The reasons for rejecting genetic engineering by the organic movement [1]

[Published in FORUM TTN, 10 November 2003]

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Introduction

It is quite clear that since 1993 the organic movement has been rejecting all aspects of genetic engineering. Until 2002 the reasons for this rejection were not always clear. In that year the International Federation of Organic Agriculture Movements (IFOAM) published an official Position Paper on this issue: "Position on Genetic Engineering and Genetically Modified Organisms". The reasons given in this Position Paper have been the starting point for writing this paper. The contents have been discussed with several people[i], but the final version remains my personal responsibility.

I wanted to find out whether the reasons used are 'good reasons', whether they can be seen as well-reasoned, consistent, even by those who are in favour of genetic engineering. This has sometimes led to a reconstruction and regrouping of the reasons mentioned in the IFOAM paper. The personal, philosophical and ethical, background of the author certainly has played a role in this reconstruction. That is why a discussion about these reasons is important, and I hope this paper can contribute to just that. It is important for the organic movement to reach some kind of consensus about these reasons; for other stakeholders in agriculture to get a better understanding of the vision behind the organic way of farming, and for politicians.

Public discussions about genetic engineering tend to be narrowed down to questions of risks and benefits for humans and the environment. This utilitarian approach very much relies on the input of natural scientists[ii]. The utilitarian framework also dominates the politically mandated institutions that advise or decide on the introduction of new (bio) technologies. This is the reason why the organic movement and organisations such as Greenpeace were almost forced to formulate their resistance to genetic engineering in terms of the existence of risks (negative consequences). Otherwise they are simply not heard or taken seriously. It is my conviction that behind the discussion about risks are the different values of various stakeholders, that play a role in risk-*perception*. But these values are rarely made explicit, let alone discussed. To understand the resistance to genetic engineering, which is also expressed by consumers, it is necessary to go into these values, and compare them with the values underlying the biotechnological approach to nature. And to do that, it is not necessary that all values are specific for organic agriculture. The values related to people's relation to nature may be specific, but other values or principles, such as the appeal to free choice, refer to generally accepted ethical principles in western societies.

Several other scholars are also researching the values underlying organic agriculture[iii], and their results have been used in my reconstruction. Some of this research is empirical in nature

[1] [Discussion Paper written for the IFOAM International Conference on "The organic reasons for rejecting genetic engineering", BioFach, 23-24 febr. 2005]

(questionnaires, interviews) or referring to the pioneers of the organic movement. But some form of normative or ethical reconstruction is usually needed to reach a consistent framework which can serve as a guide to organic agriculture[iv]. On the basis of the reasons mentioned in the Position Paper, IFOAM calls for a ban on genetic engineering in 'all of agriculture'. On the basis of an appeal to values which are specific for organic agriculture this is hard to defend, unless one assumes that these are absolute values, valid for all people. A total ban can only be defended when there is proof of irreversible threats to human health and the environment in all applications. When the application of genetic engineering goes against generally accepted principles such as the 'liberty right' (see below), by making GMO-free agriculture impossible in certain areas, a local ban can be demanded. In the case of uncertainty a temporary ban (moratorium) is in place.

Summary of the organic reasons against genetic engineering

1. Genetic engineering is perveived as a (risk-laden) technology which does not fit into the holistic worldview of organic agriculture. A strong form of the precautionary principle should apply.
   This combines the following reasons mentioned by IFOAM:
   - *Negative and irreversible environmental impacts*
   - *Release of organisms which have never before existed in nature and which cannot be recalled*
   - *Pollution of off-farm organisms*
   - *Unacceptable threats to human health*

2. Genetic contamination will lead to the violation of freedom of choice for both organic farmers and consumers of organic products.
   IFOAM:
   - *Pollution of the gene-pool of cultivated crops, micro-organisms and animals*
   - *Denial of free choice, both for farmers and consumers*

3. The present socio-economic embeddedness of biotechnology is incompatible with the socio-ethical ideals of the organic movement
   IFOAM:
   - *Violation of farmers' fundamental property rights and endangerment of their economic independence*

There is one reason remaining in the IFOAM list: *Practices which are incompatible with the principles of sustainable agriculture*. I agree with this reason, but think that the principles have to be specified. Doing this leads to a number of extra reasons which I summarise for myself by using the concept of 'naturalness'. The concept of naturalness does not refer to 'pristine nature' (not influenced by man) but to a specific (organic) view of the relation between humans and nature:

4. Genetic engineering is a continuation of the trend towards further industrialisation of agriculture, which is contrary to the organic attitude towards nature

5. Genetic engineering is a method of breeding in which synthetic geneconstructs are forcefully introduced, rather than that in which natural processes are used and where the self-regulation of organisms is stimulated

6. The transgression of species barriers does not respect the intrinsic value or species-specific nature of plants and animals. Closely related to this is the view that the making of GMOs is a violation of the integrity of living organisms

7. Genetic engineering is a technology, which increases the distance between food production and the common sense experience of nature by farmers and consumers

8. Genetic engineering promotes globalisation and loss of agro-biodiversity at a regional level. Variation or diversity is essential for the evolution of life and for food-security

Reason 1: Genetic engineering is perceived as a (risk-laden) technology which does not fit into the holistic worldview of organic agriculture. A strong version of the precautionary principle should apply

IFOAM states that genetic engineering causes, or may cause 'negative and irreversible environmental impacts' and 'unacceptable threats to human health'. The irreversibility is related to the idea that GMOs have never before existed in nature and cannot be recalled when released.

