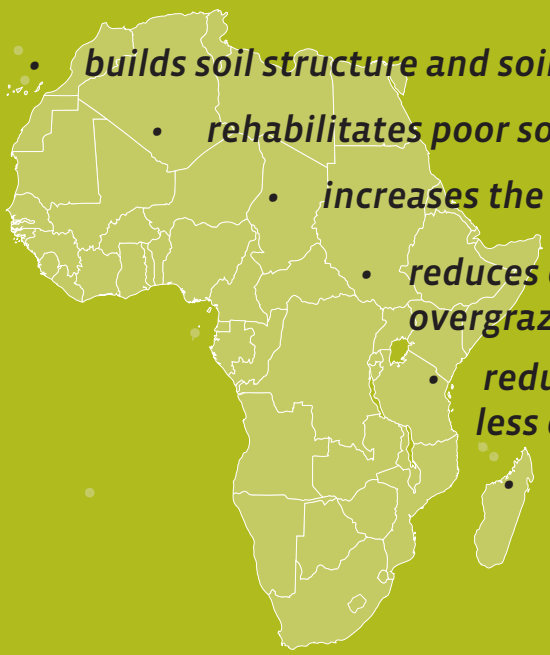
IFOAM
INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS

The CONTRIBUTION *of* ORGANIC AGRICULTURE *to* CLIMATE CHANGE ADAPTATION *in* AFRICA

Organic agriculture



- *builds soil structure and soil fertility*
- *rehabilitates poor soils and brings degraded soils back into productivity*
- *increases the water retention capacity of soils*
- *reduces erosion caused by wind and water as well as by overgrazing*
- *reduces the financial risk of farm operations as farmers are less dependent on external inputs*
- *increases biodiversity which builds resilience to storms, heat and increased pest and disease pressure*

Prepared by:

With support from:

The African Case

1. Climate change impacts on agriculture in Africa

In many African countries the agricultural sector is the most important economic sector and constitutes the largest part of GDP[1]. The majority of households depend on agriculture. This large dependence on agriculture makes those countries more vulnerable to the effects of climate change. Agriculture in Africa is already constrained, but climate change will aggravate this difficult position even more. Due to changed rainfall patterns, a decrease in fertile arable land and more extreme weather events, agricultural production is likely to decrease. Combined with an increasing population, per capita food production is expected to decline even further. Food security will decrease due to a reduction in the length of growing season and a reduction of fertile arable land. According to the Intergovernmental Panel on Climate Change (IPCC), projected reductions in yield in some countries could be as much as 50% by 2020, and crop net revenues could fall by as much as 90% by 2100, with small-scale farmers being affected the most. This will have a large effect on food security as well as on the economy at large[2].

