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# Organic Animal Breeding 2012 - a Position Paper from the European Consortium for Organic Animal Breeding, Eco AB

Wytze Nauta[1], Anet Spengler Neff[2], Joanne Conington[3], Therese Ahlman[4], Peter Løvendahl[5], Lotta Rydhmer[4]

[1]Louis Bolk Instituut, LA Driebergen, The Netherlands; w.nauta@louisbolk.nl; www.louisbolk.org; [2]Research institute of organic agriculture FiBL, Frick, Switzerland; [3]Animal & Veterinary Sciences, SAC, Roslin Institute Building, Midlothian EH25 9RG, Scotland; [4]Dept Animal Breeding and Genetics, Swedish University of Agricultural Sciences, Uppsala, Sweden; [5]Dept Molecular Biology and Genetics - Center for Quantitative Genetics and Genomics, Tjele, Denmark

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**Abstract**

The Europan consortium for Organic Animal Breeding (www.ecoab.org) wrote this overview on organic animal breeding, showing differences between organic and conventional breeding, pointing out arising problems and possible solutions, and introducing several organic animal breeding projects that had been carried out in different European countries over the past 15 years.

## 1. Introduction

Livestock selective breeding has made a major contribution to farming productivity in recent decades. Improvements mainly concerned production characteristics (e.g., quantities of milk, meat and eggs per animal and speed of production and growth). Recently, more attention has been laid on health and functional traits. The development and application of reproductive techniques like AI, and multiple ovulation plus embryo transfer (MOET) in cattle, are the main catalysts for these increases. Breeding programs are becoming more efficient, the accuracy of breeding value estimates is high and the focus is on shortening of the interval between generations to speed up genetic progress. Nowadays, genomic information is used to predict breeding values of young animals. This shortens the generation interval and thereby increases the genetic progress (Brascamp et al., 1993; De Roos, 2011).

Organic farming is a low input production system based on the use of local resources and on outdoor- and free range animal husbandry. Production does not focus on maximum output from maximum input (regardless of the source), but on natural processes and cycles and ecosystem services where ever possible. Animals in organic farming should be able to adapt to the local conditions and local breeds should be used (EU, 1999).

The gap between conventional and organic production systems is increasing. Many years of improving production capacity of the animals resulted in dairy cows (mainly Holstein Friesian) with annual productions of 10,000 kg milk and more, sows producing 26 piglets per year, slaughter pigs gaining almost 1 kg of body weight per day, broilers reaching 1.5 kg body weight in 5.5 weeks and laying hens producing up to 330 eggs per year. All this is possible with maximum feed supply (sometimes including antibiotics and feed additives).

There are increasing concerns about fertility, health and welfare of high producing animals, even in conventional farming (Rauw et al., 1998; Augsten, 2002; Knaus, 2009). Health problems common in conventional production are also found in organically managed dairy cows, such as poor udder health, low fertility and claw disorders (Ahlman et al., 2010). However, the magnitude of different diseases may differ to some extent (Fall et al., 2008; Sundberg et al., 2009). Involuntary culling rates are also high on organic farms: many cows only fulfil 2-3 lactations, but productive life is still slightly higher than in conventional herds (Knaus 2009). Under organic conditions high producing animals cannot always be fed properly and encounter a range of problems known from under-feeding. This can become an animal welfare issue. In organic production systems the greatest emphasis in animal selection and breeding has to be placed on functional characteristics (health, fertility and efficiency of production). In dairy cows health, longevity and a milk production level that is adapted to local characteristics have high priorities. This corresponds to the desires and demands of consumers who prefer healthy high-quality products from healthy animals with good welfare (Harper and Makatouni, 2002; Padel and Foster, 2005).

