EFFECTS OF ACTARA® 250 WG (THIAMETOXAN) APPLICATION ON SUGARCANE RATOONS OF 'SP 81 - 3250' VARIETY.

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SUMMARY

The effect of Actara® 250 WG on plant development sugarcane ratoons (*Saccharum spp*.), 'SP 81 - 3250' variety was evaluated. This research was developed at the experimental area of Agência Paulista de Tecnologia dos Agronegócios (APTA) in Andradina/SP/Brazil. Vases of 100 liters of capacity were used to plant sugarcane ratoons. Experimental design was split-plot randomized blocks with five replications. Main treatments consisted of Actara® 250 WG (0.2 L ha^{-1}); Actara® 250 WG (0.4 L ha^{-1}); Actara® 250 WG (0.6 L ha^{-1}); Actara® 250 WG (0.8 L ha^{-1}) and Actara® 250 WG (0.6 L ha^{-1}) + Maleic Hydrazide (0.8%) applied 30 days after Actara, respectively. Secondary treatments (time of stalks sampling) occurred at 30, 60, 90, 120 and 150 days after the product application (April 18th, 2006), besides another initial evaluation. Results showed Thiametoxan acted as a bioactivator, promoting changes in shoot and root system. Actara® 250 WG at 0.2 and 0.4 L ha^{-1} increased the root dry matter, leaf área and stalk dry matter and length.

Key words: Saccharum spp., bioactivator, root system

RESUMO

Com o objetivo de avaliar o efeito da aplicação do Actara® 250 WG no desenvolvimento de cana (Saccharum spp.) variedade 'SP 81-3250', este trabalho foi desenvolvido em área experimental da Apta Regional, em Andradina/SP/Brasil, utilizando-se vasos de 100 litros de capacidade. O delineamento experimental foi em blocos casualizados com cinco repetições. Os principais tratamentos consistiram de Actara® 250 WG (0,2 L ha-1); Actara® 250 WG (0,4 L ha-1); Actara® 250 WG (0,6 L ha-1); Actara® 250 WG (0,8 L ha-1) e Actara® 250 WG (0,6 L ha-1) + (0.8%) de hidrazida maleica aplicada 30 dias após o Actara, respectivamente. Tratamentos secundários (tempo de amostragem de colmos) ocorreram em 30, 60, 90, 120 e 150 dias após a aplicação do produto (18 de abril de 2006), além de avaliação inicial. Verificou-se que Thiametoxan atuou como um bioativador, promovendo alterações no sistema radicular e aéreo. Actara® 250 WG em 0,2 e 0,4 L ha-1 aumentou a matéria seca de raiz, matéria seca de colmo, área foliar e o comprimento de colmo.

Palavras chaves: Saccharum spp., bioativador, Sistema radicular

INTRODUCTION

Plant development and growth is an important aspect for sugarcane production system. There are few studies concerning the knowledge of a plant root system, due to the difficulties

in removing the soil and separating roots. Aguiar (1976) mencioned by Casagrande (1991), noted that the maximum development of root system occured at 75 days after planting.

Yield is influenced by morphological and physiological characteristics of sink and source. Phytomass production depends on photosynthesis activity, although CO_2 assimilation is just one of the factors that influences plant development and growth (Foyer & Galtier, 1996). According to Duncan & Baligar (1991) cited by Pimentel 1998, a plant should have high efficiency in the use of nutrients, and so, an efficient root system for the acquisition of these resources. In tropical regions, plants should invest in the root system to be more efficient.

Nowadays, the concept of bioactivator was established as a complex substance, not a bioregulator, that can modify growth, able to act in transcription factors of plants and in gene expression, in proteins of membrane changing ion transport and in metabolic enzymes able to influence secondary metabolism, modifying mineral nutrition, inducing the synthesis of vegetal hormone precursors, leading to hormone synthesis and plant responses to nutrients and hormones (Castro et al., 2006).

