

HOW TO ASSESS BIOSECURITY ON-FARM?

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Introduction

Pigs are susceptible to a wide range of endemic and epidemic diseases, including zoonotic infections, which can affect health, welfare and productivity, and thereby have a major economic impact. The implementation of biosecurity measures along the production chain presents itself as one of the major solutions to minimize the risk of introduction of these diseases into a farm, as well as their spread within the farm (Anon., 2010a). Biosecurity is a term used to describe management measures for the prevention of pathogens entering a farm (external biosecurity) or the spreading of pathogens within the farm (internal biosecurity) (Amass and Clark, 1999; Vangroenweghe et al., 2009)

The present manuscript will discuss the importance of biosecurity and how biosecurity can be scored in pig herds. In a third part, the results of scoring biosecurity in pig herds from different European countries (Prohealth project) will be presented.

Importance of biosecurity

Different studies have shown positive associations between biosecurity and some production parameters (Laanen et al., 2013; Postma et al., 2016) and between biosecurity and farm profitability (Corrégé et al., 2012; Siekkinen et al., 2012; Rojo-Gimeno et al., 2016; Collineau et al., 2017). In addition, a higher biosecurity level had a positive impact on reducing the amount of antimicrobials used in Belgian pig production (Laanen et al., 2013; Postma et al., 2016). This is promising considering that antimicrobial use in pig production has been identified as one of the highest among livestock sectors in the EU (Filippitzi et al., 2014; Carmo et al., 2017).

Despite these documented positive effects and the recognized importance of biosecurity measures, there are still major shortcomings in the implementation of these measures among European pig farms (Laanen et al., 2013; Backhans et al., 2015; Filippitzi et al., 2017). There are several examples of spread of diseases due to insufficient implementation of biosecurity measures, such as the porcine epidemic diarrhea (PED) (Scott et al., 2016), African Swine Fever and the highly pathogenic strain of porcine reproductive and respiratory syndrome (HP-PRRS) (Brookes et al., 2015). Thus, it is highly needed to continue emphasizing the importance of biosecurity in disease prevention.

Assessing biosecurity in pig herds in an objective and quantitative way is a necessary first step to create and/or increase the awareness of the farmer. It also allows the farmer to benchmark his/her farm and to implement proper changes to improve the biosecurity level.

Scoring system

A web-based tool based on a questionnaire Biocheck.ugent® has been developed by Ghent University (Laanen et al., 2010) and been used in over 5000 pig herds in 40 different countries. For the PROHEALTH project, some minor revisions were made by the different consortium members. The on-line tool can be accessed by the following web-addresses and is free for use:

<https://www.survey.ugent.be/lime/index.php/691653/lang-en>

The questionnaire is divided into a number of subcategories, each containing questions related to specific items of management and biosecurity. There are six subcategories for external biosecurity and six for internal biosecurity.

The subcategories within external biosecurity include purchase policy, vermin and bird control, location and environment, removal of carcasses and waste, access check, and equipment. The subcategories of the internal biosecurity are management of diseases, farrowing and suckling period, nursery period, fattening period, cleaning and disinfection, and compartmentalization, working lines and equipment. Detailed information about the questionnaire is described by Laanen et al. (2010). Each subcategory and each question within a subcategory has a weight based on information from scientific literature, expert opinion and general knowledge of management and infection risks e.g. purchase of breeding animals implies a higher risk for disease transmission than not purchasing breeding animals. Depending on the response to a question, a higher or lower score is obtained for that question, for that subcategory and finally for the entire questionnaire. The final score for management and biosecurity for a herd may vary between 0 (absence of any measure) and 100 (presence of all biosecurity measures). The questionnaire and scoring tool is applicable for every type of pig herd e.g. sow herds and fattening herds. In the case of a fattening pig farm, the tool will adapt and calculate the score for fatteners, without showing questions for sows and piglets. The questionnaire has been pretested in farms from different countries.

After completing the questionnaire, a general score is obtained and provided to the farmer. In addition, the results for external and internal biosecurity as well as the score for each subcategory are provided. The scores are visualized by a spider chart which immediately compares the farmer's result with the average results of his country and the average results throughout the world. This allows the farmer to identify those items related to biosecurity requiring further improvement.

Results of biosecurity scoring in pig herds in the prohealth project

The biosecurity was scored in sow herds from 6 different European countries: Belgium, Denmark, Finland, Germany, The Netherlands and Spain. The farms are considered to be fairly representative for the pig farms in the different countries. However, as they were not randomly selected, a full representation cannot be guaranteed.

A total of 236 sow farms completed the questionnaire. The aim of the project was to include 50 herds in the six participating countries. For different reasons this number of farms could not be met in every country. The number of farms where the biosecurity was assessed are shown in the table below. In every country the same questionnaire was used, the way in which data was collected differed slightly per country.

Table 1. Number of sow farms in different EU countries where biosecurity was scored

Country	Data were collected through ...	Number of participating farms
A	farm visit	52
B	telephone interview	27
C	farm veterinarians	51
D	farm visit	29
E	the integration	50
F	telephone interview	27
Total number of farms		236

An overview of the general characteristics of the sow farms is provided in Table 2.

