ID # 14-10

STOLON MASS AND CLASSES IN WHITE CLOVER (*Trifolium repens* L.) WITH TWO SOIL WATER AVAILABILITY LEVELS

O. Scheneiter and E. Pagano - Forrajeras INTA EEA Pergamino 2700- Pergamino, Argentina

oscheneiter@pergamino.inta.gov.ar

Abstract

Two trials were carried out to study the stolon mass and classes in white clover (*Trifolium repens* L.) under two soil water availability levels in summer. In each trial, treatments were two white clover cultivars. From December 15th to February 15th in 1993/94 and again during the same period the following year, white clover was grown under 30 to 70 % (Forced water uptake) or 85-to100 % (Maximum water uptake) of field capacity. Every two months, throughout two years, total stolon mass, and buried, superficial, and aerial stolons were measured. Differences between cultivars were detected in stolon mass and percentage of each stolon class in both trials.

Keywords: Stolon, white clover, water availability

Introduction

In the north of Buenos Aires province, Argentina, white clover persists through vegetative propagation and also through sexual ways under some conditions. In this region, high summer temperatures and water shortage can kill young stolons and affect vegetative spread of white clover. Stolons have been classified according to their position on the soil surface as buried, superficial, and aerial (Hay, 1983). The vertical development of buried stolons in spring could have implications in the vegetative persistence of white clover owing to the strong root system of these stolons (Forde et al, 1989). In addition, some Mediterranean and North American white clover populations of giant and large leaf types have shown tolerance to transient water deficits and warm temperatures (Williams, 1987). In Pergamino, soil water deficit occurs from late October to late February, being more pronounced in December and January (Rebella y Zeljkovich, 1980). According to this fact, two trials were carried out to study the stolon mass and classes in two white clover populations, under two soil water availability levels in summer.

Material and Methods

Two adjoining trials were carried out at Pergamino Agricultural Experiment Station (33º 56' S, 60º 33' W) on a Typical Argiudol Soil from December 1993 to August 1995. In each trial, treatments were two white clover cultivars: Experimental L-49, and Espanso of large and giant leaf type, respectively. In one trial (Forced water uptake), white clover was grown with water availability between 30 and 70 % of field capacity between December 15th and February 15th, in each of two consecutive years. In the other trial (Maximum water uptake), white clover was grown with water availability between 85 and 100 % of field capacity in the same period. The rest of the year, both trials received only water from rainfall. These targets were reached by protecting the first one with a transparent plastic film against the rain whenever it was necessary and by watering both trials. Watering decisions were taken after combining a Periodic Water Balance Programme (Perez y Zeljkovich, 1993) with regular soil water content determinations. In each trial, treatments were arranged in a completely randomized block design with three replicates. Plots were defoliated with motorscythe whenever they reached 0.2 m height. Every 60 days, from December 1993 to August 1995, two samples of 0.04 m^2 per plot were taken. In each sampling, after leaf removal, aerial, superficial, and buried stolons were consecutively harvested.

In lab, each stolon class was washed and weighed. Then, dry and organic matter content was determined. Total stolon mass was determined and percent of each class was calculated.

Data for each trial and sampling date were analyzed separately by the ANOVA procedure of the SAS system. Previous to the analysis, data of stolon mass and class percentage were appropriately transformed to keep the ANOVA assumptions.

Results and Discussion

Forced uptake trial. Stolon mass, averaged over the whole trial, was higher in Espanso than in L-49 ($p<0.001$). Throughout the experimental period, differences between treatments where detected on six sampling dates (Table 1). Percentage of buried stolon was higher in Espanso than in L-49 (43 v 34 %, $p<0.05$) and, through the year, differences were detected at the end of 1994. In most of sampling dates, buried stolon percentage was between 40 and 60 % in Espanso, and between 20 and 40 % in L-49. These values were rather lower than reported by Hay et al (1987) in mixtures under grazing. They found a cyclic pattern of buried, superficial and aerial stolons through the year, with percentages around the 80 % for the former at the beginning of spring but this did not occur in our trial. Averaged over the whole trial, percentage of superficial stolons did not show any difference between cultivars in the (35 %, in average). Percentage of aerial stolons was higher in L-49 than in Espanso ($p<0.05$, 30 v 24 %, respectively) and, through the year, differences were found in the second half of 1994.

Maximum uptake trial. Averaged over the whole trial stolon mass was higher in Espanso than in L-49 ($p<0.001$) and throughout the experimental period differences between cultivars were detected in June and October in 1994 (Table 2). Averaged over the whole trial, percentage of buried stolons were higher in Espanso than in L-49 (41 v 32 %, $p<0.01$) and, through the experimental period, differences were detected in August and in December in 1994.

