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# SUSTAINABLE DEVELOPMENT AND ANIMAL BREEDING GOALS

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The currently popular term „sustainable agriculture“ is used to represent everything from organic agriculture to agriculture maximising economic yields. A few years ago it was concluded that there were 800 published definitions of sustainable agriculture, so today there are no doubt many more (Francis, 1997). Sustainability is based on a holistic philosophy, a set of values and principles, but may also involve a specific set of practises. When trying to define animal breeding goals, it is necessary to see and describle the animals as an integrated part of sustainable production systems.

Vavra (1996) explored a philosophical discussion of sustainability and made application to sustainability of animal production systems. He suggested that sustainable systems exist in the overlap of what the current generation wants for itself and future generations, and what is biologically and physically possible in the long run. Further, the same quantity of meat, milk, eggs or fibre should be harvested indefinitely from a given land base in a sustainable livestock production system.

Environmental and economical aspects were also considered here in addition to biodiversity and ethical aspects. The new idea in the term sustainability is that environmental, genetic diversity, social and ethical aspects should be accounted for in addition to short and long term economic value.

We can hope that the diversity of views on sustainable agriculture can lead to more discussion and progress towards improwed animal breeding. However, also a growing consensus is desirable for progress on theory development and practical implementation. Fortunately this consensus can be found around the elements connected to the term "sustainable agriculture", at les among those who are seeking long-tem and equitable solutions to the challenge of food production. Francis and Callaway (1993) summarised these elements of sustainability:

- resource efficiency: most efficient possible use of non renewable resources, and whenever possible substitute renewable resources for those imported from outside the farm;
- profitability: economically profitable in both the short and the long term;
- productivity: maintain and enhance the productivity of all basic resources vather than destroying or degrading them;
- environmental soundness: minimal negative impact both on the farm and beyond the farm borders;
- social viability: equitable systems favouring owner/operator farms, contributing to viable rural economy, infrastructure and community, supporting and integrating with overall society.

Francis (1997) lists probable characteristics of future agrucultural systems. Some of his characteristics and other future development trends we find relevant to animal breeding. These are together with potential animal breeding strategies given in Table 1.

Many of the potential animal breeding strategies mentioned refer to a broader definition of breeding goals, not criming at higher production levels per animal only, but balancing higher productivity with improved functional traits, like health, fertility and feed intake capacity.

Sustainable production systems are adjusted to the local natural and social conditions. Recognition of differencies in cultural/social aspects between regions, but also in natural circumstances, enhances the differentiation in breeding goals. Especially when considering the increased privatisation of breeding companies and increased world wide trade of breeding stock, differentiation in breeding goals is important for maintenance of world wide genetic variability in domestic animals (Hammond, 1993). Not only heterogenity of production circumstances among regions, countries or individual farms, but also uncertainity and associated ris about future circumstances are incentives to differentiate between breeding goals and to maintain different breeding stocks.

Genetic improvement is a biological and technological development. The essence of these developments is to improve the efficiency of a production system: saving inputs of production factors per unit product and a change towards use of cheaper production factors. Different constraints on the production system give rise to alternative uses and therefore alternative values of saved production factors. Therefore breeding for high input systems in the developed countries only is not sufficient, nor is it culturally and socially acceptable to simply transfer such high input systems to developing countries together with the breeding stock. Table 2 summarises important traits which should be emphasised in a breeding goal according to the environmental stress and feed constraints of the production system. When the feed resources are constrained, feed efficiency traits become more important, whereas adaptation, health and functional traits are more critical for systems with high environmental stress. Again, adaptation to local natural and social conditions is important.

An additional reason to differentiate between breeding goals and to perform testing programmes in specific environments is genotype x environmental interaction. When wanting to improve performance in a range of environments sinultaneously , general adaptation a robustness (as opposite to environmental sensitivity) of animals my become and important trait for selection.