The problem with these reasons is twofold. It has not yet been proven that the eating of GMOs in general causes or may cause threats to human health. That they 'may' cause allergic reactions for instance is known. And also with environmental impacts it is generally accepted that GMOs 'may' cause negative environmental impacts which go beyond the impact of the pesticides used. That is why, in most western countries, advisory committees have been established to prevent such negative and irreversible environmental impacts occurring. These are scientific committees, and so to use this argument one must produce well-established scientific proof that such negative and irreversible impacts occur, which is very difficult. And further it has to be proven that they outweigh the proposed benefits of GMOs.

The state of affairs mentioned in the last paragraph makes the use of this IFOAM reason dependent on the state of scientific knowledge at a certain moment. Negative environmental impacts have occurred due to the use of some GMOs, but it is also true that in almost all cases the methodology used for evaluating these impacts has been questioned by other scientists. This leads me to the hypothesis that these scientific controversies are typical of the discussion about risks in the life sciences, in contrast to physics and chemistry. And further that part of the controversy is due to different views of risks (risk perception in particular) between (reductionistic) molecular biologists and (holistic) ecologists.

The distinction between reductionism and holism may offer a fruitful perspective for understanding and defending the argument that genetic engineering is perveived to be a 'risk-laden (unreliable and unpredictable) technology' inside organic agriculture. Several authors[v] have mentioned holism as one of the basic organic values. The IFOAM EU Group has published a Position Paper on co-existence in October 2003, in which it is said: "We also view this technology as inherently risky, because it is based on the reductionist scientific

principles that have been shown to be flawed and are increasingly discredited". A number of facts about the existing technology may substantiate this view:

- The low efficiency (rate of success) of the technology itself (making transgenic organisms);
- The gene constructs used to make GMOs are synthetic constructs. The introduction of natural DNA would lead to its rejection by the receiving organism. The production of synthetic constructs is necessary in order to have any effect. Whether they work or not is tested in a trial and error process.
- The introduction of foreign DNA leads to many unintended and unexpected effects[vi]. The uncertainty in traditional breeding, due to recombination, can not be compared with the sometimes large effects of changing a single gene. Very often genetic engineering has to be followed up by traditional breeding to remove the unintended effects.
- Positive views on the benefits of genetic engineering and the risks involved often go together with a belief in genetic determinism (the idea that there is a fairly direct relation between certain genes and the properties of an organism). This paradigm is no longer supported by the facts. Non-genetic and epigenetic influences during the development have shown to be as important, or even more important in some cases than the influence of DNA[vii]. The DNA in the genome is much more dynamic than thought before, so much so, that some authors now say that the role of DNA is determined by the state of the organism as a whole, in interaction with the environment.
- Reductionistic approaches to problems in agriculture are often seen as symptomatic treatments, which are not sustainable. Evidence lies in the resistance of insects to the pesticides used together with GMOs, or to Bacillus thuringiensis which is used in insect resistant GMOs[viii].

In organic agriculture it is generally believed that there is a fundamental difference between living (organic) nature and non-living (inorganic) nature. Chemical pesticides are banned because of their (cumulative) effects on living systems. It is the dynamic complexity of the organism or ecosystem as a whole which leads to unpredictability and unintended effects. Genetic engineering is based on a way of thinking which is characteristic of the physico-chemical sciences.

All the arguments given, including the scientific controversies about the risks, are enough reason to apply the precautionary principle in connection with the use of GMOs[ix]. The stability of the gene constructs and the controllability of the technology cannot be guaranteed. Genetic engineering is therefore seen as an unreliable, unpredictable, and therefore risk-laden technology, and the organic movement is not convinced of its benefits for agriculture, for the environment or for humankind.
Basic to the idea of 'risk' is that someone (in this case the genetic engineer, or an advisory committee) voluntarily accepts the risks (chance that an undesirable effect occurs) implied in the engineer's actions[x]. To accept or not to accept these risks depends on one's risk perception. It is not a conclusion based on objective facts. Present risk-analysis is first of all done by those who want to introduce a GMO, and then checked by scientific committees. When people who are exposed to eventual threats or harms of a technology have a different risk perception, then the burden of (scientific) proof is now on their side. With the use of the precautionary principle this is different. It accepts that there are different risk perceptions and therefore the process of applying the precautionary principle should be an open (informed and democratic) process, in which a scientific proof of a causal relationship between the introduction of a gene construct and a specific negative effect is not decisive.

