

LOW INPUT PRODUCTION SYSTEM SUITABLE FOR BLACK SLAVONIAN PIG BREEDING

Vladimir MARGETA ^{1,2}, Kristina GVOZDANOVIĆ ³, Polona MARGETA ⁴, Ivona DJURKIN KUŠEC ⁵, Žarko RADIŠIĆ ⁶, Dalida GALOVIĆ ⁷, Goran KUŠEC ⁸

ABSTRACT

Pig production in Croatia is organized on the big farms and small family farms. During the last 10 years there has been a drastic decrease in number of pigs. One of the reasons for this decrease is high production cost. For that reason it is necessary to reorganise pig production and introduce low cost production systems. Basis for this kind of production lies in the tradition and organic production, where most suitable pig breeds are indigenous, such as Black Slavonian and Turropolje pig. Due to its excellent quality the meat from these pig breeds can be used for production of traditional products. Furthermore, they both represent an old genes pool which is necessary to preserve for next generations of breeders and producers. Genetic improvement programmes can serve as tool for improving pig production in specific region. Chosen genotypes should be able to survive environmental stress without decreasing in productivity. Integration of genetic improvement programs should be in accordance with genetic resource and variation in production environments.

Key words: Black Slavonian pig, production systems, genetic improvement programmes, low cost production, traditional products

1 INTRODUCTION

The basic principle of low input production system is organic production and tradition (Rydhmer and Gourdine, 2013). This kind of production should have simple designed facilities with minimum environmental controls and labour-saving devices. During the last decade there has been an increase in the field of organic and low input farming. From 2002 to 2007 number of organically raised pigs increased from 0.39 million to 0.89 in the Europe Union. Despite this increase, only 0.5 % of these pigs is raised organically (EU, 2010). Organic pig production is based on the EU regulation on organic livestock farming (Escribano 2016). Due to the diverse climatic conditions, variation in organic housing, man-

agement conditions, organic farming regulations and histories of organic pork production there are differences in low cost system production between European countries (Fruh, 2011). Low investment/intensity systems have a lot of advantages and some of them are: remodeling and maintenance can be done without special skills; existing facilities can be used; the facilities can be fully used with less pressure. However, there are also some disadvantages. These include environmental concerns such as problems with flies, odour, and runoff; relatively high labour requirement and may require supplemental heat and bedding during the winter for optimum pig performance (Abel *et al.*, 2004; Wooliams, 2006). Taking into consideration all mentioned advantages and disadvantages of low investment / intensity systems we can con-

1 University of Josip Juraj Strossmayer in Osijek, Faculty of Agriculture in Osijek, Department of Special Zootechnics, Kralja Petra Svačića 1d, 31 000 Osijek, Croatia

2 Corresponding author, e-mail: vmargeta@pfos.hr

3 Same address as 1, e-mail: kgvozdanic@pfos.hr

4 Same address as 1, e-mail: polona.frajman@gmail.com

5 Same address as 1, e-mail: idurkin@pfos.hr

6 Same address as 1, e-mail: zradisic@pfos.hr

7 Same address as 1, e-mail: dalidag@pfos.hr

8 Same address as 1, e-mail: gkusec@pfos.hr

clude that this kind of production is suitable for keeping of autochthonous pig breeds. There is two autochthonous pig breeds in Croatia and they are Black Slavonian pig and Turopolje pig.

Black Slavonian pig is an indigenous pig breed suitable for keeping in extensive conditions. It is black in colour and very resistant to climate conditions. Due to good meat quality traits it is suitable for production of high quality traditional products. Cost effectiveness and profitability of breeding the Black Slavonian pigs come from a series of advantages: in comparison with conventional breeds, Black Slavonian pigs have more resilience and longevity. Furthermore, they do not need modern accommodation facilities with high maintenance cost but modest needs for food. Other characteristic of Black Slavonian pig are excellent quality of muscle and fat tissue (Karolyi *et al.*, 2010). Considering the fact that Black Slavonian pig is autochthonous pig breed it represents pool of old genes. Regarding that it can be used in some genetic improvement of other pig breeds. Connection between genetic improvement and its actual application in the production is reflected with response to changes in production system, marketing opportunities, and knowledge about pig breed, production objectives as well as producer preferences. Some constrains of implementation genetic improvement programs are: difficulty to identify contemporary groups, low numbers of sows per producers, free-roaming boar sand early slaughter of male pigs. For successful genetic improvement within agricultural system there must be some marketing of the final products. Moreover it is necessary to recognize the risks associated with change in genotype and its interactions with environmental factors.

