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EVALUATING THE POTENTIAL CONTRIBUTION OF ORGANIC AGRICULTURE TO SUSTAINABILITY GOALS

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Preface

This paper was prepared by Ms. Els Wynen, consultant, under the guidance of the Environment and Natural Resources Service (SDRN). The first draft of this paper was shared with experts throughout FAO and IFOAM's Head Office for comments. The paper has been further reviewed by Ms. Kathleen Merrigan. In light of the many views expressed, SDRN has brought the document to its present form.

The ambition of this paper is not to give an answer to the extent of the contribution of organic agriculture to farm sustainability but to raise attention to the factors requiring special consideration in such evaluations. The FAO position on organic agriculture will be the subject to its governing bodies' recommendations following their discussions on the issue in January 1999. A number of studies are foreseen in the coming future to provide a better information base for the many aspects of organic agriculture. A particular point to be developed (and not sufficiently addressed in the present paper) will be the nutrient and energy balance - one of the important parameters in evaluating the sustainability of production systems.

The thoughts advanced in this paper are based on existing data and information on organic agriculture in developing countries which are, as many would expect, rather scarce. More focused statements would need extensive field research. This paper has therefore attempted to offer a conceptual framework that could be used for evaluating the sustainability and productivity of existing or potential organic agriculture systems, under different bio-physical and socio-political settings.

In a complex world subject to continuous change and new information and experience, we can only provide a tentative approach to reality. The participatory and adaptive nature of these findings makes this paper an "evolving" document, subject to further refinement. Any feedback on eventual gaps and usefulness of this document would be welcome for its development.

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1. INTRODUCTION

The question considered in this paper is how to evaluate the feasibility of organic agriculture[1] and its impact on farm sustainability, and hence its role in food security. FAO (1996a) defines food security as "...a situation in which all households have both physical and economic access to adequate food for all members, and where households are not at risk of losing such access B There are three dimensions implicit in this definition: availability, stability and access. Adequate food availability means that, on average, sufficient food supplies should be available to meet consumption needs. Stability refers to minimizing the probability that, in difficult years or seasons, food consumption might fall below consumption requirements. Access draws attention to the fact that, even with bountiful supplies, many people still go hungry because they do not have the resources to produce or purchase the food they need. In addition, if food needs are met through exploitation of non-renewable natural resources or degradation of the environment, there is no guarantee of food security in the long term".

The concept of food security involves a number of issues, such as population growth, resource availability (e.g., land, minerals and capital), infrastructure (e.g., transport), institutions (e.g., land-tenure, agricultural support systems, marketing systems, social relationships, legal systems) and international trade (FAO 1994). Many argue that those, indeed, are the major factors inhibiting food security, and that the actual agricultural system is only of secondary importance in solving the problems of food security. When the focus is on the agricultural system, as in this paper, the question is therefore not whether a particular farm management system can secure food as defined above, but whether certain systems are more appropriate for moving towards a situation of food security.

Sustainable food security entails producing and consuming food in a manner that conserves the regenerative capacity of the natural resource base and maintains biodiversity for present and future generations. The feasibility of any alternative to present agricultural production systems must, therefore, include considerations which are related to sustainability. Such considerations were crystallized during the FAO/Netherlands Conference on Agriculture and the Environment in 1991: "In evolving towards more sustainable production systems, agriculture and rural development efforts should ensure the attainment of three essential goals: food security by ensuring an appropriate and sustainable balance between self-sufficiency and self-reliance; employment and income generation in rural areas, particularly to eradicate poverty; and natural resource conservation and environmental protection." (FAO, 1991).

In this paper, the organic agriculture system comes under scrutiny, with particular attention being given to developing countries. The quest for a better management system entails increased availability of food, production stability and access to food. The conditions determining whether organic agriculture can offer a feasible agricultural system are discussed.

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1. The term "agriculture" includes agriculture, aquaculture and forestry systems. Although most cases reviewed for this study cover agricultural systems in the strict sense, this paper's issues and considerations apply to the agricultural sector in its broadest sense.

2. DEFINING ORGANIC AGRICULTURE

Organic agriculture is best known as a method of agriculture where no synthetic fertilizers and pesticides are used[2]. This description does not mention the essence of this form of agriculture, however, which is the management of farms in such a way that soil fertility and pest problems are prevented. Although many single techniques used in organic agriculture are used in a wide range of agricultural management systems, what differentiates organic agriculture is the focus of the management. Under the organic system, the focus is on maintaining and improving the overall health of the individual farm's soil-microbe-plant-animal system (a holistic approach), which affects present and future yields. The emphasis in organic agriculture is on using inputs (including knowledge) in a way which encourages the biological processes of available nutrients and defence against pests, i.e., the resource "nature" is manipulated to encourage processes which help to raise and maintain farm productivity. The soil is a central part of that system. Most fertilizers and pesticides are considered to hinder that process and are, therefore, prohibited. As can be seen from the list in Box 1, in organic agriculture, management is directed towards preventing problems, while stimulating processes which assist in nutrition and pest management.

For market purposes, a strict definition of organic agriculture is required to protect both producer and consumer interests. Definitions were first developed in the private sector. The most widely adopted definition was developed and promoted by the International Federal of Organic Agriculture Movements (IFOAM), a non-governmental organization that has existed for 25 years (see Box 2). The IFOAM Principle Aims are used as guidelines for setting standards for organic agriculture in individual countries. The word "organic" (or a similar word) is protected by law in a number of countries (see US definition in Box 2). Long before the word was legislated, the need was felt within organic agriculture circles to define the concept, and to spell out, in considerable detail, what it meant in practice. The details, as described in the standards, are the minimum requirements to which those working with organic products (such as farmers, processors, transporters, retailers) need to keep themselves. Apart from indicating to the producer which practices are allowed, standards (and the certification structure which goes with them) safeguard fair competition within organic management. That is, nobody can sell products under the name while using cheaper practices which are not allowed under organic management. At the same time, standards indicate clearly to the consumer what the conditions are under which the products are grown.

2. The word "pest" is used in this paper as an umbrella word referring to all forms of life of negative influence on farm productivity, including insects, weeds, fungi, nematodes, livestock parasites, etc. Similarly, the word "pesticide" covers all agricultural biocides such as insecticides, herbicides, fungicides, nematicides and anthelmintics.

BOX 1: ORGANIC MANAGEMENT PRACTICES

Soil management practices include increasing humus content and biological activity as well as meeting mineral deficiency of soils:

- manipulation of crop rotations and strip-cropping: deep and shallow rooted plants bring different nutrients to the surface; different crops require different nutrients;
- growing green manure;
- undersowing;
- application of rock dust, manure, crop and agro-industry residues, household waste, compost;
- soil tillage, such as use of an implement which aerates the soil.

