SEED QUALITY OF FIVE NATIVE GRASSES OF THE HUMID ARGENTINE PAMPA PRAIRIE: GERMINATION CONDITIONS

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ABSTRACT

The aim of this study was to determine the germination conditions as well as an approach to seed quality of five native grasses of the humid Argentine Pampa prairie: *Bothriochloa laguroides*, *Sporobolus indicus*, *Glyceria multiflora*, *Briza subaristata* and *Chaetotropis imberbis*. They are considered as good and very good forage species. Mature inflorescences were sampled in Brandsen (Flooding Pampa sub-Region, Buenos Aires province, Argentina) from December, 1994 to March, 1995. A three factor completely randomized design with 4 replications was applied. Treatments combined prechilling (I: yes/II:no), KNO3 (A:yes/ B:no) and germination temperatures: 2 constant 15° and 20°C and 6 alternating 15-10°C, 20-10°C, 20-15°C, 20-25°C, 20-30°C and 20-35°C in 8-16hs period. Constant temperatures were not effective except for Briza subaristata. Time of after ripening applied (5-6 months) removed the most dormancy; high levels of normal germination percentage were observed for treatments II B. Prechilling and KNO3 treatments enhanced germination response of the studied species, showing differential behaviour of seeds within the same population. For the better germination conditions the lowest germination percentage of mature caryopsis was over 78.8%.

KEYWORDS

Germination, seed quality, native grasses, *Bothriochloa laguroides*, *Sporobolus indicus*, *Glyceria multiflora*, *Briza subaristata*, *Chaetotropis imberbis*

INTRODUCTION

The sub-Region Flooding Pampa (Buenos Aires province, Argentina) is an extremely flat area of nearly 5,800,000 ha belonging to the Humid Pampa Region. This sub-Region is a temperate area, with 800-1000 mm/year precipitation without a dry season, covered mostly by native grasslands. Predominant soil sub-Group is Typic Natraqualf. Main activity is cow/calf production. (Josifovich *et al*., 1989). *Bothriochloa laguroides*, *Sporobolus indicus*, *Glyceria multiflora*, *Briza subaristata* and *Chaetotropis imberbis* are perennial species. They are co-dominant grasses that characterize different places of the Flooding Pampa (Soriano, 1991). They are important species considered as good or very good forage grasses (Deregibus and Cahuepé, 1983; Cahuepé *et al*., 1895). For physiologists germination begins with water uptake by the seed and ends with the start of elongation by the embryonic axis, usually the radicle (Bewley and Black, 1994). Seed testers consider the germination of a seed in a laboratory test as the emergence and development of the seedling to a stage where its essential structures indicate whether or not it is able to develop further into a satisfactory plant under favorable conditions in soil (ISTA, 1993). To monitor seed quality of any specie in a germination test, seeds must be exposed to suitable environmental conditions controlled by water, oxygen, light, temperature and chemicals. These controls apply to seeds whose dormancy has been broken, as well as to those which never had any dormancy. Several controls act simultaneously in most species for the end of dormancy. In some species dormancy is also broken in darkness by chilling, by alternating temperatures, by exposure to nitrate in the soil and by after ripening in the 'dry' or near-dry state (Bewley and Black, 1994). In seed laboratory tests, better combinations of germination temperatures and factors that break dormancy for a given specie are those that produce the higher percentage of normal seedlings in the shorter period of analysis. The aim of this experiment was to determine these conditions, having a preliminary approach to seed quality for the cited species.

