Effect of soil conditioners on nutrient uptake by a green pepper crop

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Introduction

Soil conditioners, whether natural (organic) or synthetic, can improve the soil structure through stabilizing the aggregates but they can also have a positive effect on moisture retention, on soil fertility and on infiltration and workability.

Water absorbent soil conditioners as hydrogels have shown their efficiency on water use and nutrients uptake by crops in media for plant growth.

This study aimed to compare the effects of two soil conditioners (1) a hydroabsorbent based soil conditioner: TerraCottem®, and (2) cattle manure: bovine) on nutrient uptake by green pepper (*Capsicum annuum* L.) in a sandy soil from a dryland of Venezuela.

Materials and Methods

Soil and location: The soil is a Ustic Haplargids loamy fine sand (Table 1), located in the Maracaibo Plain (lat. 10 ° 31 ', long. 71 º 39', alt. 26 meters). The average annual rainfall is 558 mm, with a mean annual temperature of 28.7 °C, ETo 2340 mm.

Treatments:

Soil + Terracottem® **(STC) :** mixture of hydroabsorbent polymers + fertilizers

Soil + Bovine Manure **(SBM):** equivalent dose 13 t ha^{-1} + urea (1,58 g/pot) + K_2SO_4 (1,27 g/pot)

Soil + Chemical Fertilizer **(SCF)**: 0,391g urea (1,8 g N); 0,254 g SPT (1,17 g P_2O_5) and 0,288g of K_2SO_4 (1,44 g K_2O)

Control **(S)**: Soil without conditioners

Irrigation doses

100 % 'pot' capacity (**L1)** (similar to field capacity).

80 % 'pot' capacity **(L2**)

Crop

Green pepper (*Capsicum annuum* L.) var. California wonder

Table 1: Physical and chemical characteristics of soil.

Sand (%)	Silt (%)	Clay (%)	Texture	Bulk density (Mg m^{-3})	Organic matter (%)	E.C. (dS m^{-1})	CEC (cmol kg^{-1})	N total (%)	pH (1:1)
80.0	17.5	2.5	aF	1,46	0,81	0,20	1,7	0,036	5,74
P	K	Ca	Na	Mg	S	Mn	Fe	Cu	Zn
					(mg kg^{-1})				
13	26	25	14	30	0,97	12	15	0,64	2,44

Results and discussion

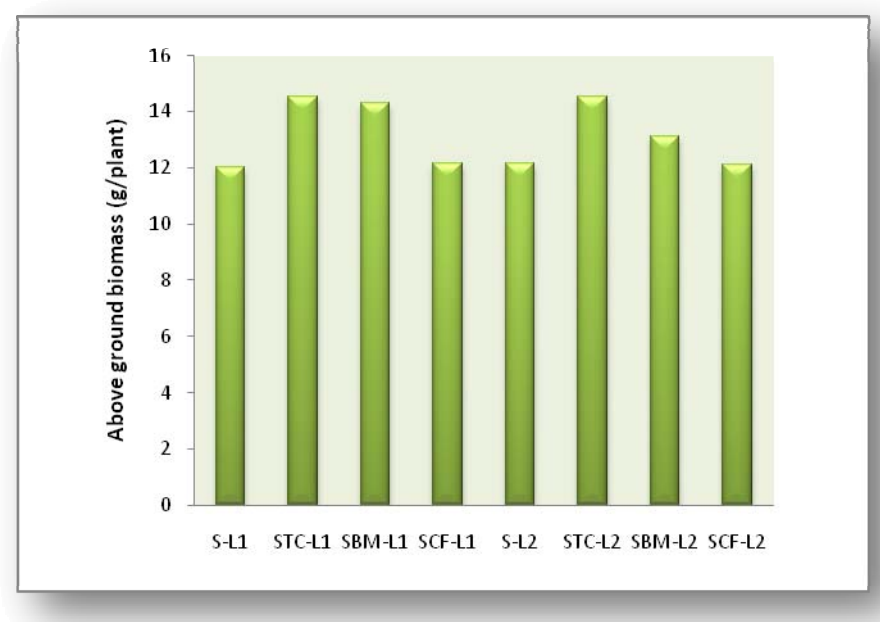

Figure 1. Production of above ground biomass (g/plant)

