Tuning up sustainable organic animal production

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Implications
In this report, within the track "Tuning up sustainable organic production", we highlight sustainability assessments and the choice of breeding goals as opportunities for improvement. We also discuss goal conflicts and small-scale effects of organic production.

Goal conflicts
An engine can be tuned up to run most efficiently. But organic production is not an engine; there is not one single "most efficiently". When striving for a more sustainable organic production we need to consider many different sustainability aspects and we encounter many goal conflicts. Examples of goal conflicts are: Good working environment vs Low production costs; Low climate impact vs High animal welfare; Low use of toxic substances vs High yield; High profit in a short-term economic perspective vs High animal welfare. The last example was shown in an evaluation of 15 different pig production systems in Europe, performed by Bonneau et al (2014). In production systems with high pig welfare the farmers' economy was, in general, worse.

How can we improve the ability to handle goal conflicts? The first step is to admit them. And to admit that some of them cannot be solved scientifically; they need political decisions. Scientifically, it is difficult to compare the value of an improvement in working environment with the value of an increase in biodiversity. As researchers, we can highlight goal conflicts and provide a scientific base for political decisions. It can done by investigating the frequency of accidents among farm workers or the number of species per m^3 soil. Remember, however, that different values underlie the choice of monitored parameters and that many assessments lack social aspects (Slätmo et al, 2017).

Production system perspective
As animal geneticists we are proud of the genetic progress leading to lower climate impact of animal production. With an ongoing genetic increase in milk production, the greenhouse gas emissions per kg milk decreases substantially. It is, however, necessary to see this improvement in its context. In the Nordic countries, a high proportion of the consumed cattle meat is a 'by-product' of milk production (80 % in Finland, Niemi & Ahlstedt, 2013). If the demand is constant, a breeding work resulting in more efficient cows with high milk production leads to less number of cows and thus less meat. If we still want to consume the same amount of cattle meat we have to increase the number of beef cows. In general, animal production with beef cattle has a larger climate impact than animal production with dairy cattle. This example, discussed by Kokko (2017), illustrates the importance of studying whole production systems. Furthermore, agriculture production should be studied together with food consumption (see for example Röös et al, 2016) when aiming for a more sustainable development.

In general, breeding has resulted in high producing plants and animals that are specialised on production systems with high input of external resources, as discussed on the workshop "Visions for genetic diversity in Swedish organic agriculture (Nilson et al, 2015). The less traits included in the breeding goal the faster is the progress in single traits and different breeds have been developed for different products, e.g. separate breeds for egg production and chicken meat production. This development can be problematic from an ethical point of view; for example male Jersey calves are neglected due to their low economic value and male chickens are killed after hatching. Selection for specialised breeds can also be questioned from a production system perspective, as

shown by Kokko (2017). She concludes that "combined milk and beef production would likely be the most viable and sustainable way to achieve self-sufficiency in beef while maintaining sufficient milk production in Finland." Her simulations show that a higher selection pressure on growth rate in dairy cattle would improve the profitability of combined milk and beef production systems (Hietala and Juga, 2016).

In organic production, dual-purpose breeds seem to have a key role. The Organization for Organic Livestock Breeding in the Netherlands is testing a small-scale poultry production system where the breeding for a dual-purpose hen is integrated into the commercial egg and meat production. Their breeding goal is a hen with a minimum laying output of 250 eggs per year that is genetically predisposed to be meatier, so that the cockerels can be raised for slaughter (Biologische fokkerij, 2017). Further selection of dual-purpose breeds and their evaluation from a production system perspective could strengthen the development of organic animal production.

Contrasting production systems

"'The organic production" is sometimes discussed as if it was one homogenous system. Within the Core Organic project OrganicDairyHealth, an inventory of organic production systems in 7 European countries has been performed (Wallenbeck et al, 2016). It shows a huge diversity, ranging from systems with on average less than five cows and below 4000 kg milk per cow and year to systems with on average more than 150 louse housed cows and production levels close to 10000 kg milk (Wallenbeck, pers comm). Different organic production systems have different challenges and their farmers probably need different advisory support and research results from different kinds of scientific studies to improve. Two organic systems were included in the sustainability assessment of pig production systems (Bonneau et al, 2014) and both got better than average 'sustainability scores' for animal welfare and working conditions, whereas one got better than average scores for environmental impact and market conformity and the other for meat safety. It could be questioned whether the organic movement has room for all kinds of different production systems or whether 'tuning up' would mean focusing on a lower number of organic production systems.

