Integrating trees and improving practices in intensive coffee farming systems in Viet Nam: Guiding existing transitions

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7th July 2022

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CGIAR RESEARCH PROGRAM ON Forests, Trees and Agroforestry

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Guiding the transition to sustainable coffee in Viet Nam

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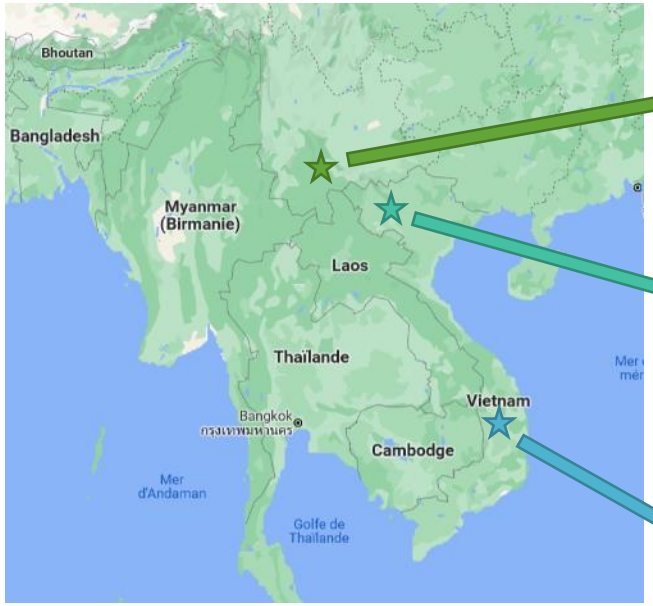
Understanding the existing transitions



1. Southwest China: intensive arabica coffee farms

Monoculture of coffee → Mixed coffee based agroforestry → Coffee and Macadamia

2. Northwest Vietnam: intensive arabica coffee farms

Monoculture of coffee → Mixed coffee and fruit trees

3. Central Vietnam: intensive robusta coffee farms

Monoculture of coffee → Coffee and pepper → Coffee, pepper and/or mixed fruit trees

Transitions are already taking place. Trees are being planted, replaced, fell.

Fruit trees are preferred, to increase incomes. Farmers rapidly adapt their farming systems to changing conditions (especially price incentives). This leads to boom and bust phenomena, and economic vulnerability.

Guiding the ongoing transitions

How to best guide these ongoing transitions?

- Acknowledging that these systems are intensive and will remain so (at least in the foreseeable future) => yield is favored over quality, mineral inputs are part of the recommended farming model.
- Acknowledging that short term benefits are key => fruit trees are part of the recommended farming model. How to best incorporate them and manage them?
- Improving the economic resilience to avoid boom and bust and favor long-term prospects => diversification is often key; coffee is no longer necessarily the main product from the recommended farming system.
- Identifying other important services that trees can provide => which services are most important/relevant? Which tree species, arrangement and management can provide them?