Pest management practices include:

- manipulation of crop rotations, to minimize survival of crop-specific pests (in the form of, for example, insect eggs, fungi) which can infest the next crop;
- strip cropping, to moderate spreading of pests over large areas;
- manipulation of pH-level or moisture level of the soil (in irrigated areas);
- manipulation of planting dates, to plant at a time most optimal for the crop, or least beneficial for the pest;
- adjustment of seeding rates, to achieve an optimal rate given the need to crowd out weeds or avoid insects;
- use of appropriate plant varieties and livestock breeds for local conditions;
- implementation of stock culling programmes, which emphasize genetic resistance against certain diseases;
- use of stock buying programmes, which minimize the import of diseases onto the farm;
- limiting field size, which aids in weed management by livestock;
- biological control methods, to encourage natural enemies of pests by providing habitat (for example hedges) or by breeding and releasing them in areas where they are required;
- trapping insects, possibly with the use of lures such as pheromones;
- biological pesticides (for example, derris dust, pyrethrum, rotenone) of which the active ingredient is short-lasting, and which may be produced locally.

Post-harvest practices include:

- in temperate countries, grains can be well conserved when harvested and stocked in conditions which allow air circulation (in jute sacs, ventilated silos, etc.);
- in tropical countries, humidity and high temperatures pose problems which can be overcome through: harvesting at complete maturity and during dry weather; storing without stripping off the bark; drying of grains under the sun before storing; mixing sand, china-clay, or wood ash to grains; adding little quantities of nut oil to niebe grains (very effective on weevil); addition of smoke or certain plants to repel insects; etc.;
- in ancient Europe and the Mediterranean basin, grains were stored in buried pits for several years: the anaerobic conditions of these pits prevented insect proliferation and the grains underwent an initial fermentation which protected it from insects and mouldiness, despite the high degree of humidity;
- traditional procedures allow conservation and enhancement of the nutritional value of cereals and leguminous, such as: fomenting rice (rice is bathed, steamed and dried) destroys insect eggs; transforming wheat in bourghoul (wheat is germinated, boiled, dried and crushed) enriches the cereal with vitamins and essential amino-acids (lysine) and pre-digest starch; fermenting certain leguminous (for example, soy in the Far East and nere in Africa) gives high nutritional quality products which can be conserved for years; fermented fish sauce (nuoc-nam) allows simple fish conservation and offers an alternative to fish drying, especially that the latter entails inevitable losses in tropical conditions.

BOX 2: DEFINITIONS

The word “organic” is legally protected in some countries. In the EU, for example, this word has been protected since the early 1990s in English-speaking countries. The equivalent in French, Italian, Portuguese and Dutch-speaking countries is “biological”, and “ecological” in Danish, German and Spanish-speaking countries.

<u>IFOAM definition</u>:

The International Federation for Organic Agricultural Movements (IFOAM), established in the early 1970s, represents over 600 members and associate institutions in over 100 countries. IFOAM (1996) defines the “organic” term as referring to the particular farming system described in its Basic Standards. The “Principle Aims of Organic Agriculture and Processing” are based on the following equally important principles and ideas:

- to produce food of high nutritional quality in sufficient quantity;
- to interact in a constructive and life enhancing way with all natural systems and cycles;
- to encourage and enhance biological cycles within the farming system, involving micro organisms, soil flora and fauna, plants and animals;
- to maintain and increase long-term fertility of soils;
- to promote the healthy use and proper care of water, water resources and all life therein;
- to help in the conservation of soil and water;
- to use, as far as is possible, renewable resources in locally organized agricultural systems;
- to work, as far as possible, within a closed system with regard to organic matter and nutrient elements;
- to work, as far as possible, with materials and substances which can be reused or recycled, either on the farm or elsewhere;
- to give all livestock conditions of life which allow them to perform the basic aspects of their innate behaviour;
- to minimize all forms of pollution that may result from agricultural practices;
- to maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats;
- to allow everyone involved in organic production and processing a quality of life conforming to the UN Human Rights Charter, to cover their basic needs and obtain an adequate return and satisfaction from their work, including a safe working environment;
- to consider the wider social and ecological impact of the farming system;
- to produce non-food products from renewable resources, which are fully biodegradable;
- to encourage organic agriculture associations to function along democratic lines and the principle of division of powers;
- to progress towards an entire organic production chain, which is both socially just and ecologically responsible.

IFOAM notes that “Genetic engineering focuses on the genetic makeup without taking into account the complete organism or system in which the organism functions. It is thus a contradiction to the above mentioned principle aims of organic agriculture.”

<u>US definition</u>:

In 1980 the US Department of Agriculture defined the concept of organic agriculture as follows: “...a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. To the maximum extent feasible, organic agriculture systems rely upon crop rotations, crop residues, animal manure, legumes, green manure, off-farm organic wastes, mechanical cultivation, mineral bearing rocks, and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests’. The report also included the following observation: “The concept of the soil as a living system which must be "fed" in a way that does not restrict the activities of beneficial organisms necessary for recycling nutrients and producing humus is central to this definition.”

Organic standards, in which the definition is set out for practical application, stipulate not only the prohibition of use of certain inputs but usually dictate a range of practices to be followed that will ensure a farm maintains its sustainable productive capacity**.** In other words, farms on which no synthetic fertilizers and pesticides are used but where no alternative measures are taken to cope with fertility and pest issues are not necessarily accepted as organic. The factors required to classify as organic agriculture depend partly on local circumstances in terms of needs and availability of resources. For example, in a country where organic agriculture is not widely adopted, and where no organic seedlings are available, seedlings originating in conventionally managed enterprises may be used on an interim basis. Similarly, in such a situation, manure may not always be available from organic farms, and sourcing it from conventional farms may sometimes be allowed. Restrictions, such as the requirement to compost the material, may be in force. Since no technology is available to determine whether organic standards have been adhered to, certification of the production process at the farm level, as opposed to product certification, was specifically chosen to ensure that organic products were indeed grown according to organic standards. Consequently, the certification process is complicated, since it includes ascertation that the farmer has incorporated a number of practices to cope with soil fertility and pests, as appropriate, in the particular area where the farm is located.

Although minimum standards have been set for many countries, standards differ between countries. However, if fundamental differences are found between local standards and those of IFOAM, an organization with those standards would be deemed unacceptable by IFOAM and hence by many traders in organic products. As mentioned before, the aim of organic agriculture is to stimulate biological processes in order to encourage nutrient needs of crops and livestock, and pest management. Since conditions influencing these factors are not the same in all countries, differences in standards are acceptable. In fact, from an economic point of view, total homogeneity of standards worldwide would be rather inefficient. At present, FAO/WHO Codex Alimentarius Commission is developing internationally applicable organic agriculture standards to protect consumers against deception and fraud. The Codex definition of organic agriculture is quoted in Box 3. The Codex Alimentarius Commission will also assist in harmonizing national legislation and settling international disputes on trade in organic produce.

BOX 3: CODEX DEFINITION

Most recently, the Codex Committee on Food Labeling has debated “Draft Guidelines for the Production, Processing, Labeling and Marketing of Organically Produced Foods”; adoption of a single definition for organic agriculture by the Codex Alimentarius Commission is expected at its next meeting in June, 1999.