Organic production and efficiency

The production level in many organic production systems is lower than in many conventional production systems and organic production is criticised for being inefficient (exemplified by Savage, 2015). This difference in production level influences the outcome of Life Cycle Assessments (LCA) and LCA reported per kg product rank production systems differently as compared to LCA reported per hectare land use (Meier et al, 2015). The review by Meier et al (2015) also shows that many LCA comparing organic and conventional systems do not differentiate the specific characteristics of the systems and often a rather limited number of aspects are assessed. Garnett (2014) describes three different perspectives on sustainable food security: Efficiency oriented, with focus on appropriate production techniques and strategies to reduce emissions; Demand restraint, with focus on decreased consumption of high impact foods; and Food system transformation, with focus on production and consumption and imbalanced relationships among actors in the food system giving rise to problems of both excess and insufficiency. Garnett (2014) states that "Everybody wants 'sustainability' and an end to hunger – but not everyone has the same vision of what the solution - the good life - might look like." A better understanding of what underlies these different perspectives could maybe help the organic movement to handle critique related to lower production levels and lead to more constructive discussions around LCA comparisons of organic and conventional production.

Breeding goals for organic production

Differences in environment and management (more roughage, outdoors, later weaning etc), costs (higher feed price etc) and revenues (higher product price) could motivate different breeding goals for conventional and organic production. 'Organic breeding programs' are rare (although poultry and cattle are selected for organic production in the

Dutch Organisation for Organic Animal Breeding, see Biologische fokkerij, 2017), but alternative breeding goals have been studied in several simulation studies. An interactive web questionnaire to dairy and pig farmers showed that when the farmers decide their breeding goal, farmers with organic production put higher weight on health traits as compared to farmers with conventional production (Wallenbeck et al, 2016b).

Slagboom et al (2016) performed a preference study among Danish dairy farmers. They identified four clusters of farmers that put most weight on Health and Fertility; on Production and Udder Health; on Survival; or on Fertility and Production. A higher proportion of farmers with organic production were found in the production-based clusters and farmers with organic production ranked production traits higher than other farmers. In organic production, milk yield and disease incidences were lower (compared to conventional) and this may explain the high ranking of milk production and the low ranking of disease traits made by farmers with organic production (Slagboom et al, 2016).

Slagboom and co-workers have created a breeding goal based on farmers' preferences and compared that breeding goal to the current breeding goal for conventional milk production and to an organic breeding goal based only on economic calculations (Slagboom et al, 2017). These breeding goals are used in simulations to compare the genetic change. In the next step, Slagboom used the four organic principles on Health, Ecology, Fairness and Care (IFOAM, 2017) and asked dairy farmers, advisors, researchers and breeders which goal traits they think are important to select for in order to follow these principles. The traits getting the most 'votes' were disease and mortality traits for the principles on Health and Care; roughage consumption and feed efficiency for Ecology and mortality traits for Fairness. The associations between goal traits and organic principles will be used to construct an additional breeding goal that will be used in Slagboom's simulation study. Creating special breeding programs for organic production, or at least special sets of weights for the goal traits, could be one way to 'tune up' the organic production (see Nilsson et al, 2015 for a discussion).

The problem of being an alternative

Being a minor alternative, counted in size of production, hinders development of a production system in general, since there are less stakeholders that can share the development costs. In animal breeding there is also a direct negative effect of small scale. With less records the accuracy of breeding values decreases, leading to lower genetic progress. Furthermore, to run a breeding program is complicated and expensive. The sustainability assessment of European pig production systems showed that small breeding organisations had less technical and human resources and were more vulnerable (Rydhmer et al, 2014). The negative scale effects could motivate cooperation between organic producers in Europe; to create a population large enough for a special breeding program. This may, however, be in conflict with the definition of organic agriculture which states that organic agriculture is a production system that … relies on ecological processes, biodiversity and cycles adapted to *local* conditions (IFOAM, 2017). With a population spread over many regions and countries, the breeding goal may become "less local".

Sustainability assessments

Regardless of differences between organic and conventional production systems, the organic movement should strive for continuous improvement and sustainability assessments can thus be useful. LCA of organic animal production has been performed (e.g. Thomassen et al, 2008) but they usually do not include social aspects. As shown by Raworth, agriculture production systems should be developed within the area framed by planetary and social boundaries, the so-called Doughnut (Raworth, 2012). In a new EU project entitled Sustainability of pig production through improved feed efficiency (SusPig, coordinator W Rauw), both environmental and social LCA of current and improved production systems will be performed. The social aspects will be identified through

stakeholder workshops. Our experiences from SusPig project may be useful when evaluating organic production systems in the future.

The long term aim of organic production

IFOAM is revising the organic standards. Looking at organic production as a marketing strategy (added value), it may make sense to strive for keeping a gap between organic and conventional production. Then "tuning up" could mean more and more complicated rules for organic production, resulting in an exclusive but small production of highly valuable niche products. This point of view could maybe justify a ban of sexed semen or artificial amino acids in feed regardless of opportunities for decreased environmental footprints. Seeing organic production as a way to sustainable development on a larger scale, complicated rules for organic production may be contra productive since they limit the number of organic farms. "Tuning up" could be to adapt the rules for organic production in accordance with new scientific results, not letting the precautionary principle lead to dead ends. The choice between these future roads for organic production ought to be discussed within the organic movement, keeping the organic principles in mind.

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