Urban Food^{Plus}

Effects of biochar and wastewater irrigation on crop production in urban horticulture of Tamale, Ghana

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Introduction

 Agricultural production needs to increase in sub-Saharan Africa, given its large undernourished population and



Results

• Biochar increased fresh matter yield of the vegetables grown in the first four cropping cycles in both clean and wastewater irrigated plots with a pronounced wastewater effect

rapid urban population growth

- Fertilizer is expensive, water is scarce, and wastewater treatment is nonexistent in most cities, thus farmers rely on the use of wastewater
- Biochar is a promising soil management option to increase SOC in environment with fast mineralization
- Little is known about the agronomic benefit of biochar in wastewater irrigated vegetable production
- This study sought to evaluate the effect of biochar amendment and wastewater irrigation on crop yield and biomass production

Figure 1. Map of study area (insert – experimental field)

Agronomic inputs

Total rainfall for 2 years: ≈ 1600 mm Total irrigation for 2 years: 2126 l m⁻² Dry season: October – March (6 months y⁻¹) Wet season: April –September (6 months y⁻¹) Mean Temperature: 27.9°C

ww: 78 N, 25 P and 13 K kg ha⁻¹ av. nutrient input/cropping cycle

FP: 62 N, 20 P and 36 K kg ha⁻¹ av. fertilization/cropping cycle

• Wastewater increased crop fresh matter yields of unfertilised plots up to 20 fold for the dry season (year 1) but there was only a mean increment of 4-fold in year-2; compared with a mean increment of 4-fold in the wet season



Methodology

01/05/2014

01/08/2014

- A two-year trial was established in Tamale, Ghana (Fig. 1)
- Four soil management practices -Farmers Practice (FP), Biochar (BC), FP+BC and control were irrigated with two water quality levels - waste (ww) and clean water (cw) and two water quantity levels (100 and 67%)
- 16 treatments were replicated in four blocks on an 8 m² plots in a multifactorial split block design
- Rice husk biochar was applied once at 20 t ha⁻¹ for the thirteen cropping cycles

01/02/2015

01/05/2015

01/08/201

01/11/2015

01/02/2016

01/11/2014

Highlights

- Biochar tended to increase yields in the first year (16 % on fertilised but effects were plots), not statistically significant in any year.
- Fertigation with wastewater contributes significantly to plant nutrition and efficient resource use.

400

Figure 2. (a) Incorporation of biochar (b) amaranth growing in the field (c) a panoramic view of the experimental field during the first crop

- For fertilised plots, a mean increment of 1.6 and 2.6-fold were observed for the wet and dry seasons. This was explained by the higher concentration of nutrients and the more frequent irrigation during the dry season (Fig. 3)
- Nutrient uptake by crops was of similar extent in the first season but significantly different between clean and wastewater in the subsequent seasons (Fig. 4)

FP+cw ■ FP+BC+ww FP+ww FP+BC+cw

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