

INTENSIVE LIVESTOCK FARMING SYSTEMS ACROSS EUROPE – A REVIEW OF THE CURRENT IMPACT FROM THE IPPC DIRECTIVE BASED ON DATA GATHERED BY QUESTIONNAIRE

Loyon L^{1,2}., Burton C. H. ^{1,2}, Guiziou F. ^{1,2}

¹Cemagref, UR GERE, 17 avenue de Cucillé, CS 64427 F- 35044 Rennes, France

²Université européenne de Bretagne, France

laurence.loyon@cemagref.fr

1 INTRODUCTION

Intensive Livestock Farming (ILF) can be a major contributor of environmental impacts including air emissions, soil contamination and surface water pollution. For these reasons ILF of pig and poultry are included in the European Integrated Pollution Prevention and Control Directive (IPPC). The first Reference Document on Best Available Techniques for ILF of poultry and pig was published in 2003. In the context of its revision, a European project was commissioned with eight partners (Italy, Netherlands, Poland, Denmark, Spain, Czech Republic, Switzerland, France) and coordinated by KTBL (Germany). Known as BAT-Support, the aim of the project was (i) to establish and update data on the systems and techniques used in ILF across Europe, (ii) to develop a documentation and assessment system for the classification of those techniques identified as “Best Available Technology” and (iii), to coordinate a review process with experts from the ILF sector. The overall objective was to develop an integrated and consistent methodology for the classification of livestock production systems including storage, treatment and spreading of the manures produced, in terms of “Best Available Technology”. The purpose of this paper is to present the main ILF pig and poultry farming systems in use based on information gathered from questionnaires and expert opinion.

2 MATERIALS AND METHODS

A questionnaire comprised two parts: the first and principal section A sought to describe the existing farm structure, the second (part B) focused on specific detail in relation to environmental impacts. The starting point were documents directly relating to the intensive breeding of the farm animal type of concern and the associated BAT, drawing from national documents from the Member States already having a regulation specific to these activities.

The section on pig production was laid out according to the phase of the production cycle: for reproduction (post weaning, gestation and maternity), and for fattening (post-weaning, fattening and finishing). The housing system was described starting from the management of the herd, the feeding regime, the type of floor and the method of collecting the manures. The section on poultry egg layers were kept separate from the meat species (broilers, turkey, duck and goose). The questions relating to layers covered the housing type, the means of collection and removal of the droppings and the nature of the feed ration (multiphase). The meat production was grouped under web-footed birds ("Ducks" and "Geese) and land birds ("Broilers" and "Turkeys"). Questions determined such details as the means of confinement, characteristics of the buildings, the feed ration nature and the method of manures collection. The techniques to control the environment within the buildings were also established. Details on the handling and the storage of effluents, the type and material of the store and the presence of covers were requested along with information on possible handling and treatment of the liquid waste on farm, including the type of equipment used for land spreading. The complete prepared questionnaire was set out using Microsoft Excel software to enable easier data analysis. Final versions can be downloaded from the project website (<http://www.ktbl.de/index.php?id=604>).

3 RESULTS AND DISCUSSION

3.1 Response received to the questionnaire

The questionnaires were despatched to 72 identified experts including Government Ministries, Research Institutes and Universities. The rate of answer was considered reasonable since it covered 63% of the 27 EU member countries for questionnaires A and 59% for the questionnaire B. Furthermore, the countries covered by the replies were primarily those with large pork and poultry industries. On the basis of statistical data taken from Eurostat (2005), the countries for which we received at least one reply to the questionnaires collectively represented for pigs: 90% of the animals and 34% of the total number of farms, and for poultry: 84% of the birds and 30% of the total number of farms. Most of the farms overlooked were small production units. The information was thus judged satisfactory for countries where the pork production, egg production or broiler production is of special importance. The extent of information was less satisfactory for information on the production of duck and goose (with the exception of one or two countries with large volume of production).

