THE VALUE OF INFORMATION IN PIG FATTENING ENTERPRISES

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Abstract: In order to determine the value of information on sex, weight and growth characteristics of fattening pigs that must be divided over different pens in a compartment of a pig fattening house the TMV simulation model and the MOM optimization model are used to calculate the technical and economical results of five different scenarios. The scenarios differ both in the way information on sex and weight (mean, distribution) at the start of the fattening period is used, as well as on the actions that are performed by the pig farmer. Compared to a practical situation some 8% improvement in net returns might be expected when the available information will be used. If the information is combined with specific actions an improvement of even 13 to 16% should be theoretically possible.

Keywords: information, fattening pig, optimization, simulation, scenarios

1 Introduction

The Dutch pig fattening industry tries to maintain its well known status in Europe, and they even try to explore some other markets too. The present state of productivity forces production to be efficiently. Increasing feed and energy costs and investments to control minerals claim much of the present pig fattening farmer (Bens et al., 1994). Pig fattening farmers, therefore feel the need to ascertain detailed information of the farm as business and of the production process itself (Vermeulen, 1995). Information, or better data can be gathered on different levels: farm, house, compartment, pen and individual pig. Nowadays, pig fattening farmers use process computers to control the climate on the compartment level, and feeding computers on pen level. An interesting question is whether it becomes economically worthwhile to invest in process computers that ascertain detailed information on individual pigs. In other words, what will be the added value of more detailed information that can be gathered on pig fattening farms.

With this background the objective of this study became to determine the value of information of a group of pigs that must be allocated to different pens in a compartment of a pig fattening house. In practice pigs are divided randomly over pens, and no additional pig information is used. However, growth of pigs and financial results depend amongst others on sex, weight at the start of the fattening
period, feeding scheme and climatic circumstances (Peet-Schwering et al., 1994). This information can be used to optimise the financial results.

2 Material and method

2.1 TMV simulation model

A working group ‘Technisch Model Varkensvoeding (TMV)’ consisting of different Dutch experts on pig feeding and climate control developed and implemented a simulation model that simulates the growth and the growth composition of individual pigs, depending on different variables (Peet-Schwering et al., 1994). The model can be used to calculate the technical and economic consequences of all kind of situations. Especially the relation between the genetic potentials of individual pigs, the feeding requirements and the climatic circumstances are of interest. It is for instance well known that feed can compensate sub optimal climatic circumstances (Ouwerkerk, 1992). In this study the TMV model has been used to calculate the technical and economic results of different alternatives.

2.2 Mixed integer LP model for optimal allocation

To cope with the present practical situation that climate is controlled on compartment level and that feed is dispensed on pen level the mixed integer linear programming model called MOM (Mestvarkens Optimalisatie Model) has been developed in order to be able to cluster individual pigs according to their characteristics (sex, weight, growth characteristics) and to allocate them to a certain pen (size) (Otte, 1996). For each pen the LP model determines an optimal feeding scheme and for the compartment as a whole one single climate scheme is determined. The LP model maximises the difference between the total financial yields for all the pigs and the total costs for feed and energy (climate). The input for the model consists of the number of pigs that should be allocated, including their individual characteristics (sex, starting weights, growth characteristics), the number of pens, the number of pigs per pen and the technical and financial results for different combinations of feeding and climate schemes. Costs for each feeding scheme and each climate scheme are determined and financial yield depends on the carcass weight and the lean tissue percentage at the end of the fattening period. Assumed is that all pigs reach their potential body weight after 112 days. So, we work with a fixed fattening period. The TMV model is used to calculate the input for MOM.

2.3 Case study ‘value of information’

To determine the additional value of information of pigs (sex, weight, growth characteristics) when they arrive on the pig fattening farm a theoretical case study has been performed. A population of 80 pigs, 40 castrated males and 40 females, with an average weight of 25 kg (see table 1 for detailed information) must be divided over 8 pens. Each pen can house 10 pigs. All pens are located in a single compartment.

Table 1. Number of pigs per sex, per weight class (distribution information) and mean weight information, for the theoretical pig population.

