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Sward characteristics of a diploid and a tetraploid cultivar of perennial ryegrass as measured by different sampling techniques

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ABSTRACT

In a grazing experiment with monocultures of 2 perennial ryegrass (*Lolium perenne* L.) cultivars it was found that over a 6-year period the tiller density of the tetraploid Condesa was on average 27% lower than that of the diploid Wendy. The lower tiller density of Condesa went along with a more open sward structure and higher weed proportions after 6 years. Sward structure was suitably characterised by means of absence frequency estimations of rooted perennial ryegrass tillers from concentric sampling quadrats.

KEYWORDS: diploid, frequency, grazing, *Lolium perenne*, sward structure, tetraploid, tiller density, weeds

INTRODUCTION

In the most recent Dutch recommended variety list for agricultural crops (Anonymous 1992), 2 of the late-heading cultivars of perennial ryegrass recommended for grazing are tetraploid, viz. the cultivars Condesa and Madera. Tetraploids are superior to diploids in terms of dry matter intake and feeding value (Hageman et al. 1993), but they generally have a lower tiller density (Neuteboom et al. 1988). The question is whether this is detrimental for sward quality.

This aspect was investigated during 1985-1991 in a grazing experiment with sown swards of the tetraploid cultivar Condesa and the diploid Wendy by means of regular tiller countings and determinations of dry weight proportions of occurring species, and by applying a new technique for characterising the open space structure of a sward. The open space structure of a sward can be characterised by measuring the absence frequency of rooted tiller bases (in our experiment the frequency of absence of rooted perennial ryegrass tillers) from concentric sampling quadrats of different sizes. Absence frequencies of rooted tiller bases from quadrats are frequencies of distances from observation points to nearest plants. Converted to percentages, absence frequencies of plants from quadrats are the cover percentages of the areas in the sward which have distances to the nearest plants of at least the radius of the quadrats (Neuteboom et al. 1992).

MATERIALS AND METHODS

The diploid cultivar Wendy and the tetraploid cultivar Condesa (Anonymous 1992) were sown in March 1985 in plots of about 0.4 ha; 3 plots per cultivar according to a randomised scheme. Seed rates were 40 kg/ha for the diploid and 60 kg/ha for the tetraploid in accordance with differences in seed size. From 1985-1987 and in 1991 the plots were rotationally grazed with steers to a sward height of 7 cm. Each year 2 silage cuts were included: the first and the third cuts in 1985, and the third and the fifth cuts in 1986 and 1987. The number of grazing cycles was 2 in 1985, 5 in 1986, 6 in 1987 and 7 in 1991. From 1988-1990 inclusive all plots were continuously grazed. Up to and 1987 inclusive all plots had been fertilised with 400 kg N/ha, after that this was reduced to 250 kg/ha.

Tiller densities were recorded in 100 cores of 0.25 dm^2 per plot in 1985 (once), in 1986 and 1987 (3 times) and in 1991 (twice). Dry weight proportions of perennial ryegrass and all other species were determined in July 1986 and at the time of tiller countings in 1991. Absence frequency recordings of rooted perennial ryegrass tillers were made in concentric rings with a radius of 0.125, 1.4, 2.8 and 5.6 cm in late April of 1986 and 1987 and in April and September 1991; 100 observations per plot.

RESULTS

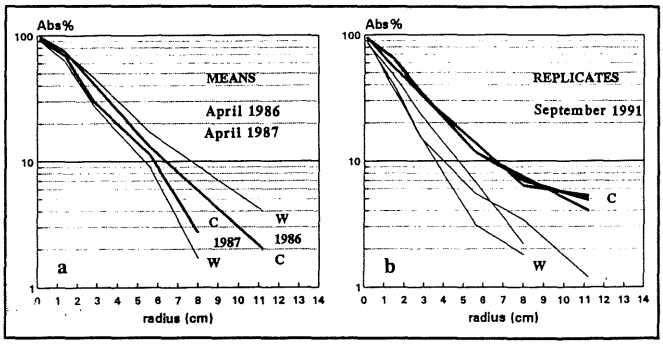
Condesa had on average 24% and 30% less tillers per dm^2 than Wendy in 1986 and 1987, respectively, and 32% and 45% less tillers in April and September 1991 (Table 1). The low tiller densities on 6 May 1986 were due to frost damage after the severe winter of 1985-1986, the low tiller densities on 19 August 1987 were due to decapitation of many reproductive stems. In both cases, Wendy recovered markedly faster because of better tillering ability. The overall higher tiller densities in 1991 were probably due to the fact that in 1988 the grazing system had been changed from rotational to continuous grazing, while with rotational grazing in 1991 no silage cuts were taken in contrast to the first 3 years of the experiment.

Table 1 Mean tiller numbers per dm^2 and weed proportions (DW%) of Wendy and Condesa

	Tiller numbers per dm^2									DW% Weed		
	1985	1986			1987			1991		1986	1991	
	20.9	6.5	18.7	15.12	27.4	19.8	8.12	29.4	30.8	20.7	April	Sept.
Wendy	71	39	60	66	79	26	46	114	102	7	11	9
Condesa	54	33	46	46	53	25	28	78	56	9	23	24

Despite its lower tiller density, Condesa had lower absence frequencies in late April 1986 than Wendy (Fig. 1a), probably because of higher germination rate and seedling survival. In April 1987, both cultivars had similar absence frequency curves (Fig. 1a); in April 1991 and in September 1991 (Fig. 1b), Condesa had systematically higher absence frequencies for all quadrat sizes than Wendy. Wendy and Condesa had similar weed proportions (7 and 9%, respectively; Table 1) in July 1986. In 1991 weed proportions had significantly increased more strongly in Condesa (up to 24% on average) than in Wendy (10%). Most important weeds in September 1991 were *Poa annua, Poa trivialis, Stellaria media* and *Elymus repens*.

Figure 1 Absence frequencies of rooted perennial ryegrass tillers from concentric sampling quadrats. (a) Means of Wendy (W) and Condesa (C) in April 1986 and April 1987; (b) Single replicates of Wendy and Condesa in September 1991



DISCUSSION

The lower tiller density of Condesa might be partly explained by its lower tillering rate as a consequence of a lower leaf appearance rate (Neuteboom et al. 1988). However, its systematically higher absence frequencies for the larger quadrat sizes might in particular suggest that with respect to Wendy also the plant density of Condesa had declined. The latter might suggest that Condesa is less persistent than Wendy. Since the lower tiller density of Condesa is expected to be partly compensated for by its larger leaves during regrowth after defoliation, the higher absence frequencies for the larger quadrat sizes might have been the main reason for the observed stronger weed increase in Condesa at the end of the experiment. Absence frequencies of rooted tillers from concentric sampling quadrats are apparently well suited to characterise cultivar differences in spatial sward structure.