Greenhouse Experiment Comparing Biochar and Compost Applications to a Saline and a Volcanic Soil to Grow Barley

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Introduction

Organic waste from either households or gardening can be processed and transformed into soil amendments. This can be a viable option for large cities where a great amount of organic waste is produced and soils are often severely degraded and need to be ameliorated. Since different types of organic amendments perform different in particular soils, our aim was to evaluate three organic amendments on 2 different soils by growing barley (*Hordeum vulgare*) in a greenhouse pot experiment.

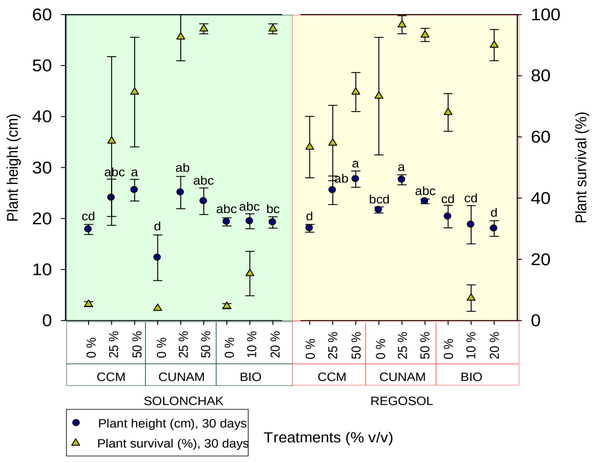
Methods

Soils (Figure 1): a) vitric Regosol (**RGO**): sandy loam with medium nutrient contents from a conservation area near Mexico City,
b) gleyic-mollic Solonchak (**SLO**): clay loam, with large contents of soluble salts sampled at former lake Texcoco.

Amendments: a) compost produced with organic waste from Mexico City (**CCM**), b) compost produced with gardening residues (**CUNAM**) and c) biochar produced with gardening residues (**BIO**). Each amendment was applied in 2 doses and the control treatment. Plants were cut down twice. The response variables were plant height, plant survival and plant biomass production. Furthermore, soil physico-chemical properties were analyzed to compare differences between treatments and between time zero (before planting) and time one (at the end of the pot experiment).

Results

Greenhouse



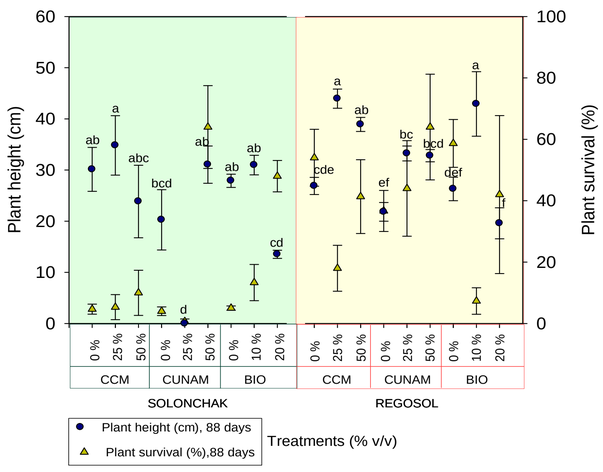


Figure 3. Average plant height with plant survival. The letters indicate significant differences in plant height between treatments after 30 (above) and 88 days (below). LSD, α =0.05, 30days: SLOp= 0.0542, RGOp = 0.0089, 88days: SLOp= 0.0017, RGOp = 0.0004

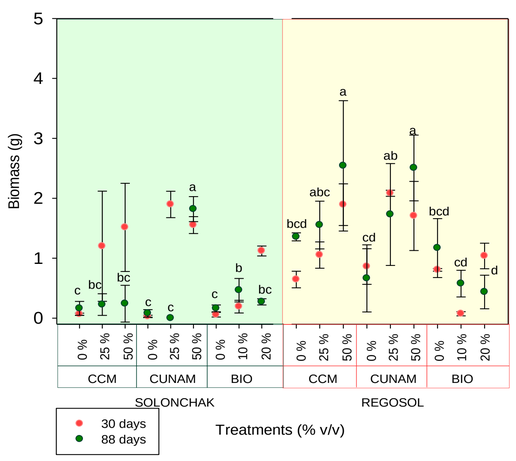


Figure 4. Plant biomass production. The letters indicate significant differences between treatments after 88 days. LSD, α =0.05, SLOp =0.0000 RGOp =0.0143

Note: All figures show mean and standard deviation .

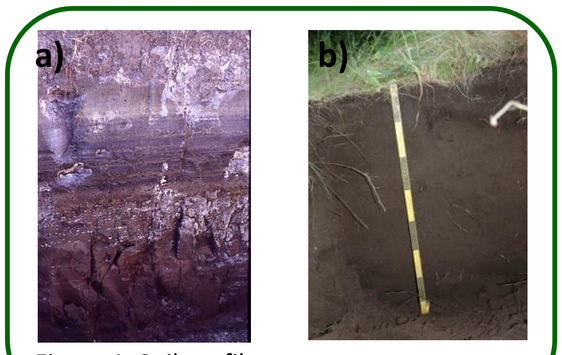


Figure 1. Soil profiles.

	pH (water)	EC (mS)	C tot (%)	N tot (%)	C:N ratio	P (%)
CCM (Michler, 2013)	8.3	14 (1:10)	27.5	2.5	11	1.31
CUNAM (Bacre et al, 2012)	7.26	10.41 (1:2.5)	41.4	2.4	17.2	0.273
BIO (Bacre et al, 2012)	9.32	5.21 (1:5)	65.2	1.6	40.8	0.318

Figure 2. Some chemical properties of organic amendements.

