Silicon fertilization in the development and production of wheat crop

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Introduction The wheat (*Triticum aestivum* L.) is a crop of great importance in the world and is used in animal feeding in the form of green fodder and hay, dual purpose, and vegetation cover, green manure and also in food in the form of grain (Scheeren, 1984). Wheat as a dual-purpose crop has been used in several countries such as the United States, Uruguay and Argentina, as excellent financial return to farmers (Fontaneli et al., 2007). The importance of silicon, which is not considered essential but beneficial to plants is mainly related to increased growth and crop production through various indirect actions, making leaves erecter with decreased self-shading, greater structural rigidity of tissues, reduced lodging, protection against both abiotic stresses, such as reducing the toxicity of iron, manganese, aluminum and sodium as biotic stresses, increased protection from pathogens and phytophagous insects (Epstein, 1994) and (Marschner, 1995). Hence, this study aimed the evaluation of the effects of calcium silicate doses on the development and production of wheat crop.

Material and Methods The experiment was conducted in a greenhouse at the Department of Experimental Stations of Unioeste, Marechal Cândido Rondon – PR campus, from May to July 2012. The experiment was established and conducted in polyethylene pots of 8.5 dm^{-3}, containing 8 dm^{-3} of soil sieved at 5 mm mesh. The soil used for filling the vessel had clayey, which was collected from the plow layer of 0-0,2 m, the city of Marechal Cândido Rondon - PR rated Oxisol, with the following attributes: pH ($CaCl_2$): 5.55 MO (g kg^{-1}): 20.51; P (mg dm^{-3}): 16,91; H + Al, K, Ca, Mg, SB and CTC: 4.4; 0.06; 3.74; 0.62; 4.42 and 8.82, and V (%) of 50.11. The experiment was conducted in randomized block design with five doses of calcium silicate (0, 1.2; 2.4; 4.8 and 9.6 t ha^{-1}) and four replications, totaling 20 experimental units. Calcium silicate ($CaSiO_3$) which trade name is *Agrossilício* was used as a source of silicon, so that this product has the composition of 25% calcium, 6% magnesium and 10.5% silicon. At the time of seeding fertilization was performed according to basic Raij et al. (1997), with application of 30 kg N ha^{-1}, 60 kg ha^{-1} of P_2O_5 and 45 kg K_2O ha^{-1} as urea, superphosphate and potassium chloride, respectively. After 30 days of culture, there was topdressing, applying 45 kg ha^{-1} of N as urea. Five seeding in wheat seeds per pot were used, BRS Pardela, and after ten days thinning was performed leaving three seedlings per pot. The pots were irrigated daily, trying to keep soil moisture close to 80% of its field capacity. At the end of the cycle plant height was evaluated right before the cutting of the plants, it was obtained by measuring from the base to the apex of plants (cm) and then there was the cutting of the shoots to quantify shoot dry matter (g), the number of tillers and yield per pot (g). The data were subjected to variance analysis through F test. When effects were significant, polynomial regression studies were applied (Pimentel-Gomes & Garcia, 2002), using SAEG 8.0 (SAEG, 1999) statistical program.

Results and Discussion Regarding dry matter production of shoots, plant height, number of tillers and grain yield there was no significant difference due to the increasing doses of calcium silicate (Table 1).

Table 1 Shoots dry matter production, plant height, number of tillers, and wheat crop productin, due to increasing doses of calcium silicate, Marechal Cândido Rondon - PR, 2012.

Silicate Dose	Dry Matter	Height	Tillers	Production
t ha^{-1}	g/pot	cm	n°/pot	g/pot
0	11.7	87.8	5.0	6.6
1.2	12.4	86.5	4.8	7.7
2.4	12.3	81.7	4.5	5.4
4.8	11.3	85.2	4.3	6.8
9.6	12.1	83.9	5,0	6.5
Average	11.9 ^{ns}	85.0 ^{ns}	4.7 ^{ns}	6.6 ^{ns}
C.V (%)	14.99	4.91	16.37	24.4

Means followed by same lowercase on the row do not differ by Tukey test at 5% probability ($P < 0.05$)

It is clear that for dry matter production the dose of 1.2 t ha^{-1} resulted in the highest accumulation of dry matter, with 12.4 g/pot while the dose 4.8 t ha^{-1} resulted in less dry matter accumulation, with 11.3 g/pot, but no significant difference. Corroborating research developed by Korndorfer et al. (2010) and Melo et al. (2003) to study the *Brachiaria* sp, reported that application of Si in the soil increased concentration of Si in plants, but did not alter dry matter production of *Brachiaria* sp. For plant height the control provided 87.8 cm, and the dose of 2.4 t ha^{-1} provided 81.7 cm, yet statistically similar. The results are in agreement with those obtained by Rocha et al. (2011) who, studying the residual effect of the slag in sorghum, observed that the height of sorghum plants was not affected by silicon fertilization. It was observed that the dose of 1.2 t ha^{-1} provided the highest production 7.7 g/pot, and the dose 2.4 t ha^{-1} gave a lower production 5.4 g/pot, however no significant differences. On the other hand Barbosa Filho et al. (2004) studied the silicate slag grain yield of upland rice and detected significant production increase within two years of rice cultivation.

Conclusions Fertilization with calcium silicate influenced neither dry matter of shoots, plant height, the number of tillers nor production of wheat crop.