

# **Influence of measures for the control of ammonia emissions in the profitability of pig farms in Spain**

Carlos Piñeiro<sup>1</sup>, Gema Montalvo<sup>2</sup>, Mariano Herrero<sup>3</sup>, Manuel Bigeriego<sup>4</sup>

<sup>1</sup>PigCHAMP Pro Europa S.A.; <sup>2</sup>Tragsega; <sup>3</sup>Feaspor; <sup>4</sup>MARM

---

---



Workshop on “Cost of ammonia abatement and the climate co-benefits”

**TFRN-5**

*October 26th 2010. Paris, France*

# Introduction

- ✓ The purpose of this report is to provide information on **the additional costs** incurred by farmers **for the implementation measures to abate ammonia** emissions from livestock systems.
- ✓ The costs shown in this report relate to the extra costs for farmers with production and management systems that are typical for the country.
- ✓ The information is intended to be used to contribute to the calculation of the **most efficient methods of reducing ammonia** emissions from European farms.
- ✓ Information about extra **costs** is compared with **profitability margins** in the last years to pig sector, to evaluate the economic capacity of farmers to support option A, B or C of Annex IX.

# Introduction

---

- ✓ Considerable advice and assistance has been provided by a number of technical experts, machinery and building manufacturers and suppliers, and by farmers and contractors during the course of the preparation of these costing.
- ✓ The calculations have been carried out according to the methodology set out in the IPPC Reference Document on Best Available Techniques for Intensive Rearing of Poultry and Pigs, 2003.
- ✓ The information has been prepared at the **request of Spanish Ministry of the Environment and Rural and Marine Affairs.**

# Objective

---



The objective of this report is to provide information on the additional costs incurred by farmers for measures to abate ammonia emissions from livestock systems

# Methodology

---

The calculation have been carried out according to the **methodology set out in the IPPC Reference Document** on Best Available Techniques for intensive Rearing of Poultry and Pigs

*Previous presentation*

# Results - Feeding techniques



Technique	Extra cost (€/place)	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Phased feeding	1.52	0.0052	10	0.32	4.8
Low protein diet with unfavourable market conditions	1.61	0.0053	30	0.95	1.7
Low protein diet with favourable market conditions	-1.92	-0.0064	30	0.95	-2.0

In GAINS, cost for feeding strategies in Spain is 6.7 €/kg NH<sub>3</sub>.

# Results - Animal housing. Gestating sows



Technique	Extra cost (€/place)	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Partial slat and reduced pit. New building	5.68	0.0021	35	0.95	6.0
Partial slat and reduced pit. Existing building	6.83	0.003	35	0.95	7.2
Littered system. N.B.	55.35	0.0208	14	0.38	146.4
Littered system. E.B.	80.45	0.0302	14	0.38	212.8
Frequent manure removal	0	0	25	0.68	0.0

In GAINS, cost for housing strategies in Spain is 27.6 €/kg NH<sub>3</sub>.

# Results - Animal housing. Lactating sows



Technique	Extra cost (€/place)	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Combination water-manure channel. N.B.	3.29	0.0004	52	1.94	1.7
Combination water-manure channel. E.B.	16.74	0.0021	52	1.94	8.6
Manure pan underneath. N.B	17.52	0.0022	32	1.19	14.7
Manure pan underneath. E.B	30.98	0.0039	32	1.19	26.0

In GAINS, cost for housing strategies in Spain is 27.6 €/kg NH<sub>3</sub>.



# Results - Animal housing. Weaners



Technique	Extra cost (€/place)	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Manure channel with sloped floor. N.B.	0.23	0.0004	60	0.43	0.5
Manure channel with sloped floor. E.B.	2.67	0.0046	60	0.43	6.2
Partial slat. N.B.	0.88	0.001	25	0.18	4.9
Partial slat. E.B.	2.25	0.0026	25	0.18	12.5
Frequent manure removal	0	0	25	0.18	0.0

In GAINS, cost for housing strategies in Spain is 27.6 €/kg NH<sub>3</sub>.

