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Review

Methods for calculating economic weights of traits in pigs

Zuzana Krupová*, Emil Krupa, Eliška Žáková

Institute of Animal Science, Praha–Uhříněves, Czech Republic

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Selection of animals is performed on the basis of a complex of traits, which are characterised by breeding values and economic weights. Various methodologies are used to choose the most important traits in pig breeding programs. Using the subjective approach, economic importance of pig traits was based on the required genetic gain and on subjective decision of the breeders. These methods could be ambiguous, however the insufficient information about the trait importance can be complemented in some cases (e.g. for organic pig farms). In objective methods, the performance of a pig production system (measured as profit or costs) in relation to improving the genetic level of a pig trait is considered. Compared to other livestock species, the pig breeding structure plays some role when defining the trait economic weights. The general, flexible and fee available computer program would be useful tool for calculating economic weights of pig traits.

Keywords: pig breeding, economic value, functional traits, production traits

1 Introduction

Selection of animals is performed on the basis of a complex of traits, which are characterised by their breeding values and economic weights. Various methodologies are used to choose the most important traits in livestock breeding programs. Economic weights of many production and functional traits were calculated for pigs in the last years and various approaches were used when defining the economic importance of the traits for the selection purposes. Generally, this approaches ranged from subjective decisions of the breeders (Sørensen, 2015; Wallenbeck et al., 2015) to the most objective and comprehensive methodologies (de Vries, 1989; Houška et al., 2010; Amer et al., 2014). Economic weights of pig traits are calculated for various breeds kept in various productions systems and management alternatives. A precise definition of evaluated trait, character of pricing system and evaluation of economic efficiency of the system is defined. Therefore, the objective of this short review is to describe methods used for the calculation of economic values of important traits for pigs.

2 Methods for calculating the economic weights

Based on the classification of Böbner (1994), the objective and subjective methods are used for calculation of economic weights of traits. Using the subjective methodological approach, economic importance of the pig trait can be based on the required genetic gain for the given trait, i.e. on the desired gain (Sørensen, 2015). The second option is when the economic weight of trait is defined by a subjective decision of the pig breeders as “ad hoc approach” (Wallenberk et al., 2015). To design the selection index in this case, economic value should be subsequently multiplied by the standard deviation of the given trait. As these approaches are not based on the real economic importance and have not been considering the genetic parameters of the given traits they could be ambiguous (Bourdon, 1998). However, Wallenberk et al. (2015) pointed out, that farmers’ preferences should be taken into consideration when developing pig breeding strategies for conventional and organic farmers mainly due to the variations in farmers’ breeding goal trait. It should be also added that economic importance of some traits (especially in organic farming) can not be uniquely and exactly defined.

*Corresponding Author: Zuzana Krupová, Institute of Animal Science, Přátelství 815, 10400 Praha-Uhříněves, Czech Republic. E-mail: krupova.zuzana@vuzv.cz

In objective methods, the behaviour of a production system when increasing the genetic level of the given pig trait is described. It means that the performance of a production system in relation to improving the genetic level of a trait is usually considered. Performance of production system can be measured e.g. as profit per animal (Houška et al., 2004) or costs per unit of production (de Vries, 1989). To model the production system, positive and normative approach can be used. Positive approach is based on the evaluation of historical data, while the actual and future (forecasted) data can be used in normative approach. As the breeding is oriented into the future, the competitive advantage is for application of normative approach. Profit functions and bio-economic models are therefore applied to describe relation between the level of important trait and the economic result of the production system. For example, the model developed by de Vries (1989) described efficiency of meat production as a function of breeding goal traits. Similarly, Tess et al. (1983) simulated the effect of the traits genetic change on life cycle efficiency of pork production. Based on these pilot studies the simple profit function (Houška et al., 2004) and comprehensive bio-economic models (Serenius et al., 2007) were developed and applied to evaluate the economic importance of traits. Using the profit functions, economic values of the trait can be simple and clearly interpreted. However, these methods may not be precise and flexible enough for various production systems and economic conditions. Therefore, the complex of equations applied in the bio-economic models is more suitable. It enables to include and characterise many biological and economics parameters of evaluated production system. After the biological and economic input data for the given production system (or for pig line) are defined they can be modified to test sensitivity of the economic values of evaluated traits comprehensively. Therefore, these models are most often used to calculate economic values of traits.