Pigs bred for conventional production and housing systems suffer under organic conditions due to more leg problems (Wallenbeck, 2009). Also reproduction results are lower. Even if more piglets are born (Ten Napel et al., 2009), mortality is higher in organic than in conventional production (Ten Napel et al., 2009; Wallenbeck et al, 2009b). Many piglets do not survive the first day because the sows, which are not selected for good maternal behaviour in a loose housing system, crush their piglets after farrowing (Damm, 2005; Weary et al., 1998; Edwards, 2002; Vermeer and Houwers, 2008). Piglets also have difficulties during the weaning period because of a lack of robustness and nutrition problems. Chickens are bred for a much higher production rate (up to 330 eggs per year) than what is possible in organic production, with organic feed. More hens die during the laying period in organic systems compared to conventional systems (Zeltner and Maurer, 2009; Leenstra et al., 2012). The reason for that is that they cannot adapt to the organic environment (Bestman and Wagenaar, 2003).

These facts indicate that animals selected for high input conventional systems cannot always cope with organic environments. There is a discrepancy between breeding goals and reproduction techniques of conventional breeding and the organic production system. The aim of the organic sector is to produce food and other products with organisms reared under the label of organic production: from the seed to the final product (EU, 1999). Should this also include the animals needed for replacement and the breeding process? In this position paper we are describing the current situation in different species and propose possible solutions towards better adapted organic breeding.

## 2. Animal Breeding, state of the art

Animal breeding techniques have been developed in the last decades - from systems based on natural mating and farm based breeding schemes towards large world-wide breeding schemes based on artificial reproduction technologies, mass data collection and genetic evaluation carried out by breeding companies.

### 2.1 Cattle breeding

Cattle breeds have been developed by different small and larger national and international breeding companies in two separated lines; dairy cattle and beef breeds. Dairy-cattle breeding has become a worldwide business focusing mainly on the Holstein Friesian breed. This breed shows the highest milk production capacity when fed with an appropriate ration in a temperate climate. For the large commercial breeds, like Holstein Friesian, breeding programs are based on AI and testing schemes. Bulls are tested on the bases of their daughters' performances and are ranked according to their estimated breeding values. Large populations of daughters milking in several different herdsare needed for more accurate selection of the best bulls. Current breeding programs are operating worldwide with up to millions of animals in a population. The genetic evaluation performed by the global Interbull organization (Interbull, 2012) provides breeding values that are comparable between member countries. Cattle breeding schemes of today use genomic data for a first selection (De Roos, 2011). Correlations between breeding values and single nucleotide polymorphisms (SNP) at DNA level are used to predict the first breeding values of new young bulls. This way bulls do not have to be progeny tested anymore before their first breeding value can be put on the market. Their breeding value is usually based on both genomic data and progeny testing.

Cattle breeding schemes are open schemes. As soon as new offspring are born from a breeding bull the farmer or a breeding company can select this animal for its own breeding program. Breeding companies compete for the best bulls on the market. Reproduction techniques like super ovulation and ova-collection and in vitro fertilisation (IVF) for female animals (often young heifers) are used to speed up the process (Dekkers, 1992; Gordon, 2004). Each year hundreds of donor heifers and young cows are selected and used for routine super ovulation and IVF and the embryos are transplanted in recipient cows.

Today reproduction technology makes it possible to separate X- and Y-sperm cells in cattle (Garner and Seidel, 2008). By buying sex-sorted semen dairy farmers can better select their animals for breeding the next generation and inseminate the rest of the herd with semen from bulls of beef breeds. This way they are able to maximise selection intensity at the farm level, reduce the production of young stock not suitable for dairy production and increase the income from young stock suitable for meat production. The use of sexed semen in conventional production herds also aims to avoid the practice of killing newborn male calves which have a very low market value when raising them for meat production .

Most organic farmers use AI bulls from conventional breeding schemes, and these bulls are commonly of the Holstein breed, or of another high producing dairy breed (Nauta, 2009; Sundberg et al., 2009). Farmers that search for more robust (dual purpose) breeds for low input organic system often use local breeds or breeds from smaller populations that are more robust like the Original Swiss Brown breed and Montbéliarde. These breeds can also be used for crossbreeding with Holsteins (Nauta, 2009). A growing group of organic dairy farmers in the Netherlands uses a bull at the farm for natural mating. These bulls are mainly purchased from other organic farms (Nauta, 2009).

