Intercropping for Resilient and Diversified Agri-food Systems in Moisture-Deficient Areas of Ethiopia

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Introduction

- Intercropping growing two or more crops simultaneously enhances productivity, resource efficiency, and system resilience, particularly in drought-prone regions
- In Ethiopia, intercropping sorghum with pulses offers a climate-smart solution to improve food security and land productivity
- However, many farmers still practice cereal to cereal intercropping, which limits both yield and efficiency

Photo 1: During harvesting

Photo 2: Nodule count

Objectives

- To evaluate different row ratios of sorghum-pulse intercropping for maximum yield and land-use efficiency
- To identify the row ratio providing the highest economic return in moisture-stressed areas

Methods

- **Location:** East and West Belesa, Ethiopia (2017–2018)
- Elevation range: 960 m.a.s.l..
- Climate: T^{O} 32 in °C, and RF 611 in mm
- **Design:** Randomized Complete Block Design with 3 replications
- **Treatments (9):**
  - **Sole crops**: sorghum, mung bean, and haricot bean
  - **Intercropping:**
    - ✓ Sorghum with mung bean (1S:1M, 1S:2M, 2S:1M row ratios)
    - ✓ Sorghum with haricot bean (1S:1H, 1S:2H, 2S:1H row ratios)
- **Spacing:** Sole sorghum: 75×15 cm; mung bean: 30×5 cm; haricot bean: 40×10 cm b/n rows and plants respectively and
- Sowing of pulses 15 days after sorghum sowing

Results

Table 1: Soil chemical properties of the experiments

Soil sample pre- planting			
		Parameters	
Location	Soil sample	Total Nitrogen %	Available Phosphorus (ppm)
East Belesa	Composite	0.062	6.1
West Belesa	Composite	0.076	10.1

Soil sample after harvesting				
	East Belesa		West Belesa	
Trt	Total Nitrogen %	Available Phosphorus (ppm)	Total Nitrogen %	Available Phosphorus (ppp)
SS	0.019	12.8	0.07	11.7
SM	0.152	16.0	0.12	15.3
SH	0.254	16.0	0.285	14.5
1S:1M	0.075	12.5	0.089	12.4
1S:1H	0.079	17.1	0.089	14.4
1S:2M	0.082	9.9	0.087	11.6
1S:2H	0.093	18.9	0.092	17.7
2S:1M	0.067	10.7	0.094	12.6

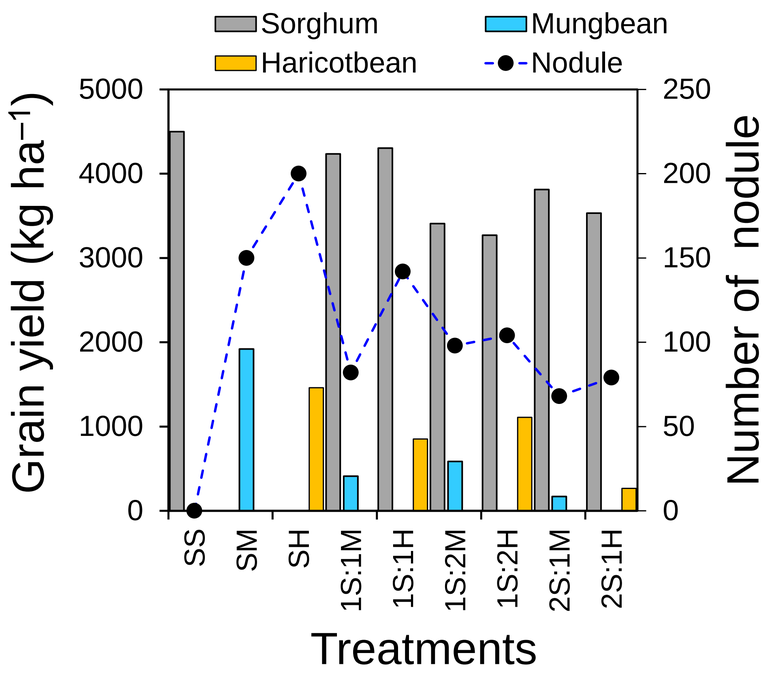


Figure 1: Combined results of grain yield and Nodule

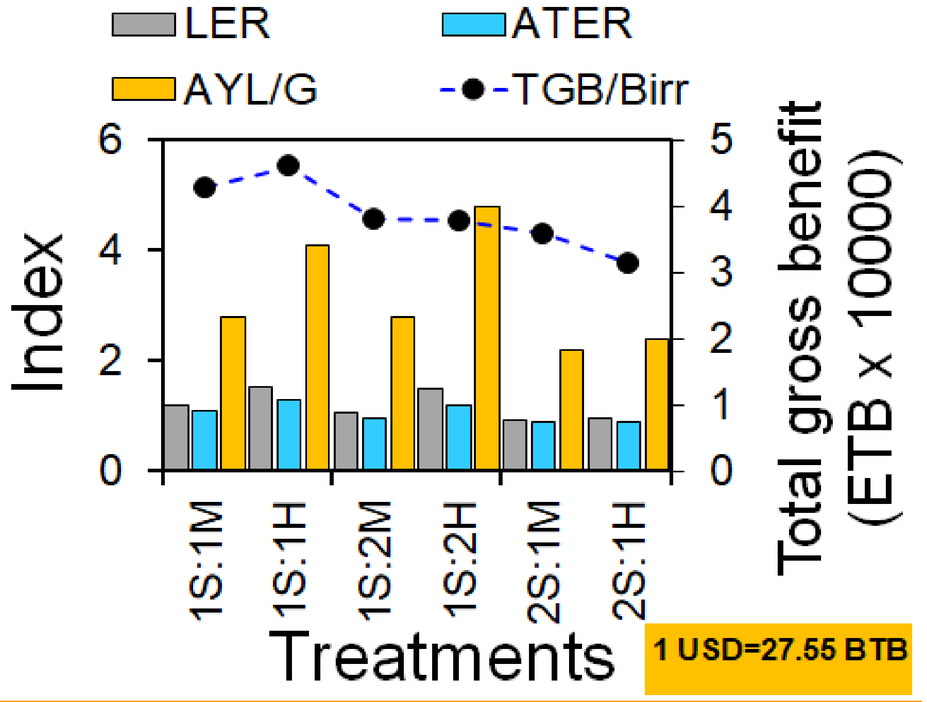
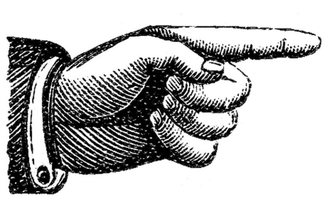


Figure 2: Results of, Land equivalent ratio, Area time equivalent ratio, Actual yield gain and Total gross benefit

- **Pre-planting soil characteristics:** Low total nitrogen (N), medium available phosphorus (P)
- **After-harvest soil results:**
  - ➢ Highest total N in sole pulses due to N-fixation
  - ➢ Highest available P and nodule number in 1:1 sorghum–haricot bean intercropping
- All intercropping treatments had **LER > 1**, showing higher productivity than sole cropping
- **1:1 sorghum–haricot bean system** achieved:
  - ➢ Highest LER: **1.54**, Yield advantage: **4601 kg/ha**, **31%** ATER benefit and Maximum net return: **45,949** Ethiopian Birr

Conclusion



- The 1:1 sorghum–haricot bean intercropping system offers a robust strategy for improving yield, economic return, and resource use efficiency in moisture deficit areas of Ethiopia
- This system supports climate resilience, promotes sustainable livelihoods, and strengthens food security through diversified cropping

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