Neonicotinoids were introduced in the begining of the ninety's decade aiming to pest control through seed treatment (Barbosa et al., 2002; Meredith & Morris, 2003; Ramiro et al., 2005; Sartorato & Rava, 2004). Other authors observed that beside pest control, yield was also enhanced (Calafiori & Barbieiri, 2001; Grutzmacher et al., 2003).

The aim of this research was to evaluate the effect of Actara® 250 WG application on sugarcane rattons of 'SP 81 - 3250' variety.

MATERIAL AND METHODS

This research was developed at the experimental area of Apta Regional, in Andradina/SP/Brazil. Vases of 100 liters of capacity were used. Employed soil was enriched with P_2O_5, besides liming for soil base saturation around 60%. Product application, using a sprayeroperating for aspray volume of30 liters per hectare, was directed to 2/3 of lower part of the plant, occurred 30 days after transplantation of the ratoons to the vases.Experimental design was split-plot randomized blocks with five replications. Main treatments consisted of Actara® 250 WG (0.2 L ha^{-1}); Actara® 250 WG (0.4 L ha^{-1}); Actara® 250 WG (0.6 L ha^{-1}); Actara® 250 WG (0.8 L ha^{-1}) and Actara® 250 WG (0.6 L ha^{-1}) + Maleic Hydrazide (0.8%) applied 30 days after Actara, respectively. Secondary treatments (time of stalk sampling) occurred at 30, 60, 90, 120 and 150 days after the product application (April 18th to 20th, 2006).

Evaluations consisted of: leaf area, leaf, stalk and root dry matter mass, number of with roots (tillers) and number of roots per node, stalk length at 120 days after application.Data were submitted to variance analyses (F test) and significant interactions analysed by Tukey's test at the level of 5% of probability and polynomial regression for time observations (Zonta & Machado, 1984).

RESULTS AND DISCUSSION

Significant differences among treatments through variance analyses were observed (Table 1). Plants treated with Actara® 250 WG at 0.20 and 0.40 (L ha^{-1}) showed significant differences from control plants. At these dosages it was observed a higher number of changes on evaluated parameters (leaf area, root dry matter mass, number of nodes with roots and number of roots per node). Physiological changes observed by the product application at these dosages promoted a cascade effect, facilitating nutrient absorption with the greatest root system development, enhancing leaf area and finally carbohydrate accumulation by the stalks. For leaf dry matter mass no difference was observed. But, there were significant differences at stalk dry matter mass with Actara at the highest dosages. Significant differences were verified in relation to the control for root dry matter mass of plants treated with Actara(R) 250 WG at 0.2 – 0.4 and 0.8 L ha^{-1}, respectively. It was also observed, 120 days after Actara® 250 WG application, significant difference in the number of nodes with roots for 0.4 L ha^{-1}, and the number of roots per node was significatively higher at 0.20, 0.40 and also 0.80 L ha^{-1}. In relation to stalk length, variance analyses showed significant difference for Actara® 250 WG at 0.40 and 0.6 (L ha^{-1}). The growth inhibitor applied (0.8% of MH) influenced stalk length, when compared to Actara® 250 WG (0.6 L ha^{-1}), and also the number of nodes with roots, probably inhibiting the stimulating action of Thiametoxan.

Table 1 Summary of variance analyses for leaf area (LA), leaf dry matter mass (LDM), stalk dry matter mass (SDM), root dry matter mass (RDM), in sugarcane 'SP 81 - 3250' treated with Actara® 250 WG. Andradina, November, 2006.

