

# Simulation and Collective Pig Slurry Treatment Plant

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A Simulation Approach to Evaluate Supply Policies of a Pig Slurry Treatment Plant by Multiple Farms

The use of a dynamical simulation model to evaluate various management policies in a two-stage production systems. Such a simulation-based evaluation is applied to the situation of Grand-Ilet (Reunion Island) where 51 pig farms must supply a collective treatment plant (CTP) with pig slurry.

## Abstract

## Introduction

## System representation

Conceptual representation

Simulation model

Tentative management policies

## Base scenario

System structure

System management

## Random disturbances

# Simulation-based evaluation of management policies

## Policy evaluation method

1. Find the configurations of parameters resulting in no stock overflow in deterministic simulations;
2. For each configuration, introduce random disturbances in the simulations, and, if needed, adapt parameter values to comply with the no-overflow criterion;
3. Rank the successful configurations according to long-term stability and robustness (ability to resist disturbances) and other selected criteria accounting for technical efficiency and cost (number and frequency of deliveries, transport times, amounts delivered, distance covered, time of shortage).

## Testing the planned (T, Q) policy

1. Time = 0-182: with initial zero stock, the CTP stock oscillates while the farm stocks are filling up.
2. Time = 182-1460: a relatively stationary state exhibiting wide fluctuations is found at the CTP.
3. Time = 1460-1825: a new transitory phase appears after a sudden drop in the CTP stock (-10% deliveries at Christmas) and correlatively a jump of the farm stocks towards a new stationary state.
4. Time > 1825: the new reached state remains stable, even when simulating over 30 years.

## Testing the reactive ( $s_i$ , $S_i$ ) policy based on farm stocks

## Testing the reactive ( $s$ , $S$ ) policy based on the CTP stock

## Discussion and concluding remarks

# Summary of simulation experiments

## Comparison of policies according to management indicators

Checking policies for robustness



No	Scenario	Index	Index		Index
			Index	Index	
1	1	1	1	1	
2	2	2	2	2	
3	3	3	3	3	
4	4	4	4	4	

Field implementation of policies

## Conclusions

## References

1. Guerrin, F., 2004. Simulation of stock control policies in a two-stage production system. Application to pig slurry management involving multiple farms. *Computers and Electronics in Agriculture* 45 (1-3), 27-50.
2. Guerrin, F., Paillat, J.-M., 2003. Modelling biomass fluxes and fertility transfers: animal wastes management in the Reunion Island. *Modsim 2003, Int. Congress on Modelling and Simulation*, 14-17 July 2003, Townsville, Australia, vol. 3, pp. 1591-1596.
3. Médoc, J.-M., Guerrin, F., Courdier, R., Paillat, J.-M., 2004. A multi-modelling approach to help agricultural stakeholders design animal wastes management strategies in the Reunion Island. *iEMSs Congress*, June 14-17 2004, Osnabrück, Germany.



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