# ENVIRONMENTAL EVALUATION OF EXCESS PIG SLURRY MANAGEMENT

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## BACKGROUND AND OBJECTIVES

Animal manure plays a crucial role in the integration of crop and livestock production systems and in the interaction between agriculture and the environment. In areas of intensive livestock production nutrients in manure usually exceed the needs of crops, threatening the integrity of aquatic resources.

In Bretagne (Western France) environmental regulations oblige livestock farmers exceeding a certain level of slurry production to either treat or export the surplus slurry in order to avoid nitrate leaching. Some groups of pork farmers are looking for strategies to collectively manage excess slurry.

The objective of this research is to evaluate the environmental performance of two modes of collective excess slurry management.

## METHODOLOGY

A Life Cycle Assessment approach has been used to evaluate the environmental impact of two collective excess slurry management scenarios. The two scenarios compared are:

(i) The Transfer scenario (Figure 1-A), includes the on-farm storage of slurry, its transport to the spreading area (at a 39 km distance) , its intermediate storage, and its application by injection into crop land in substitution of fertilisers.

(ii) The Treatment scenario (Figure 1-B) includes the on-farm storage of slurry, its transport to a collective treatment station (at 12 km), its treatment via intermittent aeration (nitrification/denitrification) with prior separation of the solid and liquid fractions and recirculation of sludge (Figure 2), the transport of the composted solid fraction (at 200 km) and its application to crop land in substitution of fertilisers.

Local measurements of gaseous emissions during storage, treatment and application were used together with European datasets (eg. IDEMAT, BUWAL 250, ETH-ESU) for the inventory of resources used and emissions for 1 m$^3$ of slurry either treated or transferred.

SimaPro™ was used to contrast the environmental performance of the two scenarios with respect to four impact categories: Acidification, Climate Change, Eutrophication and Non-Renewable Energy Use.

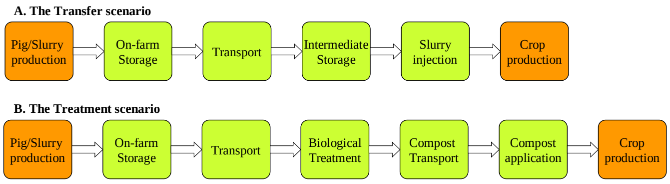


Figure 1. Processes within the Transfer and Treatment scenarios. The production of pigs and slurry as well as crops are considered to be identical in the two scenarios

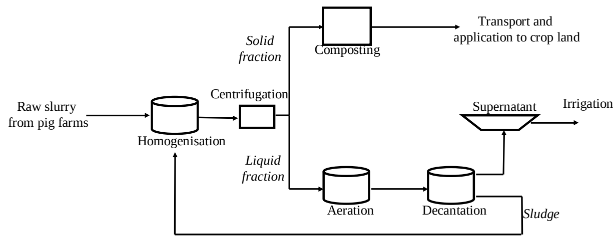


Figure 2. The biological treatment process

## RESULTS

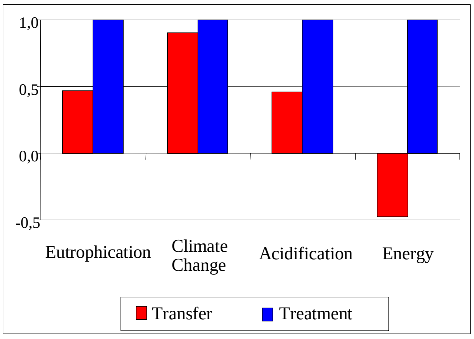


Figure 3. Normalised values for the four impact categories

The overall environmental performance of the Transfer scenario is better than that of the Treatment scenario, as it involves considerably less Acidification, Eutrophication and Non-Renewable Energy Use (Figure 3).

For both scenarios, ammonia emitted is the most important contributor to Acidification and Eutrophication, while methane contributes most to Climate Change. Both ammonia and methane are predominantly emitted during the storage of slurry (on-farm and on-station) and, in the case of the Treatment scenario, also during composting the solid fraction of the slurry.

Electricity needed for the treatment process is the main contributor to Non-renewable Energy Use for the Treatment scenario, while the Transfer scenario represents a net energy saving, as energy saved by the substitution of fertilisers compensates for that needed for transport and injection of slurry (Figure 4).

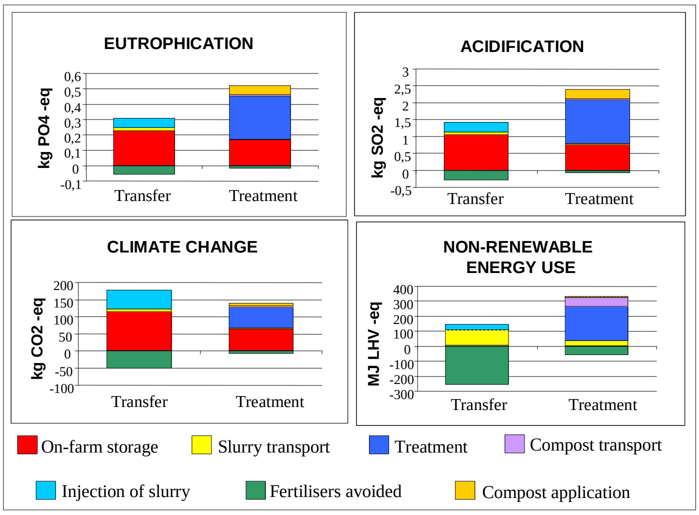


Figure 4. Contribution of the different stages of the Transfer and Treatment scenarios to four environmental impacts expressed per m$^3$ of slurry transferred or treated

## CONCLUSIONS AND FURTHER RESEARCH

Collective transfer of excess slurry and its injection into crop land in substitution of fertilisers might represent a better option than its collective treatment, as in the later more gaseous losses occur during storage of slurry, less mineral fertilisers can be substituted by the application of by-products and more energy is needed.

Further research will focus on the development of dynamic models simulating (a) the logistics of both scenarios in order to fine-tune the values used for storage time and (b) the biophysical processes determining gaseous emissions during storage and application of slurry.

Technologies such as individual treatment stations, bio-digesters, storage covers and application techniques are being evaluated as well as the uncertainty of the emission coefficients used.

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