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of management changes (Perestrelo et al, 1992). The main difficulty of this kind of approach is finding partners with an open mind.

REFERENCES


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Prevention of reproductive disorders in sows

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Summary — Data collection related to production performances and health parameters was developed in 31 intensive pig farms in Portugal (from 100-800 sows each) in 1 580 of 10 000 sows over 7 yr (1985–1992). Using prospective surveys and subsequent preventive veterinary medicine programs in pig farms, we demonstrated the value of risk-factor analysis in the improvement of production performances: an increase in litter size from 9.15 piglets born/litter (sd 2.93) to 13.4 (sd 2.13); an increase in number of weaned piglets per sow per year: 15.73 (sd 1.93) to 20.46 (sd 1.92); and a decrease in returns to oestrus (25.3 to 2.3%).

swine / epidemiology / intensive pig farms / preventive veterinary medicine / reproduction disorders

* Correspondence and reprints
Résumé — Prévention des troubles de la reproduction de la truie. L'étude, réalisée dans 31 exploitations porcines portugaises spécialisées et intensives (100-800 truies par élevage) pendant 7 ans, avait pour objectif d'évaluer l'efficacité d'une méthode comprenant l'identification initiale des facteurs de risque des troubles de la reproduction de la truie, leur correction et l'observation de l'effet de celle-ci sur la prévention des troubles. Après correction des conditions d'élevage déf ectueuses précédemment décrites comme facteurs de risque, les résultats observés (augmentation de la prolificité et de la taille de la portée sevrée, réduction des taux de retour en oestrus des truies) permettent de valider le rôle de ces mêmes facteurs en tant que facteurs de risque des troubles de la reproduction dans la population d'étude.

truie / épidémiologie / exploitation porcine intensive / médecine préventive / troubles de la reproduction /

INTRODUCTION

Pig farming efficiency depends strongly on reproductive performances. As characterized by others (Dagorn, 1983), the number of piglets weaned per sow, per year, is influenced by prolificacy (piglets born/farrowing) and by reproduction rhythm (number of farrowings/sow/yr). Reproductive disorders such as low prolificacy and high incidence of returns to oestrus have been previously studied through the analysis of risk factors involved in their development. In this report, we have used this methodology to evaluate the efficiency of preventive veterinary programs to identify and correct the above-mentioned disorders in intensive pig herds. This epidemiological survey involves the measurement of several parameters concerning the animals and their environment (Madec, 1986).

MATERIALS AND METHODS

Study population

A total of 1 580 sows, from 31 farms around Lisbon, were studied. The farm size varied from 100 to 800 sows each, for a total of 10 000. These farms were chosen independently of their technical or economical performances and they are likely to be considered representative of intensive pig farms in Portugal. The animals were mainly Large White, Landrace or crossbred.

Data collection

Data collection was performed from May 1985 to November 1992. Sows were individually and carefully observed on each farm from weaning to 30 d after mating. During this period, risk factors associated with reproductive disorders (Madec, 1986) were recorded. Surveys were performed at different times, depending on the selection of available means mainly related to the farmer's willingness to cooperate. Preliminary meetings between the survey performer, the veterinarians, and the farmers were carried out to analyze previous farm performances over the last few years. Before starting the prospective survey, the whole farm was thoroughly investigated through a detailed visit to all the unit sections, starting early in the morning at feeding time. According to the first cross-sectional examination, the details of the protocol were discussed with the farmer. Data collection was conducted in each herd respecting the requirements of the protocol and the particularities of the farm.

The protocol

Early morning urine taken from each sow under study was submitted to the laboratory diagnosis (Madec and David, 1983). Blood was collected by jugular vein puncture using Venoject system. Blood samples were tested for antibodies against viral diseases (eg, parvovirus, Aujeszky's dis-
ease), brucellosis and leptospirosis. At mating time, the sow's body condition was scored on a scale from 1 (very thin sow) to 5 (good condition) according to previous studies (Madec, 1980), and previous reproductive performances of sows and boars were tabulated. Particular observations were made concerning the handling method, the sow's behavior, and the duration of copulation. Details on level of feeding and composition of the diet were also recorded. Room temperature was recorded daily over the first month after service.

**Data analysis**

The above-mentioned forms were completed once the 15 risk factors had been carefully measured, and the profile of each sow was obtained and computerized. The computer located each sow on a map obtained using the factorial analysis of correspondence (Benzecri, 1976; Madec, 1986). In each of the 31 herds, a group of 15–25 randomly selected sows were submitted to the protocol.

**The follow-up period**

After a first evaluation of the risk factors, subsequent groups of sows were monitored in the herds, particularly in those affected with severe reproductive disorders. In these farms, a corrective program was adapted to each condition. Subsequent groups were used to test the relevance of the preventive measures applied after the first survey. From 2 to 9 groups of sows were followed in each herd. Subsequent surveys allowed us to visualize the evolution of the herd situation through its position on the above-mentioned map. According to their respective profile concerning the risk factors, the sows could be plotted on this map. For a given sow, the more the profile includes 'bad values' for the risk factors, the more this sow is located on the bottom left-hand part of the map, and accordingly, reproduction performance is expected to be low. The opposite was expected for the sows classified at the top right-hand part of the map. The relevance of the risk factors was tested by comparing the location on the map and the farrowing results of the sows.