Reason 2: Genetic contamination will lead to the denial of freedom of choice for both farmers and consumers [xi]

The problem of genetic contamination is at the heart of the question whether agriculture with and without GMOs can co-exist. Organic agriculture is defined as a production method in which no GMOs may be used in all phases. Crucial for this is that the seeds are free of GMOs. For that it is important that genetic contamination is prevented during the whole chain of production. But even experts doubt whether this can be guaranteed, especially in the future, when the number of GM crops increases. A recent study published by the Union of Concerned Scientists[xii] says: "The study found that the seeds of traditional varieties (corn, soybeans and canola) bought from the same retailers used by U.S. farmers are pervasively contaminated with low levels of DNA sequences originating in genetically engineered varieties of those crops".

In European policy the guideline at the moment is that neighbouring farmers should sit together and come to some kind of voluntary agreement. In the organic movement one doubts whether this will work and that it will be enough. They want a legislated code of practice, a certification system for the users of GMOs and application of the polluter pays principle. It is further decided in the EU that products have to be labelled when they contain more than 0,9% GMOs. No labelling is necessary in the case of adventitious and technically unavoidable contamination with genetically modified ingredients below this threshold. If the contamination is below 0,9% but avoidable or not adventitious, labelling is still required. It looks, however, as if this threshold is interpreted as a maximum threshold not for unintentional contamination but as a level up to which contamination will be permanently allowed[xiii]. The organic movement considers this interpretation a violation of their right to grow and eat food uncontaminated with GMOs (EU Regulation 1829/2003). The contamination is then no longer adventitious but deliberate. When the same way of reasoning is used with seeds, it will no longer be possible to maintain that the organic production method is without the use of GMOs, because the farmer knows in advance that a certain percentage of the seeds is contaminated.

Supporters of the use of GMOs might argue that adventitious contamination with pesticides is accepted in organic agriculture, why not a small amount of GMOs in the product? They sometimes say that the organic movement should simply accept this because other farmers (and consumers) also have the right to make use of (or eat) GMOs if they want to. Some supporters even go so far as to say that the organic movement should itself pay the costs of separation when they want to stick to an impossible zero contamination level.

To counteract this argumentation two things are needed. First it must be argued that there is a difference between pesticides and GMOs. The simplest answer is that, as we shall see, many more reasons, including ethical ones, are involved in the rejection of GMOs as compared to pesticides. It could perhaps be compared with someone who is a vegetarian not only because of risks for his own health but because of ethical reasons. For the latter vegetarian it makes a difference when he or she comes to a restaurant and hears that there is less than one percent meat in the food. This vegetarian will probably refuse this food. But then, if this seems a reasonable argument, does the organic movement indeed have (and share) such ethical reasons? The word 'ethical' is not used in the IFOAM Position Statement.
Secondly a distinction has to be made with respect to the principle of free choice. It should be shown that the question of free choice entails more than just the freedom to do this or that.

With smoking for instance it can be argued that the freedom of the smoker should be limited because harm is done to the health of non-smokers. When co-existence is not possible in certain cases (with specific crops or at specific places) it could be argued that growing GMOs harms the organic farmer (and consumers of organic products) and should therefore be prohibited. But what kind of harm is it? If it is no more than economic loss due to the impossibility to sell the products as organic, then a solution could be some kind of liability system and economic compensation.

IFOAM is opposed to all genetic engineering in agriculture, but not only because of "the particular economic and environmental risks it poses for the organic producers", also "in view of the unprecendented danger it represents for the entire biosphere" and the "unacceptable threats to human health" (Position Statement, 2002). As I said before, there is no proof that the danger is as great as said in these statements. It is better to argue that, if co-existence does not seem to be possible, then the basic right to produce (and eat) food without GMOs is violated. It is what the Swiss Ethics Committee on Non-Human Gene Technology (ECNH)[xiv] has called a ' liberty right' ('Abwehrrecht') and not a 'claim-right' ('Anspruchsrecht'). The freedom to choose for GMOs can be called a claim-right to choose for a particular production method or product. The committee argues that freedom of choice in connection with GM-food should be interpreted as a liberty right, meaning that "nobody should be *compelled* to consume GM products, and the state has a duty to protect consumers from this compulsion". It would not be ethically justifiable to place consumers (the same applies to organic farmers) in a situation where they are forced to buy GM products. The philosopher Paul Thompson[xv], a specialist on ethics and agriculture, has called it "the human right to opt out of a particular food system". This right is violated when GMO-free food can no longer be produced, or when the food is not labelled properly.

The conclusion is that the argument of freedom of choice is not enough for the general claim that GM-agriculture should be forbidden, because this violates the claim right of those who want to grow or eat GMOs. This could only be claimed when unacceptable threats to human health and the environment are proven.
What can be claimed on the basis of freedom of choice as a liberty right is:

- Certain crops should be forbidden if they endanger co-existence
- GMO-free zones should be offered to organic farmers when co-existence is not possible
- Not to use the 0,9% (or any other) threshold as a maximum level up to which contamination is allowed
- Application of the polluter pays principle in the case of contamination of organic farms with GMOs.

