

RICE BEAN IMPROVES SOIL HEALTH IN SLOPING AGRICULTURAL LAND IN NORTH WESTERN VIETNAM

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INTRODUCTION

- Over the past decade, fruit trees have been gradually replacing maize in sloping agricultural uplands in Son La Province
- This transition has been mainly driven by economic reasons e.g. improving land productivity and profitability.
- But no assessment was made so far on land use changes effects on soil health
- We studied the effect of the transitioning from maize (M) (*Zea mays*) to fruit tree (FT) plantation, and fruit tree associated with rice bean (*Vigna umbellata* (Thunb.)) (FT+RB) on three main soil functions:
 - 1) Soil structure maintenance,
 - 2) Nutrients recycling, and
 - 3) Carbon transformation

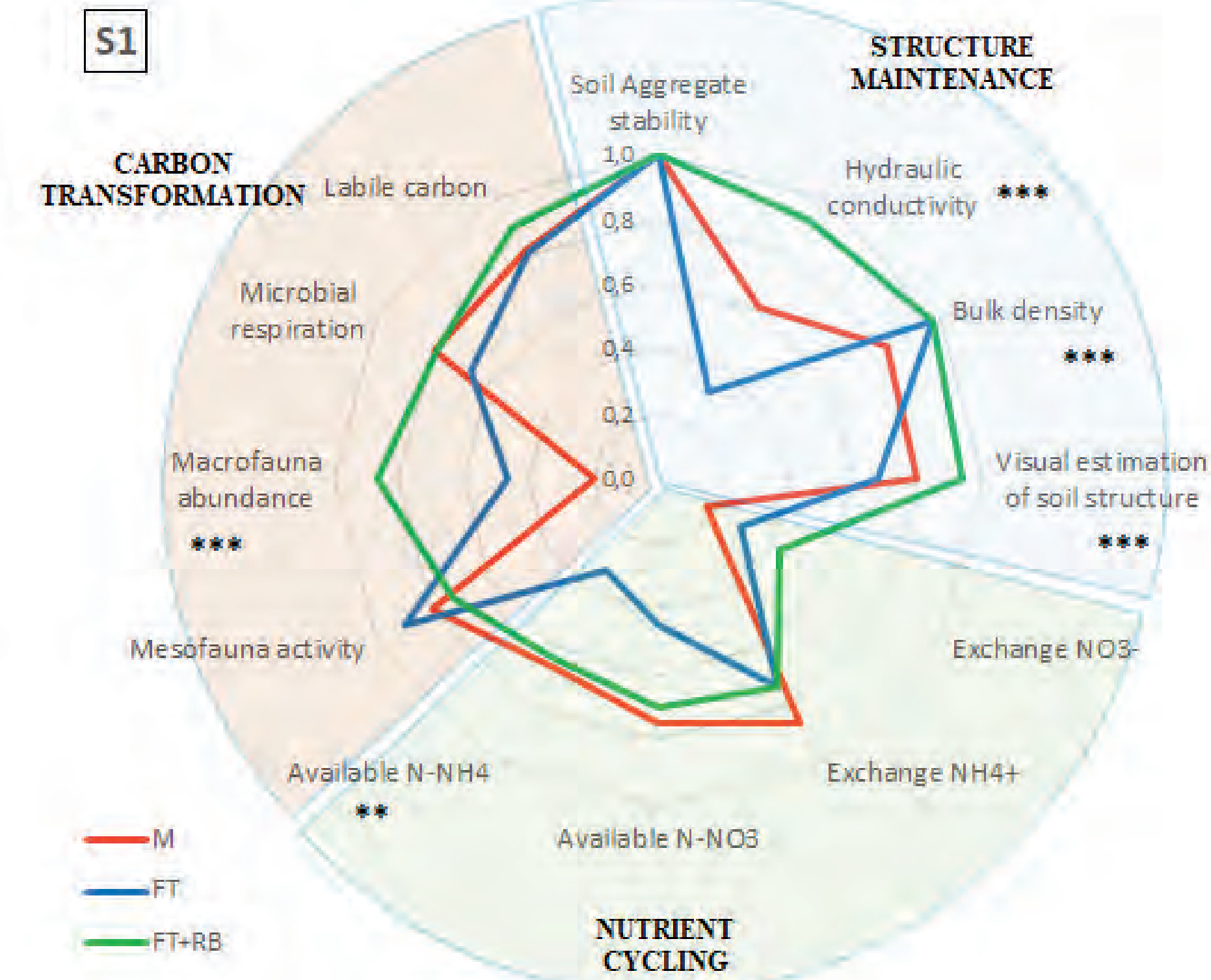


METHODS

- We used a combination of 14 soil indicators, 10 directly assessed in-situ, and 4 in laboratory, which were then aggregated into a Soil Health Index (SHI)
- The study was conducted in October 2023 in 3 mixt Maize-Fruit trees sites in Chieng Hac commune, Moc Chau district, Son La Province
- At assessment time, maize plots have been continuously cultivated for more than 10 years under monocropping, all fruit trees were former maize plots turned into mango (*Mangifera indica*) plantations 5 to 8 years prior to the study; rice bean has been cultivated in FT+RB treatment for 3 to 4 years

RESULTS

- Surprisingly, no significant change in SHI observed when shifting from maize to fruit trees
- The intercropping of rice bean in mango plantation significantly improved SHI, with notably:
 - o a significant increase in hydraulic conductivity and macrofauna under FT+RB as compared to FT and M,
 - o an improvement of soil structure under FT+RB as compared to FT,
 - o similar soil N availability between FT+RB and M, whereas no fertilization was applied under FT+RB



CONCLUSION

- Despite significant benefits of rice bean intercropping on soil health, the practice remains little adopted by farmers (abandoned with maize, decreasing use with fruit trees)
- Main limiting factor is market opportunity for rice bean grains.
- This study confirmed the benefit of legumes integration in agricultural systems, and raise the question on how to better value and incentivize legume-based environmental-friendly practices.



Function	Indicator	Description
Soil structure maintenance	AggSurf	Stability of surface (0-2cm) aggregates in water
	AggSoil	Stability of soil (2-10cm) aggregates in water
	Ks	Soil hydraulic conductivity
	Bulk density	Soil bulk density
	VESS	Visual Estimation of Soil Structure
Nutrient cycling	AEM NO3	N-NO ₃ ⁻ exchange rate
	CEM NH4	N-NH ₄ ⁺ exchange rate
	N NO3	Available NO ₃ ⁻ in soil
	N NH4	Available NH ₄ ⁺ in soil.
Carbon transformation	Lamina baits	Mesofauna activity
	Earthworm	Earthworm and/or casts abundance
	Other macroF	Other macrofauna abundance
	SituResp	Soil basal respiration (microbial activity)
	POxC	Permanganate Oxidable (labile) carbon

