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WEED POPULATION UNDER DIFFERENT AMOUNTS OF SUGARCANE STRAW IN SAO PAULO STATE, BRAZIL

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Abstract

Maintenance of the straws on the soil surface has been proved essential for environmental quality of the sugarcane productive system in Brazil. However, this practice requires changes in the current management systems used around the country. This requires the use of tolerant varieties to the presence of straw residue on the soil surface, improvement in fertilization process, and also pest, disease and weeds control. In this context, this study aimed to evaluate the incidence of weed populations in the sugarcane cultivation under different levels of straw, in order to support possible changes in the management of these plants. Treatments were based on five levels of straw left on the soil surface at harvest, as follows: 0% - 25% - 50% - 75% - 100%, arranged in a randomized block design with four replications. The weeds evaluation was performed using the square method randomly thrown on the floor throughout the experiment area, reaching a total of ten samples per plot. This method was used to determine the density (plants/m^2) and absolute frequency (%) of the predominant species individuals in three assessments (34, 106 and 177 days after harvesting). It was observed the predominance of the species *Cyperus rotundus* L. and *Cynodon dactylon* L. Pers. independently of treatments applied. At 34 days after harvest *Cyperus rotundus* was the more frequent weed in the treatments with low and no straw respectively, however with 106 pos-harvests the presence of higher levels of straw (75% and 100%) privileged the growth of this species. Results shown that there was a tendency to increase the number of *Cyperus rotundus* individuals per area with the development sugarcane cycle, due to the increase in the layer of straw left on the soil.

Keywords: agricultural residue; soil conservation; weeds; sugarcane straw

INTRODUCTION

The end of the pre-harvest burning operation in sugarcane is a reality in São Paulo state, Brazil, which tends to move to other regions of the country, in the medium period of time. This new practice drives both the harvesting mechanization and the adoption of new technologies for soil-plant-water management, with emphasis on adaptations of practices that involve the use of tolerant varieties to the presence of sugarcane straw on the soil surface, refinement in fertilization process, and also pest, disease and weeds control.

From the conservationist point of view the maintenance of the sugarcane mulch, with the straw left on the soil surface brings substantial benefits to culture, such as reduction in surface water runoff, nutrient cycling and increase in water storage. Furthermore, the reduced weeds incidence (Pereira 2003; Vellum 2003), but this statement should be made carefully, since in long period of time this may not occur. Gravena et al. (2004) support that mulch left on the soil surface causes chemical, physical and biological changes in the soil and may cause the selection of the weed community and suppress infestations usually considered important in the cane fields, such as *Digitaria horizontalis* Willd., *Brachiaria plantaginea* (Link) Hitchc., *Brachiaria decumbens* Stapf and *Panicum maximum* Jacq, but on the other hand, Martin et al. (1999) observed an increase in species such as *Euphorbia heterophylla* L. and *Ipomoea grandifolia* (Dammer) O'Donell, which are adapted to the system of raw cane, which in the medium to long periods of time can become a problem in the sugarcane production system.

Understanding the dynamics of weeds and the action of herbicide products with the presence of high amounts of coverage on the soil surface is essential to the continued success of sugar and ethanol production in Brazil. Accordingly, Correia and Durigan (2004) studied the effects of different amounts of straw on the emergence of six species of weeds (*B. decumbens, D. horizontalis, Sida spinosa* L., *I. grandifolia, Ipomoea hederifolia* L. and *Ipomoea quamoclit* L.) and found that levels of coverage over five tons per hectare reduce the emergence of *B. decumbens* and *S. spinosa*. However, there was no interference in the emerging process with the presence or absence of straw for the species *I. grandifolia* and *I. hederifolia*, while the density of *I. quamoclit* increased with the presence of this residue on the soil.

The behavior of herbicide products is another priority in raw cane production system. Locke and Bryson (1997), studying the herbicides performance when sugarcane straw where left on the soil surface, found that this residue intercepts chemical molecules making them vulnerable to degradation caused by volatilization and/or photodecomposition, until they be leached to soil. Vellum and Negrisoli (2000) observed in their studies that the maintenance of five tons per hectare of sugarcane

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straw on the soil surface results in the retention of almost all the herbicide applied and significantly affect weed control.

Given the importance of maintaining the straw on the soil surface to the environmental quality of the production system of sugarcane in Brazil, this study was carried out to evaluate the incidence of weed populations in the sugarcane cultivation under different levels of straw, in order to support possible changes in the management of these plants.

MATERIAL AND METHODS

The survey of invasive plants populations was held in the São Rafael Farm Rafael, located in Araras city, São Paulo state, Brazil during the third sugarcane harvest (October 2010-July 2011) of the variety RB-845210 grown in an Latossol. This activity was part of the evaluations of a long-term project that involves the sugarcane management under different levels of straw left on the soil surface after harvest.

The experiment area was setup in a randomized block design in with four repetitions, and treatments containing 0, 25, 50, 75 and 100% of sugarcane straw, corresponding respectively to 0, 5.8, 11.5, 17.2 and 23 t ha^{-1} of dry biomass distributed on the soil surface. The plot consisted of six lines and two useful edges of 15 m of cane sugar, spaced 1.5 m between lines, which corresponded to a total of 135 m^2 of cultivated area.

