ECOTYPIC ADAPTATION OF *MEDICAGO POLYMORPHA* ALONG A GRADIENT IN CENTRAL CHILE: GROWTH AND SEED PRODUCTION.

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ABSTRACT
Relative growth rate, total dry weight and seed yield on 19 accessions of burr medic (*Medicago polymorpha* L.) from different bioclimatic conditions, were assessed at Cauquenes (35°58';72°17'W) in the subhumid mediterranean region. The accessions were sown in microplots over raised beds during two years (1991 and 1992), and swards cut periodically at 2, 6 and 10 cm height. There were significant differences between accessions in both total dry weight and seed yield ($P < 0.001$, Table 1), but the interaction between accessions and height of cutting was not significant ($P > 0.05$). Total dry weight was positive correlated with days to flowering ($r^2 = 0.81$; $P > 0.01$).

KEYWORDS
Burr medic, accession, dry weight, seed production, climatic gradient

INTRODUCTION
Burr medic (*Medicago polymorpha* L.) was introduced to Chile by the 16th or 17th century, inadvertently, in the wool of livestock or other domestic animals brought by the Spaniards. Today, *M. polymorpha* is widely distributed along the mediterranean area between the arid region (32° S; 130 mm of annual rainfall) and the perhumid region (38°; 1300 mm) (Del Pozo et al., 1989, Ovalle et al., 1993).

Despite its relatively short history in the country (< 400 years), the impressive range of bioclimatic and edaphic conditions in which this species now occurs suggests a process of remarkably rapid acclimatisation and adaptive radiation. In fact, there is a clear ecotypic differentiation in precocity (days to flowering) among accessions from different latitudes (Ovalle et al., 1993 ; Del Pozo, Ovalle and Avendaño, 1995). The objective of this paper was to compare the growth and total dry matter and seed production of 19 accessions (ecotypes) collected in a macrogradient of bioclimatic conditions. Because the different accessions may differ in their growth response to grassing pressure, the accessions were tested at three heights of cutting.

MATERIAL AND METHODS
Fifty three accessions were collected along a bioclimatic gradient in 1989, and sown in the following year for phenological evaluation and to increase the number of seeds (Ovalle et al., 1993). A selection of 19 accessions were sown in microplots of 0.5 m^2 in raised beds at Cauquenes (35°58';72°17'W), at the rate of 1000 plants/m^2, in two consecutive years, 1991 and 1992. Plots received the equivalent of 100 kg/ha of P_2O_5, 44 kg/ha of S, and 2000 kg/ha of $CaCO_3$. There were 4 replicates plots per accession in a randomised block design.

Dry matter was measured every 15 days in winter and every 5 days in spring, and the height of cuttings were 2, 6 and 10 cm. Seed production was evaluated at the end of each growing season. Relative growth rates (RGR) were calculated for the winter and spring periods, using the following equations (Hunt, 1982) :

$$RGR = (\ln W_2 - \ln W_1)/ (t_2 - t_1)$$

where W_2 and W_1 are dry weights at time t_2 and t_1, respectively.

The main effects of accessions and height of cutting were assessed by analysis of variance using SAS.

RESULT AND DISCUSSION
There were significant differences between accessions in both total dry weight and seed yield ($P < 0.001$, Table 1), but the interaction between accessions and height of cutting was not significant ($P > 0.05$).

Two earlier flowering accessions from the arid (MPO 7-88) and semiarid (MPO 1-88) mediterranean region, showed very high seed yields (Table 1). Accessions MPO 19-88, MPO 25-88 and MPO 30-88, from the subhumid mediterranean region, presented high dry weight and seed yield (Table 1). Later flowering accessions (MPO 33-88 and MPO 39-88) from the perhumid mediterranean region presented the greatest total dry weight. The accession MPO 33-88 had also the greatest relative growth rate, but there was not a clear relationship between RGR and earliness of the accession (Table 2).

Total dry weight was positively correlated with days to flowering ($r^2 = 0.81$; $P > 0.01$). Previous studies showed a positive correlation between the latitude where the accessions were collected and days to flowering (Ovalle *et al*., 1993). Something similar was found in subterranean clover where later flowering cultivars were more productive than earlier flowering cultivars (Lodge et al., 1993).

Total dry weight and seed yield increased when the height of cutting increased ($P < 0.001$). Other studies (Young et al., 1994; Conlan et al., 1994) showed that heavy grassing during spring may reduce seed production in annual medics.

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Table 1
Location of the accessions and total dry weight and seed yield. Values are mean of three height of cutting and two years of evaluation.

Accession	Latitude	Longitude	Total D.W. (g/m^2)	Seed yield (g/m^2)
MPO 45-88	29,55	71,17	436	60
MPO 10-88	30,07	70,41	566	92
MPO 7-88	31,09	71,00	530	109
MPO 13-88	31,13	71,36	541	91
MPO 4-88	31,53	71,28	544	95
MPO 44-88	31,53	71,28	492	96
MPO 3-88	32,16	71,27	461	77
MPO 1-88	33,11	70,46	540	100
MPO-19-88	33,57	71,32	622	119
MPO 21-88	34,26	71,27	580	80
MPO 24-88	34,47	71,40	620	80
MPO 25-88	34,58	71,41	618	96
MPO 29-88	35,41	72,29	651	63
MPO 30-88	35,52	72,11	576	101
MPO 31-88	35,58	72,19	638	90
MPO 43-88	35,58	72,19	646	83
MPO 42-88	35,58	72,19	640	72
MPO 33-88	38,14	72,41	656	90
MPO 39-88	38,47	72,49	681	82

Table 2
Relative growth rate (RGR, g/g day) of 19 accessions grown in microplots at Cauquenes, in 1992. Values are mean of 3 height of cutting.

Accession	1992		
	July	August	September
MPO 45-88	0.025	0.037	0.016
MPO 10-88	0.036	0.059	0.014
MPO 7-88	0.023	0.027	0.014
MPO 13-88	0.030	0.044	0.017
MPO 4-88	0.015	0.025	0.014
MPO 44-88	0.038	0.051	0.016
MPO 3-88	0.017	0.021	0.013
MPO 1-88	0.029	0.058	0.014
MPO-19-88	0.000	0.073	0.017
MPO 21-88	0.012	0.068	0.016
MPO 24-88	0.028	0.066	0.016
MPO 25-88	0.064	0.067	0.017
MPO 29-88	0.020	0.070	0.017
MPO 30-88	0.031	0.062	0.019
MPO 31-88	0.033	0.058	0.014
MPO 43-88	0.010	0.072	0.016
MPO 42-88	0.055	0.047	0.015
MPO 33-88	0.619	0.135	0.021
MPO 39-88	0.009	0.068	0.023