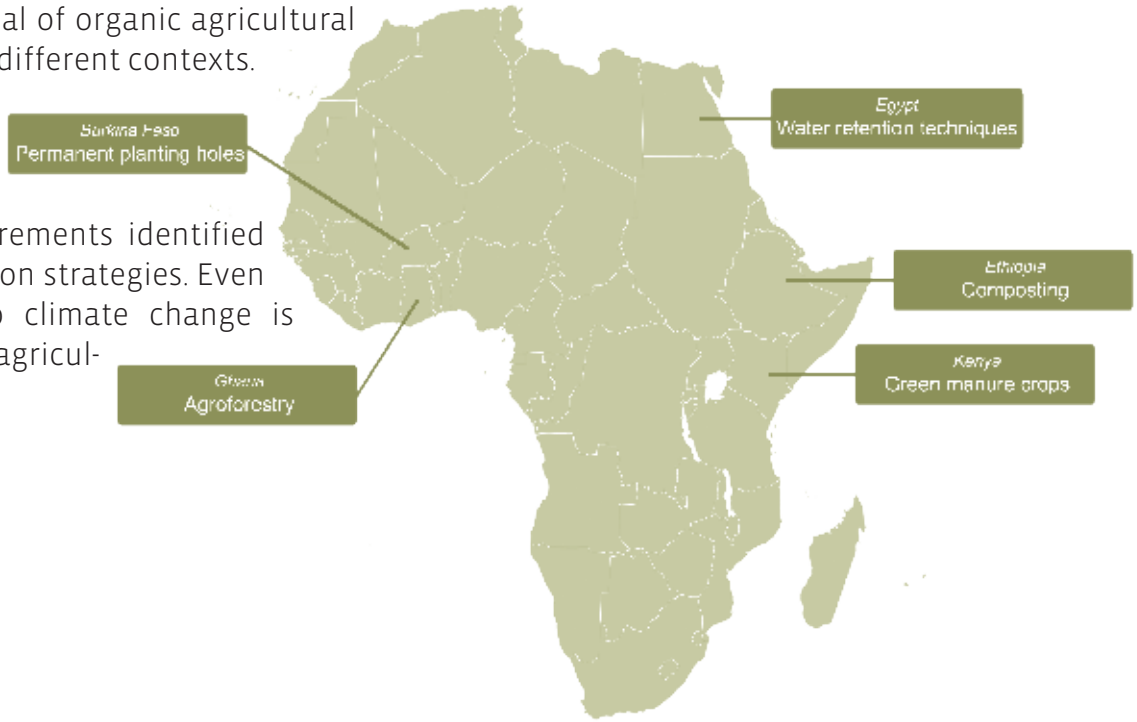
In sum, climate change will severely affect African agricultural and the many millions of people who are dependent on it. There is urgent need for adaptation of the agricultural sector to the changes in climate.

2. Benefits of Organic Agriculture in relation to climate change adaptation

Organic farming practices preserve and restore soil organic matter, soil structure and water holding capacity, and are therefore able to maintain productivity in the event of drought, irregular rainfall events, with floods and rising temperatures. This adaptive quality of organic agriculture is very important for the agricultural sector in Africa.

A series of five analytical cases have illustrated the beneficial effects of organic agriculture on climate change adaptation. The case studies describe different practices, and encompass diverse regions of Western, Northern and Eastern Africa; they demonstrate the adaptation potential of organic agricultural practices in these very different contexts.

All five case studies demonstrate that organic agriculture fulfils most of the requirements identified for successful adaptation strategies. Even greater adaptation to climate change is built in when organic agriculture is practiced.



The main conclusions from the case studies are the following:

- Organic agricultural practices increase the nutrient and water retention capacity of soils through high organic matter content and soil cover. As a result, nutrients and water are used more effectively for agricultural production and less water is needed;
- Soil fertility and soil structure improve when utilizing organic agricultural practices;
- Organic agriculture increases biodiversity, by using trees and diverse crops, intercropping and crop rotations. Enhanced biodiversity reduces pest outbreaks, the severity of plant and animal diseases, thereby increasing the production of high quality agricultural produce;
- Organic agriculture decreases soil erosion caused by wind and water as well as by overgrazing;
- Organic agriculture is well adapted to local circumstances as it encourages the use of local and indigenous farmer knowledge and adaptive learning techniques;
- Organic agriculture reduces the financial risk of farm operations, since farmers are less dependent on external inputs like synthetic fertilizers, seeds, irrigation equipment etc. They do not have to borrow money to buy these inputs and are therefore financially less affected in case of crop failure.
- **In sum, all these positive contributions of organic agriculture result in higher yields, and thereby in increased food security and better options for development.**

3. Recommendations and strategies for further application and scaling-up of benefits

More emphasis on healthy soils. The sub-optimal conditions for agriculture in Africa and a changing climate require a stronger focus on physical and biological soil characteristics: soil organic matter, soil biology, soil structure and soil water holding capacity.

