10th International Conference on Sustainable Solid Waste Management

Application of Pistachio Shell Biochar with Organic Cow Manure for Sustainable Agriculture Practice

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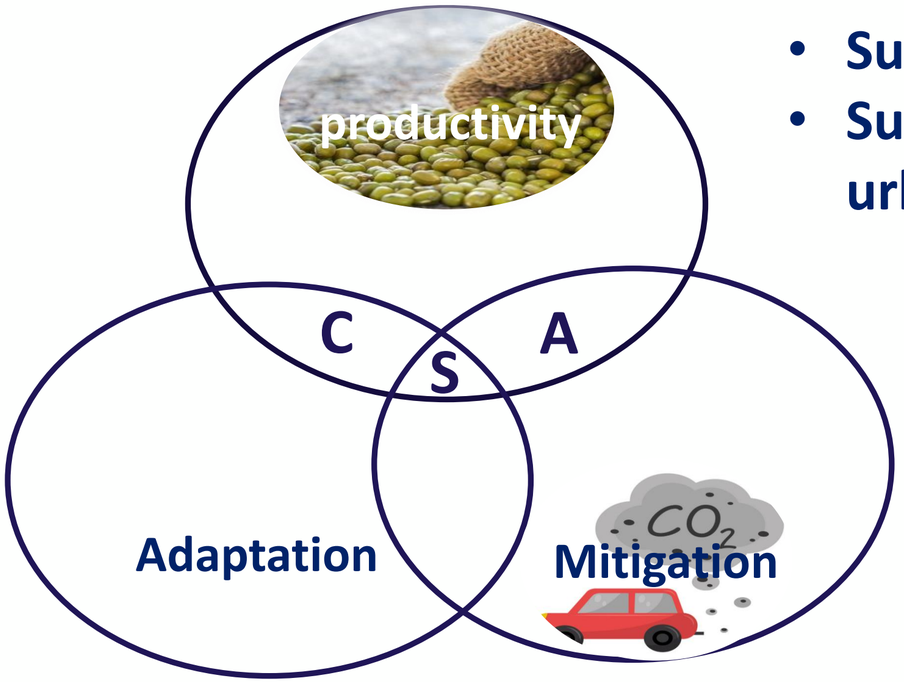
Background

Food and land-use system



- **Sustainable food security**
- **Support to rural and urban livelihoods**

Strengthen resilience of agriculture & food systems to climate changes & variability

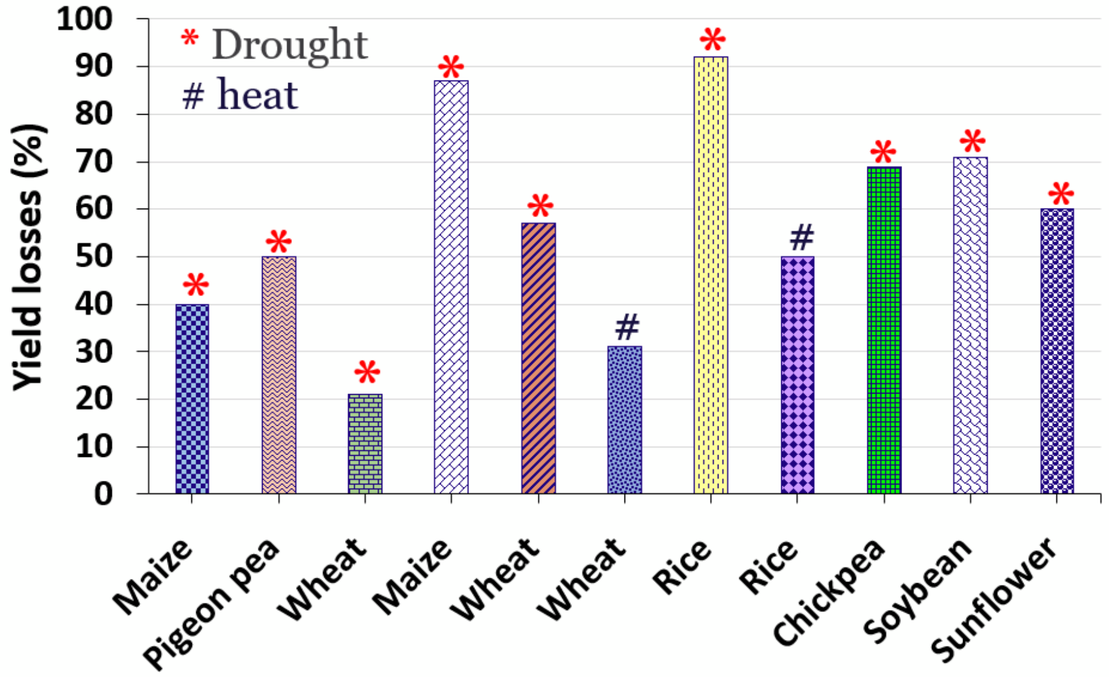
- **Reduced GHG emissions from agricultural activities**
- **Carbon sequestration on farmland**

