INFLUENCE OF DIFFERENT SPECIES OF CROTALARIA IN INDICATORS OF QUALITY OF SUGARCANE

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ABSTRACT

The study of plants of the family of leguminous plants has shown great potential in the recovery of soil productivity, in addition to being a profitable practice. This work was aimed at assessing the response of quality indicators of sugarcane subjected to four different species of crotalária, used as green manure during the period of reform of cane. The experiment was conducted in the commercial area of sugarcane in an Acrustox dystrophic, in Eldorado Group ETH Bioenergy Plant S/A, in the municipality of Rio Brilhante, MS. The installation of the treatments was held in october 2008, with the planting of four varieties of crotalária. In june 2009 was held the planting of sugarcane, being that in the period leading up to rut were made of desiccation and incorporation operations with harrowing of legumes in the soil. Thus, the experimental design was entirely blocks, consisting of six treatments: T1: witness, T2: *Crotalaria breviflora*, T3: *Crotalaria juncea*, T4: *Crotalaria ochroleuca*, T5: *Crotalaria spectabilis* and T6: NPK fertilization, each with four repetitions. Manually three lines were drawn with Central 10 meters long in each installment, for the evaluation of quality indicators. There was no significance in statistical analysis of the effect of legumes on indicators of quality of sugarcane; although insignificant difference compared the averages, *Crotalaria juncea* can contribute in total or partial elimination of fertilization.

KEYWORDS: *Crotalaria* spp., management and soil conservation, *Saccharum* spp.

INFLUÊNCIA DE DIFERENTES ESPÉCIES DE CROTALÁRIA NOS INDICADORES DE QUALIDADE DA CANA-DE-AÇÚCAR

RESUMO

O estudo de plantas da família das leguminosas tem demonstrado um grande potencial na recuperação da produtividade do solo, além de ser uma prática economicamente rentável. Este trabalho teve como objetivo avaliar a resposta de indicadores de qualidade da cana-de-açúcar submetidos a quatro diferentes espécies de crotalária, utilizadas como adubo verde durante o período de reforma do canavial. O experimento foi conduzido em área comercial de cana-de-açúcar, em um

Latossolo Vermelho distrófico, na Usina Eldorado - Grupo ETH Bioenergia S/A, no município de Rio Brilhante, MS. A instalação dos tratamentos foi realizada em outubro de 2008, havendo o plantio de quatro variedades de crotalária. Em junho de 2009 foi realizado o plantio da cana-de-açúcar, sendo que no período antecedente à sulcação foram feitas operações de dessecação e incorporação com gradagem das leguminosas no solo. Assim, o delineamento experimental foi o de blocos inteiramente casualizados, constituído de seis tratamentos: T1: Testemunha, T2: *Crotalária Breviflora*, T3: *Crotalária Juncea*, T4: *Crotalária Ochroleuca*, T5: *Crotalária Spectabilis* e T6: Adubação NPK, cada um com quatro repetições. Foram retiradas manualmente as três linhas centrais com 10 metros de comprimento em cada parcela, para a avaliação dos indicadores de qualidade. Não houve significância na análise estatística do efeito das leguminosas sobre os indicadores de qualidade da cana-de-açúcar; apesar de insignificante diferença, em comparação as médias, a Crotalária juncea pode contribuir na supressão parcial ou total da adubação.
PALAVRAS-CHAVE: *Crotalaria* spp., manejo e conservação do solo, *Saccharum* spp.

INTRODUCTION

Due to environmental problems caused by the burning of sugarcane, the agroindustry is abolishing this practice began to use the cane harvest. Thus, the stubble of sugarcane is left almost intact on the surface of the soil when harvested manually or, if the ground is mechanized harvesting (PERES et al., 2010).

However, the end cuts of up to seven at the time to reform the cane plantation, the soil remains uncovered for several months, with frequent occurrence of high rainfall in this period, becoming quite severe problems arising from soil erosion, aggravated by inadequate management the traditional and conventional tillage (CÁCERES & ALCARDE, 1995).

