African Organic Agriculture Training Manual

A Resource Manual for Trainers

1 DEFINITION AND BENEFITS

Draft Version 1.0
June 2011

Ready for field testing

FiBL

IMPRINT

Publisher:
FiBL, Research Institute of Organic Agriculture, Switzerland, www.fibl.org

Collaboration:
› IFOAM, International Federation of Organic Agriculture Movements, Germany, www.ifoam.org
› NOGAMU, National Organic Agricultural Movement of Uganda, www.nogamu.org.ug
› FENAB, Senegal
› OPPAZ, Organic Producers and Processors Association of Zambia, www.oppaz.org.zm

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Draft version 1.0, September 2011.
This is an interim version. Comments and recommendations for improvement are welcome.

All materials resulting from the Africa Organic Agriculture Training Manual project are available free of charge in the internet under www.organic-africa.net

The production of this manual was funded by the Bill and Melinda Gates Foundation and the Syngenta Foundation for Sustainable Agriculture with the goal to promote organic farming in Africa.

The African Organic Agriculture Training Manual is based on research funded by the Bill & Melinda Gates Foundation and the Syngenta Foundation for Sustainable Agriculture. The manual's findings, conclusions and recommendations are those of the authors, and do not necessarily reflect positions or policies of either Foundation.

Please cite this publication as follows:
FiBL (2011): African Organic Agriculture Training Manual. Version 1.0 June 2011. Edited by Gilles Weidmann and Lukas Kilcher. Research Institute of Organic Agriculture FiBL, Frick

ISBN 978-3-03736-197-9

CONTENTS

DEFINITION AND BENEFITS

Learning targets for those actors who will be trained in this module:

- Understand the key challenges facing agriculture in Africa
- Understand the similarities, differences and cross-learning opportunities between agricultural systems such as traditional agriculture, conventional agriculture, sustainable agriculture, agroforestry, conservation agriculture, organic agriculture
- Determine the most appropriate and, in the long-term, most successful farming approach under specific local conditions
- Understand the specific requirements, benefits and potential of organic agriculture in Africa
- Learn how to analyse and discuss openly pros and cons of different agricultural systems

1. Introduction

More than 60 percent of the population in sub-Saharan Africa lives in rural areas and depends on agriculture as the main source of livelihood. Agriculture's dominance in Africa's economies makes its performance a major determinant of the continent's economic development. Despite vast arable land with potential to feed Africans and produce surpluses for export, undernourishment and famine are widespread and even increasing. Africa today is a net importer of food and its food trade deficit has been widening. The low productivity of farm labour and land is a clear indication of the untapped potential of Africa's farms.

Facing this challenge, there is an increasing need to re-think the overall approach to agricultural development in Africa. There is a tremendous need for innovation, for locally adapted technologies and a need to cross-learn from each of the various agricultural systems and models in order to increase the productivity, sustainability and resilience of food production in Africa. African farmers need support to increase their knowledge, capacities and skills to develop their own technology to sustainably produce more food. Interdisciplinary approaches are required, involving economic, ecological, social, cultural and political dimensions.

CHALLENGES OF AGRICULTURE IN AFRICA

This introductory module provides the trainer background-information to facilitate open initial discussions amongst the training participants about challenges and possible solutions as well as about the potential benefits organic agriculture can provide. Details about organic farming tools and management techniques are the focus of the following modules. Section 2 of this module provides an overview of the key challenges facing agriculture in Africa. Section 3 discusses a range of possible agricultural systems applied in Africa. Organic agriculture is one of the systems in the 'family of sustainable agriculture' with a high potential to provide valuable solutions for the African rural population and a high level of ecosystem services. Section 4 focuses on the definitions, tools and benefits of organic agriculture. Section 4.2 aims to give scientific background to the debate about the benefits of organic agriculture, quoting studies and literature. This section may be theoretical for most farmers, but it is important background information for trainers, advisors and researchers.

Understanding the challenges to agriculture

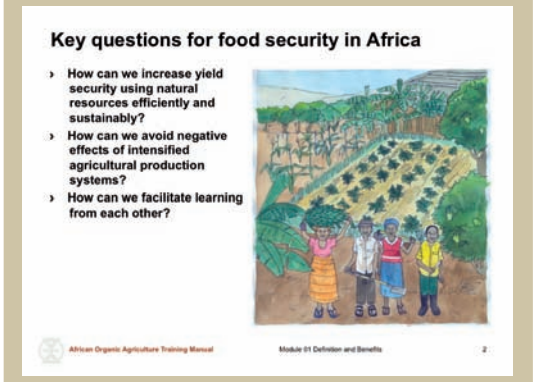
Engage the farmers in a discussion to assess the local challenges to agricultural production at household level, at community level and regional level. Note the results (for example on a map) and use them as a basis for discussions in the following sections.

2. Challenges facing agriculture in Africa

Increasing agricultural productivity remains a priority for sub-Saharan Africa, given the very low yields in the region and widespread hunger, poverty and malnutrition. Farmers are experiencing various unprecedented limitations to agricultural production. Some of these include:

- **Low soil fertility –** Due to overgrazing, deforestation, soil erosion and poor soil management practices on cultivated lands, the extent of soil degradation is increasing in many parts of Africa. Even in areas where the soil is not completely degraded, the consistent decline in fertility – for example erosion or loss of the water and nutrient-retention capacity of the soils – is leading to the same result. Some farmers abandon parts of the farm that are no longer productive and clear fresh fallow land.
- **Low yields –** Poor soil fertility management, use of low-yielding cultivars and infested seeds, lack of pest and disease management, lack of water-saving irrigation systems and very limited mechanisation, are among the main causes for low crop yields.
- **Shortage of land –** As the population continues to grow and the arable land continues to decrease, shortage of land and land fragmentation result in increasing land use intensity and land conflicts in many countries.

KEY QUESTIONS FOR FOOD SECURITY IN AFRICA



- **Effects of climate change** – Most agriculture in Africa is rainfed and farmers heavily rely on the rainfall patterns to plan their production activities. With the increasing unpredictability of rains in terms of amount and timing, crop failures and famine are becoming increasingly common. This can be attributed to the broader climate change factors, but also to poor water conservation measures at farm and household level.
- **Limited access to safe and sustainable inputs** – Seeds, fertilisers, sustainable pest and disease management agents and tools are not accessible to many farmers. Many farmers cannot find inputs in the nearby centers, this is especially the case for organic inputs such as resource-responsive and resistant seeds, biological agents and raw material for organic fertilizers. Low literacy levels and lack of knowledge make their effective use and application another challenge.
- **Limited access to reliable markets** – Most farmers do not have the knowledge and experience to give value to their farm products. They hardly have access to better paying and reliable markets because they lack market information, are poorly linked with farmer markets and lack collaboration with other farmers and market partners. They also suffer low product quality and lack of consistency as well as poor road infrastructure.

