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SEASONAL VARIATION IN THE VERTICAL DISTRIBUTION OF WHITE CLOVER (Trifolium repens L.) STOLONS IN TWO CONTRASTING PASTURES

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Abstract

Swards under rotational grazing by cattle (RGC) and under set stocking by sheep (SSS) were sampled every 2 months for 3 years, and white clover stolon dissected into 3 vertical classes; aerial, surface and buried. Despite large differences in yearly herbage production, sward structure, white clover content, total stolon weight and proportioning of stolon among the vertical classes between the sites, the greatest differences in distribution of stolon among the vertical classes were associated with month of sampling and this was consistent among years at both sites. These results indicate that over a 3-year period, in both swards studied, the white clover component underwent an annual cycle of burial of stolons in winter, re-emergence of growing points in spring and surface stolon development over summer.

Keywords: white clover, *Trifolium repens,* stolons, vertical distribution, seasonal variation.

INTRODUCTION

Recent studies on distribution of white clover *(Trifolium repens* L.) stolons among 3 vertical classes (aerial, surface and buried) in grazed grass-white clover swards reported the effects of season (Hay 1983), grazing management (Hay 1983, Hay *et al.* 1983) and environment (Hay and Chapman 1984). These studies found that the proportion of total stolon dry weight in each vertical class varied with season or time of year. Buried stolon was at a maximum in late winter, and surface and aerial stolon were at a maximum in summer-early autumn. The work, however, was conducted over only one year.

This study reports on the vertical distribution of white clover stolons over a 3-year period, in 2 contrasting lowland swards and on the consistency of the seasonal pattern of vertical distribution.

MATERIALS AND METHODS

Detailed description of the sites, pastures and the sampling procedure has been given by Hay (1983). An outline of essential features follows.

Sites

Rotationally grazed cattle (RGC)

The sward sampled was situated at 'Aorangi', Grasslands Division's experimental area at Kairanga. Four paddocks were sampled in a 1.62 ha farmlet of 8 paddocks which was stocked with 7.4 Friesian bulls/ha as it had been for 3½ years. Paddocks were grazed in strict rotational order; rotation length varied from 24 days in spring, to 65 days in autumn; no pasture was conserved.

Set-stocked sheep (SSS)

The sward sampled was situated at Grasslands Division, Palmerston North, and had been sown in September 1978 with 'Grasslands Ruanui' ryegrass and

'Grasslands Huia' white clover. After an establishment period of 1 year the pasture was set-stocked at 22 ewes plus lambs/ha. Lambs born in mid August were sold in December. No pasture was conserved.

Sampling

The two swards were sampled at 2 monthly intervals from 30 March 1981 to 31 January 1984 by randomly taking 12 cores of 50 mm diameter to 50 mm depth from either each of"4 paddocks, or from each quarter of the paddock, of the RGC and SSS pastures respectively. White clover stolons in the cores were dissected into aerial surface and buried classes (Hay 1983) and dry weights obtained.

Analysis of data

Percentage distribution of stolon among the aerial, surface and buried classes (% of total stolon dry weight in each class) was calculated so that swards containing different quantities of stolon could be compared. Each vertical class was tested independently by analysis of variance after a square-root transformation of the data.

RESULTS

Although mean total dry weight of stolon in the third year was only 70% of that in the 2 previous years (1st yr 423, 2nd yr 431, 3rd yr 298 kg/ha; LSD 5% = 44 kg /ha), the distribution of stolon among the aerial, surface and buried classes was generally not significantly different among years (Table 1). Mean total dry weight of stolon differed between sites (RGC 515, SSS 255 kg/ha) (P<O.OOl) and distribution among the vertical classes was also different at the 2 sites (P<0.001; Table 1). More stolon was present in the aerial and surface classes at the RGC site and correspondingly less in the buried class than at the SSS site. Mean total stolon dry weight varied with month of sampling (P<O.OOl) with minimum values in November (245 kg/ha) and maximum values in May (484 kg/ha). This effect was consistent among years and the month of sampling x year interaction was not significant.