Use biological nitrogen fixation. The benefit of soil fertility improvement using leguminous, nitrogen fixing plants is evident. The use of this organic practice needs to be upscaled and promoted in programs and projects that are aimed at improving agriculture in Africa

Combine water harvesting with organic fertilization. In the Sahel and other dry areas, susceptible to frequent droughts, a combination of water harvesting and concentrated organic fertilization is required. Water harvesting alone will not be sufficient to increase crop yields, because soils are too poor. Organic fertilization alone will not be sufficient if it is spread to thinly over the field, and if water runoff and soil erosion are not controlled. The combination has shown spectacular effects: yields have increased enormously.

Use the available biodiversity. Africa is rich in a large number of food crops and varieties, many of which have not yet been subject to breeding or improvement programs. This richness is a key resource underpinning the resilience of agriculture in Africa.

Low capital-input food crops. Emphasis should be placed on food security again. Self sufficient food crop systems can be successfully intensified without capital inputs. This requires knowledge and labor intensive organic farming systems, making the best use of a healthy soil, biodiversity and organic fertilization.

Involve farmers in the adaptation of agricultural practices. Farmers' situations are highly diverse and the impact of climate change is ongoing. This means that there will be a need for many different adapted recommendations for improved farm practices. Research and extension should involve farmers, in order to guarantee that the recommendations will be relevant for farmers and will be subject to continued adaptation and improvement.

1 Mendelsohn R., W. Morrison, M.E. Schlesinger and N.G. Andronova, 2000a: Country specific market impacts from climate change. Climatic change, 45, 553-569.

2 Mendelsohn, R., A. Dinar and A. Dalfelt, 200b: Climate change impacts on African agriculture. Preliminary analysis prepared for the World Bank, Washington, District of Columbia, 25 pp.

Ethiopia

Case Study by Sue Edwards[a]

Organic agricultural practices increase climate change resilience

Tigray Region in Northern Ethiopia is generally regarded as being the most degraded in the country[1] and climate change is likely to worsen the situation. However, organic agricultural practices have contributed to the regeneration of the agricultural land. This case describes a successful project that has increased soil fertility and water retention capacity by using organic agricultural practices like composting. This way, the region and its inhabitants are now better equipped to adapt to the effects of climate change.

Climate change in dryland areas

Climate change poses a huge threat to dryland areas. Climate change causes prolonged droughts and erratic rainfall, which in turn leads to, a reduced water retention capacity of the soil, increased erosion and biodiversity loss. According to the UN Intergovernmental Panel on Climate Change (IPCC), large areas of Africa could be stricken by yield decreases of over 50% by the year 2020 as a result of an increasingly hotter and drier climate. This ultimately threatens food security and resilience of the inhabitants of the drylands. Therefore, means have to be found to adapt to climate change. For successful adaptation, optimal use of the scarce water resources and improvement of the conditions of the soil are a pre-requisite. The organic agricultural practices used in this case contribute to water efficiency and the building up of healthy soils, thereby increasing the resilience of the people and the environment.

Composting

Composting is an important organic practice and a very important tool for adaptation to climate change. Composting involves the accumulation and proper mixing of animal manure, crop residues, weeds and organic household waste so that they can be broken down into compost, which is used as a soil conditioner. During the composting processes fungi and bacteria decompose the raw material so that nutrients are stabilised within the organic matter. It also kills or reduces weed seeds, pests and diseases. Composting increases soil fertility by holding and gradually releasing nutrients and building up organic matter levels in the soil. Composting also improves the water holding capacity of the soil and makes crops better able to survive droughts and floods.

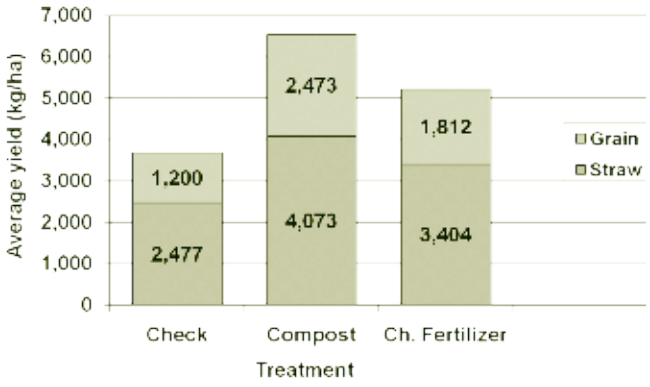


Figure 1: average yield for grain and straw for all crops samples, 2001-2006:

