



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



Is Genomic Selection Compatible with Organic Principles?

Karsten Klint Jensen
Dept. of Food and
Resource Economics

UNIVERSITY OF
COPENHAGEN



Background



- › **This presentation grows out of discussions within the EU project LowInputBreeding**
- › **In a subproject it is planned to examine the potential for using genomic selection in breeding of organic dairy cows.**
- › **These plans have been subject of some controversy within the organic movement,**
 - › **both in the planning process up to the application**
 - › **and later at the First LowInputBreeds Symposium in Wageningen 15-16 March**

Purpose



- › **In the following, I shall present my reconstruction of concerns and arguments, that I have come across during my participation in the LowInputBreeds project**
- › **The discussions have revealed that it is not altogether clear what the organic value base, as it is expressed in IFOAMs principles, really imply for breeding methods and breeding goals in specific circumstances.**
- › **I shall therefore use the specific issue of genomic selection for dairy cows as an opportunity to analyze the more general issue about implications of the organic values for breeding.**

Agenda



- › **EU regulation on breeding**
- › **Analysis of IFOAM Principles with regard to breeding**
- › **Concerns about Genomic Selection**
- › **Non-ideal Situation**
- › **Weighing GS vs concerns**
- › **Conclusion**

EU Regulation on Breeding



- › **Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91**
- › ***Article 5***
- › **Specific principles applicable to farming**
- › (j) the choice of breeds having regard to the capacity of animals to adapt to local conditions, their vitality and their resistance to disease or health problems

EU Regulation on Breeding (2)



› **Article 14**

› **Livestock production rules**

(c) with regard to breeding:

(i) reproduction shall use natural methods. Artificial insemination is however allowed;

(ii) reproduction shall not be induced by treatment with hormones or similar substances, unless as a form of veterinary therapeutic treatment in case of an individual animal;

(iii) other forms of artificial reproduction, such as cloning and embryo transfer, shall not be used;

(iv) appropriate breeds shall be chosen. The choice of breeds shall also contribute to the prevention of any suffering and to avoiding the need for the mutilation of animals;

Principle of Health



- › ***Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.***
- › **IFOAM explains that the Principle of Health “points out that the health of individuals and communities cannot be separated from the health of ecosystems – healthy soils produce healthy crops that foster the health of animals and people.”**
- › **A first approximation could be to say that the individual should be ‘well adapted’ to the ecosystem. However, the relevant sense of ‘adaptation’ cannot be explained in terms of natural evolution.**
- › **Hence, it is probably a better approximation to say that the ecosystem of organic farming and the individual should be well adapted to each other.**

Principle of Health (2)



- › **Generally, this is seen to imply that illness and various other forms of malfunctioning should be avoided, not through treatment of symptoms, but through a "healthy" ecosystem where the symptoms don't occur on a serious level.**
 - › Hence, avoid the use of fertilizers, pesticides, animal drugs and food additives, and mutilations like dehorning, castration, tail docking, beak trimming etc.
- › **It seems reasonable to conclude that breeding also should be seen in this light:**
 - › Breeding should ensure that animals are well adapted to their conditions in the ecosystem made up by the farm.
 - › Breeding should *not* be used to cure symptoms, i.e. address problems resulting from the fact that the animals are not well adapted to their conditions.

Principle of Ecology



- › ***Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.***

- › **“[o]rganic management must be adapted to local conditions, ecology, culture and scale. ... Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity.”**

- › **This suggests to me that**
 - › **organic agriculture should be based on local breeds. And**
 - › **there should be continuity in breeding such that traditional local breeds and their genetic diversity are maintained over time, albeit developed through breeding.**

Principle of Fairness



- › ***Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.***
- › **In particular, this principle “insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behavior and well-being.”**
- › **It is hard to draw precise implications of this statement. But at least it seems clear that it would be wrong to breed animals to live in conditions *not* in accord with their “physiology, natural behavior and well-being”.**

Principle of Care



- › ***Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.***

- › **Underlying this principle is the idea of sustainability.**
 - › **“Practitioners of organic agriculture can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and well-being.”**

- › **This could mean that health and well-being should not deteriorate over time.**

- › **The aim of organic agriculture can be understood as the maximisation of the harvest under the constraint that the harvest “fit the cycles and ecological balances in nature”.**

Principle of Care (2)



- › **This has implications for the use of new technologies:**
 - › “Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken.”
- › **Lack of knowledge is seen as a reason to stick to well-known technologies with foreseeable consequences rather than new and uncertain ones:**
 - › “This principle states that precaution and responsibility are the key concerns in management, development and technology choices in organic agriculture.”
- › **Science can correct traditional technologies. But genetic engineering is mentioned as an example of an “unpredictable” technology which thus involves a risk that should be avoided.**
- › **Hence, a breeding regime which involves serious risk of adverse effects on future health and well-being of humans and/or animals violates the organic principles.**