**RESULTS**

The 1580 sows studied were plotted on the map according to the values they obtained for the 15 risk factors (table I and fig 1). The sows were given a symbol according to the result of mating, so the prediction was given by the position on the map and the real result was given by the symbol. It appeared that the sows with the best results at farrowing were located in the upper right-hand part of the map whereas the sows that returned in heat were mainly gathered on the bottom left-hand part of the map. The zone-by-zone global analysis of our data showed a clear trend for the results to get better from the 'at-risk' area to the 'target' area. The general relevance of the risk factors to predict mating results was verified for Portuguese intensive swine herds. Figure 2 shows the position of the groups of sows that were individually followed. The accu-

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Reduction risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health of sow</td>
<td>Rectal temperature &lt; 39°C</td>
</tr>
<tr>
<td>Parvovirus infection</td>
<td>Homogeneous profile</td>
</tr>
<tr>
<td>Urinary infection</td>
<td>Absent</td>
</tr>
<tr>
<td>Breed</td>
<td>Crossbreed</td>
</tr>
<tr>
<td>Sow performance</td>
<td>Good</td>
</tr>
<tr>
<td>Boar performance</td>
<td>Good</td>
</tr>
<tr>
<td>Farrowing–mating interval</td>
<td>30 d for more</td>
</tr>
<tr>
<td>Sow condition score</td>
<td>Good (4 or 5)</td>
</tr>
<tr>
<td>Lysine intake</td>
<td>≥ 24 g</td>
</tr>
<tr>
<td>Sow locomotor activity</td>
<td>≥ 50% standing</td>
</tr>
<tr>
<td>Copulation time</td>
<td>&gt; 4 min</td>
</tr>
<tr>
<td>Sow behaviour at mating</td>
<td>Good</td>
</tr>
<tr>
<td>Insemination method</td>
<td>Natural</td>
</tr>
<tr>
<td>Environmental temperature &lt; 28°C</td>
<td>Safety</td>
</tr>
<tr>
<td>Soil condition at mating</td>
<td>Safety</td>
</tr>
</tbody>
</table>
The at-risk concept has been widely investigated particularly in human health (Evans, 1976; Grundy, 1973; Hill, 1965).

The ecopathological approach has been previously published for intensive animal production (Madec and Tillon, 1988). Risk factors are particular circumstances belonging to the animals or to their surroundings which are regularly associated with an increased occurrence of health disorders, and they should not be confused with etiological causes. Such risk factors are obtained through exhaustive prospective surveys and they have a predictive value regarding the onset of the disorders. Accordingly, risk factors may be used as a scientific basis for modern preventive veterinary medicine. For the total success of the application of the ecopathological method, 3 conditions are required: the motivation of the farmer, the veterinarian’s skill and the possibility of creating an enthusiastic team with reciprocal trust. Indeed, the success of the...
operation depends as much on knowledge sensu stricto as on human qualities of the people concerned with the project. Team spirit is the basis of all work, so the farmer should be satisfied with answers to urgent problems (urinary infection, for example). The visits to farms must be planned very carefully as they help to stimulate data collection which is sometimes laborious. It is necessary for the farmer to adopt an active vision of his own problems. It is equally fundamental for the veterinarian to play his role of consultant respecting the aim of the method; throughout the protocol of data collection he plays the role of a ‘mirror’ that progressively allows the farmer to discover his mistakes, and then he becomes an advisor by discussing the different available solutions. The correction of certain risk factors is usually easy to carry out and the expected response is also easy to obtain: body condition of the sows, sow water intake to fight urinary troubles, farrowing–mating interval, etc. In other cases, the correction is slow and requires a deeper, structural intervention (changing the genetic scheme, for example). Finally, other parameters are hard to understand for the farmer and require explanations from the veterinarian (level of hygiene, for example). These points are the most difficult to correct, because some of the bad practices had been used routinely for several years before the troubles occurred.

In our studies, the use of the mapping procedure could be of great help as it allows to visualize the migration of the herd ‘status’: the migration from zone 3 (‘at-risk’ area) to the top (‘target’ area) corresponded to a gain of 3–4 piglets/litter. This situation could not be related to a ‘parity effect’, since the parity in zone 3 was 3.8 on average but 3.5 in the ‘target area’. The wide use of micro-computers provides new tools for such practices, but the results depend largely on the knowledge and ability of the operators (Perestrelo, 1993). This work clearly shows that such a methodology is a highly valid basis of work when implementing a preventive veterinary medicine program.

REFERENCES


Grundy PF (1973) A rational approach to the ‘at risk’ concept. Lancet 2, 1489


