



Assessing growth and yield in maize-mungbean and maize-chili pepper relay intercropping for farmers income diversification and sustainable soil health management in Southern Benin

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Background

Overall objective

Promote the crop diversification in maize-based production area by introducing vegetables legumes for higher productivity, profitability and soil fertility improvement

Specific objectives

- ☐ To assessed the growth and yield of maize, chili and mungbean in relay intercropping systems comparing to sole cropping.
- ☐ To evaluated the economic viability and income diversification potential of maize-mungbean and maize-chili intercropping
- ☐ To investigated the impact of intercropping on soil health indicators and sustainability of agricultural production systems.



Materials & methods

- ❑ Study area: 5 villages (Allada)
- ❑ Experimental design: randomized complete block design with 3 replications
- ❑ Farmers involved in mixed trials across villages and gender

N°1	Villages	Men	Women	Total
1	Ahota	2	1	3
2	Gbedji	1	2	3
3	Lanmandji	3	-	3
4	Tokpa - Zounledji	3	-	3
5	Sohoun	2	1	3
Total		11	4	15



Sowing systems tested for each intercropping system

Maize – chili pepper intercropping

- sole maize
- sole chili
- (1:1) maize – chili
- (2:2) maize – chili

Maize – mungbean intercropping

- sole maize
- sole mungbean
- (1:2) maize - mungbean
- (1:3) maize - mungbean
- (2:2) maize - mungbean

Materials & methods

Data collection

- **Growth data:** plant height, stem diameter, number of branches for chili and mungbean and number of leaves for maize were collected at three phenological stages of the plants.
- **Yield:** fruits and grains yield were collected.
- **Farmer's perceptions:** on the performances of each sowing system were collected during field days.



Data analysis

Productivity and efficiency in land use of the sowing systems

- Fruits and grain yield
- Land equivalent ratio
- Actual yield loss or gain

Economic viability and income diversification potential of maize - mungbean and maize - chili pepper relay intercropping

- Monetary advantage index (MAI)
- Gross returns from maize mungbean and chili pepper production in both intercropped and monocropped systems

Results

Growth performance of maize, mungbean, and chili across sowing system

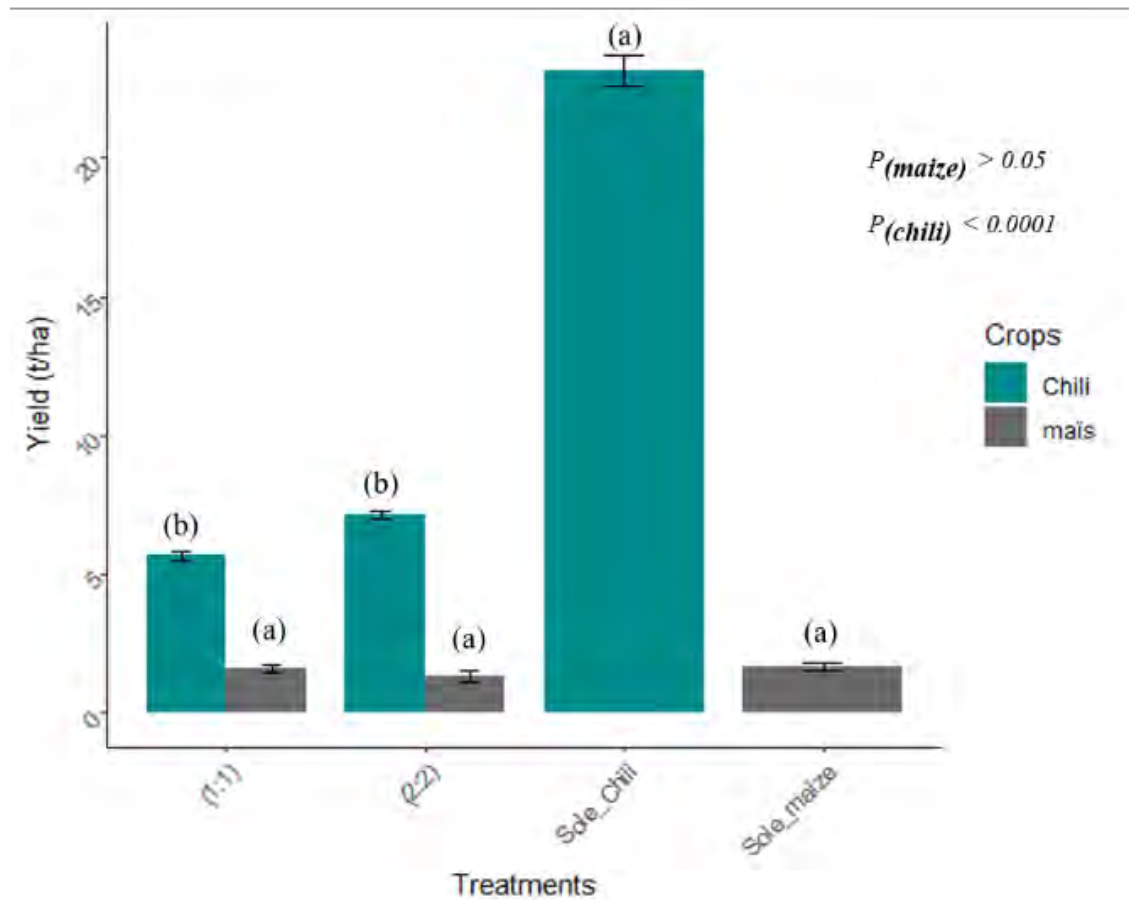
- ❑ Plant height, stem diameter and number of leaves for maize were not significantly affected ($P > 0.05$) while chili and mungbean growth were significantly influenced across the sowing systems ($P < 0.0001$)
- ❑ Treatment (2:2) in maize-chili showed high growth performance for chili while treatment (1:3) for mungbean in maize-mungbean intercropping



