Principles of Organic Farming

Discussion document prepared for the DARCOF Users Committee

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Danish Research Centre for Organic Farming
DARCOF

The main objective of the Danish Research Centre for Organic Farming (DARCOF) is to conduct research of high-quality, international standard relating to the philosophy and problems of organic farming. This work is designed to further the development of organic farming, thereby expanding the options for changing from traditional to organic production and promoting a sustainable, economic, ecological, and social development in agriculture.

DARCOF is a 'centre without walls', whose research programmes involve the collaboration of about 100 scientists working at 15 research institutes. The scientists thus work in their own environment but co-operate across institute boundaries. The centre is managed by a Board made up of representatives of the Danish Institute of Agricultural Science, the National Environmental Research Institute, the Royal Veterinary and Agricultural University, Risø National Laboratory, the Danish Institute for Agricultural and Fisheries Economics, and the Danish Veterinary Laboratory.

To ensure the relevance of its research activities and maintain its contact with different user groups, DARCOF has set up a User Committee. This body comprises representatives of the Organic Food Council, the Danish Association for Organic Farming, The Association of Organic and Biodynamic Plant Producers and Processers in Denmark, the Danish Family Farmers Association, the Consumer Council, the Danish Agricultural Advisory Centre, the Danish Association of Horticultural Producers, the Economic Council of the Labour Movement, and the Danish Farmers Union.

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Preface

In the course of about 10 years, organic farming in Denmark has expanded from covering less than 0.5% of the agricultural land area and about 500 farms to the present situation in which it is practiced on 6.5% of this land and on 3,500 farms. A very dynamic development in organic farming has thus occurred, although it is generally agreed that much more is to come. The direction and basis of this development is, however, less clear.

To support this development, Denmark has introduced a policy that includes economic support for the transition to organic production, the provision of relevant advice, and the conduct of research into organic farming. As part of this policy the Danish Research Centre for Organic Farming (DARCOF) was established in 1996. One of the main remits of this centre is to initiate and co-ordinate research projects that support and help the development of organic farming.

DARCOF research must be pro-active and forward-looking, have a long-term perspective, and help to promote organic principles. These objectives can only be fully satisfied, however, if a degree of consensus is reached on the ecological aims and principles of organic farming.

For the planning of new research projects (see Appendix 1), the Board and User Committee of DARCOF have discussed various issues concerning the principles of organic farming and its future development. These discussions revealed a certain degree of uncertainty, and against this background the User Committee expressed a desire to make the discussion more fundamental, and at the same time open it up to many more people.

The original goal was to get Danish organisations, associations, branches, etc. to discuss organic principles and the future development of organic farming. The various participants were asked to provide their comments, recommendations, and criticisms to DARCOF – both for the formal discussion and as recommendations for the development programme presented at the end.

It turns out, however, that in many of our neighbouring countries there is a similar need and interest to discuss goals, principles and development opportunities for organic farming. Against this background we have prepared this English version of the Danish debate, on the basis of which we hope to inspire a broader international discussion. We would greatly welcome receipt of any comments or suggestions, also for inclusion in the Danish discussion.

Erik Steen Kristensen
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February 2001
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Before research projects can be initiated to support and underpin developments in organic farming, it is necessary to achieve a degree of consensus concerning its ecological objectives and principles. With this in mind, this document aims to stimulate a discussion on the direction and fundamental basis of future developments.

It starts with a description of some of the basic principles and values that pertain to organic farming. The original objectives of the International Federation of Organic Agriculture Movements (IFOAM) and the National Association for Organic Farming (LØJ) are described, and several central issues relating to caution, sustainability, organic animal production, and social aspects of organic farming are discussed. It is noted that in comparison with earlier times, far less attention is currently being paid to social and cultural values.

It is concluded that three basic principles can be identified:

- The cyclical principle
- The precautionary principle
- The nearness principle.

Following this, examples are given of current uses of technology and inputs. The working hypothesis is that progress in organic farming depends to a large extent on which new approaches are accepted and which are rejected. Ideally, this choice is determined by the basic principles and values. The acceptance of new technology is examined and compared with the above-mentioned ecological principles. Rather good agreement is observed between practical advances in organic farming and the precautionary and (to some extent) the cyclical principles, respectively. A steep learning curve is also evident, such that many new methods are currently being applied (e.g. in the areas of weed control and the anaerobic storage of manure and feed) that do not directly oppose these basic principles. At the same time, however, it is observed that almost all the new technologies have helped to raise productivity, increase farm sizes and promote specialisation in organic farming.

Finally organic farming is discussed and its perspectives examined. It is concluded that because of the greater specialisation and larger size of farm units there will continue to be considerable pressure on ecological principles, particularly the cyclical and nearness principles. Organic farmers should therefore consider the extent to which this development ought or can be regulated with a view to preserving confidence in organic farming, and how the nearness principle can be applied more exactly.

It is also observed that there is currently a risk that organic foods appear as products that comply with a series of more or less transparent regulations rather than products of a realistic production alternative. There is therefore a big need for greater clarity and simplification with regard to the question of what organic farming really stands for.
Finally several approaches are recommended for increasing public confidence in organic products. These include:

- closer relationships between producer and customer
- more openness and transparency in marketing
- simplified and more fundamental regulation of organic farming involving for example:
  - the prohibition of artificial fertilizers, pesticides, and GMOs,
  - the demand for grazing and roughages in animal husbandry,
  - increased withdrawal times for medicines,
  - tighter controls on the importation of non-organic fertilizers and feeds,
  - regulations that counter specialisation,
  - regulations that promote the nearness principle.
1 Introduction

During the last decade, the proportion of agricultural land devoted to organic farming in Denmark has increased from less than 0.5% (about 500 farms) to about 6.5% (about 3,500 farms) at the present time. Organic agriculture is thus a very dynamic sector, in which re-organisation has brought about big changes. Developmental aspects have also become the focal point of Action Plan II, which has just been given the title Ecology in Development. All are therefore agreed that organic farming is developing and that it should develop. The question remains, however, as to whether there is also full agreement on the direction and basis of this development, and how rapidly progress should occur.