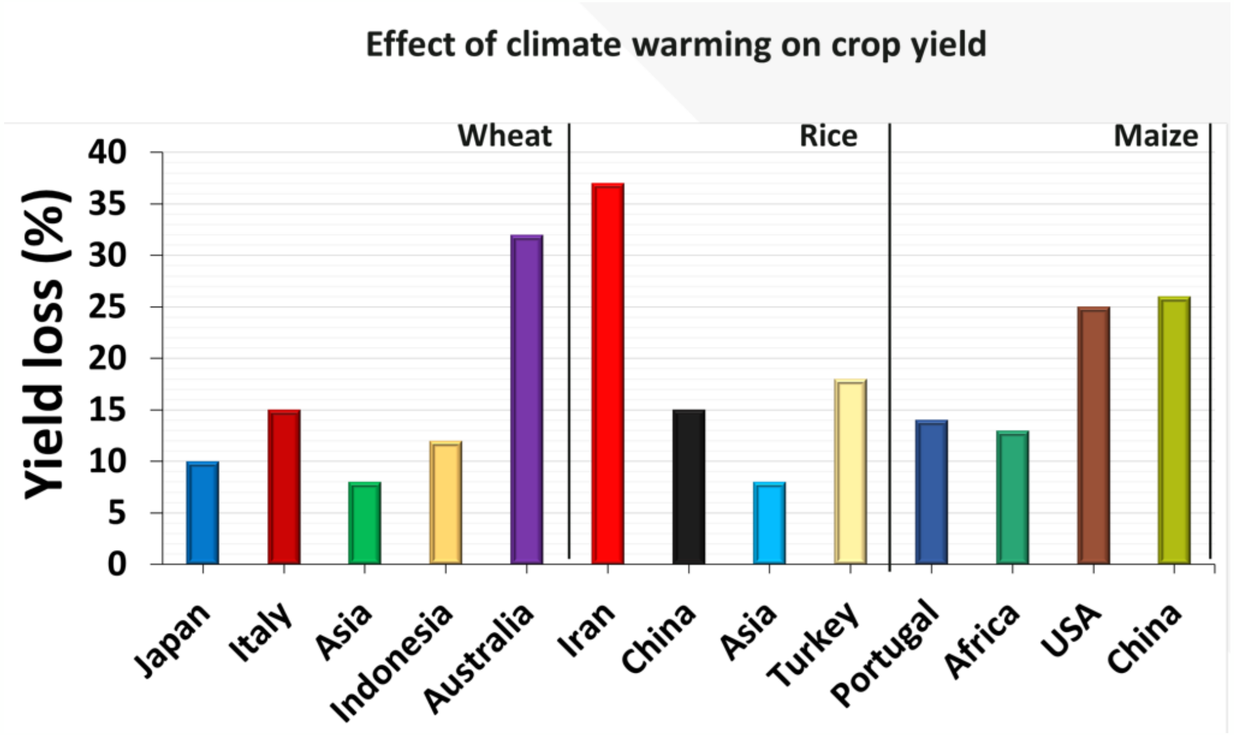
(CSA: climate smart agriculture)

Major issues in agriculture practice

- Increase in global atmospheric temperature
- Reduction in rainfall
- Soil infertility
- Loss of nutrients from the soil
- Excessive use of chemical fertilizers

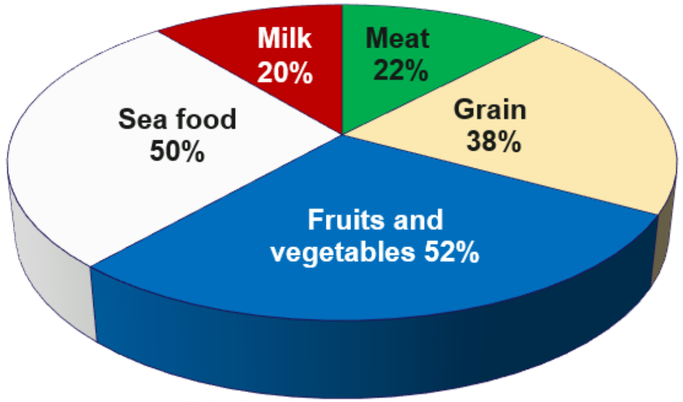
Impact of climate change on agriculture production





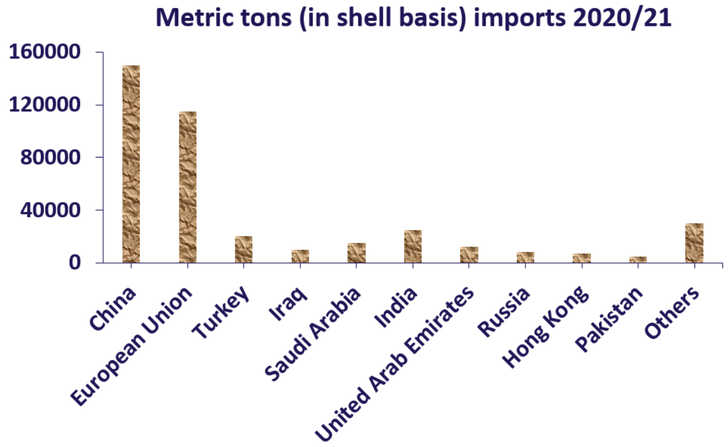
Daryanto et al. (2016); Nam et al. (2001); Kamara et al. (2003);
Bala et al. (2011); Lafitte et al. (2007); Li et al. (2010); Nayyar et al. (2006);
Samarah et al. (2006); Mazahery-Laghab et al. (2003); Isfaq et al. (2020)

