CAN INTERCROPPING OF COWPEA AND AMARANTH IMPROVE CROP PERFORMANCE UNDER DROUGHT CONDITIONS IN KENYA?

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Figure 1: Partial view of the field trial at KALRO Kiboko, Kenya, showing individual 3 × 5 m plots The trial involved sole cropping and intercropping of cowpea (*Vigna unguiculata*) and amaranth (*Amaranthus* spp.) using an additive intercrop design under two irrigation regimes.

Introduction

- Drought stress is a major constraint to agricultural productivity, nutritional security, and food availability in semi-arid and arid regions.[1,2,3]
- Diversifying cropping systems through intercropping may enhance resilience, improve resource-use efficiency and diversify diets, particularly for smallholder farmers in water-limited environments.[4,5]
- This study assessed the effects of intercropping and different harvest intervals on dual-purpose cowpea (*Vigna unguiculata*) and vegetable amaranth (*Amaranthus* spp.) in Kenya's drylands.
- The objective was to evaluate whether intercropping can improve land-use efficiency and support sustainable, nutrition-sensitive agriculture under drought-prone conditions.

Materials and Methods

- The study was conducted at KALRO Kiboko, Makueni County, Kenya (AEZ LM 5-9). A two-factorial randomized complete block design was used (Fig. 1).
- Treatments included two cropping systems (sole and additive intercrop of cowpea and amaranth) and two water regimes (irrigated and less irrigated).
- Each of the 48 plots (3 × 5 m) was subdivided into three subplots (1.3 × 1.3 m) for physiological measurements and two harvest intervals (short and long). Standard agronomic practices and pest control were applied according to local recommendations (Fig. 1).

Results

- Cowpea grain and leaf yields showed no significant differences between cropping systems under either irrigation regime as well as flowering time and date of physiological maturity (Fig. 2B,C).
- Amaranth leaf yield and total leaf number per plant was consistently lower in the intercrop compared to sole cropping (Fig. 2A).
- Less frequent cowpea harvesting led to increased lateral growth into adjacent rows, occasionally suppressing amaranth, though this was not consistently observed (Fig. 3).
- Land Equivalent Ratio values >1 indicated improved land-use efficiency and higher productivity of intercropping compared to sole cropping at system-level (Fig. 2D).
- No indicators of enhanced drought resilience due to intercropping.