In the planning of the research programme "DARCOF II" certain questions, reflecting a degree of uncertainty, were raised: For example, as to whether work should be done on the production of greenhouse vegetables in soil-less growth media, and to what extent conventionally reared animals should be used in trials pertaining to organic farming. The assimilation of background information (e.g. relating to pigs, the quality of Nature, the consequences of GMOs, ground-water protection, and nutrition and health issues) prior to the commencement of research activities can also be justified by the uncertainty pertaining to the most appropriate course for organic farming.

Consequently, within DARCOF’s Management Board and User Committee there is a great desire for more discussion and a clearer statement of intentions concerning the goals and principles of organic farming. This discussion is important for several reasons: in the case of DARCOF the main concern is the fact that its research must be pro-active and forward-looking, and should predict developments over a 5 - 15 year period. Before setting up research projects that both underpin and take due regard to future developments it is necessary to have a degree of consensus on these issues.

It is also evident that in recent years organic farming has been characterised by increasing regulation and control, which many producers find to be frustrating. The discussion must therefore also focus on greater clarity on the subject of what organic farming really stands for. This would provide opportunities for simplifying the list of regulations.

The present document presents key aspects of the discussion conducted by DARCOF’s User Committee in recent months. It starts with a description of some basic principles and values that relate to organic farming (Section 2). Following this, Section 3 presents examples of questions on the use of technology and inputs, since acceptance of new approaches has great importance for the future course of organic farming. Finally in Section 4 the development is discussed and put into perspective.


2 Fundamental principles and values of organic farming

Sections 2.1 - 2.3 of this chapter are mainly a repeat of the description given in Action Plan II: “Fundamental principles of organic farming” (Pages 10 – 14). Through the contribution of the Organic Food Council, the text of Action Plan II was influenced by many different interest groups. It therefore represents the expression of a common Danish point of view. The sections on caution and sustainability have, however, been elaborated by the description of Alrøe (1999) to provide more depth to these central concepts.

Section 2.4 relates to organic animal production, the introduction of recent EU regulations having spawned a series of new analyses and considerations concerned with the basic principles of this area of activity. These are summarised in Section 2.4. Section 2.5 deals with the more social aspects of organic farming.

2.1 Objectives

Organic farming is distinguished from conventional agriculture by exercising particular respect for the environment, nature, and animal welfare, etc. For example, the Nordic ecological associations have accepted the following description of organic farming:

“Organic farming describes a self-sustaining and persistent agro-ecosystem in good balance. As far as possible, the system is based on local and renewable resources. It builds on a holistic view that incorporates the ecological, economical and social aspects of agricultural production in both the local and global perspectives. In organic farming nature is considered as a whole with its own innate value, and man has a moral obligation to farm in such a way that cultivated landscape constitutes a positive aspect of nature.”

This very responsible attitude is further expressed in farming advice from the National Association for Organic Farming (LØJ). This specifies the following important issues with regard to the environment, animal welfare and feed quality:

- Work as closely as possible in closed cycles and use local resources
- Preserve the natural fertility of the soil
- Avoid all forms of pollution that arise from farming practices
- Promote tillage practices that show most concern for the environment and nature
- Produce foods of optimal nutritional value
- Reduce the use of non-renewable resources in agriculture, including fossil fuels
- Work to ensure that the waste products from towns and food industries achieve a quality that allows their re-use as fertilisers in agriculture
- Provide all animals with living conditions that satisfy their natural behaviour patterns and needs
- Do everything possible to ensure that all living organisms that the farmer works with are allies, (be they micro-organisms, plants or animals).
In this connection it can be stated that LØJ is a member of IFOAM and that the above-mentioned goals are taken from "The Principle Aims of Organic Production and Processing" (See Appendix 2, IFOAM Basic Standards, Basel 2000).

2.2 Precautionary principle
One of the concepts that has won acceptance in the debate relating to agriculture, the environment and health, and the associated legislation, is the precautionary principle. This principle is interpreted, however, in several different ways. It has its roots in the German word "Vorsorgeprinzip" that was used in a legal context for the first time in 1976. According to this principle, responsibility for future generations demands that the natural basis for life must be preserved, and that irreversible damage must be avoided.

In practice the principle is also used (translated from Boehmer-Christiansen, 1994):

- for the early demonstration of risk through comprehensive research
- to act before there is any scientific evidence of possible irreversible damage
- for the reduced leakage of pollutants and the promotion of cleaner technologies.

"Vorsorgeprinzip" was originally translated to the English "precautionary principle" and from there to the Danish "forsigtighedsprinzip". Because of this background it is often suggested that in Danish the principle should be called the "forebyggelsesprincip" (i.e. the preventative principle) since it focuses on how to avoid damage to the environment, such that society is exempted from fighting the environmental and social consequences of inappropriate actions.

The German word "vorsorge" can be translated to the English "care", and alludes to our responsibility for Nature and the environment. It thereby forms a bridge to the concept of sustainability. In the Danish version of this article the word "forsigtighed" (i.e. caution) was used because of its general meaning in relation to environment and health, and partly to tie it to the concept of "functional integrity" (see Section 3) which is part of the sustainability concept.

The use of industrially produced pesticides and other environmentally alien compounds is not allowed in organic farming. Likewise genetically modified organisms are not permitted. By virtue of these prohibitions the risk of pesticide contamination in food, drinking water and the environment, for example, is minimised. These bans can be conside-
red as a different and more extensive desire for caution and care in our relations with Nature than the assessment of risk that underlies the use of pesticides in conventional agriculture.

The rationale behind the precautionary principle is that in organic farming the interaction between Nature and Man is an important ingredient of the philosophy. As indicated in the section on objectives, organic farming builds on the concept that Nature is an integrated whole that people have a moral duty to respect, both for its intrinsic value and because, by using its regulatory mechanisms, one can establish a more self-sustaining agroecosystem. Nature is a very complex, coherent system, of which Man has often too little understanding to appreciate the consequences of specific actions. Damage to Nature and the environment will ultimately damage Man.