Food waste and major issues

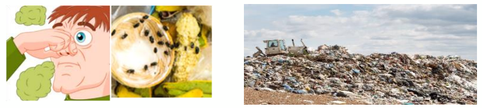


Global food waste generation: 1.3 billion tonnes

Pistachios shell



Worldwide (United States Department of Agriculture, Foreign Agriculture)



Odor and germs

Land acquire

Leachate

Harmful to cattle and birds

Impact on environment

2% biochar application was benefit for plant growth

Previous study (Pradhan et al., 2021)

Biochar a solution

Pistachio shells

- 30% of the weight of the nut is the shell
- Not easily degradable and take almost more than two years to decompose.
- The shell contains 7% moisture, which requires less or no energy for drying
- Therefore, produce biochar from pistachio shell and application to the soil could be impact on sustainable agriculture practice.

Slow pyrolysis at 350, 450 and 550 °C

Physico chemical properties analysis

Soil quality improvement
Plant growth test
Water retention test
Plant biomass production
Nutrients retention

Biochar

Organic cow manure

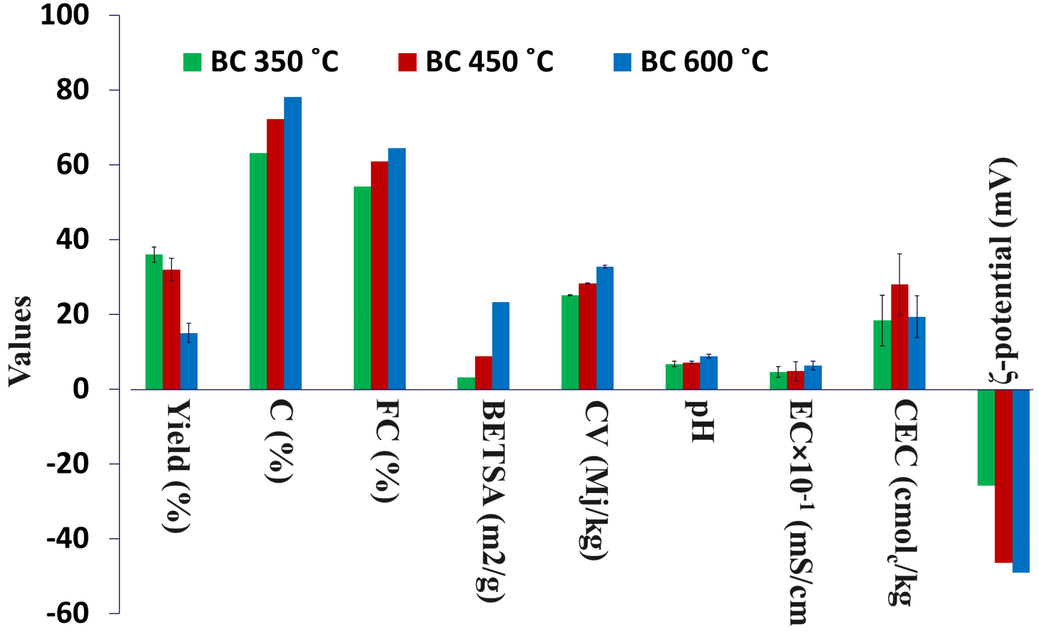
Pot test

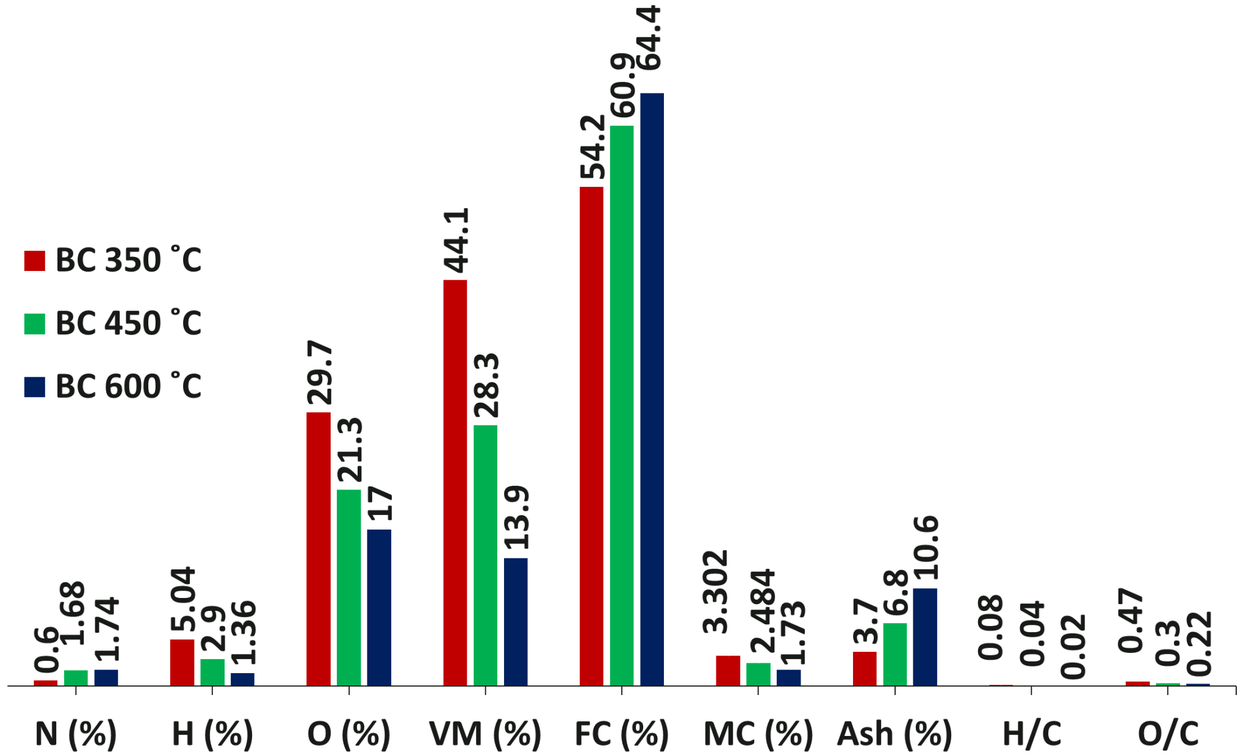
0%, 2%, 4%, and 8%

Biochar amendment

Egg plant seeds

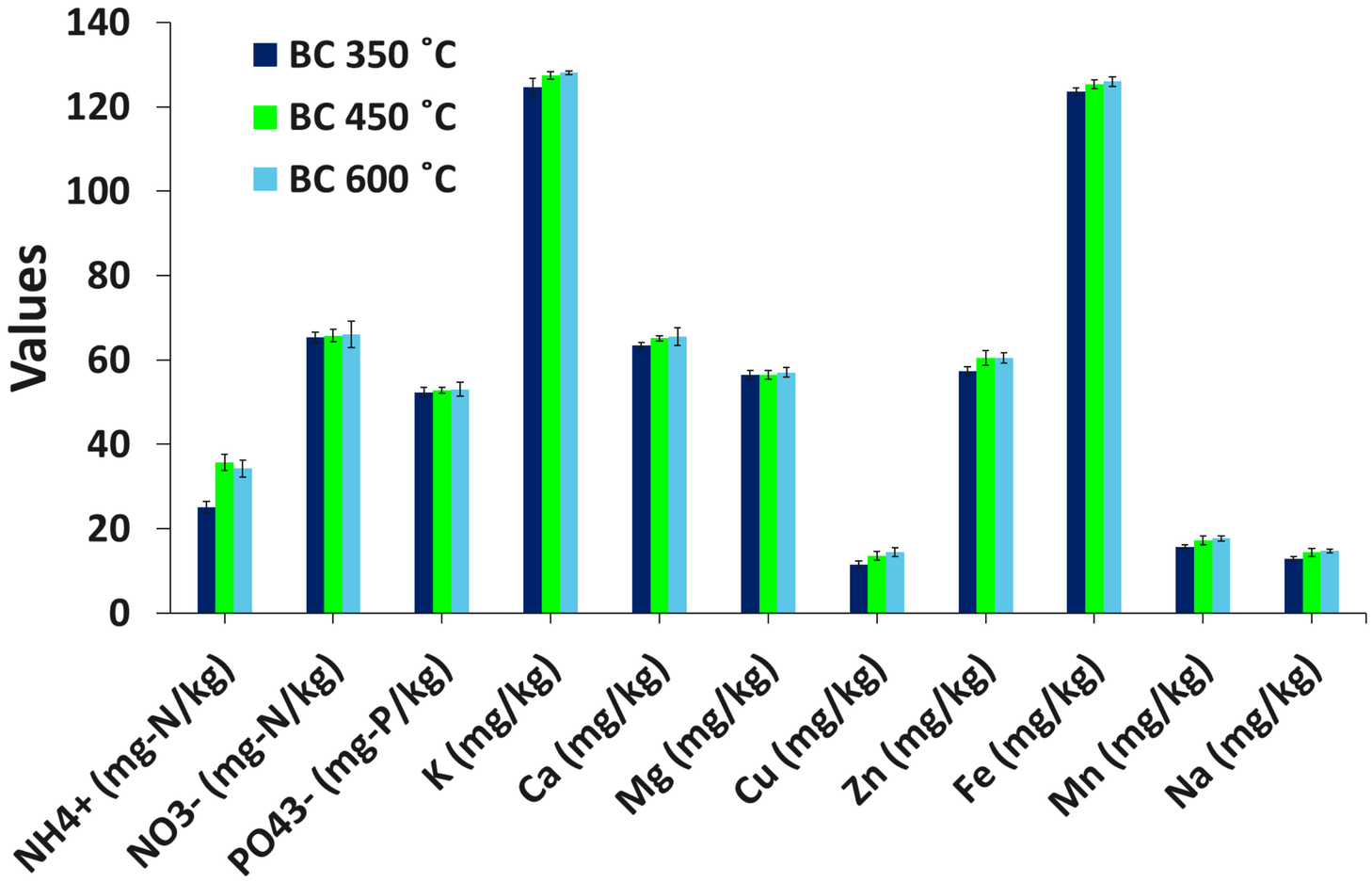
Impact of pyrolysis temperature on biochar properties





