The Potential for Biochar to Mitigate the Impact of Climate Change

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1. Introduction

Climate change is one of the big challenges faced by the modern world. In the Middle East, and specifically the UAE, there are humid summers and warm winters which have influenced agriculture production. Biochar has been described as a possible means of improving soil fertility, water holding capacity and sequester carbon (C) to mitigate climate change. Therefore,

The aim of this project is to test date palm frond and biochar as a means of enhancing water holding capacity in UAE soils

2. Methodology

- Date palm frond (DPF) waste (figure 6) and sandy soil were collected from Abu Dhabi, UAE.
- The DPF samples were sent to the lab (Durham University, UK) and cut into small pieces (figure 7) then charred at 250 ° C for 4 hours and 1 hour cooling.
- Hydro-physical properties were analysed using two experimental pot trials: First cycle was based in the lab (Durham University (figures 8- 10) and the second cycle was based at a residential garden in Abu Dhabi, UAE (figures 11-14).
- The pots were irrigated on a daily basis (during the wet cycle) and monitored its height, pH, moisture, humidity, temperature and light using both roller and moisture probe (figure 1).
- The experiment was a complete factorial with respect to the following factors: the controls (Sharp sand, DPF and Biochar) and treatments for both Biochar and DPF concentrations (1%, 6%, %15 and 18%) (figures 2-5).

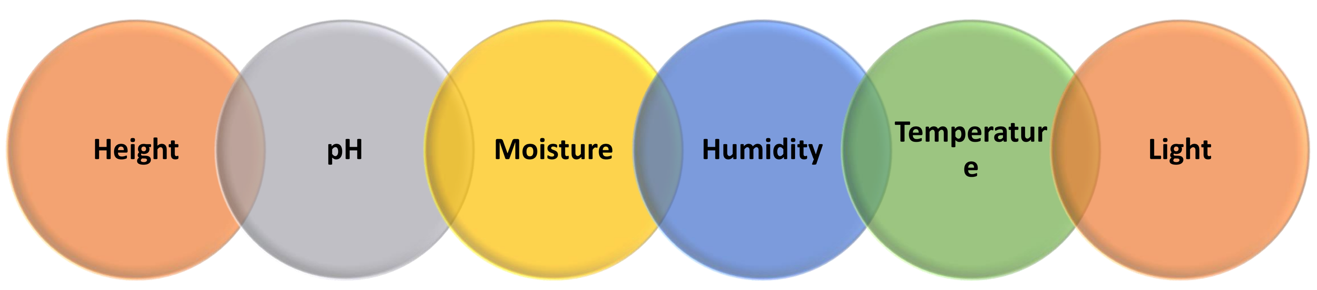

Figure 1: Soil parameters used for detecting the hydro-physical properties of UAE sand, DPF and its Biochar