The precautionary principle in organic farming can therefore be justified as recognition of our limited understanding of Nature and the risk that we damage something of which we are ourselves a part. This can be interpreted to mean that since Nature is an organic entity, Man must take care not to exercise too much influence on individual parts of the ecosystem because such actions could produce unexpected consequences. Nature is considered to be something more original than Man, and has its own regulatory mechanisms. Man (especially the farmer) should utilize Nature rather than try to control and transform it by the addition of (industrially manufactured) inputs from outside. This interpretation is underpinned by such expressions as “preserve the natural fertility of the soil” and “make sure that all living organisms remain allies”.

At first sight, this interpretation could be taken as a very exploitative understanding of Man’s interaction with Nature. However, the difference from other forms of agriculture is the predominant belief that Man must exercise precautionary attitudes and make as few changes as possible, the reason being that we ourselves, and future generations, could be hit by negative consequences that we cannot predict. It is thus an anthropocentric understanding of our ethical concerns relating to our interaction with Nature.

Against this, the expression “Nature has its own value” can be understood to mean that we have an ethical duty to look after Nature for its own sake. This point of view builds on an idea that the richness of Nature’s diverse life forms and ecosystems has intrinsic value, irrespective of whether Man appreciates these features. The Norwegian Arne Naess refers to this as “ecology” and thinks that we have ethical claims on these values irrespective of their significance for Man or other conscious beings. This distinction between anthropocentric and eco-centric ethics easily leads on to the idea that Man either confers on Nature instrumental values (for his practical or economic use) or accepts that there are inherent values in Nature that should be respected, irrespective of his own desires.

This distinction is, however, too narrow. Even if one takes an anthropocentric view one can still accept that there are independent values in Nature that as humans appreciate and therefore wish that others would respect. One example is the variation in wild herbs on banks and in hedges. There are many people who would like these habitats to be conserved to sustain the richness of Nature, simply because they confer value on...
it and perhaps think that bio-diversity itself contributes to their quality of life. It is not clear which of these two views of Nature ethics and values are most predominant in the ecology movement, and there is no need for agreement on the issue since no serious conflict exists between the two viewpoints. By virtue of its precautionary principle, however, organic farming has better options for satisfying the desire of different groups of the population to enjoy a better environment and conserve its natural riches.

The agricultural industry manages a large part of our natural environment, so application of the precautionary principle in farming practice can be seen as a strategy to prevent environmental problems. In this regard Ariansen (1992) observes that our technical ability and the associated environmental problems lead to two fundamentally different views of causes and solutions:

1. The cause of environmental problems is ignorance, and the solution lies with even more highly developed technical control incorporating technically reasoned limits.
2. The cause of environmental problems is our technological life form; and the solution lies in changing our life-styles to a form that is both intrinsically valuable and implies the ecologically better management of Nature.

Extending the above discussion of the precautionary principle, the ecological movement will be sceptical about a technological fix (point 1.) because technological development not only redresses current ignorance but also reveals new ignorance. In this regard Ingemann (1999) distinguishes between error-friendly technologies and risky technologies. The former technologies and their external effects are predictable and allow a line of retreat. In contrast, risky technologies are characterised by their unpredictability, which means that the knowledge on which they are based carries with it a considerable amount of non-knowledge or ignorance. We are aware that we do not know enough about the consequences of implementing risky technologies. Actual examples of these technologies are the use of antibiotic growth promoters and the use of genetically modified organisms. According to the thinking of the ecological movement, therefore, environmental problems are not only solved through the acquisition of more knowledge and technology, but also through an increased recognition of the ignorance associated with technology, the avoidance of risky technologies, and the continued use of production systems that experience has shown to function well. The reason for environmental problems may well lie with ignorance (see point 1. above); but this ignorance may reflect our technical life-style (see point 2. above), and a solution that involves more technology can cause even more ignorance of possible consequences for Nature, the environment and Man.

2.3 Sustainability

Organic farming is not alone in having sustainability as a goal. Sustainability is, for example, also an objective in Danish agriculture’s presentation for Integrated Production (The Executive Committee of the National Committees 1996). But as Douglass (1984) has shown, "sustainability" has different connotations for different groups in agriculture, so it is important to examine the meaning of...
this concept more closely. In this we will follow Thompson (1997), who argued that there are two philosophically different meanings of sustainability:

- Resource sufficiency
- Functional integrity

Sustainability in the sense of resource sufficiency emphasizes the use of resources and the production and distribution of food, focusing first and foremost on the relationship between input and output in the systems under consideration. A sustainable development infers that agriculture can satisfy the requirements for food and textiles, etc, for current and future generations, such that the most productive systems are also the most sustainable. This concept has been the most dominating one in modern conventional agriculture.

Sustainability in the sense of functional integrity sees agriculture as a complex system of values and relationships, and emphasizes the frailty of the system that results from our lack of understanding of the interactions between production methods and ecological and social survival. The basic consideration is that the system is vulnerable, and that some of its fundamental elements recur over a period of time in a way or at a rate that depends on the condition of the system at an earlier date. The genetic characteristics of specific farm animals and crops, for example, are crucial to the next generation of these animals or crops, and treatments that change the fertility of the soil can be critical to production over the longer term. In general, nature is seen as an inseparable aspect of society's sustainability or functional integrity, and this understanding underpins strategies to oppose and avoid irreversible changes. Caution is thus a valuable

Figure 1. Two views of the relationship between man and nature
approach to avoid negative consequences in our relationships with Nature. With its focus on the vulnerability of the system and recognising the limitations of our knowledge, sustainability (as functional integrity) is closely associated with the idea of Man as an integral part of Nature. The ecological movement generally uses the concept of sustainability in this way. The relationship between sustainability and our perception of reality has been examined by Alrøe and Kristen- sen (1998) who argue that the two meanings of sustainability (discussed above) arise from different attitudes to Nature. The resource sufficiency interpretation approaches Nature from the outside, whereas (since it views Man as an integral part of Nature) the functional integrity interpretation approaches Nature, in some sense, from the inside. The two different underlying perceptions of nature in resource sufficiency and functional integrity are illustrated in Figure 1.