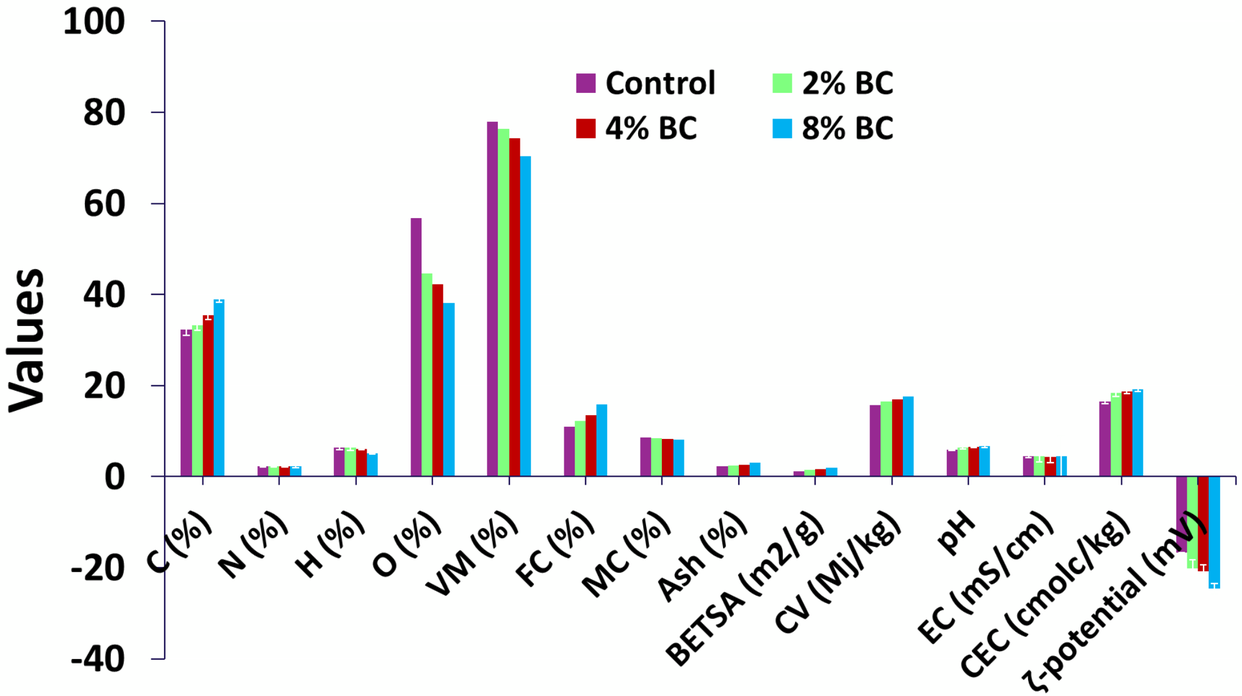
Physicochemical properties biochar produced by three pyrolysis temperature

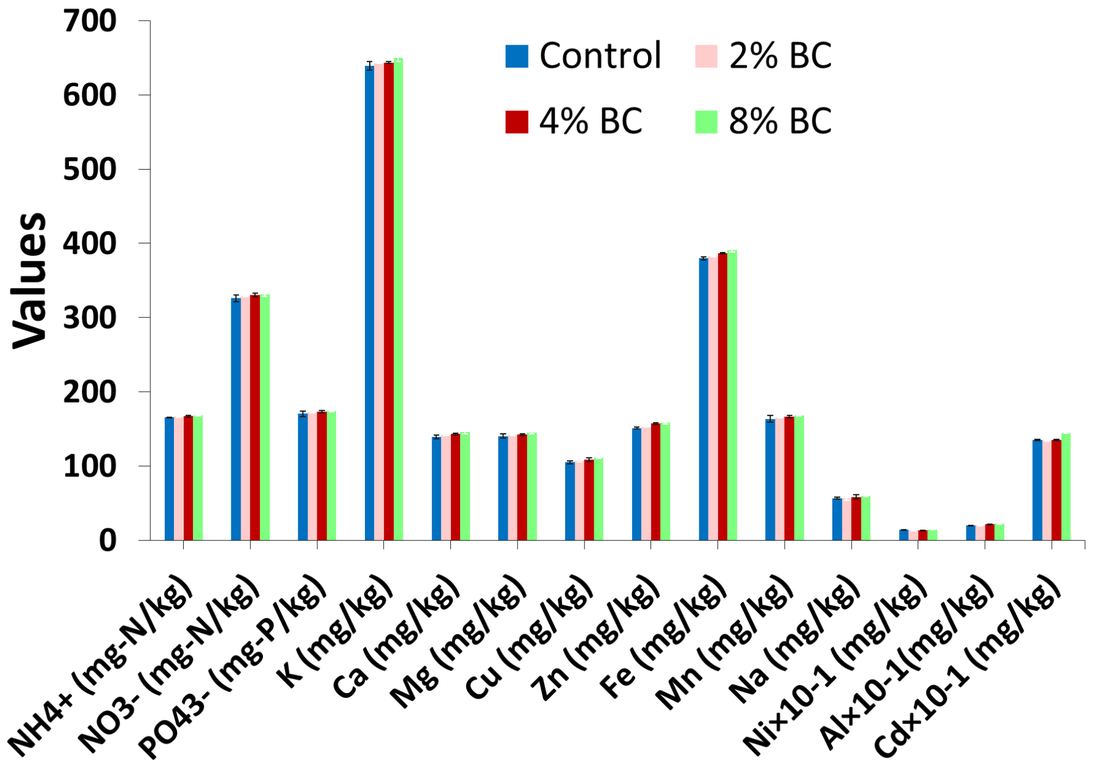
Impact of pyrolysis temperature on biochar nutrients



