Ethics of Plant Breeding: The IFOAM Basic Principles as a Guide for the Evolution of Organic Plant Breeding

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When it comes to discussions on genetically modified organisms (GMOs) and organic agriculture, biotechnologists often ask: "Why are your rules so strict? Why ban GMOs when they are the only tool to secure the world's future need for food? They are more efficient, quicker, etc!" When asked these questions I explain the underlying values of organic agriculture. In this article I will discuss the basic values of organic agriculture as laid down in the IFOAM four basic principles (see Figure 1), and will relate them to the field of plant breeding. I also discuss the consequences and challenges for the further development of organic plant breeding.

Normative values

In 2004 Hugo Alrøe from DARCOF, Denmark, described three perspectives within the organic movement.

1. Values. Organic agriculture is founded on concerns about soil fertility and the belief that the living soil is a basis for a healthy plant and farming system. Such values initiated the development of an organic movement. The recent reformulation of the IFOAM principles of health, ecology, fairness and care (see www.ifoam.org) show that organic agriculture is still value driven from "inside" the movement.

2. Protest against conventional agriculture. In the 1970s more and more people supported organic agriculture as a protest against conventional agriculture. They were driven by political issues such as environmental pollution and chemical residues. The driving force came more from the "outside", but was closely connected to the values from "inside" the organic movement.

3. Niche market. Since the 1990s the organic sector has further grown as conventional traders discovered that organic products were an valuable niche market. The driving force behind this type of development was triggered by economic factors, working as an "outside" motive for further development.

Nowadays organic agriculture is a result of an interaction between the three perspectives. The standards for organic agriculture are an expression of the current underlying values and serve to justify the sector's arguments against undesirable developments, while giving guidance on the desirability of new developments.

Product or process based values?

The values of organic agriculture and, therefore, its norms and standards are process orientated rather than product orientated. That is, they are based on the process of farming and not specifically on the product. A farmer, for example, receives certification because his farm management conforms to the standards and not because his products achieve a certain level of quality.

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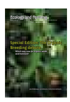


This difference between product and process-based focus causes confusion in the public discussion of GMOs. In a discussion people may speak from different standpoints, focussing either on the product or the process of genetic engineering. Those who are product orientated are only concerned with the effects a new technique or product may have on issues like health or the environment. For them, the methods or processes is unimportant. Others who are very critical about genetic engineering regard the process of forcing foreign genes into the genome of a living organism as a violation to the integrity of life.

Interestingly, the European regulation on GMOs is based on both process and product. This means that oil derived from genetically modified soybeans is considered a GMO even though it contains no modified DNA (only protein contains modified DNA). This is in contrast to the USA where the regulation is purely product based, and the oil is not considered as a GMO.

Integrity of Life

The European attitude towards GMOs reflects a shift in society to considering not only humans and sentient animals as ethically relevant but all living entities including plants. This view considers autonomy and dignity as intrinsic values of all living beings. The interpretation of intrinsic value depends on the relationship with nature. Considering plants merely as a set of genes that can be changed according the preference of mankind, makes a farce of the idea of integrity of plants. Organic agriculture does not support such a biocentric framework of action, it acknowledges the integrity of humans, animals and plants. It also means that this value system should be taken into account when making decisions on farming systems, and also in breeding policies.

Integrity of life refers to an organism's inherent nature, its species specific characteristics and the balance it maintains with its natural (or, in the case of cultivated plants, to its organically farmed) environment. This respect for the integrity of life does not imply that interference in nature is prohibited in organic farming; interference is allowed but not at all costs. Organic farm management aims at producing food for mankind, but in such a way that one cooperates with life and not by overruling or bypassing it.

The consequences of the IFOAM principles for plant breeding

As plant breeding and seed production are part of organic agriculture, the respect for life will also influence the way that the breeding process is approached. This ethical attitude is reflected in the IFOAM principles of health, ecology, fairness and care, (see Figure 1).

