WEEDS OCCURRENCE IN AREAS SUBMITTED TO DISTINCT WINTER CROPS IN WESTERN REGION OF BRAZIL

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ABSTRACT: This study aimed to assess the weed community in distinct winter crops post soybean, in terms of level, diversity and severity of infestation. The following treatments were evaluated: no-till system with fallow, and oilseed crops (crambe, radish, rapeseed) in the winter; conventional tillage system with fallow in the winter. The level of infestation was characterized in each treatment by number of weed plants and its dry mass 75 days after emergence (DAE), and the diversity indexes of Margalef, Menhinick, Simpson and Shannon-Weiner were determined. Areas were also grouped by cluster analysis based on UPGMA applied at Jaccard's similarity matrix. Radish was the most efficient crop in suppressing weed species. Conventional tillage and winter fallow allowed higher occurrence of troublesome weeds. Winter fallow also showed the highest absolute level of infestation. Overall, oilseed crops in the winter do contribute to lower levels of infestation by weed species at these areas.

Key words: phytosociology; oilseed crops; infestation; crambe; rapeseed; radish.

INTRODUCTION

At the Western region of Brazil, it is usual to have two agricultural harvests at the same cropping season due to the suitable environmental conditions. Soybeans planted at the first monsoons are harvested in late January or early February, when corn, the second crop, is immediately planted. In this scenario, areas are usually not used from corn harvest (around July) until October.

As cropping areas are large at the region, farmers often are not able to plant soybeans at the totality of the area by the time of the first monsoons, thus corn second crop may not be planted in time. At these areas where corn is not planted, farmers do not use winter crops leaving areas in fallow until the next monsoons. For these areas, winter oilseed crops aiming production of bio-fuels is one of the best alternatives, as for example crambe (*Crambe abyssinica*), radish (*Raphanus sativus*) and rapeseed (*Brassica napus*). The use of these crops as winter coverage may be positive when all the benefits to the cropping system

(mainly in terms of soil coverage and inhibition of weeds emergence) are considered.

In addition, crambe and radish are known by exsudation of compounds with allelopathic effects (Grodzinsky, 1992), which could contribute significantly for the inhibition of weeds emergence.

This study aimed to assess the weed community in distinct wintercroppings post soybean crop, in terms of level, diversity and severity of infestation.

MATERIAL AND METHODS

The experiment was installed under field conditions at Embrapa Western Region Agriculture, Dourados, Mato Grosso do Sul State, Brazil, located at geographical coordinates 22° 16' S and 54° 49' W at 408m above sea level. The trial was installed in strip-plot experimental design with no replication. The plot dimension was 12m x 120m.

Treatments were composed by distinct wintercropping managements in the last year: (1) soybean in no-till followed by winter fallow; (2) crambe (*Crambe abyssinica*); (3) radish (*Raphanus sativus*); (4) rapeseed (*Brassica napus*); and (5) conventional soil tillage soybean crop followed by winter fallow. At treatment 5, right after soybean harvest, the area was lightly harrowed.

The oilseed crops were drill planted on May 26th 2011, in rows spaced in 0.40m. Fertilization was done only at planting by applying 347 kg ha^{-1} of NPK 08-20-20 at the seeding furrow. There were no further managements (weeds or pests control, fertilization) in post-emergence of the crops.

Characterization of weed species emerged from soil seed bank was carried out 75 days after emergence (DAE). For that, the *Random Quadrats* method (Barbour et al., 1980) was used and 10 areas of 1 m^2 in each management system were sampled. Areas were also intra-characterized by the diversity coefficients of Margalef (α), Menhinick (Dm), Simpson (D) and Shannon-Weiner (H').

Based on Jaccard's coefficient, areas were grouped by cluster analysis considering quantitative traits only, according to Gower's algorithm (Gower, 1971). Hierarchical grouping was obtained from Jaccard's similarity matrix by using the *Unweighted Pair Group Method with Arithmethic Mean* (UPGMA) method. Threshold level for defining the number of groups was based on the simple mean of Jaccard's matrix.

RESULTS AND DISCUSSION

The number of weed plants for all areas and their dry mass are shown in Figure 1.