### 2.2 Pig breeding

Pig production has been in the hands of large multinational breeding companies for many years. They also provide organic farmers with hybrid animals. The base lines of these hybrids are pure bred mother lines (Large White, Landrace) selected for high reproduction and lean growth rate. These lines are crossed and the F1 gilts are mated with a sire breed boar (Duroc, Hampshire, Pietrain) to produce finishing pigs. These sire breeds are selected for optimum meat production traits like lean growth rate and a high proportion of valuable cuts.

Breeding of pure bred lines is done in closed schemes. F1 gilts are produced at so-alled ‘multiplier’ farms and sold to the farms that produce piglets or pigs raised for slaughter. The pure bred lines are kept indoors under conventional conditions. AI is used to disseminate the genetic progress from the nucleus herds via the multiplying herds to the herds producing pigs raised for slaughter. Selection is based on data collection of the animal itself, full- and half-sibs and all other relatives. The main traits important for organic production are similar as in conventional production; lean growth rate maternal behaviour, piglet survival (Wallenbeck, 2009). However, these animals have to be effective under organic conditions: organic feed, no sow crates, outdoor systems, less use of antibiotics etc. That means behaviour and robustness is even more important on organic farms. In the UK where outdoor-reared pigs is commonplace, breeds that are better suited to outdoor systems are used (e.g. Duroc), regardless whether they are organic or conventionally- reared.

## 2.3 Poultry breeding

Poultry breeding is mainly controlled by three multinational companies. These companies have their pure lines that they use for crosses to create different "products" (hybrids) for production of eggs (layers) or meat (broilers). In the top-breeding lines AI is sometimes used for getting offspring of selected breeding cocks from specific hens. The further multiplication of breeding stock is normally based on natural mating Selection in the top lines is based on data collection from the animal itself and full- and half-sibs, and increasingly, data are collected from commercial farms to inform selection decisions to increase robustness of their elite breeding stock to produce offspring that are adapted to a range of different rearing environments..

Many organic poultry farmers use hybrids that are more suited for free range systems. The organic sector is too small to set up specific breeding schemes. Over the last 15 years different hybrids were produced for free range systems with names like Silvernick, Amberlink, Lohman Braun and Bovans Black. The main goals these hens have been selected for are brown eggs, low feather pecking, efficient production on less concentrated diets (i.e. approximately 260 eggs per year) and low stress. For meat production specific broiler hybrids have been bred for growth to 1.5 kg body weight in 12 weeks (instead of 5.5 weeks in conventional systems). Organic egg producers have more variation in mortality rates and in average higher mortality rates than conventional producers (Sparks et al., 2008; Thiele and Pottgüter, 2008; Anderson, 2010). The environment during rearing of the young hens was found to be very important for the behaviour and survival of the hens during the laying period (Bestman and Wagenaar, 2003).

## 2.4 Sheep and goat breeding

A large part of the breeding of small ruminants is still in the hands of relatively small local breeders that mainly use natural mating and farm-based breeding schemes. In some countries, the collection of data for genetic evaluation and selection of breeding bucks and rams is often not very well organised, selective breeding is only ongoing on a small scale, and sometimes semen is collected for AI (www.ELDA.nl). The method of AI is relatively expensive for small ruminants. Farmers usually inseminate only a small number of ewes to breed males that are then used as breeding bucks by natural mating in the herd. For cervical and laparascopic AI, groups of females need to be synchronised by treatment with the follicle stimulating hormone (FSH)so they can be inseminated together on the same day to reduciethe costs. Synchronisation with hormones, however, is not permitted in organic farming and the costs for AI per ewe or goat are therefore too expensive. In the UK, the number of farms using AI has declined in recent years due to the high costs associated with using it, coupled with the relatively low level of return form the sale of lambs. However, in Norway as well as the UK, recognised group breeding schemes with common breeding goals have been operating since the 1970s, using breeding goals designed to accelerate growth and meat quality as well as maternal ability, both for organic and conventional systems. Breeding indices for meat and maternal sheep (Conington et al., 2001; 2006) expanded to include additional traits such as lambing ease and resistance to parasites. A new project to design a breeding programme for milking goats started in 2012 in the UK, where a few large herds produce half of all goat milk sold in the UK. As sheep and goat systems in the UK nearly always are based out of doors, there is often very little tangible difference between organic and conventional farming with the exception of prophylactic drug usage and use of laparascopic AI.
Often, breeding stock for sheep and goats are mainly owned by some 'elite breeders' that provide most of the breeding bucks and rams to other farmers.. This situation can result in high inbreeding levels which may be problematic in some dairy goat populations (Borsten, 2011) although was not found to be significant in others (Conington et al., pers.comm).

