

## Introduction



- Gravelly soils: >15% of gravel
- Occur naturally or poor management
- Gravels create dual-porosity flow → increases water and fertilizers loss

### Why rice husk biochar (RHB)?



Decomposition is slow (high C:N ratio)

- Properties of biochar:
- highly porous
  - particle sizes
  - high CEC
  - high P content

Biochar reduces interlayer spaces and increases soil CEC

**Objective:** Evaluate the effect of RHB on water balance components and fertilizer use efficiency of pearl millet planted on a gravelly soil.

## Materials and Methods

### Greenhouse Experiments:

- Reconstructed gravelly soils (0%, 10%, 30%, 40%, 60%v/v)
- Biochar applied at 25 tons/ha in 3 modes: no biochar (1), top 10 cm (2) and full mix (3)



### Parameters measured:

- Water balance components, electrical conductivity (EC), total biomass and grain yield

### Parameters estimated

$$ETa = I - (R + D) \pm \Delta W \quad [1]$$

$$TDS \text{ (mg L)} = 640 \times EC \text{ (mS cm)} \quad [2]$$

$$WUE = \frac{\text{Grain yield (g)}}{\text{Cumulative } ETa \text{ (mm)}} \quad [3]$$

$$PFP = \frac{Y_N}{F_N} \quad [4]$$

## Results

### Water balance components and fertilizer use efficiency

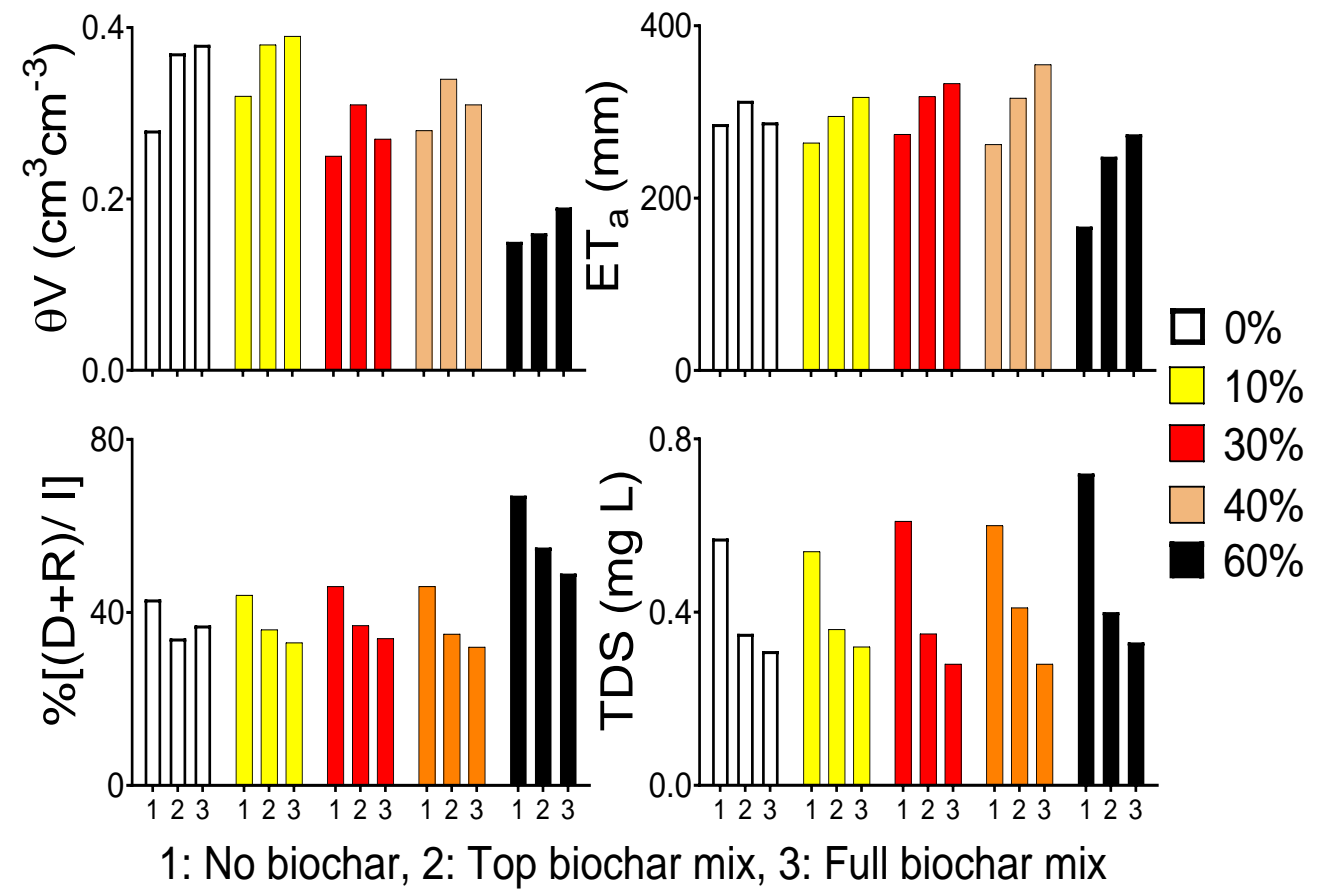


Fig 1: Biochar effect on water balance components and total dissolved salt (TDS)