Brainstorming
Collect the key questions for food security in Africa in a brainstorming session. Evaluate the results of the brainstorming session and discuss possible solutions of key questions with the participants.

3. What is the best agricultural system for Africa?

The main challenges in African agriculture are food security, soil degradation, biodiversity loss and the effects of climate change. These challenges require discussion and solutions that respect national and international laws as well as environmental and safety constraints. Furthermore, in every country there is a requirement for ethical or cultural conduct. Diverse agricultural production systems exist in Africa, from traditional low input farming up to industrial resource-intensive farming. Whether it is organic farming or conventional farming, approaches have trade-offs between ecosystem services and the urgent need for affordable, safe and diverse foods. Some of the key questions are:

- How can we increase food production and obtain yield security while using natural resources efficiently and sustainably?
- How can we avoid the negative effects of intensified agricultural production systems?

CHARACTERISTICS OF THE BEST AGRICULTURAL SYSTEM

› How can we facilitate learning from each other, share knowledge and technology?

IAASTD proposes an integrated approach for African agriculture:
The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) analyses on African agriculture as follows (IASTAAD 2008). In order to avert the challenges of agriculture in Africa, IAASTD recommends an integrated agricultural production system which

› addresses the challenges from a value chain outlook from production through to processing and marketing with a local and regional perspective.
› accounts for the multiple functions of agriculture that include the improvement of livelihoods, the enhancement of environmental services, the conservation of natural resources and biodiversity, and the contribution of agriculture to the maintenance of social and cultural traditions.
› recognizes that women, who account for approximately 70 percent of agricultural workers in sub-Saharan Africa, need significantly, increased representation in decision making, and equitable access to education, credit, and secure land tenure.
› recognizes the need for higher quality education, research and extension that addresses the development and sustainability goals.
› promotes the adoption of soil management technologies that are applicable to local soil conditions and aims towards integrated nutrient management approaches, emphasizing the need to conserve both water and soil organic matter. There is a great need to increase investments in agroecological conservation and small-scale biodiverse farming methods.
› further emphasizes the need to improve soil fertility and regenerate the degraded land using locally accessible means to farmers such as improved fallows, crop rotations, mixed livestock-cropping systems, and incorporation of green and livestock manures, where available.
› promotes the use of agroforestry, no-till or minimum tillage and the use of local farm implements that offer integrated agroecological approaches to reducing soil degradation.[1]

[1] Agriculture at a Crossroads. International assessment of agricultural knowledge, science and technology for development (IAASTD) : Sub-Saharan Africa (SSA) report / edited by Beverly D. McIntyre et al.

Group work: Approach to farming for Africa

Ask the farmers to build groups of 3-5 participants. Each group shall design their desirable way of farming, meaning a farming system that will address the challenges mentioned by them. Ask the groups to list the key characteristics into a scale to be used to evaluate the different systems below. Make a final discussion after the presentation of each group work. Farming system requirements, as defined by IAASTD, may be used to offer a complete view to all aspects that need to be considered in the discussion.

WHAT IS TRADITIONAL AGRICULTURE?

Many kinds of sustainable agriculture claim to be environmentally sound, resource-conserving, economically viable, socially supportive and commercially competitive. However, there is no general agreement to which extent sustainability must be achieved and which methods and inputs can be accepted. There seems, however, to be a consensus that African small-holder farmers need a system which provides and enables

- good yield security for high quality (thus well-priced) products.
- higher income that allows re-investments into agriculture.
- efficient and sustainable use of local resources.
- minimal costs for external inputs.
- a solid socio-economic environment for agriculture and life in rural regions.

In the following paragraphs, the relevant systems for Africa are discussed.

a. Traditional agriculture

Generally, traditional African agricultural systems do not use many external agricultural inputs. Therefore, they are sometimes also termed 'organic-by-neglect'. However, the non-use of external agricultural inputs does not mean that a system is sustainable. Some of the shortcomings of traditional systems include the failure to implement soil fertility measures, prevent soil erosion, cutting down of forests and burning of biomass (e.g. slash and burn systems). In some areas, for example in perennial plantations like coffee or cocoa, no additional nutrient supplies are given or pest management strategies carried out, yet the crops are continuously harvested. While maintenance costs are low due to the lack of appropriate soil and crop management, soil fertility, plant health and productivity gradually decrease with time and the often severe yield failures result in famine.

The other challenge is that in many African countries, population is increasing and traditional farming yields have been unable to meet the consumption demand of the population. Due to reduced fallow periods, overgrazing or exploitative cultivation, many traditionally farmed areas face severe degradation.

At the same time, traditional farming systems have selected and preserved numerous useful methods and techniques, which have been proven to be successful under specific local conditions. For example, the use of adapted and tolerant cultivars and breeds can be extremely useful in the pursuance of a sustainable agricultural system.

Discussion on traditional agriculture

Discuss with the farmers what the benefits are of locally practiced traditional systems of agriculture in terms of cultivars and breeds, soil fertility and pest management, and animal husbandry among other aspects. Try to rate this farming system together with the farmers using your scale of a sustainable agricultural system.

WHAT IS CONVENTIONAL AGRICULTURE?

b. Conventional agriculture

Conventional agriculture is not a clearly defined production system. In contrast to other production systems such as traditional or organic agriculture, it is usually referred to as a high external input agriculture. The conventional approach focuses on increasing yields and maximizing profit per cultivated area by the intensive use of external inputs such as chemical fertilizers, pesticides, seeds that require high resource input and irrigation. This production system can easily lead to soil degradation, contamination of soil and water and finally results in the permanent loss of productive land, biodiversity and even the extinction of fauna and flora species. Furthermore, conventional practices such as monocultures make farmers dependent on a few crops or even a single crop and expensive external agricultural inputs, which increases costs and risks to production, particularly amidst the danger of decreasing prices for farm products.