As an example of an organic farming rule that relates to sustainability as functional integrity, we can mention the prohibited use of artificial fertilizers. By avoiding these fertilizers organic farming is forced to work with Nature's own nutrient cycles and become more self-reliant.

2.4 Animal husbandry

In the EU regulations for organic animal production (No. 1804/1999 of 19th July 1999) several general principles are given for the management and rearing of farm animals. In connection with an analysis of the ecological regulations relating to animal health and welfare (performed by DARCOF in February 2000) much consideration was given to the question of whether organic farming involves distinctive animal welfare issues (Alrøe et al., 2000). The conclusion was that organic farming incorporates several distinctive aspects.
of animal welfare. First and foremost it relates to the ethical decision of how well animals should be kept, and associated with this, the definition of good animal welfare.

In organic farming animal welfare is seen to include better options for developing natural behaviour, these involving access to out-door areas and freedom of choice as a means of satisfying the preferences of individual animals. These options imply that care, as a concept of Man's responsibilities to animals, acquires greater importance. In this context it should be mentioned that detailed regulation of the layout of housing etc. does not necessarily ensure better animal welfare, since care and husbandry methods also play important roles. The "naturalness" of animals or lack thereof in organic farming can also be an important question, seen from the viewpoint of their integrity. In this context the breeding and reproduction of animals that are adapted to organic production systems, as well as the choice of breeding methods, are central concerns. Finally organic farming incorporates the perception that Man and farm animals are parts of a wider ecological system. This perception can be of significance for animal welfare in the context of harmony, this concept expressing the sustainability, health and integrity of the system in the broadest sense. However, without doubt there are different values and perceptions associated with the concept of animal welfare, even within the ecological movement. Further clarification of this situation would provide a useful tool for the advancement of organic farming.

In summary, one can imagine a forward-looking perspective for the development of organic farming in relation to animal welfare. Instead of demanding more detailed regulation, this perspective will focus on the special features of organic farming: greater opportunities for the development of natural animal behaviour and harmony in the structure and function of the farming system.

2.5 Social aspects

Social issues take a central position in organic farming. The following main objectives are set out in International Federation of Organic Agriculture Movements (IFOAM) Basic Standards (Anon., 2000):

- To draw together the social and ecological consequences of organic production and processing.
- To ensure that all who work in organic farming and processing have a quality of life that meets their basic needs and provides adequate and satisfactory returns for their labours, including a good working environment.
- To strive to make the whole chain of events in production, processing and distribution both socially and ecologically justifiable.
In 1999 the Nordic ecological and biodynamic associations (Nordic IFOAM) adopted the following principles:

- To produce foods of high quality, in sufficient quantities and fairly distributed
- To make it possible for the farmer to get a reasonable income, a safe working environment and meaningful work
- To strive for close contacts between food producers and consumers
- To ensure the greatest possible re-cycling of nutrients through the integration of urban societies, agro-ecosystems and natural ecosystems

There is thus no doubt that social issues take a central position in the ecological movement. On the other hand it must also be stated that these aspects are not particularly obvious in Danish organic farming at the present time. It is not included in Action Plan II – Ecology in Development; and in the National Association for Organic Farming’s production recommendations the above-mentioned principles are not even mentioned. This can be taken to reflect the fact that in recent years disagreements have arisen in Denmark over the interpretation of these principles. This subject is often discussed, for example, in the journal “Økologisk Jordbrug”(i.e. Organic Farming). At the ecological congress in Brøndstrup (1st and 2nd November 2000) there were also many contributions that focused on the social aspects of agriculture.

An essential reason for the dampening down of social issues in recent years is probably the rapid development that has occurred in the

<table>
<thead>
<tr>
<th>Table 1. Prioritised reasons for changing to organic farming (Noe, 2000)</th>
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<tbody>
<tr>
<td><strong>Reason for transition:</strong></td>
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<tr>
<td>Environmental concerns</td>
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<tr>
<td>Disagree with conventional agriculture</td>
</tr>
<tr>
<td>Future of Danish agriculture</td>
</tr>
<tr>
<td>Agronomic challenge</td>
</tr>
<tr>
<td>Better foods</td>
</tr>
<tr>
<td>Animal welfare</td>
</tr>
<tr>
<td>Higher income</td>
</tr>
<tr>
<td>Worries about working conditions</td>
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<td><strong>n=923</strong></td>
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</tbody>
</table>
ecology movement. This has meant that many farmers have different reasons for going organic than had the original ecologists. Many of the new players – both within agriculture and associated activities – have but little contact with the currents and movements that brought about the today's ecological developments. This is illustrated by the fact that in a recent study the reasons given by organic farmers for making the transition was seen to have changed in recent years (Table 1). These farmers were asked to give their main reasons for transferring to organic farming.

It can be seen that for many farmers environmental concerns were the main reason for their transfer to organic farming, both in the beginning and towards the end of the 1990s. But whereas many transitions in the early 1990s reflected a dislike of conventional farming methods, towards the end of the decade transfers were more often due to the potential for higher income.

The apparent falling disagreement with conventional agriculture is explained by the fact that the majority of new converts are organised within traditional farming organisations (the Danish Farmers Union and the Danish Family Farmers Association) whereas the National Association for Organic Farming (LØJ) currently represents relatively few of Denmark's organic farmers. The increased move to organic farming can thus be seen as an affiliation to a production concept rather than a movement in which social aspects play a central role. Despite this development, however, there are still groups in Denmark that are orientated towards the local and original organic farming (Jelsøe et al., 2000).

