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EVALUATION OF WEED SEED BANK IN PASTURE IN THE MUNICIPALITY OF LAGOA DO OURO - PE, BRAZIL

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ABSTRACT

The objective of this work was to evaluate the weed seed bank in pasture area. The experiment was carried out at the Federal University of Alagoas, in 2018, with soil from Lagoa do Ouro, Pe. For seed bank evaluation, 20 soil samples were collected in pasture area. For seed bank determination, seedlings emerged from the trays, whose identification and counting were determined at 15, 30, 45, 60, 75 and 90 days after the implementation of the experiment. The phytosociological indices analyzed were: the frequency with which species were germinating (F); plant density (D); abundance (A); relative frequency (FR); relative density (DR); relative abundance (AR); value of importance index (IVI); Relative importance value index (IVIR). Fourteen weed species with a density of 303 plants m^{-2} were verified, being *Mollugoverticullata*, the species with the highest density and importance value index, with 45.4 plants m^{-2} and 47.6%, respectively. The species with the highest frequencies were *Acanthospermumhispidium DC*, *Portulacaoleraceae*, *Turneraulmifolia L.* with 0.80% respectively for both.

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INTRODUCTION

The active weed seed bank is constituted by all viable diaspores present in the soil, all these components determine the composition of emerged plants in the area. Being characterized by dynamic behavior, as a function of constant increases through production, seed dispersal and loss and its structure is closely related to the diversity and abundance of species that make up weed populations on the soil. In cultivated soils, the seed bank is dominated, in cultivated soils, the seed bank is often dominated by few weed species, which stand out for hard-to-control species or those best suited to growing systems (GOMES JÚNIOR E CHRISTOFFOLETI, 2008). In cultivated soils, annual weed seeds are the main constituents of the bank, usually reaching 95% of the total with perennial weed seeds being poorly represented (MARTINS e SILVA, 1994).

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Weed communities can vary significantly in response to soil and climate characteristics, crop management and herbicide use. In cultivated areas this bank is often dominated by few species which first set up hard-to-control species or even those more adapted to the cultivation systems adopted (KRENCHINSKI *et al.,* 2015). These few weed species competing for growth factors, promote low pasture support characteristics, increase forage formation and recovery time, may cause injury and or intoxication to animals and compromise the aesthetics and value of herd property and quality (SILVA *et al.,* 2012). The process of weed infestation in cultivated areas depends directly on the germination of its seeds (ROBERTS, 1999). Thus, its control assumes an extremely important role in the management of cultivated plants, as it has direct effects on crop yields per unit area and production costs. Control methods should promote greater rationality, effectiveness and cost savings (MELLONI *et al.,* 2013). Reducing the bank may mean less weeds in agricultural areas and therefore savings for farmers, especially with herbicides, as well as a healthier environment with less chemical use (MONQUEIRO E SILVA 2005). In agricultural areas, according to Buhler *et al*. (1997), the characteristics of seed banks influence both weed dynamics and the success of weed management in a given crop. Seed banks and weeds that are not eliminated with management practices are the main sources of future infestations (EKELEME *et al.,* 2003). On the other hand, Melo (2009), it was verified that the composition of the viable weed seed bank in cultivated soils of each species has been highlighted as indispensable study factors for proper management, thus allowing a greater technical efficiency in its control as well as one of the forms of sustainability of agroecosystems. Therefore, the evaluation of the species that make up the soil seed bank is essential, which serves as an indication for decision making or which method or management strategies to use in weed control.Being considered a dynamic system, where the accumulated total is variable according to the balance of seed inputs and outputs in the area (GASPARINO *et al.,* 2006). Silva *et al*. (2012), consider as a set of seeds available germination in the soil, being found in various ways. Given the above, this study aimed to study the weed seed bank in pasture area in the municipality of Lagoa do Ouro-PE, in 2018.

MATERIAL AND METHODS

This study was conducted from March to June 2018, at the Center for Agricultural Sciences of the Federal University of Alagoas (CECA-UFAL), located in Rio Largo - AL.According to Carvalho (2003) The soil is classified as coarse yellow clay oxisol with medium clay texture. The municipality is situated at a latitude of 9 ° 27 'S, longitude 35 ° 27'W, according to Köppen classification as type As, rainy tropical climate with dry summer, average altitude of 100 to 200 m above sea level, with annual average temperature and rainfall between 21.4 ° C and 1297 mm, respectively. For seed bank evaluation, 20 soil samples were collected from Fazenda Rosilha, Lagoa do Ouro-PE, in an area of 0.5 ha^{-1} in the conventional management system, with a surface area of 0.25 m². at a depth of 0.0-10 cm with equidistant spacing of 10x10m, in a pasture area, they were then enumerated and allowed to dry in the shade for a period of 72 hours on a plastic tarp.After drying, the samples were homogenized, breaking the clods and collecting the 500 g aliquots, which were distributed in plastic trays with dimensions of 22.0 cm x 15.0 cm x 3.0 cm, and allocated in the greenhouse.The trays were drilled in order to obtain good drainage, were irrigated daily, identified according to the respective sample taken from the field.