Treatments	Dosages (L ha^{-1})	Evaluated Parameters						
						Tillers - 120 Days after application		
		LA (cm^2)	**LDM (g)**	**SDM (g)**	**RDM (g)**	**Nodes with roots**	**Roots/nodes**	**Stalks (cm)**
Control	-	380.09 b	39.17 abc	51.44 c	27.17 b	3.4 bc	18.40 b	69.8 c
Actara® 250 WG	0.20	494.94 a	47.62 a	53.34 bc	37.09 a	4.0 bc	25.20 a	68.2 c
Actara® 250 WG	0.40	550.13 a	43.09 ab	57.06 bc	36.22 a	5.6 a	25.20 a	77.8 ab
Actara® 250 WG	0.60	348.41 b	34.02 c	59.98 b	28.19 b	4.6 ab	22.40 b	83.2 a
Actara® 250 WG	0.80	386.46 b	35.91 bc	69.32 a	35.57 a	4.0 bc	24.0 a	73.2 bc
Actara® 250 WG + MH	0.60 + 0.8%	367.48 b	38.94 bc	67.71 a	33.88 a	3.2 c	20.0 b	70.4 c
LSD (Tukey 0,05)	-	61.68*	8.64*	6.48*	3.99*	1.36*	5.13*	4.99 *
V.C. (%)	-	17.86	26.50	13.25	14.74	24.95	17.22	3.40
Interaction	-	**	**	**	**	*	*	*

^{NS} not significative MH = Maleic Hydrazide

* Significative at 5% of probability.

** Significative at 1% of probability.

Due to the significative interaction for leaf area, treatments were analysed in each time in relation to the control (Table 2). Thirty days after treatment applicationof Actara(R) at 0.20 L ha^{-1}, leaf área showed increase in relation to the control, meanwhile 0.4 L ha^{-1} showed such diference only 60 daa. Polynomial regression for time of stalks sampling showed a polynomial effect at 0.4 and 0.8 L ha^{-1}, indicating an anticipation of leaf area development. These results are important once the earlier development facilitates crop management, mainly in relation to light interception and also weed control. Dosage of 0.4 L ha^{-1} was kept signicatively higher than the control 150 daa, like showing that a square regression model. This difference can be related to the higher root dry matter mass found 60 daa (Table 5). This situation is according to the suggestions proposed by Duncan & Balizar (1991) andFoyer & Galtier, (1996).

Statistical analyses for the treatments in each time did not show any significant differences for leaf dry matter mass (Table 3). It can be observed the effect of the bioactivator Actara® 250 WG (0.4 L ha^{-1}) at 60 daa if compared to the higher dosages.

Table 2 Summary of the variance analyses of treatments in each time for leaf area (LA) and the respective polynomial regression model, in sugarcane 'SP 81 - 3250' treated with Actara® 250 WG. Andradina, November 2006.

Treatments	Dosage (L ha^{-1})	Leaf area (cm^2) – Days after application (daa)					
		30	60	90	120	150	Regression model
Testemunha	-	245.03 b	342.48 bc	401.39 abc	426.06 b	485.48 bc	Linear
Actara® 250 WG	0.20	398.69 a	445.38 b	523.82 a	536.43 ab	570.37 b	Linear
Actara® 250 WG	0.40	233.98 b	641.28 a	500.77 a	632.68 a	741.96 a	squared
Actara® 250 WG	0.60	252.78 b	357.75 bc	291.70 c	403.70 b	436.11 bc	Linear
Actara® 250 WG	0.80	256.97 b	287.17 c	472.70 ab	515.24 ab	400.25 c	squared
Actara® 250 WG + MH	0.60 + 0.8%	251.91 b	292.49 c	341.16 bc	465.91 b	485.92 bc	Linear
Standard error	33,64						

MH = Maleic Hydrazide

Table 3 Summary of the variance analyses of treatments in each time for leaf dry matter mass (LDM) and the respective polynomial regression model, in sugarcane 'SP 81 - 3250' treated with Actara® 250 WG. Andradina, November 2006.

Treatments	Dosage (L ha^{-1})	Leaf Dry Matter Mass (g) - Days after application (daa)					
		30	**60**	**90**	**120**	**150**	**Regression model**
Control	-	22.39	44.45 abc	44.02 ab	46.91	38.06	squared
Actara® 250 WG	0.20	36.31	62.57 a	50.57 a	51.64	37.00	squared
Actara® 250 WG	0.40	21.65	62.99 a	45.55 ab	42.29	43.00	squared
Actara® 250 WG	0.60	22.85	38.29 bc	30.63 b	43.43	34.90	Linear
Actara® 250 WG	0.80	20.93	27.18 c	52.59 a	47.14	31.70	squared