Physico – Chemical analyses

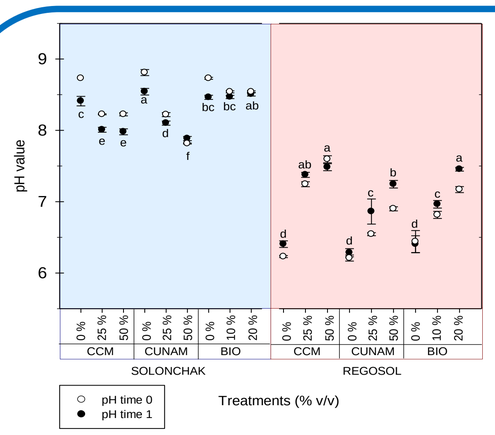


Figure 5. Soil pH. LSD, α =0.05, SLOp =0.0000 RGOp =0.0019

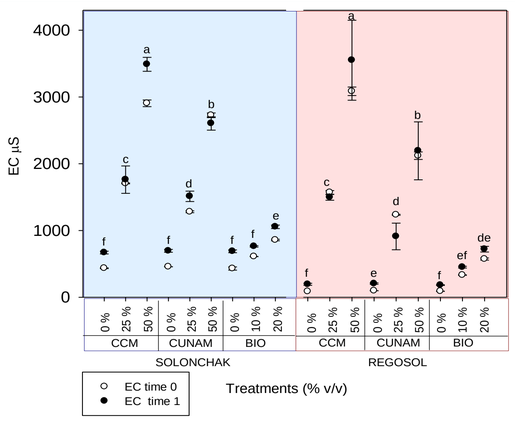


Figure 6. Electrical Conductivity EC (µS). LSD, α =0.05, SLOp =0.0000 RGOp =0.0000

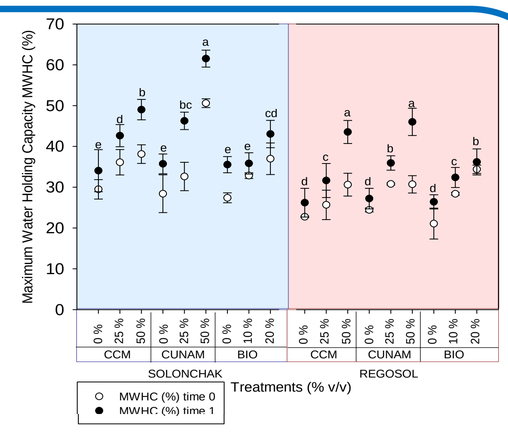


Figure 7. Maximun water holding capacity MWHC (%). LSD, α =0.05, SLOp =0.0000 RGOp =0.0002

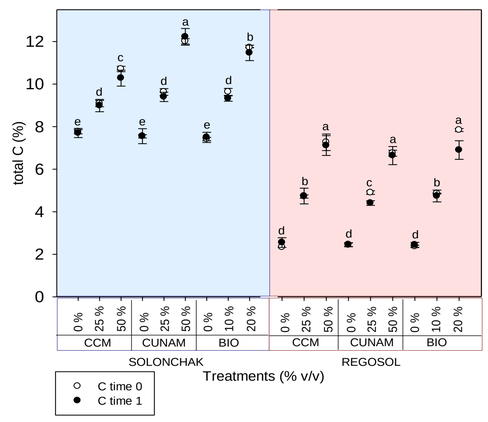


Figure 8. Total Carbon (%). LSD, α =0.05, SLOp =0.0000 RGOp =0.0000.

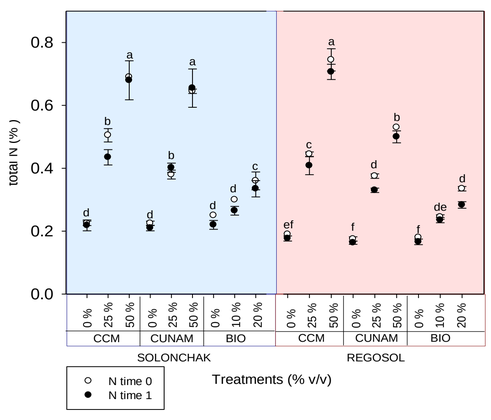


Figure 9. Total Nitrogen (%). LSD, α =0.05, SLOp =0.0000 RGOp =0.0000.

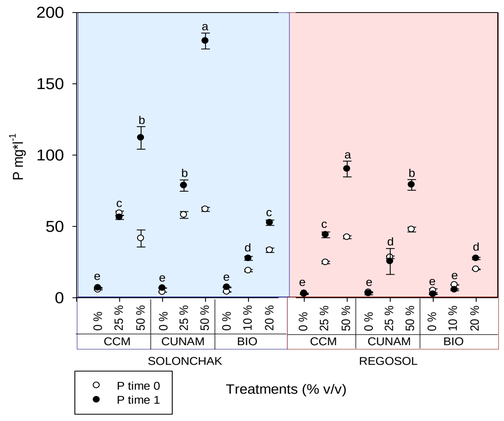


Figure 10. Soil Phosphorus content (mg*l^{-1}). LSD , α =0.05, SLOp =0.0000 RGOp =0.0019

Note: All figures show mean and standard deviation . The letters indicate significant differences between treatments at the end of the pot experiment (time 1)

Conclusions

There is a clear and significant response of soil properties and plant biomass to addition of organic amendments.

The better responses for the greenhouse experiment and physico-chemical properties were observed with composts (CCM and CUNAM) overall in Solonchak (SLO) treatments.

The addition of organic amendments was crucial for plant survival in the SLO treatments.

This was probably due to the increased the water holding capacity of up to 100% by the addition of amendments when it is compared with the control treatment.