

## FARM SPECIFIC CONTROL OF THE INTRODUCTION AND SPREAD OF SALMONELLA AT FINISHING PIG FARMS

**M.A. van der Gaag<sup>1</sup>, J. Enting<sup>2</sup>, M.F. Mul<sup>3</sup>**

*Animal Sciences Group-Applied Research, P.O. Box 2176, 8203 AD Lelystad, The Netherlands*

*<sup>1</sup>Monique.vanderGaag@wur.nl, <sup>2</sup>Ina.Enting@wur.nl, <sup>3</sup>Monique.Mul@wur.nl,*

### **Abstract**

In The Netherlands, a system to control the prevalence of Salmonella in the pork supply chain is under development by the Product Boards of Livestock, Meat and Eggs. Therefore, the Animal Sciences Group-Applied Research has developed a tool to support pig-finishing farms to control Salmonella. This tool contains eight checklists. The checklists are based on the principles of the HACCP methodology. Important hazards and control measures were determined. Each checklist deals with a part of the farm procedures; supply of water, piglets, pelleted feed, cereals, roughage, liquid co-products and hygiene and daily management. By means of the developed tool, farm specific control measures to reduce the introduction and spread of Salmonella can easily be identified by the farmer.

The effectiveness and practical feasibility of the checklists are determined by implementing advised measures during eight months at three finishing farms. These farms had a high Salmonella prevalence in august 2001. The finishing pigs were tested bacteriologically and serologically every three months. At the end of the testing period, the farmers completed an evaluation form to get insight in the farmers' opinion of the checklists.

The farmers indicated the checklists are user-friendly, complete and recommendable to other pig farmers. The measures that were advised after completing the checklists were mostly general in nature. At one farm the percentage of positive samples decreased. The other two farms had only a few positive samples during the entire research period. To maximise the benefit of the checklists, the checklists should be completed along with a farm adviser or veterinarian.

## **Introduction**

In many Western European countries, the interest for food safety of agricultural products is increasing. In The Netherlands, a lot of effort is put in Salmonella in pigs and poultry. About 25% of the annual cases of human salmonellosis in The Netherlands are caused by Salmonella serotypes occurring in pigs (Van Pelt & Valkenburgh, 2001). The Product Boards of Livestock, Meat and Eggs (PVE) are developing a system to control the prevalence of Salmonella in the pork supply chain. In The Netherlands Salmonella occurs in more than 90% of the pig farms. One of the first stages in the control of Salmonella in the chain is the control at finishing farms. A finishing farm buys piglets of 25 kg from a multiplying farm and sells the pigs at a live weight of 110 kg to the slaughterhouse. In the Netherlands, there are about 11,500 farms with about 6 million finishing pigs (Anonymous, 2002). Between the farms there is a lot of variation in housing systems, feeding strategies and management. For an effective control of Salmonella, the differences in finishing farms have to be taken into account. The PVE asked the Animals Sciences Group-Applied Research (ASG) to develop a tool that could support finishing farms to control Salmonella and test this tool in practice. This paper describes the tool that the ASG developed and the testing of this tool in practice.

## **Material & Methods**

The research consisted of three parts: 1) risk analysis based on HACCP methodology, 2) development of tool for farmers and 3) testing of tool at farms. Part 1 and 2 are presented briefly. The emphasis of this paper will be on part 3.