According to the proposed Codex definition, "organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system."

Many organizations or countries have their own certification scheme, which needs to be of the same level as, or of higher standard than, IFOAM's guidelines. In total, more than 100 national or regional standards have been developed, some of them in developing countries, in particular in Latin America. Certification can be carried out by an organization outside the country, especially if no national standards for organic agriculture are available, and no local certifying organization exists. Developing countries in particular make use of this possibility, as setting up the infra-structure needed for certification of organic products (standards, inspection scheme, ratification, appeal procedures, etc.) can be costly, and is seldom self-financing, especially in the early stages. In the early days of organic certification, traders found it sometimes difficult to know which schemes genuinely certified organic produce. IFOAM has developed an Accreditation Program, which evaluates certification schemes and hence assists both the traders and the evaluated scheme.

If the gains from organic agriculture are internalized (that is, if the total benefits of adopting organic management are received on the farm itself) production standards may not be critical. However, if the word "organic" is not protected and no effective certification exists, it may be considerably more difficult to safeguard a premium, if one exists. In one study (UNDP, 1992) the absence of the protection of the word "organic" was mentioned as a reason for the organic farmers being unable to make the most of the available premium. In some countries (such as China) interest in organic markets is mainly due to price premiums in the market (Thiers 1997). In such cases, an official certification system is essential.

3. GROWING INTEREST IN ORGANIC AGRICULTURE

Up until the early 1990s, organic agriculture was practiced by less than one percent of farmers in most countries. Since the 1990s, adoption rates of organic agriculture have increased considerably, especially in Europe - in the German and Scandinavian speaking countries. In 1996 Austria (the only country which equates sustainable agriculture to organic agriculture), counted over 7 percent of its agricultural land as being under organic management, and Switzerland 6 percent (for more details, see Ecology and Farming (1996), and Wynen (1997)). The Central and Eastern European countries show the same trend in growth, although the absolute rates of adoption are considerably lower at present, with a growth from below 4 000 hectares under organic management in 1990 to over 94 000 hectares in 1996 (N. Lampkin, University of Wales, Aberystwyth, personal communication, May 1997).

Changes in government policies, especially in Western Europe, are a major contributing factor to the increase in adoption rates of organic agriculture. In those countries with a high growth rate in particular, government support was provided in areas such as conversion, education, research, extension and marketing. The European Union supports organic agriculture through its agro-environmental programme, where Regulation 2078/92 covers both conversion to, and continuation in, organic agriculture (Lampkin and Weinschenck 1996). This support clearly recognizes the environmental benefits of organic agriculture.

The growth in interest in organic agriculture in the developed world is also attributed, in large part, to the problems experienced with existing practices, both on and off the farm, which threaten food security. The following are some examples:

- degradation of soil quality (structure and fertility) (NRC,1998; Hodges and Arden-Clarke 1986);
- pollution of soil, water and food with pesticides and nitrates;[3]
- health effects on farmers, farm workers, farm families, rural communities (apart from concerns about the non-intended effects of pesticides on human beings in general, sound use of pesticides requires a technical knowledge which is often lacking in developing countries);
- resistance of pests to pesticides;
- dependence on off-farm agricultural inputs which can increase poor farmers' dependence on credit facilities (to purchase synthetic fertilizers, pesticides and seed), which may result in decreased local food security and self-reliance.

Recognition of problems caused by synthetic fertilizers and pesticides has led a number of developing countries to reduce, or totally abolish, subsidies on those inputs. For example, in Indonesia where, after a period of subsidies on pesticides, the use of this input was prohibited while efforts were put into Integrated Pest Management programmes. In China, pesticide problems in products both on the domestic and export market has resulted in government involvement in certification organizations for "green food", including also a small amount of organic produce (Thiers 1997). Both these policies facilitate a shift towards organic agriculture.

Completely different problems are experienced by farmers in areas where more food is needed, but where the successes of the Green Revolution are not achieved. In those areas, the option, with an expanding population or deterioration of the existing land base, is to move into the more marginal areas. Paarlberg (1994) calls this "first generation rural environmental problems", where soil erosion, tree cutting and habitat destruction occur. This happened especially amongst those who owned little or no land in fertile areas in Asia, and in general in Africa. In Latin America the poor, making up more than 90 percent of farmers in many countries, are also in this category. For people in such circumstances, different reasons are relevant for interest in organic agriculture. They can include low external input use, with a decreased need for credit and interest payments, and decreased risk in production. Certainly in the initial stages, delivering to niche markets, and thereby securing premiums, can be important (see, for examples, UNDP (1992); Ong (1997); Thiers (1997)). These premiums can be available for organic production *per se* or for a fair trade component.

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3. Pollution by pesticides and nutrients is an area of great concern in many countries. Some countries have taken action to curb their use of agricultural pesticides and nutrients, such as Sweden, Denmark and The Netherlands. In some areas organic agriculture is encouraged, in order to decrease the negative effects of conventional agriculture on drinking water (Heid 1997; Egmont-Florian 1997).

Respondents to surveys on reasons to farm organically in developed countries mention the health of the farmer and the farmer's family and problems with soil, crop, livestock, and the wider environment. Some of those reasons (such as problems with crop and livestock) are directly related to potential financial returns to farming; others to non-financial costs (such as health and considerations for the environment) (see, for example, Lockeretz and Wernick (1980); Lockeretz and Madden (1987); Wynen (1989); and Wynen (1992)). Reasons for decreased input costs and increased output prices, although mentioned, never took on the importance of the aforementioned problems.

In developing countries, reasons to change management systems will, of course, be rather dependent on the actual situation, as conditions vary between and within countries. Reasons to shift to organic agriculture mentioned by farmers in developed countries are likely to be relevant only to those farmers in developing countries with, what Paarlberg (1994) calls, "second generation rural environmental problems". That is, farmers (mainly in Asian countries) who adopted the technology of the Green Revolution (in which they combined the planting of higher yielding crop varieties with excess water and fertilizer use, inadequate nutrient and animal waste containment, loss of biodiversity and excessive reliance on pesticides) and have now encountered problems. These include farm family health, resistance to pesticides, secondary pests, deterioration of soil and water quality, drop in groundwater level, and increased risk of crop diseases. In Latin America, this includes some of the non-peasant farmers who, encouraged by export booms and domestic subsidies, have used synthetic fertilizers and pesticides to such a degree that environmental problems proved inevitable.

Despite government policies during these last decades to subsidize agricultural inputs, these remain out of reach to poor farmers. In Senegal, peanut production in the Fleuve watershed uses today 10 percent of the fertilizer volume it applied in 1978 because of the farmers' decreased capacity to invest for purchasing this input. Farmers in Senegal attribute decreased productivity to expensive credits, delays in receiving inputs, harvest losses during heavy rains (that also decrease fertilizers' efficiency), compacted soils, non-remunerative prices, and management problems, especially water (von der Weid, 1998). Farmers of the developing world tend to prefer more resilient systems that build on traditional management systems to technologically-costly production systems. Organic agriculture can respond to these needs by contributing to the intensification of traditional management systems and their diversification. It shares with farmers the traditional logic that aims at optimizing the diversity of natural conditions but needs to import scientific knowledge for an enhanced use of natural resources.