## 3. Results from research and development

As organic animal production became a more important and recognised business the first research projects started on selection and breeding of animals for organic production. Back in the 1980s, some dairy cattle farmers and researchers started to look for possibilities for specific breeding schemes and traits especially for organic farming. At the University of Munich, Prof. Bakels promoted a crossbreeding scheme with three different Holstein Friesian lines from the USA already in the 1960s and he promoted selection for lifetime production (Bakels, 1982). In the Netherlands, Baars discussed with farmers about the possibility of farm based breeding based on kinship breeding schemes (Baars and Endendijk, 1990). In these years Postler (1998, 1999) and Bapst (2000) worked out a first alternative breeding value estimation (Eco-Breeding value) with more emphasis on 2nd and 3rd lactations to stimulate selection for lifetime production. These activities focussed on a specific selection for organic producers out of the mainstream supply of breeding bulls. Approximately five years later, discussions and surveys about organic breeding started with farmers and other stakeholders in Switzerland and the Netherlands (FiBL and Louis Bolk Institute). These discussions showed a concern about the selection of the right type of animals and in the field of animal welfare, animal integrity, natural procedures of reproduction and also the image of organic products (Nauta, 2009; Bapst and Zeltner, 2002, Haas and Bapst, 2004; Idel and Mathes, 2004). Data on the performance of dairy cattle on organic farms were collected in different countries showing that animals originating from conventional breeding schemes were weak in production, longevity, health and fertility (Hardarson, 2001; Hovi et al., 2003; Margerison et al., 2002). Some studies on genotype-environment interaction (GxE) indicated that there were interactions between organic and conventional farming, but only when environments differed strongly (Nauta et al., 2006, Simianer, 2007, Sundberg et al., 2010, Wallenbeck et al, 2009). This means that the selection of animals from conventional systems results in a lower reliability of breeding values for organic farms (Nauta, 2009). These interactions are different for different traits and for different species. For milk production in most countries relatively small effects of GxE were found. For health and fertility traits, important traits for organic farms, larger effects were measured (Bapst and Stricker, 2007; Simianer, 2007) indicating that selection within the organic environment would be more effective. It was questioned whether organic agriculture needed own specific traits to select for? (Spengler Neff, 2011). In general animals should be selected for disease- and parasite resistance (IFOAM, 2003), not least because these have higher economic values in the organic environment influenced by given organic regulations. Other traits that have been suggested as especially important in organic production are longevity, vitality, fertility, milk production persistency, roughage converting efficiency, foraging ability, temperament and body condition (Bakels, 1982; Haiger 1998; Pryce et al., 2001; (Spengler Neff 2011) and, especially in pigs, strong legs (Wallenbeck, 2009).

For setting up distinct organic breeding schemes over more farms or on (inter-)national bases, complex challenges have to be overcome (Nauta, 2009). An overall breeding program meets problems like the size and diversity of populations, costs, inbreeding, biodiversity, and social as well as economic differences (Pryce et al., 2001; Harder et al., 2004; Pryce at al., 2001; Rozzi et al., 2007; Schmidtko, 2007; Nauta, 2009). In Switzerland and in the Netherlands the first breeding schemes are set up for dairy cattle in co-operation with existing companies and structures (Nauta, 2012, Spengler Neff, 2012, pers. com.). Also individual farmers set up their farm-based breeding, by purchasing bulls or selecting bulls from within their own herd. Their reason for doing this are to become more closely associated with the ethos of organic production and to work with ‘closed cycles’, for breeding (Nauta, 2009).

