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Molecular and Agronomic Screening of Extra-early-provitamin-a-quality-protein Maize Inbred Lines under Contrasting Environments

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Abstract

Striga, a parasitic weed and low soil nitrogen (low-N) constitute major constraints to maize production and productivity in sub-Saharan Africa (SSA). The normal maize, grown and used as staple food in SSA, is deficient in provitamin-A and essential amino acids - tryptophan and lysine. The objectives of this study were to: (i) examine genetic variation among the first generation of tropical Zea extra-early-provitamin-A-quality-protein maize inbred (TZEEIORQ) lines in SSA and (ii) identify parental lines that combine genes for *Striga* resistance and tolerance to low-N with elevated levels of provitamin-A, tryptophan and lysine (PVATL). Seventy-six lines along with four checks were evaluated in six environments (under Striga, low-N and optimal environments for two years) using 10×8 alpha lattice design with two replications, from 2016–2017 at Ile-Ife (rainforest agroecological zone), Mokwa and Abuja (southern Guinea savannah agroecological zone) in Nigeria. Equally, the lines were screened with beta carotene hydroxylase (crtRB1) markers and the levels of provitamin A (using high performance liquid chromatography, HPLC), tryptophan and lysine were quantified in the lines. Highly significant ($p < 0.01$) genetic variability existed among the lines for grain yield and other traits. One of the DNA markers categorised the lines into two and the groups were significantly ($p < 0.01$) different in their average levels of provitamin-A based on the results of the HPLC. Although the DNA marker selected the line (TZEEIORQ 54A) with the highest level of provitamin-A (11.0μg/g), some lines such as TZEEIORQ 72A (8.9μg/g) and TZEEIORQ 59 (8.8μg/g) had relatively high levels of provitamin A and were not selected by the markers. The following lines: TZEEIORQ 5, TZEEIORQ 52A, TZEEIORQ 55A, TZEEIORQ 57A, TZEEIORQ 58 and TZEEIORQ 62 combined *Striga* resistance and low-N tolerance with high levels of PVATL. The lines could be used to develop an improved population from where lines with superior performance for all the desirable traits can be extracted. Furthermore, the lines could be crossed in all possible combinations to develop maize hybrids/varieties that could, at once, address the problems of Striga, low-N, vitamin A deficiency and protein malnutrition in SSA.

Keywords: HPLC, low-N, striga, TZEEIORQ

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