In this context, the use of green manures that bring benefit to the protection by maintaining soil moisture, temperature decrease, an increase of organic matter, lower incidence of weeds and recycling/maintenance of nutrients with increased crop yields lead to conservation practices in sugarcane (AMADO, 2001; ROSSETTO, 2004).

Thus, the study of these plants, especially the legume family, has shown great potential in the recovery of soil productivity, as well as being a practical cost-effective (DOURADO et al., 2001). The reasons for preference for legumes are numerous, and the main aspects are in fact the ability to fix atmospheric nitrogen by bacteria living in symbiosis with their roots, presence of organic matter with higher accumulation of minerals along with a branched root system and deep and low C/N ratio, favoring the mineralization of nutrients, especially nitrogen (MASCARENHAS et al., 1994).

Among the species most used legumes as green manure, the *Crotalaria juncea* L. is considered the most productive, with higher rates of coverage and extraction of nutrients compared to other legumes (CÁCERES & ALCARDE, 1995, DUARTE JÚNIOR & COELHO, 2008). However, their contribution to soil chemistry occurs in a larger time frame than the others, usually 90 to 120 days (ALCÂNTARA et al., 2000).

Duarte Júnior & Coelho (2008), explain that there are very few the surveys on the recommendation of the use of other legume species, along with limited data that demonstrates the economic benefits of these species and ma justify adoption of green manure in cultivated soils, especially cultivated with sugarcane.

This study aimed to evaluate the response of indicators of quality of sugarcane under four different species of crotalária, used as green manure during the reform of the sugarcane plantation.

MATERIAL AND METHODS

The experiment was conducted in the commercial area of sugarcane, in an Acrustox classified according to the methodology of EMBRAPA (2006) and according to *Soil Survey Staff* (1998) it is an Oxisol, in Plant Eldorado - ETH Bioenergy Group S/A, in Rio Brilhante, MS, whose coordinates are located at 21°50' South Latitude and 53°57' West Longitude, with an average elevatio n of 650 m.

The climate in the region is Tropical Savannah, with rainy season concentrated in the dry season in summer and winter, Aw type according to *Köppen-Geiger* classification, with average rainfall of 1,400 mm per year.

The variety used was RB867515 launched by the Federal University of Viçosa, characterized by rapid growth, drought tolerance, high agricultural productivity and late maturity, with rich maturity curve. This should be planted on soils of medium/low fertility where it is harvested in mid-season, or at the very end to explore the rapid growth (MARQUES & SILVA, 2008).

The installation of the treatments was conducted in October 2008, with the planting of four varieties of crotalaria. In June 2009 we carried out the planting of sugarcane, and the period preceding the furrowing drying operations were done with plowing and incorporation of legumes into the soil.

Thus, the experimental design was a randomized complete block, consisting of six treatments: T1: control; T2: *Crotalaria breviflora*; T3: *Crotalaria juncea*; T4: *Crotalaria ochroleuca*; T5: *Crotalaria spectabilis*; and T6: NPK fertilization, each with four reps.

Were used in each plot with five rows of trees 50 m long, spaced 1.5 m apart. Thus, each of the six plots of each block had a length of 50 m and width of 7.5 m and eachone had four blocks of 50 m long by 45 feet wide. The distribution of plots with treatments and their repetitions was random, avoiding any interaction.

In july 2010, were manually removed the three central lines in the sugarcane crop with 10 meters long in each plot for the evaluation of quality indicators through ATR (total recoverable sugar), Brix% (soluble solids present in the broth), Fiber, POL (apparent percentage of sucrose contained in a solution), PC (POL% corrected) and PZA (purity).

The results were submitted to ANOVA and when significant, means were compared by Tukey test at 1 and 5% probability through computer application Assistat (SILVA & AZEVEDO, 2009)

RESULTS AND DISCUSSION

There was no statistical difference in any of the quality of sugarcane, and a 5% significance level in Tukey's test, under the effect of treatments with legumes used (Table 1). CÁCERES & ALCARDE (1995) also did not obtain effects of green manure on the technological characteristics of sugarcane in three sections studied. According to the authors, the effect became significant when measured productivity in tons of cane per hectare (TCH).