Reason 3: The present socio-economic embeddedness of biotechnology is incompatible with the socio-ethical ideals of the organic movement

In the Position Paper IFOAM speaks about the 'Violation of farmer's fundamental property rights and endangerment of their economic independence'[xvi]. The production of GMOs is at present fully embedded in the global market. Biotechnology is not only a product of these developments; it will also lead to the restructuring of the agro-industrial production chain[xvii]. If genetic engineering should be just a new neutral technique only, one could argue that it could in principle be used by organic agriculture as well.
The globalisation of the present free market economy tends to have a number of specific consequences which are not desirable from the organic point of view:

- The rise of multinational seed companies, who dominate the market and who depend on the patenting of new technologies, was accelerated by genetic engineering. As a result of this, the variety of seeds available decreases and very often the right of farmers to use the seeds of their own crops will be curtailed even more than is the case already. The organic movement tends to think globally, but to act locally. This means a tendency towards regional production, adapted to specific natural and cultural circumstances. It wants to increase the freedom and self-determination of the farmers, and stimulate direct interaction with the consumers. The Danish Research Organisation for Organic Farming (DARCOF)[xviii] speaks about the 'nearness principle' as one of the basic principles of organic agriculture: "Direct contact between producer and consumer reduces the alienation that often characterises modern society. Learning on the basis of local experience and research into whole systems will be a central element for securing social and cultural values and the relationship to Nature". A good example of this is community supported organic farming in the USA.
- Rise of supermarkets who compete with each other and thereby reduce prices. Farmers usually have to pay for these price reductions. That organic food is sold as widely as possible is a good thing, but when retailers do not take into account the organic values it may have negative consequences as well. This has been illustrated by Michael Pollan[xix] in an essay about the 'organic-industrial complex' in the USA. From a strictly economic point of view organic is just another marketing niche. There is constant pressure from the supermarkets to adapt the criteria for certification as 'organic' to the demands of the world market, i.e. to water them down.
- Dependence on multinational breeding companies. In organic agriculture one wants to make use of the farmer's own experience in the improvement of plant crops and animal breeds. This experiential knowledge of the farmer refers to the plant or animal as whole organisms, living under specific production circumstances. With the rise of modern genetics, farmers have become dependent on the specialist (reductionistic) knowledge of geneticists and molecular biologists, who work for special breeding centres. The high tech approach usually goes together with exclusion of the farmer's own experience, and thereby his autonomy is reduced. The field trials are done by the breeding companies. The farms are used but the decisions about breeding are generally not taken by the farmers[xx].

The next reasons (4-8) refer to the IFOAM statement "Practices (such as genetic engineering) are incompatible with the principles of sustainable agriculture". This argument is problematic as long as these principles are not made explicit, and this is not done in the Position Statement. The concept of sustainability is used in very different ways by different stakeholders. For example, genetic engineering in agriculture ('green biotechnology') is also said to be a contribution to a sustainable agriculture. Here sustainability often means no more than reduction of pesticide use in agriculture. In organic agriculture it is much more seen as an ecological concept, related to the continuing carrying-capacity of the soil, and a particular attitude towards nature. An organic sustainable solution is one which is lasting and not just fighting the symptoms (i.e. the bad consequences of conventional agriculture). When sustainability is defined in terms of people, planet and profit then also reason 3 could be added here. Here sustainability is used in connection with the human-nature relation.

Reason 4: Genetic engineering is a continuation of the trend towards further industrialisation of agriculture, which is contrary to the organic attitude towards nature

To illustrate the different attitudes towards nature in connection with different meanings of sustainability, I refer to research done by Lammerts van Bueren & Hospers[xxi] on the growth of lettuce in an economically very efficient industrial setting and under biodynamic conditions. By an industrial setting is meant the fully automatised and computer directed growth of lettuce in a water culture (hydroponics), with artificial light and fertiliser. It is a closed system without any contact to nature and therefore no pests can enter into the system, and no pesticides have to be used. This project was part of a Dutch development program towards 'sustainable' agro-technology. It is interesting to see how the media wrote about this 'ecotechnocratic' solution. One journalist said that however good the products may be, there will always be an emotional resistance to vegetables which lack "any natural spontaneity". Another journalist said: "Competitor of ecological and biodynamic farmers eliminates nature…In the lettuce factory the bond with nature is reduced to zero". This is the opposite of what organic agriculture tries to do. As the latter journalist said: "ecological farmers want to have a strong bond with nature".

To argue for Reason 4, it is necessary to show that genetic engineering fits into this industrial approach to agriculture. In the Memorandum[xxii], published by Wirz et al, the opposition to the use of GMOs in food is not only based on the risks, but also on the industrialisation of agriculture and the consequences of this for our relation to plants and animals. In the Memorandum, industrialisation is connected to globalisation (multinationals), large-scale agriculture, uniformity of products, the dumping of surpluses in the third world, destruction of landscapes and loss of biological and cultural diversity. But formulated in this way it can also be subsumed under one of the other reasons.
Reason 4 focuses on the difference between the view of nature as a (living) organism or as a material mechanism, an object of human analysis, control and interference. The word 'industrial' then indicates the trend towards production in a particular kind of 'closed systems', where everything is under human control[xxiii]. It refers to our relation to (living) nature. One could argue that the problem of co-existence is solved if GMOs are produced in closed systems. This shows by the way that a technology brings with it a particular kind of surroundings. Another technical solution for the co-existence problem could be the consistent use of terminator technology (GURTs) to prevent the spreading of DNA or GMOs. This too, is a way to bring about a separation between GMOs and their natural surroundings.

