Strategic and Tactical Urban Farm Design

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STRATEGIC AND TACTICAL URBAN FARM DESIGN

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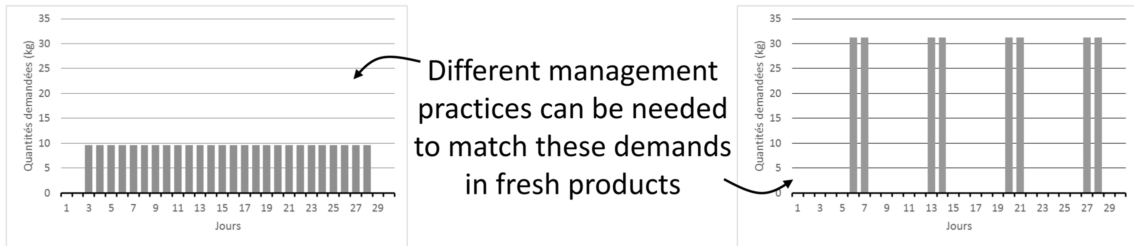
Context and problem description

- Model to support decision in creating new urban farms and adapting existing peri-urban farms with viable business models
- Multi-techniques, multi-products and multi-clients systems producing perishable products on limited surfaces with expensive labor cost
- Considering fresh products perishability requires to include tactical scheduling decisions in our strategic sizing problem

Considering products perishability

- Short-time perishability (some days)
- Response to daily demands/prices
- ➢ On-plot and cold room limited storages, loss functions, price reduction