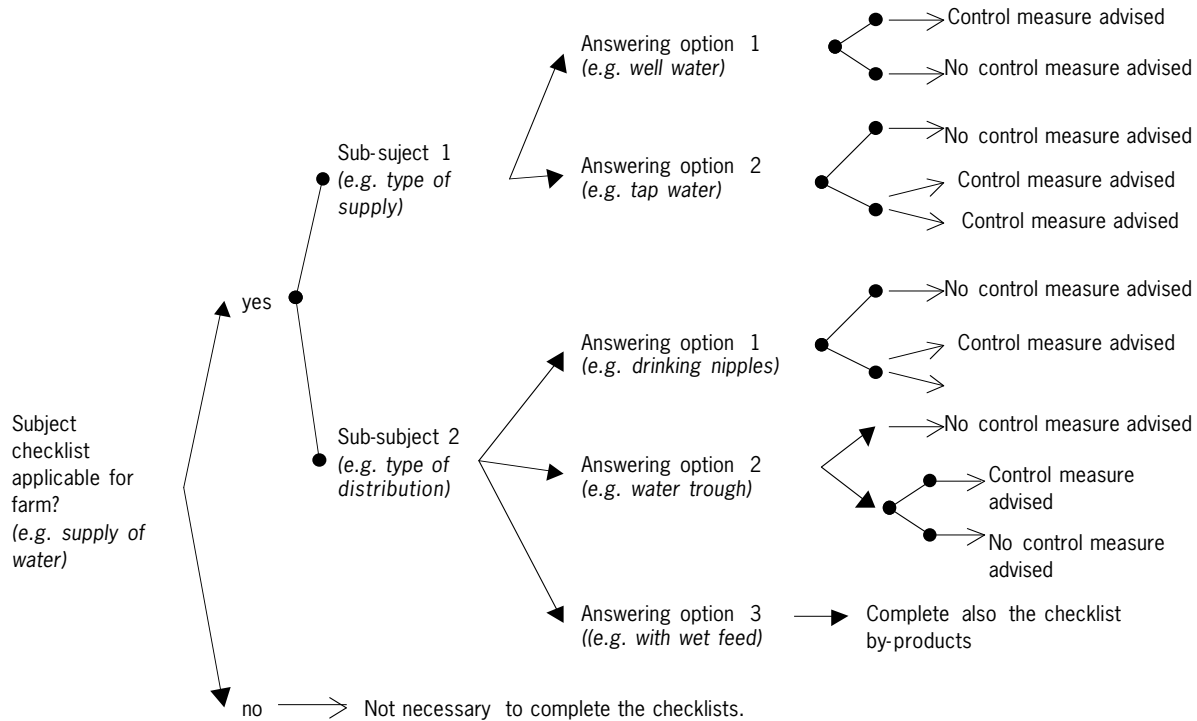
### *Risk Analysis based on HACCP methodology*

The aim of this part of the research was to identify the hazards associated with introduction and spread of Salmonella at a finishing farm. To fulfil this aim in a structured way, the methodology of HACCP is used. Since it is not possible to eliminate all hazards with respect to Salmonella at the finishing farm, it is no real HACCP procedure. However, following the principles of HACCP resulted in 1) a structured approach of the hazard identification, 2) clear distinction of importance of the identified hazards and 3) the possible control measures per hazard. This part of the research resulted in the identification of 42 hazards of which 34 are of major importance. These hazards can be controlled by over 100 possible control measures. Most of the control measures deal with hygiene, such as cleaning and disinfecting compartments, consequent use of a sanitary lock, separate materials for the sick bay.

#### *Development of tool for farmers*

The aim of the development of a tool for farmers was to determine at each kind of farm the specific control measures that can reduce the introduction and spread of Salmonella. This tool had to be simple, user friendly, cover all farm processes and completing it should not take too much time. To fulfil all these requirements, eight checklists designed as decision trees are developed. The knowledge obtained from the risk analysis has been applied to the checklists. Each checklist deals with a part of the management or working procedures of the finishing farm. There is a checklist for 'supply of piglets', 'use of drinking water', 'use of pelleted feed', 'use of cereals', 'use of roughage', 'use of liquid co-products', 'hygiene management' and 'daily management'. Figure 1 presents the design of a checklist. The checklists consist of branches with questions and answers. The farmer follows the questions and chooses the answer that is applicable for his farm. Each branch ends with an advised control measure or with a remark that the current procedure is already effective to control introduction or spread of Salmonella. A farmer can complete the checklists by following the branches with a yellow marker. After the farmer completed all checklists, the control measures that should be implemented at his farm to reduce Salmonella are determined. The checklists are developed for specialised finishing farms.

