MODELLING FRUIT YIELD AND QUALITY ON THE MANGO TREE
- Recent Progresses and Future Steps -

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INTRODUCTION

Knowledge on the processes involved in mango fruit yield and quality development, and biotic and abiotic factors that affect them, has been acquired [1,2]. Modelling is a powerful and convenient tool for synthesizing knowledge about a complex crop production system, exploring crop system functioning or simulating its evolution under different weather or technical scenarios. However, such models are few on perennial fruit crops and concern mainly well-studied temperate species but not tropical species. Our aim is to develop a crop model that predicts fruit yield and quality development on the mango tree. The ongoing modelling approach, developed for the cultivar Cogshall in Réunion Island, is presented.

THE MODELLING FRAMEWORK

The MANGO CROP MODEL combines complementary phenological, architectural and ecophysiological viewpoints and relies on two sub-models: a **functional sub-model** (Fig.1A) and a **structural sub-model** (Fig.1B; see Boudon et al in this conference). The model will then be coupled with PEST MODELS (Fig.1C).

(A) Functional sub-model

- A first model is based on C-related ecophysiological processes at the fruit unit scale [3] and water relations at the fruit level [4]
- C exchanges are currently considered at the tree scale through an adaptation of the QualiTree peach crop model [5]

(B) Structural sub-model

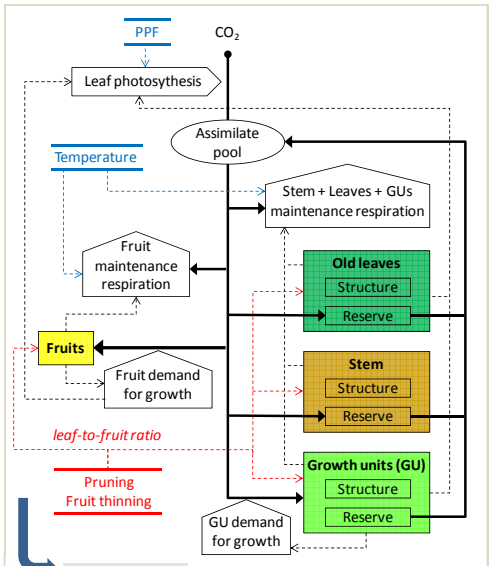
- Based on development rules (accounting for endogenous structural and temporal factors) and temperature-controlled laws

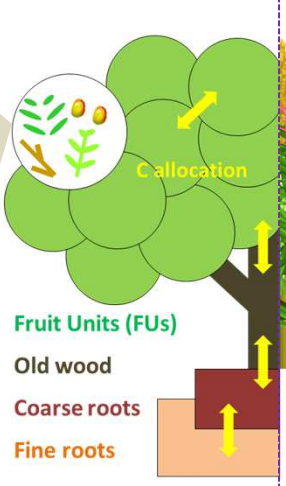
Inputs

Outputs

- Number and position of growth units, inflorescences and fruits
- Dates of budburst and fruit set for individual organs

Schematic description of the model developed at the fruit unit scale. It considers weather and source-sink factors, as affected by cultural practices. GUs are currently added.



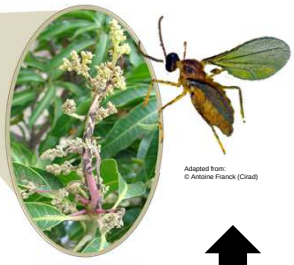


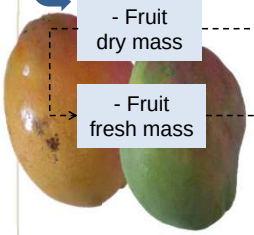
Mango tree structured into global and individualized (FUs) compartments

3-D representation of simulated architectural development and phenology of a mango tree

(C) Crop-pest interactions

- **Inflorescence infestation by blossom gall midge:** depends on spatio-temporal distribution of inflorescences, the sensitive mango stages





- Fruit dry mass
- Fruit fresh mass

- Process-based **maturation model** [6]
  - Ethylene
- Empirical **quality models** [4]
  - Sugars
  - Organic acids
  - Minerals

(C) Crop-pest interactions

- **Fruit infestation by fruit fly** : depends on fruit maturity, assessed by fruit ethylene content

PEST MODELS

- **Population dynamics at the orchard scale**

Symbols indicate if a sub-model is achieved (✷), under development (✷) or not yet started (✷).

Fig.1. *Schematic description of the modelling framework*

DISCUSSION AND CONCLUSION

- Further steps are: (i) to link the sub-models and validate the global crop model; (ii) to incorporate the effects of cultural practices (pruning, irrigation and fruit thinning) on the temporal and quantitative components of tree development; and (iii) to develop and link the pest models to the crop model.
- From an applied point of view, the mango crop-pests model will allow simulation-based design of management solutions [7] for a sustainable mango production.

References

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