Compared to other livestock species, pyramidal structure of pigs breeding and specialisation of dam and sire lines play some role while economic values of the pig traits are estimated. The economic values of pig traits published in literature were calculated e.g. separately for maternal traits of sows in farrowing units (Amer et al., 2014) or for maternal and sire line traits of an integrated production system (de Vries, 1989). In last mentioned study a maternal line index comprising the farrowing and finishing farms was considered. Furthermore, it was recommended (Wolfová et al., 2001) that position of a breed in the given breeding system should be taken into account when economic weights of pig traits are calculated. Additionally, discounting of expressions connected with revenues and costs occurring in the individual genes (traits) of evaluated breed in different links of the crossing system (from farrowing sow to slaughter animals) should be reflected.

Reviewing above mentioned studies, calculation models are developed mostly for specific production systems and/or specific pig breeding programs and have generally not been freely available. Therefore a general and flexible computer program for calculating the economic weights for wide range traits in pig breeds should be developed.

3 Conclusions

Various methodologies are used to choose the most important traits in pig breeding programs. They ranged from objective to subjective approaches. Using the subjective approach, economic importance of pig traits were based on the required genetic gain and on subjective decision of the breeders. These methods could be ambiguous, however the insufficient information about the trait importance (e.g. for organic pig farms) can be complemented in this way. In objective methods, the performance of a production system (measured as profit or costs) in relation to improving the genetic level of a trait is considered. Profit function and bio-economic models are the most often used to calculate economic values of pig traits. Compared to other livestock species, the pig breeding structure plays some role when defining the trait economic weights. A general, flexible and fee available computer program should be developed for calculating economic weights of pig traits.

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References

AMER, P. R., LUDEMANN, C. I. and HERMESCH, S. (2014) Economic weights for maternal traits of sows, including sow longevity. *Journal of Animal Science*, vol. 92, pp. 5345–5357. doi: http://dx.doi.org/10.2527/jas.2014-7943

BOURDON, R.M. (1998) Shortcomings of current genetic evaluation systems. *Journal of Animal Science*, vol. 76, p. 2308–2323.

BÖBNER, C. (1994) *Schätzung wirtschaftlicher Gewichte für sekundäre Leistungsmerkmale bei Schweizerischen Zweinutzungsrindern unter Anwendung der dynamischen Optimierung*. Dissertation Thesis. Zürich: ETH, 127 p.

DE VRIES A.G. (1989) A model to estimate economic values of traits in pig breeding. *Livestock Production Science*, vol. 21, pp. 49–66.

HOUŠKA, L., WOLFOVÁ, M. and FIEDLER, J. (2004) Economic weights for production and reproduction traits of pigs in the Czech Republic. *Livestock Production Science*, vol. 85, pp. 209–221.

SERENIUS, T., MUHONEN, P. and STALDER, K. (2007) Economic values of pork production related traits in Finland. *Agriculture Food Science*, vol. 16, pp. 79–88.

SØRENSEN A. C. (2015) Subjective definition of traits and economic values for selection of organic sows in Denmark. In: *66th Annual meeting of the European Federation of Animal Science. Book of abstracts*, Warsaw: European Federation of Animal Science, p. 465.

TESS, M. W., BENNETT, G. L. and DICKERSON, G. E. (1983). Simulation of genetic changes in life cycle efficiency of pork production. I. A bioeconomic model. *Journal of Animal Science*, vol. 56, pp. 336–353.

WALLENBECK A. et al.. (2015) Preferences for pig breeding goals among organic and conventional farmers in Sweden. *Organic Agriculture*, pp. 1–2.

WOLFOVÁ, M., WOLF, J. and NITTER, G. 2001. Impact of incorrect weighting of traits in the aggregate genotype of pigs on genetic gain. *Czech Journal of Animal Science*, vol. 46, pp. 474–480.