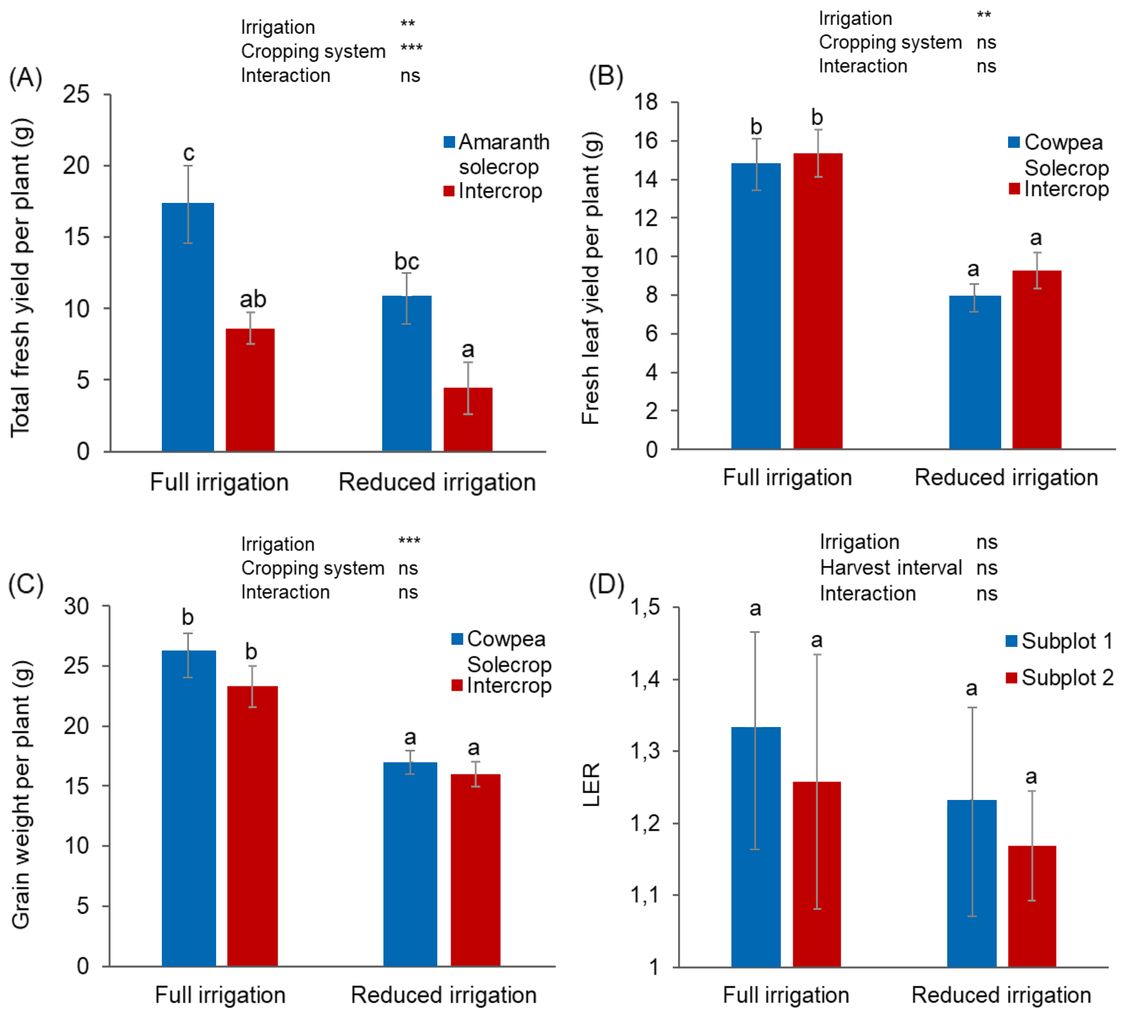

Figure 2: Effect of cropping systems on (A) amaranth total leaf yield, (B) cowpea total leaf yield, (C) cowpea total grain and (D) the effect of harvest intervals on Land Equivalent Ratio (LER) of a cowpea-amaranth intercrop under different irrigation regimes. Mean values (A n = 16, B n = 32, C = 24, D = 8) ± standard errors. Averages across harvest intervals and foliar treatments (A-C), averaged across all leaf harvests and foliar treatments (D). The LER was calculated based on leaf yield per square meter (g/m²). Letters indicate pairwise comparisons (Tukey's test, α = 0.05) among cropping systems and irrigation regimes. ANOVA (ns P > 0.05; * P ≤ 0.05; ** P ≤ 0.01; *** P ≤ 0.001).

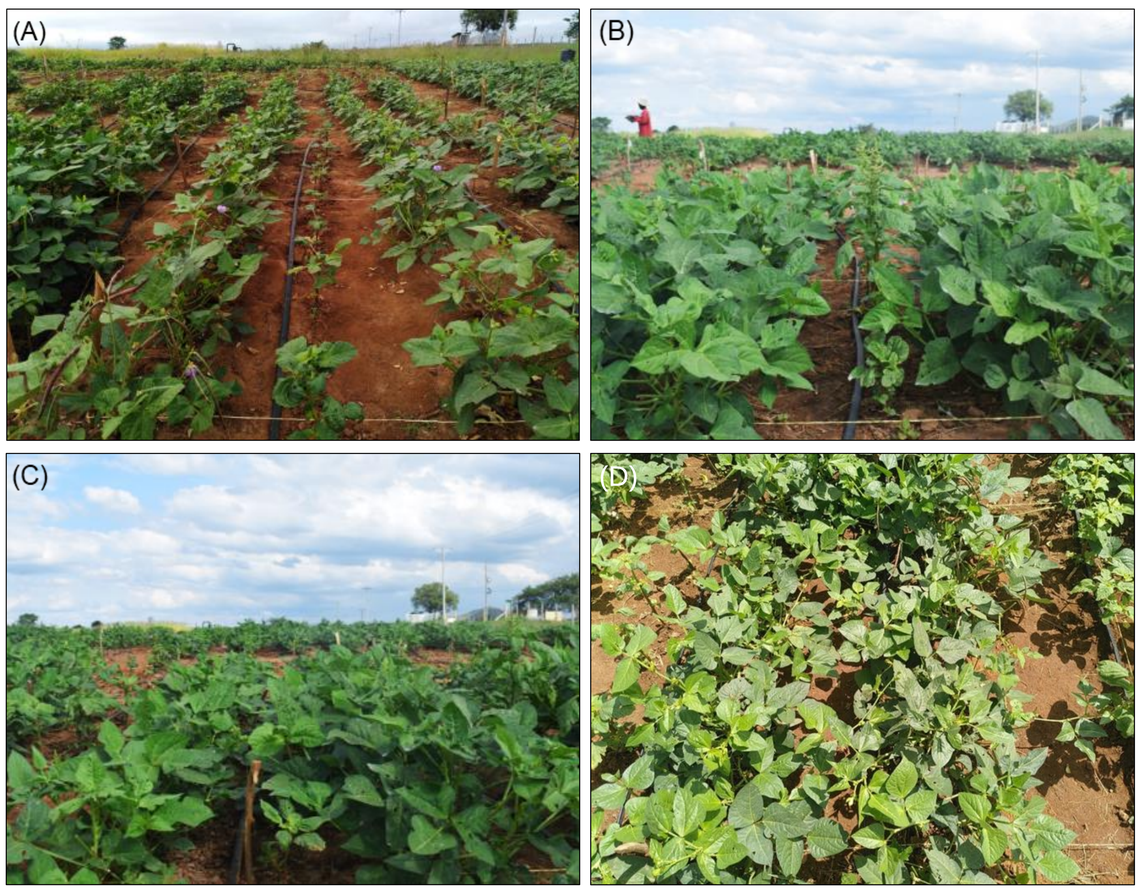

Figure 3: Visual differences in cowpea and amaranth growth habit across the three subplots of the fully irrigated trial on 21 May 2024. Shown are plants in (A) subplot one with frequent leaf harvest, (B) subplot two with reduced harvest frequency, (C) subplot three without leaf harvest and (D) subplot three from above. They are representative of the respective subplot treatments under full irrigation.

Conclusions and Outlook

- Intercropping reduced amaranth productivity but increased productivity at total-system level through compensatory cowpea growth and the additive design. This is indicated by increased LER values.
- Although no improvements in physiological stress responses were observed, the system offers potential by combining crops with complementary functions and nutrient profiles.
- The consistent reduction in amaranth yield, however, underlines the need to optimize intercrop design under water-limited conditions.
- Optimizing planting density, spatial arrangement, and harvest management could enhance intercrop performance in future studies.

Literature

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