FAO European Cooperative Research
Network on Recycling of Agricultural,
Municipal and Industrial Residues in Agriculture
(Formerly Animal Waste Management)

RAMIRAN

Sustainable Organic Waste Management for Enviromental Protection and Food Safety

Edited by:
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Raúl Moral
Rafael Clemente
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CALCULATION OF UNIT COST FOR TECHNIQUES FOR THE REDUCTION OF AMMONIA EMISSIONS FROM LIVESTOCK PRODUCTION

G Montalvo[1], P. Illescas[1], M. Ryan[2], C. Piñeiro[3], M. Herrero[4], M. Giráldez[5], M. Bigeriego[6]
[1]Sanidad Animal y Servicios Ganaderos S.A. Spain; [2]DEFRA,UK ; [3]PigCHAMP Pro Europa S.A., Grupo Proinserga, Spain; [5]FEASPOR, Spain; Consultant, Spain; [6]Ministerio de Agricultura Pesca y Alimentación, Spain. carlos.pineiro@pigchamp-pro.com

ABSTRACT

The purpose of this paper is to provide information on the additional costs incurred by farmers for measures to abate ammonia emissions for livestock systems under Spanish conditions. The information is intended to be used to contribute to the calculation of the most efficient methods of reducing ammonia emissions from Spanish farms. This is a requirement of both the IPPC Directive and the UNECE Gothenburg Protocol. The costs shown in this report relate to the extra costs for farmers with production and management systems that are typical for the country. For each abatement technique the typical (or reference system) is described in addition to the changes that needed in order to reduce emissions. The calculations have been carried out according to the methodology set out in the IPPC Reference Document on Best Available Techniques (BAT's) for Intensive Rearing of Poultry and Pigs.

This is a previous work required to provide a basis for the calculation of the environmental benefits and the costs when several BAT's are implemented in the same livestock system. In the future, the development of a program that integrates these data to support the work of technicians and the authorities should be considered.

Keywords: BAT's, costs, poultry, pigs.

INTRODUCTION

A calculation on the costs of every BAT under Spanish conditions is presented. The information is intended to be used to define the most efficient methods of reducing ammonia emissions from Spanish farms, which is a requirement of both the IPPC Directive and the UNECE Gothenburg Protocol. The costs shown in this report relate extra costs that are typical for the country.

MATERIALS AND METHODS

The calculation has been carried out according to the methodology set out in the IPPC Reference Document (BREF).

- Current cost have been for all calculations, contacting suppliers of equipment and raw materials
- Capital expenditure have been annualised over the economic life of the investment (deducting any grants)
- Annual running costs have been added to the annualised cost of capital
- Changes in performance have been taken into account
- The calculations are based on an amortisation rate of 5% (current rate of interest commonly incurred by farmers)

The costs have been calculated for feeding techniques, animal housing, slurry storage techniques and spreading techniques. This is a previous work required to provide a basis for the cal-

culation of the environmental benefits and the costs when several BAT's are implemented in the same livestock system.

RESULTS AND DISCUSSION

An example of calculation of costs for one technique in each stage is presented.

Phased feeding of growing pigs (including feed)

- Technical description:
  - Building capacity: 720 places
  - Feed storage bin: 10 tones
  - Distribution auger: 140 m
  - Power requirement: 1 kwh
  - Time for motor: 3 hours / day
- Assumptions for the calculations:
  - Feed storage bin life: 10 years
  - Auger life: 5 years
  - Repairs: 2% investment costs
  - Interest rate: 5%
  - Power cost: 0,12 €/kwh
  - Price difference between feeds: 14 €/tm
  - Feed consume 20-60 kg: 1.4 kg/pig and day
  - Feed consume 60-100 kg: 2.2 kg/pig and day
  - 20-60 kg: 55 days
  - 60-100 kg: 45 days
  - Ratio occupation building: 85%
  - Cleaning and disinfections: 10 days

	Units	Capital costs (€)	Total cost (€/unit)
Storage bin investment cost		1554	
Auger investment cost		3300	
Annual cost			
Amortization of bin	Place/year		0.28
Amortization of auger	Place/year		1.06
Repairs	Place/year		0.13
Power	Place/year		0.18
Feed	Place/year		-1.75
Total	**Place/year**		**-0.10**

Animal housing: replacement of traditional channels with V channels in existing buildings

- Technical description:
  - Building capacity: 720 places
  - Building surface: 700 m²
  - Floor: 100% concrete slat
  - New pit: with slanted side wall
- Assumptions for the calculations:
  - Pit life: 10 years
  - Repairs: 2% investment costs

nplemented in the

- Interest rate: 5%
- Traditional pit cost: 17.52 €/place
- V-channel cost: 16.25 €/place
- Pit adaptation cost: 7.29 €/place
- Extra waste of water: -0.11 m³/place and year
- Water cost: 1.30 €/m³

ented.

Table 2. Example of cost for animal housing.

	Units	Capital costs (€)	Total cost (€/unit)
Investment cost		9.29	
Annual cost			
Amortization	Place		0.94
Repairs	Place		0.15
Waste water	Place		-0.14
Total	**Place**		**0.95**

Slurry storage techniques: replacement of lagoon with concrete slurry tanks without covers

- Technical description:
  - Tank: 28.61 m Ø
  - Total height: 4.85 m
  - Effective height: 4.60 m
  - Capacity: 2963 m³
  - Pump power: 2.2 kw
  - Time for pump power: 1 hour per year
  - Agitator power: 18.8 kw
  - Time for agitator motor: 48 hour per year
- Assumptions for the calculations:
  - Tank life: 20 years
  - Repairs: 2% investment costs
  - Pump life; 10 years
  - Repairs: 5%
  - Agitator life: 10 years
  - Repairs: 5%
  - Interest rate: 5%
  - Power cost: 0.12 €/kwh

Table 3. Example of cost for slurry storage.

	Units	Capital costs (€)	Total cost (€/unit)
Tank investment cost		172050	
Pump and agitator investment cost		14358	
Annual cost			
Tank amortization	m^3		4.66
Pump and agitator amortization	m^3		0.63
Tank repairs	m^3		1.16
Pump and agitator repairs	m^3		0.24
Pump power	m		0.03
Agitator power	m^3		0.04
Total	**m^3**		**6.76**

il cost (€/unit)
0.28
1.06
0.13
0.18
-1.75
-0.10

ng buildings

Spreading techniques: slurry application by trailing hose machines

- Technical description:
  - Tanker: 15000l
  - Working width: 6 m
  - Tractor power: 150 HP
  - Work rate: 19 m3 per hour, no reduction in work rate compared with reference system
- Assumptions for the calculations:
  - Machine life: 6 years
  - Repairs: 14.3% investment costs
  - Interest rate: 5%
  - Slurry applied: 6000 m3 per year
  - Annual hours: 320

Table 4. *Example of cost for spreading techniques.*

	Units	Capital costs (€)	Total cost (€/unit)
Investment cost		11400	
Annual cost			
Amortization	m^3		0.37
Repairs	m^3		0.27
Tractor and driver	m^3		0.00
Total	m^3		**0.64**

CONCLUSIONS

In the future, the use of a common methodology by all countries is necessary because deep differences between countries costs were found in the BREF. This theoretical calculation should be compared with the costs achieved once the techniques have been implemented and meanwhile can provide a basis for its implementation feasibility.