SELECTION FOR FORAGE YIELD AND SEED COMPONENTS IN A NON - DORMANT ALFALFA ECOTYPE

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ABSTRACT
Selections of a local non-dormant alfalfa ecotype and alfalfa cultivars were tested in the third year after sowing for dry matter yield and for seed set at two deferment dates. The design for this plot experiment was a randomised complete-block. After the deferment dates of September 30 and October 27 (early and mid spring), weekly observations were made on the seed yield components. The components that contributed most to the reduction of seed yield were as follows: low number of inflorescences per stem, reduced number of tripped flowers per inflorescence and low number of legumes per inflorescence. In general the deferment date of October 27 allowed the best forage and seed yield production.

KEYWORDS
Brazil, alfalfa, forage yield, seed yield components, deferment dates for forage and seed yield

INTRODUCTION
The State of Rio Grande do Sul in Southern Brazil is the country's biggest alfalfa hay producer, despite the small cultivated area . Alfalfa was introduced by early settlers (Germans and Italians) in small fertile river valleys. They would make hay for four or five years and then the old stand of alfalfa was left for seed production and new stands were sown for hay production. This system allied with natural selection originated a locally adapted population called 'Alfalfa Crioula', which is a good forage producer and has shown an equilibrium with the main diseases and insect pests that accompany alfalfa around the world. Alfalfa crioula shows variability for several agronomic characteristics including forage yield. However, due to the regional climate (humid subtropical with hot summers that varies with seasons and years) and to problems with pollination, it produces very low seed yields. The objective of this work was to determinate the best deferment date for forage and seed production and the seed yield components most affected by these conditions.

MATERIAL AND METHODS
Three populations selected from Alfalfa Crioula, cv. WL 520 and two check Crioula materials, one from seed produced in Chile (Crioula CRA) and the other from seed produced at the Agronomic Experimental Station of the Federal University of Rio Grande do Sul (EEA- UFRGS) were tested for forage yield and seed yield components in the third year after sowing. The experiment was conducted in 1994-1995 at the EEA-UFRGS, localized at 30° 05' 52" South latitude and 51° 39' 08" West longitude in a humid subtropical climate with hot summers. The soil (ground water laterite) had an initial pH 5.6, 8 ppm of phosphorous, 155 ppm of potassium, 1.9% of organic matter and zero of aluminium, due to previous fertilizer applications. It was limed with dolomite 3 t. ha^{-1} and fertilized with 300 kg P2O5 .ha. yr^{-1} (concentrated superphosphate), 300 kg K2O. ha. yr^{-1} (potassium chloride) and 20 kg. ha. yr^{-1} of "borax" (boron). Plots measured 1.8 x 9.0 m, with six rows 0.30 m apart in a randomised complete-block design with 6 replications. Two deferment dates for seed yield were allowed: September 30 and October 27 (early and mid spring). After the deferment period each plot was subdivided in two parts, one for seed harvest and the other to evaluate the dynamics of flowering by weekly observations. Five harvests were conducted before the September 30 deferment and six before the October 27 deferment in 1994. Plant height was measured before each cut and samples were taken for determination of leaf-stem ratio and dry matter yield. After the deferments counts were made of the stems. m^{-2}, flowering stems. m^{-2}, inflorescences . $stem^{-1}$, flowers . $inflorescence^{-1}$, tripped flowers . $inflorescence^{-1}$, ovules . $tripped\ flowers^{-1}$, pods . $inflorescence^{-1}$, of spirals.pod^{-1}, and of seeds. pod^{-1} at weekly intervals. Seed yield . ha^{-1} was determined by one harvest made in January 11, 1995. Data were statistically analysed by analysis of variance and Tuckey test.

RESULTS AND DISCUSSION
As Alfalfa Crioula is a non-dormant type, it keeps growing all year in a mild climate like the one of Rio Grande do Sul, where winters have some frosts but very seldom snow. The total dry matter yield (Table 1) obtained by the harvests done before the deferment dates was significatively different only for cv. WL 520, compared to Crioula. In previous selection works the Crioula population showed variability for forage yield measured on progenies from polycross nurseries (Pozzobon *et al*.,1984, Olivira *et al*.,1993). The average plant height at the moment of the harvest was around 0.50 m and the Crioulas were superior to WL 520. Soil fertility was improved by incorporating lime and fertilizers through plowing (about 20 cm deep). However, under the plow layer the soil maintains its original condition of low pH and low phosphorous levels which are associated with aluminium toxicity, and which inhibit root penetration and limit plant height. The average leaf-stem ratio was not different among the treatments but varied among seasons of the year.

