Cost – effectiveness of environmental impact mitigation strategies in a European pig production system

Authors: G. Pexas [a]*, S. Mackenzie [a], M. Wallace [b], I. Kyriazakis [a]
[a] Agriculture, SNES, Newcastle University, Newcastle upon Tyne, England
[b] School of Agriculture and Food Science, University College Dublin, Dublin, Ireland
* Corresponding author: G.Pexas2@newcastle.ac.uk

Introduction

Emerging technologies and alternative farm management practices have the potential to reduce the environmental impact of pig production systems. It is important that such innovations are also economically viable to maintain the overall sustainability of the system.

Goal of the study

Assess the cost - effectiveness of environmental abatement strategies related to the pig housing and manure management components of a European pig production system

Materials & Methods

Baseline system

A typical Danish pig production system (500-sow, integrated pig farm) was simulated using a whole farm bio-economic model over a 25-year time horizon.

Pig Housing related Abatement Measures (PHs)

Improved Insulation (**IMIN**), Increased Ventilation Efficiency (**IVE**), Frequent Slurry Removal (**FSR**), Increased Slurry Dilution (**ISD**)

Manure Management related Abatement Measures (MMs)

In-house Acidification of slurry (**Acid**), On-farm Anaerobic Digestion of slurry (**AD**)

Methodological steps

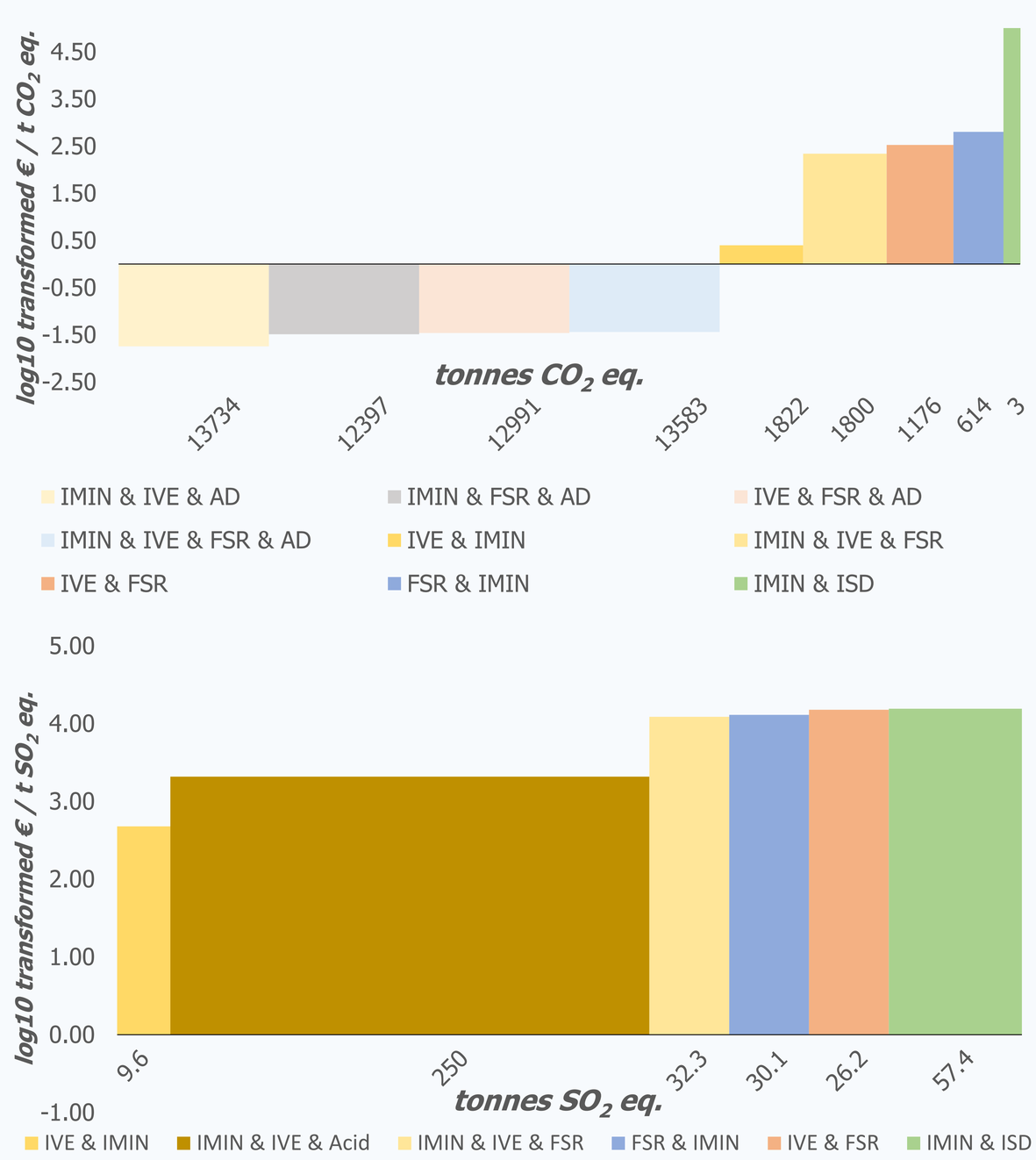
I. We estimated the abatement potential for Global Warming Potential (**GWP**) and Acidification Potential (**AP**) of the abatement measures considered, through a cradle-to-gate Life Cycle Assessment
II. We estimated the Net Present Value and Internal Rate of Return (IRR) of the abatement measures through a Discounted Cash Flow analysis over the time horizon
III. We compared the cost – effectiveness of the abatement measures as i) *stand-alone investments* and ii) as the *top-10 combinations based on their IRR*

Results

Tables 1-2: Cost of abatement (€) for the reduction of GWP and AP considering the stand – alone (top) and combinations of abatement measures (bottom)

Stand-alone investments	AP (€ / t SO_2 eq.)	GWP (€ / t CO_2 eq.)
Acid	€ 2,085	*No Reductions*
AD	*No Reductions*	-€ 64.3
FSR	€ 16,264	*No Reductions*
IMIN	-€ 158	-€ 1.84
ISD	€ 2,430	*No Reductions*
IVE	€ 1,870	€ 3.40

Top-10 combinations based on IRR	AP (€ / t SO_2 eq.)	GWP (€ / t CO_2 eq.)
FSR & IMIN	€ 12,961	€ 635
IMIN & FSR & AD	*No Reductions*	-€ 30.7
IMIN & ISD	€ 15,528	€ 342,330
IMIN & IVE & Acid	€ 2,079	*No Reductions*
IMIN & IVE & AD	*No Reductions*	-€ 55.6
IMIN & IVE & FSR	€ 12,231	€ 219
IMIN & IVE & FSR & AD	*No Reductions*	-€ 27.6
IVE & FSR	€ 15,076	€ 336
IVE & FSR & AD	*No Reductions*	-€ 29.0
IVE & IMIN	€ 477	€ 2.51



Figures 1-2: Cost - effectiveness curves for the combinations of abatement measures mitigating GWP (top) and AP (bottom). The abatement potential for each measure is shown on the x-axis.

Conclusions

- GWP required higher investments to achieve cost – effective reductions
- Combining abatement measures was overall a more cost – effective method than their stand-alone implementation