The conventional approach can be successful in the short- and mid-term in areas where the natural soil fertility is high, water availability is not restricted and access to capital is easy. These favorable conditions, however, rarely come together for African small-holder farmers. It is, therefore, unlikely that conventional agriculture can help to resolve the challenges that affect African agriculture in a sustainable way. Conventional agriculture lacks the affordable, resilient and productive farming practices essential to addressing and meeting the needs of the local population and ecosystem.

c. Sustainable agriculture

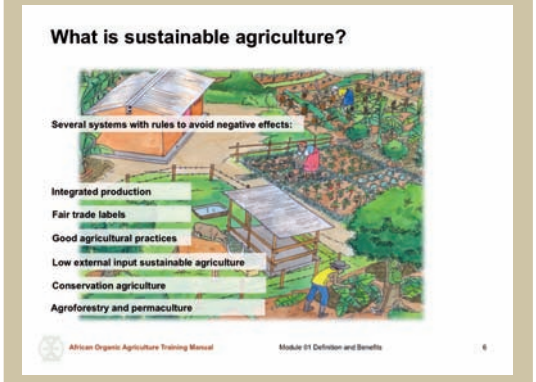
Different philosophies and various trends claiming to promote 'sustainable agriculture' exist. They essentially all contain certain rules such as the ban of toxic inputs to avoid negative effects of the agricultural production to the environment, the consumer and the farmer. Among the 'family' of sustainable agriculture systems, organic agriculture is the only system which rejects the use of synthetic-chemical inputs. The relevance of organic agriculture for Africa and the requirements for labelling are described in Module 7.

Usually the modern sustainable production systems are branded, have a name and the producers are more or less strictly controlled and certified. Nowadays, to produce for the export market, it is a big advantage–sometimes even a must–to be a certified label producer. Independent certification and marketing-oriented labelling are comparative advantages of organic agriculture compared to other sustainable systems (details about certified production, standards and certification see module 7).

Discussion on conventional agriculture

What are the characteristics of the locally practiced conventional system of agriculture in terms of cultivars and breeds, soil fertility and pest management, animal husbandry and other aspects? Try to rate this farming system together with the the farmers using your scale of a sustainable system of agriculture.

WHAT IS SUSTAINABLE AGRICULTURE?



Among the 'family' of sustainable agriculture systems there are several 'non-organic label production systems' relevant for Africa. The following list, while not complete, serves as an overview:

- '**Integrated Production' (IP)** does not refrain from using agrochemicals, but aims to reduce the quantities applied. For plant protection, if possible and economic, a combination of biocontrol methods and chemical pesticides is used (Integrated Pest Management). If infestation by pest or disease reaches pre-defined threshold levels, chemical pesticides are applied. For plant nutrition, chemical fertilisers can be used, but usually maximum amounts per crop are defined. Some IP-labels require regular soil analysis. IP-Labels are also relevant in Africa, such as the Integrated Production of Wine (IPW), a voluntary environmental sustainability scheme established by the South African wine industry in 1998 (www.ipw.co.za). Other programmes are more production oriented and do not necessary target label marketing (e.g. the FAO-funded Integrated Production and Pest Management (IPPM) Programme in West Africa). The strength and novelty of such a programme lies in bridging the fields of epidemiology, public health, ecotoxicology, risk assessment, entomology, agronomy, economics, policy sciences and natural resource management (FAO 2008).
- **Fair trade labels,** such as Max Havelaar (www.maxhavelaar.be/international) are highly relevant for African small-holder producers. There are two distinct sets of fair trade standards, which acknowledge different types of disadvantaged producers. One set of standards applies to small-holders that are working together in cooperatives or other organizations with a democratic structure. The other set applies to workers, whose employers pay decent wages, guarantee the right to join trade unions, ensure health and safety standards and provide adequate housing where relevant. Fair trade standards also cover terms of trade. Most products have a fair trade price, which is the minimum that must be paid to the producers. In addition, producers get an additional sum—known as the 'fairtrade premium'—to invest in their communities. Fair trade standards do not include organic production regulations and, therefore, fair trade does not automatically imply an organic product. However, several fair trade programmes have double certification for both fair trade and organic. Most fair trade labels are members of the international umbrella organisation Fairtrade Labelling Organizations International (FLO) (www.fairtrade.net).

Discussion on sustainable agriculture

Ask the farmers what they have heard or experienced about sustainable agriculture, controlled label production and certification. How do they rate this approach to farming related to the use of cultivars and breeds, soil fertility and pest management, animal husbandry and other aspects? Rate the system using your scale of a sustainable system of agriculture. Do you have your own experience with producing for a label, or do you have colleagues who are producing for a specific label? If yes, which ones? What are your or your colleagues' positive and negative experiences with this system?

- A certification that is increasingly required by importing retail companies is **'Good Agricultural Practice'** (GAP) (www.globalgap.org). The GLOBALG.A.P standard is primarily designed to reassure consumers about how food is produced on the farm by minimising detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare. For example, many supermarkets in the European Union require compliance with the GlobalG.A.P standard. In Africa, mainly exporters of fruit and vegetables are GlobalG.A.P-certified.
- Sustainable agriculture includes systems such as **'Low External Input Sustainable Agriculture' (LEISA)** www.puttingfarmersfirst.ca/leisa/). LEISA is highly relevant in Africa and is promoted through many programmes. It partially renounces the use of agrochemicals and seeks to optimise the use of locally available resources by interlinking the components of the farm system, so that they complement each other and have the greatest possible synergistic effect. External inputs are only recommended to provide elements that are deficient in the ecosystem and to enhance available resources. LEISA practices go hand-in-hand with Conservation Agriculture (see below). LEISA, however, is not (yet) a controlled and certified system with a label for products.

Discussion on conservation agriculture

Ask the farmers, whether they have heard about conservation agriculture. How do they rate this approach to farming in terms of use of cultivars and breeds, soil fertility and pest management, animal husbandry and other aspects? Rate this system using your scale of a sustainable system of agriculture.

d. Conservation agriculture

Conservation agriculture aims to achieve sustainable and profitable agriculture and subsequently aims at improved livelihoods of farmers. Conservation Agriculture is based on enhancing natural biological processes above and below the ground. It is characterized by three principles, which are linked to each other, namely:

- Continuous minimum mechanical soil disturbance
- Permanent organic soil cover
- Diversified crop rotations in the case of annual crops or plant associations in case of perennial crops

It is praised, for example, by the FAO in Africa (www.fao.org/ag/ca; FAO 2011). Conservation agricultural practices are shown to be clearly beneficial in Africa, as they contribute to keeping the land fertile and protecting the soil from erosion. Conservation agriculture does allow for the use of chemical inputs, how-

ever, action is taken that they are carefully applied. Herbicides are, for example, used to manage weed problems.

