An Ecologically Intensive Approach for the Design of Sustainable Horticultural Systems in the Tropics

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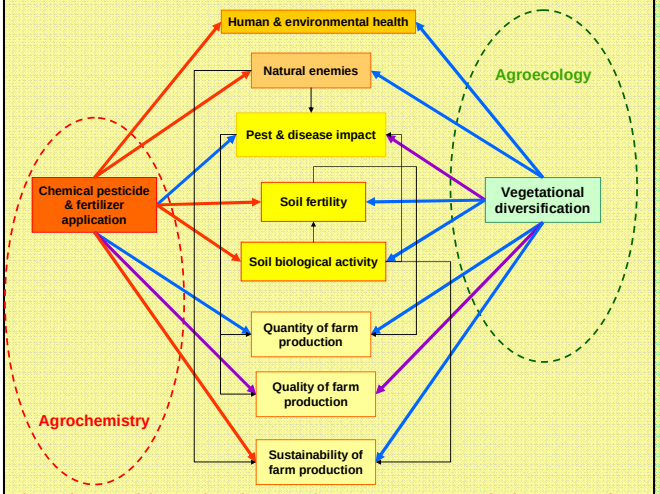
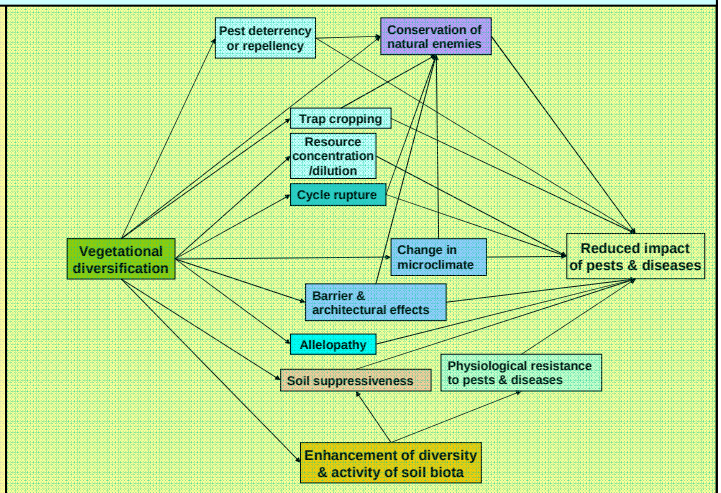
cirad

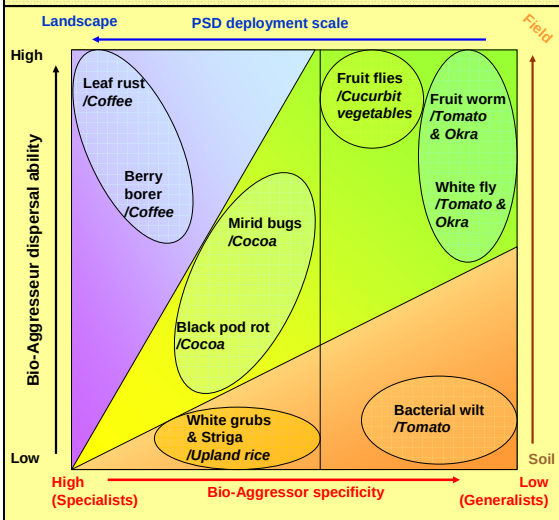
Fruit and vegetable growers in the tropics are faced with plant protection issues resulting in food insecurity and low-income in low-input traditional agrosystems (e.g. in the Sudano-Sahelian zone of Africa), and pesticide-induced adverse impacts on human health and the environment in intensive systems (e.g. in French overseas islands). Setting up an "ecologically intensive" horticulture by modifying agrosystems to mobilize natural regulation mechanisms according to the scientific principles of agroecology, has therefore become a major challenge.



The planned introduction and management of plant species diversity (PSD) is the most promising way of breaking with "agrochemistry" and moving to "agroecology" [1].



Besides agronomic benefits [2], introducing PSD in agrosystems induces different pest and disease regulation processes.



The Cirad Omega^3 project [3] builds on case studies taken in tropical cropping systems, representing a broad range of PSD levels, scales and deployment modalities, according to a typology of pests and pathogens based on life-history traits the most amenable to manipulation by PSD.

In Niger, in terms of trap cropping potential for Tomato Fruitworm (TFW) on okra:
Pigeon Pea > Sorghum > Cotton > Sweet corn

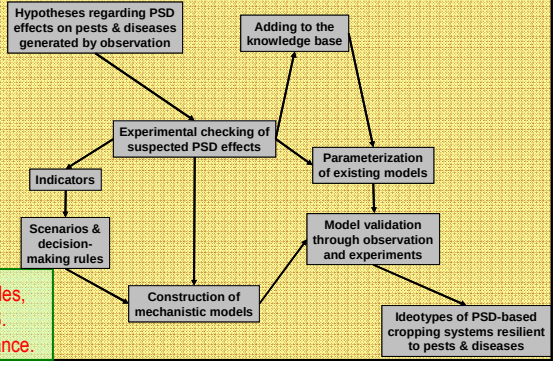
In Martinique, in terms of Sweet corn cultivar attractiveness for TFW on tomato and « dead-end » potential:
Sugar > Java > Challenger

In Martinique, 6 plant species/cultivars were selected based on host status, potential for Multiplying *Ralstonia solanacearum* populations in the rhizospheric soil, anti-microbial effect and agronomic performance:

- *Allium fistulosum*
- *Tagetes patula*
- *Raphanus sativus*
- *Mucuna deeringiana*
- *Crotalaria juncea cv-IAC1*
- *Crotalaria spectabilis*

Horticultural cropping systems, which are basically multispecies-based, provide ideal frameworks for studying the impact of PSD on pest and disease impact reduction, and contribute to Omega3 via 3 case studies.

After formalizing the ecological processes studied, results on case studies on generalist *vs* specific pests & pathogens with low *vs* high dispersal ability, will provide decision-making rules which will help set up mechanistic models to predict the impact of PSD plants & deployment modes on pests & pathogens with similar life-history traits. Existing models can also be used with adequate parameterization: e.g. individual-based models for the push-pull effects on TFW at the field/immediate neighboring levels, and differential equation-based models for allelopathic effects on *Ralstonia* at the soil/field level.



References: [1] Deguine et al., 2008. Protection des cultures: De l'agrochimie à l'agroécologie. Versailles, France: Quae; [2] Malézieux et al., 2009. Agron. Sustain. Dev. 29, 43-62; [3] Ratnadass, A., et al. 2008. Proc.Endure International Conference: Diversifying crop protection, 12-15 Oct 2008, Grande-Motte, France.

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