# Results - Animal housing. Finishers



Technique	Extra cost (€/place)	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Partial slat. N.B.	0	0	30	0.95	0.0
Partial slat. E.B.	3.61	0.0123	30	0.95	3.8
Manure channel with sloped floor. N.B.	0.73	0.0263	10	0.32	2.3
Manure channel with sloped floor. E.B.	6.45	0.0219	10	0.32	20.4
Littered system. N.B.	25.72	0.0875	20	0.63	40.7
Littered system. E.B.	42.07	0.1431	20	0.63	66.6
Frequent manure removal	0	0	30	0.95	0.0

In GAINS, cost for housing strategies in Spain is 27.6 €/kg NH<sub>3</sub>.

# Results - Slurry storage techniques



Technique	Extra cost (€/m <sup>3</sup> )	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Natural crust	0	0	28	0.15	0.0
Floating cover	2.3	0.0288	70	0.75	3.1

In GAINS, cost for storage strategies in Spain is 3.0 - 3.6 €/kg NH<sub>3</sub>.

# Results - Spreading techniques



Technique	Extra cost (€/m <sup>3</sup> )	Extra cost (€/kg pig)	% red	Ammonia reduction (kg/place)	Extra cost (€/kg NH <sub>3</sub> )
Trailing shoe	1.41	0.0176	50	0.27	5.1
Band spreader	1.21	0.0151	40	0.22	5.5
Incorporation	0.61	0.0076	30	0.16	3.7

In GAINS, cost for land application strategies in Spain is 5.7 – 12.1 €/kg NH<sub>3</sub>.

# Discussion

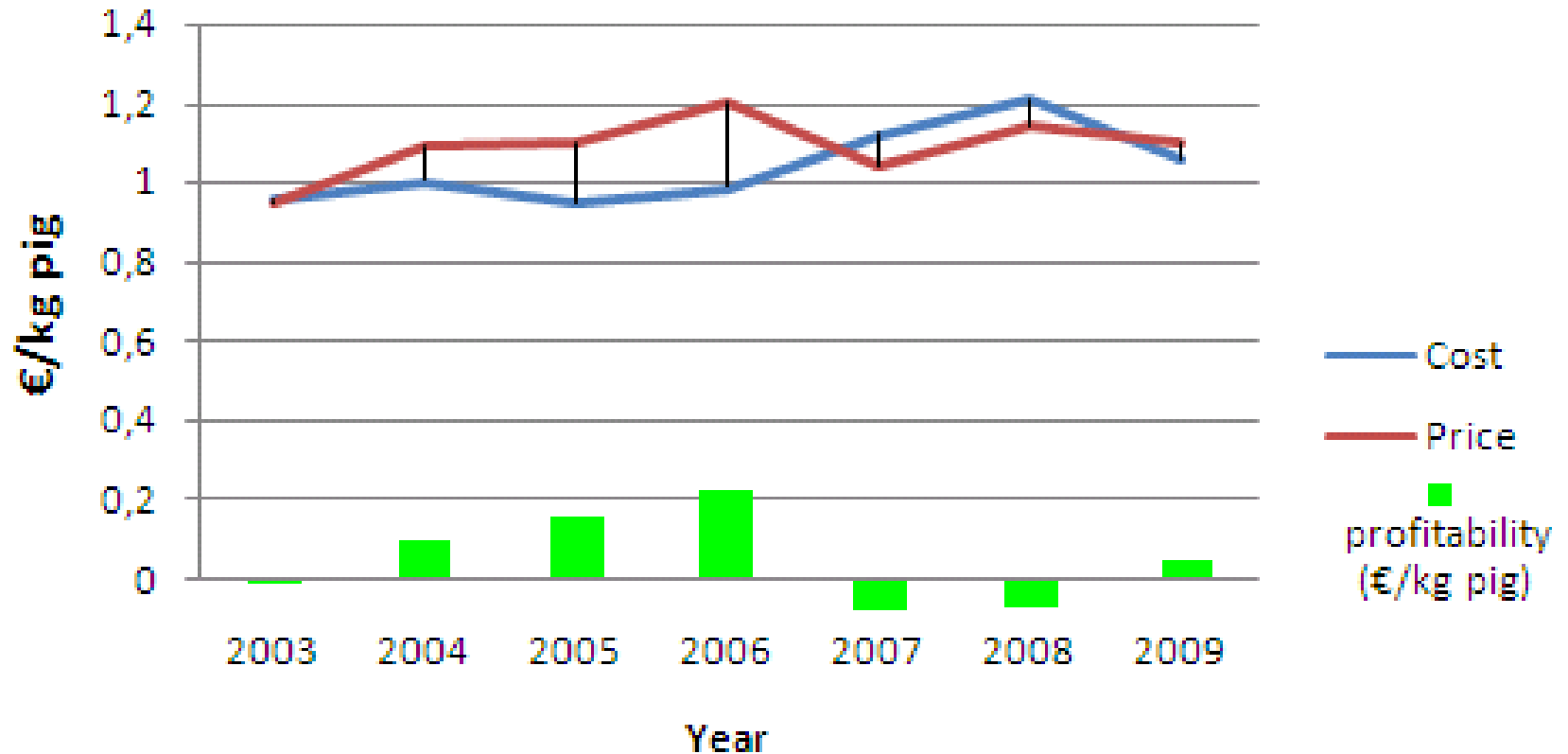
## Cost production in the pig sector in Spain