Spontaneously, many people say that the application of this mechanical approach to living systems is 'unnatural', not fitting into the nature of living systems. This argument is not used by IFOAM, although the idea that organic agriculture is a 'natural' way of farming is widely used in advertisements for organic products. In a brochure written by Biologica, the umbrella organisation for organic agriculture in the Netherlands, the argument of unnaturalness is explicitly used[xxiv]. It is said that "organic (biological) is natural, natural is free of gene-technology". Using the results of a research project by Verhoog et al[xxv] about the meaning of naturalness in organic agriculture, we can classify the reasons 4 to 9 as different applications of the concept of naturalness.

To prevent misunderstanding and confusion it is crucial to stick to the meanings of naturalness as outlined in the paper by Verhoog et al. In reason 4 the focus is on the relation between culture and nature. In the high tech (industrial) approach to nature mentioned before, the tendency is towards full control over nature by humans. Nature is, in some sense, eliminated. The total opposite to this is pristine nature, untouched by human beings. With the latter meaning of nature it is of course impossible to speak about 'natural' in relation to agriculture, because every form of agriculture means interference in nature.

The best way to describe the position of organic agriculture is to say that nature and culture are seen as two poles of a polarity relation, and both poles have to be cared for. We could call this the integration of nature and culture[xxvi]. This means agri-*culture*, but with respect for the independence and autonomy of nature. This respect for the relative independence of the nature-pole in agricultural activities manifests itself in different ways:

- The use of natural ('organic'), rather than 'synthetic' substances, and stimulation of the self-regulation of organisms and the ecosystem (natural processes). This comes up again in reason 5.
- Respect for the specific characteristics ('nature') or intrinsic value of plant and animal species, (agro-) ecosystems, landscapes. Reason 6.
- Preference for a view of nature which is close to direct (common sense) human experience. Reason 7.
- Respect for (bio)diversity as an important characteristic of the evolution of life. Reason 8.

Reason 5: Genetic engineering is a method of breeding in which synthetic geneconstructs are forcefully introduced, rather than that in which natural processes are used and where the self-regulation of organisms is stimulated.

In organic agriculture, genetic engineering is seen as a technology which forces the organisms to do what humans want, instead of eliciting a reaction in which the natural entity retains its relative independence as a partner[xxvii]. Illustrative of this is the way humans have dealt with reproduction in the process of domestication of cows (and other domestic animals). Step by step (artificial selection - artificial insemination – embryo transplantation – genetic modification and cloning) the animal's own role in reproduction, its independence, is completely taken away from it and brought under human control.

What is at stake here is the difference between traditional breeding and breeding with genetic engineering. Supporters of genetic engineering very regularly argue that there is no fundamental difference. I give one example, written by a Dutch science journalist, in the weekly Elsevier (my translation)[xxviii]:

> "Present tomatoes differ thoroughly from the tomatoes as they were once meant 'by nature'…They are the result of centuries of breeding and improvement. This process is officially not called genetic manipulation, but of course it is…The tomato, the corn cob and the potato are just as well products of human ingenuity as the whistling kettle. It is sloppy thinking to consider the kettle as artificial, but to see food as a gift of Mother Nature which should be left alone by the technician. With a little exaggeration: since man has descended from the trees, he is practising biotechnology and genetic manipulation. The difference is that at present we can do it more precisely".

This whole way of reasoning is based on a comparison of the results of two totally different processes: the genome is changed in both cases, and therefore both are said to be the result of genetic manipulation. The whole organic certification system is process-oriented, and not result-oriented. And for organic agriculture there is a tremendous difference between the two processes. With genetic engineering there is direct interference in the genome of plants and animals by forcefully introducing gene constructs (which can only be created in an artificial environment: in vitro), which in some cases (BT for instance) are totally synthetic. And in general (non-evolutionary time-scales) the gene constructs contain genes which would never be transferred by natural means (trans genesis). The latter is part of the definition of genetic engineering in official documents, and this is not the case in traditional breeding, and therefore the latter should not be called genetic manipulation.

Reason 6: The transgression of species barriers does not respect the intrinsic value or species-specific nature of plants and animals. Closely related to this is the view that the making of GMOs is a violation of the integrity of living organisms.

