Is alfalfa a pasture option in dryland livestock systems in Mediterranean Chile?

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INTRODUCTION: The Mediterranean region of Chile presents a strong concentration of rainfall in autumn and winter (May to September), and a prolonged dry season of 5-6 months. The strategy to improve pasture productivity of dryland has been the introduction and use of annual legumes, like subterranean clover, burr medic, balansa clover and arrow leaf trefoil, as well as mixtures of the above species. However, the distribution of the production of these species is very concentrated in spring. We hypothesize that perennial deep-rooted legumes, like alfalfa can improve pasture productivity by extending the production period and increasing the water use efficiency.

MATERIALS AND METHODS: The experiment was conducted at the INIA Experimental Center of Cauquenes (35° 58' S, 72° 17' W; 140 m. above sea level), in the sub-humid Mediterranean zone of Chile. The soil was an Alfisol of pH 6.8, the organic matter content was 1.6% and phosphorus in the top 20 cm was 12 mg kg^{-1}. The average annual temperature in this region is 14.7 ºC, the minimum average is 4.7 ºC (July) and the maximum 27 ºC (January). Long-term average annual precipitation is 695 mm with 5-6 month without rainfalls. Nine cultivars of alfalfa from Australia and USA (Table1) were evaluated between May 2012 and January 2018. Two months seedlings previously inoculated and lime pelleted with *Sinorhizobium meliloti* strain WSM2141 were planted in two 3 m long rows separated by 40 cm (60 plants per plot), in July 2012. The experimental design was a randomized complete block with four replicates. Plant survival (%) was assessed at the end of the summer period of each year by counting the number of green plants per plot and expressing the result as a percent-age of the establishment density. Biomass was evaluated annually at the end of winter (August), at flowering (November) and before entering summer dormancy (January) by harvesting 3 m row.

RESULTS: Alfalfa presented a high survival rate (varying from 98% in the first year to 50% in the sixth) under the severe water restriction during the summer period. The effects of cultivar and year, and the interaction cultivar*year were significant. Cultivars with low or no fall dormancy were the most productive during the winter period and in the whole growing season (Table 1). Indeed, the most productive ones reached 2,500 kg DM ha^{-1} in late winter, which is not possible to achieve by any of the annual legumes options currently used in dryland Mediterranean areas of central Chile. Total annual production was significant higher in cultivars Sardi Ten, Aquarius, Genesis and Sardi Seven (Table 1).

Table 1. Fall dormancy and winter and total dry matter production (average of six years) of nine cultivars of alfalfa in a rainfed Mediterranean site of central Chile.

Cultivar	Fall dormancy	Winter production	Total production (kg DM ha^{-1})
WL 326 HQ (USA)	4	1.611 bc*	6.565 c
Venus (Australia)	5	1.977 b	7.120 b
SARDI Five (Australia)	5	1.817 b	7.104 b
WL 458 HQ (USA)	6	1.718 bc	7.377 b
SARDI Grazer (Australia)	6	1.992 b	7.537 ab
Genesis (Australia)	7	2.496 a	7.733 ab
SARDI Seven (Australia)	7	2.441 a	7.693 ab
Aquarius (Australia)	8	2.428 a	8.365 a
SARDI Ten (Australia)	10	2.514 a	8.875 ab

* P<0.05, Test Duncan´s

CONCLUSIONS: These results show that alfalfa has a great potential of as a forage crop in the interior dryland of central Chile. The most cultivars were Sardi Ten, Aquarius, Genesis and Sardi Seven.