Conservation agriculture holds tremendous potential for farms of all sizes and agroecological systems in Africa, but its adoption is perhaps most urgently required by small-holder farmers, especially those facing acute labour shortages. It is a way to combine profitable agricultural production with environmental concerns and sustainability and it has been proven to work in a variety of agroecological zones and farming systems. It is been perceived by practitioners as a valid tool for Sustainable Land Management (SLM).

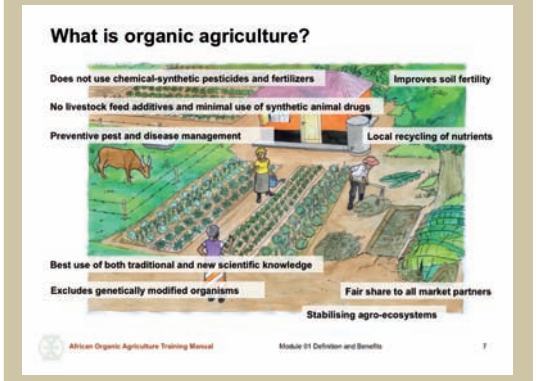
e. Agroforestry and permaculture

Agroforestry and permaculture are interesting systems that try to combine a higher biodiversity of crop plants on the productive area. Usually, annual and woody crop plants (trees, bushes) are planted and managed together. The goal is to create a production environment which is better for the physiological requirements of a certain crop than it is the case in a monoculture (e.g. cocoa, as a rainforest tree of the medium stratum, shows better performance if grown under shade trees). As biodiversity is higher than in monocultures, agroforestry and permaculture systems show a higher and better stabilized self-regulation to prevent epidemics of pests and diseases. The combination with trees allows a better use also of the third dimension of the productive area. Thus, with a smart combination of complementary crops and an appropriate, careful management, these systems cansecure yield, be profitable and highly sustainable. The optimal set-up and management of agroforestry and permaculture systems, however, requires considerable knowledge and very attentive management. Agroforestry is highly relevant and practiced in many countries in Africa. It is promoted in Africa, for example, by the World Agroforestry Centre in Nairobi. The Centre's vision is a rural transformation in the developing world as small-holder households strategically increase the use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability (www.worldagroforestrycentre.org).

Discussion on Agroforestry

Ask the farmers whether they have heard about agroforestry. Ask them which ideas appear interesting to them offering potential improvements in biodiversity, soil fertility and pest management, animal husbandry and other aspects. Rate this system using your scale of a sustainable system of agriculture.

WHAT IS ORGANIC AGRICULTURE?



4. What is Organic Agriculture?

Organic farming is considered one of the most consistent approaches in the family of sustainable production systems. Because of the ban or restricted use of many direct control techniques such as pesticides, herbicides, fast acting fertilizers and veterinary medicines, organic farmers rely heavily on preventive and system-oriented practices. Organic agriculture is a production system that aims at sustaining the health of soils, ecosystems and people. It relies on ecological processes, biodiversity, cycles adapted to local conditions, and the use of on-farm and local inputs. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

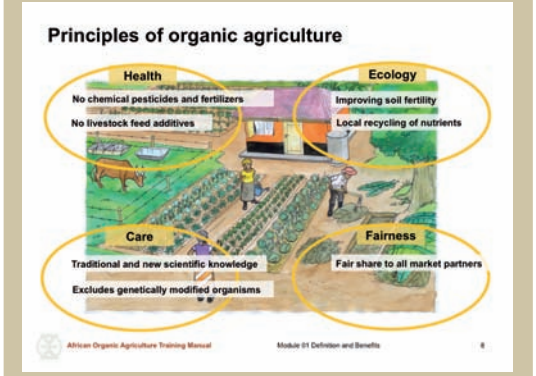
This implies that organic agriculture:

- Works with nature to create a healthy balance between naturally available resources and farming while increasing the resilience of food systems.
- Does not use chemical-synthetic pesticides and fertilizers.
- Renounces livestock feed additives and minimizes synthetic animal drugs.
- Excludes genetically modified organisms including seeds, plants or animals.
- Makes best use of both traditional and new scientific knowledge to come up with the best farming practices that are adaptable to the local conditions and opportunities.
- Relies on ecologically sustainable practices such as feeding the soil with organic material to improve and maintain its productivity, maximal possible disease prevention by the use of tolerant cultivars and appropriate system design and enhancement of beneficial insects to control pests.
- Wherever possible, establishment of integrated market chains from field to fork that guarantee a fair share of the benefits of organic products to all partners in the food chain.

Discussion on differences in organic farming

Inquire among the farmers about their understanding of organic farming. What do organic farmers do with respect to crop cultivars and animal breeds, soil fertility management, pest and disease management, animal husbandry and other aspects? Rate organic farming using your scale of a sustainable system of agriculture.

PRINCIPLES OF ORGANIC AGRICULTURE



Characteristics of organic food and farming systems

Modern organic farm management aims at maximizing the stability of agroecosystems. It builds on improving soil fertility through the incorporation of legumes and compost and by strengthening the local recycling of nutrients and organic matter. It uses many preventive measures copied from nature in order to regulate pests and diseases in crops and livestock. Moreover, since it is free from synthetic pesticides and undergoes only gentle and careful processing, using few additives, organic agriculture offers consumers high-quality and healthy food. The organic concept of how to farm, produce and process foods is globally regulated by a range of very similar regulations and standards. Trade is enabled by third-party certification from accredited bodies. In addition, and in order to meet the needs of small-holder farmers and local, low-income consumers, tens of thousands of farms in developing countries are engaged in participatory guarantee systems (PGS).

In 2009, 37.2 million hectares of agricultural land are managed organically in 160 countries (FiBL and IFOAM 2011).[2] In Africa in 2009, more than 1 million hectares of land was certified organic. Since 2000, the organic area has grown more than 15-fold. Global organic food and drink sales expanded by roughly five percent to 54.9 billion US dollars[3] in 2009.

