SHORT-TERM EFFECTS OF GRAZING AND REST TREATMENTS ON THE SEED BANKS OF TWO CONTRASTING SITES IN THE SEMIARID PAMPAS, ARGENTINA

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ABSTRACT

The germinable seed bank was characterized in relation to season, grazing, and site type at southcentral San Luis, Argentina. Vegetation is typical of the semiarid western extreme of the Pampas grasslands. Our objective was to evaluate the effect of grazing and rest during the growing season on seed banks for two contrasting sites. Seed banks were sampled twice, in spring and fall. In each date, soil cores were obtained in sand-dune and flat sites, for pastures grazed or that remained ungrazed during the growing season. Soil was spread in trays under suitable conditions for germination. Evaluations were done on total seed abundances, and abundance of dicots, warm-season grasses, and cool-season grasses. Seed numbers increased from spring to fall after completion of the growing season for all species groupings. Rest during the growing season increased the seed bank of warm-season grasses. Beneficial effects of rest are probably transient because of limited seed carry-over from season to season, particularly for cool-season grasses.

KEYWORDS

Grasses, grazing, seed bank, grassland, Pampa, Argentina

INTRODUCTION

The effect of long-term grazing on seed banks has often been addressed (Kinukan and Smeins, 1992; O'Connor and Pickett, 1992; Willms and Quinton, 1995), but little is known about effects of seasonal rest on the replenishment of key components of the seed bank, particularly grasses. Our interests were focused on the readily-germinable seed bank (Thompson and Grime, 1979) to detect changes due to variation in range management. Site differences were also assessed. Our objective was to evaluate the effect of grazing and rest during the growing season on seed banks of two different sites in the western Pampas, Argentina.

METHODS

The study site was at Dos Hermanos, southcentral San Luis Province. Climate is semiarid, and rainfall occurs mostly during spring and summer. Mean annual precipitation at Unión (35° 09' S latitude; 65° 57' W longitude), located 12 km from the site, is 418.8 mm. Vegetation is typical of a semiarid grassland in the western extreme of the Pampa ecosystem (León and Anderson 1983). Sites were classified as vegetated sand-dunes and flat sites between the dunes according to landscape position in the gently rolling topography. Vegetation of each site is dominated by warm-season grasses (Table 1). Seed banks were sampled twice: previous to the beginning of spring rains on 4 October 1994; and immediately after the peak of dissemination of warm-season species and previous to the germination of cool-season species on 28 March 1995. Four pastures were sampled at each date. In each date, two pastures were either grazed or ungrazed during the previous growing season. Sampling was stratified in each pasture considering both site types. Five subsamples were obtained of each site x pasture combination, each subsample was in turn a composite of five randomly located cores. Statistical analyses were performed on the mean values of the five subsamples. Factors of analysis were: date (OCT-94 and MAR-95), treatment (grazed or ungrazed), and site (sand-dune or flat), (N=16, 2 dates x 2 treat x 2 sites x 2 replicats). Soil cores had an area of 25 cm^2 and depth of 3 cm. Each date x treatment x site x replicate combination had 1875 cm^3 of soil volume. Soil cores were broken apart, mixed and spread in a 1-cm deep layer in plastic trays maintained in a greenhouse at suitable conditions for germination. The procedure was repeated twice for each sample. Seedlings were identified and removed. A non-parametric Kruskal-Wallis test was used to detect differences in total seed abundance, abundance of dicots, warm-season grasses, and cool-season grasses due to non-homogeneity of variances.

RESULTS AND DISCUSSION

Seed abundances were less at the beginning of the growing season than at the beginning of the fall (total; 790 vs 6030; dicots, 292 vs 4224; warm-season grasses, 448 vs 1314; and cool-season grasses, 40 vs 284; for spring and fall, respectively). Seed banks are usually greatest following pasture dissemination (Russi et al., 1992). The relative small number of seeds after winter time was in agreement with species with little carry-over from season to season. Even fewer seeds are expected to remain after enhanced germination due to occurrence of rainfall. The described pattern was remarkable for cool-season grasses.

Warm-season grasses are the most important component of the grassland vegetation (Table 1; 93.6 % vs 78.4 % of biomass for the sand-dune and flat sites, respectively). Rest during the growing season increased the seed bank of warm-season grasses significantly (Fig. 1), consistently across dates and sites (non-significant date x factor interactions). Seed abundances of warm-season grasses were higher at the dune than at the flat site (Fig. 1). Cool season grasses differ in importance across sites (Table 1; 6.4 % vs 21.6 % of total biomass for the sand-dune and flat sites, respectively). Seeds of cool-season grasses were much less in the sand-dune than in the flat site (Fig. 1). There was a non-significant trend for greater seed abundance in the ungrazed treatment.

Although dicots hardly contribute to the total biomass of vegetation for both sites, the proportional contribution to the total seed bank was important (Fig. 1). No significant differences between sites were detected. Grazing during the growing season increased the amount of seeds of dicots (Fig. 1), but significant interactions between date x site, and date x treatment were also found. Grazing often increases the proportion of annual dicots, but usually after long-term treatments (Kinukan and Smeins, 1992; Willms and Quinton, 1995). Soil disturbance is likely to result in a successional community dominated by annual dicots, the most important component of the total dicot population (Table 1). In the subhumid inland Pampa, first stages of secondary succession are recurrently dominated by annual forbs (D'Angela et al., 1986).

