Productivity and land use efficiency of finger millet cropping systems in Chad

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Introduction

The CROP4HD project promotes agroecology, crop diversification, and the use of nutrient-rich Neglected and Underutilised Species (NUS) like finger millet [*Eleusine coracana* (L.) Gaertn.] to improve diets and combat malnutrition. Although finger millet is highly nutritious, its production in Chad is low, and research on optimal cropping systems is limited. Traditionally broadcasted, finger millet planting saves time but leads to uneven germination, weed management issues, and lower yields.

Objectives

To evaluate the productivity and land use efficiency of seven finger millet cropping systems under organic conditions. We tested four pure stands: broadcasting finger millet at 10 kg ha^{-1}, sowing finger millet in rows (25 cm × 25 cm) with and without board bending and a transplanting system from nursery to field (25 cm × 25 cm) with board bending. Additionally, we assessed three strip intercropping systems, which involve four rows of finger millet alternating with two rows of legumes (bambara bean or groundnut or cowpea). The three legumes in pure stand were evaluated as well.

Methods

A field experiment was conducted at the Ba-Illi Agricultural Technical School in the Chari-Baguirmi region, situated in southwestern Chad, characterized by a semi-arid tropical climate during the rainy seasons (Mai-October) of 2023 and 2024, following a randomized complete block design with three replications. A linear model was applied incorporating orthogonal linear contrasts with finger millet broadcast (FM-br) serving as the control. Additionally, the Land Equivalent Ratio (LER) was calculated for intercropping systems. Twenty farmers, comprising ten men and ten women, were invited to assess the seven cropping systems during a one-day workshop held five days before harvest **(Fig. 1).**

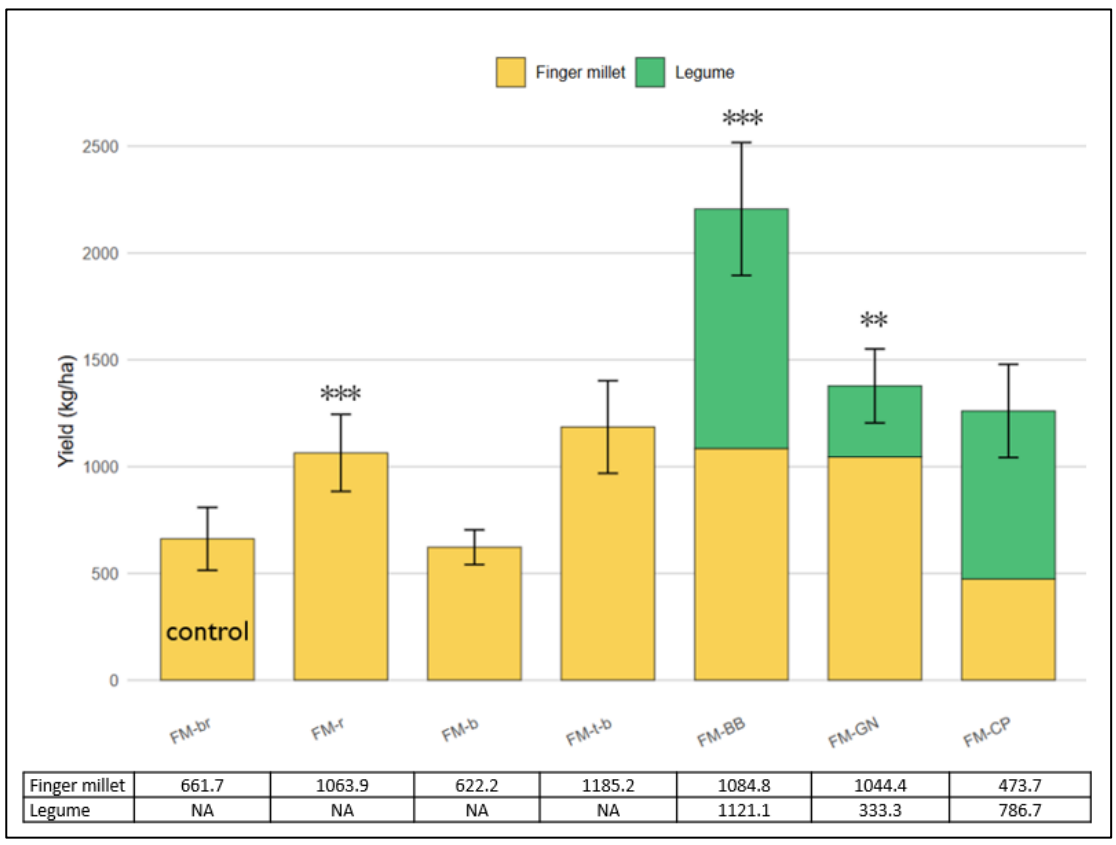
Results

- Highly significant differences ($p < 0.001$) in grain yield were observed between FM-br (661.7 kg/ha) and FM-r (1063.9 kg/ha), as well as between FM-br and FM-BB (2205.9 kg/ha), while a significant difference ($p < 0.01$) was found between FM-br and FM-GN (1377.7 kg/ha) **(Fig. 2)**.
- The provided LER values for the three intercropping systems are: FM-BB: 2.5; FM-GN: 1.5 and FM-CP: 0.9.
- According to farmers' perceptions, the cropping systems that combine finger millet with bambara beans (FM-BB) and groundnuts (FM-GN) are the most appreciated.

Conclusion & Outlook

- We recommend intercropping finger millet and bambara bean (FM-BB), due to its highest grain yield and LER, as well as its acceptance by farmers. This system offers a viable alternative to broadcast finger millet sowing, aiming to enhance food security and conserve agricultural land.
- Further on-farm trials should be conducted to evaluate performance across multiple locations and to assess farmer acceptance before recommending this technology to farmers.

Fig. 1 Participatory evaluation conducted with 10 female and 10 male farmers of finger millet cropping systems. The image illustrates the intercropping system of finger millet and bambara bean during a focus group discussion (Foto: Leone Ferrari, FiBL).



	FM-br	FM-r	FM-b	FM-t-b	FM-BB	FM-GN	FM-CP
Finger millet	661.7	1063.9	622.2	1185.2	1084.8	1044.4	473.7
Legume	NA	NA	NA	NA	1121.1	333.3	786.7

Fig. 2 Grain yield (kg/ha) for 7 treatments:

Finger millet in pure stand with broadcast sowing (FM-br) as control,
Finger millet in pure stand sown in rows (FM-r),
Finger millet in pure stand sown in rows and board bending (FM-b),
Finger millet in pure stand with transplanting and board bending (FM-t-b),
Intercropping of finger millet and bambara bean (FM-BB),
Intercropping of finger millet and groundnut (FM-GN),
Intercropping of finger millet and cowpea (FM-CP).

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' for orthogonal linear contrasts, finger millet in pure stand with broadcast sowing (FM-br) is our control for analyses.

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