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INTERNATIONAL FARM MANAGEMENT CONGRESS 2003
FARMING AT THE EDGE

THE PIG FARM MANAGER FOR MODELLING PIG PRODUCTION SYSTEMS

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Abstract

Before setting up or changing a pig farm operation, the consequences of the farm set up must be explored and changes planned. To calculate technical and economic consequences a farm manager model for pig production systems, the Pig Farm Manager, has been developed. The Pig Farm Manager estimates the effects of various farm designs as well as farm management on production, environmental and economical parameters. The Pig Farm Manager includes simulations for sow farms and finisher pig farms.

In the model the user enters farm data on e.g. farm size, housing system or farm management (e.g. feeding strategy), which the model uses to calculate output-parameters. The Pig Farm Manager estimates cost price, profits, gross margins, costs and income per farm, per sow or finisher place.

To evaluate the analytical capacities of the model a comparison between a standard sow farm and a high-health-status farm was made. The high-health-farm (HHF) had better growth of piglets, lower mortality rate and better fertility traits for sows compared to a standard farm. However, the HHF had higher investment costs and required more labour. Overall, on the HHF, cost price per piglet was 3.19 lower and yearly farm income about 21,000,- higher compared to the standard sow farm.

Introduction

Pig farming throughout the world is going through significant changes. Public concern about negative environmental effects of pig farming, as well as ethical issues such as animal welfare and medicine use, are gaining importance. In order to cope with these developments, changes in farm set up and management have to be considered, as they may result in an increase of cost price. However, pig farmers must also provide their families with adequate income in the long run and due to recent developments the income of pig farmers decreased in the last decade. Therefore, the aspects of costs and revenues caused by changes in farming systems and management have to be included in the decision before the changes are implemented. The Animal Sciences Group, part of the Wageningen University and Research Centres, The Netherlands is working on new farming systems, where environmental goals are realised, animal welfare is secured and farmers get a profitable income. In order to combine these aspects and calculate the expected technical and economic results of new systems, a multidisciplinary model is designed: the so-called "Pig Farm Manager". In this paper, this model will be presented, including a case where a standard sow farm is compared with a high-health-farm.

Pig Farm Manager

In the 80th, the development of simulation models for pig farms started. The first simulation models dealt with specific parts of the pig farm (growth model, investment model for housing, etc.), leaving out the interactions between different aspects. In

2001, a project was started to combine these models and new insights into a new model: Pig Farm Manager. The Pig Farm Manager is a strategic and tactical management tool not only for pig farmers, but also for veterinarians, agriculture advisors, teachers, etc. With the Pig Farm Manager pig farmers can calculate technical results of a specified farming system and translate these results into economic consequences.

The goals of the development of the Pig Farm Manager were:

1. to create a planning and evaluation tool for calculating the consequences of changes in strategic and tactical farm management, by making an integrated farm simulation;
2. to provide targets and verification criteria that can be used to review farm results and to analyse the strong and weak points of a particular farm;
3. to simulate scenario's of non-existing pig systems or specific elements within the pig system.

Model structure

The Pig Farm Manager is a computer model developed in Delphi for Windows using an object-oriented design. Users enter general farm data on e.g. farm size, housing system or farm management (such as feeding strategy) in the interactive interface by answering questions. The number and type of questions may depend on the answers given in previous questions. In that way, the model gathers the required information. The model is flexible and it is possible to include new modules about specific topics in the future. At the moment, the Pig Farm Manager contains three modules: one general module, one module about housing conditions and one module about feed and feeding regime for finishing pigs (figure 1).

