INTRODUCTION

Silicon is not an essential element (Epstein, 1999), but its fertilization to Si-accumulating plants, such as sugarcane, could exhibit increased yields (Fox et al., 1967, Elawad et al.,1992; Anderson et al.,1991; Korndörfer et al., 2002).

Soils cultivated with sugarcane were classified in four groups (Berthelsen et al.2002) as a function of the amount of soluble Si in $CaCl_2$ 0.01 Mol L^{-1} (mg kg^{-1} Si): very low (0-5), low (5-10), limited (10-20), and sufficient (20 to >50). Several classes of soils in Brazil are classified as low silicon content (Korndörfer et al., 2002) and these soils are cultivated with sugarcane.

Considering the lack of data on Si fertilization of sugarcane in Brazil, our objectives were to evaluate Si availability in soils, dry matter and uptake in sugarcane cultivated in three soil types with and without silicate.

MATERIAL AND METHODS

The experiment was conducted in pots (100 L) under field conditions from January 10 to November 26, 2008 at the APTA Pólo Centro Sul experimental farm in Piracicaba, SP, Brazil. The IAC 87 3396 sugarcane cultivar was used. It was set up in a completely randomized factorial scheme (4 x 3 x 2) with silicon rates (0, 185, 370 and 555 kg ha^{-1} Si) and soils (Table 1): Quartzipsamment (RQ), Rhodic Hapludox (LV) and Rhodic Acrudox (LVdf), in 4 repetitions. The Ca-Mg silicate contained 10.8 g kg^{-1} Si, 262 g kg^{-1} Ca, and 56.8 g kg^{-1} Mg. All plots received the same Ca and Mg quantities with additions of lime (343 g kg^{-1} Ca, 96 g kg^{-1} Mg) and/or $MgCl_2$ (11.9% Mg) when necessary.

Table 1. Texture, soluble silicon in acetic acid 0.5 mol L^{-1} (AA) and $CaCl_2$ 0.01 mol L^{-1} (CC) and chemical characteristics of soils.

Soils	Clay	AA	CC	pH	MO	P	K	Ca	Mg	H+Al	T	V
	%	mg kg^{-1} Si		$CaCl_2$	g kg^{-1}	mg dm^{-3}	----------- $mmol_c$ dm^{-3} ----------					%
RQ	6	1.0	0.9	4.2	11	18.0	0.4	3.0	1.0	16	20.4	22
LV	22	8.1	4.9	4.6	22	8.0	0.7	18.0	5.0	31	54.7	43
LVdf	68	10.7	5.7	4.0	26	3.0	0.9	7.0	3.0	80	90.9	12

The materials (silicate, lime and or $MgCl_2$) were applied in soils remaining in an incubation period for 40 days. Two sugarcane plants were transplanted in each pot on January 14, 2008. Soils received basal fertilization in planting (180 kg ha^{-1} P_2O_5 .30 kg ha^{-1} N; 100 kg ha^{-1} K_2O) and surface fertilization (30 kg ha^{-1} N, 100 kg ha^{-1} K_2O). Micronutrients were not used because their levels were sufficient before planting.

Sugarcane was harvested on November 26, 2008 and divided into leaves and stalks. The height and diameter of the stalks and the weight of the fresh matter were evaluated. After that, Si content determination was done as described by Elliot e Snyder (1991). The analyses of variance were made applying the F test. The soils were compared by the Tukey test and rates of Si by polynomial regression.

RESULTS AND DISCUSSION

The soluble Si concentrations in the extractants were increased with higher rates of Si, and were different for each type of soil (Figure 1).The LVdf soil showed the higher soluble Si concentration, followed by LV and RQ in all the extractants due to clay content (Raij and

Camargo,1973; Camargo et al.,2007a). The concentrations in acetic acid (AA) were greater than that obtained by $CaCl_2$ (CC), as already shown by Camargo et al. (2007b).

