Phenotyping African eggplant growth and nutrient dynamics under abiotic stresses

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INTRODUCTION

- A predicted Increase in **temperature** and **heat waves** frequency in the future combined with limited **water availability** puts pressure on current food systems, requiring the use of heat and drought-tolerant species.
- **A high nutritional quality** and economically viable **yield** are crucial to ensure **vegetables** sustainability in future food systems.
- The African eggplant, ***Solanum aethiopicum***, while widespread through the continent and highly nutritious, is not used at its full potential and **lacks data** to support its use under climate change conditions.
- This project is focusing on the **combined effects of heat and drought stress** on the vegetative stage of DB3 (Gilo variety).

MATERIALS AND METHODS

MEASUREMENTS:

- Twice weekly:
  - Photosynthesis rate
  - Stomatal conductance
- At harvest:
  - **Nutrient analysis**
  - Plant height
  - Stem diameter
  - Number of leaves
  - Moisture content
  - **Above and underground dry and fresh biomass**.

- 4 treatments, 6 replicates, maintained for 3 weeks, starting 6 weeks after sowing:
  - No stress: 28° C/21° C – WW:NT
  - Heat stress: 40° C/33° C – WW:HT
  - Drought: 50% pot capacity – DD:NT
  - Heat stress and drought – DD:HT

Figure 1 – WW:NT and DD:NT plants after 2 weeks of stress.

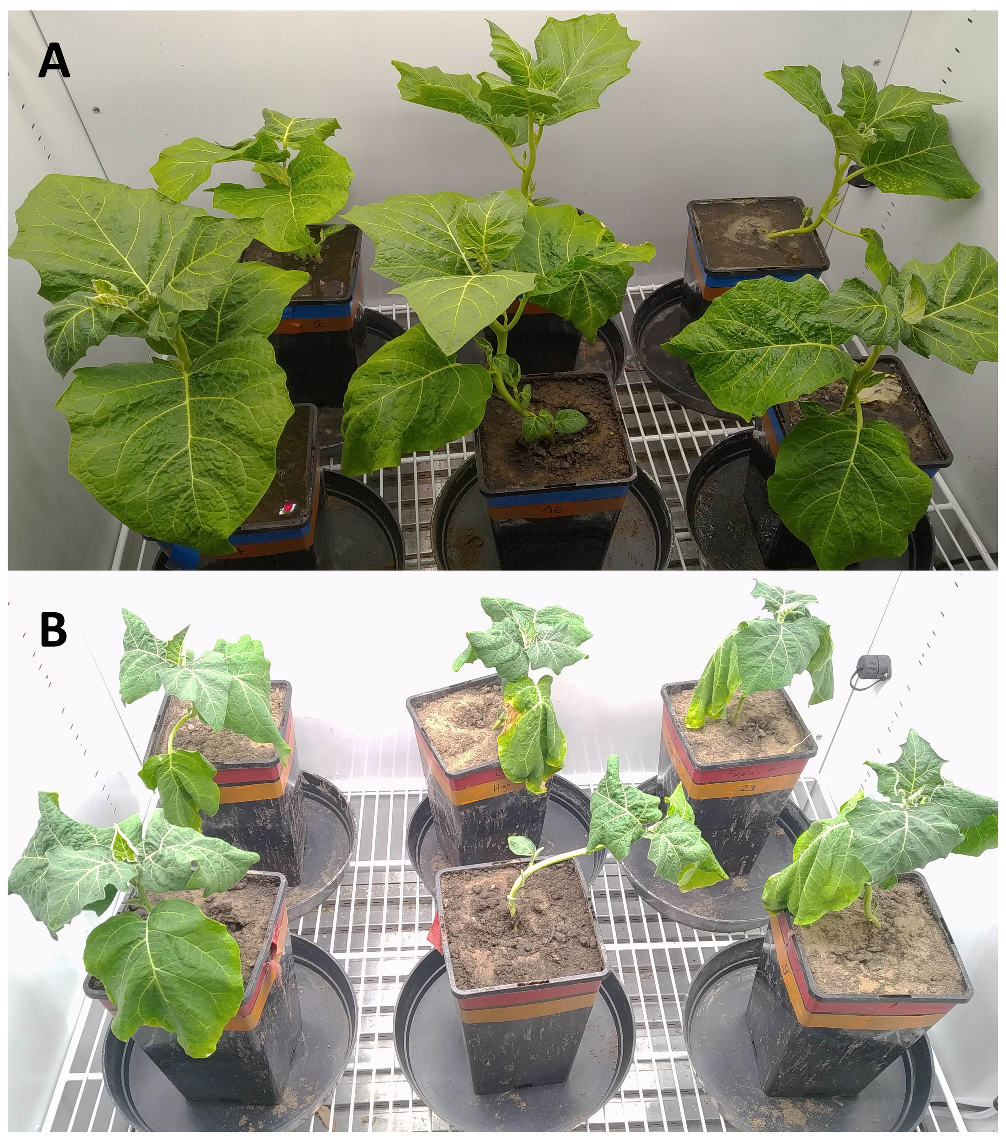

Figure 2 – WW:HT (A) and DD:HT (B) plants after 2 weeks of stress.