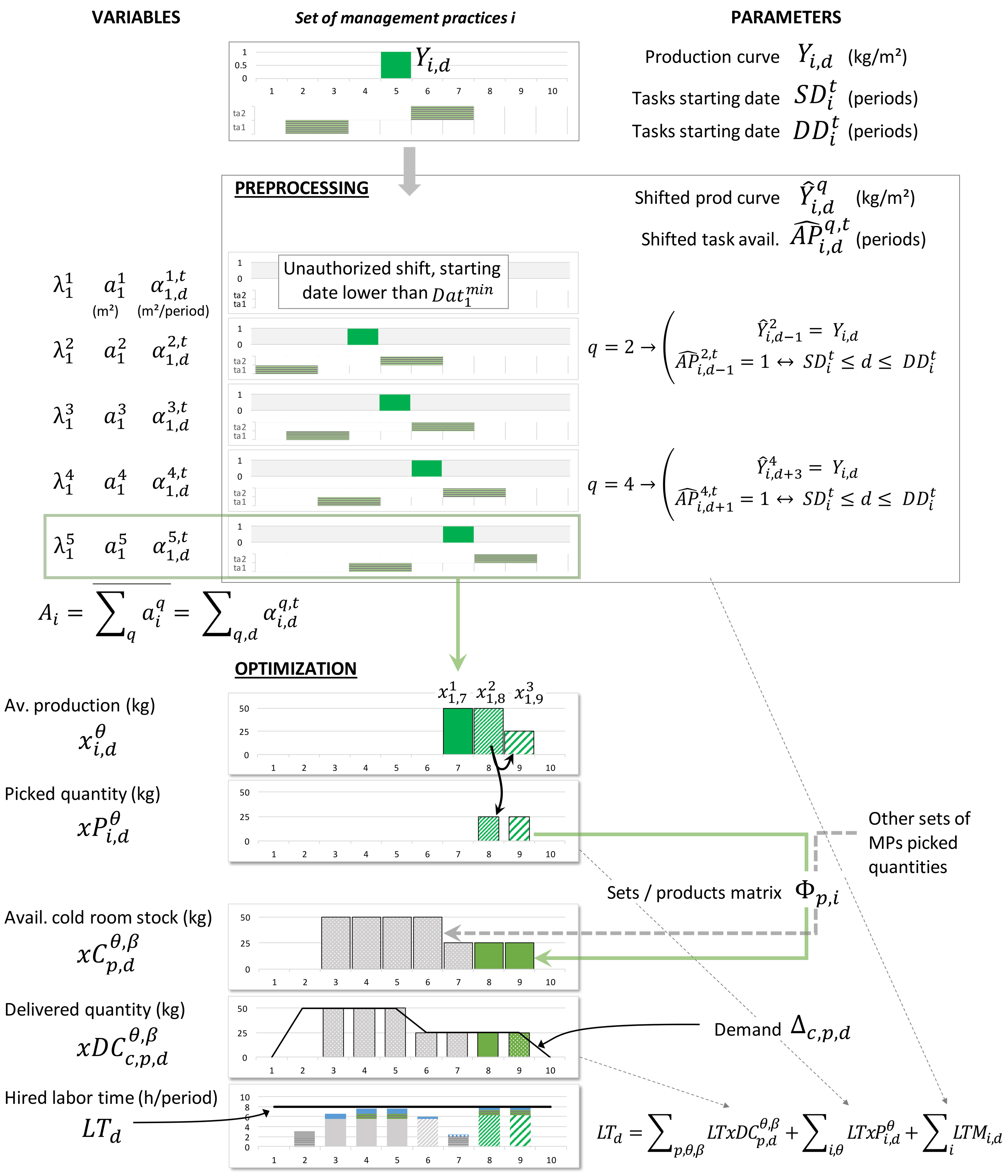


MILP model structure

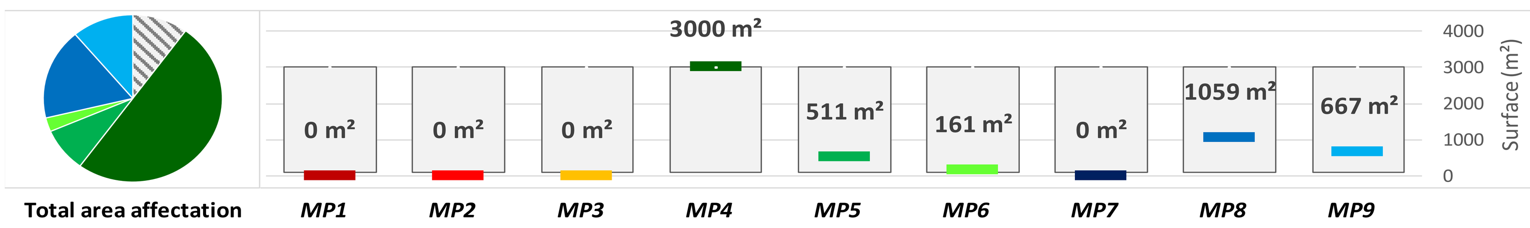
Objective :

$$\max R = \underbrace{\sum_{p,\theta,\beta,d} xDC^{\theta,\beta}_{c,p,d} * PR_{c,p,d} * (1-\omega^{\theta,\beta}_{i,p})}_{\text{Sales}}$$
$$- \underbrace{\sum_{i} (Amof_i + a_i * Amov_i)}_{\text{Amortization}} - \underbrace{\sum_{i,t} A_i * C_i^t}_{\text{Tasks cost}} - \underbrace{\sum_{d} LT_D * CLT + \sum_{d} CLT^{\pm} * (LT_d^{+} + LT_d^{-})}_{\text{Labor cost}}$$