For pig production the first attempts towards organic breeding programs are currently underway. Nauta et al. (2003) showed that Dutch pig farmers wanted to develop organic breeding. GxE interactions were found between organic and conventional pig production in Sweden (Wallenbeck et al., 2009a). As organic rules state that new gilts should be raised under organic conditions, pig farmers need to breed their own replacement females. In 2009, a so-called ‘flower breeding’ project started in the Netherlands with a rotation breeding scheme, led by IPG and the breeding company Topigs (Merks and Leenhouwer, 2010). This is similar to the principles of Norwegian ‘ram circles’, and sheep 'sire reference schemes' that have been operational in the UK for decades, whereby either male rams or their semen are rotated among a group of co-operating farms thereby increasing the scale of comparisons for genetic evaluations. In some countries, many organic farmers with small scale pig production use native breeds like Bunte Bentheimer and British Saddleback (ADAS, 2002).

In the UK, a new project aims to breed a new broiler-poultry line with high levels of functional fitness including legs and robustness. In the Netherlands, poultry farmers said they would like to set up organic breeding, although they knew that this would be difficult since margins are small and supplied hybrids are very productive (Nauta et al., 2003). The importance of breeding on organic farms seems to be well recognised in this sector. In the regular production of layers, for every laying hen that is produced, a male chick is killed right after hatching because these roosters do not show good growth rates for meat production. Discussions in society about the killing of male one-day chicks have stimulated various initiatives towards dual purpose breeding. Lohman geneticists have started a project with some biodynamic farmers in Germany where they set up rotational breeding to "*bring the breeding back to the farm environment*" (Willy Baumann, pers. com., 2011 and Baumann, 2012). In the Netherlands a project was started on testing more dual purpose hybrid laying hens and their brothers for meat and egg production (Leenstra et al., 2009). Also an on-farm breeding system was set up in 2009 based on a kinship breeding scheme. This is a breeding scheme with at least 5 different family lines that are bred on farm and crossbred in such a way that inbreeding is minimized (Nauta et al., 2010). First results show that the hens that are bred on farm are more robust. It is known that there are very strong genotypexenvironment-interactions between laying hen lines and cage or outdoor production systems (Kjær and Sorensen, 1997). Breeding at farms with outdoor systems may be a solution.

In the last decade new technologies were developed for breeding (sperm sexing, genomic selection), and therefore in 2009-2010 organic dairy farmers and researchers were asked again about the use of different breeding technologies ((Spengler Neff and Augsten 2009); Nauta, 2010, pers. com.). A concern was found about the introduction of more technology into organic farming in particular for sexed semen. Sexing of sperm was not wanted by most of the organic farmers (80%) in the Netherlands because they were afraid of decreased fertility in cattle in the future and other unknown effects on the animals. But, perhaps more important was the risk of damage to the image of organic farming. Genomic selection was seen as both positive and negative for organic use. The farmers thought that it could be useful for traits that have a low heritability but it could promote more inbreeding at a global scale (Nauta, 2010). The recognition that genomic technologies have a big part to play in the selection against deleterious alleles associated with diseases will enhance both conventional farming as well as organic production.

## 4. Discussion

Organic animal breeding became a real issue when the organic sector grew fast in the 1990s. At that time there were no possibilities for organic breeding unless farmers started selecting their own male and female animals and used natural mating (Baars et al., 2005; Haiger, 1999; Metz and Spengler Neff, 2007). At the same time, breeding did not seem to be a topic many organic farmers were interested in (Nauta, 2009). It was easier to use conventional breeding stock from the breeding companies they were members of. But times are changing fast for animal breeding and for organic farming. Conventional dairy cattle breeding programs evolved from a progeny testing system based on AI towards breeding based on modern reproduction technologies (MOET, IVF), genomic selection and also in some cases, sperm sexing. Genetic progress for production traits in high-input production systems increased fast in cattle, pigs and poultry. This development increased the gap between organic intentions and conventional breeding practices, which in turn increases the need for animal breeding on a completely organic basis.