The weed management was the same for all treatments and matched to application of commercial herbicide 40th days after harvesting. Weeds evaluation was performed using the square method based on the use of a sampling frame of 0.25 m^2, released randomly on the cultivated area, reaching a total of ten samples per plot. This method was used to determine the density (plants/m^2) and absolute frequency (%) of the predominant species individuals (Duarte Junior 2009) in three assessments (34, 106 and 177 days after harvesting).

RESULTS AND DISCUSSION

The field surveys showed a significant presence of *Cyperus rotundus* followed more timidly by *Cynodon dactylon*, which were classified by Procopio et al. (2003) and Cristoffoleti et al. (2005) as highly important in sugarcane farming. The high incidence of *Cyperus rotundus* (39%) confirms the results presented by Oliveira (2005), Kuva et al. (2007) and Duarte Junior et al. (2009) in raw cane evaluations. However, *Cynodon dactylon* was visually detected in 11% of commercial areas assessed by Kuva et al. (2007) while in the present study the average incidence was 3%.

The occurrence frequencies of these two species are presented in Table 1, both in the critical period of competition (30 to 100 days after harvesting, according Cristoffoleti et al. 2005) with sugarcane and after this period. The results shows that 34 days after harvesting the *Cyperus rotundus* was more frequent in the treatments with low levels of straw (25%) and without straw (0%) respectively, but at the 106 day post-harvesting the presence of higher levels of straw (75% and 100%) privileged the growth of this species. The increase in the frequency of *Cynodon dactylon* was also observed in higher levels of straw (75% and 100%) and in the last evaluations (106 and 177 days after harvesting), being the 177 day post-harvesting outside the critical period of competition with the sugarcane cultivation.

Table 1. Occurrence frequency of *Cynodon dactylon* in a third sugarcane harvesting, variety RB-845 210, grown under different levels of straw in Araras city, SP.

Straw level	*Cyperus rotundus* frequency (%)			*Cynodon dactylon* frequency (%)		
	34 DPH*	106 DPH	177 DPH	34 DPH	106 DPH	177 DPH
0%	43	28	15	0	0	0
25%	60	38	35	3	0	0
50%	30	28	33	3	0	0
75%	33	53	48	5	8	8
100%	28	58	48	3	7	8

*days post-harvesting (DPH)

The absolute density of *Cyperus rotundus* and *Cynodon dactylon* individuals are shown in Fig. 1. There was an increase tendency towards the number of *Cyperus rotundus* by area in the last two surveys due to the increase in the layer of straw left on the soil. Silva et al. (2003) also found that layers of straw up to 8 t ha^{-1} did not reduce the epigean manifestations of *C. rotundus*, providing only a latecomer effect, as occurred in this test. Leaving 16 t ha^{-1} of straw on the soil surface, these authors reported a reduction in the number of shoots, but without affecting the shoot biomass and the development of new tubers.

Fig. 1 also shows the tendency to enhance the *Cynodon dactylon* population over time with higher levels of straw. There are no reports of this behavior in other studies with sugarcane. It should be noted that researches involving weeds and levels straw, point out to the increase or decrease in the population of these plants, without much discussion about the factors that lead to this behavior. As a long-term project, which will be evaluated several sugarcane harvests; there is an intention to clarify the possible causes in order to contribute to better weed management system on raw cane under Brazilian conditions.

CONCLUSIONS

The results presented lead the conclusion that there is a tendency to increase the number of individuals per area of *Cyperus rotundus* with the development cycle of

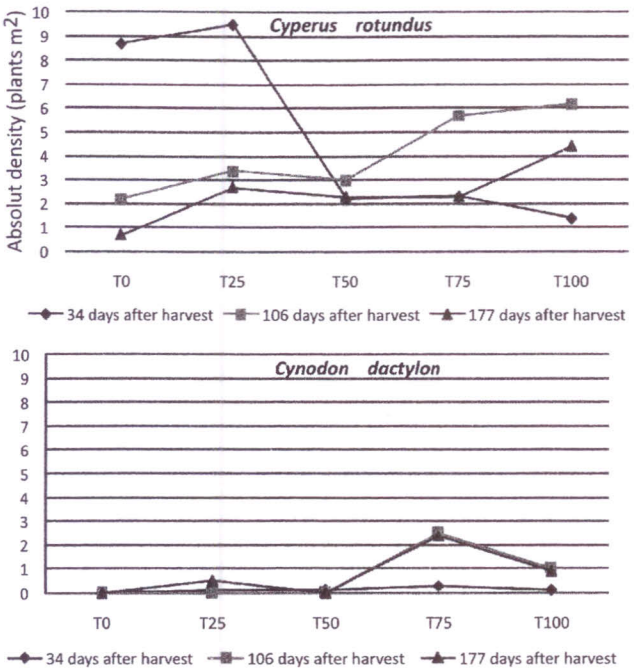

Fig. 1. Absolute density of *Cyperus rotundus* and *Cynodon dactylon* individuals in the third sugarcane harvesting, variety RB-845 210, grown under different levels of straw in Araras city, SP.

sugarcane, due to the increase in the layer of straw left on the soil surface.

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