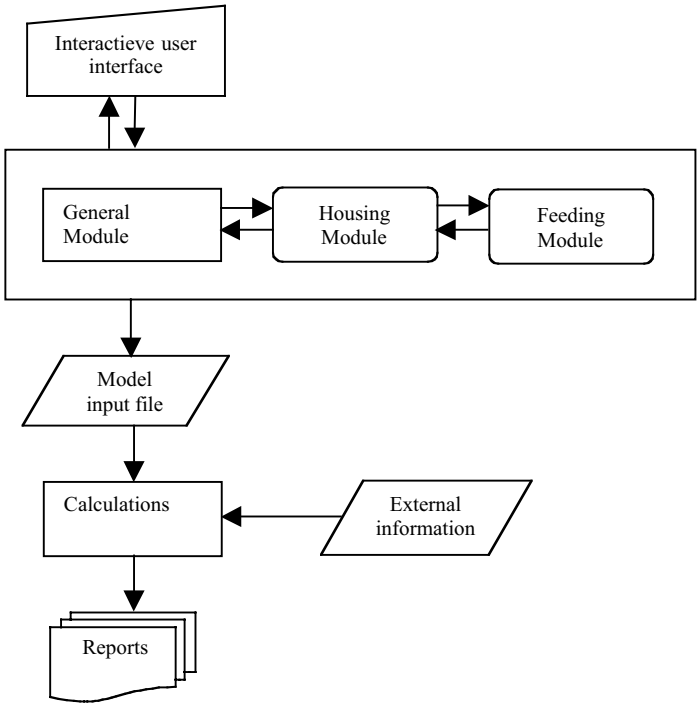

Figure 1: Structure of the Pig Farm Manager

The model is developed in such a way that almost every pig farm can be simulated.

General module:
In the general model, the user enters all necessary farm data on e.g. farm size, technical parameters, farm management, prices (feed, meat, piglets) and general costs (insurance, electricity, water).

Housing module:
Investment costs per pig place depend on a lot of factors like number of pig places, building material, automation of processes, etc. Within the housing module detailed specifications for barn design can be indicated, resulting in a calculated investment cost per pig place. This investment cost per pig place uses the model to calculate the cost price per piglet or kilogram meat.

Feed module:
The feed module is based on a model that was developed by Van der Peet-Schwering in 1994: Technical Pig Feeding Model. The feed module is meant to evaluate alternative feeding and management strategies. The feed module predicts the influence

of feed intake, feed composition, genotype, sex and climate on growth, body composition and mineral excretion of healthy growing/finishing pigs. The effects of growth, body composition and mineral excretion are translated into economical parameters like gross margins and cost price. This can be very helpful to assist pig farmers in determine the most profitable feeding strategy and improving the production efficiency (Van der Peet-Schwering et al., 1999).

Reports:

The Pig Farm Manager uses the data from all the modules and external information (like the national payment scheme for pig meat) to estimate cost price, profits, gross margins, costs and farm income per farm, per sows or finisher place.

A case study

In this case a strategic choice made in the past (a high-health status) is evaluated by making an integrated farm simulation with the Pig Farm Manager. The importance of a disease-free status is being increasingly recognised nationally as well as at farm level, particularly for the purpose of export. The amount of veterinary medicines used on pig farms is under discussion in relation to food safety. The Research Centre in Lelystad houses a Specific Pathogen Free (SPF) population of sows and finishing pigs since June 2001. The sows were imported from a SPF sow population in France. These sows are free of diseases such as Mycoplasma, PRRS, Infectious Atrophic Rhinitis and *Actinobacillus pleuropneumoniae* (APP). The high-health-status is maintained by applying strict hygiene protocols.

High-health-farm in Lelystad

The choice to invest in a high-health-farm (HHF) in Lelystad was, among other factors, based on the better technical achievements of other high-health-farms. Mandrup and Madsen (1980) found a 10% higher daily gain and feed conversion in their SPF-herd of finishing pigs. They also found 30% reduction of curative and preventive treatments and 70% reduction of registered diseases in slaughter pigs. Kuiper and Martens (1994) found better fertility traits for their sows, 10% higher non-return rate at 28 days and 6% more piglets per litter. The total costs for health and veterinary aspects were reduced by 70% per sow per year.

To get more insight in the question whether this extra investment in the HHF is compensated by a better animal performance in this system, the HHF was compared to a standard sow farm using the Pig Farm Manager. Both farms are typical Dutch sow farms with 400 sow places. Except for the parameters listed in Table 1, the parameters for both farms entered in the model were the same. The results of the HHF are from the period between February and July 2002. Results of the SF are based upon the average technical results national wide (SIVA, 2001) in 2000. Technical results from 2001 were not representative due to the Foot and Mouth Disease outbreak in the Netherlands that year. Costs for the SF were based on strategic predictions for five years (KWIN-V, 2002).

Table 1: Differences in technical parameters and costs between the high-health-status farm (HHF) and a standard farm (SF).