Information about details on technical aspects (what optimal kind of rotations, which crop varieties to use, optimal planting dates, nutrient status of organic materials or crop row distances) are often most urgent in the conversion stages, but can be important for a longer time. Organic farmers in Australia required information on ways to cope with specific production problems (such as weeds, source and efficiency of inputs which could be used in production, and marketing arrangements) for a long time after conversion (Wynen 1992). It should also be recognized, however, that many organic agriculture practices would become "common knowledge" if this management system were to be practiced by many and over several generations, so that the need for a certain kind of information will decrease over time. Although the basic principles can be introduced from outside, expertise on local conditions is essential. Lack of knowledge means that shifting to organic agriculture is considered by many as risky.

4. INFORMATION GAPS

As organic agriculture is not practiced or studied by many people, knowledge on technical details is often scarce. Although it has been shown that organic agriculture is interesting in connection with the levels of returns to inputs and pollution, lack of formal research means that there are many questions remaining about why and how the system works. Lack of more information on organic agriculture in general, and on specific technical details in particular, is generally mentioned as the first obstacle to shifting to organic agriculture. Centers such as the Kenyan Institute of Organic Agriculture (located in Nairobi) and Gami Seva Sevana in Sri Lanka are established with the purpose of filling this gap. Sharing and enhancing traditional knowledge in developing countries is very important in organic agriculture.

For the developed world, insights in the topics of bio-physical and socio-economic characteristics of organic agriculture have been the focus of many studies, especially in the last decade. In contrast, relatively few studies of organic agriculture in developing countries have been undertaken. Many articles on this subject relate to practical experience, but have emited few scientific data. Perhaps the most extensive study, which greatly contributed to the development of this paper, is by the United Nations Development Programme (UNDP), which commissioned a 1992 study on organic agriculture in developing countries, to "...determine if organic agriculture systems can be an attractive alternative for current non-sustainable practices".[4]

Researching basic questions related to organic agriculture could, apart from increasing progress in organic agriculture, yield a high pay-back in terms of returns to applying the principles in areas of conventional farming. At the same time, progress in organic agriculture is, by its very nature of making use of local resources, dependent on knowledge of optimum local conditions. For example, a certain crop rotation in one place might prove excellent in keeping a particular weed within manageable limits, while in a different place (with a different climate) the threat of a potential insect pest requires a different rotation. In particular, soil fertilization varies between agro-ecosystems and even within production

[4.] The geographical distribution of the case studies indicates a wide distribution. In total, projects in 21 countries were included (i.e., Asia and Pacific: 4; Near East: 3; Sub-Saharan Africa: 6; Latin America: 8). Of the total, 6 projects were situated in marginal degraded areas, 12 were related to export-oriented organic agriculture, and 3 were oriented equally towards cash and food crops. This distribution was due mainly to the nature of the study (which was to be short), so that those projects were chosen for which data were reasonably easily accessible at the time. Most of the studies only considered aspects of one (main) crop, and many of the projects were still in the conversion stage (where yields can often be lower, and investments higher, than when the farm is an established organic farm). One of the cases described by UNDP was elaborated further in Werf (1993), where he studied 7 pairs of farms on a number of agronomic aspects in which the two systems differed, and then calculated the financial differences between the two systems, based on market prices (no premiums for organic products).

systems and parcels. There are, therefore, no ready-made solutions and extensive experimentation work and creativity are required.

Specific solutions are required, adapted to environmental conditions, level of organization and participation of farmers, and existence of qualified technical support. More often than not, related scientific information will be lacking in extension and research services. Besides the need to re-orient research agenda and train extension and development workers in organic agriculture, farmers play a crucial role in advancing research. In particular, the mobilization of traditional knowledge and dissemination of innovations introduced or known by farmers are an essential starting point for more responsive agricultural research. Technicians can greatly assist farmers in developing adapted technologies in a better position to respond to sustainability goals. Results of collective farmers' research can be documented in several countries of Latin America, Africa and Asia. Farmers knowledge of their agro-ecosystem, analytic capacities and willingness to experiment and innovate offer immense opportunities for research and hence, an improved information base.

Because of the public good properties of many inputs used in organic agriculture, unless a specific attempt is made by public policy bodies, a comparative lack of knowledge in organic agriculture will remain. Therefore, a first step in increasing the availability of knowledge on organic agriculture is to acknowledge that this form of agriculture could be an interesting option for agriculture both in developed and developing countries and that it has a role in improving food security and environmental sustainability, especially in poorly endowed environments. Extensive communication with those who have expertise in the area of organic agriculture is advisable. More active support could be given in the area of implementing projects for the collection of relevant data.

5. EVALUATING THE POTENTIAL OF ORGANIC AGRICULTURE

5.1. Difficulties in evaluating the feasibility of organic agriculture

It is difficult to assess the likelihood of success in organic agriculture. Several concerns need to be born in mind when evaluating the feasibility of organic agriculture in a given environment. These factors include:

- parameters reflecting greater "sustainability" do not necessarily imply organic practices;
- in practice, it will often be difficult to differentiate between the effect of different factors on a farming system, as the introduction of organic management could be not the only change at the time (for example, a number of years with very (un)favourable weather conditions);
- some parameters (such as yield) need to be averaged over a number of years, as factors other than the management system influence variability between years (for example, weather);
- benchmark figures, which indicate the conditions before a change occurs in a system, are not always available. In such cases, they must be obtained before organic

management is adopted but this is not always possible (especially when resources are scarce);
- many of the changes may be observable only in the long-term, such as changes in yield or soil;
- because organic agriculture is such an under-researched area, conditions which initially seem difficult may be easy to cope with after some experience has been gained, and *vice versa*; and
- those who have no experience in thinking within the context of organic agriculture are not likely to be able to judge possibilities in organic agriculture accurately.

Success in organic agriculture also depends greatly on local conditions. Organic agriculture is a production system which tries to create conditions such that problems with soil fertility and pest management are prevented, in order to optimize present and future output. One of the main characteristics of organic agriculture is the use of local resources to achieve this aim (including on-farm biological processes such as availability of pest predators or soil fungi which make nutrients more accessible to the plant). In Box 1 several individual techniques are listed but these can obviously be combined in many ways, with different weights on individual techniques. As potential agricultural problems, and availability of resources to cope with those problems, can differ greatly from location to location, the practicalities of organic agriculture can also vary considerably. For example, in areas with an abundance of organic material and labour, using compost as a way to maintain soil fertility may be more logical than using green manure in the rotation. This means that constraints can also differ greatly between localities. Determinations of the suitability of organic agriculture must include agro-ecological, economic, and social and institutional considerations, as given below.