It can be difficult to interpret the fundamental principles that lie behind the social aspects of organic farming. Seen in relation to the other principles, especially those relating to solidarity with Nature and the concept of functional integrity, one can point to the concept of nearness as a central principle. We are here referring to vertical nearness, as exists between the players in the production, processing and distribution of organic foods, and horizontal or geographic nearness, in which the stream of nutrients is anchored locally in a naturally well-defined region. Michelsen & Kølster consider the nearness principle to be a very central principle in organic farming.

2.6 Summary of fundamental principles
The main thread in the description of ecological principles and goals is that in organic farming Man is considered as an integral part of Nature, and that Nature is such a complex entity that we do not fully comprehend the consequences of our influence on it. From these fundamental assumptions some principles for action can be set out (see Figure 2).

The cyclical principle, discussed at the top of Figure 2, is based on the fact that nutrients are recycled and used again, and with the help of sunshine renewable resources are built up. In the same way, Man must recycle nutrients, and avoid the use of non-renewable resources or ruthlessly exploit resources in general. Developments must be in harmony with Nature, and can be achieved by versatility and diversity in production.

The precautionary principle, discussed in the middle of Figure 2, recommends care in the
use of new technology, partly because Man is himself part of the natural cycle, and partly because Nature is complex and it can be difficult to foresee the consequences of Man's activities. A natural consequence of the precautionary principle is that older, known and well-functioning technologies will automatically have precedence over new technologies developed on a more theoretical basis. Similarly error-friendly technologies ought to be chosen rather than risky technologies. The nearness principle, discussed at the bottom of Figure 2, is concerned with how to secure special social aspects of organic farming, for example, transparency, safety, a sense of local belonging, and peace of mind, not to mention humanity and social justice. 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.

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Development principles</th>
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</thead>
<tbody>
<tr>
<td>Man is an integral part of Nature's cycle.</td>
<td>Collaboration with Nature should be promoted through the establishment and build-up of a cyclical principle that ensures versatility, diversity and harmony, and the re-cycling and use of renewable resources. (Cyclical principle)</td>
</tr>
<tr>
<td>We do not know the full consequences of our actions on Nature.</td>
<td>Known and well-functioning technologies are better than risky technologies. It is better to prevent damage than to depend on our ability to cure the damage. (Precautionary principle)</td>
</tr>
<tr>
<td></td>
<td>Transparency and co-operation in food production can be improved by nearness. For example, using experience-based knowledge and local interests concerning the development of cultural and social values. (Nearness principle)</td>
</tr>
</tbody>
</table>

**Figure 2.** Fundamental assumptions and principles relating to the development of organic farming.
As shown in Figure 2, the acquisition of information and knowledge about Nature and agriculture can be used to develop organic farming. Central to this is the importance of having a high degree of certainty about the possible consequences of using new technology, and an assurance that the development is in accord with cultural and social values.
3 Technological questions relating to the development of organic farming

In the Danish journal "Økologisk Jordbrug" (Organic Farming) there are often articles and debates on the development of organic farming. For example, there have been several statements about new tillage processes and the housing and treatment of farm animals. Similarly, on many occasions there have been contributions and articles on relationships between producers and customers as well as the general development of agriculture.

A working hypothesis is that the development of organic farming depends very much on the acceptance or rejection of new technologies. Ideally, this choice is determined on the basis of principles and values. Any disagreements in principle can be revealed by examining accepted new technology and relating this to basic organic principles.

In Tables 2 – 4 an attempt has been made to assimilate the last 10 – 15 years’ debate on the use of new and older technologies that appeared in Organic Farming.

Furthermore, an assessment is made of the extent to which this technique can be considered to be acceptable in relation to organic production.

3.1 Plant production
Table 2 illustrates that in the area of plant production there are many examples of the use of new technology in recent years. There are, however, certain exceptions, in particular the ban on Genetically Modified Organisms (GMOs) and synthetic sprays.

There has been, and there still continues, a debate on the steaming of top-soil and greenhouse production in compost (i.e. tillage systems without soil). The steaming of top-soil does occur, however, in greenhouses.

It is also evident that the debate has also extended to older technologies, such as spraying with sulphur and copper sulphate.
Table 2. Examples of techniques and inputs that are used and / or can be used in organic plant production

<table>
<thead>
<tr>
<th>Technology:</th>
<th>New technology:</th>
<th>Older technology:</th>
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<tbody>
<tr>
<td></td>
<td>Accepted</td>
<td>Under debate</td>
</tr>
<tr>
<td>Manually controlled row cultivation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Mechanically controlled row cultivation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Weeding robots</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Flame treatment</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Steaming of top-soil</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Straw covering</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Net covering</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Plastic covering</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spraying with sulphur</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spraying with copper sulphate</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spraying with humus and silicon preps.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spraying with plant extracts</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spraying with chemicals</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Kemink system (deep cultivation)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Driving with heavy machinery</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of stubble / catch crops</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Use of compost</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of farmyard manure / liquid manure</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Use of slurry</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of artificial fertilizers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Greenhouse production without soil</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Traditional plant breeding</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Use of GMOs</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of micro organisms (EM)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of conventional varieties</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of conventional manure</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of fossil fuel</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use of bio-gas</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
3.2 Animal production

In animal production (Table 3) there are only a few examples of new techniques that have been accepted without question. At the same time there are many older techniques that are under debate or banned. The limits of tolerance of new technology are evidently lower when it concerns individual farm animals than they are for plants or the herd / flock as a whole.

Table 3. Examples of the technology debate in organic animal production

<table>
<thead>
<tr>
<th>Technology:</th>
<th>New technology:</th>
<th>Older technology:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accepted</td>
<td>Under debate</td>
</tr>
<tr>
<td><strong>Orientated to the individual:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dehorning of cattle</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Castration of cattle</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Ringing the noses of bulls</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Castration of pigs</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Ringing the snouts of pigs</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Filing or clipping of teeth</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tail docking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beak trimming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curative medicines - synthetics</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Curative medicines - non synthetics</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Orientated to herds / flocks:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prophylactic medicines with synthetics</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Vaccinations</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Mechanical milking</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Milking robots</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use of traditional breeds</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use of artificial insemination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of embryo technology</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use of GMO</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Large herds / flocks</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Covered outdoor areas</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>No-straw systems</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>No feeding of roughage / zero grazing</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Feeding of silage</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Fully automated feeding</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Use of conventional feeds and straw</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Sale of bull calves</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Feeding with green pellets</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Loose housing</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
3.3 Processing, marketing and re-cycling

Within the areas of processing, marketing and re-cycling (Table 4), new technology is generally accepted for marketing, whereas the questions of processing and the recycling of town waste are subject to much greater debate.