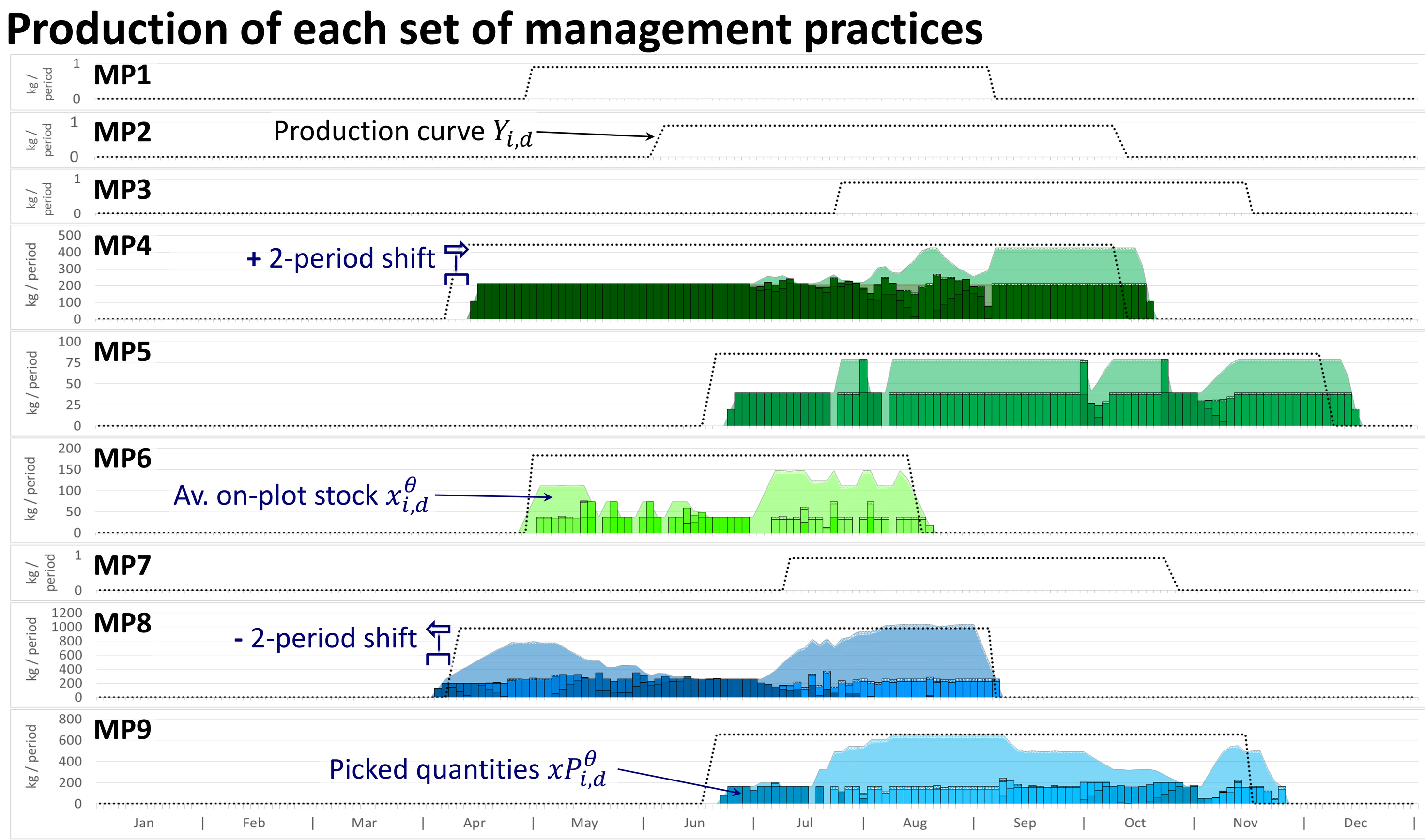
Preprocessing and optimization



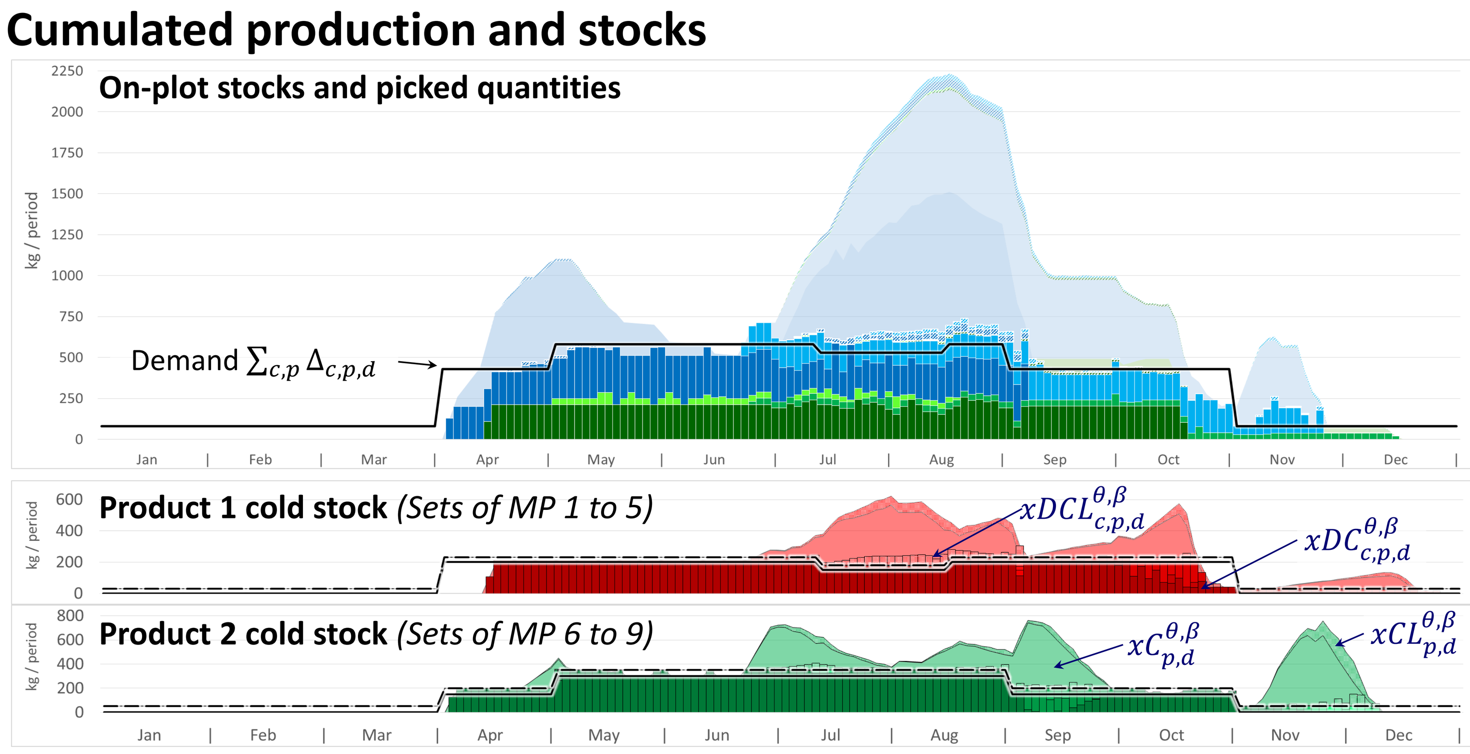
Graphical representation of the results



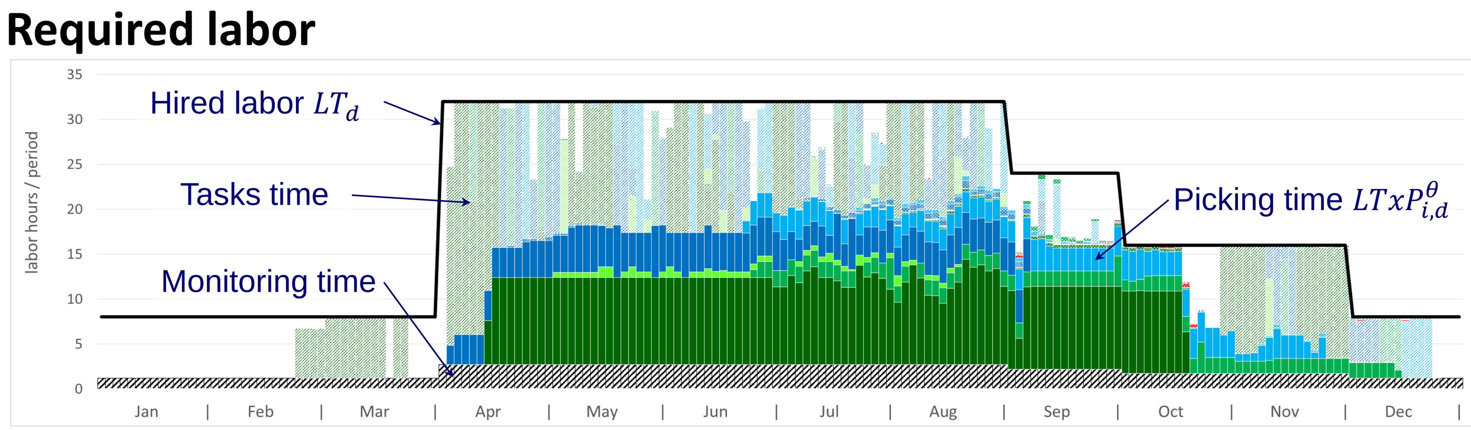
Production of each set of management practices



Cumulated production and stocks



Required labor



Data instances & computation times

- 5 to 9 sets of management practices, 1 or 2 products, 4 to 9 plots max, 1 or 2 clients.
- Optimal solution reached in 8 to 1100s (Cplex 12.6, Intel Core i7-4600U 2.10GHz proc, 8.0 Go of RAM).

Prospects

Model tested on real farm data (lettuce, strawberry and tomato farm)

- ➢ New formulation of lot sizing constraints and better optimization algorithms to speed up resolution
- ➢ Integration of multi-year strategic sizing, robust solutions.

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