5.1.1. Agro-ecological considerations

- availability of natural resources: such as land, soil quality, vegetation, access to material which can be used in compost and mulch, availability of other materials such as rock dust;
- evaluation of other resources needed, such as machinery and tools;
- suitability of enterprises, that is, crops to be grown or livestock to be raised, given the availability of natural and other resources;
- problems to be expected: which pests are common, what is the cause, what can be done to avoid them within available resources? For example, a primary pest may be avoided by planting at a time when the insect cannot complete its life cycle, even though that results in a certain decrease in yield due to non-optimal conditions in other aspects such as heat; a secondary pest could stop after abandoning the use of pesticides and natural predators return;
- total production of all enterprises, not only of the main enterprise; yield difference in good and bad years (that is, yield variability).

5.1.2. Economic considerations

- labour requirements (quantity and timing of labour);
- total net return, that is, income (or use) from main crop and other crops and livestock, minus the cost of the inputs used for the production;
- long-term productivity: the effect of present production on the soil and implications for future yields;
- marketing possibilities: in times when consumers are willing to pay a premium, improved marketing possibilities should be taken into account when production decisions are made.

Suitability of a system (such as organic agriculture) depends on its profitability, if that concept includes all aspects which affect the farmer's welfare. For example, low return of a marketable crop as compared with another farming system may mean very little if inputs are also low, or if the farmer can harvest other products which can be grown simultaneously in the one system, but not in the other (such as fish with irrigated rice when no pesticides are used). In addition, relative incomes can change drastically with changing input or output prices. A pest problem may be managed easily in one area where a predator is present, and be a major problem in a different area where no such solution is available (such as changing planting dates). One opinion is that organic agriculture is only possible where the soil is high in organic content, yet successful organic farms can be found on all kinds of soils, including infertile soils. In other words, although it is likely that some conditions are easier for organic farmers to handle than others, at present it is not clear what exactly those conditions are which make it inadvisable for farmers to adopt an organic management system.

5.1.3. Social and institutional constraints

Respondents to a survey amongst European researchers in organic agriculture mentioned that constraints for the advancement of research in organic agriculture were institutional rather than technical (Wynen (1997). In other words, technical problems were seen as being surmountable. Gabriel (1994) came to a similar conclusion during a workshop with researchers in sustainable agriculture in the USA. The most important institutional considerations include:

- belief systems: possibly, the single biggest constraint to the development of organic agriculture is that most people in all kinds of areas, including scientists, researchers, extension officers and politicians strongly believe that organic agriculture is not a feasible option to improve food security. For this reason, very few farmers can obtain information about this management system, even when they inquire about it. If those who make policy decisions on the allocation of resources, such as for research and extension, are not aware of the possibilities of organic agriculture, no positive consideration towards this farming system can be expected;
- land tenure: the land-tenure system is important in assuring farmers that the future benefits of current farm improvements can be achieved. If this is not so, long-term investments which improve sustainability will not be made;

• vested interests: organic agriculture differs greatly in input use from conventional agricultural systems. Many of the inputs used in organic agriculture are public goods (which can be used without impeding use by others, such as knowledge about practices). Hence, there is little private interest in promoting particular inputs which are used in organic agriculture;

• social obstacles: survey respondents in developed countries often mention the social isolation which organic farmers endure as a result of their choice of management system. Farmers in Australia feel that they were considered “odd” or “eccentric” and that they needed a “thick skin” to be able to withstand the social pressure (Wynen 1992). This factor is also mentioned in literature in developing countries, but it is difficult to know how important an obstacle this is in a change. Other social obstacles can include the rights of other than the farmer to use materials such as crop residuals or animal manure;

• private investment: the advancement of organic agriculture to date has to a large extent been due to private investment. This has been in the form of consumers’ willingness to pay for organic commodities (price premiums) and farmers’ readiness to experiment and innovate, despite the risks involved with such on-farm research.

5.2. Issues requiring scrutiny when contemplating a shift to organic agriculture

A shift to organic agriculture brings about significant change. First, the composition of the inputs changes. Together with a reduction in the use of synthetic fertilizer and pesticides, an increase of other inputs can occur, such as organic material, labour and machinery. At the same time, rotations change, affecting yields and yield variability, total production and income (both present and future). This, in turns, influences food security, and the environment. Those changes are often influenced by, and influence, social changes within the community. In all cases, farmers will want to evaluate five issues to determine their likelihood of success in organic agriculture.

5.2.1. Labour input

.2.1. Labour input

Labour costs are an important input in the production process. Many studies find that labour can be a major impediment to the adoption of organic agriculture. Lampkin and Padel (1994) noted that, in many European countries, labour costs on organic farms are high, although some of those costs cover marketing and processing activities. In Australia, in contrast, Wynen (1994) found that both in the cereal-livestock and dairy sectors, labour requirements on organic and non-organic establishments were not different.

Projects in the UNDP study (1992) showed labour requirements to be high on some organic farms, especially on plantations, as well as on those organic farms where labour-intensive methods were used, such as composting. In cases with a high opportunity cost for labour (such as on plantations), higher total costs in the organic projects were seen. In some cases, labour and total costs were lower on private organic farms. For example, Werf (1993) found that median labour used on the seven Indian organic farms was lower than on the non-organic farms. However, that was by no means true of all projects in which individual farmers were involved.

If compared to large-scale mechanized agricultural systems, organic systems appear more labour-intensive. This is especially true in areas with low ecological potential. Many techniques used in organic farming require significant labour (e.g., Zai planting pits, strip farming, non-chemical weeding, composting). In the developed world, labour scarcity and costs may deter farmers from adopting organic management systems. This is also true for cash-poor farmers and those supplementing their incomes with off-farm work.

However, where labour is not such a constraint, organic agriculture can provide employment opportunities in rural communities. Furthermore, the diversification of crops typically found on organic farms, with their various planting and harvesting schedules, may result in more work opportunities for women and a more evenly distributed labour demand which helps stabilize employment.

The timing of labour requirement is an important aspect of labour in developing countries. The question whether organic agriculture, with its tendency for diversification of crops, brings with it a more evenly distributed time of labour requirement, is yet to be settled. However, as planting and harvesting dates are not similar for all crops, labour requirements are likely to be spread out over the year.

Another important issue to consider, however, is not the quantity of labour, but the quantity of output per unit of labour, or labour productivity. While organic agriculture is likely to generate good labour productivity, the issue of wage depends on a number of other factors.

5.2.2. Other inputs

Decreasing the use of synthetic fertilizers and pesticides goes together with increasing other inputs. These inputs can be bought or produced on the farm (such as manure), others come in the form of knowledge about actions to be taken (e.g., timing of planting or best rotational combinations,). In addition, the change in the combination of inputs may change the effectiveness of certain processes which influence farm output, such as the cycles of water, nutrients, energy and knowledge (inter-generational). Farmers' knowledge of local conditions and of traditional practices are of key importance in the success of organic agriculture.