According to data from Eurostat (2005) 70% of pig production (based on the numbers of head) is accounted for by six countries, Germany (DE, 17.3% of animals), Spain (SP, 14.7%), Poland (PL, 11.5%), France (FR, 9.6%), Denmark (DK, 8.8%) and then The Netherlands (NL, 7.3%). However, production is less concentrated in Poland which has 18.4% of the EU-27 pig farms. Most (70%) of poultry production is centred across the six countries, France (18.7% of birds), Spain (11.5%), the United Kingdom (UK: 11.5%), Poland (10%), Italy (IT, 9.8%) and Germany (7.9%). Again, the production in Poland is less intensive and distributed over many farms (representing 19% of the total for Europe).

3.2 Current practice of livestock production in use in Europe

Pig production

Breeding pigs (mating and gestating sows, farrowing sows). Dry sows rearing in individual and group housing systems are both common. Group housing is predominant especially in the northern States (SE, FI, DK). The housing of sows as groups in an open yard is rarely applied in Europe with the exception of the Czech Republic. Partly slatted floors are commonly used everywhere, whereas fully slatted floors and solid floors with bedding are only commonly in some states (FR, IT, CZ, parts of BE and PT and DK). Liquid slurry systems with slatted floors are most commonly used system; the slurry is either stored underground in deep pits or it is removed frequently by a vacuum system. In countries where group housing is common, sows are housed on litter, the manure removed by scraping (e. g. SE, DK, CZ, CY, FI). Other systems like flushed channels, using fresh or treated slurry, are only rarely used. Farrowing buildings are generally well insulated, or, exceptionally, partly insulated. Open climate housing is only rarely applied on IPPC farms. Heating whether electric or gas/oil is applied locally either above the animals, to defined areas of the housing or by preheating of the incoming air. Only in some states (esp. CY, DK, DE) the pre-treatment of incoming air to the housing, (including cooling and/or water spraying) is commonly applied. Ventilation is mostly mechanical. Outlet air treatment only has an important role in NL and BE-Wallonie, but otherwise, it is hardly used at all in the other states. Animal feeds are supplied either as dry or as liquid rations. Controlled feed diets and phase/multiphase feeding adapted to the needs of the animal are widespread. The addition of supplements (such as amino acid, phytase and/or inorganic digestible phosphate) to reduce the release of nitrogen and phosphorous are also widespread but to varying levels according to the country.

Fattening pigs (weaners, growers and finishers). The rearing of piglets and, subsequently, fattening pigs is commonly done in groups smaller than 20 animals in most European countries but larger batches are common in several countries, reaching 100 animals in EE. Piglet rearing is achieved both on completely slatted floors and on partial slats, which is especially the case for CZ, SE, FI, PL, DK and EE. Partly slatted floors for fattening pigs are predominate in NL, CZ, IT, SE, CY, FI, PL, DK and PT. In other countries (DE and BE), flooring is fully slatted. The main exceptions are Spain where the slatting can be both partial or total and in the United Kingdom where straw bedding is common. Both systems for the storage of slurry are common: underground deep pit and frequent removal by channel systems. Deep litter systems are rarely used with just a few examples in IT for fattening pigs. Both, the feeding of piglets and of fattening pigs is equally likely to be by liquid or solid diets. The feeding regime of fattening pigs is more controlled than for piglets. Phase and multiphase regimes are widespread for piglets and fattening pigs as much as the use of feed supplements to reduce the amounts of waste. Buildings are in general well insulated and usually heated (but depending on the country). Heating is mostly by either electricity gas or oil. Heating is either applied locally within the housing or by hot air. Mechanical ventilation of buildings is the most

common option in all countries. Nonetheless, the use of controlled natural ventilation is also of significance in some countries including IT, DE, CY, PL, PT, F. In ES, FI and DK. Ventilation with pre-treated air is used in ES, PL and DK. With the exception of DK outlet air treatment is rarely applied.

