THE USE OF A HUMIC ACID-BASED SOIL CONDITIONER IN SUGARCANE CROP

By

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Abstract

EFFORTS have been made to find ways to increase the productivity of sugarcane crops by using less mineral fertilisers, leading to a cost reduction and sustainability. Based on these principles, organic-mineral products have been used to promote physical, chemical and biological alterations in the soil system. The use of a commercial humic acid-based soil conditioner product was evaluated, in order to measure its influence on sugarcane production and to check its interaction with the mineral fertilisation. The experiment was carried out on Santa Candida sugar mill, located in Bocaina, São Paulo state, using the sugarcane varieties RB 867515 (plant cane), and PO88-62 (ratoon). The experiment was laid out in a split-plot design, using 0, 800, 1600 and 2400 kg/ha of the mineral fertiliser 2.5–10–10 (main plot treatments) with 0 and 350 litres/ha of the commercial product (sub-plot treatments) at sugarcane planting, and 0, 800, 1600 and 2400 kg/ha of the mineral fertiliser 10–00–10 (main plots) with 0, 300 and 600 litres/ha of the commercial product (sub-plots), at first ratoon. Results showed that the use of the commercial product causes a significant increase in the crop production, both in plant cane and first ratoon, equivalent to the use of 1200 and 1100 kg/ha (interpolated) of the mineral fertiliser.

Introduction

Organic matter providing enormous benefits to agricultural production is ancient knowledge, but yet little is known about it. Use of organic matter improves soil physical, chemical and biological properties, and has technical advantages.

However, due to high cost and / or large volumes required, the application of organic matter as fertiliser in fields is limited to a small group of growers.

Composition of soil organic matter is still unknown by the great diversity and variability of compounds and origins, but is generally called ‘humus’ due to the large presence of humic acid, which appears to be the ‘active principle’.

Many attempts have been made to increase sugarcane productivity. One of them is to use mineral fertilisers more efficiently, and thus reduce costs and sustain production of the sugar-alcohol sector.

Under this principle, organic minerals with a humic-acid base were selected with the aim to improve the level of soil organic matter, and soil physical, chemical and biological properties.

This work was to determine the effect of an organic soil conditioner, organic mineral humic acid, in plant and ratoon cane. Furthermore, its interaction with mineral fertiliser was also investigated.

Materials and methods

Two trials were conducted at Santa Cândida Mill, City of Bocaina – SP. The first trial was plant cane of variety RB 867515 located in Farm Bateia, with neosoil quartzenic sandy soil found in the production environment D1 (Prado, 2005). After opening the furrows, the application of the organic mineral product was done at the same time as the application of mineral fertiliser. The second trial was ratoon cane of variety PO88-62 located in Farm Santa Inês, with neosoil quartzenic sandy soil found in the production environment D2 (Prado, 2005). The application of organic mineral was performed during the mechanical cultivation of the ratoon.

Experimental design for both trials was randomised blocks in split plots with 4 replications.The main treatment was fertiliser rates. In the plant cane trial, there were two rates of the organic mineral (0 and 350 L/ha) in combination with 0, 800, 1600 and 2400 kg/ha of liquid fertiliser 2.5–10–10. However, in the ratoon cane trial, there were three rates of the organic mineral product (0, 300 and 600 L/ha) in combination with 0, 800, 1600 and 2400 kg/ha of liquid fertiliser 10–0–10. Each plot comprised four rows, 50 metres in length. Samples were taken from the middle 30 metres.

The Agrolmin® organic mineral product used in the experiment was obtained by extraction from a natural peat mine with the following properties: pH = 5.67, total organic matter (humic substances) = 89.72%, total N 5% (patronised from the natural product complemented with mineral N).

At harvesting, cane was cut, weighed and evaluated. Analysis of variance was performed by SAS statistical program, the test medium analysed by the Tukey test at 5% significance.

Results and discussion

There was a significant difference in cane yield related to the rates 1600 and 2400 kg/ha of mineral fertiliser when compared to the control. However, there was no significant difference between the rates of 800, 1600 and 2400 kg/ha. It was also found that the use of 350 L/ha significantly increased the cane yield to 177.78 t/ha, compared to the control, 130.02 t/ha (Table 1).

Table 1—Averages of productivity in the cane-processing plant, variety RB 867515. Bocaina-SP. ESALQ, 2009.

Fertiliser	Rates	Productivity (t/ha)	
Mineral fertiliser (kg/ha)	1600	129.17	a
	2400	128.35	a
	800	123.96	ab
	0	114.13	b
Agrolmin® (L/ha)	350	177.78	a
	0	130.02	b

Means followed by the same letter are not different by Tukey test at 5% probability for all treatments.

In ratoon cane, there was a significant response in cane yield (Table 2) using the Agrolmin ® compared to the control, but no significant difference between rates of 300 L/ha and 600 L/ha.

Table 2—Averages of productivity treatments in ratoon cane, variety PO-8862. Bocaina-SP. ESALQ, 2009.