2 CHOICE OF BREED

Low cost production system requires breeds that can use local feed (by products) with sufficient rate of ability to adaptation, sows with small rate of piglets mortality and good milk quality, and pigs with good health

Table 1: Comparison of production traits between Black Slavonian pig and conventional pig breeds (Uremović *et al.*, 2000.)

Traits	Black Slavonian pig	Conventional pig breed
Live born per litter	6.3–7.4	7.2–13.7
Weaned per litter	5.7–6.6	4.0–10.8
Mortality until weaning, %	4.5–20.0	8.7–20.9
Average daily gain, g	450–550	658–927
Lean meat, %	28.51–38.50	48.2–58.4
Feed conversion	3.0–5.8	2.5–3.5

status. Indigenous pig breeds are particularly suitable for low input production system. However, conventional pig breeds could also be raised in low input production system, but it has to be done under extensive keeping conditions. Pejaković (2002) recommended crossbreeds with Duroc or Hampshire as suitable genotypes for low cost production systems. In Table 1. comparison of production traits between Black Slavonian pig and conventional pig breed can be observed.

Black Slavonian pig was established in the second half of 19th century near Osijek in Slavonija, as across bred between Poland China, Mangalisa, Berkshire and Cornwall. It has good meat quality suitable for production of traditional products (Karolyi *et al.*, 2010; Margeta, 2013). Excellent characteristics of this pig breed was confirmed by gold medal at Vienna World Exposition in 1873. Breed is suitable for extensive keeping and half extensive housing with pens and free space (Karolyi *et al.*, 2007). Advantages of keeping the pigs in this way are ecological acceptability, lower financial investment and farming in accordance with pig's welfare. Production traits and fertility of Black Slavonian pigs are modest, but some improvement in fertility can be achieved by crossing it with conventional pig breeds, such as Duroc. Under the extensive keeping condition fattening is rather low; average daily gain is approximately 478 g (Uremović *et al.*, 2000). The carcasses of Black Slavonian pig are characterized by high percentage of fat tissue. In comparison with conventional pigs, Black Slavonian pig has lower utilization of main cuts (ham, loin, shoulder, neck) (Karolyi *et al.*, 2007).

3 GENETIC IMPROVEMENT

The main objective of livestock improvement is to support the stability of production and increase food security as well as animal welfare. Components of genetic improvement program include economic viability, environmental compatibility, production efficiency and social responsibility (Moser, 2001). If genetic improvement is based on selection process within local population, it is recommended that this population should be indigenous. Than this is also a method for conservation of old-new genetic resources (Bichard, 2000). Furthermore, indigenous pig breeds are resources of transgressive and cryptic alleles and also source of adaptability to some specific environmental challenges. There



Figure 1: Piglets on deep litter

are several advanced technologies relevant for genetic improvement. For example, reproductive technologies which contribute to genetic improvement are artificial insemination, *in vitro* fertilization, multiple ovulation and embryo transfer (Olivier *et al.*, 2002). Mixed model methods for animal evaluation to include multi-breed or multi-population situations can serve as good basis for implementation of genetic programme. Another very important tool is application of molecular genetics in animal breeding. Application of genetic methods opens up new possibilities of breeding under extensive keeping conditions. Finally, one of very important technologies is information technology which improves information flow from breeding associations to the market.

There are several activities that can lead to integration of genetic improvement into low cost production system. They involve management of environment and animal health, preparation of the product for market and collaboration of producers (Kosgey and Okeyo, 2007).



