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Step-wise selection for early canopy traits followed by stress tolerance indices as an approach for improving drought tolerance in groundnut (*Arachis hypogaea* L.)

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Rationale:

Drought stress at the pod filling stage of groundnut is a major yield constraint in the semi-arid tropics of Africa and Asia.

Methods:

A population of 600 MAGIC lines (MLs) ($F_{8/9}$ generation) is studied in Leasyscan, a high throughput phenotyping platform (HTPP) that assessed canopy growth up to 45 days after planting (DAP), and under managed stress environment that uses drip lines for application of uniform and measured quantity of water in well-watered (WW) and water-stress (WS) plots. Intermittent drought was imposed from 60 DAP coinciding with pod-filling stage, and time domain reflectometry (TDR) probes measured soil moisture.

Results:

During 2018-19, the Mean Score Index (MSI) of Productivity and Resilience indices selected 20 MLs (MSI=9-10) at par with the checks, ICGV 02266 (MSI=9.4) and ICGV 03043 (MSI=9.2). About 50% of the MLs (320) recorded a Leaf Area Index (LAI) of <0.30 from which 12 MLs recorded high MSI. From 122 MLs that recorded superior digital biomass (11173 to 11297 m³) at 45 DAP than the drought tolerant check ICGV 02266 (10245 m³), eight MLs recorded high MSI. Extreme water stress of 100 mm imposed at pod filling stage in 2021-22 resulted in a yield reduction of >70% in 402 MLs, however, 29 MLs with <20% yield reduction were selected.

Conclusions & Perspectives:

Early generation selection using HTPP (LeasyScan) for early canopy traits followed by stress index-based selections in managed stress environment is proposed for drought tolerance breeding in groundnut. The MAGIC population is a valuable source for improving drought tolerance.