Fertility and quality of soil as affected by external additives: effect of integrated biochar and polymer application

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SOILS: WHERE FOOD BEGINS

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Introduction

Application of biochar along with traditional mineral fertilizers, and combined with other soil amendments such as polyacrylamide (PAM) could be an effective approaches for improvement of soil fertility and health and crop production, and soil and water conservation.

Objective

To examine the effect of corn biochar as the external nutrients and anionic PAM as a soil stabilizer on soil quality and wheat yield under rainfed field condition.

Methodology

- Location: Temperate region (Turkey)
- Wheat: seedling 200 kg/ha
- Alfisol: clay loam, medium quality
- Vegetation: November-July
- Biochar (corn): 2 t/ha
- PAM (anionic): 20 kg/ha
- N: kg/ha
- P: 20 kg/ha

Treatments

- Control
- Biochar
- Biochar + PAM

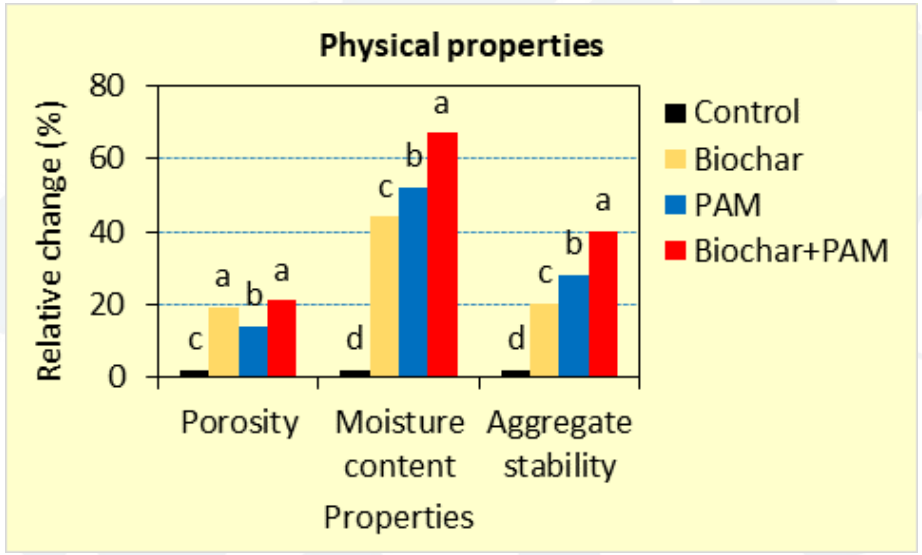
- Field Plots: 2 x 8 = 16 m^2
- Replications: 3
- Slope 12 ^{0}