The word intrinsic value (or inherent worth) indicates that living organisms have a value 'of their own', a value which is inherent to them, and independent of their usefulness (instrumental value) for human beings. Again a reference to the acknowledgement of the independence of nature, but now at a moral level. Here I refer to the Proceedings of the last two Ifgene Conferences in Dornach in 2001 and Edinburgh in 2002 (see note xxvii). Both dealt with the issue of the intrinsic value and integrity of plants and animals. Rutgers & Heeger[xxix] have defined animal integrity as follows: "The wholeness and completeness of the animal and the species-specific balance of the creature, as well as the animal's capacity to maintain itself independently in an environment suitable to the species". It just depends on how wide you interpret the word 'wholeness'. Strictly speaking, with the word integrity, the emphasis is not so much on respect for the independence or 'otherness' of nature, but on the wholeness of an organism. The element of wholeness (Reason 1) returns here in a normative statement. One could as well say that respecting the intrinsic value of a living being is referring to a more general attitude towards nature, whereas the concept of integrity is more specific, as can be seen from the use of it by Edith Lammerts van Bueren[xxx]. In her recent work on the integrity of plants she transformed the concept into a moral instrument for judging quite specifically the various technologies used in modern plant breeding.

IFOAM does not mention any moral reasons in the Position Paper[xxxi], which is a pity, because EU regulation has published Directive 2001/18/EU in which it is mentioned that ethical criteria may be used by countries when deciding about the market introduction of GMOs.

Reason 7: Genetic engineering is a technology, which increases the distance between food production and the common sense experience of farmers and consumers

Having respect for the intrinsic value and integrity of living entities (Reason 6) strengthens the emphasis on holism in organic agriculture. Reason 7 refers to another aspect of holism, namely that a holistic view of nature is closer to the common sense experience of nature than the reductionistic view. In that sense it is also more 'natural' and reductionistic science more unnatural.

This meaning of unnatural is used by Wolpert[xxxii] in his book 'The unnatural nature of science'. Wolpert says that scientists should distrust 'natural' thinking (the way nature is experienced in day-to-day life):

> "Physics teaches us that the greenness of grass, the hardness of stones and the coldness of snow are not the greenness, hardness and coldness that we know in our own experience, but something very different".

Doing science requires one to remove oneself from one's personal experience. With science Wolpert means not only physics but also molecular biology, where explanations for an enormous variety of phenomena are sought at the most fundamental level. The laws of nature found at this level cannot be inferred from normal day-to-day experience.

In is interesting to compare the title of Wolpert's book with the title of a book by Kass[xxxiii]: 'Toward a more natural science'. The word natural is used in the same way, but now to plead for a science which bridges the gap between nature studied scientifically and 'life lived naturally'. This is particularly important when we deal with human and environmental

health. He speaks about "cultivating habits of living that assist the body in its (natural) efforts towards wholeness". This is exactly what is aimed at by organic agriculture and complementary kinds of medicine. It also explains why it attaches value to the so-called 'experiential knowledge' of the farmer, and why farmers themselves actively take part in the research process. What has been said about the process of reproduction of cows, in which the cow's own role in reproduction is reduced to a minimum, also applies to the farmer's role in breeding animals and cultivating crops. The more reductionistic science is used, the more the farmer becomes dependent upon specialists (geneticists, molecular biologists, etc.) (see also Reason 3. Economic reasons such as increasing efficiency may also lead to further specialisation).

The two kinds of science lead to different kinds of technologies, which are sometimes called 'hard' and 'soft' technologies[xxxiv]. Genetic engineering is experienced by organic agriculture as a hard technology based on reductionistic experimental science. Wolpert's experimental science is inherently technological. In the experiment one tries to create a closed system, with all variables controlled by man, just as in the high tech sustainable production of salad mentioned under Reason 4. The search for universal laws at fundamental levels translates into hard technologies which are applicable world-wide. They fit perfectly well into the economic trend towards globalisation. The application of hard technology often has unexpected and unpredictable effects at higher levels of organisation.
Soft technology is the result of a more 'natural' science, which remains close to human experience and respects the idea that nature has an intrinsic value, and should be seen as a partner. Being holistically oriented it does not so easily loose sight of the larger contexts in which it is applied.

Reason 8: Genetic engineering promotes and loss of (agro)biodiversity at a regional level.

I have suggested that there is a link between the universal laws of reductionist experimental science and a hard technology which is applied globally. In Reason 7 we linked this with the direct experience of nature of consumers and farmers. In Reason 8 the link is with (agro)biodiversity. In the context of a global economy the application of hard technology tends to lead to a reduction of the diversity in landraces of both animals and plants.
In the Memorandum (see note xi) it is said that agriculture traditionally also produces landscapes with an aesthetic or cultural value. Further industrialisation by means of GMOs leads to large-scale agriculture and loss of biological and cultural diversity. The authors plead for a cultural revaluation of agriculture, in which important values such as respect for the earth, (agro)biodiversity and sustainability ('Philosophie der Achtung') have to play a role. A social consequence of this critique of globalisation is that, rather than leading to a worsening of the world food situation (as is often claimed by biotechnologists), a softer, small-scale (regional) approach to agrotechnology is expected to be a much better means to reduce world hunger.