Table 4. Examples of questions that are discussed in the areas of processing, distribution and sales, and the re-use of town waste

<table>
<thead>
<tr>
<th>Technology:</th>
<th>New technology:</th>
<th>Older technology:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accepted</td>
<td>Under debate</td>
</tr>
<tr>
<td>Homogenisation of milk</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pasteurisation of milk/cheese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additives</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Packaging</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Washing of vegetables and potatoes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Farm gate &amp; market sales</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Supermarket sales</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sales by subscription arrangements</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sales via the internet</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Long distance transport</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Re-use of human urine and compost</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Re-use of sludge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-use of human faeces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work environment</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
3.4 Discussion on the use of new technology

In the following a discussion is given of the level of agreement between the examples given in Tables 2 – 4 and the principles presented in Figure 2.

It can be seen that in all the examples there is apparently broad acceptance of machine technology. Against this there is concern about or a ban on technology connected with synthetic (chemical or biological) inputs. The rationale behind this agrees well with the precautionary principle, since the use of machine technology is more limited and predictable in relation to Nature than are chemical and biological inputs.

The ban on artificial fertilizers cannot directly reflect the precautionary principle since the technique is well known, and its consequences predictable in relation to Nature. It can, however, be motivated by the cyclical principle, at least under Danish conditions in which large excesses of nutrients are sometimes used. The problem is, however, that in line with increasing specialisation in organic farming, the ban on artificial fertilizers itself causes increased use of resources for the transport and handling of organic manures, as well as a dependence on conventional agriculture.

This can produce conflicts with other environmental issues, as well as with the nearness principle.

The use of organic manures, preferably in the form of well-rotted compost, is and has been considered to be most appropriate for organic farming. To a large extent this may relate to biodynamic farming principles in which the incorporation of oxygen and humus preparations into animal manures is seen as an important step for preserving and producing “living soil”. Correspondingly, biodynamic farmers use other preparations, such as silicon, to promote the ripening process in corn. It must be recognised, however, that these farming practices are currently used to only a very limited extent in Denmark.
The use of slurry (ideally preserved undegraded and in the absence of oxygen) in organic farming has been the subject of much debate. Nevertheless, slurry-based systems now constitute a widely used and well-understood technology amongst organic farmers. The shift from compost to slurry rests with the accumulation of information over the last 15 years, several investigations having shown that animal manures, in the form of compost, have greater risk of losing nitrogen than does slurry. Furthermore the fertilizer value of compost is much lower than that of slurry, particularly for the production of corn on sandy soils. It has not yet been shown that compost gives rise to better quality products and/or higher fertility (see, for example, DARCOF report No. 7, 2000).

A corresponding shift in technology is seen in cattle production, where silage is now widely used in organic farming. Silage is green material that is compacted and conserved under anaerobic conditions, in contrast to, for example, hay that is dried and stored aerobically.

The shifts in technology for the conservation and use of animal manures and feed are very fundamental, at least in relation to the biodynamic farming principles that formed an important backdrop to Danish organic farming. They provide a good example of the learning process that is taking place in organic farming. At the same time it is important to emphasise that this process is locally and nationally based on research findings and practical experience alike, the question of slurry use, in particular, having been widely discussed. From the middle of the '80s, organic farming in Denmark became more established, it adapted its technologies to Danish conditions.

In the area of animal husbandry, a number of older practices relating to individual animals (e.g. de-horning, castration, ringing, and the clipping of teeth, etc.) have been debated in recent years. These practices can rightly be said to constitute an interference in the nature and integrity of the animal, but they cannot be justified on the basis of the precautionary principle since they are well known, predictable and without risk to Nature. The background to this debate is thus the widespread Danish interest in animal welfare. In Denmark the salient attitude is regard for the animal according to a consciousness-centred ethic in which all conscious beings have a moral claim on respect. This attitude is not necessarily shared in, for example, many southern European countries.
At the present time the acceptance of these older practices for interfering in the nature and integrity of animals is unclear. On the other hand, the fact that tail-docking and beak-trimming are forbidden is not an issue (Table 2). This can be explained by the fact that the latter practices were primarily designed to counter the consequences of poor production systems, whereas other interventions are undertaken in respect to such factors as the environment, product quality, and the safety of man and animal. Thus, at the individual level within organic farming the balance between respect for animals and concern for other matters is continuously being assessed. The special feature of organic farming is that, based on the precautionary principle, known and well-functioning practices are given precedence, whereas interventions relating to the size and efficiency of production are not accepted. In addition, consideration of other production systems may perhaps instigate a new assessment.

With regard to developments at the herd level, several new technologies have been debated in recent years (Table 2). Bans have been imposed on the use of GMOs and prophylactic medicines in accordance with the precautionary principle and the findings of risk assessments. Prohibitions have also been placed on production systems in which straw is not used for bedding, as well as systems that do not use roughages or allow access to outdoor areas. These exclusions can be explained on the basis of the cyclical principle, since they ensure a relationship between forages and herds and thus the demand for harmony on the farm. Loose housing is a new method that is widely accepted in organic farming because it satisfies the natural behaviour needs of animals better than by the tie-stall system that constituted the most common type of housing at the beginning of the 1990s.

