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Integrated Pest and Pollinator Management (IPPM) as a Novel Tool to Merge Ecosystem Services: Lessons Learnt from Avocado in Kenya

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Abstract

Ecosystem-based services such as pollination and integrated pest management (IPM) are key drivers of sustainable productivity and resilience of African agricultural production systems. Although pollination and IPM could interact in multifarious ways to ensure healthier agricultural ecosystems and improve food security, they have mainly been promoted in isolation with minimal efforts to demonstrate their synergies. We present a study that tested the combined effect of beehive supplementation and IPM treatments through an innovative integrated pest and pollinator management (IPPM) approach against the oriental fruit fly Bactorcera dorsalis and the false codling moth Thaumatotibia leucotreta among smallholder avocado (*Persea americana*) farmers in Muranga, Kenya. Production systems were characterised for the role of pollinators and insect pests at the landscape level using freely available Sentinel^{-2} remotely sensed data to calculate normalised difference vegetation index (NDVI) as a proxy for vegetation productivity. Based on socio-economic surveys of 529 farmers, ex-ante studies revealed that farmers were willing to pay USD 56, 70 and 195/farm for IPM, pollination supplementation and IPPM, respectively. Subsequently, one of four treatments (IPPM, IPM, *Apis mellifera* beehive supplementation or control) was implemented on avocado orchards with 36 participating farmers. Pollination deficits, amounting to 27 %, was eliminated completely in farms in high and medium vegetation productivity areas following beehive supplementation, while in low vegetation production areas, pollination deficit remained at 4 %. Results equally showed the benefit of IPPM on pest populations, especially for low vegetation productivity areas. IPPM is a novel concept, which may be highly beneficial in pollination-dependent crops in East Africa.

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Awareness was created through training of 1,411 farmers and local government representatives to help increase the diffusion rate of IPPM among avocado-growing communities.

Keywords: Avocado, integrated pest and pollinator management, Kenya, landscape, normalised difference vegetation index, pollinator