On many organic farms one also tries to stimulate 'nature development' for its own sake, to increase biodiversity in the stricter sense of 'wild' plants and animals. In organic agriculture one does not want to seperate nature from culture and culture from nature. This implies that the concept of biodiversity may be widenend to include human (agri-cultural) activities as well. Even more general one can say that diversity (variation) is not only a characteristic of evolutionary processes, it is an essential element. This means that there will always be a field

of tension in organic agriculture between monoculture, which is often needed to produce enough food in an efficient way and the principle of (bio)diversity.

Conclusion

The IFOAM standards say a clear no to GMOs, and this Discussion Paper is not about that choice of principle. It rather deals with the reasons underlying this choice, in the hope of improving these reasons[xxxv]. Eight reasons have been formulated,which could be used by the organic movement against genetic engineering. The question now is whether they can be considered 'good reasons': can they be seen as well-reasoned and consistent, even by those who are in favour of genetic engineering? These supporters of GMOs might not accept (some of) these reasons, but could still acknowledge that other people may think differently and still be rational. It could also be possible that not all people in the organic movement agree with (all of) these reasons. Perhaps some reasons have been forgotten and perhaps some values referred to have been misunderstood. IFOAM is presently reformulating its basic principles. Whatever comes out of this process, I think the reasons against genetic engineering should follow from these principles.

Notes

[i] This essay has first been published in Dutch ("Waarom de biologische landbouw tegen gentechnologie is", Driebergen, 2004) and discussed in various gremia. The lessons learned from those discussions were used in writing this English version. I want to thank Hugo Alrøe and Diederick Sprangers in particular for giving comments on the English version.

[ii] H.Verhoog: The alliance of utilitarianism and scientific thinking in public debates about genetic engineering in the agrifoodsector (37-39). Proceedings 4th Congress of EURSAFE (Ethics as a dimension of agrifoodpolicy), Toulouse, 20-22 march 2003, Toulouse. Also by the same author: Über die Eingeschränktheit der Ethikdebatten zur Gentechnologie (82-96). In Christian Hiss (Hrsg.), Der GENaue Blick, Ökom Verlag, München, 2003.

[iii] Hugo Alroe (working at DARCOF. See note…); Vonne Lund (2002). Ethics and animal welfare in organic animal husbandry. Doctoral Thesis, Swedish University of Agricultural Sciences, Skara.

[iv] The Organic Revision Project coordinated by DARCOF, in which the author participates (EEC 2092/91 Revision), speaks not only about identifying the ethical values of organic agriculture, but also about 'balancing and integrating them', which necessarily involves some kind of critical, theoretical analysis (this is usually called 'normative ethics' as opposed to 'descriptive ethics')

[v] In a paper at Cordoba V. Lund distinguished three basic values in Organic agriculture: respect for nature, sustainability and a holistic outlook. Holism also plays an important role in the dissertation of T. Baars: Reconciling scientific approaches for organic farming research. Wageningen Agricultural University and Research Centre, 2002. H. Alroe & E. S. Kristensen (DARCOF) speak about systems research or a systemic approach.

[vi] Lukas Rist (2000). Theoretische und experimentelle Untersuchungen über den Einfluss der Genmanipulation auf die Integrität der Arten. Dissertation Gesamthochschule Kassel

[vii] Craig Holdredge & Steve Talbott: Sowing technology. The ecological argument against genetic engineering down on the farm. Sierra Magazine. Also Michel Haring; Blick ins Labor. In Christian Hiss (Ed.) Der GENaue Blick. Ökom Verlag, München.

[viii] Astrid T. Groot & Marcel Dicke (2001). Transgenic crops in an agro-ecological context: multitrophic effects of insect-resistant plants, Wageningen / COGEM. A good example of a non-reductionistic approach to agronomic problems is given by Florianne Koechlin: Solutions of agronomic problems based on 'ecological integrity'. In David Heaf & Johannes Wirz (Eds.), Proceedings Ifgene Workshop Dornach 9-11 may 2001.

[ix] In the Position paper on 'Co-existence between GM and non-GM crops' (october 2003) the IFOAM EU Group says: "In the case of GM technology we believe there is sufficient doubt, about the consequences of the release of these products on the environment in general and human health in particular, for the precautionary principle to be invoked". Also DARCOF (nov. 2000): Principles of Organic Farming. The precautionary principle is seen as one of three basic principles guiding OA (the orther ones are the cyclical principle and the nearness principle).

Risky technologies are characterised by their unpredictability, based on our limited understanding of complex organisms and ecosystems, and nature as an integrated whole.

[x] I thank Hugo Alrøe (personal communication) for pointing out to me the distinction made by Niklas Luhman between risk (voluntarily taken by a moral, responsible agent) and danger (which someone else is exposed to), in "Risk: A Sociological Theory. New York, De Gruyter, 1993"

[xi] This reason is also mentioned in the "Memorandum zur Koexistenz von Gentechnik-Landwirtschaft, konventionellen und ökologischen Betriebsweisen", written by Johannes Wirz, Nikolai Fuchs & Ruth Richter (Dornach 2003)

[xii] Union of Concerned Scientists (2004): Gone to seed. Transgenic contaminants in traditional food supply. Cambridge, Ma.