[2] FiBL and IFOAM (2011): The World of Organic Agriculture 2011. Statistics and Emerging Trends. Edited by Helga Willer and Lukas Kilcher: International Federation of Organic Agriculture (IFOAM), Bonn, and Research Institute of Organic Agriculture (FiBL), Frick

[3] 1 US dollar = 0.71895 Euros; average exchange rate 2009, Source: http://www.oanda.com/lang/de/currency/average

www.ifoam.org/about_ifoam/principles/index.html

4.1 Principles of organic agriculture

The principles of organic agriculture as defined by IFOAM (International Federation of Organic Agriculture Movements)—the umbrella organisation for organic organisations worldwide— apply to agriculture in the broader context, including the way farmers manage soils, water, plants and animals in order to produce, process and distribute food and non-food produce. The four basic principles health, ecology, fairness and care can be viewed as the basis upon which organic agriculture is built. The principles stated by IFOAM give the basic orientation; the detailed rules and regulations, however, are specifically elaborated on by the

specific national legislation ministries and the private label organisations. For the European Union, a common organic legislation exists for all member states (see module 7). The principles of the IFOAM standards are explained in detail here:

Health
Organic agriculture, whether in farming, processing, distribution, or consumption, seeks to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, organic agriculture intends to produce high quality, nutritious food that contributes to preventive health care and well-being. As such, health starts with balanced nutrition that avoids or eliminates the use of chemical-synthetic fertilizers, pesticides, animal drugs and food additives that may have an adverse side effects on health and well being.

Ecology
Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.

Fairness
This principle emphasizes involvement in greater communities. In organic agriculture human relationships should be conducted in a manner that ensures fairness at all levels and to all parties - farmers, workers, processors, distributors, traders and consumers. Organic agriculture should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products. This principle also insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behavior and well-being. Finally, natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations.

Care

This principle states that precaution and responsibility are the key concerns in management, development and technology choices in organic agriculture. Given the incomplete understanding of ecosystems and agriculture, care must be taken. Consequently, new technologies need to be assessed and existing methods reviewed. Science is necessary to ensure that organic agriculture is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. Organic agriculture aims at preventing significant risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected through transparent and participatory processes.

Biodynamic farming

Biodynamic farming fulfils all principles and standards of organic farming, but goes a step beyond, taking philosophical aspects into consideration. Biodynamic farming is inspired by the philosophical concept called 'Anthroposophy' developed in the 1920's by the Austrian philosopher Rudolf Steiner. The term 'biodynamic' refers to the biological (organic) aspects of agriculture (i.e. the physical soil, water, plants, animals); whereas the dynamic refers to the cosmic formative forces that underline the physical world. Biodynamic products are labelled 'Demeter' which is worldwide the best known organic label. Biodynamic farming also exists in Africa (see for example Biodynamic Agricultural Association of Southern Africa www.bdaasa.org.za). The building blocks of biodynamic farming are:

- The farm as an organism: A farm is considered as a whole organism integrating plants, animals and humans. There should be just the right number of animals to provide manure for soil fertility and plant nutrition, and these animals should be fed from the farm itself.

Discussing philosophic aspects:

Ask the participants, for example, the following questions:

- Do you think that agriculture can also concern philosophic aspects?
- Do you as a farmer or do you know other farmers who involve religious or philosophic aspects in farming?

- Biodynamic preparations: Naturally occurring plant and animal materials are combined to form seven different basic preparations. By specific storage methods, the preparations get 'charged' with cosmic forces, and are later applied—at the correct cosmic constellation—in highly diluted form to compost piles, to the soil or directly to the plants. The forces and substances within these preparations support, stimulate and harmonize the regulation mechanisms in the system.
- Cosmic rhythms: The rhythms of the sun, moon, planets and stars influence the growth of plants. By timing the activities of tillage, application of preparations, sowing and harvesting, the farmer can use these forces to stabilize and improve the farm performance.
- Vitality: Besides the physical and chemical characteristics, a product has also a dimension of 'vital quality'. Thus, biodynamic farmers and gardeners aim to enhance the 'vital quality' of their products as well.

How do organic farmers implement the principles of organic farming? The following five topics are summaries that are discussed in detail in subsequent modules:

Organic farmers improve and conserve soil conditions

Organic farmers give central importance to the improvement and conservation of soil conditions. They protect the topsoil as well as organic matter in the soil from loss through soil erosion control, mulching, cover cropping, green manuring, application of compost, adequate mechanisation and management methods to avoid soil compaction and degradation and minimum tillage practices. All these measures improve and stabilize the soils physical structure, enhance its ability to absorb and store water and plant nutrients, and stimulate the activity of soil organisms, roots and finally plant performance.

Organic farmers recycle plant nutrients

Organic nutrient management is based on biodegradable materials (i.e. plant and animal residues) that can be decomposed. Farms strive to create closed nutrient cycles whereby nutrients exported from the farm with the sold produce need to be replaced in some way. With the help of composting, mulching, green

manuring, crop rotation and cultivation of nitrogen fixing plants. Farm animals also play an important role in the nutrient cycle: their waste is of high value and its use allows to recycle nutrients provided with the fodder. If carefully managed, losses of nutrients due to leaching, soil erosion and through gases can be reduced to a minimum. These measures mentioned minimize the need and the dependency on external nutrient inputs and help to save significant production expenses.

Organic farmers conserve and enhance biological diversity

Organic farms grow several crops, including, trees, in carefully planned rotations or even as mixed cropping systems. Ideally, also husbandry is an integrated part of the farm system (see below). The diversity not only allows optimum use of resources, but also serves as a form of economic security as it decreases the risk of vitality lost through pests, diseases, unfavorable weather or market conditions for certain crops.

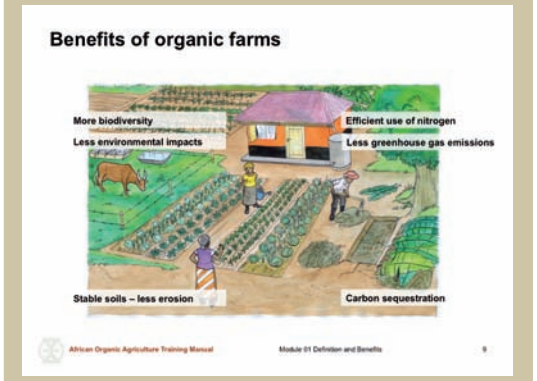
It is not only the biodiversity of the produced crops and animals organic farms are aiming for, but also for the biodiversity of wild-life flora and fauna. A good proportion of the wild-fauna often consists of beneficials to control pests in the crops, thus are very useful helpers to assure and stabilize yield security. Providing and preserving a vital habitat for wild flora and fauna species—increasingly endangered and becoming extinct—is an extremely important and valuable service that sustainable agriculture provides that benefits society as a whole.