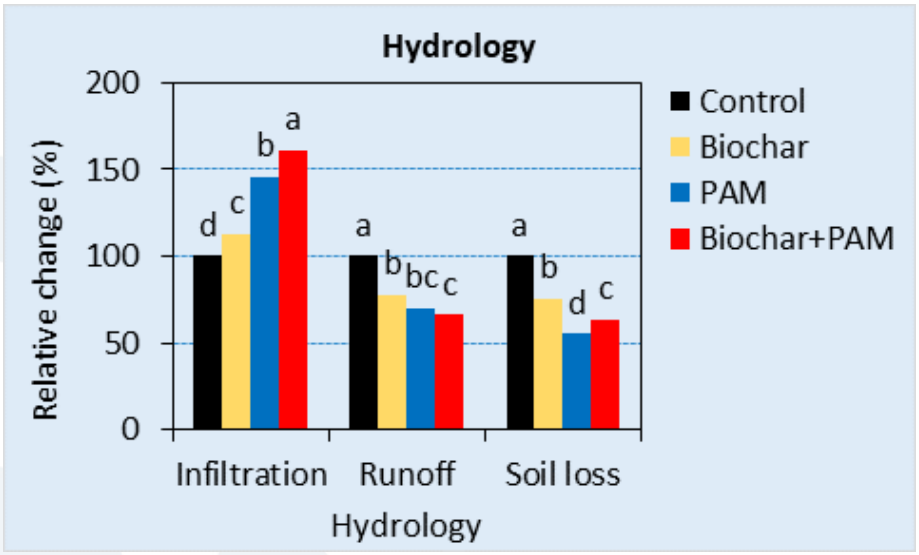
Measurements

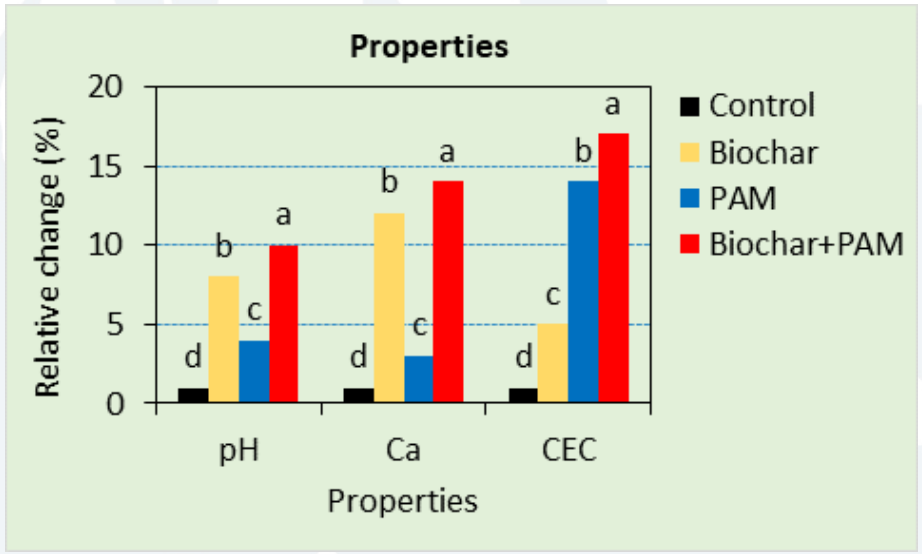
Soil quality-fertility: • pH, Ca, CEC • Porosity, Moisture content, Aggregate stability

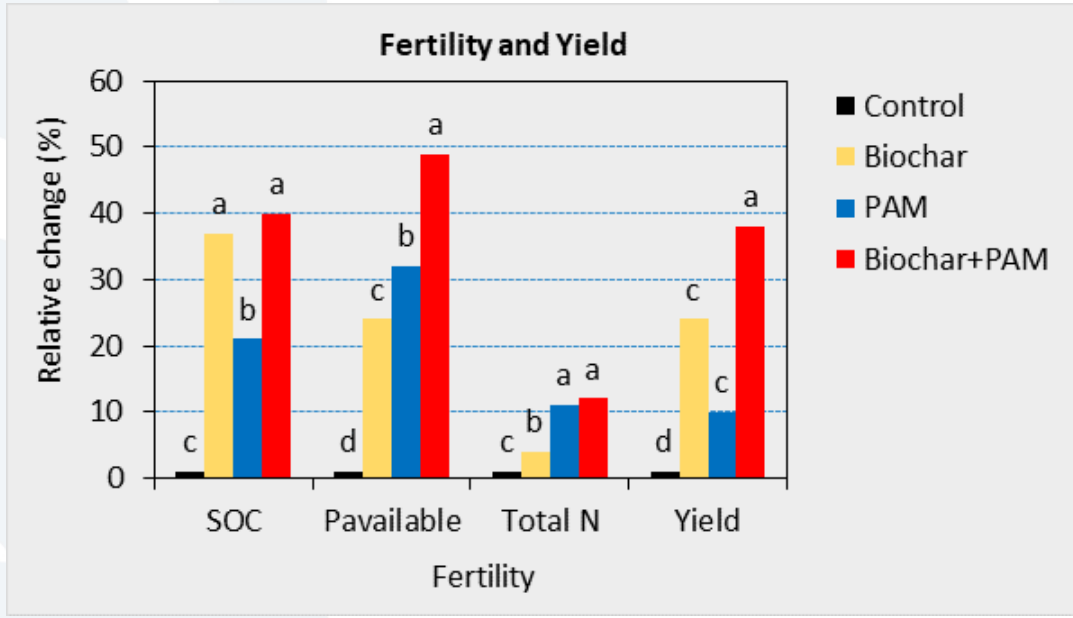
- infiltration, runoff, soil loss • SOC, P_{av}, Total N, Yield

Results









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Results

Compared with the control, biochar and biochar + PAM treatments

- soil pH, Total N, exchangeable Ca, cation exchange capacity (CEC): 7−12%.
- Soil organic carbon (SOC: 26−36%), available phosphorous (P: 22−40%), wheat yield (21−34%)
- Soil macroporosity, soil water content (12−19%) and infiltration (15−42%).
- Soil loss (28−42%) and associated nutrient loss (N: 18−34%, P: 21−48%).

Biochar + PAM had an interaction effect, leading to the improved soil fertility and quality and crop yield by the following order: Control < Biochar < Biochar +PAM.

Discussion

- The affirmative effect of the treatments were related to the improved
  - soil pH, soil nutrients content (N, P, SOC), and water content as a consequence of biochar adding as an external stable nutrient sources.
  - soil structure and water retention capacity and thus decreased soil erosion and nutrient loss by the PAM application, as a faster soil stabilizer.
- Combined effect of the amendments increased soil water and nutrient use efficiency and subsequently crop development and yield.

Conclusion

- The effect of biochar application on crop productivity was associated with both chemical and physical properties of soils.
- As a feasible soil fertility management, Biochar + PAM influence on soil quality and fertility and crop yield was much more effective than biochar alone treatments.
- Integrated application could be used in the context of sustainable management and climate change mitigation.

Thank you !

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