Treatments differed in terms of weed infestation, being the area under fallow the one which presented the highest number of weed plants (Figure 1). Radish was the winter crop most capable of inhibiting the development of weed plants; probably this low infestation is due to its capacity of exsudating allelopathic compounds. In addition, rapeseed is not characterized by presenting high allelopathic issues, but crambe is recognized by its ability in inhibiting weeds appearance in a similar way to radish (Grodzinsky, 1992).

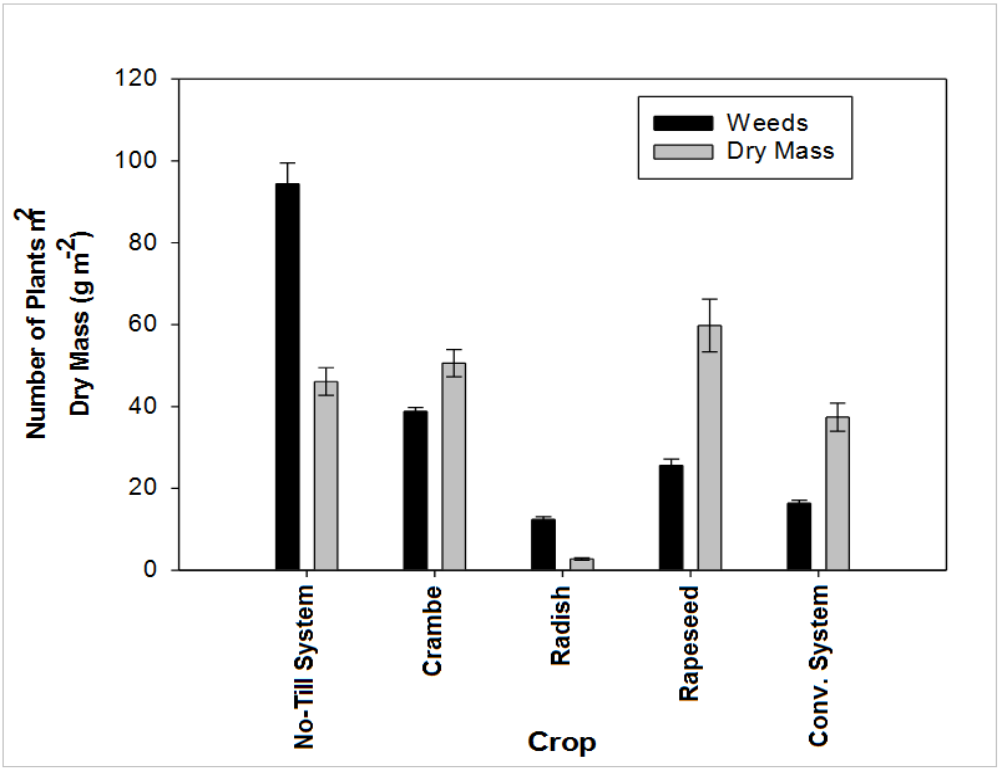

Figure 1. Number of plants of weed species and dry mass of the weedy community as a function of the winter management of the area. Embrapa Western Region Agriculture, Dourados-MS, Brazil, 2011.

The soybean conducted in conventional system (T5) with fallow in the winter also presented a low number of weed plants in comparison to the areas with winter crops, except for radish (Figure 1). The dry mass of the weedy community also differed among treatments, however with a distinct behavior compared to the observed number of weed plants. Soybean in no-till with winter fallow area (T1), the dry mass of weedy species was about half of the total number of plants.

Both for number of weed plants and for dry mass, the area grown with radish presented the lowest infestation, with number of weedy plants of about 12.6%, 31.6%, 57.1% and 92.3% of the observed for no-till fallow, crambe, rapeseed and conventional soil management areas, respectively (Figure 1). For dry mass, the area grown with radish presented 7.1%, 6.6%, 4.9% and 10.0% of the observed for no-till fallow, crambe, rapeseed

and conventional areas, respectively (Figure 1).

A diversity index is a statistic which is intended to understand the variety of individuals of a given population (Barbour et al., 1980). It was observed a similar behavior among all indexes (Table 1), except for Dm. In addition, α and H' showed to be more sensitive than Simpson's D in differentiating the areas.

Table 1. Diversity indexes in areas with distinct winter managements. Embrapa Western Region Agriculture, Dourados-MS, Brazil, 2011.