### Average costs per pig slaughtered with 100 kg

	2003		2004		2005		2006		2007		2008		2009	
	€	%	€	%	€	%	€	%	€	%	€	%	€	%
<b>Feed</b>	51.10	71.14	54.10	73.14	59.4	62.4	61.6	62.5	73.3	65.2	82.1	67.7	68.1	64.4
<b>Fixed costs</b>	14.90	20.74	14.80	20.01	28.0	29.4	29.1	29.5	30.1	26.8	30.0	24.7	29.1	27.5
<b>Insemination</b>	0.95	1.32	0.91	1.23	0.9	0.9	0.9	0.9	1.1	1.0	1.2	1.0	1.0	0.9
<b>Renewal gilts</b>	1.88	2.62	1.26	1.70	1.6	1.7	2.0	2.0	2.0	1.8	2.1	1.7	2.0	1.9
<b>Medication</b>	3.00	4.18	2.90	3.92	5.3	5.6	5.0	5.1	5.8	5.2	5.9	4.9	5.6	5.3
<b>Total cost (pig)</b>	95.80	100	100.3	100	95.2	100	98.6	100	112.4	100	121,3	100	105,8	100
<b>Total cost (per kg)</b>	<b>0.958</b>		<b>1.003</b>		<b>0.952</b>		<b>0.986</b>		<b>1.124</b>		<b>1.213</b>		<b>1.058</b>	

# Discussion

## Economics of pig sector in Spain



# Discussion

---

- ✓ Profitability **margins are narrow** and provide negative values in several periods.
- ✓ As an example, in an on site pig farm with 100 sows, what produces 20 pigs marketed (100 kg) per sow per year, the average annual profitability in the studied period (2003-2009) was **9880 € each year** (0,0494 €/kg pig).

# Discussion

## Ammonia abatement possibilities under Spanish conditions for pig sector

	<b>Option A</b>	<b>Option B</b>	<b>Option C</b>
Feeding	Low protein diet	Phased feeding	Phased feeding
Housing	Partial slat	Partial slat	Partial slat
	Frequent manure removal	Frequent manure removal	Frequent manure removal
	Manure pan of manure channel	Manure pan of manure channel	Manure pan of manure channel
Storage	Floating cover	Floating cover	Floating cover
Spreading	Trailing shoe	Incorporation	Incorporation