Results

Yield variation for maize, chili pepper and mungbean across sowing systems for both intercropping

**Divers products harvested:
maize, chili**



- Maize yield was not statistically influenced across the sowing system for maize - chili and maize – Tomato intercropping ($P > 0.5$)
- Yield for 2nd crop (chili) was significantly affected across the sowing systems ($P < 0.0001$) for both intercropping



Figure 1: yield for maize and chili pepper variation across sowing systems

- Treatment (2:2) provided higher yield for maize and chili compared to treatment (1:1)



Results

Yield variation for maize - mungbean across sowing systems for both intercropping

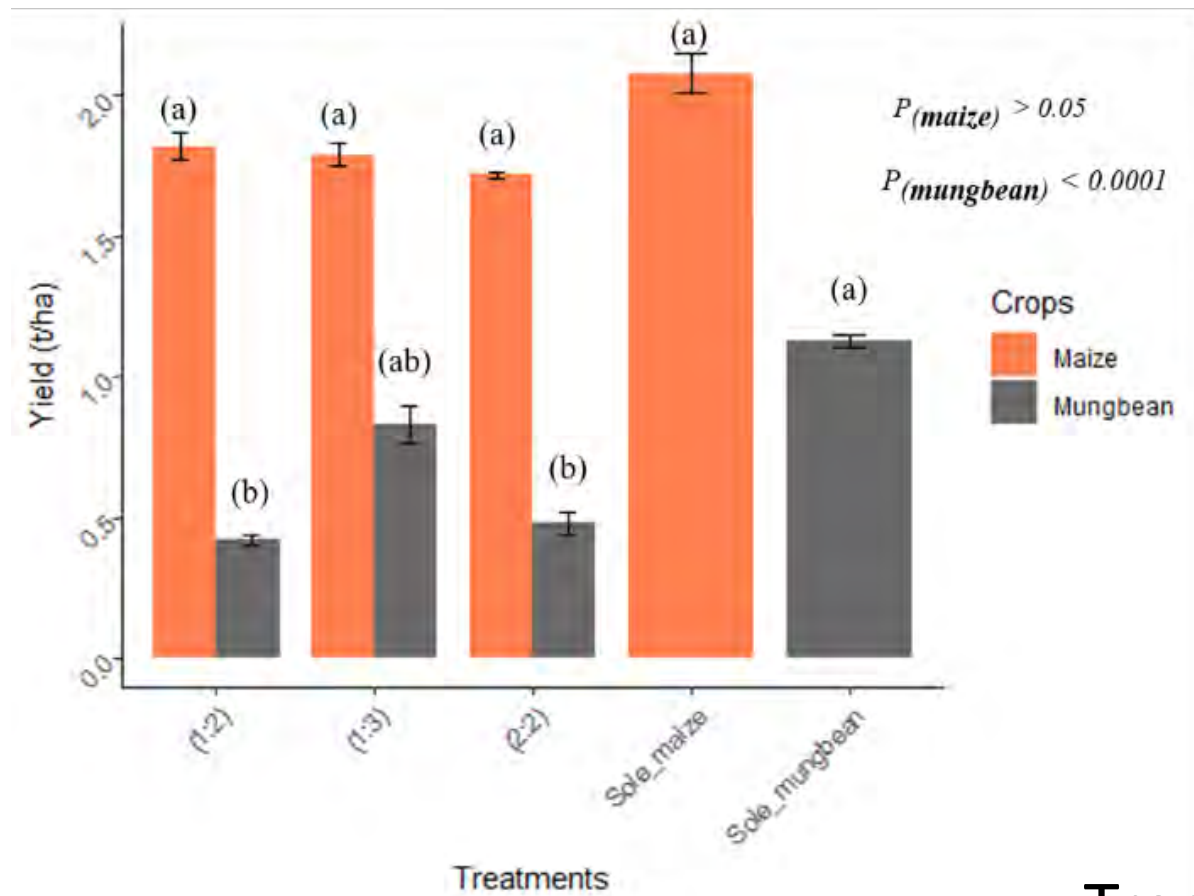


Figure 1: yield for maize and mungbean variation across sowing systems

Maize yield was not statistically influenced across the sowing system for maize – mungbean intercropping ($P > 0.5$)

- Treatment (1:3) provided higher yield for maize and mungbean followed by treatment (2:2);

- Treatment (1:2) showed the weakest performance for both crops

Divers products harvested: maize, mungbean



Results

Productivity and efficiency in land use of the sowing systems

Land equivalent ratio

- ❑ LER for all intercropping are greater than 1.