NB: Environmental services are important, but they are only part of the solution

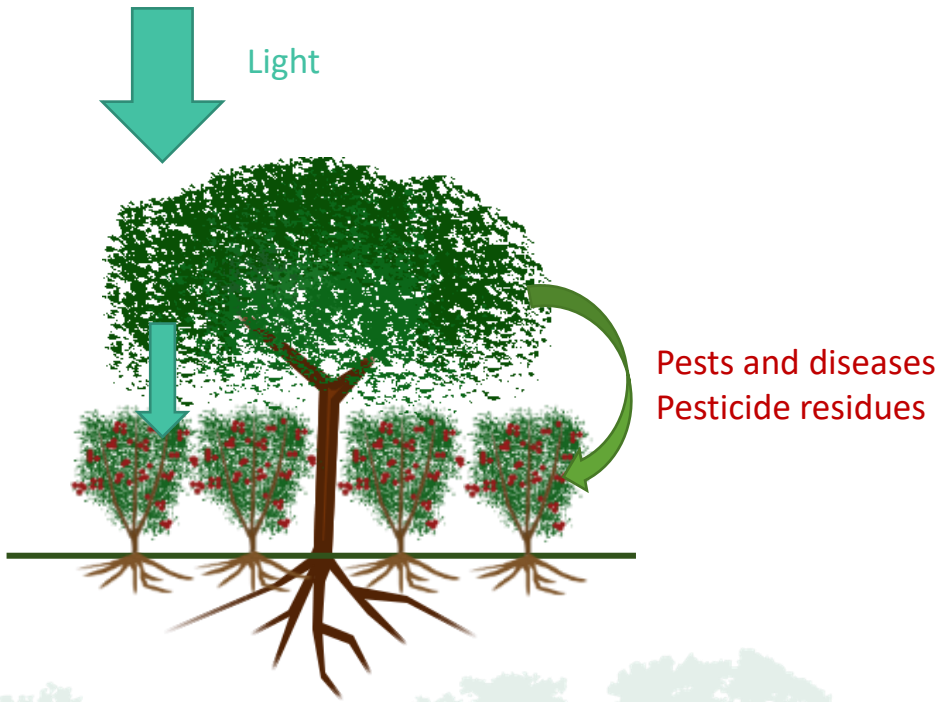
Incorporating fruit trees

Pros

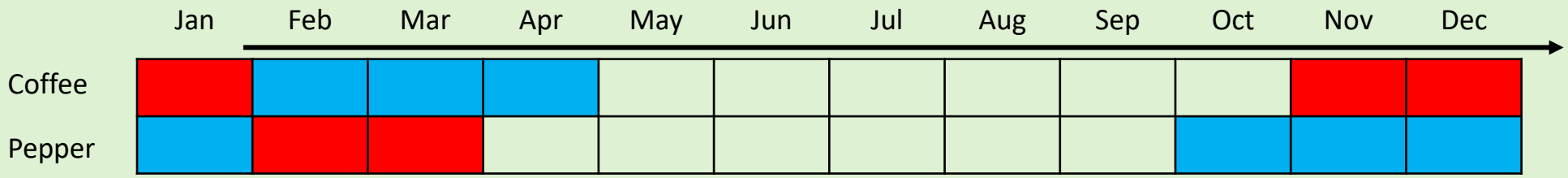
- Bringing economic benefits
- Benefiting from ongoing inputs (fertilizer, irrigation…)
- Requiring limited labour requirement

Cons

- Requires new skills and value chains
- Competitive for resources (light, nutrients, water)
- Can bring pests & diseases
- Can require different/incompatible management



Incompatible irrigation schedules



Incorporating fruit trees

Guiding the transitions:

⇒ We cannot avoid competition. But we can identify and avoid barriers/incompatibilities

⇒ Competition might lower coffee yield. It's ok if the total output balances the coffee loss.

⇒ Fine-tuning the system through technical recommendations, in particular to <u>improve resource use efficiency</u>.

Improving fertilizer use efficiency

Improving fertilizer use efficiency

Fertilizer inputs and labor (especially for harvest) are the 2 main costs => improving fertilizer use efficiency.

- Fertilizer inputs = 22-27 million VND/ha (950-1150$/ha) before the surge in fertilizer prices in 2022. This represents 10 to 25% of gross product.
- On average, around 300 kg.N/ha + 300 kg.P/ha + 300 kg.K/ha of inputs. In comparison, harvest of 3t of coffee leads to removal of 100 kg.N + 20 kg.P + 130 kg.K.

How much fertilizer input is needed? (minimum input to sustain high yields)

Why do farmers use and spend so much on fertilizers ?

Improving fertilizer use efficiency

How much fertilizer input is needed ?

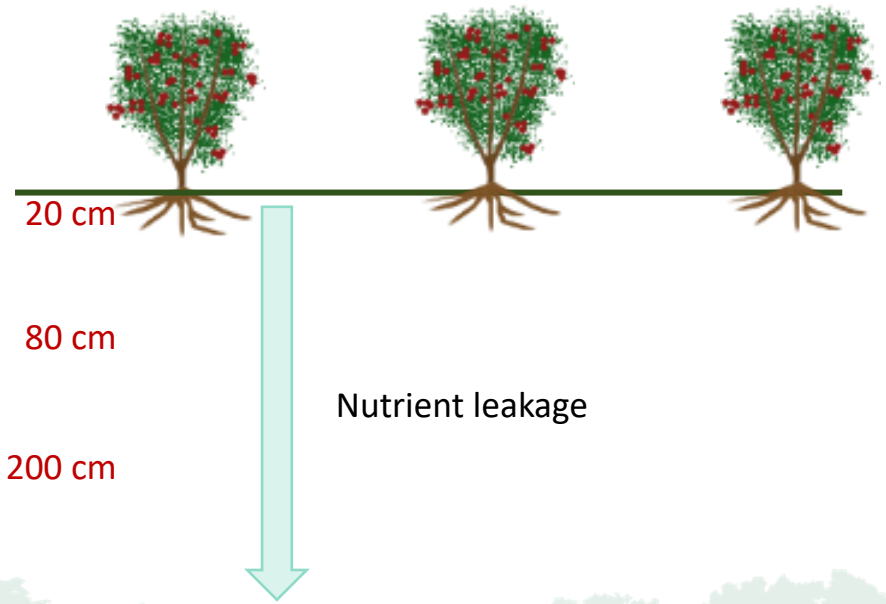
w% of fertilizers are taken up by the crops (used)

x% are lost to runnoff and the atmosphere (lost)

y% build up in soil (stored)

z% leached in deep soil horizons (lost)

We believe nutrient leakage is the most common => we set up trials to measure it, in order to measure the potential for reduction in fertilizer inputs