Other inputs used are seed or animal breeds, water and energy. The emphasis of crop seeds and animal breeds used in organic agriculture is on local suitability with respect to disease resistance and adaptability to local climate. Due to the change in soil structure and organic matter content under organic management, water efficiency is likely to be high on organic farms. Water scarcity and erosion of agro-biodiversity are indirectly addressed by organic agriculture since this form of agriculture relies mostly on endemic biodiversity that is resilient to local ecological stress (e.g., drought). Studies evaluating the impact of organic agriculture on water security and agro-biodiversity have not been available for this review.

In general, non-renewable energy inputs are used on organic farms. Standards for organic agriculture include environmental degradation as a criterion for acceptance of certain practices. However, there are many conventional farms where environmental pollution is kept to a minimum. In general, in developed countries, the financial cost of inputs (excluding labour) on organic farms can be lower than on many non-organic farms (see Lampkin and Padel 1994), although the magnitude differs between enterprises and countries. The difference is generally greatest in those enterprises where inputs can be readily substituted by low-cost alternatives, as fertilizers by nitrogen-fixing crops or green manure. For those inputs where substitutes are costly, such as labour cost for weeding (often in more intensively grown crops), differences in expenditure on input between organic agriculture and other systems tend to be relatively low, or costs on organic farms can be higher.

In the 21 projects reported in UNDP (1992), the input requirements generally shifted from off-farm to on-farm inputs or inputs available from nearby farms. In a number of cases, livestock became of greater importance to the farm than it had been. However, on a tea plantation, where many soil nutrients were applied, the cost was higher than on the non-organic part of the plantation.

Werf (1993) found the median variable costs on the organic farms in South India to be lower than on the paired non-organic farms, although five of the seven organic farms had higher variable costs (as calculated for all inputs, including those derived from the farm). However, some of the organic farmers adopted organic practices because the cash component of the input costs was lower on the organic farms (50 percent of the calculated cost as compared with 67 percent on High-External Input Agriculture - HEIA - farms). Other methods used in organic agriculture, generally to cope with soil fertility and pest management problems, were evident on the farms in this study. There was a higher diversity of crops and stock on organic farms (measured in number of crops per farm, number of trees per farm, and kinds of livestock on the farm). The number of techniques used to maintain soil fertility (such as deep rooting crops, use of farm-yard and other manure, night soil and compost), and to increase plant diversity (such as intercropping, hedges, alley cropping, cover crops, multistorey cropping) was also greater on organic farms.

Zemp-Tapang (1996) reported on the adoption of organic agriculture practices in Northern Ghana, in one area by an entire village. Her informants, growing mainly sorghum, millet, cowpeas, groundnuts, sweet potato and maize, stressed the importance of substituting fertilizer with organic matter (either in the form of crop residues or composting any organic material available locally).

5.2.3. Crop rotation

.2.3. Crop rotation

While not exclusively practiced by organic farmers, crop rotation is required under organic certification programmes and is considered to be the cornerstone of organic management. Agricultural pests are often specific to the host (such as a particular crop), and will multiply as long as the crop is there. Manipulation of crops between years (management by rotations) or within fields (strip-cropping) is therefore an important tool in the quest for management of pest problems, and also for maintaining soil fertility. As the use of synthetic fertilizers and pesticides allows the farmer to grow the crop which is financially most rewarding, not using those inputs leads to restrictions in choice of crops. The loss in (present) income through a change in rotation is to some degree reflected in, and compensated by, the decrease in input costs. Projects discussed in UNDP (1992) are a good example of the importance of a widening of rotations, and inclusion of more crops or livestock on organic farms, leading to greater diversity on organic farms.

The success of an organic farm depends on the identification of end-uses and/or markets for all the crops in the rotation, as few farmers can afford to leave fields fallow. This remains one of the most significant challenges in organic agriculture.

5.2.4. Yield

.2.4. Yield

Lampkin and Padel (1994) gathered a number of studies on the economics of organic agriculture in many developed countries. In their analysis of these studies, it was concluded that yields on organic farms fall within an acceptable range.[5] Another finding in Lampkin and Padel (1994) was that, contrary to popular belief, yields on organic farms in the 1990s were significantly higher than those on farms before the 1950s, thus dispelling the notion that organic agriculture is "going back to the past". Part of this progress can, presumably, be attributed to new plant varieties and better knowledge on how to manipulate biological processes within agricultural systems.

A factor which can also make a difference in yields is the time and length of the growth period of a crop. Due to slow mineralization of nitrogen under cool growing-conditions, crops on organic farms have a shortage of nitrogen early in the season. However, in countries where low soil temperature is not a limiting growth factor, as in many developing countries, this factor should not prove significant. The variability of yield and financial returns has been a topic of study in developed countries. Lampkin and Padel (1994), analyzing results of several studies, found no clear indication that the management system is a major factor in the degree of yield and financial variability. They hypothesized that exogenous factors (such as climate) are more likely to be important in this regard.

A growing number of success stories are being recorded. Stable, high yields under organic management were also recorded in the Philippines, where Padilla (1991) found rice yields of 6.1 ton per hectare on Bontoc irrigated rice terraces, without the use of modern cultivars, synthetic fertilizers and pesticides. Ten years earlier a similar yield (6.2 tons per hectare) was recorded by Omengan (1981; as reported in Padilla (1991)). This compares with 7.3 tons per hectare in IRRI's long-term experiments, including new cultivars and fertilizer (N-P-K:140-30-30) grown in the dry season (no indication was given about yields under irrigation).

Projects in UNDP (1992) showed a varied picture, where especially the export-oriented crops show low yields. Most of these projects were trader-initiated, and therefore possibly

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5. The study found that the greater the output per hectare in High External Input Agriculture (HEIA), the larger the difference in yields between the systems. This factor is of great interest in connection with developing countries, as on many farms optimal production conditions do not exist in any case. This point is borne out by Werf (1993), who found that the median yields over two years were higher on organic farms for 4 out of the 5 crops. Some of these were considerably higher (such as 54 percent for paddy rice), while the median for finger millet, the only crop with lower yields, was 7 percent lower on organic farms.

more assured of a output premium, so that optimal production was less important. An interesting case with relatively high organic yields was a tea plantation, where considerable resources had gone into the provision of organic matter with a resulting 11 percent increase in yield. This increase was not as spectacular as that reported in some other cases, for example in Burkina Faso, where yield increases in climatically good yields were reported of 10 to 50 percent, and in adverse years of three times that on HEIA fields.

Pretty, Thompson and Hinchcliffe (1996) show high yields for sustainable farming, defined as using low levels of external inputs. Apart from low levels of external inputs used, other characteristics of the projects from which these data originate included: group or collective approaches in production; an emphasis on farmer-centered activities and involvement of women as key producers and facilitators; exclusion of certain activities (such as temporary provisions of subsidies to "buy" the participation of local people); and an emphasis on value-added activities.

