



A Comparative Review of Insecticide Resistance Management Strategies and Their Impact on Malaria Vector Susceptibility in the Mwea Rice Irrigation Scheme, Kenya

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Abstract

The Mwea Rice Irrigation Scheme in Kenya is a high malaria transmission area, where the aquatic habitat supports prolific mosquito vector populations. Intensive insecticide use in agriculture and public health has driven the development of insecticide resistance in local *Anopheles* mosquitoes, undermining malaria control. This review compares the efficacy and impact of two principal insecticide resistance management strategies—*insecticide rotation and mosaic deployment*—on restoring malaria vector susceptibility within the Mwea irrigation agro-ecosystem. A systematic review of published and grey literature was undertaken. Included studies reported on insecticide resistance status, implementation of resistance management strategies, or entomological outcomes for *Anopheles* mosquitoes in Mwea. Data were synthesised thematically to compare the two core strategies. Evidence indicates that a structured insecticide rotation strategy, when consistently implemented, showed a more reliable trend towards restoring partial susceptibility in *Anopheles arabiensis* populations than mosaic deployment. A recurring theme was the practical difficulty of executing mosaic strategies at community level, which frequently resulted in unintended mixing of chemicals. One report documented a marked reduction in resistance intensity following two complete rotation cycles. While both strategies are theoretically sound, rotation appears more pragmatically feasible and effective in this specific irrigated setting. However, regaining full susceptibility is improbable without incorporating complementary, non-chemical vector control measures. Programme managers should implement a formal, district-wide insecticide rotation plan for vector control, coordinated with agricultural pesticide regulations. Investment in community engagement and routine resistance monitoring is crucial. Future strategies must integrate environmental management to reduce dependence on insecticides. malaria, insecticide resistance management, vector control, *Anopheles arabiensis*, rice irrigation, Kenya This review provides a comparative analysis of insecticide resistance management strategies in a defined agro-ecological system, offering evidence to inform policy and operational decisions for malaria vector control in irrigated schemes in sub-Saharan Africa.

Keywords: *malaria vector control, insecticide resistance management, East Africa, pyrethroid resistance, Anopheles arabiensis, integrated vector management, agricultural pesticides*

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