The seed yield components for the two deferment dates are shown in Table 2. The average number of stems. m^{-2} was superior for the deferment date of September 30 (early spring) . Almost 100% of the stems flowered, but the number of inflorescences or racemes . $stem^{-1}$ was very low with slightly higher values for the October 27 deferment. The number of flowers . $raceme^{-1}$ varied from 8 to 13 which was considered normal, but the number of tripped flowers . $inflorescence^{-1}$ was very low, from 1 to 3, indicating pollination problems with the honey bees and the wild bee species present in the area. The number of ovules . $tripped\ flower^{-1}$ varied from 7 to 9, the number of seeds . pod^{-1} ranged from 1 to 3 and the average number of pods. $inflorescence^{-1}$ was also very low, around 1 and 2. The number of spirals. pod^{-1} varied between 2 and 3. The combinations of these variables caused the very low seed yields and pointed to some differences in the Crioula material and to the superiority of the mid-spring deferment. WL 520, like other previously tested cultivars is not adapted to Rio Grande do Sul conditions and therefore not recommended for use in the region. The main problems for seed production in the State are as follows: 1) the climatic conditions that vary from year to year, especially the annual 1,400 precipitation distribution (Cunha *et al*.,1993) with some heavy rains in the spring and summer; 2) the pollination problems related to the alternative flowering species; and 3) the double purpose (forage and seed) farming system.

REFERENCES
Cunha,G.R., J.R.F.de Paula, H.Bergamaschi, J.C. de Saibro and M.A.Berlato. 1993. Evapotranspiration and water-use efficiency of alfalfa in the subtropical region of Brazil. Proc. 17th Int. Grass. Cong. Palmerston North, New Zealand. p. 1575-1577.

Oliveira,P.R.D. , N.R.Paim and A.B.C. Czermainski. 1993. Seleção para rendimento e qualidade da forragem em alfafa crioula. Pesq. Agropec. Bras., Brasília. **28**: 1039-1044.

Pozzobon, M.T., N.R. Paim, M.T.Schifino and J. Riboldi. 1984. Teste de progênies de policruzamento e cultivares de alfafa. Pesq. Agropec. Bras., Brasília. **19**: 1123-1130.

Table 1
Total dry matter yield (kg. ha^{-1}) for two deferment dates, average height of plants (cm) and leaf stem ratio (w/w) for alfalfa in the State of Rio Grande do Sul in Southern Brazil.

Treatments	Deferment Dates[1]		Plant height	Leaf-stem ratio
	Sept. 30	Oct.27		
Selection 1	6063 a[2]	6434 a	50.3 a	0.82 a
Selection 2	6256 a	6916 a	50.5 a	0.82 a
Selection 3	5840 a	6048 a	50.0 a	0.77 a
WL 520	2618 b	3295 b	43.5 b	0.82 a
Crioula CRA	5456 a	6544 a	50.0 a	0.79 a
Crioula EEA	5555 a	6304 a	48.2 a	0.83 a

1 Deferment of Sept. 30, 5 harvests and deferment of Oct.27, 6 harvests.
2 Different letters in the same column indicate significant differences by Tuckey's at the 0.01 level

Table 2
Seed components in non -dormant alfalfa selections and cultivars after two deferment dates in the State of Rio Grande do Sul in Southern Brazil

Selections or cultivar	stems.m^{-2}	infloresc .stem^{-1}	flowers. infloresc^{-1} infloresc^{-1}	tripped flowers. flower^{-1}	ovules. tripped	pods. infloresc^{-1}	seeds. pod-1	seed yield kg. ha^{-1}	
Deferment of September 30 average numbers[1]									
Select. 1	394	2.8	9.5	1.5	8.4	2.3	2.8	32.5	a[2]
Select. 2	474	3.1	9.7	2.0	8.8	2.1	2.1	32.1	a
Select.3	457	3.0	9.1	1.5	8.0	2.2	2.8	31.4	a
WL 520	349	1.8	7.7	1.3	6.8	1.3	1.0	1.8	b
Crio.CRA	455	2.7	9.5	1.5	8.6	2.2	2.5	31.3	a
Crio.EEA	433	3.9	10.1	1.8	8.2	2.1	2.8	31.1	a
Mean	427 A[4]	2.9	9.3	1.6	8.1	2.0	2.3	31.7	B[3]
Deferment of October 27									
Select. 1	300	3.6	12.5	2.6	8.7	2.5	3.0	46.0	ab
Select. 2	322	3.9	11.9	2.2	8.5	2.6	3.5	40.0	b
Select. 3	331	4.2	12.8	2.8	8.2	2.4	2.8	41.3	b
WL 520	192	2.1	10.2	2.0	8.4	2.3	2.7	3.0	c
Crio.CRA	332	3.1	12.5	2.5	8.6	2.4	3.2	41.3	b
Crio.EEA	361	4.2	12.5	2.5	8.7	2.4	3.2	51.1	a
Mean	306 B[4]	3.5	12.1	2.4	8.5	2.4	3.0	43.9	A3

1 Average values of weekly observations after deferment dates until harvest of seeds on January 11
2 Different letters in the same column indicate significant differences by Tuckey's at the 0.05 level.
3 Mean only for Crioula's material
4 Different letters in the same column indicate significant differences by Tuckey's at the 0.01 level