RESULTS AND DISCUSSION

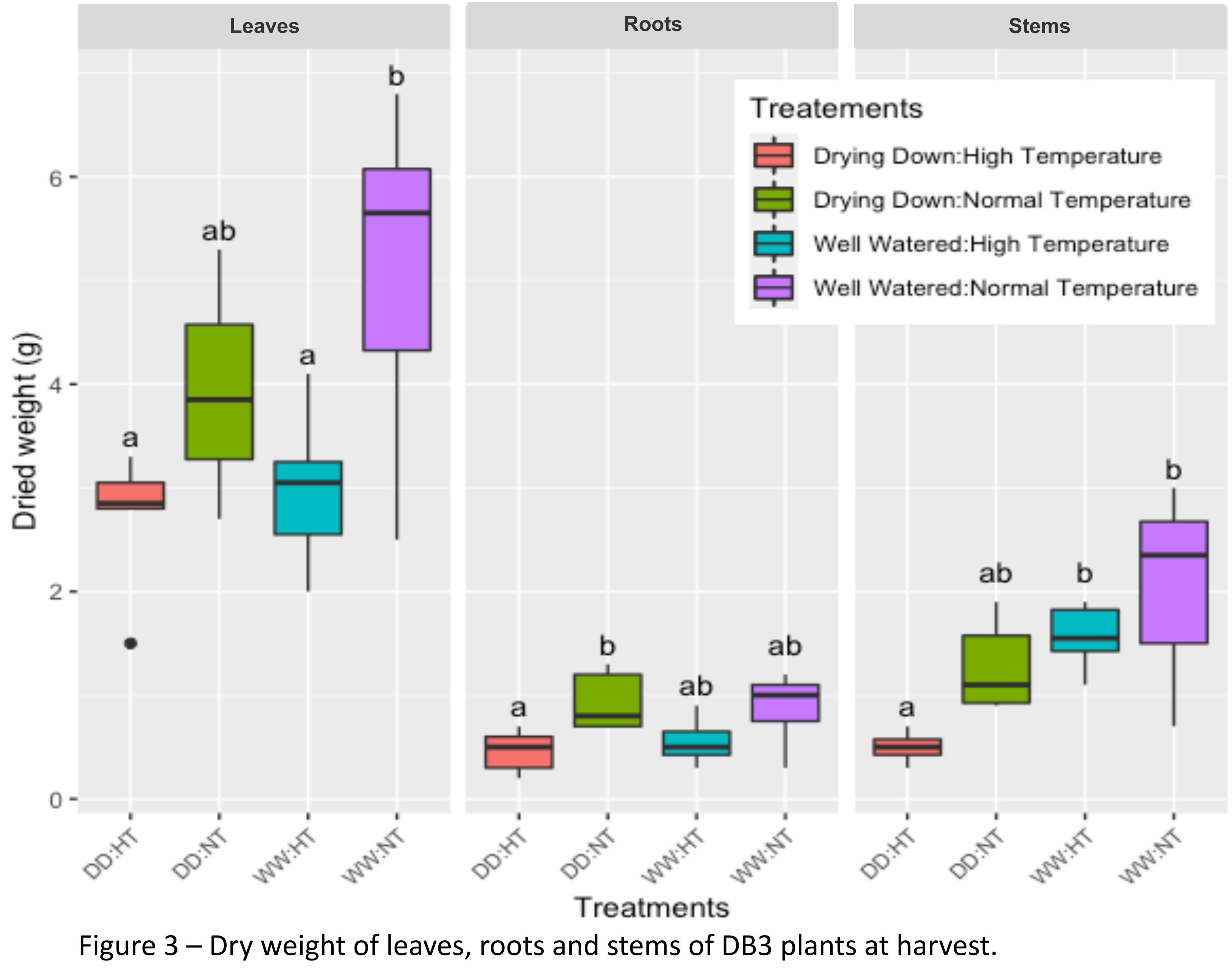

Figure 3 – Dry weight of leaves, roots and stems of DB3 plants at harvest.

