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Economic optimization of feeding strategy in pig-fattening units with an individual-based model

Mohsen Davoudkhani, Fabrice Mahé, Jean-Yves Dourmad, Alexandre Gohin, Eric Darrigrand, Florence Garcia-Launay

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M. DAVOUDKHANI¹, F. MAHÉ², J.Y. DOURMAD¹, A. GOHIN³, E. DARRIGRAND², F. GARCIA-LAUNAY¹

¹PEGASE, INRA, Agrocampus Ouest, 35590 Saint-Gilles, France

²IRMAR, Université de Rennes I, CNRS, UEB, Campus de Beaulieu, 35042 Rennes, France

³SMART LERECO, INRA, Agrocampus Ouest, 35011 Rennes, France



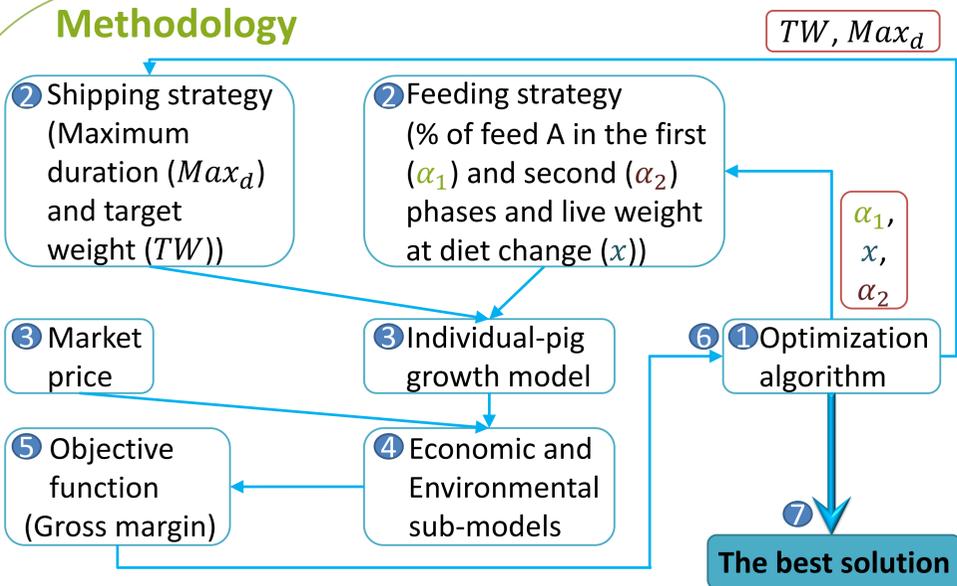
Context

- Economic results of pig farming systems are highly variable and depend on the price of feeds, pig performance, and pork price.
- Shipping strategy affects farm income since lightest pigs that don't reach the target weight at maximal fattening duration result in a lower payment.
- Thus, feeding and shipping strategies are major levers for improvement.

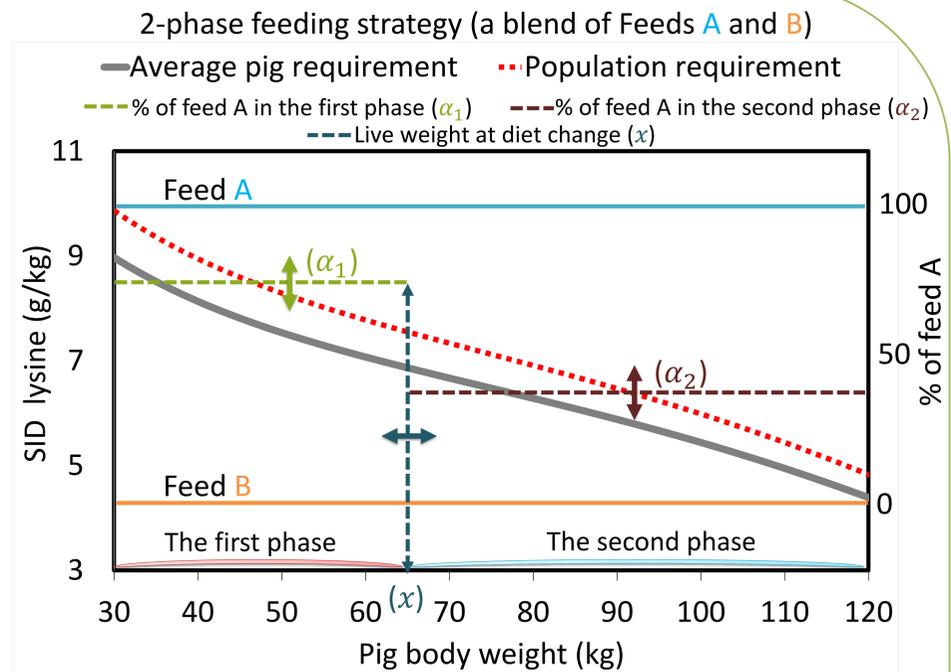
Objectives

- Develop an optimization procedure that finds the best feeding and shipping strategies to maximize the profitability of the pig-fattening unit.
- Illustrate the potential of the model to improve profitability of the pig-fattening unit (**20 batches of 400 pigs**).