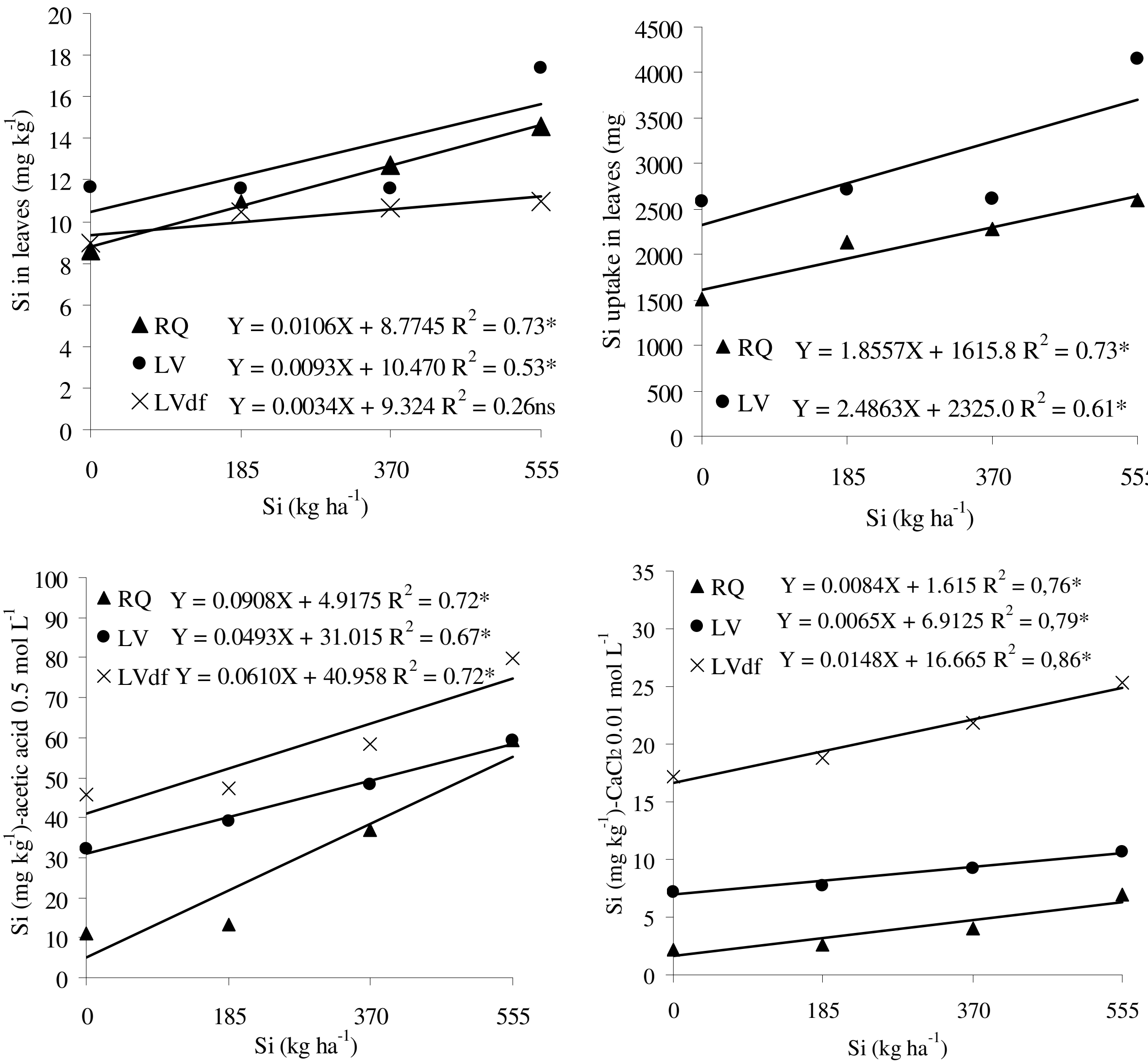

Figure 1. Concentration uptake in leaves and stalks after harvest of sugarcane and soluble silicon in soils with silicon (*$p<0.05$).

There were influences from soil type and rate of Si on its concentration in leaves (Figure 1). The concentrations were lower with LVdf, and this could be associated with a dilution effect once the plants achieved their best yield in this soil (Table 2). This was confirmed by the Si uptake levels of LV and LVdf, which presented the greatest values.

Higher rates of Si promoted increases in uptake in the leaves of plants grown in RQ and LV (Figure 1) as a consequence of their low initial Si contents (Table 1). Additionally, it is important to emphasize that the LVdf soil did not show positive effects due to its higher clay content (Table 1), which could provide greater quantities of Si to plants, but it is not shown by the extractants. Soils with high clay, Fe and Al oxide contents could yield underestimated concentrations of soluble Si, extracted with acetic acid or with $CaCl_2$, due to certain Al-Si or

Fe-Si formations (Camargo et al., 2007b). There was positive relationship between Si total uptake and soluble Si to RQ (AA R^2=0.38; CC R^2=0.39,$p<0.05$), LV (AA R^2=0.36;CC R^2=0.47,$p<0.05$) and LVdf (AA R^2=0.24; CC R^2=0.35,$p>0.05$), respectively. In contrast, Si uptake in stalks did not show any difference between soils and rates (Table 2). This could be related to low contents in that particular part of the plant or to the occurrence of dilution effect.

Table 2. Dry matter of sugarcane (leave +stalk) and silicon concentration and uptake on leaves in three soils.

Soils	Dry matter		Concentration	Uptake
	Leave	Stalk		
	-------------------g-------------------		-------g kg^{-1}------	-------mg--------
RQ	182.1b	400.9b	3.47 a	1362.6a
LV	231.0a	486.6a	2.57 b	1251.5a
LVdf	232.0a	437.1ab	2.47 b	1084.4 a
MSD*	20.43	57.8	0.800	341.8

*Means followed by the same letter in the column did not differ by Tukey test ($P<0.05$).

CONCLUSIONS

Added Si applied increased the amounts of soluble content in all soils but Si uptake in leaves of sugarcane were just increased to RQ and LV. However, addition of Si to the soils did not promote changes in dry matter yields and Si uptake on stalks of sugarcane.

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