Morpho-physiological characteristics and grain yield attributes of selected cowpea genotypes under phosphorus and moisture stress conditions on a South Africa Typic Ustipsamment

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Introduction

Cowpea (Vigna unguiculata (L) Walp) production in South Africa is currently at subsistence level with limited commercial production solely for fodder. Its productivity as pulses is however, constrained by drought and widespread phosphorus (P) deficiency problems. An agronomic field trial was planted at during 2012/13 summer growing season to assess the response of 8 selected genotypes to low soil P and moisture stress conditions so as to identify potential genotype that adapt well to South African field conditions.

Materials and Methods

- **Description of trial site:** Ukulima Farm (24°32′58.1" S, 28°06′21.1" E, 1237 masl) in Limpopo Province, South Africa; rainfall amount less than 400 mm annually; Soil is loamy sand, low in phosphorus and classified as Typic Ustipsamment.

- **Treatment and trial lay out:**
  - Treatments: 2 soil P levels (low and high), 2 moisture status (water stress and well-watered); and 8 cowpea genotypes (Tvu 4632, Tvu 6365, Tvu 9848, Tvu 15445, Tvu 16408, Tvu 15143, Oloyin and IT00K-1217).
  - Low soil-P level implies _in situ_ available P<8 mg kg⁻¹ while high P level was 40 kg P ha⁻¹ application rate.
  - Treatments laid out as split plot arrangement, fitted into RCBD and each replicated 4 times.
  - Each subplot measured 9 m × 10 m; cowpea seeds sown at 90 & 20 cm inter and intra-row spacing, respectively; P fertilizer applied as SSP (10.5% P).

- **Data collection:** (i) growth parameters-plant height, number of branches, number of trifoliate leaves, stem diameter using vernier calliper; cowpea root architecture-stem and taproot diameter at different depths, number of basal root and root angle essential for optimizing water-use and P-use efficiency) during reproductive stage using legume phenotypic shoveling scoring and root scanner (Fig 1), and (ii) grain yield at harvest.

- **Data analysis:** ANOVA was performed on plant growth, root and grain yield data generated using Statistix 10.0; treatment means separated at 5% probability level.

Conclusions

Elevated level of soil available P mitigated the negative effect of moisture stress through enhanced root growth and development. Tvu 15143 withstand better moisture stress than any other genotypes while Tvu 16408 gave the highest grain yield. However, Oloyin was the least performer under these abiotic stress conditions.

Acknowledgements

The North-West University, South Africa and the National Research Foundation South Africa are greatly acknowledged for travel grant support (Grant UID:110165).