Manure storage and handling (pig breeding and fattening). According to the floor type of the housing, manures are removed and stored either as slurry or as farmyard manure (FYM). Over all of Europe a capacity of 4 – 6 months is applied for solid manure. In the northern regions (SE, FI) even larger storage capacities are generally specified. Storage of FYM on floors made of concrete (with or without sidewalls) is most common while field storage is still often practised. The requirement to collect and store seepage water are applied only in few countries (CZ, IT, DE). FYM is rarely treated but if so, the options are composting, drying and (very rarely) anaerobic treatment.

Usually slurries are stored in tanks made of concrete or steel panels above or below ground. Also deep pit storage within the housing and externally lagoons are still in common use. Only in some states (e. g. NL, DK) are the storage facilities covered by roofs. Open storage is still very widespread along with the use of natural or artificial crust forming. A storage capacity of 6 months seems to be a common standard in Europe, but also shorter (4 months; CZ, ES, PL) and even longer storing times are common (NL, DK, DE, SE, FI). The treatment of slurry is generally of minor importance. In some southern countries (IT, CY, PT) solids separation seems of practical importance possibly because of the high value ascribed to the organic matter recovered. Amongst all other treatment techniques, anaerobic and (to a lesser extent) aerobic treatments have some uptake. Anaerobic digestion has increased interest due to the rewards of biogas production.

For field application methods, all types of mechanical spreaders are in use but there is little difference in the perceived environmental impact. All types of techniques are applied (splash-plate, band spreader, trailing hoses/shoes, injection) but especially splash-plate. Irrigation systems are only commonly in use in IT.

Poultry production

Laying hens. Egg production is achieved from birds kept in compact “battery” cages. In the new member states, “stair step” and “flat deck” cages are still in use. The handling of wastes produced as droppings is by the frequent removal using a conveyor belt. The pre-drying of droppings is also used in certain countries UK, NL, DE, IT, BE and PT. Various other management systems are used in France, The Netherlands and Spain (eg: slurry systems, or manure storage in deep pits). In Cyprus, the management of wastes is based on a daily removal of droppings and then drying outside. Farms that rear birds in the alternative systems (deep litter or aviary) or free range is common in UK, NL, IT, DE, SE, CY, FI, LT, PL, DK and F. For the free range system, various manure management options are indicated: for example, systems on partially slatted floors and deep litter or systems based on perches with the storage of wastes in a pit or removed by conveyor. Both, phase and multi-phase feed regimes adapted to the needs of the birds are widespread and likewise the addition of supplements (amino acids, phytase and/or the use of digestible inorganic phosphorous) to reduce N and P losses. Examples of the use of additives (such as essential oils, saponins, enzymes and vitamins) is reported in the Czech Republic, Germany and Portugal.

Broilers. Broiler (poultry meat) poultry production is mostly commonly carried out on litter in closed buildings with forced ventilation, the exceptions being CY, PT and F where natural ventilation is commonly used with the option of forced ventilation. Artificial lighting of buildings is commonly used in the UK, NL, CZ, CY, FI, LT, BE, PL and DK. Natural lighting is used in the EU countries in the south (IT, ES, CY and PT) as well as Sweden. Both methods of lighting are used in F and De. In all countries, the management of excreta, in the form of poultry litter, is by the removal of accumulated material at the end of the bird crop. Phase and multi-phase feed regime for an improved feed conversion is widespread. The feed supplements to limit the release of nitrogen and phosphorous are similarly used in the NL, CZ, IT, DE, ES, FI, PL, DK, PT and F).

Turkeys. Turkey production is largely done in closed buildings using litter with forced ventilation, the exceptions being NL, IT, DE, SE, PT, F where natural ventilation with the availability of mechanical means. Lighting of the buildings is mostly either artificial or natural (as in IT, and PT) or both as in De and FR. Normal practice is the removal of accumulated excreta and litter at the end of the crop when the building is cleaned prior to the next cycle. The use of a phase and a multi-phase feed regime for an improved feed conversion is widespread. The feed supplements to limit the release of nitrogen and phosphorous are similarly used all over Europe.