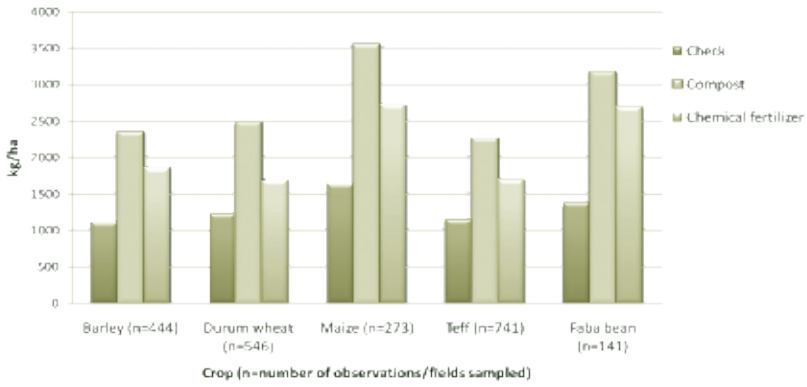


Figure 2: average yield for five different crops, 2000-2006:

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Adaption through organic farming in Ethiopia

The Tigray Region in Northern Ethiopia is a dryland area that is threatened by the effects of climate change. In that area the 'Tigray Project' has been carried out in which farmers, NGOs and scientists have proved that organic agricultural practices, such as composting, intercropping, crop rotation, and planting of multi-functional trees have resulted in climate change resilience for the region and its inhabitants. Results of the project include higher yields, higher groundwater levels, better soil fertility, increased household income and stronger livelihood opportunities for women.[2]

Composting has been a key factor of success in the project. Evaluation has shown that the application of compost generally doubled the grain yield compared to the yields from plots with no inputs.[1] The difference was significant (95% confidence limit). The compost also increased straw yield, but not to the same extent. In addition, the use of compost also resulted in higher yields than those achieved with chemical fertilizer. Figure 1 shows the differences in average yields of several types of grains. Figure 2 shows the impact of using compost on five different kinds of crops. Both figures show the measured differences between crops grown with the use of chemical fertilizer, the use of compost and no input at all.

Conclusion

The results in Tigray Project have shown that organic farming can be a very effective and important tool in adaptation to climate change. By using organic farming practices, farmers in Tigray have succeeded in using water more efficiently and increasing yields to ultimately improve their food security situation and livelihoods. Soil and vegetation are healthier and therefore better able to withstand stress and be restored afterwards.

The government of Ethiopia has acknowledged the success of organic farming and has adopted the approach used in the Tigray Project in 165 districts throughout the country. The government is now introducing compost production and application as part of the standard practice in extension programmes in all crop-growing areas of the country.

Adi Nefas: Tigray, 1997: degraded and eroded land.

Same area in Adi Nefas, Tigray, 2003: rehabilitated land.

1 Edwards, S. & H. Araya, 2009. The Tigray Project: organic agriculture with smallholder farmers in a mountainous environment. Ecology & Farming, August 2008: 28-30.

2 ILundberg, J. & F. Moberg, 2008. Ecological in Ethiopia: farming with nature increases profitability and reduces vulnerability. Publication of Swedish Society for Nature Conservation (SSNC). http://www.ifoam.org/about_ifoam/around_world/aosc_pages/pdf/Ecological_in_Ethiopia.pdf

Burkina Faso

Case Study by Ferko Bodnár[a]

Organic agriculture and water harvesting

Smallholder farmers in northern Burkina Faso use permanent planting holes, locally known as Zaï, to maximize the use of water and organic fertiliser: crop residues and manure. Using this system, in line with the organic principles, farmers are able to recover degraded soils in an area affected by climate change.