- ❑ (1:1) had a higher LER compared to (2:2)
- ❑ (1:3) showed highest LER followed by (2:2) and (1:2)

Actual yield loss or gain

- ❑ Positive AYL across all the intercropping patterns.
- ❑ (2:2) provided the highest value in maize – chili intercropping
- ❑ (1:3) was 2.42 while 1,18 and 1,11 respectively for (1:2) and (2:2)

Intercropping	Treatments	LER	AYL
Maize-chili	(1:1)	1.15	0.13
	(2:2)	1.13	0.24
Maize-mungbean	(1:2)	1.24 (b)	1.18 (b)
	(1:3)	1.60 (a)	2.42 (a)
	(2:2)	1.25 (b)	1.11 (c)

Results

Economic viability and income diversification potential of maize - mungbean and maize - chili relay intercropping

Monetary advantage index (MAI)

- ❑ **Maize – chili** : treatment (2:2) exhibited high monetary advantage index compared to treatment (1:1)
- ❑ **Maize – mungbean** : treatment (1:3) had the highest MAI followed by treatments (2:2) and (1:2) respectively

Intercropping	Treatments	MAI
Maize and chili pepper	Mono crop	-
	(1:1)	833.32
	(2:2)	925.74
	Significance	P < 0.0001
Maize and mungbean	Mono crop	-
	(1:2)	192.17 (b)
	(1:3)	485.46 (a)
	(2:2)	198.43 (b)
	Significance	P < 0.0001



Results

Economic viability and income diversification potential of maize - mungbean and maize - chili relay intercropping