Ducks. In those countries with large scale production (UK, NL, CZ, DE, PL and F), rearing is done essentially in closed building with forced ventilation. The building floor is managed as litter in Germany whereas in France, the slatted system is most commonly used. In the United Kingdom, production is with litter or on floors with

part slating. In Poland, the buildings work on litter or full slats. With the slatted floor systems, wastes are collected and transferred to an external pit: for the litter system, manure is removed from the building at the end of each crop. With respect to feeding, only multi-phase regimes are in common use.

Geese. Large scale geese production is mostly in France, Poland and Germany. Production is essentially done on alternative systems: the building is part open with rearing on litter with this being collected at the end of each crop. However, in Poland many farmers rear geese in closed buildings under artificial and natural lighting. As for duck rearing, only multiphase feed regimes are in use.

Building characteristics. Overall, poultry buildings across Europe are well insulated and heated with gas/oil with a predominance of radiating heating elements set up above the animals. The heat is principally used to rear chickens (both egg layers and broilers) in closed buildings. The ventilation of these buildings is mostly forced mechanical. The use of air conditioning is common in the NL, Italy, Spain, CY, Denmark and France and used particularly for rearing egg layers and broilers.

Manure storage and handling. The manure storage is mostly as solids (farmyard manure or droppings). In the majority of countries, poultry waste is removed to outside stores. Capacity is often a minimum of four months storage with uncovered heaps kept in the field. However, in certain countries such as DK, NL; DE, CZ, IT, ES, CY, LT, PL, DK, PT and F the management of wastes is equally done on concrete areas with or without store covers. The management of liquid manures (slurries) in LT, PL, DK, PT and F is based around a minimum storage of 4 to 8 months in an external concrete pit with the formation of a natural crust in the case of Sweden and Poland. Any sort of treatment of wastes prior to land spreading is not common. The land spreading of solid wastes is done by various techniques but mostly based on mechanical distribution systems.

Manure treatment (pig and poultry)

Manure removal systems. Collection of droppings on conveyor belt is an already well established, progresses, and the inclusion of drying equipment, follows this trend. For meat poultry no changes were evident. Flushing technology although well-proven is relatively rare.

Technologies for liquid/solid separation for manures. These technologies relate mostly to pig production. Systems already in use or coming into use are similar and relate to established systems such as centrifugation (decanter centrifuges), screw press or roller presses. Technologies implementing stages of sedimentation/decantation are receiving increased interest. The use of membrane technologies is not used on commercial farms

Treatments of the solid fraction. Pig manures are treated either by composting, at the farm level in the majority of cases, or by methanisation (biogas production). Similar systems exist for centralised facilities and those at the farm. For egg laying poultry, treatment are less developed and are essentially drying systems, with a few cases of methanisation and incineration.

Treatments of liquid fractions. The applied technologies relate to little or none of poultry production. For treating pig slurries, aerobic and anaerobic (methanisation) processes were equally represented. The treatment by methanisation is more often better done on centralised sites, often with co-digestion, under mesophylic conditions with the re-cycling of some of the heat produced.

4 CONCLUSIONS

This study gives an overview of the Intensive Livestock Farming of pig and poultry in use across Europe. Techniques like phase and multiphase regimes are widespread across Europe for piglets and fattening pigs as much as the use of feed supplements to reduce the amounts of waste produced. Manure treatment is not common but there are examples of anaerobic digestion with biogas production in several countries driven by the financial incentives to encourage energy production. Less common are examples of aerobic treatment systems for the removal of surplus nitrogen and the use of separators to aid manure handling.

ACKNOWLEDGEMENTS

This study was funded by the European Commission, DG Research, within the 6th Framework Programme.