Experiences of organic production in ecosystems with low-productivity potential such as in Wardha, India, have demonstrated the potential to double or triple average yields through traditional management (Chetana-Vikas, 1996). The results are of course due to very low initial yields on these lands but such conditions correspond to many countries of the developing world. If similar results were to be achieved in the less endowed regions of the world, present food deficits could be partly resolved. In any case, increased yields are more likely to be achieved if the departure point is a traditional system, even if degraded, rather than a modern system.

5.2.5. Total farm production

It is important to discuss not only yields, but also whole farm production. The total production on the farm is the yield times the area in the different crops or that used for livestock. Usually it is measured per unit of land (hectare), but when other inputs are critical, such as labour or water, these could be judged as being more appropriate as indicators. When measuring production, one also needs to be aware of the concept of net production, especially relevant in developing countries. This refers to the production net of specific inputs, such as the costs of nutrients. It is very easy, for example, to increase the yield of a cow by feeding her concentrates. The question is, however, whether it was worth the extra input. This can be determined by an assessment of the net returns to farming.[6]

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6. In the UNDP study (1992) results on the net returns to farming are somewhat mixed. Out of the 11 projects, 9 show an increase in net income on the organic enterprises, and 2 a decrease. When premiums are deducted, 5 of the 11 organic projects showed higher net returns than non-organic farms. Werf (1993) found the median gross income (calculated on the basis of all products, including those consumed domestically, and based on local, non-premium, prices) to be higher for non-organic farms than for the organic farms, although 4 of the 7 organic farms had a higher gross income per hectare than their neighbour. However, those organic farmers also had higher variable costs per hectare (as mentioned above), which led to a median gross margin (gross income minus variable costs) lower for organic farms. The median net cash income per hectare (gross margin minus fixed costs) and the returns per person day were higher on organic farms. Five organic farmers had a higher net income per hectare than their neighbour.

In situations where inputs are subsidized, as fertilizers and pesticides have been in a number of developing countries, the financial returns on organic farms may not be as attractive. Similarly, not counting the environmental and health costs of such inputs as is generally the case, means that organic agriculture is under-valued. It should be realized that, during the conversion process**,** yields may be lower and investments higher than at a later stage when the organic farm has been established. The net returns to farming can therefore be lower in such a period than later. In the UNDP study several of the case studies were still in the conversion stage.

5.3 Potential impacts

5.3.1. Long-term productivity

Protecting soils and enhancing their fertility or land stewardship implies ensuring productive capacity for future generations. Deteriorating soil quality is often quoted by farmers as a major reason for adopting organic management, as in many of the projects described in UNDP (1992) and as referred to by many South Asian NGOs assisting farmers who have adopted the Green Revolution technologies (1996 field observations by Nadia Scialabba). It can, therefore, be assumed that those farmers who adopted organic management practices found a way to improve the quality of their soil within the new management system, or at least stemmed the deterioration. There is sufficient research carried-out to know that organic agricultural methods do have a positive influence on soil quality (see, for example, Reganold (1995); and several papers in Oestergaard (1996) and Kristensen and Hoegh-Jensen (1996)).

However, in the quest to improve soil quality for the future, probably the single most important factor to determine whether farmers are interested in the issue is whether they will benefit from the change. Security of land tenure is, therefore, an extremely important factor in this respect. If security is not guaranteed, there is little reason for farmers to invest in a method that will bring them income in the future rather than immediate rewards.

5.3.2. Food security and stability

.3.2. Food security and stability

In organic agriculture in general, and on most of the projects mentioned in UNDP 1992, a diversity of crops are grown and kinds of livestock kept. This diversification means that the risk in variation in production is spread**,** as different crops react differently to climatic variation, or have different times of growing (both in the time of the year and in length of growing period). This implies that, although there is less chance of a bumper year for all enterprises on organic farms (likely to coincide with relatively low prices), there is also less chance of low production for all crops and livestock simultaneously, thus contributing to food security and stability of food available for consumption. Decreases in the variation of yields has the same effect as a spreading of enterprises.

Food security is not necessarily achieved through food self-sufficiency. Consumers' demand for organically-produced food and sometimes impressive premiums provide new export opportunities for farmers of the developing world, thus increasing their self-reliance. Although few studies have assessed the long-term potential of such market premiums, returns from organic agriculture have the potential, under the right circumstances, to contribute to local food security by increasing family incomes.

Organic agriculture can contribute to local food security in several ways. Organic farmers do not incur high initial expenses so less money is borrowed. Synthetic inputs, unaffordable to an increasing number of resource-poor farmers due to decreased subsidies and the need for foreign currency, are not used. Organic soil improvement may be the only economically sound system for resource-poor, small-scale farmers.

This characteristic of the production process on organic farms means that organic farmer-consumers are less dependent on a factor over which they may have little control, thereby increasing the food security situation. In some of the projects studied in UNDP (1992) low cash costs were cited as a major reason for starting organic agriculture.

5.3.3 Environmental impact

Organic farmers forego the use of synthetic fertilizers. Most certification programmes also restrict the use of mineral fertilizers, which can only be used to the extent necessary to supplement organic matter produced on the farm. There are environmental advantages to this: non-renewable fossil energy needs and nitrogen leaching are often reduced. Instead, farmers enhance soil fertility through use of manure (although the kind and its handling has a great effect on nitrogen content and poor usage can create leaching problems), crop residues (e.g. corn stover, rice residues), legumes and green manures, and other natural fertilizers (e.g., rock phosphate, seaweed, guano, wood ash). Disadvantages to discarding synthetic fertilizer must be considered as well: energy needs can escalate if thermal and mechanical weeding or intensive soil tillage is used and, in some cases, organic farmers burn to clear land which reduces fertility. Many resource-poor farmers do not have access to livestock manure, often an important fertility component. Sometimes sewage sludge is used, which may contain pathogens and other contaminants. Finally, some areas in tropical countries may have such low soil fertility that synthetic inputs are necessary.

Organic farmers rely on natural pest controls (e.g. insect pheromones, plants with pest control properties) rather than synthetic pesticides which are known to kill beneficial organisms (e.g., bees, earthworms), cause pest resistance (e.g., in Asia, cotton is sprayed 15-16 times a season versus 5-6 times ten years ago), and oftentimes pollute water and land.

Soil protection techniques used in organic agriculture (e.g., terracing in the humid tropics, cover crops) combat soil erosion, compaction, salinization, and degradation of soils, especially through the use of crop rotations and organic materials which improve soil fertility and structure (including beneficial microbial influence and soil particle evolution). Integrating trees and shrubs into the farm system also conserves soil and water and provides a defense against unfavourable weather conditions such as winds, droughts, and floods.

Techniques used in organic agriculture also reduce water pollution and help conserve water on the farm. A few developed countries subsidize or compel farmers to undertake organic production as a solution to water quality problems. In certain areas around Muenchen (Germany) farmers are paid to convert to organic agriculture in a bid to maintain drinking water quality of the city (Heid 1997). In Brittany (Northern France) whole valleys are compelled to convert to organic agricultural management as drinking water is found to be of unacceptable quality (Egmont-Florian 1997).

