TECHNICAL NOTE

LowInputBreeds

Breeding for organic and low input pig production systems

Jascha Leenhouwers

About

Breeds and breeding strategies for organic and low input pig production systems need to be adapted to the specific characteristics and regulations of this type of production. This technical note presents an overview of research results on this topic, as obtained in the LowInputBreeds project.

Introduction

The breeds used in organic and low input pig production systems often originate from breeding programs used in conventional (i.e. intensive) production. Within these breeding programs, pure breeds are improved and crossed to breed parent sows.

These crossbred sows are purchased by organic herds and mated to purebred parent boars via artificial insemination to produce slaughter pigs (Figure 1).

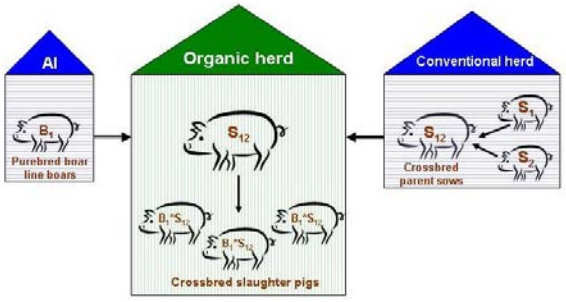

Figure 1. Organic herds using replacement gilts from conventional herds

Such crossbreeding programs have advantages in the sense that they make use of heterosis and enable a balanced selection in father and mother genetic lines. Heterosis refers to the superiority of the crossbred animal relative to the average of its straight bred parents and is especially beneficial for vitality or functional traits. Crossbreeding programs require an extensive breeding infrastructure based on specialist crossbred sow production units, artificial insemination (for boar semen production) and the use of relatively large populations for selection.

Unfortunately, the present size of organic and low input production does not justify the investment into dedicated crossbreed programs. As a result, most commercial low input and organic pig producers use genetic lines from conventional breeding programs.

These genotypes have been selected under intensive conditions for breeding goals which are important in intensive management, e.g. litter size, high growth rate, efficient utilization of nutrient dense diets and low back fat thickness. Regrettably, most conventional pig breeding programs put relatively little emphasis on improving robustness or resistance to environmental stress or pig survival, which are important characteristics required by the organic and low input sector.

Leenhouwers (2014): Breeding for organic and low input pig production systems. LowInputBreeds technical note.
Download at www.lowinputbreeds.org

Additional problems arise, because European Union regulations on organic livestock farming limit the use of replacement gilts from conventional origin and promote a closed herd policy.

Therefore it is clear that to achieve progress with respect to priority traits (pig survival, product quality and environmental stress resistance) required by the organic and low input sector, it is essential to develop specific breeding infrastructures, methods, and programs that are adapted to both the size of the sector and its regulatory requirements.

Breed choice

Both conventional and traditional breeds are kept in low input and organic production systems (see photos 2 & 3).

Typical conventional pig breeds include crosses of Landrace, Large White and Duroc, and specialized genetic lines developed by breeding companies.

Photo 2. Conventional TOPIGS[1] breed in low input pig farm in Brazil. Photo: Jascha Leenhouwers

Traditional breeds have been bred by farmers for many decades, before the drastic reduction of breed variety caused by the rise of industrial agriculture. Well-known examples of traditional breeds include the Saddleback (photo 3), Mangalitza and Iberian pig.

For many years, there has been debate about the suitability of traditional versus conventional breeds in low input and organic systems. Performance comparisons of these breeds, based on literature studies and farm surveys (see Table 1), have increased our insight in the suitability of traditional versus conventional breeds for low input and organic systems (Leenhouwers and Merks, 2013).

[1] TOPIGS is a leading company in pig breeding and artificial insemination. It is active in over 50 countries. For more information see http://www.topigs.com.

Photo 3. Traditional Saddleback breed kept in outdoor farm in UK (Photo: Sandra Edwards, Newcastle University)

Table 1 shows that in comparison with traditional breeds, conventional breeds wean more piglets, have efficient and fast growth, and their slaughter pigs are much leaner (a lot of muscle and little fat).

Table 1. Performance of conventional *vs*. traditional breeds in low input and organic systems (adapted from Leenhouwers and Merks, 2013)

	Conventional breeds		Traditional breeds	
	Average	Range	Average	Range
Live born per litter (no.)	11.0	7.2-13.7	8.1	6.1-11.0
Mortality until weaning (%)	18.3	8.7-20.9	12.6	4.4-23.0
Weaned per litter (no.)	8.8	4.0-10.8	7.2	5.4-9.9
Daily gain (g/d)	782	658-927	540	250-750
Feed conversion ratio	3.0	2.6-3.5	4.1	3.0-5.8
Lean meat (%)	55.3	48.2-58.4	46.3	28.8-55.2

Traditional breeds

Traditional breeds show high variation between breeds in reproductive and finishing performance, they roughly fall into two categories:

(1) a group of prolific breeds with good finishing performance such as Saddlebacks and Pulawska

(2) breeds kept for special meat production (e.g. Ibérico, Cinta Senese).