MATERIALS AND METHODS

Mature inflorescences of *Bothriochloa laguroides*, *Sporobolus indicus*, *Glyceria multiflora*, *Briza subaristata* and *Chaetotropis imberbis*, were sampled in Brandsen (Flooding Pampa sub-Region, 58° 00'-58° 30' W, 35° 00'- 35° 20' S, Buenos Aires province, Argentina) from December, 1994 to March, 1995. They were dried in paper bags at room temperature for 7 days and then threshed by hand. Seeds were blown, obtaining homogeneous working samples for each specie that were then stored in paper bags in the laboratory at about 20° C. Tests were performed with 5-6 months of afterripening. A three factor completely randomized design with 4 replications of 100 seeds was applied. Treatments combined 2 levels of prechilling: 7°C during 72 hs, (I: yes / II: no prechilling, seed taken directly to germination temperatures); 2 levels of KNO_3 : 0.2% solution to saturate the germination substrate, (A: yes / B: replacing it by distillated water), and 8 levels of germination temperatures: 2 constant: 15°C, 20°C and 6 alternating 15-10°C, 20-10°C, 20-15°C, 20-25°C, 20-30°C and 20-35°C in 8-16 hs periods. Seeds were placed on top of moist (KNO_3 solution or distillated water) filter paper in trays which were then enclosed in polyethilene bags and clip sealed. Germination chambers with light and temperature control were used. The response variable for this experiment was the number of normal seedlings (healthy seedlings, with root system, shoot axis, coleoptile and first leaf). They were counted and removed at 3 day intervals. Germination percentages were recorded at 35 days after seeds were placed under germination temperatures. Final count included fresh seeds (not germinated and probably dormant), dead seeds and abnormal seedlings. These three variables are not considered in this comunication. To check the reliability of test results, the average percentage of the replicates was compared with values of tolerance tables (ISTA, 1993). ANVA and Tukey test were applied. Statistical significance was assumed at $p<0.05$.

RESULTS AND DISCUSSION

Figures 1 and 2 show the percentage of normal seedlings. The remainder for each treatment of *Briza subaristata* were in most cases dead seeds and abnormal seedlings (Ferrari and Lopez, 1995); for the other species this difference was due mainly to fresh seeds, probably dormant. The behaviour of these seeds could be related to temperature conditions which did not favour germination promoting secondary dormancy (Bewley and Black, 1994). For *Briza subaristata* temperature and KNO_3 main effects and all interactions were significant. Constant temperature of 15° C differed from the rest, and the KNO_3 solution promoted germination. Higher normal seedling counts were recorded at II A 15° C and I B 15-10°C. For *Chaetotropis imberbis* constant temperatures and high alternating ones were not adequate for germination. Main effects and interactions were significant. The best germination temperatures were 20-25°C and 20-15°C. KNO_3 and prechilling produced significant differences; the last promoted germination of normal seedlings at 20°C. Germination was consistently greater at I A 20-25°C. For Sporobolus indicus constant temperatures and low alternating ones had no response. All main effects were significant; only prechilling-by-KNO_3 did not show a interaction. The best germination temperature was 20-30°C, here KNO_3 and prechilling had significant effects, KNO_3 increased and prechilling decreased germination percentage. Time of afterripening seemed to be correct. The best treatment was II B 20-30°C. For *Bothriochloa laguroides* constant temperature of 15°C and alternating 15-10°C were not effective. KNO_3 and temperature main effects were significant as well as significant interactions for all treatments except prechilling-by-KNO_3. There were no significant differences among 20-10°C, 20-15°C, 20-25°C, 20-30°C and 20-35°C germination temperatures. KNO_3 had significant effect and favoured germination. The best treatments were I A 20-25°C and II A 20-25°C. For Glyceria multiflora temperature and KNO_3 main effects were significant and there were significant interactions for all treatments. Tukey tests showed 20-10°C and 20-15°C as the best temperatures. I A 20-10°C was the treatment that produced the highest number of normal seedlings. Constant temperatures were not effective except for *Briza subaristata*. Time of afterripening removed most dormancy; high levels of normal seedling percentage were observed for treatments II B. Prechilling and KNO_3 enhanced germination response, showing a differential behaviour of the seeds within the same population. For the better germination conditions the lowest germination percentage of mature caryopsis was 78.8%. During December, 1995 to March, 1996, 7 to 15 accessions of the cited species were collected in a greater area of the Flooding Pampa region for future germination analysis using the best treatments from the present experiment.