[xiii] A good example is the Farm Scale Evaluations in UK where the scientists have calculated how large the minimum distance between GM and non GM maize fields should be to stay below the 0,9% threshold of contamination.

[xiv] Gene Technology for Food, Bern, march 2003

[xv] Paul B. Thompson: Why food biotechnology needs an opt out. In: B. Bailey & M. Lappé (eds.), Engineering the farm. Island Press, Washington, 2002.

[xvi] Also the Memorandum mentioned in note xi

[xvii] Guido Ruivenkamp: De invoering van biotechnologie in de agro-industriële productieketen. Dissertation, Amsterdam, 1989. Very enlightening is the report of the Food Ethics Council (UK, 2003): Engineering nutrition. GM crops for global justice. It deals with the golden rice case.

[xviii] DARCOF: Principles of Organic Farming, 2000.

[xix] Michael Pollan: The organic-industrial complex. How organic became a marketing niche and a multibillion-dollar industry. New York Times Magazine, may 13, 2001, Section 6.

[xx] It should be admitted that some groups are trying to develop biotechnology in a form which is applicable to poor farmers in developing countries, including farmer participation. But in most cases this does not apply to genetic engineering. One example is the Technology and Agrarian Development Group of Wageningen University and Research Centre (G. Ruivenkamp, website: sis.wau.nl/tao). See also: Biotechnology. Building on farmer's knowledge by Joske Bunders et al. (eds.), Macmillan Education, London, 1996.

[xxi] E. Lammerts van Bueren & M. Hospers: Technologisch groen versus biotechnologisch groen. Een onderzoek naar de kwaliteit van industrieel en biologisch-dynamisch geteelde sla. Louis Bolk Instituut, Driebergen, 1991.

[xxii] See note xi

[xxiii] The term 'closed system' is also used in OA, but with a totally different meaning, namely in the sense of an organic cycle where there is a balance of input and output (of energy) or where the food for animals comes from the farm (or other farms in the same regio) where the animals live, and the manure of the animals is used to grow the plants in the same agro-ecosystem.

[xxiv] The representative of IFOAM in the Netherlands (Biologica) has published a brochure for consumers which is called "Biologisch is natuurlijk, natuurlijk is gentech-vrij" (Biological is natural, natural is gene-free).

[xxv] H.Verhoog, M. Matze, E. Lammerts van Bueren & T. Baars: The role of the concept of the natural (naturalness) in organic farming. Journal of Agricultural and Environmental Ethics 16 (2003) 29-49.

[xxvi] In the DARCOF brochure Principles of Organic Farming it is formulated slightly differently. OA does not approach nature from the outside, but from the inside. Man is an integral part of Nature. What we do to nature always affects ourselves. Agriculture is seen as a complex and vulnerable system of values and relationships.

[xxvii] See also the author's contributions to the Proceedings of the Ifgene workshops in Dornach (9-11 may, 2001): "Intrinsic value and integrity of plants in the context of genetic engineering" (15-19) and Edinburgh (18-21 sept. 2002): "Genetic engineering and the intrinsic value and integrity of plants and animals", both edited by David Heaf and Johannes Wirz (order: 101622.2773@compuserve.com).

[xxviii] Simon Roozendaal: Greenpeace moet zich schamen! Elsevier 7 febr. 2004, 71-76

[xxix] Bart Rutgers & Robert Heeger. In:Marcel Dol et al. (eds.), Recognising the intrinsic value of animals, 41-52. Van Gorcum, Assen, 1999)

[xxx] Edith Lammerts van Bueren: Organic plant breeding and propagation: concepts and strategies. Dissertation Wageningen University, 16 dec. 2002. Also E. Lammerts van Bueren together with P.C. Struik, M. Tiemens-Hulscher & E. Jacobsen: Concepts of intrinsic value and integrity of plants in organic plant breeding and propagation. Crop Science 43 (2003) 1922-1929.

[xxxi] In a short paper about Organic Agriculture and Genetic Engineering, in Ecology and Farming (nov.1994, p.25) Linda Bullard et al. mentioned an ethical consideration: "Genetic engineering inherently reduces the integrity of organisms".

[xxxii] Lewis Wolpert: The unnatural nature of science. Faber and Faber, London, 1993.

[xxxiii] Leon R. Kass: Toward a more natural science. Free Press, New York, 1985

[xxxiv] As defined by Arnim von Gleich: Der wissenschaftliche Umgang mit der Natur. Campus, Frankfurt, 1989.

[xxxv] This is one of the aims of the conference about the contents of this paper which is planned on the occasion of the BioFach Fair 2005 (23-24 febr. 2005) in Nurnberg. That is the reason why it is also distributed electronically (websites: www.louisbolk.nl; www.ifoam.org; www.organic-revision.org), to increase the participation of as many people as possible. The author would welcome comments during the process leading to the Biofach Fair: h.verhoog@louisbolk.nl.