

## AGRONOMIC EVALUATION OF ALFALFA CULTIVARS IN RIO GRANDE DO SUL , BRASIL

J.C. de Saibro<sup>1</sup>, R. Battisti and T.M.S. Freitas

<sup>1</sup> Dept. Forage Crops & Agrometeorology (DFCA), Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brasil, [jnsaibro@zaz.com.br](mailto:jnsaibro@zaz.com.br);

### Abstract

From April 1995 to June 1998, thirty five alfalfa (*Medicago sativa* L.) cultivars (cvs.) were evaluated in a field trial at the “Depressão Central” ecoclimatic region, in southern Brazil. Two years after sowing, 30 cultivars were excluded from the test due to their poor overall agronomic performance, mainly low forage DM yields. The remaining cultivars: Crioula (local genotype used as a check), Victoria, Rio and P 30 are hay-type cultivars while Alfagraze is a grazing-tolerant type. Twenty-two harvests were made and no significant differences were found for total DM yields among cvs. Crioula, Victoria, Rio and P 30; however, cv. Crioula yielded 25,854 kg.ha<sup>-1</sup>, showing a significant ( $P < 0,05$ ) superior performance compared to cv. Alfagraze (17,478 kg.ha<sup>-1</sup>). The highest average annual and seasonal DM yields were obtained by cv. Crioula and spring was the best growing season. Cv. Alfagraze showed the highest crude protein content and leaf to stem ratio. Incidence of foliar diseases was low, affecting all cultivars similarly. Cv. Victoria showed the lowest stand persistence. Alfalfa root density did not differ among cultivars and the highest average value was found at the 0-10 cm topsoil layer. Results indicate that cvs. Crioula and Alfagraze are well-adapted, productive and persistent alfalfa

genotypes for hay production and grazing, respectively, under the soil and climatic conditions of the “Depressão Central” region.

**Keywords :** *Medicago sativa*, alfalfa genotypes, hay-type , grazing-tolerant , root density , stand persistence, leaf diseases, crude protein content

### **Introduction**

Alfalfa is the most important perennial forage legume for hay production in Rio Grande do Sul , with an estimated cropped area of 16,000 ha, while the total harvested Brazilian area is estimated to be around 26,000 ha. Cv. Crioula, a local, naturally selected alfalfa genotype, is the one most widely used at the state and regional levels. It is a non-dormant, well adapted, productive hay-type cultivar that shows a good stand persistence under the subtropical growing conditions of southern Brasil (Saibro, 1985; Costa and Monteiro, 1997). However, there is a need to evaluate new, exotic hay-type alfalfa cultivars to assess their potential agronomic value on a new environment, to allow their use on the farms as an alternative or substitute for cv. Crioula. On the other hand, grazing-tolerant alfalfa genotypes have been released elsewhere (Bouton et al., 1991), offering great promise to improve animal performance at lower costs in livestock pasture-based production systems. The main objective of this work was to evaluate the agronomic performance of several introduced alfalfa cultivars by measuring forage yield and quality, disease incidence and root density as well as the effect of alfalfa stand reduction on forage dry matter yield over three years.

## **Material and Methods**

Thirty five alfalfa (*Medicago sativa* L.) cultivars introduced mainly from Argentina were sown in April 1995, on a limed and fertilized Red Latossol, at the Experimental Agronomic Station/UFRGS (30°05'22"S, 51°39'08"W, 46 m.a.s.l.), Rio Grande do Sul, Brazil. Average annual rainfall is 1400 mm, which occurs mainly from April to September, with eventual dry spells during the summer. Treatments (cultivars) were arranged in a randomized complete block design, with three replications. Dry matter (total, annual and seasonal) yield, forage crude protein content, leaf to stem ratio, foliar diseases incidence, root density and alfalfa stand persistence were evaluated. Two years after the establishment, 30 cultivars were excluded from the test, primarily due to their poor forage productive performance and lack of stand. The remaining cultivars: Crioula, Victoria, Rio, P 30 and Alfagraze were subjected to a total of 22 harvests at early flowering from April 1995 to June 1998, divided into four cuts during winter, seven in spring, six in summer and five during the fall. Leaf disease rates were scored from 0 (no damages) to 3 (severe damage) before each harvest, according to Lenné (1982). Stand reduction was determined every year in winter, by measuring alfalfa row segments lacking plants and stand persistence was estimated as a proportion of the original stand. Root samples were extracted from the soil using the "monolith method", as described by Böhm (1979), washed, dried and weighed. Soil root density was determined according to Tennant (1975), at three soil depth layers.

