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Can intercropping of cowpea and amaranth improve crop performance under drought conditions in Kenya?

ANNABELLE HEID¹, JOHANNA KRIPPNER¹, IRMGARD JORDAN², BOAZ S WASWA², MICHAEL KINYUA², MICHAEL FREI¹

¹*Justus Liebig University Giessen, Department of Agronomy and Crop Physiology, Germany*

²*The Alliance of Bioversity International & CIAT, Kenya*

Abstract

Drought stress is one of the major factors affecting global food security, especially in semi-arid and arid regions, and is expected to intensify due to climate change. Farmers need to adapt their cropping strategies and practices to improve resilience and resource efficiency. This study investigated effects of different cropping systems and harvesting intervals on dual-purpose cowpea (*Vigna unguiculata*) and vegetable amaranth (*Amaranthus* spp.) yields, to better understand whether diversification of small-holder agriculture improves farmers' resilience in drought prone areas. The field experiment was conducted at the Kenya Agricultural and Livestock Research Organisation (KALRO) Kiboko research station in the drylands of Makueni County (AEZ = LM 5–9), Kenya. A two-factorial randomised complete block design with two water-regimes (irrigated vs. less irrigated) and four replications was established, including two cropping systems (sole crops of cowpea or amaranth, and strip-intercropping of both species). Each plot (N = 48, 3 × 3 m, spaced 1 m apart) was subdivided into three subplots for (i) non-destructive physiological measurements, (ii) short and (iii) long harvest intervals. Pest control and common agronomic practices were carried out according to local practice. While cowpea leaf and grain yields showed no significant differences between cropping systems, both in well-watered as well as drought conditions, amaranth intercrop leaf yield was significantly lower under reduced irrigation compared to sole crop yield. However, LER (land equivalent ratio) values >1 in both water-regimes indicated improved land-use efficiency through intercropping of cowpea and amaranth. The diversification of the system through intercropping of dual-purpose cowpea and vegetable amaranth does not come at the expense of land use efficiency. Our findings suggest that cowpea may be successfully integrated into intercropping systems without reducing productivity, while vegetable amaranth leaf yield performance in this intercrop needs further improvement. Overall, intercropping of cowpea and amaranth showed potential for diversifying smallholder cropping systems in water-limited environments, particularly as green leafy vegetables and legumes contribute to a healthy diet and strengthen the resilience of farming systems.

Keywords: Amaranth, Cowpea, diversification, drought, intercropping, Kenya, resilient farming systems