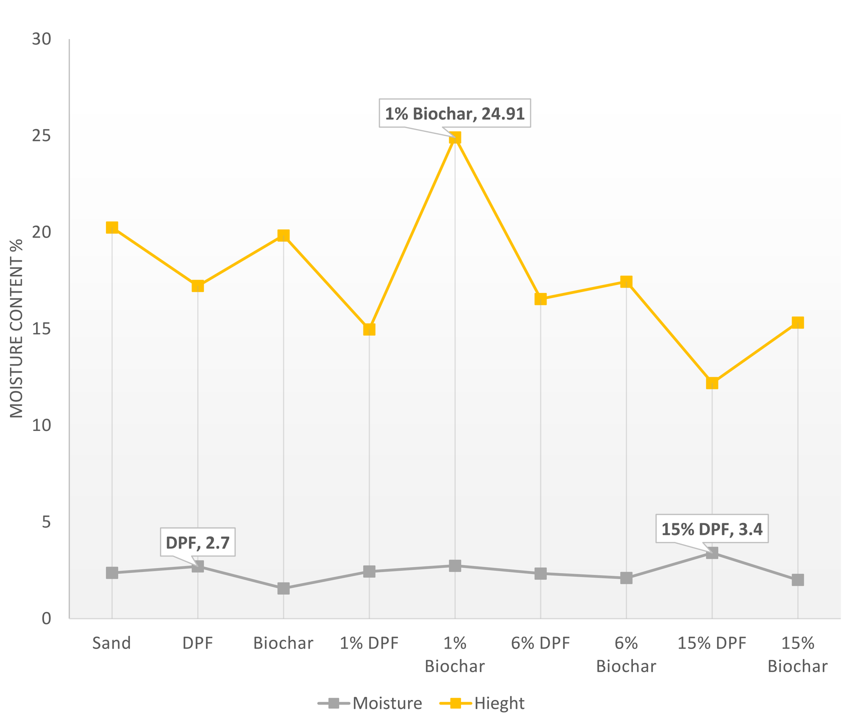

Figure 2: The chart illustrates the outcome of the controls and treatments during the first weeks of wet cycle which took place in the lab using the growth tent

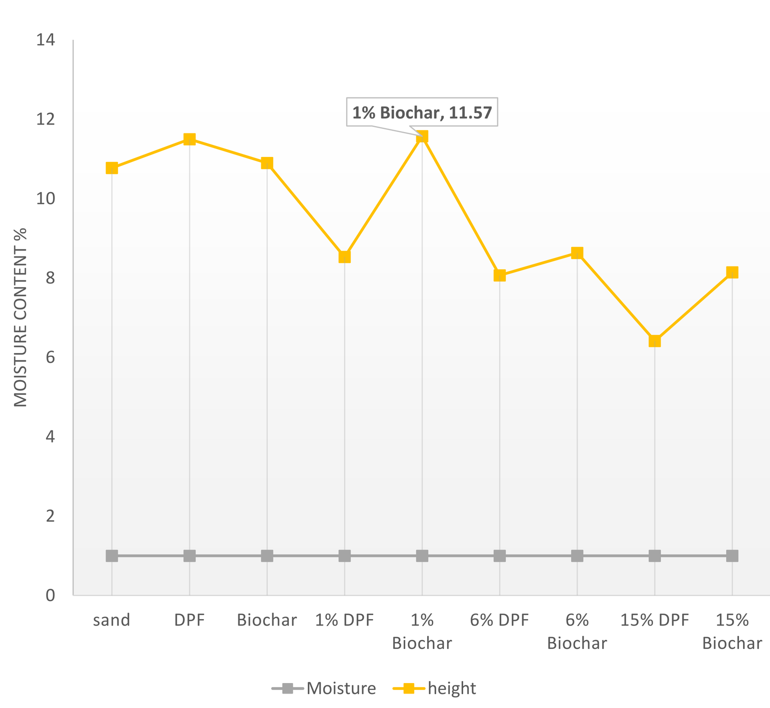

Figure 3: The chart illustrates the outcome of the controls and treatments during the final weeks of the dry cycle

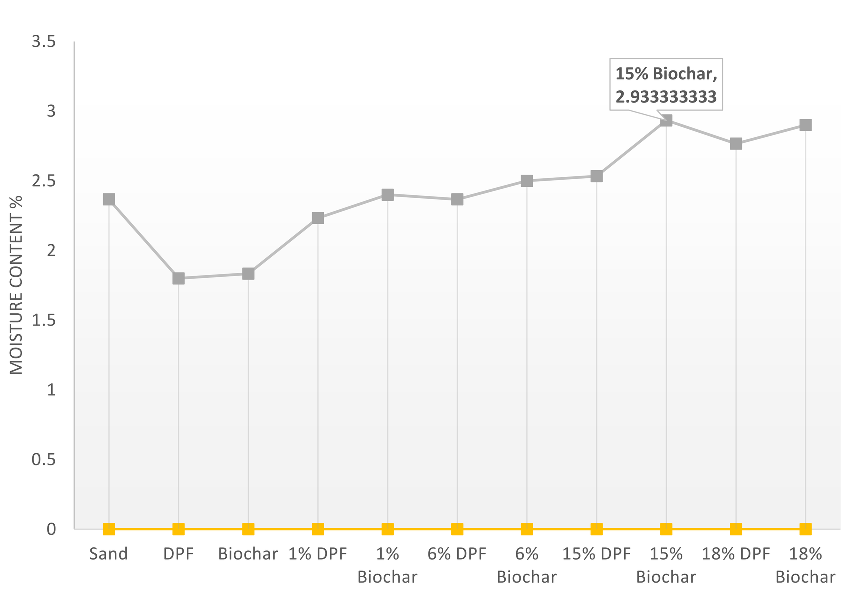

Figure 4: The chart illustrates the outcome of the controls and treatments during the first weeks of the field experiment in Abu Dhabi, UAE (open field)

