

Modelling, control, and optimization for tropical agriculture

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Agriculture plays a major role in the economy of many developing countries, providing export revenues, food and employment. As pests are responsible for severe crop losses every year, their control is a major issue. It often relies on chemical pesticides, which are often costly and detrimental to the environment, so alternative solutions are sought. In this talk, we tackle this issue by designing ecologically friendly controls for two pathosystems: the phytophagous plantain nematode, which attacks plant roots, and the coffee berry borer, which feeds and reproduce in the berries. In both cases, the yield is maximized in order to be economically viable. An efficient method to reduce the nematode population in the soil consists in having fallow periods between cropping seasons. We developed an ODE/hybrid seasonal model for the nematode–root dynamics [1] and we exploit it in the present work to globally optimize the duration of the fallow periods, which potentially vary from one year to the other. For the coffee berry borer, we study how the persistent effect of entomopathogenic fungi can impact the optimal yield, compared to non-persistent controls obtained on a single season ODE model of the berry–borer dynamics [2]. Moreover, we extend our results to a seasonal framework, as for the plantain–nematode pathosystem.

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References

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