On the other hand, modern dairy cattle selection has now turned to include broader breeding goals taking a range of functional traits into account, and thereby better meet the objectives for organic producers (Miglior et al., 2005, Buch, 2010). There are also large differences between countries regarding differences between conventional and organic farming environments. Attitudes regarding breeding techniques are likely to differ between countries due to history, traditions and culture. For example, conventional dairy cattle breeding in

Nordic countries faced challenges similar to those of organic farming, namely high cost of disease treatment, demands for good fertility, and robustness to harsh climatic conditions. That led breeding organisations to record disease treatments and fertility events as well as a range of other functional traits, and to include those in a multi-trait selection index with low weight on productivity and high weight on disease resistance and fertility, in comparison to those used in other countries (Miglior et al., 2005). By taking this approach organic dairy farmers in Nordic countries have so far not demanded separate breeding schemes but joined efforts with the conventional farmers as their goals were more alike than different. Furthermore, realised production levels for organic dairy herds are at around 90% of the conventional (Trinderup & Enemark, 2003) and thereby differences between systems are much smaller than differences between farms within each system. But in a country like The Netherlands, converting to organic farming means that the ration of concentrated feed fed to lactating cows will drop because of large differences in price. In that country, conventional concentrated feed is relatively cheap because of large and cheap imports of ingredients and high land prices. In Switzerland organic rules allow only 10% of concentrates in the yearly rations of ruminants. This causes larger environmental effects on cattle compared to countries where dairy farms generally grow more of their concentrated feed and do not have stringent restrictions in organic systems. Such differences between countries have large impact on decision making for organic breeding at a European level.

The rules of organic farming do not include clear directions for animal breeding. Animals should be able to adapt to the local environment, local breeds should preferably be used, natural processes should be followed as much as possible and the use of MOET is restricted (EU, 1999). It is also stated that organic production should include the whole production chain, including breeding practises (EU, 1999; IFOAM, 2003). A new issue for discussion is the introduction of cloning and genetic modification (GM) in animal breeding (Brophy et al., 2003). So far, no GM farm animals are used in European agricultural production. Cloning has been introduced as a breeding tool but has not yet become a very common practice in conventional breeding. Cloning and GM are strictly forbidden in organic animal farming. If cloning and GM would become more widely performed by breeding companies this would close the doors for organic farmers to use such breeding stock. This leaves us with the question what to do for organic production without the supply of conventional breeding stock. If needed, how can organic breeding programs become organised? A number of aspects must be considered.

First of all, do organic farms have large enough animal populations to initiate  distinct organic breeding schemes?  More generally, how can we better utilise the existing evaluation systems in place (e.g. for dairy cattle) to meet the needs of organic producers?  Organic farming is diverse in its nature. Due to it being a low input system by definition, , a strong link to soil and climate and a dependence on local or regional markets, different types of animals are needed to meet the different farm environments (Bapst, 2003; Spengler-Neff, 2011).  Breeding for a larger group of farms will also put up the question "How to breed for everyone?" It will be a challenge to find large enough groups of farms that have more or less the same farm environment and management, maybe even in an international setting (Nauta, 2009) However – if dairy farms were known and classified accordingly then this information could be used to extrapolate more suitable bulls for breeding in organic systems. A determination is needed to facilitate such a system in the dairy sector. Alternatively, genotypes or breeds that can adapt to a large range of environments and farm conditions would offer a useful compromise.  As genetic biodiversity is  a goal of organic farming,  to create one 'European organic population' is not the spirit of organic farming. Furthermore, it would not be in accordance with the Interlaken declaration about animal genetic resources for food and agriculture (FAO, 2007).

Secondly, the type of animals required for organic farms should be defined and documented.  This may differ according to different countries but the basics of key attributes should be agreed..  When the aim is known, the next step is to evaluate whether there is a chance to get this type of animal from conventional breeding programs or not. The organic rules are in some cases putting demands on livestock that have been removed in conventional systems. In general, organic dairy cows have to produce on diets based more on roughage (Thomet and Steiger Burgos, 2007). Another example is the access to open range for organic hens, demanding social skills that have not been selected for during years when cage layers were the predominant conventional production method (Kjær and Sorensen, 1997). Animals selected for highest possible production are more sensitive for changes in environment than animals with a lower production potential (Kolmodin et al., 2002; Strandberg, 2007;  Ravagnolo and Misztal, 2002). Thus dual purpose breeds or local

native breeds, with lower genetic merits for production traits, could fit better to organic farms than more specialised high producing breeds, also when they are purchased from conventional breeders. Low-producing native breeds are mainly used in organic niche production or for hobby farming (Wanke and Biedermann, 2005; Rahman, 2006).
Cross breeding with dual purpose breeds is another solution chosen by organic dairy farmers (Nauta, 2009; Heins et al., 2006, Spengler Neff et al., 2012).