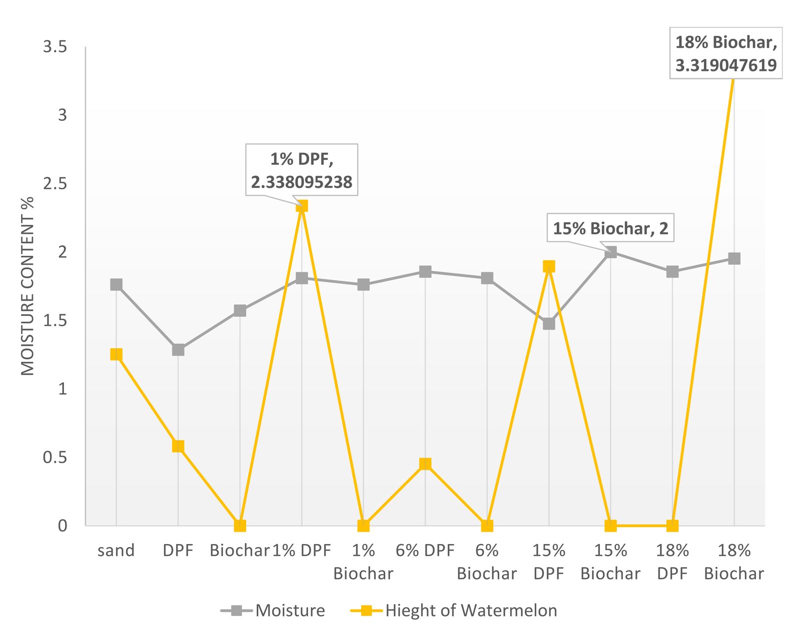

Figure 5: The chart illustrates the outcome of the controls and treatments during the last weeks of field experiment (closed field)

3. Results

- First cycle
  - Date Palm Frond (DPF) control and 15% DPF had the highest moisture concentration during the first cycle (figure 2).
  - 1% Biochar showed the highest plant growth during both wet and dry cycles (figure 2 and 3).
- Second cycle
  - 15 % Biochar managed to retain water longer comparing the controls and other treatments (figure 4 and 5).
  - Plant growth increased after it was covered where it mostly showed in two pots: the 18% Biochar and 1% DPF (figure 5).


