



Tropentag, September 9-11, 2020, virtual conference

“Food and nutrition security and its resilience
to global crises”

Increasing Chickpea (*Cicer arietinum* L.) Tolerance to Soil Acidity: Screening Landraces for Tolerance to Aluminium and Manganese Toxicity in Solution Culture

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Abstract

Chickpea (*Cicer arietinum* L.) is a nutritious food security crop but its production in many parts of the world is constrained by soil acidity (Aluminium and Manganese toxicity). Selected chickpea landraces (90) from Ethiopia, Bangladesh, Nepal, India, Australia (Striker, Amber) and wild cicer (6) from Turkey were screened for tolerance to Al or Mn toxicity, in a plant growth room, using a hydroponic screening method. In each experiment, replicated thrice, main plots were 0, 15, and 60 μM Al or 2 and 150 μM Mn treatments, subplots were the chickpea accessions. The chickpea accessions were harvested at 10 (Al) and 26 (Mn) days after sowing (DAS). The longest root length (LRL; Al), shoot and root dry weight (Al, Mn) and visual (toxicity) symptom score (Mn), and shoot length (Mn) were measured. Relative Root Elongation index (EI) was derived from the LRL data. Chickpea landraces were classified as Tolerant ($EI > 70$), Moderate ($EI \leq 70$, $EI > 50$) or Sensitive ($EI \leq 50$). In 15 M Al treatment, wild cicer (wC) (499398 and 50011) were tolerant while landraces (41046, and 42395) were tolerant in 60 M Al. Most landraces and wC, in addition to Amber and Striker, were tolerant to Mn (150 μM) toxicity. Chickpea landrace (41046) was tolerant to both Al (15 and 60 M) and Mn toxicity while landrace (42400) was tolerant to Al (60 M) and Mn toxicity. Striker and wC 49938 were tolerant to Al (15 M Al) and Mn toxicity. Landraces; 41046 and 42400, and wC 49938 require further investigations in acid soils as they show promising tolerance to both Al and Mn toxicity. Further collection of chickpea landraces and wC grown on acid soils such as eastern Kenya and Ethiopia is recommended to extend the range of acid tolerant germplasm for screening and, to identify candidates for use in breeding programmes to produce acid tolerant chickpea.

Keywords: Acid tolerance, chickpea landraces, hydroponic screening, wild cicer