# Discussion

Ammonia abatement extracost for different options

	Feeding strategies	Housing	Storage	Spreading	Total (€/kg pig)
Option A	0.0053	0.0263	0.0288	0.0176	<b>0.0780</b>
Option B	0.0052	0.0123	0.0288	0.0076	<b>0.0539</b>
Option C	0.0052	0	0.0288	0.0076	<b>0.0416</b>

# Discussion

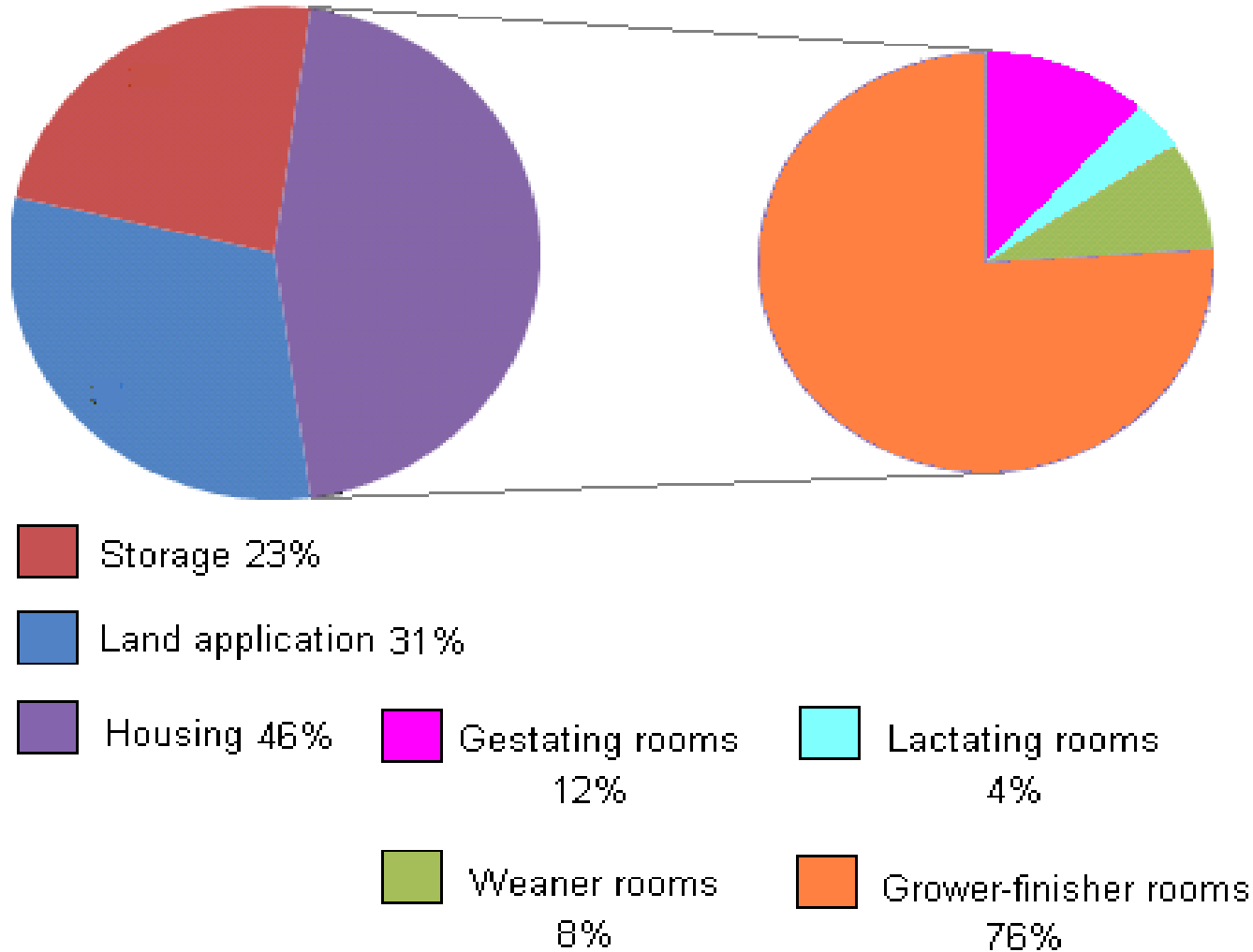
## Influence of different options in farm profitability