For seed bank determination, seedlings emerged from the trays, whose identification and counting were determined at 15, 30, 45, 60, 75 and 90 days after the implementation of the experiment.The spelling of the scientific names of the species found in the study was confirmed by the Missouri Botanical Garden (MBG, 2017) and the Flora do Brazil list (FB, 2017). Then the sum of the six observations was used to analyze the variables under study. From the species count, the phytosociological indices were calculated: the Frequency (F) with which the species were germinating, in%; Plant density (D) per m^2; Abundance (A), in unit; Relative frequency (FR) in%; Relative density (DR), in%; Relative abundance (AR) in%; Value of importance index (IVI), in%; Relative importance value index (IVIR), in%. For thisthefollowing formulas wereused:

$$\text{Frequency (F)} = \frac{\text{Number of parcels containing species x 100}}{\text{Total number of parcels used}}$$

$$\text{Density (D)} = \frac{\text{Total number of individuals by species}}{\text{Área total coletada}}$$

$$\text{Abundance (A)} = \frac{\text{Total number of individuals by species}}{\text{Total number of parcels containing the species}}$$

$$\text{Relative frequency (FR)} = \frac{\text{Species Frequency x 100}}{\text{Total frequency of species}}$$

$$\text{Relative density (DR)} = \frac{\text{Species density x 100}}{\text{Total density of species}}$$

$$\text{Relative Abundance (AR)} = \frac{\text{Abundance x 100}}{\text{Total abundance of species}}$$

Value of importance index (IVI) = FR + DR + AR

$$\text{Relative importance value index (IVIR)} = \frac{\text{IVI of species x 100}}{\text{Total IVI of all species}}$$

RESULTS AND DISCUSSION

The composition of the seed bank showed a great diversity of weed species, showing great variability among them, with the presence of 14 plant species distributed in 10 botanical families.The *Asteraceae* family was the most significant among the others, with 3 species, followed by the *Aramanthaceae* family with 2 species; *Rubiaceae* with 2 species; *Compositae; Gramineae, Lamiaceae, Molluginaceae, Portulacaceae, Solanaceae, Turneraceae*with 1 species each.

There was great variability in the botanical composition of the seed bank (Table 1), *Asteraceae* and *Poaceae*are the main predominant weed families in Brazil.According to Oliveira and Freitas (2008) these families are also present in traditional areas of sunflower, soybean and corn production, also appearing with great importance in areas cultivated with sugarcane and pastures.According to Tuffi Santos et al. (2004) report that these species are also present in floodplain and grassland crops. Works performed by Gonçalves et al. (1974) presented divergent results to the present study,in which the most representative families were *Malvaceae, Convolvulaceae, Cyperaceae, Leguminosae, Rubiaceae* and *Solanaceae*, in the various agricultural centers of the State of Pará with the presence of 144 weed species. Lacerda *et al.* (2005), conducted research on seed bank in two soil management systems, found different results to the present study. Similar results were found by Martins et al. (2008),working with seed banks as an indicator of restoration of a degraded area by kaolin mining in the state of Minas Gerais,*Asteraceae* (9), *Rubiaceae* (5) and *Poacecae* (4) were found.Brena et al. (2012), working with density and floristic composition of the seed bank of a semideciduous seasonal forest in the fields of the Federal University of Viçosa, Minas Gerais, found similar results to the present study with: *Asteraceae* (15), *Solanaceae* (4) and *Poaceae* (3). In a research by Ruedell (1995) that listed the main fall-winter and spring-summer weeds present in grain crops in Rio Grande do Sul, are similar to those presented in this paper. Among the observed species there was a higher predominance of dicotyledonous plants with 92.85% of the total identified plants, represented by 10 botanical families, covering 14 species, while monocotyledons had 7.15% of

Table 1. List of weeds identified in the soil seed bank in pasture cultivated area, Lagoa do Ouro - PE, 2018