The Sahel zone stretches south of the Sahara from Senegal in the west to Ethiopia and Eritrea in the east. The low annual rainfall of between 250 and 500 mm and the poor soils of the area make it difficult for farmers to grow crops. The soils have a tendency of forming a thin, hard crust, which reduces water infiltration and increases water run off. Most soils are of the tropical ferruginous type that is extremely low in soil organic matter and fertility. Farmers grow the drought resistant cereals millet and sorghum and traditionally keep a large grain stock anticipating a possible crop failure. Most farmers grow cereals for home consumption and cannot afford synthetic fertiliser.[1]

Farmers in the Sahel have experienced a dramatic change in climate. Over the last five decades, especially between the 1950s and early 1980s, rainfall has gradually decreased in the region. This has resulted in a move of people and animals southwards, especially after the devastating drought in 1983. Farmers have to cope with even more erratic rainfall and more frequent droughts.

Permanent planting holes

Some farmers in northern Burkina Faso use a traditional organic method of permanent planting holes, locally known as Zaï. In a degraded field, often covered by an impermeable soil crust, farmers make holes, 10-20 cm deep and 20-40 cm in diameter, about 50-100 cm apart. These holes capture and concentrate the rainfall from the surrounding crusted area. All organic material that is available, crop residues and manure, are put in the hole, where the millet or sorghum is sown. On degraded and crusted soils, Zaï gives much better crop yields than normal cultivation without planting holes. After a number of years of successful cultivation with Zaï, the soil has improved in structure, and water infiltration and water holding capacity have increased, making it possible for farmers to cultivate the entire plot normally, on the flat. However, this traditional practice had been abandoned or forgotten in many areas. A similar soil and water conservation technique is the 'half-moon planting station', slightly larger in size, capturing run-off water from sloping land, and also concentrating water and organic matter. Often these techniques are combined with other soil and water conservation methods such as stone rows. These traditional methods are in line with the organic principles. They are a good way to recover degraded lands in dry areas and is better adapted to climate change.

Organic agricultural practices contribute to adaption to climate change

Several projects have encouraged farmers to practice and improve the traditional Zaï method. In Burkina Faso, a number of projects were involved in soil and water conservation combining a number of practices, including Zaï. The project staff and farmers experimented with and adapted the Zaï system, making larger holes, applying more manure, and even planting tree seedlings in these permanent planting holes as a way of reforestation.

An evaluation, considering the combination of soil and water conservation practices, showed that the area in northern Burkina Faso was indeed greener in 2001 than in 1980[2]. They found that soil and water

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conservation (Zaï, sometimes with stone rows), especially in combination with compost, increased sorghum yield. This increase was more pronounced in relatively dry years (+94%), due to the effective water harvesting of the Zaï (Figure 1). In the three provinces Bam, Sanmatenga and Yatenga, food security in a year with good rainfall improved from 67% self sufficiency in 1980-1985 to 88% self sufficiency in 1999-2001, while farmers continue to rehabilitate their degraded lands.

The 'half-moon planting station technique', a practice similar to Zaï, combining water harvesting with concentrated application of manure or compost, shows a similar yield increase. The planting on the flat resulted in a total crop failure in 1998 and 1999. The half-moon practice without any application of compost or manure resulted in a very low sorghum yield (42 kg/ha), while the combination of half moons with manure or compost resulted in very good sorghum yields (1359 and 739 kg/ha respectively)[3].