**Figure 1** *Design of the checklist for farmers to define the specific control measures to reduce the introduction or spread of Salmonella at finishing farms*



- Explanation of arrows:
- Make a choice between the following answering options
  - Complete all (sub-)subjects that are following
  - End of the branch (either a control measure advised or no control measure advised)

**Figure 1** Design of the checklist for farmers to define the specific control measures to reduce the introduction or spread of *Salmonella* at finishing farms

### *Testing the tool at finishing farms*

The aim of the third part of the research was to test the user friendliness of the checklists by farmers and to evaluate the effectiveness of the checklists. For a successful test, the farmers should be motivated to reduce the introduction and spread of Salmonella at their farm. In the fall of 2001, the Animal Health Service (GD) in the Netherlands conducted serological tests of pigs of many farms in order to find Salmonella free farms. The database of the GD was used to select three farms with a high prevalence of Salmonella to participate in the third part of this research. In this part, the selected farms completed the checklists and had to implement at least a part of the advised control measures during eight months. To determine the effectiveness of the measurements on the reduction of Salmonella, pigs at slaughter weight were tested bacteriologically (faecal samples at the finishing farm) and serologically (blood samples at the slaughterhouse) in May 2002, August 2002 and November 2002. A faecal sample was tested with a qualitative test and the blood samples with a mixed ELISA (positive when OD < 10%). At the end of the eight months, the farmers completed an evaluation form with 28 statements in order to get insight in the opinion of the farmers about the checklists and the advised control measures. The statements were divided in three subjects: design and use of checklists, effect of checklists on the daily practice at the farm and future perspectives related to Salmonella control.

## **Results and discussion**

### *Farm characteristics and advised control measures*

Five farms were approached to participate in the research and the checklists were completed for these farms. Two farms decided to refrain from further participation because they were not willing to implement control measures. Table 1 presents the main characteristics of the three farms that participated in the research. None of the farms supplied cereals or roughage to the pigs, so no control measures from these checklists were applicable to the farms. Only Farm A supplied liquid co-products and completed the checklist about liquid co-products. All farms completed the other five checklists, which resulted in a number of advised control measures (Table 1).

### **Characteristics of the farms that participated in the research and the number of control measures that are advised and implemented**

	Farm A	Farm B	Farm C
Number of finishers at the farm	2300	2250	1900
Number of sows at the farm	0	0	250
Number of suppliers for piglets	2	1	0
Number of finishers per compartment	80	88 - 100	80

Source of drinking water Feed supply (type of feed)	Tap water Pelleted feed & liquid co- products	Tap water Pelleted feed	Well water Pelleted feed
Number of advised control measures	37	36	33
Number of control measures implemented	25	24	18

All farms were advised to implement additional hygiene measures (e.g. cleaning and disinfecting of the compartment after selling the pigs to the slaughter, cleaning the silo for restoring feed, cleaning waterworks including the drinking nipple). Other advised measures were strict all in – all out per compartment, avoid that pigs from different ages have to walk the same route and look after the pigs in the sick bay at the end of the working day.

Some months after the start of the testing period, farm B started to acidify the water more frequently (ones a week) than before (ones a month). Supply of water or feed with a pH < 4 has a reductive effect on Salmonella.

No differences of the production results such as daily weight gain and feed conversion were seen before the implementation of the control measures and after the control measures were implemented for eight months. The slaughter results such as fat-meat ratio and percentage of abnormal livers also did not alter significantly. No differences were expected due to the limited duration of the research.

#### *Faecal and blood samples*

Although all farms showed high prevalence of Salmonella in fall 2001, the number of positive samples of farm A and farm C in all sample rounds were very limited. Farm A already started to implement control measures (disinfecting after cleaning the compartment) in the winter of 2001 after the results of the Animal Health Service were communicated. The percentage of positive samples of Farm B decreased during the research period (see Table 2 and 3).

