Stolon Growth and Its Morphological Components in White Clover (*Trifolium repens* L.) Cultivars

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STOLON GROWTH AND ITS MORPHOLOGICAL COMPONENTS IN WHITE CLOVER (*TRIFOLIUM REPENS* L.) CULTIVARS

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Abstract

A trial was performed to study the seasonal changes in stolon growth and its morphological components in four white clover cultivars, in the north of Buenos Aires Province, in Argentina. Stolons were tagged in four seasonal measurements periods per year, during two consecutive years. Leaf, stolon and flowerheads weights were recorded at regular intervals in each measurement period and total stolon growth was calculated. Differences among cultivars were found in stolon growth and its morphological components in most of the measurement periods. In spring and summer, differences among cultivars in stolon growth were related to flowering quantity and earliness, and cultivar response to the environment. In autumn and winter, differences were associated to the ability of cultivars to grow at low temperatures.

Keywords: Stolon, white clover, cultivars

Introduction

White clover is widely spread, naturally or seeded in complex mixtures, in the northern portion of Buenos Aires Province, in Argentina. Differences in the pattern of herbage accumulation and persistence were found in both, between and within leaf size categories of white clover cultivars. In addition, seasonal and varietal variations were found in stolon dry weight and its components that brought out information about the mechanisms related to differences in seasonal herbage accumulation of white clover cultivars of several origins (Williams and Hoglund, 1978). According to that, a trial was performed to study the seasonal changes in the growth of stolons and its morphological components in white clover cultivars of medium large and large leaf types.

Material and Methods

The trial was carried out at Pergamino Agricultural Experiment Station (33º 56' S and 60º 33' W) on a Tipic Argiudol soil (pH: 5.9, O.M.: 2.9 % and P (Bray 1): 31 ppm). Treatments were four white clover cultivars: the medium large leaf type cultivar Grasslands Pitau (GP), and the large leaf type cultivars Grasslands Kopu (GK), Experimental L-49 (L-49) and Gigante Lodigiano (GL).

Each cultivar was sown in pots in March and seedlings were grown in a glasshouse for 45 days and were then transferred to the field. Experimental units consisted of plots of 5.65 m2 with plants disposed in rows 30 cm apart. Experimental units were separated each other by tall fescue buffer plots. Treatments were arranged in a completely randomized design with four replicates.

Four seasonal measurements periods were carried out annually for two consecutive years (Year 1 and Year 2). At the beginning of each measurement period, thirty stolons of similar size were tagged per experimental unit. Tagged was done in the youngest internode by a colored plastic ring. Three samplings of ten stolons in each measurement period were made every 10 (spring), 15 (summer and autumn) and 20 (winter) days. In each sampling date, stolons were cut at the tagged internode level. In laboratory, leaf of that node, roots and the youngest folded leaf were discarded. The remaining material was divided in the following components: leaf (leaflet plus petiole), stolon and rest (flowerhead, peduncule and, eventually, buds with a folded leaf). Each component was dried and weighed.

Owing to the loss of an experimental unit, data were analyzed by GLM procedure using the SAS System for each measurement period. Values expressed as percentage were transformed before the analysis. When differences among treatments were detected, means comparisons were done using the T test ($p<0.05$). For simplicity, only the final data of each measurement period are shown.

Results and Discussion

Year 1. In Spring, stolon growth in L-49 was higher than in the other treatments (Table 1). In average, leaf, stolon and rest comprise 59, 28 and 13 % of the total stolon growth, respectively. There were differences among cultivars in dry matter partition: L-49 assigned more dry matter to rest and less to leaf and to stolon than the others treatments. Early flowering in L-49 appeared to be responsible for differences among cultivars in total stolon growth and morphological components. In Summer, stolon growth in L-49 and GL was higher than in GP and GK. In average, leaf, stolon and rest comprise 43, 33 and 24 % of the stolon growth, respectively. L-49 and GL allocated more dry matter to rest and less to leaf than GP. In autumn, stolon growth was higher in L-49 and in GL than in GP and GK. Though L-49 and GL allocated more dry matter to stolon and less to leaf than GP, leaf was still the main morphological component that accounted for differences in stolons growth of these cultivars respect to GP. In winter, stolon growth in L-49 was higher than in the other treatments. Leaf was the main morphological component that accounted for differences in stolon growth in favor of L-49, although rest also made up 10 % of total stolon growth in this cultivar. L-49 had the better performance in stolon growth around the year. This maybe related to its better overall adaptation to Pergamino environment, where it was bred.

