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Inheritance, Stability, and Validation of Provitamin a Markers in Striga Hermonthica-Resistant Maize

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Abstract : The development of maize varieties combining Provitamin A (PVA), high yield, and Striga resistance is an effective and affordable strategy to contribute to food security in sub-Saharan Africa, where maize is a staple food crop. There has been limited research on introgressing PVA genes into Striga-resistant maize genotypes. The objectives of this study were to: i) determine the mode of gene action controlling PVA carotenoid accumulation in Striga-resistant maize, ii) identify Striga-resistant maize hybrids with high PVA content and stable yield, and iii) validate the presence of PVA functional markers in offspring. Six elite, Striga-resistant inbred females were crossed with six high-PVA inbred males in a North Carolina Design II and their offspring were evaluated in four environments, following a 5x8 alpha lattice design with four hybrid checks. Results revealed that both additive and non-additive gene action control carotenoid accumulation in the present study, with a predominance of non-additive gene effects for PVA. Hybrids STR1004xCLHP0352 and STR1004xCLHP0046 - identified as Striga-resistant because they supported fewer Striga plants – were the highest-yielding genotypes with a moderate PVA concentration of 5.48 and 5.77 µg/g, respectively. However, those two hybrids were not stable in terms of yield across all environments. Hybrid STR1007xCLHP0046, however, supported fewer Striga plants, had a yield of 4.52 T/ha, a PVA concentration of 4.52 µg/g, and was also stable. Gel-based marker systems of CrtRB1 and LCYE were used to screen the hybrids and favorable alleles of CrtRB1 primers were detected in 20 hybrids, confirming good levels of PVA carotenoids. Hybrids with favorable alleles of LCYE had the highest concentration of non-PVA carotenoids. These findings will contribute to the development of high-yielding PVA-rich maize varieties in Uganda.

Keywords : gene action, stability, striga resistance, provitamin A markers, beta-carotene hydroxylase 1, CrtRB1, beta-carotene, beta-cryptoxanthin, lycopene epsilon cyclase, LCYE
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