	2003	2004	2005	2006	2007	2008	2009	Average 03-07	Total (€/farm*/year)
<b>Option A (€/kg pig)</b>	-0.086	0.009	0.070	0.136	-0.162	-0.151	-0.036	-0.0314	<b>-6286</b>
<b>Option B (€/kg pig)</b>	-0.062	0.033	0.094	0.160	-0.138	-0.127	-0.012	-0.0073	<b>-1466</b>
<b>Option C (€/kg pig)</b>	-0.050	0.045	0.106	0.172	-0.126	-0.115	0.001	0.0050	<b>994</b>

\*A 100 sows-on site farm, with 20 pigs (100 kg) per sow per year.

# Discussion

## Ammonia emission in pig production (farrow to finish farm)



# Discussion

Ammonia emission in pig production (farrow to finish farm):

- ✓ It is necessary to **select the points to act** in the application of abatement techniques.
- ✓ For example, housing strategies in gestating, lactating or weaners rooms **increase production costs** significantly and the reduction in **ammonia emissions is negligible**.
- ✓ To introduce partial slat in existing building in a farrow to finish farm (100 sows) for these phases has a cost of **1960 €/year**. Total ammonia emission reduction is **2.3%**.

# Conclusions

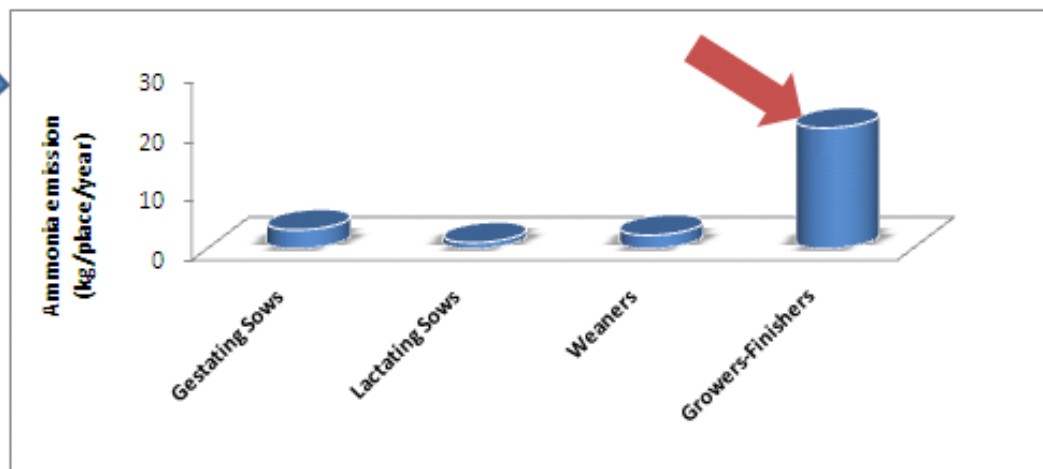
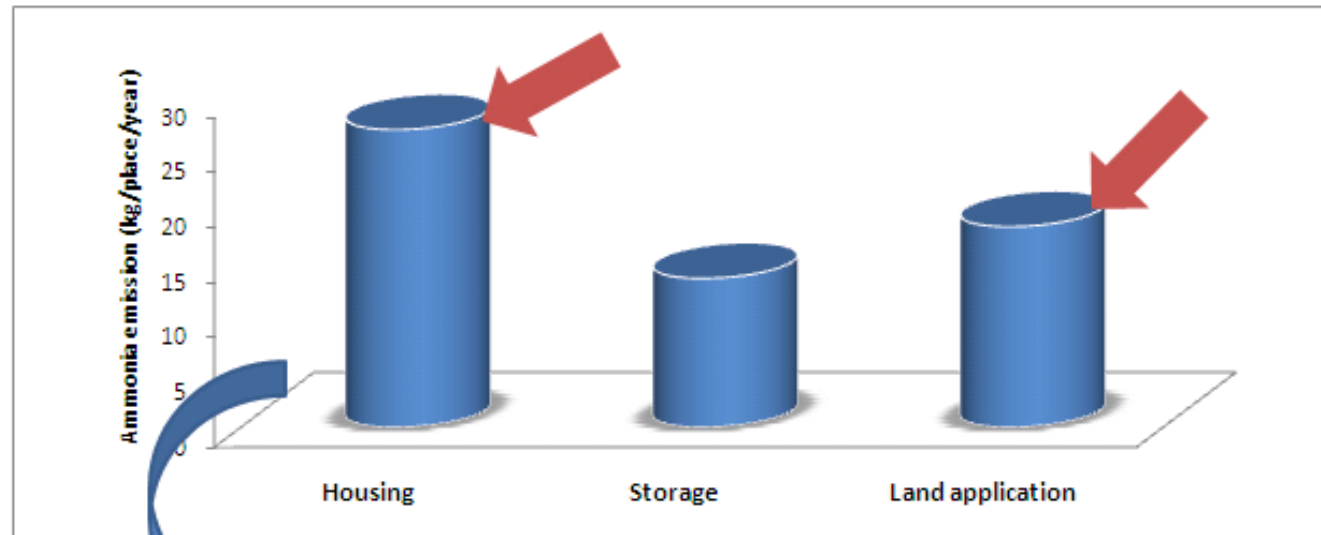
- ✓ Results obtained with cost methodology **BREF, 2003** adapted by Spanish Working Group are in range with **GAINS** data. We can conclude that both systems are overall **equivalent**.
- ✓ Some techniques can be **rejected by their high cost**, as littered systems.
- ✓ **Economic resources** to improve environmental conditions in pig farm are **limited** because the small profitability of Spanish pig sector. This situation is transferable to most of the livestock sector in Europe.