Figure 2: Pigs under extensive keeping conditions

4 ENVIRONMENTAL PROTECTION

Livestock production has a great impact on water, air and soil quality. Intensive pig production system can have a negative influence on environment (Krystallis *et al.*, 2009). This is primarily related to problem of pig manure because there is still no environmentally acceptable solution for its management. Orientation on the production systems based on the deep litter and keeping the pigs on pastures helps to preserve the soil structure which leads to higher fertility and preservation of the soil as the basic resource for agricultural production.

5 PRODUCTION EFFICIENCY

The crucial factor in deciding on the organization and implementation of pig production system is its cost effectiveness and profitability. Production results are basis of profitability under the intensive keeping conditions. This leads to the excessive loading of the pigs and also exploits pig's production and biological capacity. The consequences of this kind of production conditions are reduced resistance of the pigs, greater susceptibility to disease and shortening of the production cycle, which than leads to high replacement rate (approximately 45 %). Concept of sustainable and low cost pig production includes realization of economic goals by the investment decrease (primarily in facilities and equipment) and decrease in organization of production processes. Under this kind of production pigs have longer production cycles (Siegford *et al.*, 2008). Emphasis of the low production system is on cost of the facilities, feeding system, replacement rates, health care and bio security measures. All these factors present financial burden to the final product, therefore the main goal of low production system is to reduce their cost. For example, raising the pigs on deep litter presents a system suitable for reducing the production costs. This kind of keeping the pigs is 50 % cheaper than raising them modern farms (Stern *et al.*, 2005). Pigs have more space, injuries are reduced, there is no dysentery of tails and health status is better.

Comparison of producing the Black Slavonian pigs and hybrid pigs is shown in Table 2. It is evident that Black Slavonian pig can be very profitable for keeping even though pig hybrids have significantly higher potential in terms of fertility and productivity. However, this potential can be expressed only under the production conditions which are usually not in accordance with the criteria of animal welfare, health, good animal husbandry practices and with favourable impact on the environment (Kralik *et al.*, 2013).

Table 2: Economic aspects of hybrid and Black Slavonian pigs production (Kralik et al., 2013.)

Indicators	Hybrid pig	Black Slavonian pig
Cost of the facility per sow	>12,000	200
Number of born piglets per litter	12	7
Number of farrowing during the production period	6–7	12–16
Total production of piglets per sow	70–80	70–85
Overall rate production	70 %	10 %
Highly skilled and expensive workers	+	–
High quality product	+	–
Favourable effect on the environment	–	+
Animal welfare	–	+
Financial supports	–	+
Meat quality	+	+

6 CONCLUSION

Future of the pig production should be based on the concept of sustainability and low cost of the production. It has to satisfy the criteria of cost effectiveness, sustainability of ecosystems and social welfare. This all can be achieved by the concept of low cost pig farming, which promotes the principles of good livestock practices and the development of livestock production.

7 ACKNOWLEDGMENT

This work has been fully supported by Croatian Science Foundation under the project number 3396.