FAMILY	BOTANICAL NAME	POPULAR NAME	CLASS	LIFE CYCLE
Asteraceae	*Emiliasonchifolian*	Pincel	Dicotyledonous	Yearly
	Ageratumgonyzoides L	Mentrasto	Dicotyledonous	Yearly
Amaranthaceae	*Amaranthusciridis L.*	Caruru	Dicotyledonous	Yearly
	Alternantheraficoidea L.	Apaga fogo	Dicotyledonous	Perennial
Compositae	*Acanthospermumhispidium DC*	Carrapicho-de-Carneiro	Dicotyledonous	Yearly
Gramineae	*Cenchusechinatus L*	Capim Carrapicho	Monocotyledons	Yearly
Lamiaceae	*Marsypiantheschamaedrys*	Hortelã-do-Campo	Dicotyledonous	Yearly
Molluginaceae	*Mollugoverticillata*	Capim Tapete	Dicotyledonous	Yearly
Portulacaceae	*Portulacaoleraceae*	Beldroega	Dicotyledonous	Yearly
Plantaginaceae	*Scopariadulcis L*	Vassourinha-de-botão	Dicotyledonous	Yearly
Rubiaceae	*Richardia brasiliensis*	Poaia	Dicotyledonous	Yearly
Solanaceae	*Physalisangulata L.*	Balãozinho	Dicotyledonous	Yearly
	Solanumamericanum	Maria pretinha	Dicotyledonous	Perennial
Tuneracea	*Turneraulmifolia L.*	Xanana	Dicotyledonous	Perennial

Table 2. Phytosociological parameters calculated in seed bank samples in pasture cultivated area, Lagoa do Ouro - PE, 2018

Species	NI	F	D	Fr (%)	Dr (%)	IVI
Acanthospermumhispidium DC	68	0.80	41.21	13.45	18.31	44.18
Portulacaoleraceae	42	0.80	25.45	13.45	11.31	31.43
Turneraulmifolia L.	45	0.80	27.27	13.45	12.12	33.79
Total	155	2.40	93.93	40.35	41.64	109.40

Number of Individuals (NI), Absolute Frequency (F), Absolute Density (A), Relative Frequency (Fr), Relative Density (Dr), and Value of Importance Index (IVI).

Table 3. Phytosociological indices of weeds in the soil seed bank in pasture cultivated area, Lagoa do Ouro - PE, 2018, Lagoa do Ouro - AL, 2018

SPECIES	F	D	A	FR (%)	DR (%)	AR (%)	IVI	IVIR (%)
Acanthospermumhispidium	0.80	41.21	12.87	13.45	18.31	12.42	44.18	14.73
Alternantheraficoidea	0.10	1.82	4.55	1.68	0.81	4.38	6.87	2.29
Ageratumconyzoides L.	0.40	14.55	9.09	6.72	6.46	8.77	21.96	7.32
Amaranthus viridis L.	0.10	1.82	4.55	1.68	0.81	4.38	6.87	2.29
Spermacoceverticillata L.	0.45	9.09	5.05	7.56	4.04	4.87	16.47	5.49
Cenchrusechinatus L.	0.20	3.03	3.78	3.36	1.35	3.65	8.36	2.79
Physalisangulata L.	0.55	13.33	6.06	9.24	5.92	5.85	21.01	7.0
Emiliasonchifolia	0.05	0.20	1.00	0.84	0.09	0.96	1.89	0.63
Marsypiantheschamaedrys	0.30	9.70	8.08	5.04	4.31	7.80	17.15	5.72
Mollugoverticillata	0.70	45.45	16.23	11.76	20.20	15.66	47.62	15.87
Cephaelis ipecacuanha	0.60	30.91	7.95	10.08	13.73	12.42	36.24	12.08
Portulacaoleraceae L.	0.80	25.45	12.88	13.45	11.31	7.67	32.43	10.81
Solanumamericanum	0.10	1.21	3.03	1.68	0.54	2.29	5.14	1.71
Turneraulmifolia L.	0.80	27.27	8.52	13.45	12.12	8.22	33.79	11.26
TOTAL	5.95	225.04	103.66	100.00	100.00	100.00	300.00	100.00