The prolific and leaner traditional breeds belonging to the first group are suitable for commodity organic pork production, especially when crossed with conventional white boar

breeds (e.g. Large White, Landrace or Duroc) to give some extra leanness to the carcass.

Special meat breeds are unsuitable for commodity organic pork production due to their low fertility and high carcass fatness, but offer extra added value by their specific meat and fat quality. Moreover, their black skin pigment makes them well adapted to be reared outdoors in hot climates as found in Southern European regions.

Conventional breeds

Conventional breeds may thrive well in North West European climatic conditions where summers are warm, but not hot, and winters are cool instead of cold. Optimal housing may be indoors with outdoor runs, as currently used widely in countries like Denmark, Germany, Sweden and The Netherlands. This provides a more controlled environment in which large litters are more easily managed, and if combined with balanced formulated feeds, high lean growth rates can be sustained.

The relatively lean meat of conventional breeds is suitable for sales through key wholesale outlets serving the commodity organic pork market. Conventional breeds may be less suitable in more free-range or extensive environments as found in Eastern and Southern Europe, where large litter sizes pose a risk for piglet mortality. Also the climatic conditions in these regions may be unfavorable. In cold winters, their low fat cover gives them poor protection against cold and in hot summers their lack of skin pigment makes them sensitive to sunburn.

Breeding strategies

Farmers that produce pork for commodity markets need to raise lean pigs without compromising on reproduction performance. This combination dictates the use of crossbreeding programs that allow the producer the best use of specialized sire and dam breeds (Todd See, 2000). In crossbreeding programs, the father (boar) of the slaughter pigs is usually bred for traits such as growth, feed efficiency and leanness. The mother of the slaughter pigs is bred for reproductive traits, such as litter size, mothering ability and longevity. The problem in a terminal crossbreeding program such as this is obtaining replacement gilts (Todd See, 2000). These gilts replace the parent sows and represent the future production of the herd. When using replacement gilts that originate from a conventional breeding program, there are basically two options for organic and low input pork producers (Figures 2 and 3).

Option 1. Organic herds purchase replacement gilts produced on specialized organic breeding farms

The greatest advantage of this option (Figure 2) to many producers is the opportunity to purchase animals of greater genetic value from a high quality selection program (Todd See, 2000). Moreover, gilts are purchased with a guarantee that they will breed, be available when needed and will be delivered to the farm (Todd See, 2000).

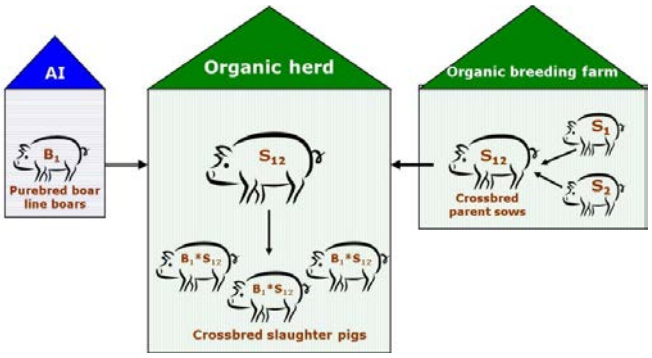

Figure 2. Organic herds using replacement gilts from organic breeding farms (Option 1)

Leenhouwers *et al.* (2011) predicted economic results of this breeding structure for organic production systems in The Netherlands. They found that this breeding structure achieved higher margins per sow compared to other breeding structures, including the rotational breeding structure described below.

Although economically favorable, implementation of such a breeding structure may have practical disadvantages. First, if organic piglet producing herds are able to sell less pigs for slaughter at time of reduced market demand, these organic breeding herds may have difficulty selling gilts as breeding replacements. In areas with a relatively high density of pig herds (e.g. in The Netherlands) problems arise in case of disease outbreaks where transport of animals is prohibited. Finally, discussions with Dutch organic herdsmen made clear that for health security reasons they preferred a 'closed' breeding structure as opposed to an 'open' structure.

Option 2. Organic herds produce their own replacement gilts on-farm by rotation breeding

In this breeding structure (Figure 3), the 'best' sows in the herd are selected as mother of the next generation of gilts and the breed of boar is changed (rotated) each generation. Rotation breeding gives less heterosis (i.e. hybrid vigor) in comparison with a first-cross dam, but it allows small herds to exploit crossbreeding in a fully self-contained and sustainable manner (Compendium of Animal Health & Welfare in Organic Farming, 2000).

A rotation breeding system is an example of a 'closed' system with on-farm sow replacement. Once the rotational program is established, the herd remains closed and only boar semen needs to be purchased for production of replacement gilts or slaughter pigs. In rotation breeding systems, breeding stock originates from a conventional breeding program, but replacement gilts are selected in an organic environment which gives advantages in terms of environment-specific adaptation. Furthermore, boars that are used to produce replacement gilts may be ranked according to a specially developed breeding index where more emphasis is given to traits important for organic production, such as piglet survival and mothering ability. Rotation breeding systems are fairly simple to follow once the herdsman chooses two or three breeds (Buchanan et al. 2004).