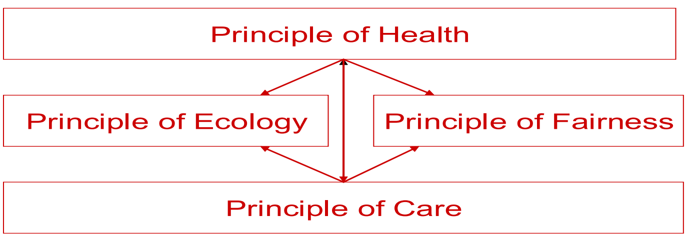
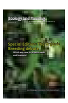


Figure 1: The four IFOAM principles (see www.ifoam.org)



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The principle of health means that organic plant breeding serves the wholeness and integrity of living systems by supporting their immunity, resilience, regeneration and sustainability. This implies that there is a need for robust and dynamic varieties that suppress weeds, tolerate disease and interact with beneficial soil organisms, such as mycorrhiza. Such a systems approach requires varieties that can be reproduced by farmers and are not male sterile.

The principle of ecology leads to the optimal functioning of a diverse range of ecological production systems appropriate for specific sites. This would imply breeding for regional adaptability through decentralised (regional) and participatory breeding programs, promoting genetic diversity as a tool for sustainability. Using ecological principles implies that breeding can take a multi-level approach to disease resistance, including the breeding for morphological or physiological traits that contribute to the robustness of a plant. For example, a cabbage variety can gain resistance to insects such as thrips by having a slightly thicker wax layer on the leaves, and wheat can overcome certain ear diseases when the haulm length is longer thus raising the ear above the moist leaf canopy where it is drier due to exposure to the wind and sun.

The principle of fairness applied in breeding aims at serving equity, respect, justice and stewardship of the shared world. This would imply free access to genetic resources, while prohibiting patents on life. It would also require equal sharing of the benefits when varieties have been bred in cooperation between commercial breeding companies and farmers.

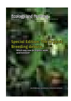
The principle of care applied in organic plant breeding should enhance efficiency and productivity in a precautionary and responsible manner. This is one of the reasons why organic agriculture refrains from the use of GMOs and related techniques such as cell fusion techniques.

Future

The question then arises: does refusing GMOs mean that organic agriculture will be cut off from future developments? My answer is: no. But we will have to deal with challenges as we have done before when we decided to refrain from using mineral fertilizers and had to learn how to compost and use organic fertilizers to build up a living soil with a good level of soil fertility. We also dealt with the challenge of not using chemical herbicides and pesticides. We had to learn how to enhance and mange biodiversity to build up agro-eco resilience. Meeting the challenges posed by genetic engineering is no different; we will learn how to breed for adaptive, flexible and nutritious varieties to build up plant robustness combined with food quality.

It is important that we clearly communicate our values concerning organic agriculture. In particular we must be more explicit in how we communicate our breeding goals. For example take the organic principles:

- When following the principle of health, the challenge is to respect plant integrity as part of the whole agricultural ecosystem, which means, for example, that improving wheat does not only include the yield, but also the length of the stem for straw and the expansion of the root system so it is able to exploit a larger volume of soil.



- With respect to the principle of ecology the challenge is to develop multilevel approaches in breeding. A crop that is able to cover the soil quickly may not only be capable of growing under low-input conditions but would also be more weed suppressive.

- The principle of fairness is also important since breeding includes not only a technical activity but also a social-economic construction. Economic constraints encountered by commercial seed producers are steering the development of the varieties. For example, varieties are made male sterile so that competitor breeders are not able to use them in them in their own breeding programs, while crops are bred as F1 hybrids so that farmers will have to buy new seed every year. Likewise, Monsanto's production of terminator seeds in which the seed can produce a crop but will not produce seed that will grow into the second generation. Commercial breeding is organized in such a way that it is only profitable when seed sales are large enough. This means that breeding for niche markets such as organic is not commercially viable. New social-economic structures such as co-operations between farmers, traders and breeders should be designed to enable breeding for such markets. Participatory breeding can be an integral part of this new model in which farmers do part of the selection. They would then be recognised and rewarded for their efforts.

We can conclude that we have many reasons to apply the precautionary principle of care by refraining from using GMOs. There are enough alternatives to improve crops, and there is plenty of unexplored indigenous knowledge to initiate new multifaceted breeding strategies. In such a way the IFOAM principles can be translated into the field of plant breeding.

References

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