## **Result and Discussion**

Total forage DM yield did not show significant ( $P < 0,05$ ) differences between cvs. Crioula, Victoria, Rio and P 30; however, cv. Crioula out yielded cv. Alfagraze (Table 1). Average annual and seasonal DM yield for cv. Crioula was significantly higher ( $P < 0,05$ ) when

compared to the remaining cvs. These data agree with results reported previously comparing DM yields from the non-dormant cv. Crioula and fall dormant cultivars introduced from the United States and Argentina, tested at the “Depressão Central” and “Missões” ecoclimatic regions in Rio Grande do Sul, respectively (Saibro, 1985). Spring was the best growing season for all cultivars (Table 1). The highest ( $P < 0,05$ ) forage crude protein content and leaf to stem ratio were obtained by cv. Alfagraze, which could be considered as an indication of its superior nutritive quality (Bouton et al., 1991). Foliar disease incidence was low, affecting all cultivars similarly. Cvs. Crioula and Alfagraze achieved a longer persistence, maintaining an average of 65% of their original stand (Table 1). Alfalfa root density did not change significantly ( $P < 0,05$ ) between cvs. Crioula, Florida 77 and Alfagraze after a three-year growth period and the 0-10 cm soil depth layer showed the highest root density when compared to deeper soil layers (Table 2). Results support and confirm cv. Crioula as a very well adapted, non-dormant, highly productive and persistent alfalfa genotype for hay production in Rio Grande do Sul. They also indicate that alfalfa grazing-tolerant types such as cv. Alfagraze have a great potential to increase animal performance in livestock pasture-based production systems in southern Brasil.

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**Table 1** - Average total , annual and seasonal dry matter (DM) yield, crude protein content, leaf to stem ratio, foliar disease rate and stand persistence of five alfalfa cultivars.

Cultivars	Crioula	Victoria	Rio	P 30	Alfagraze
Total DM (kg.ha <sup>-1</sup> )	25,854 A <sup>1</sup>	22,265 AB	22,189 AB	21,694 AB	17,478 B
Annual DM (kg.ha <sup>-1</sup> )					
1995/1996	7,469 b	8,102 b	7,715 b	7,141 b	5,325 b
1996/1997	12,042 a	10,425 a	11,024 a	10,642 a	8,738 a
1997/1998	6,343 c	3,739 c	3,450 c	3,911 c	3,416 c
Average	8,618 A	7,422 B	7,396 B	7,231 B	5,826 C
Seasonal DM (kg.ha <sup>-1</sup> )					
winter	4,404 c	4,524 c	4,539 c	4,533 c	3,016 c
spring	10,522 a	9,105 a	8,857 a	8,740 a	6,965 a
summer	7,413 b	5,793 b	5,852 b	5,517 b	5,295 b
Fall	3,515 d	2,843 d	2,941 d	2,905 d	2,203 d
Average	6,464 A	5,566 B	5,547 B	5,424 B	4,370 C
Crude Protein (g.kg <sup>-1</sup> )	275 B	274 B	276 B	272 B	285 A
Leaf to stem ratio (g.g <sup>-1</sup> )	1.13 C	1.14 BC	1.09 C	1.28 B	1.49 A
Disease rate (0 - 3)	1.03	1.18	1.21	1.03	0.92
Stand persistence (% of original stand)	65.3 A	57.2 B	60.8 AB	n.d. <sup>2</sup>	65.5 A

<sup>1</sup> Means followed by the same capital (rows) or small case type (columns) letters did not differ significantly by Duncan's test at 5% level.

<sup>2</sup> not determined.

**Table 2** - Root density of alfalfa cultivars at three soil depths.

Cultivars	Crioula	Alfagraze	Flórida 77	Average
Soil depths (cm)	Root density (cm.cm <sup>-3</sup> )			
0 – 10	1.18	0.78	0.51	0.82 a <sup>1</sup>
10 – 30	0.38	0.39	0.22	0.33 b
30 – 50	0.23	0.28	0.21	0.24 b

<sup>1</sup>Means followed by the same letter did not differ significantly by Duncan's test at 5% level.