Improving fertilizer use efficiency

In total: 102 porous cups, 39 soil moisture sensors & 15 tensiometers

Measuring N concentration at different locations and depths

+

Modelling water displacement in soil layers

=

Nutrient leakage

Improving fertilizer use efficiency

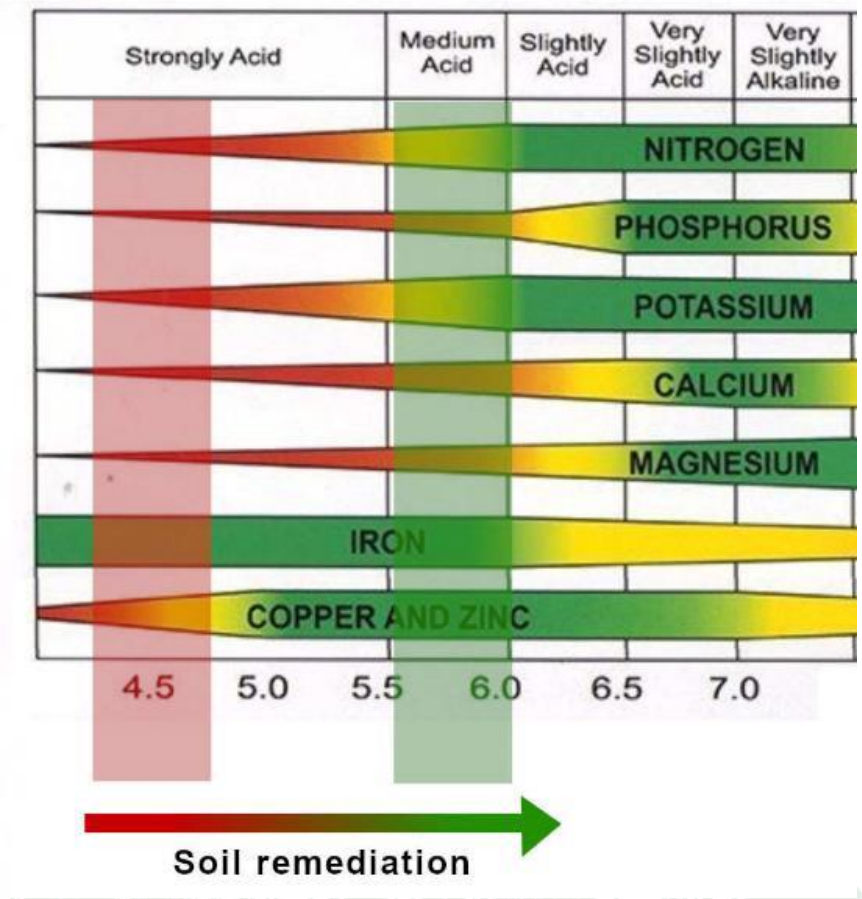
Why do farmers use and spend so much on fertilizers ?

Potential reasons:

- Low costs compared to the benefits + lowering risks
- Soil acidity reduces NPK use uptake by crops

Potential improvements:

- Soil remediation techniques
- Agroforestry for deep rooting systems of fruit trees



Improving fertilizer use efficiency

Checking root profiles of coffee and fruit trees.

Testing coffee husk biochar as a soil remediation technique

Duplicating the trials in monoculture and agroforestry systems.

Improving water use efficiency

Improving water use efficiency

Farmers irrigate coffee from February to May-June (rainy season) to ensure a synchronous harvest & high yields.

- Usual practices = 500-600 L/tree/round = 160-200 mm/year
- Official guidelines = 400 L/tree/round = 130 mm/year

=> Temporary drop of ground water tables in the dry season

=> The last research conducted on water (in 2005) hinted that 250 L/tree/round should be enough

How much water is needed ?

Why do farmers irrigate that much?

Improving water use efficiency

How much water is needed ?

x% of water evaporates into the atmosphere (lost)

y% goes in deep soil horizons (lost)

z% is used up by the crops (transpiration)

Measuring coffee transpiration will inform us on the minimum requirements of the crops

Preliminary results already hint that:

- Coffee uses 20-30% less water in agroforestry with fruit trees
- 250L of water is enough water to sustain high transpiration rates

Improving water use efficiency

Sapflow sensors on coffee trees, pepper vines and intercropped fruit trees

Soil moisture sensors and weather stations

Testing 2 treatments: 400L vs 250L of water

Improving water use efficiency

Why do farmers irrigate that much ?

Potential reasons:

- Water is free

Potential improvements:

- Agroforestry/intercropping for shading coffee trees and reducing their need for irrigation
- Tailored scheduled: 1 first big irrigation volume for triggering blooming, then reduced irrigation volumes in rounds 2 and 3

How does coffee-pepper systems impact irrigation needs?

Thank you very much

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