Thirdly, there is the question which breeding- and selection systems and reproduction-distribution technologies can be used in organic production. Even if the tools themselves are not problematic for welfare or environment, they can be questioned by some farmers and consumers due to 'unnaturalness' (Baars and Nauta, 1998). Should such methods (like sperm sexing or selection based on genomic data) be allowed in organic production? Genomic information could become very useful for small populations and for traits that are difficult and expensive to record, e.g. health traits and other traits important for welfare. Another concern is that technologies like sperm sexing and genomics could lead to increased losses of genetic variation in general (Bapst and Zeltner, 2002; Spengler Neff and Augsten, 2009; Nauta, 2010). However, if locally-adapted breeds are used then the likelihood of this being realised in the short term is small. Every technology used in breeding has its good and bad sides and responsibility of farmers and breeding companies in how to apply such technologies is of great importance for the organic sector.

Another important aspect is the amount of direct and indirect costs of dedicated organic breeding for different species. Direct costs are the costs for selecting and breeding the animals themselves. These costs are very high because of several European rules in the area of preventing disease from spreading (EU, 1992). In a testing scheme of bulls the whole procedure for one bull will cost about 30,000 euro. This will be difficult to cover where the organic sector is small. However, for example in small populations a 'young bull system' (Bichard, 2004) can be used instead. It is a more realistic and cheaper alternative. A young bull system is based on an annual selection and supply (through AI) of a group of young bulls from the best animals of the population based on their estimated breeding value and phenotype. By using a group of 10-20 young bulls, always the best genetics will be used in average and risks are spread. This system is also coming up for breeding based on genomic selection (Veeteelt, 2008).

The indirect costs reflect the production capacity of the animals. Many organic farmers have concerns about the loss of genetic input if they refuse stock from conventional breeding schemes (Nauta, 2009). For example, laying hens from conventional programs may lay up to 300 eggs per year on some organic farms. Can hens from organic breeding schemes compete with that? If not, producers need much higher prices for the eggs and therefore organic breeding will have a strong impact on market prices. Or the other way around; the market prices will have a strong impact on the possibilities of setting up an organic breeding scheme, and use organic breeding stock with lower merit for production. So, evidently there is a dilemma between strong intentions and staying in business and market.

Finally, some social aspects are also important to consider. Natural mating may have a negative image. It can be regarded as an old fashioned way of breeding with large risks when it comes to transmission of diseases and farmers working conditions and safety. The power of breeding companies could also become an influencing factor. Will they feel threatened by organic farmers trying to start their own breeding schemes? Or will they see an additional market and provide their knowledge and service to these farmers?

Many organic farmers want to be in charge of decisions concerning selection of breeding stock and they do not want to be forced to use 'certified organic' breeding stock (Nauta, 2009). Breeding is also a matter of trust. Farmers first want to see the results before they chose a new breeding program and stock. Therefore an organic breeding scheme would have to be introduced step by step, providing learning by doing (Østergaard, 1997). In the Netherlands an increasing interest is seen in the setup of rotational breeding systems for pigs (Merks and Leenhouwers, 2010) and the supply of some organic AI bulls that farmers can start using now (Nauta, 2012; Spengler Neff, 2011). Surprisingly, newly converted farmers seem to be more open to using organic breeding stock (Nauta, pers. com., 2012).

It is clear that for some species, in some organic systems, the use of animals bred for higher input, conventional systems is inappropriate. In these circumstances, taking on board the responsibility to breed locally-adapted livestock will bring benefits to farmers if collective breeding goals and shared ideals are realised. However, in other situations, particularly where there are relatively small differences between organic and conventionally reared animals, adjustments to existing sources of livestock for organic systems may be sufficient. This could be simply a matter of placing greater emphasis on functional fitness traits by the individual when choosing potential bulls or boars – or it could mean customising indices to better suit the needs of organic farming systems.

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