## le 2 Results of serological sampling

Date	Farm A	Farm B	Farm C
Fall 2001*	23 / 39 (59%)	9 / 38 (24%)	15 / 19 (79%)
May 2002	0 / 20 (0%)	10 / 21 (48%)	1 / 15 (7%)
August 2002	2 / 24 (8%)	4 / 24 (17%)	1 / 24 (4%)
November 2002	1 / 24 (4%)	1 / 24 (4%)	2 / 24 (8%)

\* Results of Animal Health Service, the Netherlands

## le 3 Results of bacteriological sampling

Date	Farm A	Farm B	Farm C
May 2002	0 / 6	5 / 6	0 / 2*
August 2002	0 / 6	0 / 6	0 / 6
November 2002	0 / 6	1 / 6	1 / 6

\* At the time of sampling, farm C had only one compartment with pigs at slaughter weight

### *User friendliness of the checklists*

The evaluation of the user friendliness of the checklists indicated that the farmers were very positive about the design and user friendliness of the checklists. According to one farmer, completing the checklists is too time-consuming. The farmers experienced that the checklists are useful to determine weak points and control measures with respect to Salmonella in a farm in a structured way. The farmers also indicated that the checklists are recommendable to other pig farmers. The farmers think it is useful to complete the checklists every year. In that way, new control measures may be advised due to changes in management and the farmer is reminded to the 'old' control measures. All farmers indicated that they had a feeling the management at their farm improved and they intend to continue with the implemented control measures.

The farmers indicated that it was striking that the advised measures were general in nature. The control measures specifically for Salmonella control are limited and the farmers were familiar with most control measures although they were not aware of the reducing effect on introduction or spread of Salmonella. Adding acid is a more specific measure, but can not be implemented easily in many farms. For instance because the water pipes made of iron are not acid resistant.

The farmers advised to introduce the checklists by a farm adviser or veterinarian at the time the checklists will be implemented at a larger scale. Hereby missing of important measures due to organisational blindness and lack of knowledge can be prevented. However, the farmers are not willing to pay for advice with respect to Salmonella reduction.

since Salmonella is not (yet) an important issue for finishing farmers. In The Netherlands, there is no price penalty or other direct incentive for farmers to invest in Salmonella control.

### **Conclusion and recommendations**

The main conclusions of the research (including all three parts of the research) were:

- The methodology of HACCP is useful to determine the weak points and the control measures in a structured way for e.g. introduction and spread of Salmonella at the finishing farm.
- The checklists are a promising tool to assist managers of finishing farms in reducing introduction and spread of Salmonella.
- The checklists are user-friendly.
- At one farm, the percentage of positive samples decreased. The other two farms had only a few positive samples during the entire research period.
- Based on this research, it is not possible to determine the effectiveness of the advised control measures on the Salmonella prevalence at the farm.
- The measures for Salmonella control are general in nature (mostly improvement of hygiene) and will also reduce the introduction and spread of other pathogens at the finishing farm.

The main recommendations based on the research are:

- To maximise the benefit of the checklists, the checklists have to be completed along with an advisor (e.g. veterinarian, advisor from feed company).
- Defining specific control measures for farmers is preferable to a general advice with all possible control measures. The specific advice results in a higher motivation to implement the control measures.
- Since Salmonella is not (yet) an important issue for pig farmers, farmers are not willing to invest much in Salmonella control. Therefore, information and consciousness-raising need additional attention.
- Although farmers are willing to implement control measures, it appeared to be difficult to implement the measures continuously. However, when a hygiene measure is carried out in 90% of the time, it may be ineffective.

<sup>1,2,3</sup> All authors are researchers at the Animal Sciences Group-Applied Research (Lelystad, The Netherlands) where applied research is carried out on topics about animal husbandry, food safety and economics. Monique van der Gaag works also as a PhD on Salmonella control in the pork supply chain in co-operation with Wageningen University (The Netherlands). Ina Enting manages the Farm Economics and Management group for pigs and poultry. Monique Mul works on issues of Mycotoxins in the pork supply chain and Animal Health and Certification Systems.