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Leveraging Genetic Innovation for Resilient African Food Systems in the wake of Global Shocks

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Genome-Wide Association Studies (GWAS) Revealed Markers Associated with Agronomic Traits in the MAGIC-Subset Chickpeas (*Cicer arietinum* L.) Population

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Abstract

Chickpea (Cicer arietinum L.) is the second most important cool season grain legume in the world. It is largely grown under rainfed conditions on residual soil moisture. In this study, a subset of 171 improved chickpea lines (F8) selected by a MAGIC (Multi-parent Advanced Generation Intercross) population were used to assess the genetic variability and evaluate their agronomic performance under two different Mediterranean environments (Morocco and Lebanon). The experiment was conducted during the 2017/2018 cropping season under winter planting conditions at the ICARDA research stations in Marchouch-Morocco and Terbol-Lebanon. Results showed significant genetic variation among the tested genotypes. Significant interactions between genotype and environment were also observed. Genotypes with good agronomic performance (M-1407, M-2038, M-2079, M-242, M-2551, M-663, M-2615 and M-987) were identified at both sites. Correlation analysis indicated that the studied traits were significantly intercorrelated, with positive correlations recorded between the earliness (D2F) and F2M, PH, and GY. GWAS were performed using three classical statistical models (GLM, MLM, and FarmCPU). In total, 38 site-common marker-trait associations (MTAs) (identified at Marchouch and Terbol) and 103 environment-specific multimodal MTAs were identified for chickpea agronomic traits. These results provide a database for further research into marker-assisted selection to improve chickpea productivity and yield stability under Mediterranean environment.