	HHF	SF*
Mortality rate until 25 kg	8.5	13.4

Daily gain until 25 kg (g/day)	380	327
Employers (FTE)	2.4	2.3
Price piglet feed (/100 kg)	25.62	26.87
Feed costs per piglet per year	7.3	7.9
Health cost per sow per year	47.00	40.00
AI costs per sow per year	40.80	20.40
Costs of accommodation per sow place	2,450.00	2,400.00

* Based upon SIVA performance data of 2001

Mortality rate until weaning was almost 5% lower in the HHF, resulting in two extra piglets per sow per year compared to the SF. Piglets on the HHF also grew faster with a better feed conversion ratio, which resulted in 7.5% lower feed costs per piglet per year. On the other hand, extra time per day (about 20 minutes) was needed for showering and other hygiene measurements for personnel. Showering and hygiene measurements also lead to higher investment costs per sow place due to extra investments in showers for personnel and equipment (e.g. UV-box). Extra costs for insemination are due to the import of special semen from a SPF-herd in France. Medicine costs per sow per year were lower on the HHF compared to SF, but due the intense guidance from external advisors the total health costs per sow per year were slightly higher on the HHF.

Using the Pig Farm Manager, the economic parameters for both farms were calculated and listed in Table 2.

Table 2: Estimated economic parameters for the high-health-status farm (HHF) and a standard farm (SF).

	HHF	**SF**
Revenues	1041	959
Feed costs and animal purchase costs	493	490
Feed Margin	548	469
Miscellaneous costs	146	121
Gross margin (per sow per year)	402	348
Gross margin (farm)	150,000	129,000
Fixed costs	227,500	221,000
Net farm income	- 77,500	- 92,000
Cost price per piglet*	48.48	51.67

* Corrected for piglets of 25 kg.

Revenues per sow, but also the miscellaneous costs were higher for HHF compared with SF. Net farm income and cost price per piglet for the HHF were 14,500,- higher and 3.19 lower, respectively, compared to the SF.

Sensitivity analyses

To analyse the sensitivity of several parameters within the model, it was assumed that the current situation on the HHF has changed in a less optimal situation due to a higher infection pressure. This suboptimal situation would lead to higher mortality, more labour and a need for more expensive feed. Mortality rate would increase with 2.5-5%, extra labour for health care with 0.12-0.24 FTE and the feed price would increase to the same level as on the SF. In table 3 the new cost price per increased factor is presented and compared to the former cost price on the HHF.

Table 3: Calculated cost price and difference per increased parameter compared to the former situation of the HHF.

	Cost price HHF	Difference
Mortality rate +2.5%	49.68	+ 1.20
Mortality rate +5.0%	50.88	+ 2.40
Labour +0.12 FTE	48.87	+ 0.39
Labour +0.24 FTE	49.25	+ 0.77
Price piglet feed (/100 kg) + 0.63	48.63	+ 0.15
Price piglet feed (/100 kg) + 1.25	48.77	+ 0.29

If in a suboptimal environment the mortality rate increased with 5%, the cost price per piglet increases with 2,40. Growth of the piglets will reduce unless more expensive feed is used to compensate. If the same feed is used as on the SF, the cost price per piglet on the HHF will increase with 0.29. Extra labour (0.24 FTE=10%) will lead to an increase of the cost price with 0.39.

Conclusions

On the HHF, the extra investments in the hygiene protocols are well compensated by the higher revenues. Especially the lower mortality rate until 25 kg resulted in a higher piglet production and therefore more revenues. From the sensitivity analyses, it became clear that an increase in mortality rate with 2.5% would raise the cost price for HHF piglets with 38%.

The case proves that a simple simulation of the two pig farming systems leads to insight in the economic consequences of each system. In this case an existing High-health-farm was compared with a standard (non existing) farm, but the Pig Farm Manager can just as easy simulate scenario's to improve the revenues of an existing farm system.

Further development of Pig Farm Manager

The results of the high-health-farm in Lelystad will be incorporated into the Pig Farm Manager model. In this way the model will be updated with the newest information available. Also, in the coming years the Pig Farm Manager will be expanded with new

modules. Simulation of farms with liquid feeding will be possible after expanding the Feed Module. Possible new modules are: (1) an Energy Module to simulate the energy-use and (2) an Environmental Module in order to simulate the mineral flows on a pig farm. In addition to these modules, the Pig Farm Manager will be adapted in order to simulate organic pig farms.

Biographical note:

Johan Zonderland graduated in 1997 in animal husbandry at Wageningen Agricultural University, The Netherlands. Currently he has a position at the Applied Research division of the Animal Sciences Group, of Wageningen UR, as project leader of several animal welfare and farm management projects.

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