Table 2. General characteristics of the sow farms in the six participating countries

Country	Average number of sow places	Average years of experience	Average FTE (full time equivalents) per farm	Sow per FTE
A	363	23	1.7	214
B	914	14	5.2	176
C	382	21	2.7	141
D	918	26	3.7	248
E	971	19	5.2	187
F	237	26	2.2	108
Average	613	21	3.4	180

The farms could be classified arbitrarily into three types of farms: farms where piglets left the farm at weaning or at the end of the nursery, or farrow-to-finish pig herds where the pigs remained on site until slaughter age (Table 3).

Table 3. Type of farms with sows that participated in the study in the 6 EU countries

Country	Type of farm: pigs until ...			Total
	weaning (3-4 weeks)	end of nursery (9-12 weeks)	end of fattening (6-7 months)	
A	1	9	42	52
B	0	27	0	27
C	4	18	29	51
D	2	12	15	29
E	11	15	24	50
F	3	8	16	27
Total	21	89	126	236

To compare the external biosecurity scores between countries, analysis of variance was performed (ANOVA, post hoc Bonferroni, IBM SPSS®) between the participating countries (Table 4). The overall external biosecurity score was highest in country B (87.5) and lowest in country A (67.3) ($p < 0.05$). Country C and D did not significantly differ from each other regarding overall external biosecurity score ($p > 0.05$).

Table 4. External biosecurity scores and subcategories in farms of the 6 EU countries.

Country	Subcategory within external biosecurity						External Biosecurity	
	1	2	3	4	5	6	Score	
A	86.5	66.1	42.8	70.4	61.6	59.0	67.3	
B	95.9	84.7	73.0	94.5	89.0	80.4	87.5	
C	92.2	75.6	57.4	86.5	74.9	49.4	76.3	
D	93.7	78.1	57.2	78.1	79.4	40.7	75.4	
E	94.2	70.1	68.3	88.7	75.0	76.0	80.0	
F	82.3	58.6	56.1	75.7	73.1	88.1	71.4	
Average	Scores	90.8	71.8	58.1	82.1	74.0	64.1	75.7
	SD	10.3	14.0	18.7	14.8	20.8	32.2	10.2
	min - max	49.9 – 99.8	31.2 – 95.7	0.0 - 100	32.3 - 100	0.0 - 100	0.0 - 100	41.0 – 96.0

The same was done for the internal biosecurity scores. In table 5, the countries are ranked according to the overall internal biosecurity scores. Country B had a significantly higher internal biosecurity (64.6) compared to countries A and C (55.0 and 51.2, respectively) ($p < 0.05$). Country F had the lowest overall internal biosecurity score (46.4) compared to countries B, E and D (64.6, 60.1 and 57.6 respectively) ($p < 0.05$).

Table 5. Internal biosecurity scores and subcategories in farms of the 6 EU countries.

Country	Subcategory within internal biosecurity						Internal Biosecurity	
	7	8	9	10	11	12		
A	59.8	58.2	58.9	62.2	45.9	50.2	55.0	
B	100.0	46.1	57.6	0.0	46.8	90.3	64.6	
C	59.7	47.7	55.0	41.0	39.9	58.5	51.2	
D	71.6	52.4	69.8	45.2	55.8	41.9	57.6	
E	79.3	55.3	56.8	50.7	47.8	69.8	60.1	
F	81.7	45.9	38.3	49.4	44.8	31.3	46.4	
Average	Scores	72.5	51.8	56.8	44.1	46.2	57.5	55.7
	SD	22.0	20.0	17.7	38.6	19.7	25.0	13.5
	min - max	15.0 - 100	0.0 - 100	7.1 – 89.3	0.0 - 100	7.1 - 100	0.0 - 100	13.0 – 91.6

The following conclusions and implication can be made:

- The external biosecurity category that had the highest average score was “purchase of animals and semen” (90.8), the one with the internal biosecurity lowest average score was “weaning period” (44.1).
- The external biosecurity category that had the lowest average score was “feed, water and equipment supply” (58.1). Where most farms do take measures concerning the animals they purchase, a lot of farms fail to do this for other things that enter the farm. For example, feed trucks cannot fill the feed bins without entering the clean road, water quality is not checked annually and/or no measures are taken for material supply, like disinfection or quarantine. In some countries however, an annual check of the water quality is imposed by quality labels.

- The internal biosecurity category that had the highest score was “Disease management” (72.5). Many participating farms were regularly visited by their farm veterinarian and stick to predetermined vaccination and medication protocols.
- The overall scores for external biosecurity were higher than the scores for internal biosecurity meaning it is easier for farmers to implement management measures for the prevention of pathogens entering a farm rather than to implement measures to prevent the spreading of pathogens within the farm.
- There was a large variation between countries, likely due to differences in farm and country characteristics and other factors.
- There was a large variation in scores between farms, meaning that there is still room for improvement in many pig farms.
- The results of the online biosecurity scoring tool can serve as an instrument to introduce and evaluate improvement strategies. They are currently used in ongoing research aiming to find risk and protective factors for production diseases in pig farms in Europe.

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