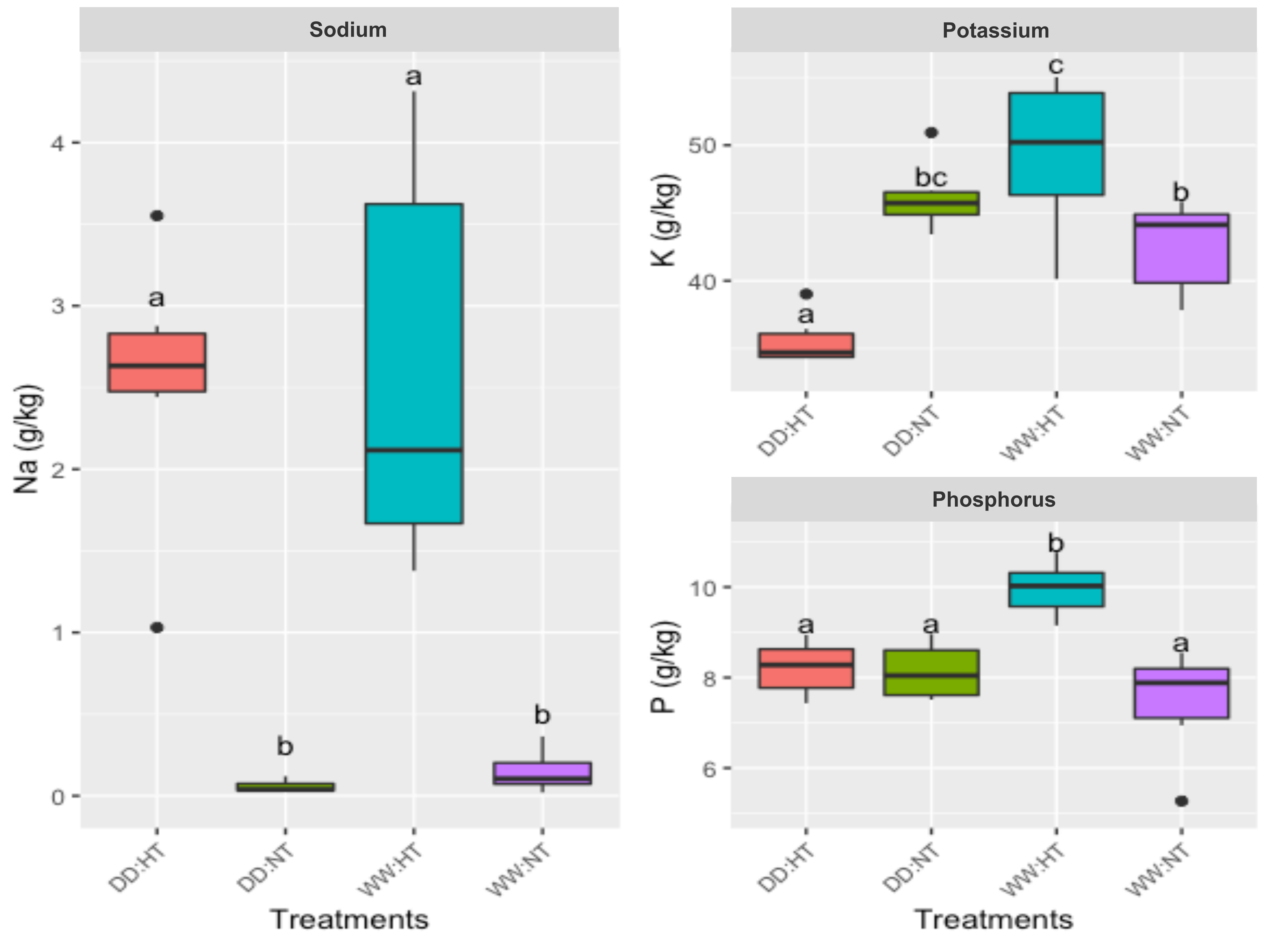

Figure 4 – Sodium (Na), Potassium (K), and Phosphorus (P) levels in DB3 leaves at harvest.

- **Leaf dry weight** (Fig.3), area, and moisture, plant height and photosynthesis rate were significantly **reduced in heat-stressed plants** but not in drought-stressed plants.
- **Stem dry weight** (Fig.3) and stomatal conductance were reduced in plants subjected to both heat and drought stresses but not in plants under no or single stress, showing the role of **stress combination**.
- **Sodium levels** highly increased under heat and combined stresses but not under drought. Combined stresses reduced **potassium content** while drought alone did not affect it and heat alone increased it, hinting at a **combined tolerance mechanism** involving potassium (Fig.4).
- Heat stress increased **phosphorus levels** while **drought and combined stresses did not change it** (Fig.4). Drought response mechanisms seem to have prevailed over heat ones.
- The combination of stresses impacted growth characteristics and nutrient dynamics differently than single stress, underling the **importance of the nature and number of abiotic stresses**.

CONCLUSION

- **Heat stress had a predominant effect over drought** for leaf dry weight and Na concentration while in the rest of the cases a **different combined effect** was observed, requiring novel approaches to improve tolerance to **multiple stresses simultaneously.**
- **Leaves' nutrient levels** were highly affected under stress, in particular sodium. The **highly diverse effects** under single and combined stresses on nutrient shows the activation of complex mechanisms **depending on the number of stresses**.

NEXT STEPS

- **Nutrient analysis** in roots and stems for *nutrient uptake dynamics* and *fertiliser use efficiency.*
- Experiments to explore the effect of **salinity stress** and **heatwave**: photosynthesis and stomatal conductance measures + nutrients, phytochemicals and vitamins analysis.
- Investigate farming amendments to **improve stress tolerance**
  - Biostimulants, fertiliser application method and timing.
  - Surveys for farmers on amendments' relevance.

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