Frequency (F), Relative Frequency (FR), Density (D), Relative Density (DR), Abundance (A), Relative Abundance (AR), Importance Value Index (IVI) and Relative Importance Value Index (IVIR)

representativeness with a single species (Table 1),These species compete with the forage with greater intensity for the nutrients contained in the soil solution, considering their larger number of individuals per m^2 and shorter cycle, thus reducing the capacity of animals per area.Studies by Zanatta et al. (2006) verified a greater diversity of dicotyledonous plants in competition with cultivated areas. On the other hand, Kuva et al. (2008) verified in sugarcane cultivation that the main species were *Amaranthus spp., Cyperus spp., Cassia patellaria, Ipomoea spp., Chamaesycehissopifolia, Sida spp*. and *Phylantustenellus*, with 85% of the species being dicotyledonous. According to Soares et al. (2003) most weed species present a fast germination, having a short cycle and large diaspore production increasing the partition of resources in the reproduction structures, and can be extremely aggressive in competition with cultivated plants. For Tuffi et al. (2004) Pasture areas with intense weed infestation reduce the animal support capacity of pastures, preventing proper use of pastures by the animal. The different cultivation systems in the dynamics of the weed population undergo changes according to the seasons, the first rains promote germination in the soil active seed bank (PEREIRA; VELINI, 2003).The studies by Blanco *et al.* (1994) showed the monthly distribution of weed emergence. They observed that, due to the first rains, on average 70% of seedling emergence resulted from the first germination flow of seeds that make up the active bank of viable soil seeds. However, over the years, the fall in the number of emerged plants is more pronounced than the number of viable seeds present in the soil bank, mainly due to the fact that these seeds do not always have sufficient vigor to germinate, giving rise to normal seedlings with significant survivability (ROBERTS; FEAST, 1972). The species with higher densities per / m^2 were; *Mollugoverticillata, Acanthospermunhispidium* DC and *Cephaelinsipecacuanha*, with emphasis on *Mollugoverticillata* which presented higher density per area,corroborating the work developed by COSTA et al. (2013) which evaluated seed bank in pasture area in the Amazon region.The good variety of species recorded in the studied area demonstrated the importance of the seed bank study, attributed to the phenotypic plasticity shown by these plants as an adaptation response to develop in different environments, acting as indicators of the quality of the environment. In the first evaluation it was observed the germination of several species, highlighting (*Acanthospermumhispidium DC, Portulacaoleraceae, Turneraulmifolia L.*) according to Table 2, which characterizes the occurrence of the most relevant species in the area. The frequency (F) at which species presented the highest occurrence rates for pasture area were; 80% for *Acanthospermumhispidium DC*, *Portulacaoleraceae L*, *Turneraulmifolia L*. 70% for *Mollugoverticillata*, 60% for *Cephaelisipecacuanha*, *Physalis angulata L*. showing 55% were observed in all samples analyzed, indicating uniform distribution in the area (Table 3).According to Araújo et al. (2005) these species heterogeneities are attributed to edaphoclimatic factors and also to soil microhabitats. Similar results were found by Cunha et al. (2016) where they observed that the largest predominance of dicotyledonous species with 79.41% of the total identified plants, represented by 15 botanical families covering 27 species,while monocotyledons were represented only by two families (*Cyperaceae* and *Poaceae*) with a total of 7 species in areas where they were predominantly cultivated with vegetables. On the other hand, Carmona (1992) states that the high soil compaction due to the trampling of the animals in the pastures makes it difficult to penetrate the seeds, keeping them on the surface, where they can receive the necessary stimuli for germination. For the importance value index (IVI), it was verified that the species *Mollugoverticillata, Acanthospermumhispidium DC, Psychotriaipecacuanha, Turneraulmifolia L,* had constant presence.The IVI is directly related to the occurrence, quantity and concentration of individuals in the different points sampled in the total area of a given species, related to all others found in the areas (NASCIMENTO *et al.,* 2011). However, the importance value index (IVI) is still defined as the combination of the relative phytosociological values of each species in order to assign a value to them within the plant community to which they belong. However, one should be concerned about species with low IVI, because according to Inoue *et al.* (2012) there are species that even with not so high IVI, should already be considered a relevant species.

Conclusion

The seed bank is more active in the most superficial layer in the samples analyzed in pasture area, 14 weed species were found presenting density of 303 plants m^{-2}, being the species *Mollugoverticullata*, *Acanthospermumhispiduim DC* and *Cephaelisipecacuanha*. presented the highest densities with 45.4; 41.2; and 30.9 plants m^{-2} and importance value index, with 47.6%, 44.1% and 36.2, respectively. The species with the highest frequencies were *AcanthospermumHispidium DC, Portulacaoleraceae, Turneraulmifolia L.* with 0.80% respectively.

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