Gross returns from maize, mungbean & chili across sowing systems

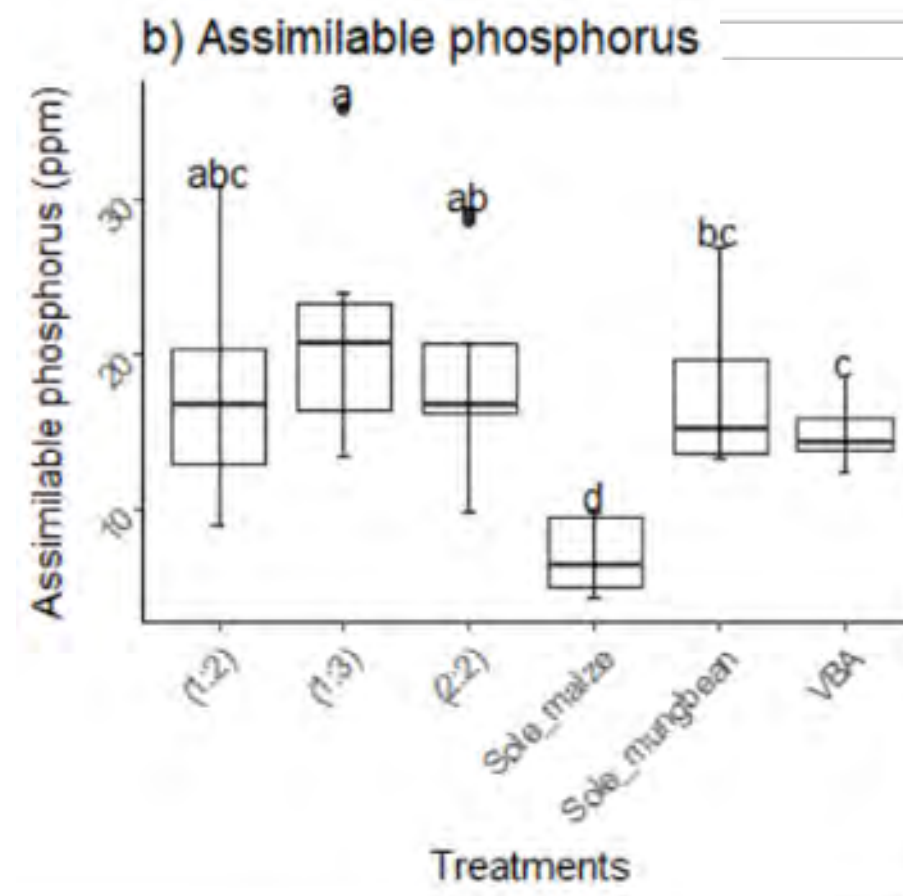
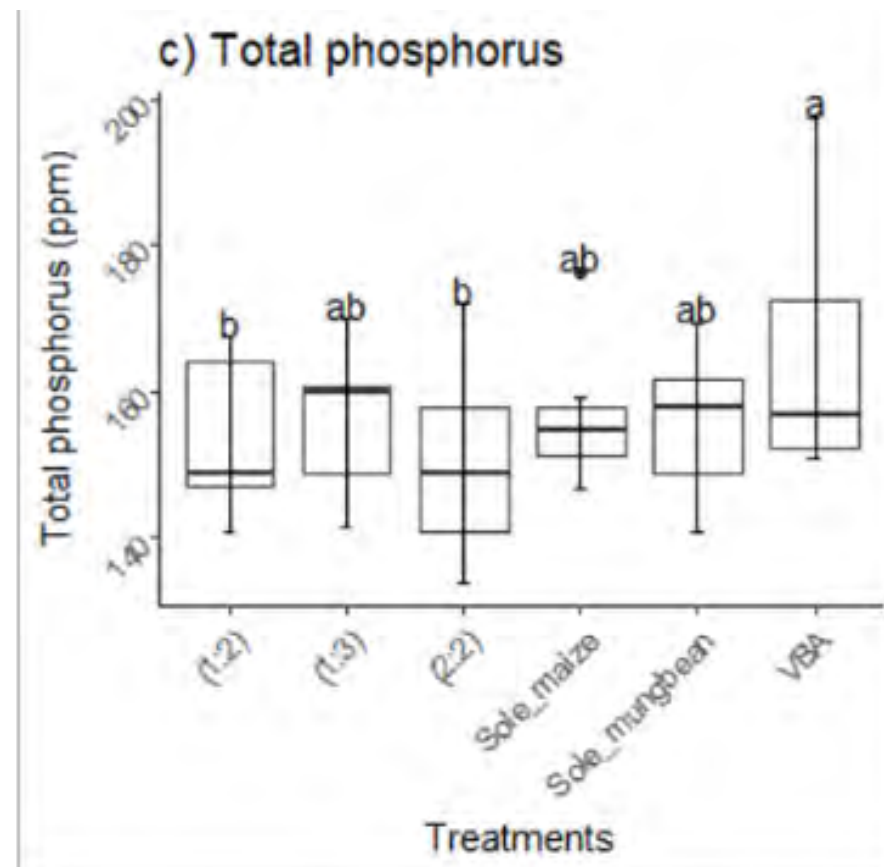
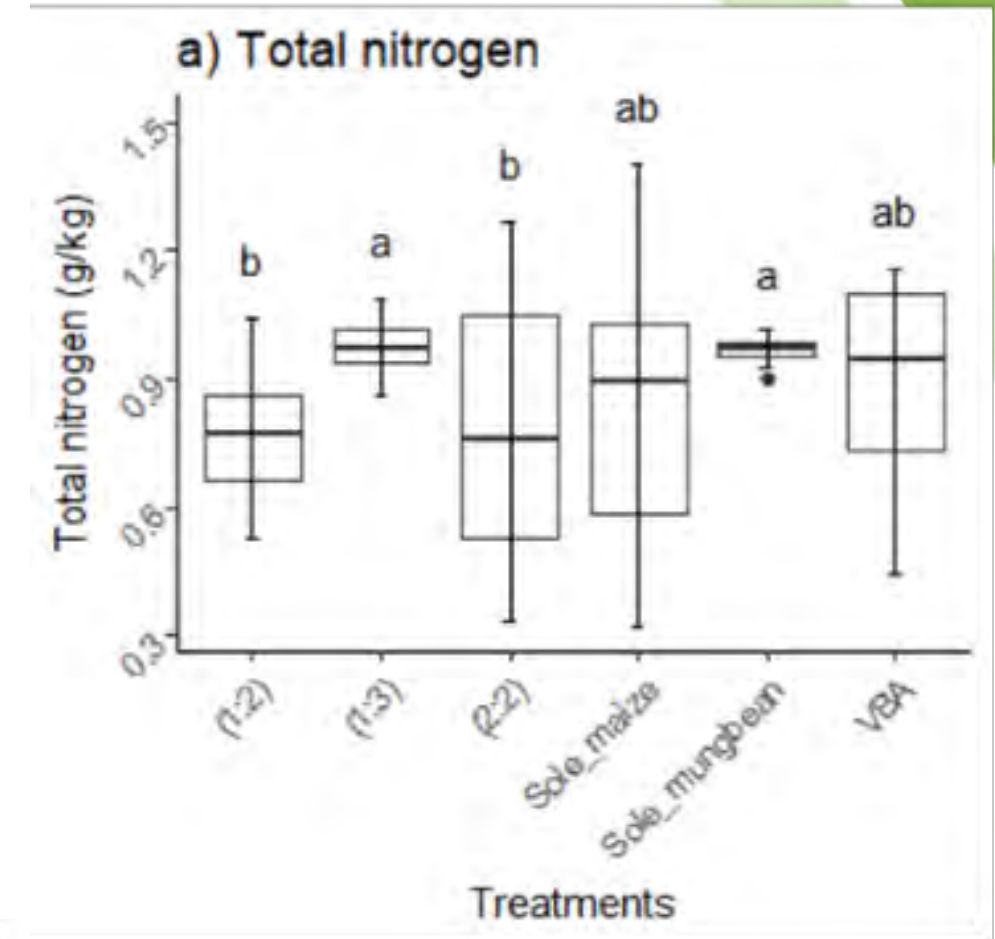
- ❑ (2:2) provided high gross return compared to treatment (1:1) for maize - chili
- ❑ (1:3) and (2:2) showed higher total gross return respectively for maize – mungbean
- ❑ (1:2) had lowest gross return for maize – mungbean