Seasonal rest had a positive impact in the replenishment of seed banks with warm-season grasses. Beneficial effects of rest may be transient because of limited seed carry-over, particularly for cool-season grasses. Annual dicots are likely to increase after heavy grazing or soil disturbance.

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Table 1

Species frequency and percent biomass distributions at the vegetated sand-dune and flat sites, Dos Hermanos, San Luis Province, Argentina[a]

	FREQUENCY (%)	BIOMASS (%)
San-dune site		
* Warm-season grasses		
Aristida mendocina	55	15.3
Bothriochloa springfieldii	65	13.3
Cenchrus pauciflorusz	85	11.5
Chloris retusa	27	3.7
Elyonurus muticus	25	1.1
Panicum urvilleanum	35	6.7
Schizachyrium plumigerum	75	36.3
Sporobolus cryptandrus	30	5.7
* Cool-season grasses		
Piptochaetium napostaense	<5	—-
Poa lanuginosa	95	6.4
Poa ligularis	<5	—-
Flat site		
* Warm-season grasses		
Aristida mendocina	25	9.0
Bothriochloa springfieldii	60	17.4
Cenchrus pauciflorus[z]	77	8.9
Chloris retusa	<5	—-
Elyonurus muticus	<5	—-
Panicum urvilleanum	<5	—-
Schizachyrium plumigerum	15	3.0
Sporobolus cryptandrus	92	40.1
* Cool-season grasses		
Piptochaetium napostaense	55	16.7
Poa lanuginosa	65	3.9
Poa ligularis	5	1.0
* Dicots[b]		
Adesmia muricata[z]		
Baccharis crispa		
Conyza bonariensis[z]		
Gailliardia megapotamica		
Glandularia sp.		
Heterotheca latifolia[z]		
Hyalis argentea		
Salsola kali[z]		
Telespherma megapotamica		
Xantium sp.[z]		

[a]Frequency and percent biomass available for grasses only. Percent biomass of grasses at the study site is >90 % of the total biomass.

[b] Dicots (species present at both sites, only presence information available).

[z] Annuals.

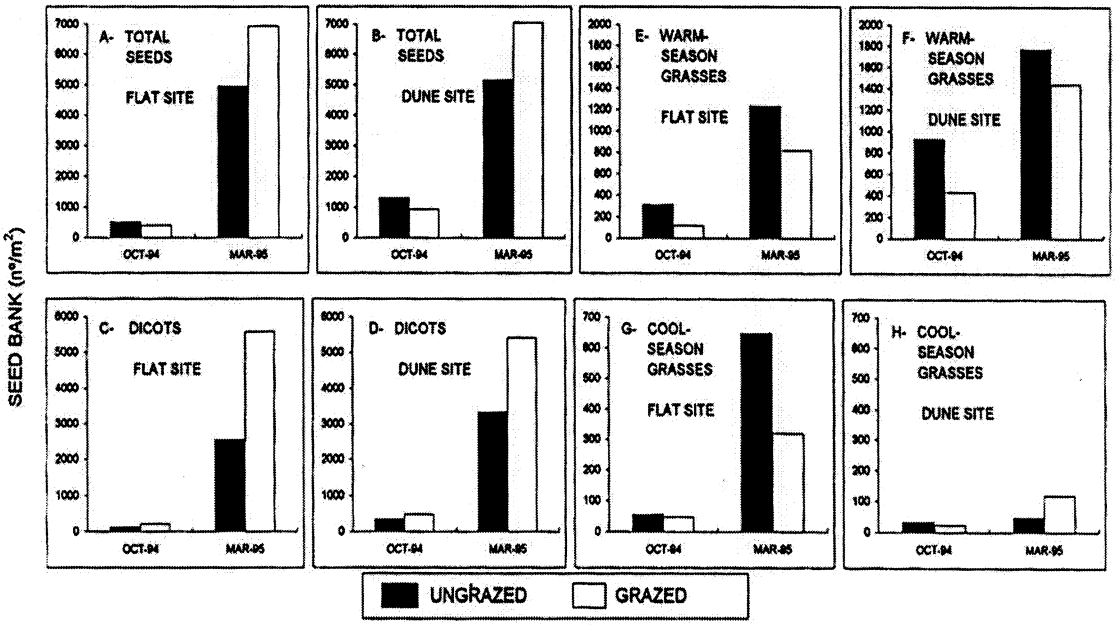

Figure 1
Seed abundancies for species groupings (see Table 1) in two grassland sites at Dos Hermanos. Non-significant date x factor interactions were found for warm- and cool-season grasses. Site (Dune>Flat) and treatment (Ungrazed>Grazed) were significant for warm-season grasses, and site (Flat>Dune) for cool-season grasses ($P<0.05$). Significant treatment (Grazed>Ungrazed) effects were found for Dicots (see text). Date (OCT-94<MAR-95) was significant for all species groupings ($P<0.05$)