Year 2. Except in Autumn, rainfall was lower than the historic average and stolon growth was greatly reduced compared with the previous year. In spring, GL had higher growth than GP and GK (Table 2). Compared with Year 1, GL was affected in lesser extent by drought conditions than the other cultivars. Although stolon growth was the same for L-49 and GL, dry matter partition was different: GL produced more and larger leaves than L-49 through the measurement period (data not shown) while this cultivar produced more flowerheads. In summer, there were no differences among cultivars in stolon growth. Leaf comprises 72 % of stolon growth. In GL treatment more dry matter was allocated to rest and less to leaf than in the other treatments, in agreement with its late flowering period. Compared to year 1, decrease in stolon total growth was evident in L-49 but no difference was observed in GK. A similar performance was observed in Australia where GK showed good recovery after a severe drought during spring (Caradus and Woodfield, 1997). In autumn and in winter L-49 had more stolon growth than the other treatments, except with that of GL in winter. Leaf comprises 74 and 78 % of stolon growth, without differences among treatments in any morphological component. In the last two seasons, differences among cultivars appeared to be related to their ability to grow at low temperatures. It is interesting to note that both GP and GK, showed good winter growth in other environments (Caradus and Woodfield, 1997) but did not exhibit this characteristic at Pergamino during the measurement periods of low temperatures.

References

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Table 1 - Stolon growth (g DM stolon^{-1}) and its components (%) in four white clover cultivars over four measurements periods in Year 1.

Measurement period	Cultivar	Leaf	Stolon	Rest	Stolon growth
	GP	61	27	12	0.63
	GK	59	31	10	1.06
Spring	L-49	53	23	24	1.58
	GL	61	32	7	1.07
	p<x	0.01	0.001	0.001	0.001
	GP	61	36	3	0.12
	GK	45	33	22	0.18
Summer	L-49	36	35	29	0.47
	GL	31	29	40	0.33
	p<x	0.05	0.05	0.05	0.01
	GP	78	19	3	0.13
	GK	74	25	1	0.16
Autumn	L-49	66	29	5	0.39
	GL	67	27	6	0.37
		0.05	0.05	ns	0.05
	GP	76	21	3	0.13
	GK	72	26	2	0.20
Winter	L-49	74	16	10	0.33
	GL	76	19	5	0.18
	p<x	ns	Ns	0.05	0.01

Table 2 - Stolon growth (g DM stolon^{-1}) and its components (%) in four white clover cultivars over four measurements periods in Year 2.

Measurement period	Cultivar	Leaf	Stolon	Rest	Stolon growth
	GP	51	19	30	0.29
	GK	52	23	25	0.43
Spring	L-49	41	12	47	0.63
	GL	52	25	23	0.84
	p<x	ns	0.01	0.05	0.01
	GP	72	27	1	0.09
	GK	78	22	---	0.21
Summer	L-49	73	27	---	0.18
	GL	64	28	8	0.20
	p<x	0.05	0.05	0.05	ns
	GP	78	20	2	0.07
	GK	75	22	3	0.17
Autumn	L-49	74	23	3	0.30
	GL	69	27	4	0.18
	p<x	ns	Ns	ns	0.05
	GP	83	15	2	0.06
	GK	75	23	2	0.12
Winter	L-49	76	23	1	0.17
	GL	78	20	2	0.13
	p<x	ns	Ns	ns	0.05