PIG BREEDING

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SUMMARY

The main session on pig breeding focusses on the changes that take place in the pig breeding industry and the effects this will have on breeding programmes. Breeding organisations will be nationally or internationally operating. The question is raised to what extent this affects the breeding objectives. Market changes and genetic progress achieved also affect the breeding goal.

With presently available facilities, methods and knowledge breeding has to be optimised. Selection is in general for overall economic efficiency. The right balance between selection for several traits at an appropriate level of investment has to be found. New methods to achieve or enhance genetic improvement will become available. This will change the optimal design of breeding programmes. Also more knowledge on the biological background of traits is needed to make use of new techniques and to make further improvements possible. A flexible approach of breeding organisations is essential.

INTRODUCTION

A pig breeding programme is a complex system in which several decisions have to be taken. Each decision tends to affect the decisions in other areas. So an integrated approach is required. The following components can be distinguished:

- definition of breeding goal
- choice of cross breeding system
- choice of breeds/lines
- design of breeding programme per line
    * traits to select for
    * sow population size and sow/boar ratio
    * size and useage of test facilities
    * estimation of breeding values
    * selection procedure
- design of the structure of the production pyramid
- dissemination of genetic improvement

The first paper of this main session deals with the definition of breeding goals and with present and future developments. The integrated approach optimizing breeding programmes is the topic of the second one. The third paper focusses on the effect of new techniques on integrated pig breeding programmes. The last paper discusses the role of biological knowledge for future pig breeding programmes.

BREEDING GOALS FOR NATIONALLY AND INTERNATIONALLY OPERATING PIG BREEDING ORGANISATIONS

The structure of pig breeding organisations has changed over the last decades. Pure bred breeding has to a large extent been replaced by cross bred breeding which is carried out by breeding organisations, i.e restructured herdbook organisations or breeding companies. These breeding organisations tend to operate more and more on an international basis. Breeding goals have to be defined for the future situation. Different scenarios give rise to different breeding goals. A question is also how breeding organisations should handle different breeding objectives in various countries. So breeding goal and selection strategy have to be designed for a range of situations depending on assumed scenarios for the future and on the type of markets to supply with genetic stock. Costs, risk and predicted genetic improvement have to be balanced.

The impact of new technologies on pig breeding programmes is not clear yet. It will probably increase genetic improvement and biological limits might be reached sooner. This will affect the breeding objectives in general and of specific lines in particular.

Breeding objectives may be achieved in the future by "traditional" selection and/or gene transfer. This will change the way we define and achieve our goals in pig breeding.

OPTIMIZATION OF PRESENT PIG BREEDING PROGRAMMES

In a pig breeding programme selection for growth and carcass traits, reproduction and other traits have to be optimised. This includes optimisation of the size and use of facilities. Nucleus population size and structure, size of testing facilities, balance between selection for growth/carcass and reproduction traits, genetic gain versus increase of inbreeding coefficient, procedures to estimate breeding values, sire/dam lines, cross breeding systems and use of field data are relevant topics.

The use of BLUP will result in a rather uniform approach for all relevant traits. Integration of this tool into existing programmes will be an important job to be done. On the short term single trait BLUP can be used. The value of multitrait BLUP will depend on the situation for a line of a specific breeding organisation. Further developments in this area are still needed.

A good quantitative insight into the effects of relevant factors on genetic improvement is needed to design programmes that can be executed in practice. For example, De Vries and Van der Steen (1990) showed that for a nucleus size of 300 sows per line the ratio of sow places for sire and dam lines could vary between 100/500 and 300/300 and still achieve more than 97% of the theoretical maximum which was obtained at a ratio of 200/400. This opens the opportunity to take economic/production aspects into consideration in a justifiable way. The percentage of the theoretical improvement achieved might be one of the most important criteria to judge the success of a breeding programme.

IMPACTS OF NEW TECHNOLOGY ON PIG BREEDING PROGRAMMES

New technology may drastically change pig breeding programmes to improve lines and may have an influence on the way lines are used.

At the moment lines are being improved by selection within lines. New techniques like cloning and embryo transfer can be used to improve the accuracy of breeding value estimation. More information from more closely related animals can become available. The question however is whether the increase of accuracy is big enough to justify the extra costs. Marker assisted selection can further improve selection.

Creation of transgenic animals can result in development of new lines. An assumption is that interesting genes can be found. Procedures to integrate development of transgenic lines into the breeding programmes have to be designed.

New techniques will also change the use of lines and animals. Cloning of superior animals, pure breds or cross breds, could result in uniform, high yielding commercial populations. The genetic progress will then be achieved by the use of animals and data of nucleus animals only.

Some future developments are hypothetical at the moment but could have marked effects on breeding programmes. Sire line progeny in an embryonic stage transferred to dam line recipients changes breeding objectives for the various lines and changes the optimal structure of the production pyramid.

New techniques will gradually become available for practical application. They will have a substantial impact on several aspects of the integrated pig breeding programme. The future of pig breeding organisations will be characterized by frequent changes of the total organisation which requires a very flexible organisation and substantial resources.

THE ROLE OF BIOLOGY IN FUTURE PIG BREEDING PROGRAMMES

Developments in pigbreeding have in the last decade been in the areas of statistics and structure of the production pyramid, i.e. optimization of genetic progress, dissemination of it and efficient use of resources (nucleus size, testing facilities etc). The traits to select for have been rather straightforward and little biological knowledge was needed. Backfat thickness, test growth, feed intake or feed conversion ratio and litter size have been the main traits.

More biological knowledge is needed to further improve pig breeding and to make use of new techniques. For example the role of voluntary feed intake in relation to protein deposition capacity is better understood now and makes it possible to adapt the selection strategy to the genetic level of traits of individual lines. Knowledge on feed intake curves can be used to select more efficiently for feed conversion ratio.

Transgenic animals can be useful for future pigbreeding provided the interesting genes are known. More knowledge at a fundamental biological level of traits is needed to find the interesting genes. On the other hand new techniques will also generate more biological knowledge which can then be used to make better use of available techniques.

Pig breeding in the future will be a combination of biology, statistics, economics, financial resources and organisation, each being a potential bottleneck.

REFERENCES

De Vries, A. G. and Van der Steen, H. A. M., 1990. Livest. Prod. Sci. (in press).