In contrast to the situation in other countries, there is currently a great deal of learning associated with the introduction of new methods of processing and marketing to Denmark (Table 3). This is explained by the different cultural backgrounds and the fact that the relationship of these approaches to Nature is much less intrusive than with plant production, for example. It is difficult to imagine a ban on the washing of green vegetables and potatoes, since the technology is well known and its consequences for Nature are predictable. In contrast to the situation in Sweden, there is a ban on the homogenisation of organically produced milk in Denmark, where this technique has been discussed and found to be unnecessary. In German-speaking countries there is much scepticism about Supermarket sales.
4 Discussion and perspectives for the development of organic farming

4.1 From local sale to large-scale organic operation

Examination of the technical questions discussed in the previous section shows that there is reasonably good accord between practical developments in organic farming and the precautionary and, to some extent, the cyclical principles, respectively. It can also be seen that a great deal of learning has occurred, and that many new techniques have been introduced which do not contravene its basic philosophy; for example, in the areas of weed control, the anaerobic storage of manure and feed, and the use of loose housing in place of the traditional tie-stall system.

At the same time it can be seen that virtually all the techniques accepted in Tables 2, 3 and 3 have helped to raise the productivity of organic farming. These techniques have contributed to the increase of farm size and specialisation. The size of organic farms in Denmark has doubled from an average of 20 hectares in 1990 to 43 hectares in 2000; and these units are three times as big as the average of those in Switzerland and Austria.

As a consequence of larger farm sizes and specialisation, pressures on the three principles outlined in Figure 2 will continue to exist, particularly with respect to the cyclical and nearness principles. These developments will particularly affect physical distances and the concepts of versatility, variety and harmony in relation to Nature. In the Danish organic debate of the last 10 – 15 years, most emphasis has been placed on other parts, especially the material aspects of the cyclical and precautionary principles.

There are good reasons to believe that structural pressures will continue, particularly those associated with the increase in farm size and specialisation. Competition between organic farmers will increase this pressure, especially in a situation of over-production. Organic farmers should therefore consider the extent to which developments can be regulated or controlled with a view to maintaining confidence in this form of agriculture. In this context they should consider whether the nearness principle should be followed more explicitly.
Using local and experience-based interpretations of the nearness principle, in earlier times organic farmers were more easily able to maintain an inner consistency and relationship in the development of production at the local level. When products are disposed of locally customers become part of the local learning process. The problem is, however, that this basis for development does not harmonise well with the current rapid advance and internationalisation of organic agriculture. Free competition and the movement of products over long distances mean that quality symbols and the associated controls and regulations are the key to continued progress. To secure customer confidence and belief in organic products there must not be too many labels or quality symbols, and the arguments for choosing these products must be clear and unambiguous. There is thus a big need to re-interpret the nearness principle, such that its interpretation is expanded from the local to the national and international levels.

The alternative is to tighten up local conditions by, for example, banning sales via supermarkets, the internet, and other routes that do not involve direct trading and communication between the producer and the consumer. This alternative would reduce organic farming to a niche enterprise, however, since by far the greatest part of organically produced produce is sold without direct communication between these two groups. On the other hand, in the national and international perspective, Danish organic farming exploits the advantage of having only one organic trade mark that is well known and enjoys considerable confidence.

4.2 Simplified basic control to ensure product credibility

In the earlier development of organic farming, when there were fewer organic farmers and most were members of the same organisation, it was relatively easy to maintain a common organic philosophy based on the same values and principles. The modest size and identical affiliations of the organic group meant that there was not the same need to formulate common values and convert them to regulations since the physical proximity and informal social control between farmers (and between farmers and their customers) was sufficient to secure reliable production. In association with the modern changes in organic farming, however, there is an increasing need to explicitly formulate these values such that they become more precise and better motivated. This is necessary because informal social control is no longer sufficient for ensuring credibility. Regulations must therefore be introduced as the basis of control, with the subsequent option of sanctions.

In Denmark this process has involved extensive collaboration between the authorities and many interested organisations, and has resulted in the formulation of appropriate legislation and comprehensive regulations. The latter, and especially the controls, guarantee to the customer the credibility of organic production and its compliance with the rules of organic farming. In those situations where “inappropriate” conditions have been observed in organic production they have often been followed up with demands for further regulation and/or further control.
Amongst the most pressing motivations for a transition to organic farming in Denmark is the desire for a better environment, an agronomic challenge and more stable earnings. Criticism of conventional agriculture plays a much smaller role for recent converts than it did for the pioneers of the organic movement (see Table 1). Earlier, organic farmers were almost all members of the National Association for Organic Farming (LØJ), the membership of which also included many customers. Today the largest organisation for organic farmers is the Danish Farmers Union that primarily organises conventional farmers.

Against this background there is no unequivocal picture of organic farming in Denmark. Amongst customers who are generally critical of conventional agriculture the distinction between conventional and organic farming can in some situations be blurred. This could have big implications for the credibility of organic produce.

There is thus a big need for clarity and simplification in our understanding of what organic farming really stands for, such that it comes to stand out as a real production alternative and not simply as a production method that complies with a set of more or less transparent regulations. The following lists a few examples of things that would raise the credibility of organic produce:
a. Relationships between producer and customer
There is a need to further develop production, processing and marketing systems that are founded on close relationships between the producer and customer. These could include subscription arrangements and customer co-operatives in which the consumer is joint owner (Community Supported Farming, CSf).

b. Openness and transparency
There is a need for marketing systems that build on greater openness and transparency, in which the producer is no longer anonymous. For this, real information about the producer should be given on the packaging, or a particular route of sale should give information about the associated farms and invite customers to visit them.

c. Simpler and more principled regulations
Regulations of the type used in conventional farming or those that have little significance for organic farming should be excluded. Instead a few, simple regulations should be applied that emphasise the difference from conventional agriculture. For example:

- the ban on artificial fertilizers, pesticides and GMOs
- the demand for grazing and roughages in animal production
- increased withdrawal times for medicines
- tighter controls on the importation of non-organic fertilizers and feed
- rules that oppose specialisation (e.g. the demand for fewer animal equivalents per hectare)
- rules that promote the nearness principle (e.g. specification of places of origin and energy utilisation).

