## ABSTRACT

Micronutrient malnutrition, particularly vitamin A deficiency, is prevalent in developing countries, including Kenya. The deficiency is higher in regions where cassava is a staple crop. the crop is ideal for biofortification since it is vegetatively propagated and retains the introgressed traits across generations. A conventional breeding approach was employed to introgress beta-carotene from yellow-fleshed clones, sourced from the International Institute of Tropical Agriculture (IITA), into early-bulking local white-fleshed clones. The study evaluated the combining ability for beta-carotene and yield traits in an F1 cassava population. Ten high beta-carotene IITA clones were crossed with ten local clones using a North Carolina Design II mating design. A total of producing 125 families, including 35 reciprocal crosses were evaluated for combining abilities. General Combining Ability (GCA) analysis showed significant effects for IITA parents in root pulp colour and plant height (while local parents had significant GCA for harvest index, number of lobes and plant height. Specific Combining Ability (SCA) was significant for harvest index and plant height. Root pulp colour was influenced by both additive and non-additive genetic effects, with maternal effects also observed, indicating that local varieties could be improved for beta-carotene without compromising agronomic performance. Clonal evaluation of 324 yellow-fleshed F1 clones showed site differences in root yield, dry matter content and disease severity for Cassava Mosaic Disease (CMD), Cassava Brown Streak Disease (CBSD) and Cassava Green Mite damage (CGM). Qaulity attributred namely cyanogenic potential, carotenoid content and the beta-carotene fraction also varied across sites. Phenotypic characterization of 551 F1 genotypes at KALRO-Thika, conducted at 3, 6, and 9 months, showed that root pulp colour correlated with external root colour, cortex thickness, and cortex colour, suggesting indirect selection for beta-carotene is only feasible late in the season. Five SSR markers were tested for beta-carotene association, four amplified but none distinguished yellow- from white-fleshed genotypes, highlighting the need for further genetic studies to develop efficient molecular selection tools. The study demonstrates that conventional breeding can enhance beta-carotene content in cassava, but careful parent selection is crucial to leverage favorable GCA effects. Multi-locational evaluations are recommended due to genotype-by-environment (G x E) interactions. These findings support the potential to improve cassava's nutritional value while maintaining agronomic performance to vitamin A deficiency in Kenya.



Key words: Cassava, combining ability, characterization, molecular markers