8 REFERENCES

- Abell, C.E., Dekkers, J.C., Rothschild, M.F., Mabry, J.W., Stalder, K.J. (2014) Total cost estimation for implementing genome-enabled selection in a multi-level swine production system. *Genetics Selection Evolution*, 46(1), 32. <http://dx.doi.org/10.1186%2F1297-9686-46-32>.
- Bichard, M. (2000) Summary of workshop outcome. In: S. Galal, J. Boyazoglu, K. Hammond (Eds.) *Developing Breeding Strategies for Lower Input Animal Production Environments, Bella, Italy, 22–25 September 1999*, ICAR Technical Series 3 (pp. 5–12). Rome: ICAR.
- Früh, B., Boichicchio, D., Dippel, S., Edwards, S., Gunnarsson, S., Leeb, C., Lindgren, K., Mejer, H., Prunier, A., (2011) Organic Pig Production in Europe-Health Management in Common Organic Pig Farming.
- EU (2010) European Commission; An analysis of the EU organic sector. European Commission Directorate-General for Agriculture and Rural Development. An analysis of the EU organic sector.
- Escribano A.J. (2016) Organic livestock farming- challenges, perspectives and strategies to increase its contribution to the agrofood system's sustainability –A review. “ *Organic Farming* (2016): Pending-Pending.
- Karolyi, D., Salajpal, K., Kiš, G., Đikić, M., Jurić, I. (2007) Influence of finishing diet on fatty acid profile of longissimus muscle of Black Slavonian pigs. *Poljoprivreda*, 13(1), 176–179.
- Karolyi, D., Luković, Z., Salapaj, K. (2010) Crna slavonska svinja. *Meso*, 12(4), 222–230.
- Kosgey, I. S., Okeyo, A. M. (2007) Genetic improvement of small ruminants in low-input, smallholder production systems: technical and infrastructural issues. *Small Ruminant Research*, 70(1), 76–88, <http://dx.doi.org/10.1016/j.smallrumres.2007.01.007>.
- Kralik, G., Margeta, V., Luković, Z., Kralik, I (2013) Stanje i smjernice razvoja svinjogojstva u Republici Hrvatskoj. *Stočarstvo*, 67(4), 151–159.
- Krystallis, A., Dutra de Barcellos, M., Kügler, J.O., Verbeke, W. Grunert, K.G. (2009) Attitudes of European citizen towards pig production systems. *Livestock Science*, 126, 46–56, <http://dx.doi.org/10.1016/j.livsci.2009.05.016>.
- Margeta V. (2013) Perspektive uzgoja crne slavonske svinje u Hrvatskoj u kontekstu pristupanja Europskoj uniji. In S. Marić & Z. Lončarić (Eds.), *Zbornik radova*, 48. *Hrvatski i 8. Međunarodni simpozij agronoma, Dubrovnik, Hrvatska, 17–22. Veljače 2013* (pp. 22–29). Osijek: Poljoprivredni fakultet Sveučilišta Josipa Jurja Strossmayera.
- Marušić L. (2010) *Proizvodna svojstva svinja crne slavonske pasmine u otvorenom sustavu držanja. Diplomski rad*. Zagreb: Sveučilište u Zagrebu, Agronomski fakultet.
- Moser, B. D. (2001) Innovation in transferring research into practice. *Livestock Production Science*, 72(1), 3–7.
- Olivier, J.J., Moyo, S., Montaldo, H.H., Thorpe, W., Zárate, A.V., Trivedi, K.R. (2002) Integrating genetic improvement into livestock development in medium-to low-input production systems. In *7th World Congress on Genetics Applied to livestock production*.
- Pejaković A. (2002) *Uzgoj svinja na otvorenom*. Zagreb: Hrvatski zavod za poljoprivredno-savjetodavnu službu.
- Rydmer, L., Gourdine, J.L. (2013) Can pig breeding contribute

- to the sustainability of low input production systems? In *Book of Abstracts of the 64th Annual Meeting of the European Federation of Animal Science, Nantes, France, 26.–30. August, 2013* (p. 507). Wageningen: Wageningen Academic Publishers.
- Siegford, J.M., Powers, W., Grimes-Casey, H.G. (2008) Environmental aspects of ethical animal production. *Poultry Science*, 87(2), 380–386, <http://dx.doi.org/10.3382/ps.2007-00351>.
- Stern, S., Sonesson, U., Gunnarsson, S., Öborn, I., Kumm, K-I., Nybrant, T. (2005) Sustainable development of food production: a case study on scenarios for pig production. *AMBIO: A Journal of the Human Environment*, 34(4–5), 402–407, <http://dx.doi.org/10.1579/0044-7447-34.4.402>.
- Uremović, M., Uremović, Z., Luković, Z. (2000) Production properties of the Black Slavonian pig breed. *Zbornik Biotehniške fakultete Univerze v Ljubljani. Kmetijstvo. Zootehnika*, 76(2): 131–134.
- Woolliams, J. A. (2006) Designs and evaluations for managing genetic diversity in breeding programs. In *Proceedings of the 8th World Congress on Genetics Applied to Livestock Production, Belo Horizonte, Brazil, 13–18 August, 2006* (communication 30-01). Belo Horizonte: Instituto Prociência.