Methodology

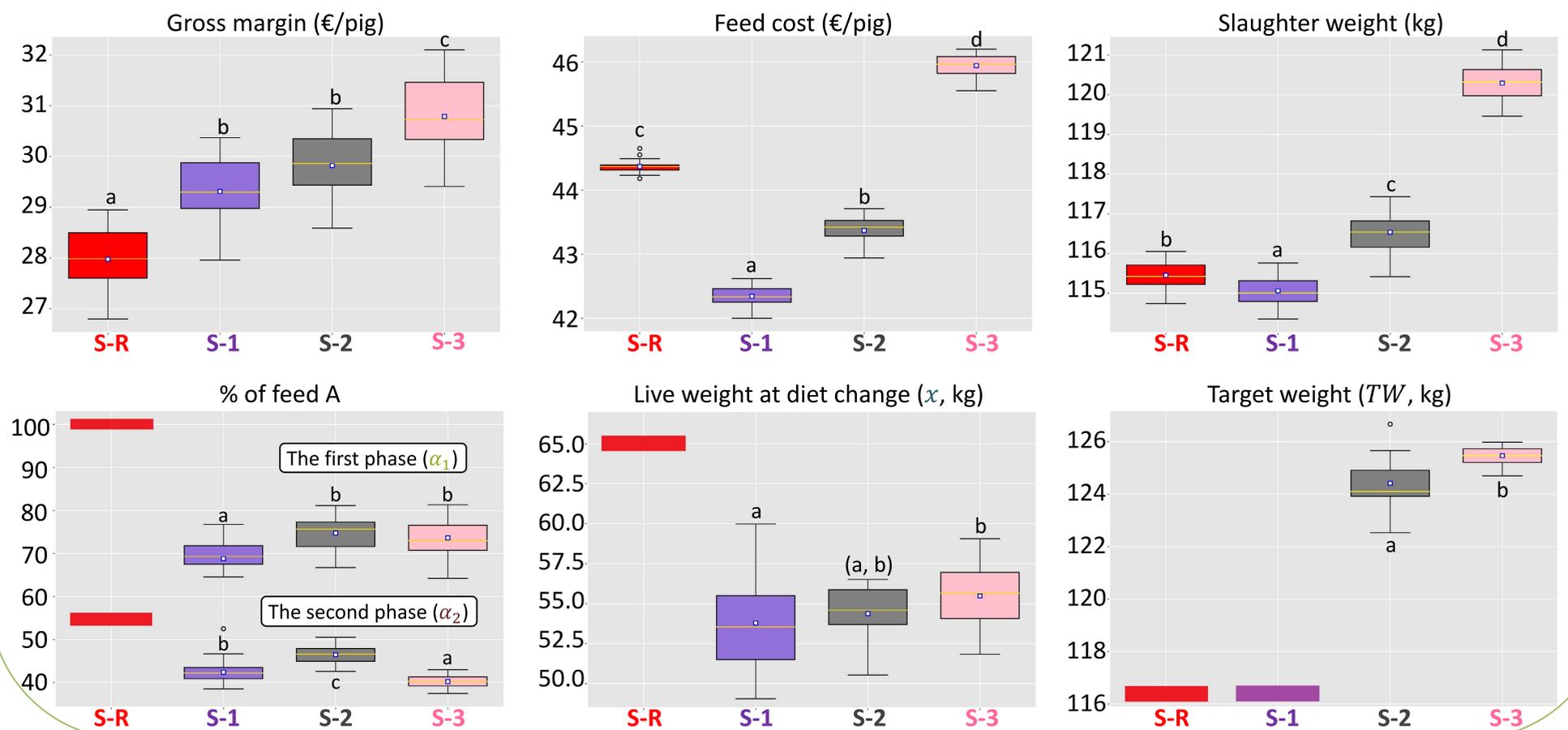


The objective is to optimize feeding and shipping strategies in order to maximize $\text{Max} \frac{1}{I} \sum_{i=1}^I GM^i(\alpha_1, x, \alpha_2, TW, Max_d)$ (With I , index of pig)



	Scenarios				
	Simulated	Optimized (using Covariance Matrix Adaptation Evolution Strategy (CMA-ES))			Bounds
✓ Decision variable/ *Input parameter	S-R (Reference)	S-1	S-2	S-3	Min Max
Feeding strategy	% of feed A (α_1, α_2) ($\alpha_1 = 100^*, \alpha_2 = 55^*$)	✓	✓	✓	0 100
Shipping strategy	Live weight at diet change (x , kg)	65*	✓	✓	30 120
Shipping strategy	Target weight (TW , kg)	116.4*	116.4*	✓	110 130
Shipping strategy	Maximum duration (Max_d , day)	108*	108*	108*	100 125

Results Means that do not share the same letter are significantly different (according to post-hoc Tukey Honestly Significant Difference (HSD) test at a 5% significance level).



Conclusions

- The optimization procedure is suitable to compare different strategies and improve economic performances of the fattening-unit.
- Accounting for more decision variables (i.e. feeding & shipping strategies) tends to improve profitability.
- Further work will include the feed formulation problem to the whole optimization procedure and investigate : Possible synergies and/or trade-offs between economic and environmental objectives.