TABLE 1. Medium of the quality of sugarcane subject to six different treatments.

ATR		BRIX		FIBRA		PC		POL		PZA	
T[1]	Kg t-[1]	T	%	T	%	T	%	T	%	T	%
3	155.29	3	18.02	1	12.30	3	15.79	3	18.45	3	90.22
4	153.33	5	17.64	2	12.25	4	15.64	1	18.39	4	29.30
2	151.37	6	17.64	4	12.21	2	15.41	5	18.37	5	85.61
6	151.37	2	17.37	6	11.61	6	15.36	2	18.28	1	84.65
1	149.88	1	17.00	3	11.56	1	15.28	4	18.05	6	84.58
5	148.89	4	17.00	5	11.49	5	15.05	6	18.02	2	78.72
D.M.S	13.42		1.27		1.86		4.84		2.23		18.75
C.V.[2](%)	3.79		3.12		6.76		13.13		5.24		9.36
S.D.[3]	5.75		0.55		0.78		2.07		0.95		8.03

[1]Treatment; [2]coefficient of variation; [3]standard deviation.

Even though statistical analysis did not show significance, it is observed that the treatment means have a small difference when compared with the indicators.

In this respect, *Crotalaria juncea* (T3) has excelled in the analysis of total recoverable sugar (ATR), Brix, Pol Fixed (PC), and Pol Purity (PZA), averaging 155.29 kg t^{-1}, 18.02%, 15.79%, 18.45% and 90.22%, respectively, being far superior in all attributes analyzed, compared to NPK fertilizer (T6), commonly performed by the plant, which defines it as ideal in the management of degraded areas, agreeing with CÁCERES & ALCARDE (1995), CARVALHO et al. (2004) and MENEZES & LEANDRO (2004).

In a study on the decomposition of plant cover, TORRES et al. (2005) found that *Crotalaria juncea* showed higher content of nitrogen accumulated and, moreover, the highest rate of N mineralization, compared to other legumes and some grasses. This is explained by its low C/N ratio, which gives rapid decomposition and nutrient release (AMBROSANO et al., 2009).

According to economic study done by MASCARENHAS et al. (1994), the cost of production of *Crotalaria juncea* under renovation sugarcane accounts for up to 10 t ha^{-1} of sugarcane. According to the authors, the use of green manure provides an increase in productivity of up to 27 tons, giving 17 tons profit for the producer, and the protection of the soil nematicide and action.

The *Crotalaria ochroleuca* (T4) was the second best of the legumes on indicators ATR (150.33 kg t^{-1}), PC (15.37%) and PZA (29.30%), followed by *Crotalaria breviflora* (T2) and finally, *Crotalaria spectabilis* (T5).

In pursuit of control in the development of weeds, ERASMO et al. (2004) concluded that *C. ochroleuca* and *C. spectabilis* act in the control of weeds, especially 45 days after sprouting, confirming studies by TEIXEIRA et al. (2004) proves the allelopathic effects of this group of plants.

Thus, in general, it is observed by comparison, that *Crotalaria juncea* is the best option for use as green manure in sugarcane. However, as between the averages of the studied species of crotalaria was no statistical difference, there is no apparent difference in their benefits in the quality of sugarcane, which makes this species one of the most important in the conservation of degraded soils, both in the recovery nutrients, as in the control of weeds and some pests.

Still, it must be remembered that the ratio of the productivity of sugarcane is

closely related to soil compaction, and species of *Crotalaria* spp. can act as a decompressor for having deep roots. Studies by BARBOSA et al. (2009) show that *C. juncea* tolerate higher levels of compression, which primarily assist in sugarcane productivity, and reduce operating costs decompression (SILVA JUNIOR et al., 2011).

CONCLUSIONS

1. There was no significant statistical analysis of the effect of legumes on indicators of quality of sugarcane;

2. Although almost negligible difference compared averages, *Crotalaria juncea* can contribute to the partial or total removal of manure, thanks to its ability to rescue the nutrients in deeper soil layers.

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