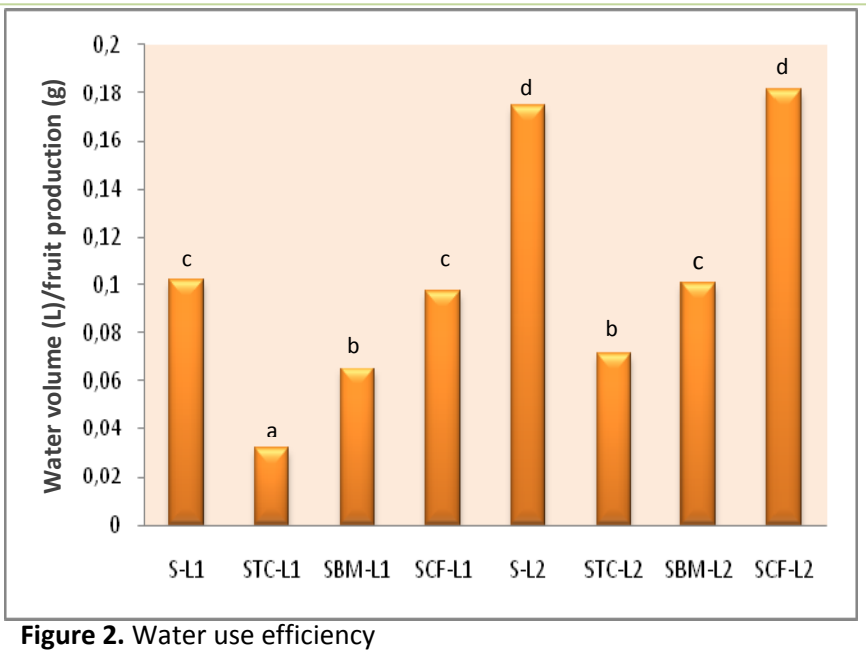

Figure 2. Water use efficiency

Table 2. Nutrient concentration in the above ground plant tissue

Treatment	N	P	K	Ca	Mg
S-L1	1,83b	0,33b	1,22b	1,86	0,14
STC-L1	2,72a	0,43a	1,93a	2,05	0,11
SBM-L1	1,69b	0,30b	0,75b	1,89	0,11
SCF-L1	2,38a	0,44a	1,10b	2,54	0,15
S-L2	1,96b	0,35b	1,18b	2,00	0,13
STC-L2	2,39a	0,41a	1,92a	2,26	0,10
SBM-L2	2,04b	0,32b	1,02b	1,89	0,13
SCF-L2	2,63a	0,35b	1,41b	2,61	0,15

No significant differences between treatments were found with respect to above ground biomass of green pepper. Howwever from Figure 1 it can be observed that treatments with hydrogel with both doses of irrigation (STC-L1 and STC-L2) and the treatment with bovine manure (SBM-L1) with highest irrigation doses showed the highest production of above ground biomass

Water use efficiency (WUE), expressed in terms of water consumption per fruit production was significantly increased in the treatments with hydrogel and the highest dose of irrigation. The lowest efficiency in water use can be observed with treatments with the lowest dose of irrigation in the chemical fertilizer treatments and control (Figure 2). The deficit irrigation (lowest dose L2, 80% pot capacity) in this soil with a high sand content negatively affected the fruit production and hence the water use efficiency was lower.

Soil conditioners and especially the hydrogel, resulted in higher concentrations of N, P and K uptake, compared to the cattle manure (Table 2). Those effects may be attributed to the increased water use efficiency when conditioners are applied.

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