concentration and colour in field swards of `stay-green` forage ryegrass managed in different ways for agricultural use. The conclusions were that the introduction of the `stay-green` character (1) confers greater greenness only at some times of year and only when there has been a sufficiently long period of regrowth, (2) is expressed only in older, as distinct from young, tillers, (3) reduces herbage yield, particularly when a long interval is allowed between defoliations, and (4) reduces the decline in the concentration of N in herbage during the latter part of a long period of regrowth.

Keywords: `Stay-green`, ryegrass, colour, yield, N, tillers, leaves

Introduction

A `stay-green` mutant of *Festuca pratensis* Hudson was identified some years ago (Thomas and Stoddart, 1975). The `stay-green` character has been incorporated in perennial ryegrass (*Lolium perenne* L.) by a programme of crossing (Humphreys and Thomas, 1998). *F. pratensis* is little used in the U.K., whereas perennial ryegrass is by far the major sown species. Incorporating the `stay-green` character in perennial ryegrass offers the possibility of producing cultivars which are visually more attractive (because they stay greener) in sports turf, (Thorogood, 1996) other amenity swards and farm fields. There is also the possibility of leaves which stay green longer being preferred by herbivores as they could be more nutritious. They could contain more protein (Humphreys and Thomas, 1998) and the protein could be less readily broken down in the rumen and during ensilage, leading to less wastage of N as ammonia. There may, of course, be disadvantages of the `stay-green` character, including reduced yield (Humphreys and Thomas 1998) due to delayed recycling of N (and perhaps other elements) within the plant.

The purpose of the present study was to investigate the effect of the `stay-green` character on herbage yield, N concentration and colour in field swards managed in different ways.

Material and Methods

The experimental treatments comprised all eighteen combinations of two grass genotypes, three intervals between cuts and three N treatments. A randomised block design was used, with two blocks.

The grass genotypes were Ba13214 and Ba13215. These are almost identical genotypes of perennial ryegrass, except that Ba13214 contains the `stay-green` character and Ba13215 does not. The three intervals between cuts were 3, 6 and 10 weeks, during the 30-week period 30

March to 26 October 1999. The three N treatments were: (1) grass sown alone, receiving 100 kg N/ha per year as ammonium nitrate, divided equally through the year in preparation for each cut; (2) as (1), but 300 kg N/ha per year; (3) grass sown with white clover (*Trifolium repens* L.), cv. AberHerald, and receiving no fertilizer N.

The experimental site was on Penglais Farm, Aberystwyth, 110 m above sea level, on gleyed brown earth soil of the Sannan series. Each plot was 1.5 m × 6.8 m. The plots were sown on 22 September 1998, with 30 kg/ha of perennial ryegrass seed and (on the appropriate plots) 3 kg/ha of white clover seed. Ground limestone (4 t/ha), triple superphosphate (100 kg/ha of P_2O_5) and muriate of potash (320 kg/ha of K_2O) were applied to all plots in 1999. The phosphate and potash applications were divided equally through the year in preparation for each cut. The plots were cut with a motor scythe with front-mounted cutter bar, leaving a stubble height of 4-5 cm. Yield was recorded from an area of 0.91 × 6.2 m in each plot. The concentration of N was determined in dried, milled total herbage by an automated technique (Faithfull, 1971). The plots were scored by eye for the colour of the perennial ryegrass leaves, a score of 5 representing much yellowing and 9 representing no yellowing. The results were analysed on the basis of the randomised block design, with 17 d.f. for error.

Results and Discussion

There was more yellowing of perennial ryegrass leaves in the Ba13215 (non `stay-green`) plots than in the Ba13214 (`stay-green`) plots in March 1999 (25 weeks after sowing), in late July 1999 (only with N treatment (1) and with the 6- and 10-week cutting treatments (5 – 7 weeks after the preceding cut)), in late October (with N treatments (1) and (2) and the 6- and 10-week cutting treatments (6 – 10 weeks after the preceding cut)), and in the period January to March

2000 (with all N and cutting treatments (10 – 20 weeks after the preceding cut)). The means of four dates of colour scoring in the latter period are shown in Table 1.

The plots sown with Ba13214 yielded 11 % less dry matter in 1999 than those sown with Ba13215 with the 10-week cutting management (Table 1); the reduction in yield with Ba13214 was 9 % with 6-week cutting and 5 % with 3-week cutting. The concentration of N in herbage was higher with Ba13214 than with Ba13215 with 10-week cutting (Table 1); with 6- or 3-week cutting, choice of genotype did not affect the concentration of N.

When perennial ryegrass tillers were marked at the 2-leaf stage and measured over several leaf appearance intervals in 1998/99 (R.A.M. Irianni, personal communication) and 1999/2000 on these plots, there was no clear difference between the two genotypes in rates of leaf appearance, leaf extension and leaf death.

Our conclusions from the present study of these two genotypes are that the `stay-green` character in perennial ryegrass for forage:

(1) confers greater greenness only at some times of year and only when there has been a sufficiently long period of regrowth;

(2) is expressed only in older, as distinct from young, tillers (further study is planned on this point);

(3) reduces herbage yield, particularly when a long interval is allowed between defoliations;

(4) reduces the decline in the concentration of N in herbage during the latter part of a long period of regrowth.

References

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Table 1 - Effects of genotype and interval between cuts on score for yellowing (5 = much yellowing, 9 = none) in January – March 2000, annual dry-matter yield (t/ha) in 1999 and mean concentration of N (%) in 1999

	Interval between cuts (weeks)			
	3	6	10	Mean
Score for yellowing				
Ba13214 (`stay-green`)	7.58	7.46	7.51	7.52
Ba13215 (non-`stay-green`)	5.68	5.48	5.79	5.65
Mean	6.63	6.47	6.65	6.58
s.e. interval means 0.056; s.e. genotype means 0.046; s.e. interval × genotype means 0.079				
Dry-matter yield (t/ha)				
Ba13214 (`stay-green`)	5.30	8.42	8.85	7.52
Ba13215 (non-`stay-green`)	5.57	9.21	9.91	8.23
Mean	5.43	8.81	9.38	7.87
s.e. interval means 0.211; s.e. genotype means 0.172; s.e. interval × genotype means 0.299				
Concentration of N (%)				
Ba13214 (`stay-green`)	3.15	2.47	2.14	2.59
Ba13215 (non-`stay-green`)	3.17	2.45	1.98	2.53
Mean	3.16	2.46	2.06	2.56
s.e. interval means 0.034; s.e. genotype means 0.028; s.e. interval × genotype means 0.048				