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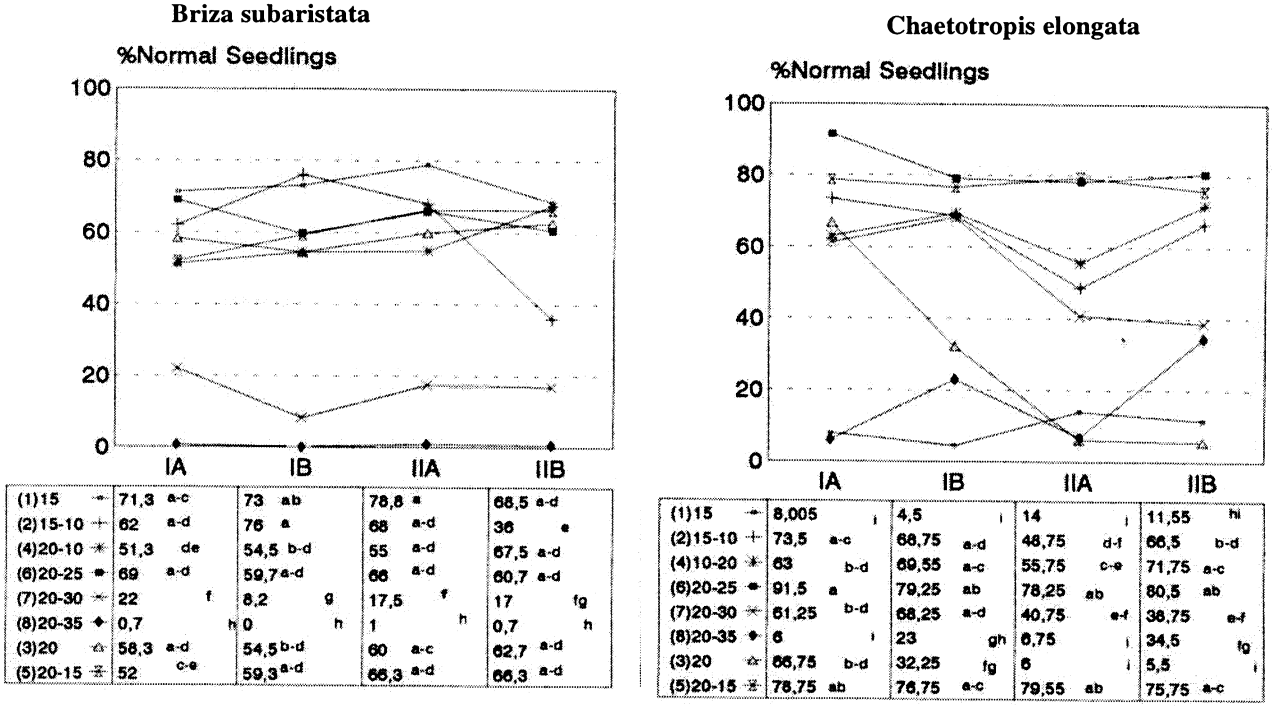
Figure 1

Normal seedlings (%) of Briza subaristata and Chaetotropis elogata for all treatments.



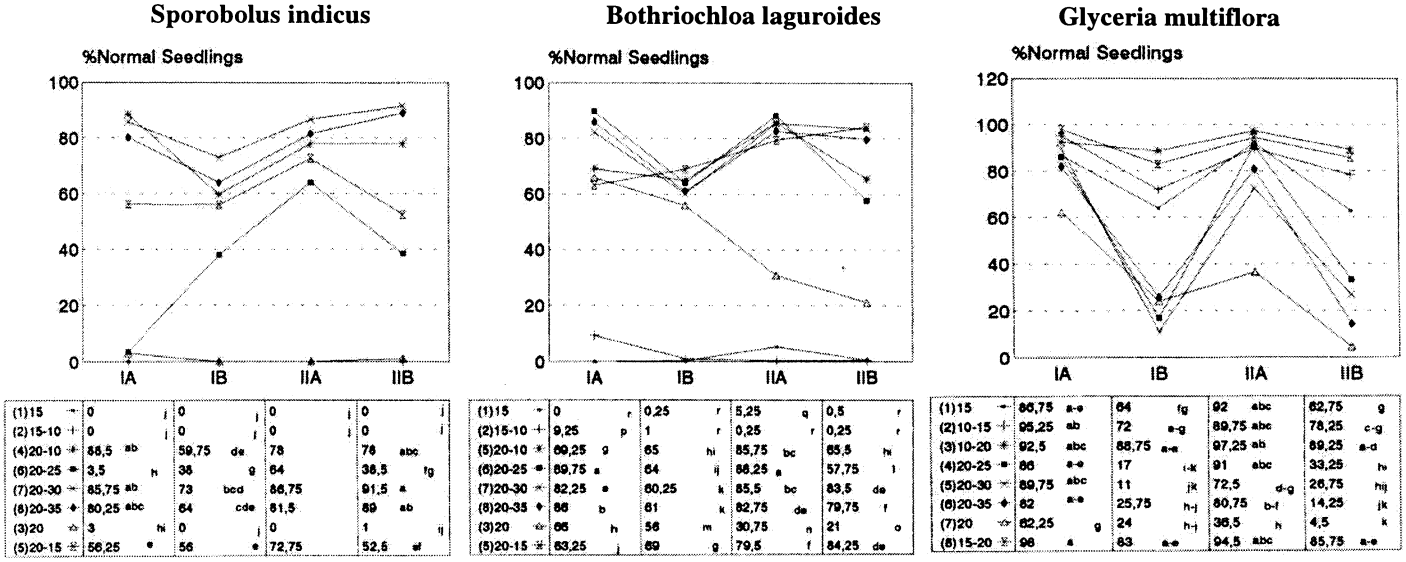
	IA	IB	IIA	IIB
(1)15	71,3 a-c	73 ab	78,8 a	66,5 a-d
(2)15-10	62 a-d	76 a	68 a-d	36 e
(4)20-10	51,3 de	54,5 b-d	55 a-d	67,5 a-d
(6)20-25	69 a-d	59,7 a-d	66 a-d	60,7 a-d
(7)20-30	22 f	8,2 g	17,5 f	17 fg
(8)20-35	0,7 h	0 h	1 h	0,7 h
(3)20	58,3 a-d	54,5 b-d	60 a-c	62,7 a-d
(5)20-15	52 c-e	59,3 a-d	66,3 a-d	66,3 a-d