Ni, Al, Cd, As, Cr, Mo, Pb and Sr are not detected

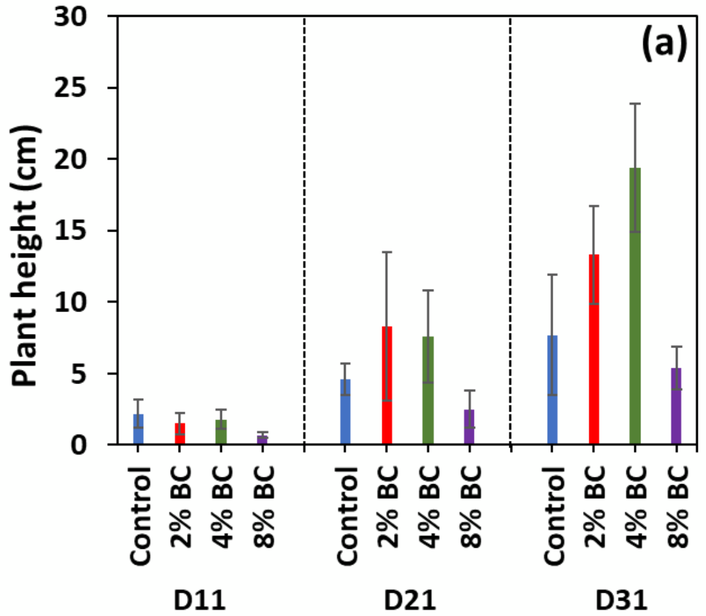
Impact of biochar amendment to organic cow manure

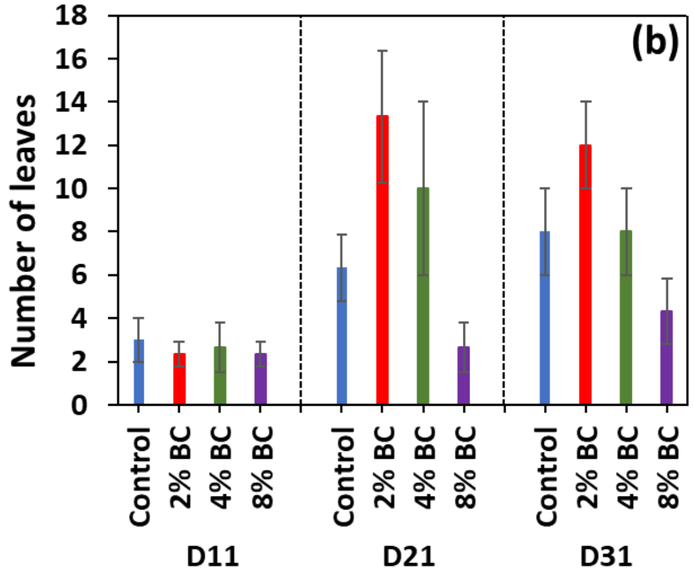


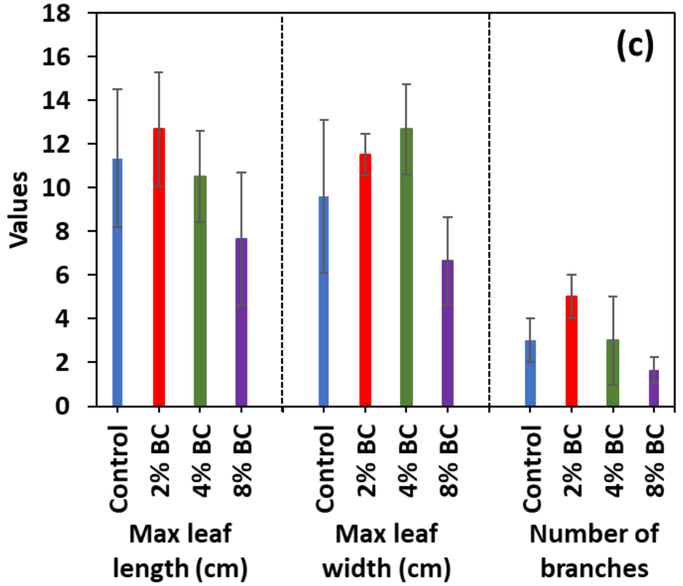


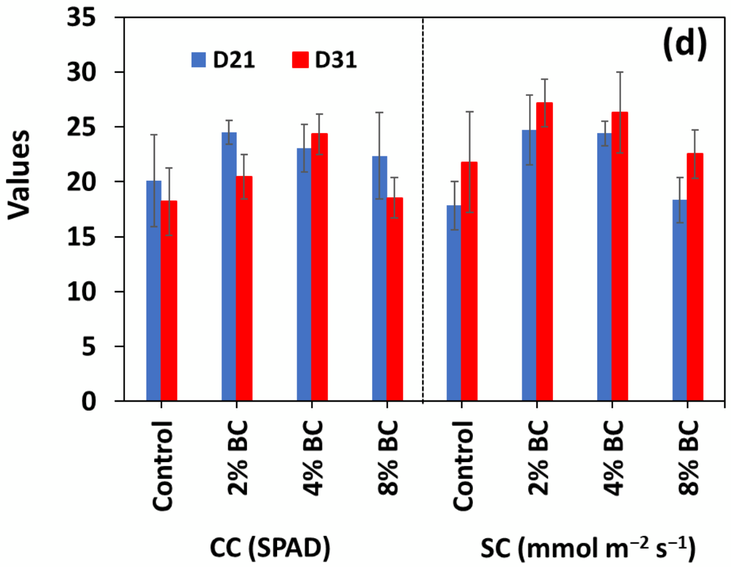
Biochar produced at 450 °C amended with the manure
BC: biochar