Actara® 250 WG + MH	0.60 + 0.8%	21.83	51.20 ab	34.84 ab	46.73	40.10	squared
Standard error	19.33						

MH = Maleic Hydrazide

Variance analyses of treatments in each time for stalk dry matter mass showed significant differences from the control after 60 daa for the treatments with Actara® 250 WG, at 0.6 L ha^{-1} and also when maleic hydrazide was applied at 0.8% 30 daa. The linear increase in stalk dry matter mass with Actara® 250 WG at 0.4 until 0.8 L ha^{-1} can be important from the physiological point of view, once the movement of photoassimilates is not affect in function of the greater leaf area.

Table 4 Summary of the variance analyses of treatments in each time for stalk dry matter mass (SDM) and the respective polynomial regression model, in sugarcane 'SP 81 - 3250' treated with Actara® 250 WG. Andradina, November 2006.

Treatments	Dosage (L ha^{-1})	Stalk dry matter mass (g) - Days after application (daa)					
		30	60	90	120	150	Regression model
Control	-	16.66	35.62 c	34.98 c	79.37 a	90.57 b	squared
Actara® 250 WG	0.20	26.77	35.90 c	35.57 c	80.59 a	87.85 b	squared
Actara® 250 WG	0.40	17.57	46.21 bc	59.97 ab	63.69 b	97.85 b	Linear
Actara® 250 WG	0.60	21.75	55.19 ab	43.37 c	77.93 ab	97.15 b	Linear
Actara® 250 WG	0.80	19.89	44.76 bc	72.83 a	90.24 a	118.90 a	Linear
Actara® 250 WG + MH	0.60 + 0.8%	26.34	62.10 a	52.00 bc	82.47 a	115.65 a	squared
Standard error	3.53						

According to the variance analysis it could be observed significant differences among treatments for root dry matter mass, for each evaluated time. Treatment with Actara(R) 250 WG (0.20 L ha^{-1}) differed from control after 60 daa, keeping this difference until 150 daa. Treatment with Actara at 0.40 L ha^{-1} was statistically different from control at 60, 90 and 150 daa. At 150 daa all the treatments were different from control, probably showing a stress condition that control could have been submitted. The greatest increase in root dry matter mass occurred between 60 and 90 daa of Actara® 250 WG. Aguiar (1976) obtained different results. Analysing the application of Actara(R) 250 WG at 0.6 L ha^{-1}, it could be verified no significant difference for root dry matter mass when the plant inhibitor was applied. Probably the period of 30 days was to long so that the inhibitor promoted the desirable effect on root system. Such inhibition observed was only for stalk growth (Table 1).

Table 5 Summary of the variance analyses of treatments in each time for root dry matter mass (RDM) and the respective polynomial regression model, in sugarcane 'SP 81 - 3250' treated with Actara® 250 WG. Andradina, November 2006.

	Root dry matter mass (g) - Days after application

Treatments	Dosage (L ha^{-1})	30	60	90	120	150	Regression Model
Control	-	22.53 ab	30.71 c	35.95 b	29.71 b	16.96 d	Squared
Actara® 250 WG	0.20	26.33 a	45.32 b	45.49 a	40.82 a	27.49 c	Squared
Actara® 250 WG	0.40	16.20 bc	66.24 a	47.04 a	21.87 b	29.77 c	Squared
Actara® 250 WG	0.60	15.71 bc	31.73 c	36.02 b	24.41 b	33.11 bc	Squared
Actara® 250 WG	0.80	13.32 c	37.64 bc	43.19 ab	39.27 a	44.43 a	Squared
Actara® 250 WG + MH	0.60 + 0.8%	23.82 ab	36.61 bc	40.57 ab	28.96 b	39.42 ab	Squared
Standard error	2.17						

CONCLUSIONS

Actara(R) 250 WG acted as a bioactivator, promoting the development of root primordia in sugarcane ratoon; increased leaf area; promoted an increase in the number of nodes with roots; increased the number of roots per node at 0.2 and 0.4 L ha^{-1}.

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