Table 1 Probable characteristics of future agricultural systems and potential animal breeding strategies (after Olesen et al.,1998).

| Characteristic of development | Animal breeding strategy |
|---|---|
| Technical and ecological asspects | |
| Increased human food requirement (larger population and more welfare) | Increase production and productivity;hegher efficiency per unit product; increased intake and utilization of non-human-food components; improve product quality |
| Higher energy and nutrient costs<br>More use of marginal land | Improve utilization of local feeds; reduce costs by improved health, fertility and other functional traits; increase intake of (bulky) roughage, and adptation to low energy-input systems |
| Diversification in systems adapted to specific locations and conditions | Reduce environmental sensitivity of animals (increased robustness and capacity of adaptation); diversification of breeding goals |
| Regulations on elements like Nitrate and Phosphate | Increase biological efficiency in broader terms (not only energy, but also protein and minerals/ elements) |
| Reduced use of chemical medications | Improve genetic disease resistance in general and tolerance to particular infections and parasites |
| Gene-and biotechnology methods | Introduce more risk averse strategies after high level ethical cosiderations; aim at low inbreeding and maintain genetic deversity |
| **Cultural/social and personal aspects** | |
| Concerns about animl welfare | Improve tolerance to metabolic stress; improve health, fertility and longevity; improve/maintain adaptation to improved management systems (e.g. floorsystems for hens). |
| Use of intellectual property rights | Alliances and co-operation; compeitive associations |
| Increased concern on animal-mediated human diseases | Improve genetic disease resistance in general and tolerance to particular infections and parasites |
| Privatisation of breeding companies, international trade, increased competition | Alliances and co-operation;competitive associations with local or market oriented and diverse breeding goals, including cultural/social aspects and recognition of personal preferences |
| Concerns about loss of historical, cultural breeds and genetic diversity | Develop conservation programs for breeds not under selection (in situ and ex situ); maintain or increase ffective population sizes of active breeding populations, and aim for broad breeding goals |

**Table 2** Important traits to include in a breeding goal according to the constraints on fed resources and environmental stress of the production system (after Amer et al., 1998)

| | Constrained feed resources | Unconstrained feed resources |
|---|---|---|
| High Environmental stress | Adaptability Feed efficiency | Adaptability Productivity |
| Low Environmental stress | Feed efficiency Product quality | Productivity Product quality |

An important consideration when deciding on how to approach problems for sustainable systems in also the probability of solving the problem trough breeding (Francis, 1997). The fewer the number of genes, the less antagonism between various important traits and the less environmental influence, the greater is the probability of success in breeding. Also, other technical and practical solutions should be considered, as genetic change is a long term and complex process. Animal breeding has so far focused on cumulative short term genetic change, because breeding optimisation has to a very large extent been based on market economy. Many examples show that animal breeding has lead to unwanted side effects, which are in conflict with sustainable agriculture.
Sustainable animal breeding is a long term and complex process and therefore we need more focus on long term biological, ecological and sociological solutions.

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## ANALYSIS OF BLOOD SERUM POLYMORPHIC PROTEINS IN JAPANESE QUAIL.

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***Summary***

In three pedigree recorded lines of Japanese quail divergently selected for low and high concentration of yolk cholesterol we analyzed polymorphism of blood serum proteins. The birds of $F_{10}$ and $F_{11}$ generation were used for this analysis. The average number of adult quails were 30 males and 60 females for every lines. for genetical mapping were used blood serum of 7 and 6 birds of LCH line, 8 and 7 birds of HCH line and 10 and 6 birds of CCH line from $F_{10}$ and $F_{11}$ generations respectively. The electrophoretic picture of blood serum albumins showed monomorphic homozygous AA combinations of all selected lines. In the transferrin locus we found in two birds of low cholesterol line genotype B. In all other birds and lines we found only genotype AB. In the albumin system of $F_{11}$ generation we found genotype AB in all blood serum protein samples. We found similar situation also in transferrin locus because of monomorphic combination of BB genotype in all tested samples of all lines.

***Key words*:** Japanese quail, blood serum proteins, polymorphism, yolk cholesterol selected lines