Summary of Analysis



- › **The choice of breeds and further breeding should ensure that animals from the outset are well adapted to their conditions in the ecosystem made up by the farm**
- › **Organic agriculture should maintain local breeds and their genetic diversity continually over time.**
- › **It is wrong to breed animals to live in conditions not in accord with their “physiology, natural behavior and well-being”**
- › **Breeding should not involve serious risk of adverse effects on future health and well-being of humans and/or animals**

Concerns about Genomic Selection



- › **The use of genomic selection may involve the use reproductive techniques, particularly embryo transfer, which in itself violate organic principles, and which may involve risks of further violations.**
- › **Wrong breeding goals may be chosen, i.e. breeding goals that will have adverse effects on the welfare of the animals, which would violate organic principles.**
- › **There is a risk of increasing inbreeding levels on a population scale, which would violate organic principles.**
- › **Genomic selection may make organic agriculture dependent on infrastructures that are detriment to its values.**
- › **An exclusive focus on genetics may take away the focus on the whole system, which is inherent in the organic principles.**

First Observation



- › **These concerns are stated quite generally. They do not specify any particular use of genomic selection. But as most technologies, genomic selection can be used in many ways and for many purposes.**
- › **It is easy to imagine uses that are of no interest for organic agriculture, e.g. breeding for increased productivity under ever more intensive conditions.**
- › **We should here be concerned with uses that could be of interest for organic agriculture.**
- › **The overall promise of genomic selection is that it can make breeding more accurate and speed it up.**
- › **What could be of interest for organic agriculture is to put more weight on low-heritable but important functional traits in order to make the animals better suited for the special (typical outdoor) conditions of organic production.**

Second Observation



- › **The concerns basically perceive genomic selection as an uncertain technology and prescribe precaution in accordance with the Principle of Care.**
- › **However, this seems to assume an acceptable baseline (status quo), from which the assessment is made.**
- › **But organic agriculture is often placed in a difficult choice.**
- › **Intensive conventional production sets standards for productivity that are hard to ignore for organic production.**
- › **However, animals bred for intensive conditions are typically not well adapted to organic conditions.**
- › **Breeds that are better adapted to organic conditions are either not available; or if they are, they are typically not productive on the same level as the breeds used in conventional production.**

LowInputBreeds (2009)



- › **Until recently, very little R&D has focused on breeding livestock breeds/genotypes specifically for organic and/or ‘low input’ (e.g. free range, pasture fed) livestock production systems. As a result the majority of such systems currently use either (a) breeds/genotypes/hybrids developed for ‘high input’ production or (b) older traditional breeds. However, it is increasingly recognised that breeding priorities differ between high and ‘low input’ systems.**
- › **The LowInputBreeds project will therefore focus on developing (a) ‘robustness’ (e.g. resistance to biotic and abiotic stress factors, survival of young animals, longevity, fertility), (b) ‘product quality’ traits (including ethical qualities related to animal welfare and environmental impact related traits) that have a higher priority in organic/‘low input’ compared to ‘high input’ conventional systems.**

Implications



- › **This seems to imply that organic livestock production is in a situation, where**
 - › **the animals are not well adapted to their conditions;**
 - › **animals have to some extent been bred to live in conditions not in accord with their “physiology, natural behavior and well-being”;** and
 - › **organic agriculture has not always maintained local breeds and their genetic diversity continually over time.**

- › **Even though this situation is accepted by the authorities, it seems clearly to violate organic principles**

Imagine



- › **The situations under consideration are roughly either to breed for functional traits on conventional breeds used in organic production to make them better adapted to organic conditions; or to breed on traditional breeds in order to make them more productive while keeping them well adapted to organic conditions.**
- › **Genomic selection could have a potential in both cases.**
- › **Imagine a use of genomic selection under organic control**
- › **How should it be assessed?**

Weighing



- › **The assessment implies weighing up**
 - › Ensuring that embryo transfer is not used vs.
 - › Achieving a better adaptation of animals to their conditions that could not be easily achieved otherwise

- › **If the improvement in adaptation is substantial, it seems to me to have more weight than avoiding embryo transfer.**
 - › Reproduction is only a minor part of life, and the conditions for the rest of the life appear overall more important

- › **It is striking that the EU regulation has the opposite priority**

Conclusion



- › **If genomic selection is used**
- › **to the benefit of organic values**
- › **and under the present non-ideal conditions has a potential to improve the conditions of the animals**

- › **Then the organic concerns about reproduction techniques do not appear weighty enough as argument against such use.**



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