There were no differences in percentage of superficial stolons (in average, 37 %) and, through the trial; Espanso had higher values than L-49 in December in 1993 and in February in 1994. Percentage of aerial stolons was higher in L-49 than in Espanso (32 v 21 %, $p<0.05$) and differences through the experimental period were detected in February and August in 1994. In the north of Buenos Aires province, Argentina, the ranking of cultivars in stolon mass and stolon classes' percentages does not change with soil water availability. The superiority of Espanso in stolons mass over L-49, under both soil water regimens, was more associated with the inherent characteristics of that cultivar rather than a different mechanism of stolons mass partitioning among stolon classes.

References

Forde M.B, Hay M.J.M. and Brock J.L. (1989). Development and growth characteristics of temperate perennial legumes. In Marten G.C. (ed) Persistence of forage legumes. Madison, Wisconsin. America Society of Agronomy, 91-109.

Hay M.J.M. (1983). Seasonal variation in the distribution of white clover (Trifolium repens L.) Stolons among 3 horizontal strata in 2 grazed swards. New Zealand Journal of Agricultural Research, **26**: 29-34.

Hay M.J.M., Chapman D.F., Hay R.J.M., Pennell C.G.L., Woods P.W. and Fletcher R.H. (1987). Seasonal variation in the vertical distribution of white clover stolons in grazed swards. New Zealand Journal of Agricultural Research, **30**: 1-8.

Perez O.G. and Zeljkovich L.T. (1993). Programa para el cálculo de la evapotranspiración potencial en la zona de Pergamino. Pergamino. Estación Experimental Agropecuaria. Carpeta de Producción Vegetal (XII) Información General 108. 8 p.

Rebella C.M. and Zeljkovich L.T. (1980). Probabilidades de deficiencia y excesos hídricos en la región de Pergamino. In Actas Reunión Argentina de la Ciencia del Suelo, 9º, Paraná, **1**: 79-85.

Williams V.M. (1987). Adaptative variation. In Baker M.J. and Williams W.M. (eds) White clover. Wallingford, CAB International, 299-321.

Table 1 - Stolon mass (g M.O..m^{-2}) and classes (%) in two white clover cultivars in the forced uptake trial

Variable	Treat-Ment	Month and Year										
		Dec'9	Feb'94	Apr	Jun	Aug	Oct	Dec	Feb'95	Apr	Jun	Aug
Stolon Mass	L-49	74^{b}	67^{b}	32	50^{b}	82	107	84	30^{b}	8^{b}	29^{b}	31
	E	114^{a}	148^{a}	158	115^{a}	99	183	188	134^{a}	75^{a}	82^{a}	76
Buried stolon	L-49	26	53	41	32	39^{b}	44	25^{b}	35	23	36	17
	E	25	58	54	42	54^{a}	62	55^{a}	28	24	46	19
Superficial Stolon	L-49	26	29	37	44	34	30	41	31	48	35^{a}	41^{b}
	E	34	31	33	41	32	20	27	37	42	24^{b}	51^{a}
Aerial Stolon	L-49	48	18	22	24^{a}	27^{a}	26	34^{a}	34	29	29	42
	E	41	11	13	17^{b}	14^{b}	18	18^{b}	35	34	30	30

Different letters for each variable and date show differences $p<0.05$ between treatments

Table 2 - Stolon mass (g MO/m^{-2}) and classes (%) in two white clover cultivars in the maximum uptake trial.

Variable	Treat-Ment	Month and Year										
		Dec'93	Feb'94	Apr	Jun	Aug	Oct	Dec	Feb'95	Apr	Jun	Aug
Stolon Mass	L-49	50	78	56	51^{b}	88	95^{b}	80	64	57	60	68
	E	121	157	158	107^{a}	136	197^{a}	126	145	96	150	173
Buried stolon	L-49	25	46	40	39	27^{b}	43	37^{b}	18	32	23	22^{b}
	E	26	51	41	39	44^{a}	55	52^{a}	24	31	27	55^{a}
Superficial Stolons	L-49	31^{b}	30	42	41	37	32	37	28^{b}	27	49	41
	E	42^{a}	33	41	46	41	32	31	36^{a}	41	51	25
Aerial Stolons	L-49	44	24^{a}	18	20	36^{a}	25	26	54	41	28	37
	E	32	16^{b}	18	15	15^{b}	13	17	40	28	22	20

Different letters in each variable and date show differences $p<0.05$ between treatments