Organic agriculture requires a diversity of crops and livestock. Many indigenous food crops (e.g., yam, sorghum, millet, oil palm, cashew, mango) supplanted by monoproduction of cash crops, pseudocereals (e.g. amaranth, buckwheat, chenopods), grain legumes (e.g., adzuki, faba, hyacinth beans) and other under-utilized plants, many of great value, can be reintroduced through crop rotations. This contributes to whole farm health, provides conservation of important genotypes, and creates habitats for beneficial species.

Although inappropriate management of inputs used in organic agriculture may be detrimental to the environment (such as an excess of manure or compost affecting water quality), one of the aims of this management system is to "minimize all forms of pollution that may result from agricultural practices". Standards are, therefore, expected to reflect local conditions so that pollution is minimized. For example, restrictions on the number of livestock or amount of manure to be used per unit of land are not exceptional.

5.3.4. Social impact

The social impact of a change towards organic agriculture is recognized as an important aspect as witnessed by its inclusion in IFOAM's Principle Aims (see Box 2). However, it has been argued that, at present, these are areas of peripheral attention, as compared to the scientific aspects of the management system. The following are some of the issues:

- the site-specific nature of organic agriculture also means that indigenous species and knowledge, so often discounted, are of great value. In many places, this knowledge has been eroded with the introduction of high external input agriculture, promotion of monocultures, and selection of "improved products." Farmers may readily welcome a management system close to their own traditions and not driven solely by a production ethic;
- organic management which relies on local knowledge of complex interactions and variations of conditions from place to place does not favour large production areas. Organic agriculture therefore carries an enhanced potential for more equitable distribution and access to productive resources, namely land;
- engaging in organic production means experimenting new techniques, introducing different management of labour time, investing efforts in different management of space, adapting and refining solutions to change, comparing different options with farmers that have similar conditions, and making appropriate choices. This can only be achieved through farmer's participation in research and its application. This on-farm research component can support rural communities, and generate new knowledge that will benefit all farmers;
- consistent labour needs, combined with the enhanced capacity of the land and protection of water associated with organic agriculture, may encourage people to permanently locate and thus reinvigorate rural communities;

- some of the projects mentioned in UNDP (1992) changed, together with the production system, the social environment of the workers engaged in organic agriculture, namely their working conditions. For example, workers were provided with plots of land for home vegetable production, improved housing situations and child care facilities;
- the concept of "fair trade" has long been part of IFOAM's guidelines. It implies a concern of the buyer for social justice for those who work in agriculture, especially with regard to a "fair wage". In fair-trade projects, traders ensure that producers receive a minimum return for their produce irrespective of the actual market price, while also other conditions can be part of the contract, such as continuation of the contract in the future. At present, certification which guarantees fair trade does not necessarily imply organic production, although IFOAM encourages fair trade projects (IFOAM 1997). Organic certification organizations favourably consider inclusion of "reasonable wage conditions" in the overall evaluation of a project;
- improving the situation of women in agriculture is recognized as an important issue within organic agriculture. However, a more structured way of action is advocated by Allen (1996). Availability of work, gender distribution of labour and access to knowledge are key considerations;
- within organic agriculture, the use of locally available inputs is encouraged, the effect on the local community of such a form of agriculture is, therefore, likely to be greater than when inputs are imported from outside the community;
- in those cases where synthetic fertilizers and pesticides are imported, adoption of organic agriculture techniques means a decrease in imports, decreasing the need for foreign currency. Although it is not clearly the case that labour needs on organic farms are higher, where value adding activities (such as processing and marketing) are developed, more labour input and a different distribution of labour can be required. The present market characteristics of organic agriculture make this more likely within this form of agriculture.

6. SUMMARY AND CONCLUSIONS

Interest in organic agriculture methods is growing, especially in areas where the present farming system has degraded resources essential to agricultural production (especially land). Non-production factors, such as the farmer's health, are also mentioned as a reason for shifting to organic management. Consumers also have an interest in organic agriculture. Consumer awareness of the environmental costs of agriculture (such as the deteriorating quality of drinking water and soil, and the impact of agriculture on landscape and wildlife) is increasing. The awareness of environmental quality and health is often promoted by environmental groups, especially in developed countries. The resulting demand for organic products creates the opportunity to sell organic products at premium prices, enabling organic farmers to continue, and often expand.

Some governments have begun to recognize the possibility that it may be cheaper to support organic agriculture than to rectify problems associated with certain resource-destruction production practices. For this reason, several governments have introduced subsidies for organic agriculture. These subsidies come in many forms, such as direct payments to farmers (both for those in the conversion stage and also for established organic farmers), and indirect aid (such as for education, research, extension and marketing).

In developing countries, two schools of interest in organic agriculture practices can be detected. First, some farmers switch to organic production without the incentive of price premiums, finding other economic and environmental reasons sufficient for management changes. In this case, improved conditions on the farm are the main focus of concern, especially increased and more sustained production as compared with what has been possible previously. Less dependence on outside inputs is also noted. As well as economic and environmental impacts, the introduction of organic principles in agricultural management brings social benefits as farmers adopt a logic close to their traditions and values.

However, if the emphasis is on future improvements, land tenure conditions are of utmost importance, where tenure is important for interest in future possibilities. An additional, but debatable issue, is that production in organic agriculture is often said to be less variable than under other management systems. In climatically adverse years, yields on organic farms can be observed to be relatively high; in areas where drought conditions are common, this can be an important point in relation to availability of and accessibility to food.

More frequently, farmers switch to organic agriculture in order to secure market premiums. In this second case, the increased income can help in improving the local food security situation, but variations in price over time should be anticipated. At present the size of the organic market is small (typically less than one percent in most countries), and therefore a small change in organic production will mean a large percentage change in quantity available, influencing price. Increased organic production in the future may have a depressing influence on prices; however, increased consumption may offset any downward pressure on prices.

It is often believed that organic agriculture is easier to undertake under certain conditions, especially where the situation is good for agriculture in general, such as on fertile soils. However, organic agriculture can be found in many different bio-physical settings. In fact, some of the projects referred to in this paper were located in rather poor areas. Nonetheless, consideration should be given to the locations and circumstances that most suit the development of organic agriculture.

National governments can play a role in encouraging the adoption of organic agriculture in developing countries. Research and development, education and extension into organic agriculture methods, legalization of the word “organic” and implementation of a certification scheme, and refraining from manipulating input and output prices (such that organic agriculture becomes less attractive to farmers) as well as the all important issue of land-tenure, all merit policy consideration.

However, the most important factor that will enable organic agriculture to usefully contribute to food security is the attitude of decision-makers. Organic agriculture must be discussed with an open mind, with the advantages and disadvantages being clearly considered. Only then can developing countries fully determine the potential of organic agriculture under various conditions. FAO can play a key role in promoting a more objective debate on the potential role of organic agriculture, and identifying the circumstances where organic agriculture can be applied most beneficially.

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