EFFECTS OF ACCELERATED AGEING AND LOW TEMPERATURES ON GERMINATION OF RANGE GRASSES

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ABSTRACT
Accelerated ageing and cold tests were used to determine the seed vigour of different valuable forage grasses from the temperate semi-arid region of Argentina (*Piptochaetium napostaense, Poa ligularis, Stipa longiglumis, Stipa tenuis, Digitaria californica, Pappophorum subbulbosum, Setaria leiantha, Sorghastrum pellitum, Trichloris crinita*). In general, warm season species showed greater vigour than cool season species.

KEYWORDS
Range grasses, germination, viability, accelerated ageing, cold test, seed vigour

INTRODUCTION
The natural grassland of the temperate semi-arid zone of Argentina, which cover some 20,000,000 ha, have been degraded by overgrazing. Valuable forage grasses, cool season (*Piptochaetium napostaense, Poa ligularis, Stipa longiglumis, Stipa tenuis*) as much as warm season (*Digitaria californica, Pappophorum subbulbosum, Setaria leiantha, Sorghastrum pellitum, Trichloris crinita*), have been and are being displaced by less valuable species. The abundance of those species depends not only on the herbivory, but also on other factors, among which the germination and the emergence of the seedling should be emphasized.

The vigour of the seedlings is one of the most important factors in the establishment of grasslands. The total number of seedlings which emerge is one of the principal components for the reseeding of grasslands.

A number of studies have shown a good correlation between field emergence and laboratory assays in accelerated ageing and cold tests, which simulate adverse field conditions (Kraak *et al*., 1984). Vigour tests could detect subtle abnormalities or weaknesses that might affect field performance. Since field conditions are difficult to predict and control, the measurement of seed vigour is highly desirable.

The objective of this study is to evaluate the effects of accelerated ageing on germination and viability, and the effects of low soil temperatures on the subsequent emergence of seedlings which are valuable forage species in the temperate semi-arid region.

MATERIALS AND METHODS
Piptochaetium napostaense (Speg.) Hert (Pna), *Poa ligularis* Nees. (Pli), *Stipa longiglumis* Phil. (Slo), *Stipa tenuis* Phil. (Ste), *Digitaria californica* (Benth.) Henr. (Dca), *Pappophorum subbulbosum* Arech. (Psu), *Setaria leiantha* Hack. (Sle), *Sorghastrum pellitum* (Hack). *Parodi* (Spe) and *Trichloris crinita* (Lag.) *Parodi* (Tcr) seeds were obtained in the field. The caryopses were gathered during the same year that trials were carried out.

VIGOUR TESTS.
Accelerated Ageing. Four replicates of 50 caryopses were used. The test was conducted according to the procedures described by Association of Official Seed Analysts (1983). Distilled water (40 ml) was added to each plexiglass box (12x12x4 cm). Seeds were placed on wire mesh trays, approximately 2 cm above the the bottom of the tray and aged at 40½C for 44 hrs (A44) and 144 hrs (A144). Following these periods, the caryopses were removed and a standard germination test conducted, according to standard procedures (Association of Official Seed Analysts, 1991), using four replicates of 50 caryopses from each species. Seeds were placed in clear plastic boxes (10x10x4 cm), on filter paper dampened with 6 ml of distilled water. Germination was carried out at 25½C with 9 hrs of light, followed by 1½C with 15 hrs of darkness. Germination percentage, as defined by radicle emergence, was determined after 15 days. In the standard germination test were included nontreated caryopses (AO) as another treatment.

Tetrazolium Test. Four replications of 25 caryopses each were used. The test was carried out according to Grabe (1970).

Cold Test. This was carried out on four replicates of 50 caryopses from each species. Soil from where the seeds were gathered was used in the trial. The soil was ground to pass through a 20-mesh screen and then tested for its water-holding capacity. Soil (17 g) was placed in the box and then covered with an additional 8 g of soil. The soil was moistened to 70% of its water-holding capacity, as described by Association of Official Seed Analysts (1983). The boxes were then subjected to 5½C for seven days. After that period, the boxes were transfered directly to a germination chamber (25½C for 9 hrs followed by 15½C for 15 hrs), and, after 15 days, the germination percentages (determined by shoot emergence) were evaluated.

Statistical Analysis. On dealing with the data, a variance analysis was applied before transforming the arcsine šVp of the values. The Tukey test ($p = 0.05$) was used for the comparison of the mean of treatments. Kruskal and Wallis' test ($p = 0.05$) was used on the original data for *Stipa tenuis*, *Poa ligularis*, and *Pappophorum subbulbatum*, as the variance analysis did not comform to the hypothesis.

RESULTS AND DISCUSSION
All the species showed high germination percentages and there were no major differences among them.

The accelerated ageing allowed the separation, by germination behaviour, of two groups. The first group consisted of *Pappophorum subbulbatum, Trichloris crinita*, and *Digitaria californica*, which were not affected by any of the ageing treatments. In the second group, formed by *Stipa tenuis, Piptochaetium napostaense*, *Sorghastrum pellitum*, *Poa ligularis* and *Setaria leiantha*, there was a significant reduction in germination at each stage of ageing. Finally there was *Stipa longiglumis*, which produced a result which would fit between the two main groups.

None of the majority of the species studied produced a marked disminution in their vialbility with any of the accelerated ageing treatments, although *Setaria leiantha, Sorghastrum pellitum, Piptochaetium napostaense*, and *Poa ligularis* were noticeably affected. *Stipa tenuis* and *Stipa longiglumis*, showed reduced viability, principally, in the most severe treatments.

The observed germination percentage decline caused by accelerated ageing can be explained, for the most part, by loss of viability.

The species least affected by the cold test were *Pappophorum subbulbatum*, *Stipa longiglumis* and *Trichloris crinita*, and the most

affected were *Digitaria californica* and *Sorghastrum pellitum*. Cold test sensitivity was not related to the respective growing season of each of the species.

The germination and later emergence of the seedlings are critical stages in the introduction of native species. Seed stress situations such as high temperature and relative humidity, together with low soil temperatures, appear, in general, to be less detrimental to warm season species.

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Table 1

The germination percentages and viability for several range grasses for different levels of ageing.

	Species								
	Dca	**Psu**	**Sle**	**Spe**	**Tcr**	**Pna**	**Pli**	**Slo**	**Ste**
				Germination					
AO	94 a*	100 a	87 a	88 a	100 a	91 a	82 a	92 a	98 a
A44	87 a*	196 a	38 b	70 b	199 a	61 b	28 b	72 b	52 b
A144	80 a*	199 a	10 c	10 c	199 a	10 c	10 c	72 b	29 c
				Viability					
AO	95 a*	198 a	82 a	87 a	196 a	97 a	94 a	97 a	97 a
A44	88 a*	100 a	78 a	68 b	194 a	68 b	46 b	80 b	96 a
A144	90 a*	199 a	10 b	18 c	100 a	10 c	10 c	72 b	72 b

* Means within a column followed by the same letter are not significantly different according Tukeyís or Kruskal and Wallisí test (p=0.05).

Table 2

Emergence percentage for several range grasses after the cold test.

	Dca	**Psu**	**Sle**	**Spe**	**Tcr**	**Pna**	**Pli**	**Slo**	**Ste**
Emergence (%)	94 a*	100 a	87 a	88 a	100 a	91 a	82 a	92 a	98 a

* Means within a row followed by the same letter are not significantly different according Tukeyís test (p=0.05).