	α	**Dm**	**D**	**H'**
No-Till System	5.89	0.98	0.82	2.89
Crambe	5.52	1.21	0.77	2.58
Radish	4.69	1.43	0.54	1.75
Rapeseed	5.53	1.37	0.81	2.79
Conv. System	4.86	1.35	0.83	2.67

Indexes: **α** = Margalef; **Dm** = Menhinick; **D** = Simpson; **H'** = Shannon-Weiner.

Simpson's D relates the probability of two randomly selected individuals from an infinitely large community to belong to different species (Barbour et al., 1980). The Simpson index considers the abundance of species in the sample while being less sensitive to species richness. According to Simpson's D, there was small variation in diversity among treatments, being only possible to highlight a smaller diversity at the area grown with radish (Table 1). This area also presented the smaller number of plants (Figure 1).

Jaccard's matrix was calculated based on plant species occurrence, and cluster analysis (Figure 2) was established by the UPGMA method, with threshold level established by the matrix mean criteria, and showed three distinct groups in terms of weeds occurrence.

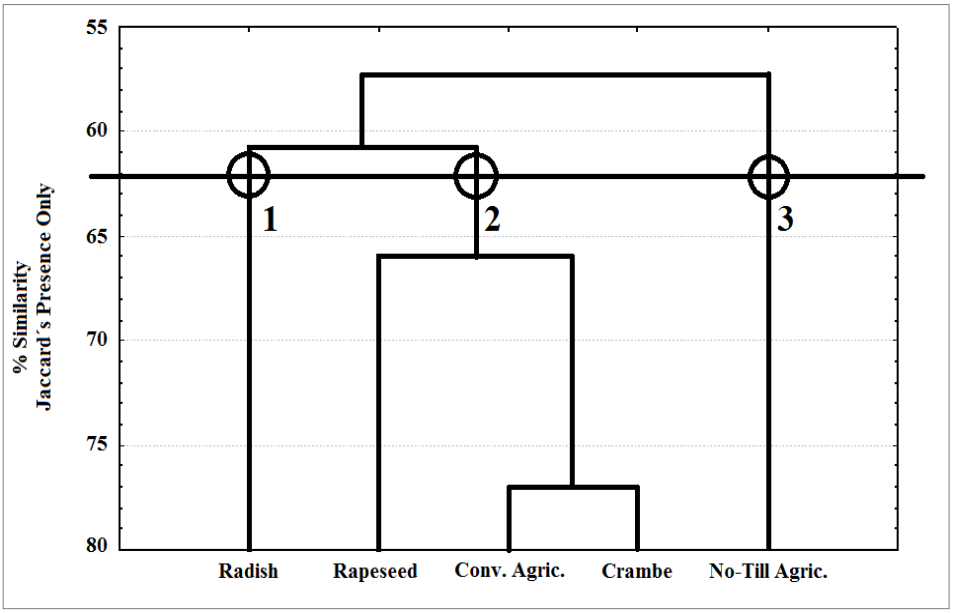

Figure 2. Cluster analysis for five areas submitted to distinct managements. Threshold level of 0.621 was based on the criteria of mean of Jaccard´s matrix, disregarding matching crosses between the same areas. Grouping was established based on the UPGMA method. Embrapa Western Region Agriculture, Dourados-MS, Brazil, 2011.

The first group was formed by radish alone, with low plant diversity and infestation, reflecting the capacity of this species in inhibiting the occurrence of weed species due to allelopathic issues. The second group was formed by rapeseed, conventional system, and crambe, characterized by a reduced infestation and higher number of species. The third group was represented by summer direct seedling agriculture with winter fallow, with high plant diversity and levels of infestation (Figure 2). These data are according to the raw data presented in Figure 1.

CONCLUSIONS

After one year of distinct winter cropping managements, there are remarkable differences both at the level of infestation and species composition between areas with and without winter coverage. As the composition of the soil seed bank was not significantly changed by a single year of distinct management (based on studies from other authors), discrepancies in infestation among areas were attributed solely to the differential management adopted.

Among treatments with winter coverage, radish was the most efficient crop in suppressing the occurrence of plants of weed species. In addition, the diversity of species

was only reduced in radish area. The area with no tillage followed by fallow presented the highest absolute level of weed infestation. Overall, the presence of oilseed crops in winter contributed to lower level of weeds infestation.

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