<table>
<thead>
<tr>
<th>Sex information</th>
<th>Distribution information</th>
<th>Mean weight information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21 (kg)</td>
<td>23 (kg)</td>
</tr>
<tr>
<td>Castrated pigs</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Female pigs</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>
Five different scenarios have been analysed. Scenarios differ in the way the pig farmer allocates (or can allocate) the individual pigs, the choice of the feeding and the climate schemes and the availability of information. In other words what is the influence of the availability of information and the actions performed by the pig farmer. The scenarios are described shortly.

**Scenario 1: reference scenario for present practical situation**
The 80 pigs are divided randomly over the eight pens and the pigs are fed according to the commonly used CVB_750 feeding scheme. On average the pigs will grow 750 gram per day. The used climate scheme is PRAK01. The air temperature starts at 22.5 °C and it decreases in four steps to 19.3 °C. The net returns per pig per fattening round of 36.65 Dfl are calculated with the TMV model and they are set to 100.

**Scenario 2: random allocation, mean weight and sex information is used to determine one feed-climate scheme for the whole compartment**
The pigs are randomly divided over the pens. The pig farmer knows the mean weight of the whole population. This information is used by MOM to determine the optimal feeding and climate scheme. So only one feeding scheme is used for all eight pens.

**Scenario 3: random allocation, weight variation and sex information is used to determine one feed-climate scheme for the whole compartment**
The pigs are randomly divided over the pens. The pig farmer knows the weight distribution of the female and the castrated male population. This information is used by MOM to determine the optimal feeding and climate scheme. So only one feeding scheme is used for all eight pens.

**Scenario 4: mean weight and sex information is used to allocate pigs and determine feeding schemes per pen and a single climate scheme for the whole compartment**
The pig farmer knows the mean weight (see table 1) of the female and the castrated male population. This information is used by MOM to cluster the pigs and to allocate them in certain pens. For each pen the optimal feeding scheme is determined.

**Scenario 5: weight distribution and sex information is used to allocate pigs and determine feeding schemes per pen and a single climate scheme for the whole compartment**
In this case the pig farmer knows the weight distribution (see table 1) of the female and the castrated male population precisely. This information is used by MOM to cluster the pigs and to allocate them in certain pens. For each pen the optimal feeding scheme is determined.

### 3 Results

TMV and MOM are used to calculate the financial consequences for the five scenarios. The scenarios differ 1) in the way detailed information on individual weights and sex is available, and 2) the actions that are performed by the pig farmer. Possible actions can be the separation of pigs according to their sex or weight and the use of different feeding schemes. The global results of the five scenarios are shown in table 2.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>sex info</th>
<th>weight info</th>
<th>allocation</th>
<th>feeding scheme</th>
<th>climate scheme</th>
<th>relative net returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (reference)</td>
<td>-</td>
<td>-</td>
<td>random</td>
<td>compartment</td>
<td>compartment</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>m/f</td>
<td>mean</td>
<td>random</td>
<td>compartment</td>
<td>compartment</td>
<td>108</td>
</tr>
<tr>
<td>3</td>
<td>m/f</td>
<td>distribution</td>
<td>random</td>
<td>compartment</td>
<td>compartment</td>
<td>108</td>
</tr>
<tr>
<td>4</td>
<td>m/f</td>
<td>mean</td>
<td>clustering</td>
<td>pen</td>
<td>compartment</td>
<td>113</td>
</tr>
<tr>
<td>5</td>
<td>m/f</td>
<td>distribution</td>
<td>clustering</td>
<td>pen</td>
<td>compartment</td>
<td>116</td>
</tr>
</tbody>
</table>
The results of this theoretical farm show that the relative net return can be improved substantially by simply using basic available information (scenario 2 and 3). If information is used in combination with the specific action (scenario 4 and 5) to cluster the pig prior to allocate them to pens, some additional 5 to 8% extra net returns might be expected.

4 Conclusion

The presented theoretical results are important enough to continue the research and to look at some scenarios that will be based on actual production results. By the interpretation of these results one should be aware of the assumptions that are made. In practical situations some of the expected improvement probably will not be reached because there will be some sub optimal circumstances such as diseases. Nevertheless we are optimistic about the applicability of the concept in MOM in order to optimise the production process of pig farmers, so that they stay at least competitive with other pig farmers in Europe.

5 References.