It must be said, however, that handling and managing a wide range of biodiversity within crops and also with wild flora and fauna demands farmers with profound knowledge, highly professional skills and long-term experience.

Organic farmers employ natural and biological control of pests and diseases

Organic farmers try to keep pests and diseases at a level which does not cause economical damage through a concept of several preventive measures. The main focus supports the vigour and robustness, or self-defence potential by cropping through careful management. Resistant or tolerant cultivars are used wherever they exist and fulfil market requirements; beneficial insects are promoted by offering them a favourable habitat and food sources. If pests reach critical population levels to decrease yields significantly, natural preparations and biocontrol agents and methods are applied as control measures.

BENEFITS OF ORGANIC FARMS



Organic farmers integrate animal husbandry into the production system
Organic farmers, when possible, integrate farm animals into their production system to support the recycling of nutrients, obtain animal products for household nutrition and sale to optimize the family income. The animals must be provided with the conditions and opportunities of life in accordance with their physiology and natural behaviour (e.g. stable construction and herd management) The health of farm animals is ensured by primarily selecting strong and locally adapted breeds, followed by providing a balanced nutrition, clean and safe housing, continuous monitoring and using natural means for disease and parasite control.

4.2 Benefits of organic agriculture

Organic agriculture generates significant environmental and developmental benefits. It can contribute to meaningful socioeconomic and ecologically sustainable development, especially in poorer countries. This is due on the one hand to the application of organic principles, which means efficient management of local resources (e.g. local seed varieties, manure) and, therefore, cost-effectiveness. At the same time, the market for organic products – at the local and international level – has tremendous growth prospects and offers excellent opportunities to improve livelihoods for farmers all over the world.

Establishing whether organic agriculture is a viable alternative for a particular holding needs to be carried out on a case-by-case basis. What potential does organic agriculture have for solving the problems of hunger and poverty? What can organic agriculture contribute to achieving socially and ecologically sustainable development in Africa? This section discusses the three groups of benefits, according to a United Nations Conference on Trade and Development's (UNCTAD) Trade and Environment Review from 2009 (Niggli, 2009), supported by numerous studies (quoted below):

1. Organic farms provide multifunctional benefits.
2. Organic farms are well-adapted to climate change.
3. Organic farming enhances food security.

Discussion on benefits of organic farming
Divide the participants into three groups (1. multifunctional benefits; 2. climate change, 3. food security). Let each group critically analyze the benefits of organic agriculture. What is needed to boost these benefits in Africa? Let the groups present their results and moderate a plenary conclusion-discussion.

Long-term farming system comparison in the tropics
There is a wealth of knowledge on the benefits of organic agriculture: NGOs and farmers' groups are increasingly adopting organic techniques as a method for improving productivity and food security in these systems. What and how organic farming can contribute to sustainable development is also of particular interest for research and development. In 2006, FiBL launched a network of long-term farming system comparisons in the tropics (Kenya, India and Bolivia). The aim of this project is to examine the contribution of organic agriculture on food security, poverty alleviation and environmental conservation. Initial results of the long-term farming system comparisons in the tropics will be available within a few years.

1. Organic farms provide multifunctional benefits

In the past, the unsustainable production of food, feed, fibre and fuel strongly degraded global ecosystems and the services those systems provided for human survival (Millennium Ecosystem Assessment, 2005). An area of 10 million hectares disappears by wind and water erosion every year, and is therefore lost for food production, due to unsustainable farming techniques (Pimentel et al., 1995).
No other form of agriculture and food production can claim to offer so many benefits to consumers and to provide such a bounty of public goods as organic farming and food systems. Such ecosystem services include, for example:

- Provision of pure water,
- Recycling of organic matter and nutrients,
- Regulation of climate and weather events by fertile soils,
- Regulation of crop pests and diseases through biodiversity and natural enemies, and
- Pollination of crops by wild animals.

These claims are substantiated by scientific evidence (for a comprehensive review of the literature, see Niggli et al., 2008; UNCTAD, 2006; Scialabba El Hage and Hattam, 2002; Stolze et al., 2000). The most notable environmental advantages may be summarized as follows:

Biodiversity

Biodiversity is an important driver for the stability of agroecosystems (Altieri and Nicholls, 2006), and, hence, for a continuously stable supply of food. In organic agriculture, biodiversity is both the means and the end. As organic farmers cannot use synthetic substances (e.g. fertilizers, pesticides and chemicals) they depend on carefully restoring the natural ecological balance. At farm level, diversity is practised through various farm activities (e.g. by adding value through processing and direct marketing, or by combining farming with farm schools, visits and trainings). In the fields of tropical and sub-tropical countries, diversity is achieved by multiple crop rotations, intercropping or agroforestry (Kilcher, 2007). Ultimately, organic farms cannot be operated in the long run simply by cultivation that focuses only on economically attractive crops.

The diversity of species on organic farms is predominantly the effect of the very specific organic techniques of farmers and the ban of pesticides, herbicides and fast release fertilizers. An organic farm becomes more successful in a diversified landscape where there are sufficient semi-natural landscape elements like hedge rows, fallow-ruderal habitats and wildflower strips, which serve as natural sources of controlling pests (Zehnder et al., 2007). Soil quality management (e.g. enrichment with compost), tillage practices (e.g. conservation tillage), crop rotation and intercropping are important additional measures, aimed at lowering the risk of pest and disease outbreaks. It is therefore in the economic interest of organic farmers to enhance diversity at all levels, because organic weed, pest and disease management would fail without high diversity.

Comparative biodiversity assessments on organic and conventional farms reveal a 30 per cent higher species diversity and a 50 per cent greater abundance of beneficial animals in organic fields (Bengtsson, Ahnstrom and Weibull, 2005; Hole et al., 2005). The higher biodiversity applies to many different taxonomic groups, including microorganisms, earthworms, insects and birds (Hole et al., 2005). In regions where the number of organic farms increased, the diversity and abundance of bees grew considerably, which contributed to the pollination of crops and wild plants over larger areas (Rundlöf, Nilsson and Smith, 2008).