- On average biochar reduced:
  - water loss by 20% (0-40% gravel content) and 30% (> 40% gravel content)
  - TDS by 23%

### Crop response to biochar amendment at different gravel content

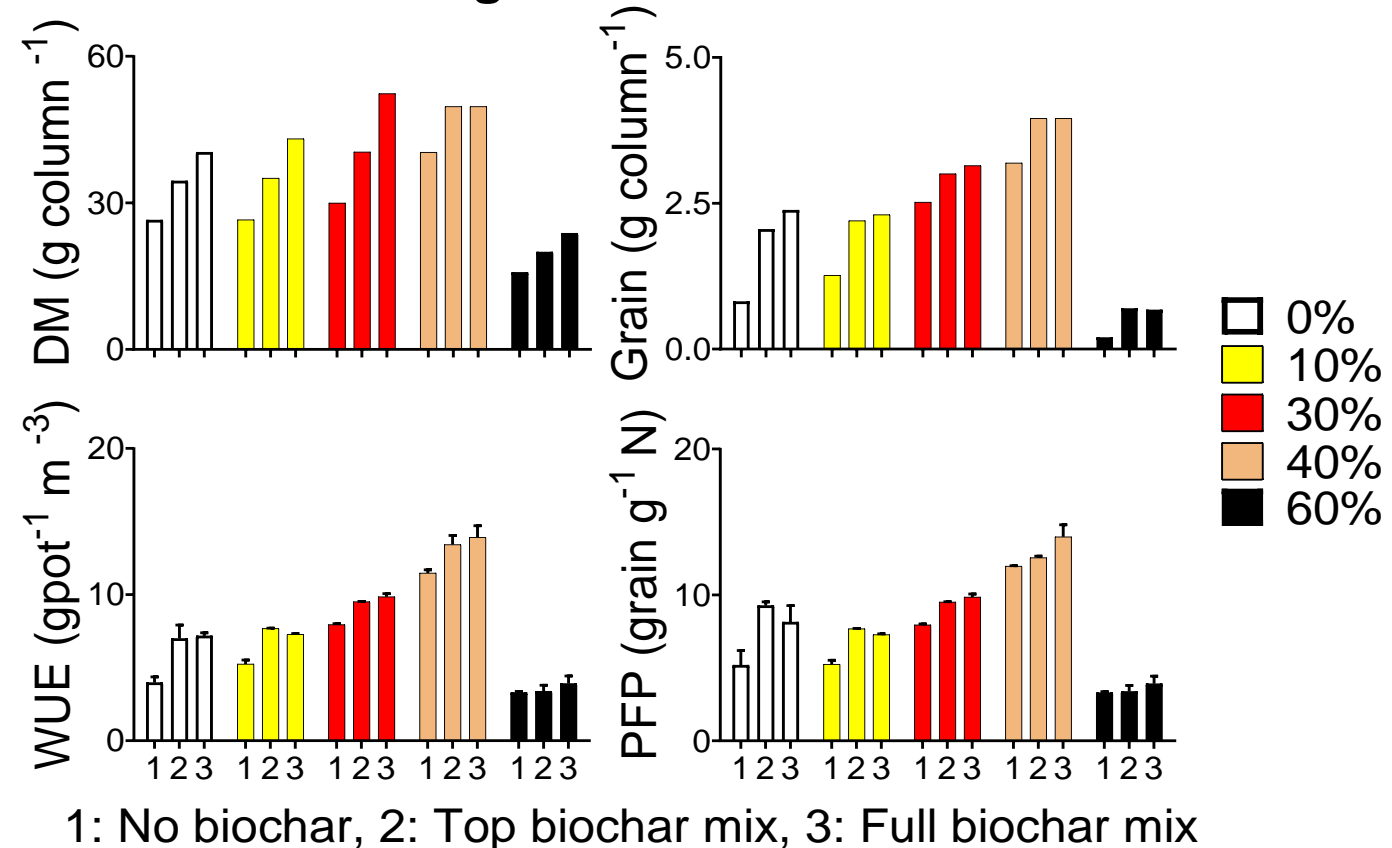


Fig 2: Effect of biochar amendment on DM, grain yield, WUE and partial factor productivity (PFP)

- On average biochar improved:
  - Dry matter by 14%
  - grain yield by 24%
  - WUE and PFP by 15% each

## Conclusion

- Biochar
  - reduced water loss
  - improved water availability
  - increased total biomass and grain yield (by improving soil water and nutrient availability)
- Full biochar mix (3) resulted in the highest benefit for biochar use

### References

- Gargiulo, L., Mele, G., & Terribile, F. (2016). Effect of rock fragments on soil porosity: a laboratory experiment with two physically degraded soils. *European Journal of Soil Science*, 67(5), 597-604.
- Frimpong Manso, E., Nartey, E. K., Adjadeh, T. A., Darko, D. A., Lawson, I. Y. D., & Amoatey, C. A. (2019). Use of corn cob and rice husk biochar as liming materials in acid soils. *West African Journal of Applied Ecology*, 27(2), 32-50.