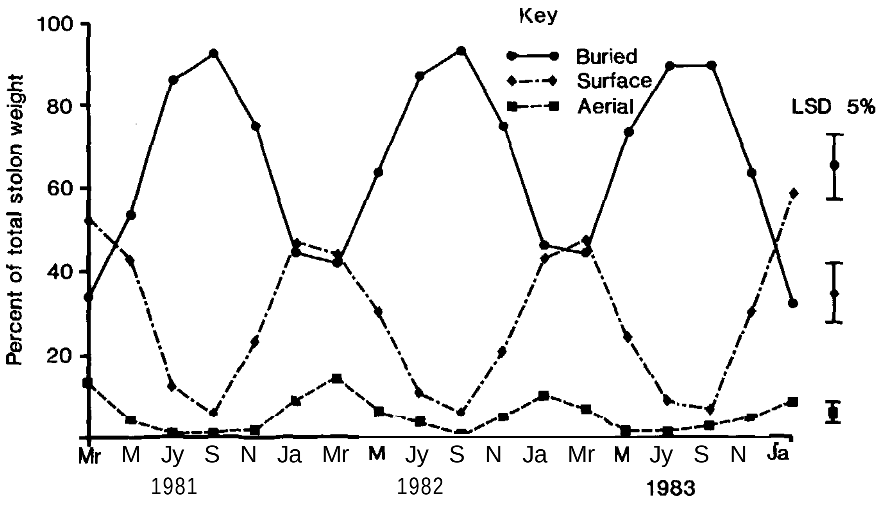

Figure 1: Mean percentage by weight of stolon in aerial, surface and buried classes at each sampling. LSD values are approximate, as they are calculated from transformed data.

Table 1: MEAN YEARLY PERCENTAGE BY WEIGHT OF STOLON IN EACH VERTICAL CLASS AT THE TWO SITES. (LSD VALUES ARE APPROXIMATE, AS THEY ARE CALCULATED FROM TRANSFORMED DATA).

Stolon class		Aerial			Surface			Buried		
Year		1	2	3	1	2	3	1	2	3
Site	RGC*	7	10	7	36	30	34	57	60	59
	SSS*	3	2	3	25	22	25	72	76	72
	LSD 5%		1.9			7.1			7.7	

* RGC = rotationally grazed cattle pasture; SSS = set stocked sheep pasture.

Large differences in distribution among the vertical classes were associated with month sampling ($P < 0.001$; Fig. 1). Each year the proportion of stolon in the buried class was at a maximum in the July – September period, and the surface and aerial classes were at a maximum over the January – March period (Fig. 1). Fig. 1 presents the mean of the RGC and SSS site data, as the month of sampling x site interaction was not significant in any of the vertical classes. The year x month of sampling and year x site interactions were not significant in either the surface or buried classes but reached significance ($P < 0.05$) in the aerial class

DISCUSSION

The swards investigated were selected because of their different characteristics. The RGC sward produced 14.4 tonnes DM/ha/yr with a white clover content of 15% (G.P. Cosgrove, unpub.), while the SSS sward produced 10.5 tonnes DM/ha/yr with a white clover content of 8% (J.L. Brock, unpub.). Grass tiller counts ranged from 11000 to 15000/m² in the SSS sward, whereas a value of 7700/m² was measured in the RGC sward at the conclusion of the trial. Although clover growing points were fewer at the RGC site (2700/m²) than at the SSS site (3800/m²) ($P < 0.05$), stolon dry weight at the RGC site was twice that at the SSS site. The number of branches per unit length of stolon at the RGC site (37.4/m) was less than half that at the SSS site (79.5/m). Thus very different swards had developed at the two sites, as was reflected in the morphology of both the white clover and grass components in the swards. The RGC site also had more aerial and surface stolon than the SSS site (Table 1). However, in spite of all these differences, the same seasonal cycle of burial of most stolon in winter and surface stolon growth in summer – autumn (Fig. 1) occurred at both sites, in a manner similar to that previously described (Hay 1983, Hay et *al.* 1983, Hay and Chapman 1984). Moreover, the pattern was consistent at both sites and in each of the 3 years. (Fig. 1).

The consistency of distribution of stolon among the vertical classes among years during this study probably reflects the even distribution and similar amounts of annual rainfall received over this period. The yearly rainfall totals of 878,871 and 795 mm were similar and were all below the 30-year mean rainfall of 995 mm at Palmerston North (NZ Met. Service 1983). Drought combined with heavy grazing pressure can modify the distribution of stolon in favour of the buried class in summer – autumn (Hay and Chapman 1984), and sustained heavy summer rainfall could have a similar effect. However, these events did not occur during this study, no doubt contributing to the consistent pattern of distributions measured (Fig. 1). Lowest total stolon weights were recorded in the third year which was also the year of lowest total rainfall (795 mm), a total in the lower 10 percentile for Palmerston North (NZ Met. Service 1983). However, although total stolon weights decreased by 30%, the distribution of stolon among the vertical classes in that dry year remained the same (Table 1).

CONCLUSION

In both these differently managed swards the white clover component in each of the 3 years studied was subject to the annual cycle previously described by Hay (1983); burial of stolons in winter, re-emergence of growing points in spring, and surface stolon development over summer. Although the degree of burial of stolon differed between sites the seasonal pattern of growth of white clover was the same at both sites. These results suggest that investigations into the effect of stolon burial on the growth of white clover will be pertinent to the performance of white clover grown under a wide range of stock managements.

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