Lower negative environmental impacts

The high dependence of traditional farming on chemical fertilizers, herbicides and pesticides has caused considerable environmental damage. Due to the ban of chemical fertilizers on organic farms, 35 to 65 percent less nitrogen leaches

from arable fields into soil zones where it could degrade ground and drinking water quality (Drinkwater, Wagoner and Sarrantonio, 1998; Stolze et al, 2000). Other nutrient elements like potassium and phosphorous are not found in excessive quantities in organic soils, which increases their efficient use (Mäder et al., 2002). Since synthetic herbicides and pesticides are not applied in organic farms, they cannot be found in their soils, surface and ground water.

Stable soils – less prone to erosion

Fertile soils with stable physical properties have become the top priority of sustainable agriculture. Essential conditions for fertile soils are vast populations of bacteria, fungi, insects and earthworms, which build up stable soil aggregates. There is abundant evidence from European, United States, Australian and African studies that organic farms and organic soil management lead to good soil fertility. Compared to conventionally managed soils, organically managed ones show higher organic matter contents, higher biomass, higher enzyme activities of microorganisms, better aggregate stability, improved water infiltration and retention capacities, and less water and wind erosion (Edwards, 2007; Fliessbach et al., 2007; Marriott and Wander, 2006; Pimentel et al, 2005; Reganold, Elliot and Unger, 1987; Reganold et al, 1993; Siegrist et al, 1998). The fact that organic farmers use a plough periodically in order to bury weed roots and seeds, does not render their soils more prone to erosion (Teasdale et al, 2007; Müller et al, 2007).

Carbon sequestration

Organic farmers use different techniques for building up soil fertility. The most effective ones are fertilization by animal manure, by composted harvest residues and by leguminous plants as (soil) cover and (nitrogen) catch crops. Introducing grass and leguminous leys as feedstuff for ruminants into the rotations and diversifying the crop sequences, as well as reducing ploughing depth and frequency, also augment soil fertility. All these techniques also increase carbon sequestration rates on organic fields. A further increase of carbon capture in organically managed fields can be measured by reducing the frequency of soil tillage.

More efficient use of nitrogen, less greenhouse gas emissions on organic farms

In agroecosystems, mineral nitrogen in soils boosts crop productivity. Crop productivity has increased substantially through the use of heavy inputs of soluble fertilizers – mainly nitrogen – and synthetic pesticides. However, only 17 per

cent of the 100 metric tons of industrial nitrogen produced in 2005 was taken up by crops. The remainder was somehow lost to the environment (Erisman et al., 2008). High levels of reactive nitrogen (NH_4, NO_3) in soils may contribute to the emission of nitrous oxides, and are a major source of agricultural emissions. The efficiency of fertilizer use decreases with increasing fertilization, because a large part of the fertilizer is not taken up by the plant but instead emitted into water bodies and the atmosphere.

In organic agriculture, the ban on industrially produced nitrogen and the reduced livestock density per hectare considerably decrease the concentration of easily available mineral nitrogen in soils and, thus, N_2O emissions. Furthermore, diversifying crop rotations with green manure improves soil structure and diminishes N_2O emissions. Soils managed organically are more aerated and have significantly lower mobile nitrogen concentrations, which further reduces N_2O emissions. As a result, the limited availability of nitrogen in organic systems requires careful, efficient management (Kramer et al, 2006). Organic farms use nitrogen in a more efficient and less polluting way (Mäder et al, 2002).

In a simplified scenario, a conversion of global agriculture to organic farming would reduce the greenhouse gas (GHG) emissions of the agricultural sector considerably and make agriculture almost GHG neutral (Niggli et al, 2009). In an in-depth study for Austria, a conversion to organic farming was modelled to reduce the Austrian GHG emissions by 3 per cent (Freyer and Dorninger, 2008). With the much higher sequestration rates as measured in the Rodale experiment in Pennsylvania, LaSalle and Hepperly (2008) estimated the potential for mitigation from organic agriculture to be 25 per cent of the total GHG emissions of the United States. This spread of the mitigation potential of different scenarios demonstrates that organic farming is an important option in a multifunctional approach to climate change.

2. Organic farms are well adapted to climate change

As a result of climate change, agricultural production is expected to face less predictable weather conditions than experienced during the last century. South Asia and Southern Africa, in particular, are expected to be the worst affected by negative impacts on important crops, with possibly severe humanitarian, environmental and security implications (Lobell et al., 2008).

Thus the adaptive capacity of farmers, farms and production methods will become especially important to cope with climate change. As unpredictability in

weather events will increase, robust and resilient farm production will become more competitive and farmers' local experiences will be invaluable for permanent adaptation. Organic agriculture stresses the need to use farmer and farmer-community knowledge, particularly about such aspects as farm organization, crop design, manipulation of natural and semi-natural habitats on the farm, use or even selection of locally appropriate seeds and breeds, on-farm preparation of fertilizers, natural plant strengtheners and traditional drugs and curing techniques for livestock, as well as innovative and low budget technology. Tengo and Belfrages (2004) described such knowledge as a 'reservoir of adaptations'.

Techniques for enhancing soil fertility help to maintain crop productivity in case of drought, irregular rainfall events with floods and rising temperature. Soils under organic management retain significantly more rainwater thanks to the 'sponge properties' of organic matter. Water infiltration capacity was 20 to 40 per cent higher in organically managed loess soils in the temperate climate of Switzerland when compared to conventional farming (Mäder et al., 2002). Pimentel et al. (2005) estimated the amount of water held in the upper 15 cm of soil in the organic plots of the Rodale experiment at 816,000 litres per hectare. This water reservoir was most likely the reason for higher yields of corn and soybean in dry years. The water capture in the organic plots was approximately 100 per cent higher during torrential rains than in the conventional ones (Lotter, Seidel and Liebhardt, 2003). This significantly reduced the risk of floods, an effect that could be very important if organic agriculture were practiced over much larger areas. Similar findings, that organic farming improved the physical properties of soils and therefore the drought tolerance of crops, where made in on-farm experiments in Ethiopia, India and the Netherlands (Pulleman, et al., 2003; Eyhorn, Ramakrishnan and Mäder, 2007; Edwards, 2007).