The marketing systems mentioned under a. and b. above can be considered as a modernisation of the nearness principle in which physical or geographical proximity is replaced by emotional nearness. They can therefore effectively advertise and symbolise organic farming. It should, however, be recognised that since we are talking of emotional nearness there is no guarantee that the remaining organic principles are respected, particularly those discussed under the cyclical principle, such as energy utilisation, versatility and the recycling of nutrients. Regulation is therefore the key for maintaining the credibility of organic produce, and the big challenge to research is to ensure that these regulations are founded on the best possible information.
5. References


Noe, E., 2000. What is happening with “organic farming” in Denmark? The Danish case analysed from an ANT perspective. Submitted for publication.


Danish research in organic farming

Organic farming addresses many problems in contemporary agriculture. A regard for the environment and Nature, animal welfare, product quality and health is part of its underlying values. The promotion of organic production, involving the advancement of research, has therefore been an aspect of Danish agricultural and food policy for many years.

To enhance the development, production and marketing of organic produce several initiatives were taken in the 1990s. In Aktionsplan for fremme af den økologisk fødevarerproduktion i Danmark [Action Plan to promote organic food production in Denmark] (Organic Food Council, 1995) and the following Aktionsplan II – Økologi i udvikling [Action Plan II – Ecology in development] (Organic Food Council, 1999) initiatives are described that are designed to secure continuing growth in organic production. In this context, a large number of problems and challenges are pointed out that research activities must help to solve.

In Action Plan II it is emphasised that crucial to the continued transition to organic farming is the solution of several key problems that currently present a barrier to further developments; for example the need to increase the production of several plant products. At the same time it is essential that the quality of organic produce is improved since any advancement must occur in line with customer demands.

The main objective of Danish research activities in the area of organic farming in the period from 2000 to 2005 (DARCOF II) is therefore to raise the production of organic produce and, at the same time, secure the relationship between their inner and outer qualities. This must be achieved by developing production systems that build on the desire to actively raise the natural aspects of organic farming, improve animal health and welfare in organic production systems, and improve the quality of organic produce, etc. This objective thus demands far more of research than simply solving problems of food quality, animal health, and environmental pressures. The intention is that organic principles can be reflected in the associated organic produce, which can then stand out as real alternatives to conventional products.

Within the framework of DARCOF II, 30 big projects are currently being undertaken which in different ways help to satisfy the main objectives of this research. The total input corresponds to about ECU 25 million. In most cases the projects were set up in collaboration with groups of scientists from different research institutes.

Research projects in DARCOF II, February 2001

Plant Cultivation

I.1 Organic production of cucumber and tomato grown in composted plant material from field crops
I.2 Development of sustainable production systems for apple and strawberry
I.3 Interactions between nitrogen dynamics, crop production and biodiversity in organic crop rotations analysed by dynamic simulation models
I.4 Nitrogen management and cropping methods for enhanced bread wheat production
I.5 Grain legumes and cereals - new production methods for increased protein supply in organic farming systems
I.6 Cultivation in ridges and mixed cropping – new approaches to organic row crop production
I.7 Soil quality in organic farming: Effects of crop rotations, animal manure and soil compaction
I.8 Perennial weeds species in organic farming
I.9 Band-heating for Intra-row weed control
I.10 Development of organic vegetable cultivation methods, and the use of catch crops to improve the production and protect the environment
I.11 Organic clover and grass seed
I.12 Preventing Mycotoxin Problems
I.13 Emission of greenhouse gases and dinitrogen fixation in grass-clover pastures

Animal husbandry
II.1 Future organic dairy production systems
II.2 Resource use, environmental impact and economy in organic pig production systems

II.3 Organic Production of Steers and Use of Bioactive Forages in Livestock
II.4 Improvement of animal health and welfare in organic dairy production with special focus on the calves
II.5 Use of antimicrobials and occurrence of resistance in organic cattle herds
II.6 Poultry production systems, health and welfare
II.7 Pig feeding under organic farming conditions with emphasis on nutrient utilisation, product quality and health.
II.8 Management in relation to health and food safety in organic pig production

Agriculture and society
III.1 Consumer Demand for Organic Foods – Domestic and Foreign Market Perspectives
III.2 Economic analyses of the future development of organic farming. Effects at the field, farm, sector and macroeconomic levels
III.3 Closing the Rural-Urban Nutrient Cycle
III.4 Organic food and health – a multi-generation animal experiment
III.5 Nature Quality in Organic Farming – Localisation, farm practice, biological conservation, ecosystem functioning and landscape aesthetics
III.6 Development of organic farming systems for environmentally sensitive areas

IV. Experimental units for research in organic farming systems
V. Co-ordination and synergy – increasing the width and depth of research in organic farming
The Principle Aims of Organic Production and Processing

Organic Production and Processing is based on a number of principles and ideas. They are all important and are not necessarily listed here in order of importance.

To produce food of high quality in sufficient quantity.
To interact in a constructive and life-enhancing way with natural systems and cycles.
To consider the wider social and ecological impact of the organic production and processing system.
To encourage and enhance biological cycles within the farming system, involving microorganisms, soil flora and fauna, plants and animals.
To develop a valuable and sustainable aquatic ecosystem.
To maintain and increase long term fertility of soils.
To maintain the genetic diversity of the production system and its surroundings, including the protection of plant and wildlife habitats.

To promote the healthy and proper care of water, water resources and all life therein.
To use, as far as possible, renewable resources in locally organised production systems.
To create a harmonious balance between crop production and animal husbandry.
To give all livestock conditions of life with due consideration for the basic aspects of their innate behaviour.
To minimise all forms of pollution.
To process organic production using renewable resources.
To produce fully biodegradable organic products.
To produce textiles which are long-lasting and of good quality.
To allow everyone involved in organic production and processing a quality of life which meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment.
To progress towards an entire production, processing and distribution chain which both socially just and ecologically responsible.

IFOAM Basic Standards 2000, p. 10