Intercropping	Treatments	Total estimated gross return per treatment (USD/ha)
Maize and chili pepper	Mono crop	-
	(1:1)	6323.08 ± 8.60 (b)
	(2:2)	7796.59 ± 64.25 (a)
	Significance	P < 0.0001
Maize and mungbean	Mono crop	-
	(1:2)	971.17 ± 9.37 (b)
	(1:3)	1301.23 ± 19.29 (a)
	(2:2)	986.76 ± 4.21 (b)
	Significance	P < 0.0001

Results

Soil fertility parameters variation across sowing systems in maize – mungbean intercropping

- Sole maize cropping decreased the total nitrogen and assimilable phosphorus contained in soil (fig. a & b).
- Treatment (1:3) significantly improved nitrogen and phosphorus contained in soil compared to other intercropping treatments (fig. a, b & c).



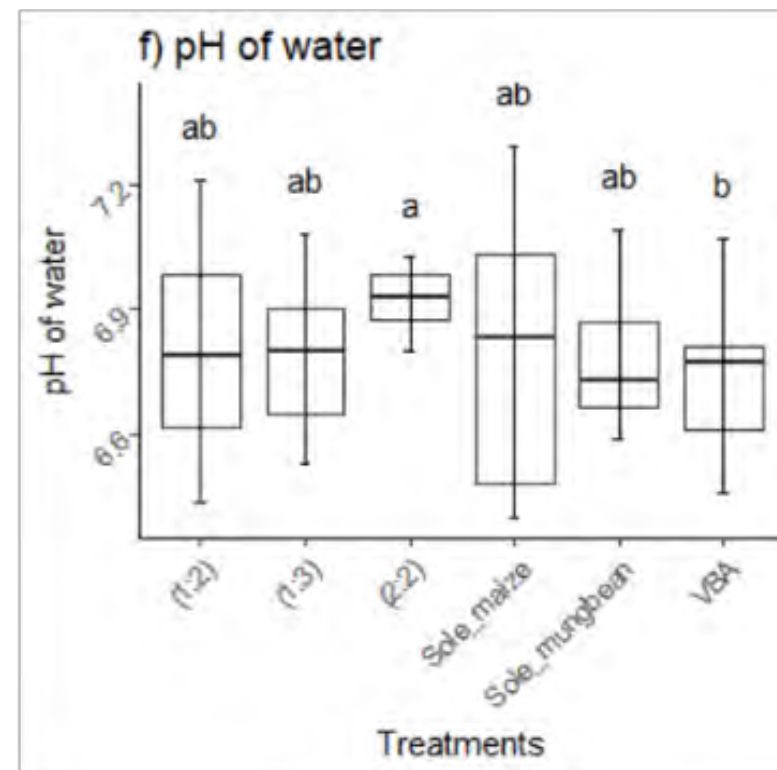
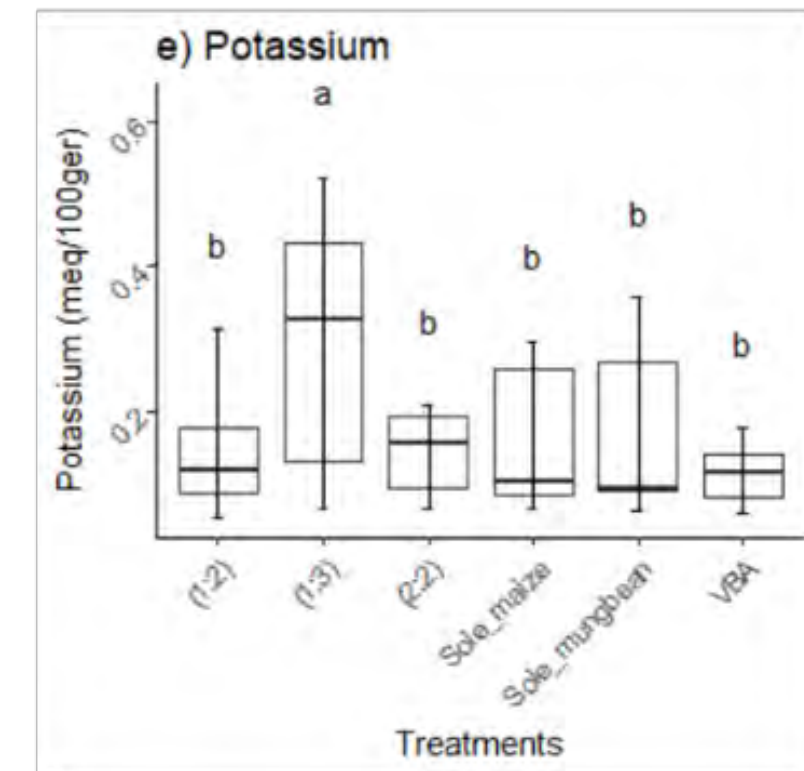
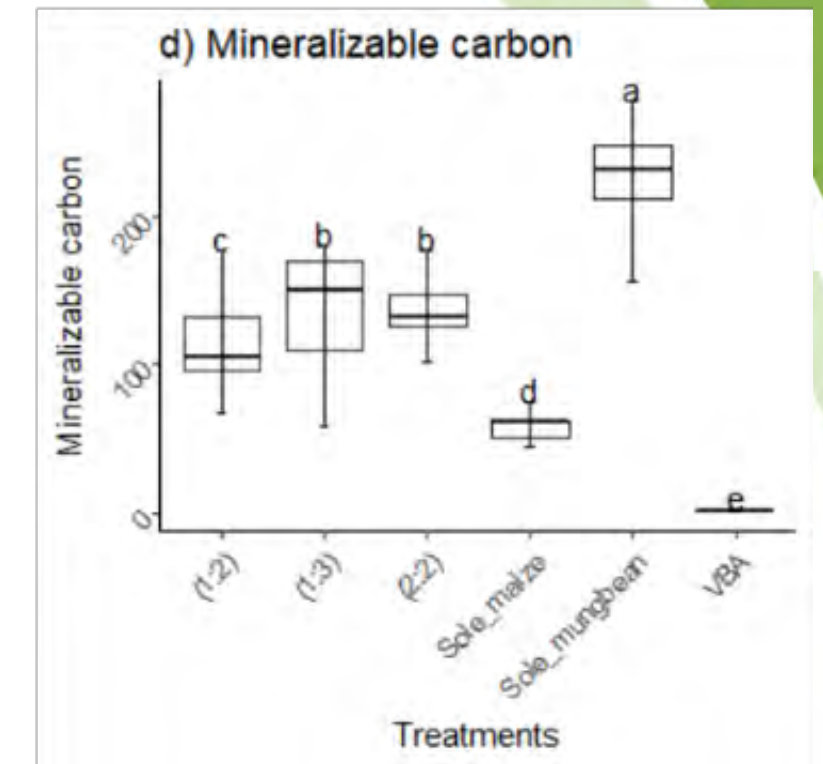
Results

Soil fertility parameters variation across sowing systems in maize – mungbean intercropping

- Treatment (1:3), improved the potassium concentration while there no statistical different in sole mungbean, sole maize, treatments (2:2) and (1:2) (fig. e)

- Sole maize cropping decreased significantly the mineralizable carbon compared to intercropping treatments

- pH of water was improved for all the treatments except sole mungbean (fig. f).



Summary

- ❑ Sowing systems did not influence growth and yield of maize while fruits and grains yield of chili and mungbean were significantly affected.
- ❑ (1:1) had a higher LER (1.15) compared (2:2) for maize–chili intercropping while (1:3) had highest LER (1.60) for mungbean–maize intercropping.
- ❑ (2:2) and (1:3) respectively for maize–chili and maize–mungbean intercropping had the highest value for actual yield gain and intercropping advantage.
- ❑ Total estimated gross return was higher for treatments (2:2) and (1:3) compared to other intercropping treatments.
- ❑ (1:3) in maize-mungbean improved soil parameters (total N, assimilable P, total P, mineralizable C & K) compared to other sowing systems.

Thank You



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