Figure 6


Figure 7

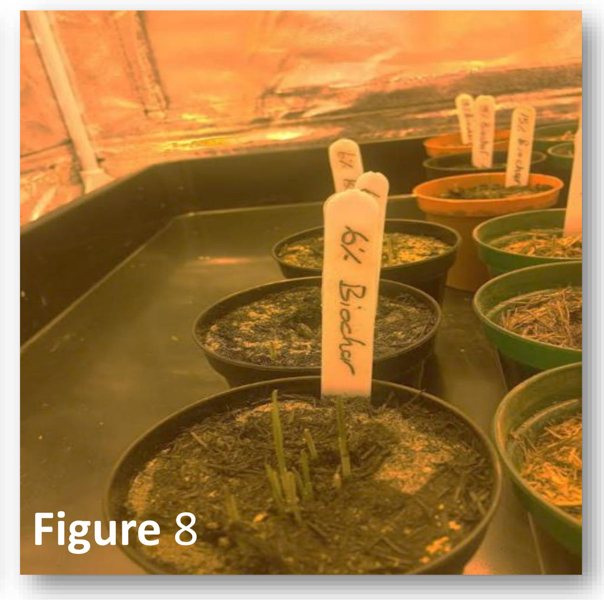
Figure 8

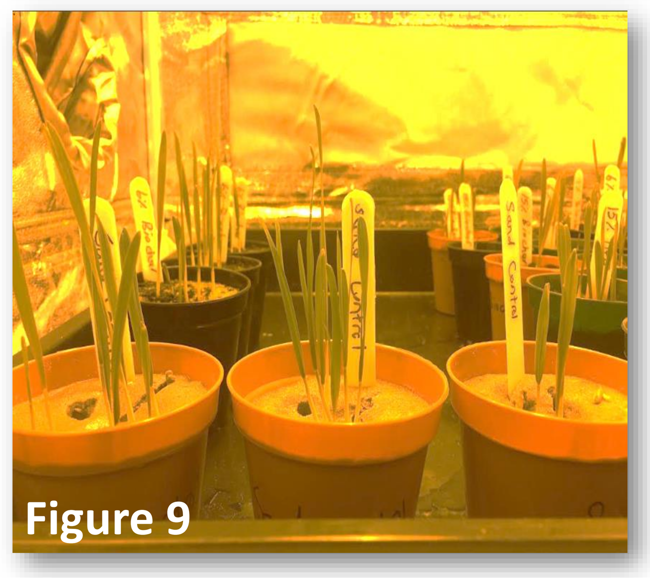
Figure 9

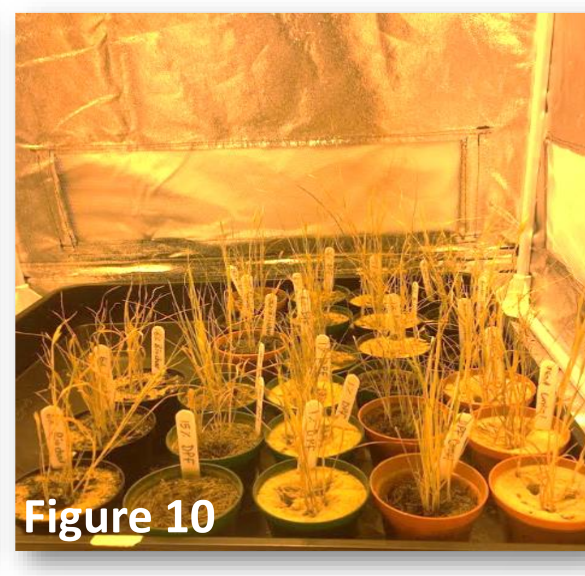
Figure 10

Laboratory based experiment


Figure 11


Figure 12

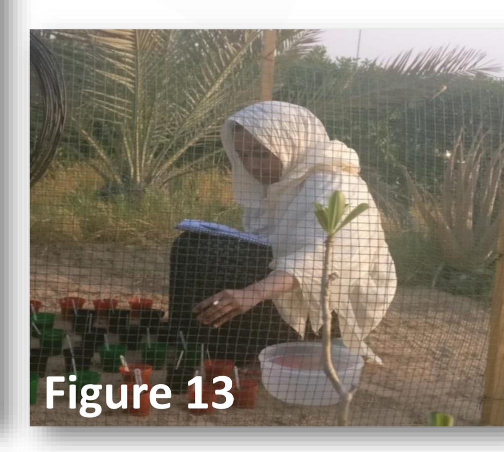
Figure 13

Field based experiment


Figure 14

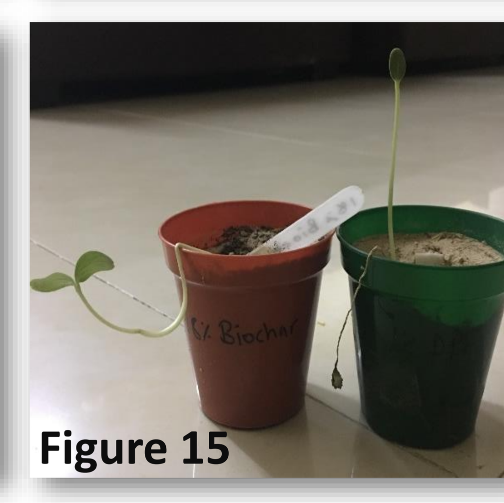
Figure 15

4. Limitation

The weight of DPF changes after being charred which may affect the results of the treatments. As similar quantities are added to the pots which may lead to increase amount of biochar in a pot.

5. Future Work

- Thermogravimetric analysis has been used to investigate rates and thermodynamics of water loss.
- CN Elemental analysis to measure the chemical properties of the samples.

6. Conclusion

This would indicate that there is good potential for DPF in retaining water. Water concentrations in the soil are similar for both DPF and Biochar, suggesting a reduced need for biochar production.

7. Acknowledgment

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