Fertiliser	Rates	Productivity (t/ha)	
Mineral fertiliser (kg/ha)	2400	127.87	a
	1600	123.95	a
	800	116.71	ab
	0	100.97	b
Agrolmin® (L/ha)	600	125.13	a
	300	122.19	a
	0	104.81	b

Means followed by the same letter are not different by Tukey test at 5% probability.

With regard to mineral fertiliser, there was a significant difference between the rates of fertiliser and control, but no significant difference between the rates of fertiliser at 800, 1600 and 2400 kg/ha. No significant interaction between rates of mineral fertilisers and rates of Agrolmin ® were found.

It was also observed during the conduct of experiments that both plant and ratoon cane treated with humic acid showed fewer symptoms of a drought-like root system, thinner stalks and shorter internodes than the plots without this input.

Cane yield was increased by number of tillers and larger diameter of the cane stalks. These symptoms are related to improved plant nutrition by greater absorption of nutrients.

Increased availability of nutrients, particularly nitrogen, was directly related to the increase in the diameter of stem and tillering of culture (Van Dillewijn, 1952; Humbert, 1968; Alexander, 1973; Clements, 1980; Rodrigues *et al*., 1983; Beauclair, 1984).

This increased availability of nitrogen is related to an increase in content and, consequently, the decomposition and mineralisation of organic matter, as suggested by Beauclair (1984), provided by using humic acid.

Although these results showed that the use of humic acid resulted in a consistent increase in cane yield, it does need a greater number of studies and analysis of the issue to better characterise the causes and effects.

Conclusions

For the cane plant, the use of a commercial product of humic acid of 350 L/ha resulted in a significant increase in cane yield, and the rate equivalent to the use of 800 kg/ha of mineral fertiliser.

In ratoon cane, the rates of 300 and 600 L/ha of humic acid resulted in a significant increase of cane yield equal to 1200 kg/ha of mineral fertiliser.

Use of this soil conditioner may be feasible to increase production combined with a reduction of mineral fertiliser.

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L'UTILISATION D'UN ACTIVATEUR DE SOL HUMIQUE ACIDE EN CULTURE DE CANNE A SUCRE

Par

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KEYWORDS: *Saccharum* spp, Fertilisation, Productivité, Acide Humique.

Résumé

DES EFFORTS ont été réalisés pour trouver des solutions permettant d'augmenter la productivité des cultures de canne à sucre, diminuer les coûts et augmenter la durabilité. Basé sur ces principes, des engrais organo-minéraux ont été utilisés pour améliorer les propriétés physiques, chimiques et biologiques du sol. Un produit commercial activateur de sol humique acide fut évalué en mesurant son influence sur la production de la canne à sucre et son interaction avec la fertilisation minérale. L'expérimentation fut réalisée sur le complexe de Santa Candida sugar mill, situé en Bocaina, dans l'état de São Paulo, avec les variétés RB 867515 en canne plantée et PO 88-62 en repousse. Le dispositif en split plot comportait les doses d'engrais minéraux en parcelles principales et les doses de produit commercial en sous parcelles. A la plantation, des doses (0, 800, 1600 et 2400 kg/ha) d'engrais minéraux (2.5–10–10) et des doses de 0 et 350 l/ha de produit commercial furent appliquées. En repousse, des doses (0, 800, 1600 et 2400 kg/ha) d'engrais minéraux (10–00–10) et des doses de 0, 300 et 600 l/ha de produit commercial furent appliquées. Les résultats montrèrent que l'application de produit commercial augmente significativement la production à la fois en canne plantée et en repousse, ce qui équivaut par interpolation à une utilisation de 1200 et 1100 kg d'engrais minéral.

UTILIZACIÓN DE UN ACONDICIONADOR DE SUELO A BASE DE ÁCIDO HÚMICO EN EL CULTIVO DE LA CAÑA DE AZÚCAR

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PALABRAS CLAVE: *Saccharum* spp, Fertilización, Productividad, Ácido Húmico.

Resumen

SE HAN realizado esfuerzos para incrementar la productividad del cultivo de la caña de azúcar utilizando menos fertilizantes minerales, con el objeto de reducir costos y lograr sostenibilidad. Con base en estos principios, se han utilizado productos orgánico-minerales para promover alteraciones físicas, químicas y biológicas en el sistema suelo. Se evaluó la utilización de un acondicionador de suelo a base de ácido húmico, con el fin de medir su influencia en la producción de caña de azúcar y su interacción con la fertilización mineral. El experimento se llevó a cabo en el ingenio Santa Candida, ubicado en Bocaina, estado de San Pablo, con las variedades RB86-7515 (plantía) y PO88-62 (soca). Se utilizó un diseño experimental de parcelas divididas, aplicando 0, 800, 1600 y 2400 kg/ha del fertilizante mineral 2.5–10–10 (parcela grande) con 0 y 350 litros/ha del producto comercial (parcela pequeña) en plantía, y 0, 800, 1600 y 2400 kg/ha del fertilizante mineral 10–00–10 (parcela grande) con 300 y 600 litros/ha del producto comercial (parcela pequeña) en soca. Los resultados muestran que el uso del producto comercial provoca un incremento en la producción del cultivo, tanto en plantía como en soca, equivalente al uso de 1200 y 1100 kg/ha (interpolando) del fertilizante mineral.