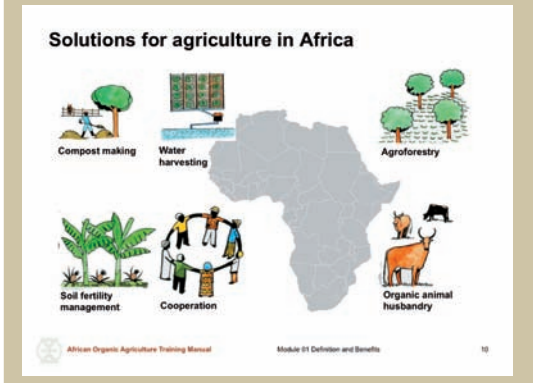
The capacity of farms to adapt to climate change depends not only on soil qualities, but also on their diversity of species and diversification of farm activities. The parallel farming of many crop and livestock species greatly reduces weather-induced risks. Landscapes rich in natural elements and habitats buffer climate instability effectively. New pests, weeds and diseases – the results of global warming – are likely to be less invasive in natural, semi-natural and agricultural habitats that contain a high number and abundance of species (Zehnder et al., 2007; Altieri, Ponti and Nicholls, 2005; Pfiffner, Merkelbach, and Luka, 2003).

3. Organic farming enhances food security

The fast growing human population gives rise to the crucial question as to whether organic farming could feed the world. The indisputable advantages of organic farming in delivering public goods and services shrink if too much land is needed to produce food. The question of the productivity of organic systems was addressed by a group of scientists led by Professor Ivette Perfecto at Michigan University. Analysing the yields of hundreds of plot and farm experiments, comparing organic and conventional farming, they concluded that organic agriculture could feed considerably more people than the current world's population of 6.7 billion (Badgley et al., 2007). According to other review papers, yields of organic crops may be reduced by 30 to 40 per cent in intensively farmed regions under best geo-climate conditions. In less favourable crop growing regions, organic yields tend to match conventional ones. In the context of subsistence agriculture, and in regions with periodic disruptions of water supply (droughts, floods), organic agriculture is competitive vis-à-vis conventional agriculture, and often superior with respect to yields. The Capacity Building Task Force (CBTF) on Trade, Environment and Development of UNEP and UNCTAD published the results of numerous case studies showing that, in comparison to traditional subsistence farming, yields were more than double (with a mean of 116 per cent) by applying organic farming practices, especially through more diverse crop rotations, integration of legumes and through closing the cycles of plant nutrients and organic matter on farms or in regions. (For data on the competitiveness and performance of organic agriculture see, for example, Badgley et al., 2007; Halberg et al., 2006; UNEP-UNCTAD, 2008b).

In many cases, organic farming is a very productive way of producing food. In addition, organic farming systems use many modern technologies like bio-pesticides, natural fertilizers and parasitic or predatory insects or microorganisms in a smart way. Even in the case of highly controversial technologies like genetic engineering, organic farming uses selectively some tools (e.g. molecular markers in breeding or in the diagnosis of pest and disease incidences in crops and livestock). Actually, there is no contradiction between organic rules and cutting-edge technologies. Technologies are banned in cases where risks are increased, where precaution is necessary and prevention offers better solutions. The ban of synthetic nitrogen showcases this strategy: Organic farmers manage nitrogen derived from organic matter, soils and legumes more carefully and with fewer losses as nitrogen is scarce. As a result, organically managed soils are more fer-

SOLUTIONS FOR AGRICULTURE IN AFRICA



tile and resilient to diseases and drought. This also makes organic farmers independent from rising oil prices, imported synthetic inputs and reduces the environmental impact of farming considerably (Granstedt, 2006; Crews and Peoples, 2004).

The overall concept of organic agriculture offers ample scope to increase the productivity of farms on the basis of eco-functional intensification. In conventional farming, 'intensification is understood primarily as using a higher input of nutrient elements and of pesticides per land unit. It also means more energy (direct for machinery and indirect for inputs). Finally, it focuses on better exploiting the genetic variability of plants and animals; to do so, all available breeding techniques, including genetic engineering, are used' (Niggli et al, 2008). Eco-functional intensification on the other hand 'means, first and foremost, activating more knowledge and achieving a higher degree of organization per land unit. It intensifies the beneficial effects of ecosystem functions including bio-diversity, soil fertility and homeostasis. It uses the self-regulating mechanisms of organisms and of biological or organizational systems in a highly intensive way. It closes material cycles in order to minimize losses (e.g. compost and manure). It searches for the best match between environmental variation and the genetic variability of plants and livestock' (Niggli et al, 2008).

Third-party certification is an important tool for accessing international markets and for creating trust in anonymous producer-consumers situations. In addition, governments should encourage/promote participatory guarantee systems (PGS) for local markets, mainly for small-holder farmers and low-income consumers in developing countries. Such systems strengthen farmer-consumer cooperation, and a sense of responsibility and cooperation (and mutual control) among farmers (UNCTAD, 2008). The International Federation of Organic Agriculture Movements (IFOAM), as the pioneer in organic regulations and criteria-setting for certification, promotes PGS, strengthening organic agriculture's role in addressing poverty in a sustainable way.

Organic agriculture is more than a less polluting form of food production. It basically raises questions about the food habits of people in the developed and emerging regions of the world. As organic farms have lower livestock densities because of their environmental impact and because of they ban factory farms, more land is available for vegetable production with a seven times higher calorie output for human nutrition. Consequently, organic agriculture inculcates an eating pattern with less meat and dairy foods and a higher proportion of vegetables

Panel discussion about solutions for agriculture in Africa

Now that you know different systems of agriculture, you may organize an open panel discussion with representatives of farmer organizations, potential customers of organic products, regional policians and farmers. Discuss which approach provides the best solutions for agriculture in Africa. Besides the training participants, you may invite people from the area to the event and create a rich and open discussion.

and fruits. Good for health thus becomes good for the environment and good for global food security!

More support needed

Supporting public and private services and incentives are important to make organic techniques economically more competitive (e.g. managing manure and waste in a proper way, growing legumes or diversifying crop rotations). More research, advisory and training is needed. International organizations should increase their efforts at facilitating South-South cooperation and knowledge exchange at all levels of organic food chains. And finally, national and international organic farmers' organizations should become more actively involved in developing innovation. The combination of organic farming and reduced tillage, for instance, would offer huge carbon sequestration options and could become the basic requirement for GHG credit schemes.

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