# Conclusions

- ✓ If Administration demands measures for the control of emissions in all stages and for all animal phases, **profitability will disappear**. **Ammonia emissions** will not be reduced, but will be **transferred** to other world areas with environmental legislation less restrictive.
- ✓ Because of this resource limitation, it is necessary to **optimise the efforts** for the minimisation of ammonia emissions, promoting measures that reduce emissions in origin and avoiding that those preliminary efforts get lost at the end of the chain.

# Conclusions

- ✓ As an example, in Spanish pig sector measures should be applied, to optimize resources, in housing (growers-finisher phase) and in land application.



# Conclusions

- ✓ **Nutritional strategies** are the most effective techniques because it reduces **nitrogen excretion in origin**, therefore, ammonia emissions along whole chain.
- ✓ For a growers-finishers pig farm, nutritional strategies that reduce nitrogen excretion (low protein diet), reduce ammonia emissions in all chain a 25%. Average cost is between -0.0064 (save) and 0.0053 €/place and year.
- ✓ **Land application strategies** have a double benefit because it reduces ammonia emission in an important phase (31% total emissions) and allows to make use of nitrogen as fertilizer, with the consequent save in fertilization.



# Conclusions

---

- ✓ It is indispensable that the **environmental demands do not uptake the profitability** of livestock sector and **current proposal** is promoting that for the affected farms affected farms.
- ✓ Because of this, to calculate **total cost of the techniques implemented** is as important as knowing the total environmental benefit.



# Thank You

(in special again to  
Martin Ryan)



MINISTERIO  
DE AGRICULTURA, PESCA  
Y ALIMENTACION

SECRETARÍA GENERAL  
DE AGRICULTURA  
DIRECCIÓN GENERAL  
DE GANADERÍA

SUBDIRECCIÓN GENERAL  
DE ORDENACIÓN DE  
EXPLOTACIONES