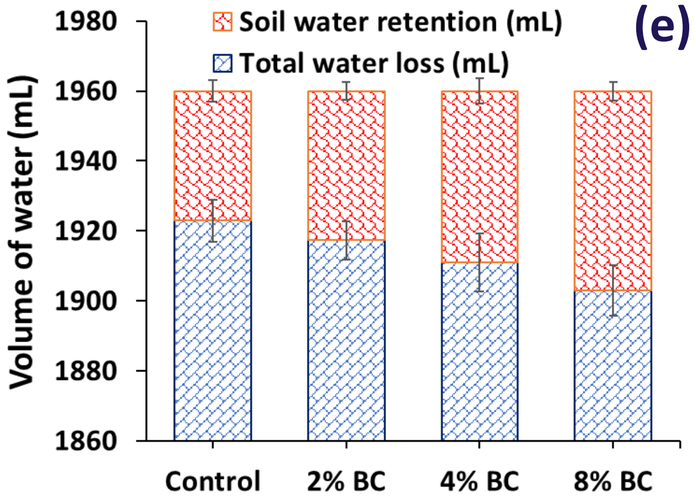
Impact of biochar on plant growth and water retention capacity

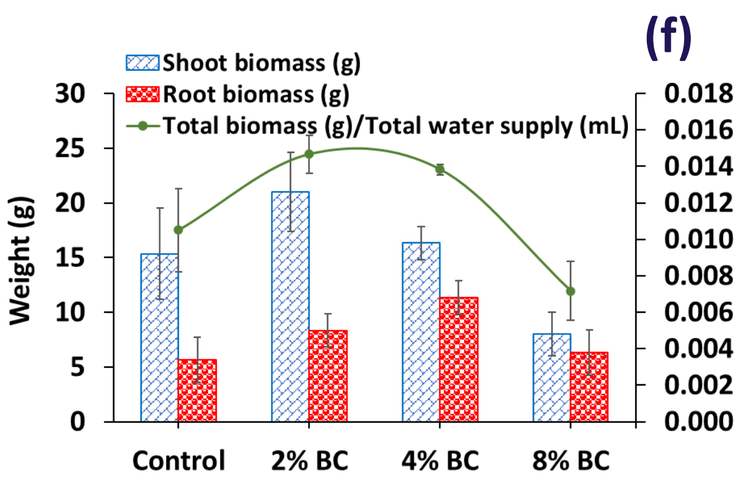






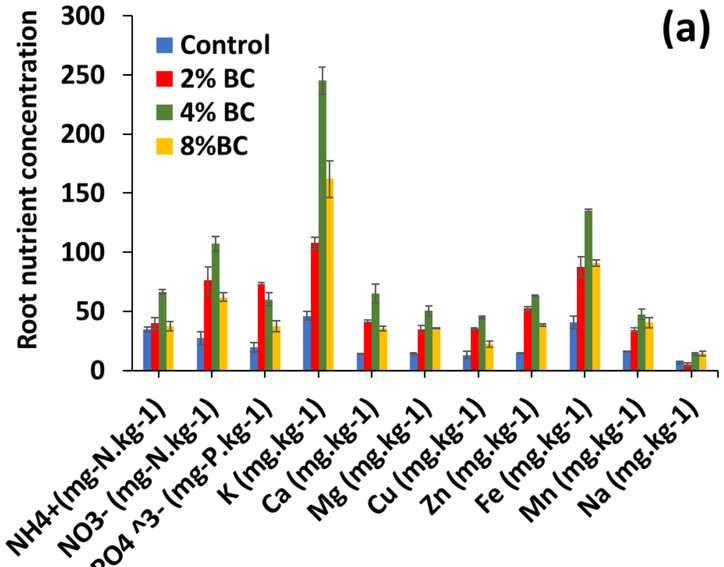


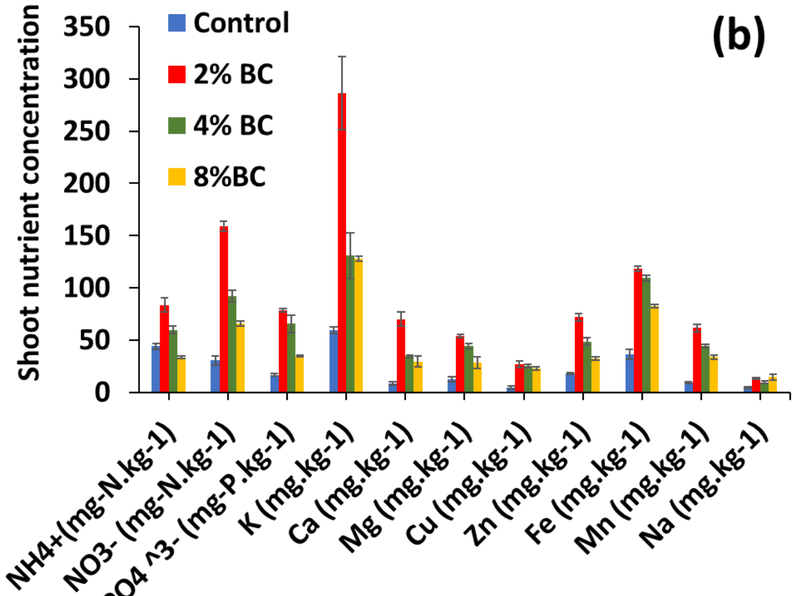


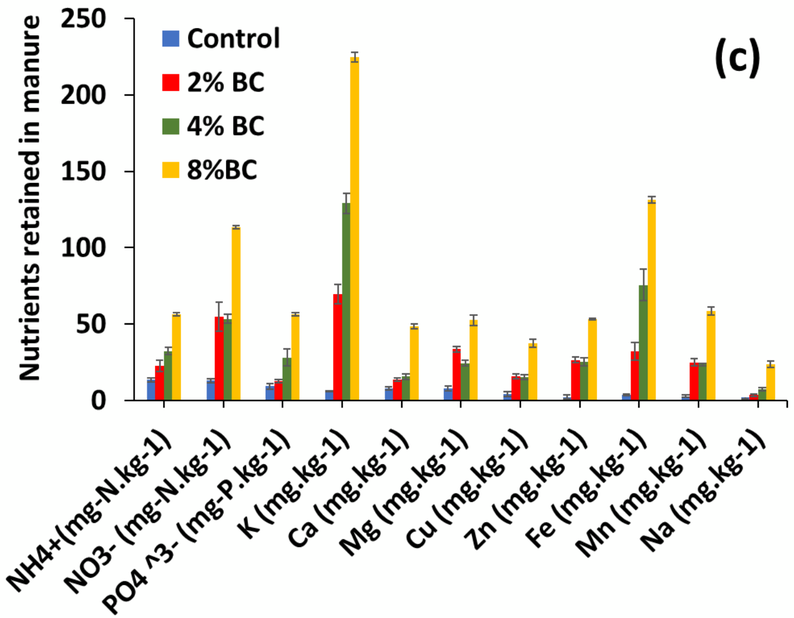


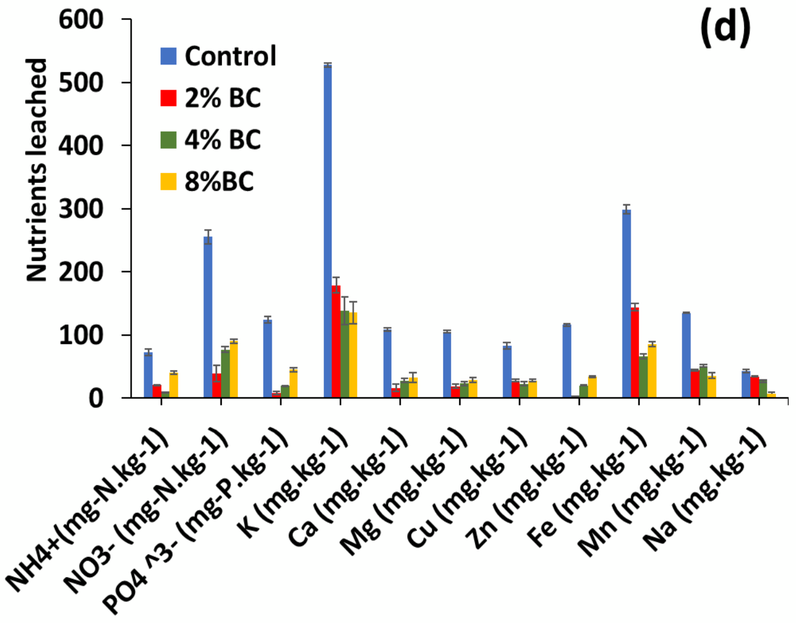
CC: chlorophyll content
SC: Stomatal conductance

Impact of biochar on nutrient content









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Conclusion

- Pistachio shell biochar produced at 450 °C is a suitable amender to improve soil quality compared to the biochar produced at higher pyrolysis temperature.
- The cow manure itself promoting better eggplant growth as it is a nutrient rich substrate but showed highest water and nutrient loss.
- Lower fraction (2%) biochar application impact more on plant growth by reducing nutrient loss by leaching and enhancing water retention.
- Application of 8% biochar showed good water retention but supress the plant growth with manure.
- Application of 2% biochar showed maximum nutrient uptake by egg plant shoot while 4% biochar showed maximum nutrient uptake by root.
- This short-term study indicates lower (2%) fraction of biochar application to the nutrient rich organic cow manure is a promising amendment to improve soil fertility and reduced nutrient loss.
- This study demonstrated that the valorization of pistachio shell to biochar in application to agriculture practice is a sustainable solution to reduce the fertilizer cost, water demand cost and boost a circular bioeconomy.

- Extended pot testing with a few more crops is the future scope of this research for long-term resilience.

Acknowledgement

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Thank You