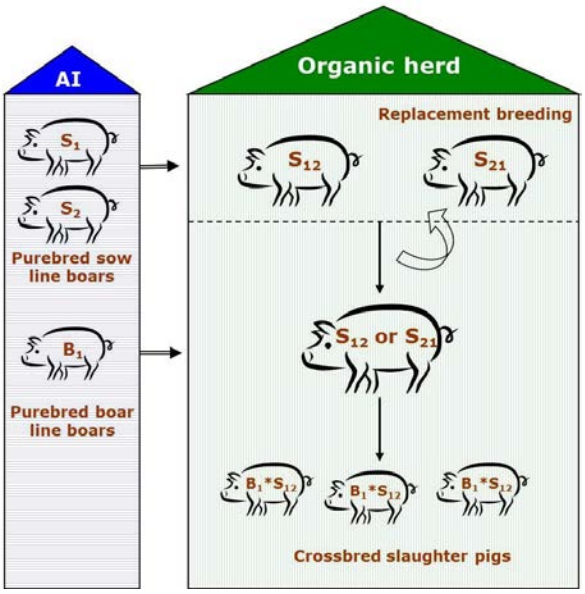

Figure 3. Organic herds breeding their own herds replacement gilts by using rotation breeding (Option 2)

Taken together, these factors make a rotation system an attractive breeding structure for low input and organic production systems. For the Dutch organic pig sector, Leenhouwers et al. (2011) proposed a two-breed rotation system where animals from conventional Yorkshire and Landrace sow lines with the highest genetic merit for desirable traits (e.g. mothering ability, piglet vitality, sow longevity) for organic pig production are selected.

Literature and recommended reading

Blair, R. 2007. Choosing the Right Breed and Strain of Pig. In Blair, R. (ed.) Nutrition and Feeding of Organic Pigs. CABI, Cambridge, USA, 258-275.

Brandt, H., Werner, D.N., Baulain, U., Brade, W., Weißmann, F. 2010. Genotype-environment interactions for growth and carcass traits in different pig breeds kept under conventional and organic production systems. Animal 4: 535-544.

Buchanan, D.S., Luce, W.G., Clutter, A.C. 2004. Swine Crossbreeding Systems. OSU Extension Fact Sheet ANSI-3603, pp. 1-4.

Compendium of Animal Health & Welfare in Organic Farming. 2000. Breeding. Pig breeds and breeding, http://www.organicvet.co.uk/Pigweb/health/breed.htm. Accessed: March 14, 2013.

Kelly, H.R.C., Browning, H.M., Day, J.E.L., Martins, A., Pearce, G.P., Stopes, C., Edwards, S.A. 2007. Effect of breed type, housing and feeding system on performance of growing pigs managed under organic conditions. Journal of the Science of Food and Agriculture 87: 2794-2800.

Leenhouwers, J.I., Ten Napel, J., Hanenberg, E.H.A.T., Merks, J.W.M. 2011. Breeding replacement gilts for organic pig herds. Animal 5: 615–621.

Leenhouwers, J.I., Merks, J.W.M. 2013. Suitability of traditional and conventional pig breeds in organic and low-input production systems in Europe: Survey results and a review of literature. Animal Genetic Resources, FirstView Article. http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8878838.

Martins, A., Kelly, H., Day, J., Stopes, C., Browning, H. Edwards, S. 2002. Optimising organic pig production. A guide to good practice. Day, J. (ed.)

Todd See, M. 2000. Should Replacement Gilts be Raised or Purchased? http://www.ncsu.edu/project/swine_extension/publications/factsheets/802s.htm. Accessed: March 14, 2013.

Wallenbeck, A. 2009. Pigs for organic production. Studies of Sow Behaviour, Piglet-production and GxE interactions for Performance. Doctoral Thesis. Swedish University of Agricultural Sciences Uppsala. http://pub.epsilon.slu.se/1989/1/2009_37_Anna_Wallenbeck.pdf. Accessed: March 14, 2013.

Imprint

Author

Dr. Jascha Leenhouwers, TOPIGS Research Center IPG, Schoenaker 6, 6641 SZ Beuningen, The Netherlands, Jascha.Leenhouwers@topigs.com

LowInputBreeds is the acronym of the project 'Development of integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and 'low input' milk, meat and egg production'. It is funded under the Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (Contract No. 222623).

Disclaimer

Review

Gillian Butler, Newcastle University, UK, and Helga Willer, Research Institute of Organic Agriculture (FiBL), Frick, Switzerland

Cover picture

Low input pig farm in Brazil. Photo by Simone Guimarães

Publishers

Consortium of the LowInputBreeds project, c/ Newcastle University, UK, and Research Institute of Organic Agriculture (FiBL), Frick, Switzerland

Download. This technical note is available for download at http://www.lowinputbreeds.org/lib-technical-notes.html