	IA	IB	IIA	IIB
(1)15	8,005 i	4,5 i	14 i	11,55 hi
(2)15-10	73,5 a-c	66,75 a-d	46,75 d-f	66,5 b-d
(4)10-20	63 b-d	69,55 a-c	55,75 c-e	71,75 a-c
(6)20-25	91,5 a	79,25 ab	78,25 ab	80,5 ab
(7)20-30	61,25 b-d	66,25 a-d	40,75 e-f	36,75 e-f
(8)20-35	6 i	23 gh	6,75 i	34,5 fg
(3)20	66,75 b-d	32,25 fg	6 i	5,5 i
(5)20-15	76,75 ab	76,75 a-c	79,55 ab	75,75 a-c

Footnote: Averages with the same letter in each specie are not different (Tukey, P<0.05)
I: prechilled, II: no prechilled; A: germination substrat saturated with 0.2% KNO3 solution; B: with distillated water.
Numbers in ( ) relate to the germination temperatures in °C.

Figure 2

Normal seedlings (%) of Sporobolus indicus, Bothriochloa laguroides and Glyceria multiflora for all the treatments applied.



	IA	IB	IIA	IIB
(1)15	0 j	0 j	0 j	0 j
(2)15-10	0 j	0 j	0 j	0 j
(4)20-10	88,5 ab	59,75 de	78	78 abc
(6)20-25	3,5 hi	36 g	64	36,5 fg
(7)20-30	85,75 ab	73 bcd	86,75	91,5 a
(8)20-35	80,25 abc	64 cde	81,5	89 ab
(3)20	3 hi	0 j	0	1 ij
(5)20-15	56,25 e	56 e	72,75	52,6 ef

	IA	IB	IIA	IIB
(1)15	0 r	0,25 r	5,25 q	0,5 r
(2)15-10	9,25 p	1 r	0,25 r	0,25 r
(5)20-10	69,25 g	65 hi	85,75 bc	85,5 hi
(6)20-25	89,75 a	64 ij	88,25 a	57,75 l
(7)20-30	82,25 e	60,25 k	85,5 bc	83,5 de
(8)20-35	86 b	61 k	82,75 de	79,75 f
(3)20	66 h	56 m	30,75 n	21 o
(5)20-15	63,25 j	69 g	79,5 f	84,25 de

	IA	IB	IIA	IIB
(1)15	86,75 a-e	64 fg	92 abc	62,75 g
(2)10-15	95,25 ab	72 e-g	89,75 abc	78,25 c-g
(3)10-20	92,5 abc	68,75 e-e	97,25 ab	89,25 a-d
(4)20-25	86 a-e	17 i-k	91 abc	33,25 h
(5)20-30	89,75 abc	11 jk	72,5 d-g	26,75 hij
(6)20-35	82 a-e	25,75 h-j	80,75 b-f	14,25 jk
(7)20	82,25 g	24 h-j	36,5 h	4,5 k
(8)15-20	98 a	83 a-e	94,5 abc	85,75 a-e

Footnote: Averages with the same letter in each specie are not different (Tukey, P<0.05)
I: prechilled, II: no prechilled; A: germination substrat saturated with 0.2% KNO3 solution; B: with distillated water.
Numbers in ( ) relate to the germination temperatures in °C.