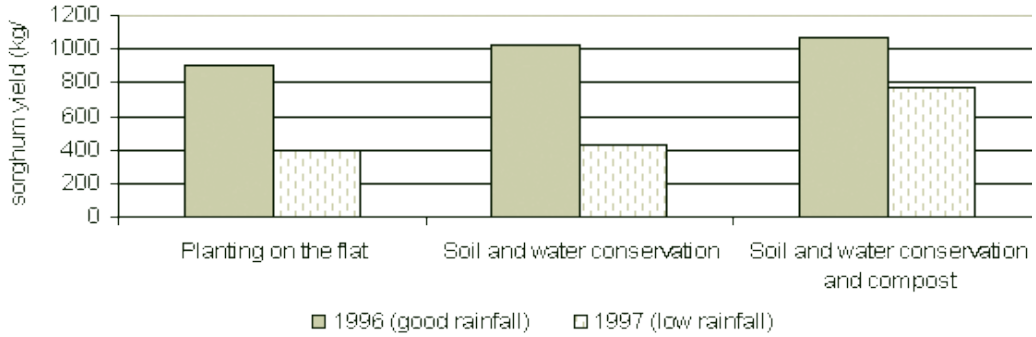

Figure 1. Sorghum yield in northern Burkina Faso in 1996 (good rainfall) and 1997 (low rainfall), on the flat, with soil and water conservation, and with soil and water conservation plus compost

Conclusion

The organic agricultural practices that have been applied in Burkina Faso, like Zaï and half moon planting, contribute to regeneration of vegetation in dry areas and to increased yields. These adaptive qualities of the farming system lead to increased resilience to weather shocks, to higher food security for the farmers and a lower chance of indebtedness, and contribute to the economic and social development of the area.

Hence, for farmers in the dryer areas of Africa, organic agricultural practice combining Zaï with manure or compost is a promising way to recover degraded land with crusted soils, and is well adapted to climate change.

Farmers making Zaï

1 Stroosnijder L. 2009. Modifying land management in order to improve efficiency of rain water use in the African highlands. Soil and Tillage Research Vol 103 (2) pp247-256.

2 Chris Reij and Taladidia Thiomiano. 2003. Rural Development and Environment in Burkina Faso: The rehabilitation of land productivity in the northern part of the central plateau between 1980 and 2001.

3 Robert Zougmore, Z Zida and NF Kambou. 2003. Role of nutrient amendments in the success of half-moon soil and water conservation practice in semi arid Burkina Faso. Soil and Tillage Research 71 pp143-149.

Kenya

Case Study by B. Freyer[a], R. J. Birech[b]

Green manure crops help farmers to adapt

Agriculture is an important sector of the economies of most developing countries. However, low land productivity is reported to affect the sector negatively, particularly in sub-Saharan Africa. Climate change threatens productivity even more, thereby putting the growing African population at risk. However, research has shown that organic agricultural practices, like the use of green manure crops, increase soil fertility and crop yields. Hence, these are very promising tools for African farmers to adapt to climate change.

Soil fertility depletion is one of the leading factors responsible for low crop yields in sub-Saharan Africa. Evidence shows that maize yields in the Kenyan Rift Valley, which represents an important agricultural region in East Africa, have been declining for the last 25 years from 5.4 tons/ha to 2.25 tons/ha.[1] This decline coupled with increasingly unfavourable weather and climate change poses a threat to the sustainability of most farming systems practiced in the region.[2]

The potential of organic agriculture

Organic agriculture combines several practices that improve soil health and soil fertility in a natural way. It makes the best use of the available nutrients and biodiversity, and protects natural resources. A promising practice that fits well in the organic principles is the use of nitrogen-fixing legumes as green manure crops to be planted in the fallow period, before the main crop is planted. This is even more profitable when combined with intercropping of green manure crops between the main crops during the long rains.

One of the opportunities in the Rift Valley of Kenya, with a long and a short rainy season, is to make better use of the short rains, during which fields are usually left fallow. By planting legumes as green manure crops during the short rains, soils are protected against erosion, nitrogen is fixed, carbon is stored in the biomass, and weed development is controlled. An additional benefit is that the green manure crops also offer food grains for humans or fodder for cows, goats or sheep.

Use of green manure crops increases climate change resilience

To analyse the potential of the use of green manure crops, the authors compared the results of organic field experiments with farmers' practice based on a field survey among 292 farmers in Eastern Mau catchment. One main feature of the farmers' practice is that they use chemical fertilizer, herbicides and pesticides, but very rarely nitrogen fixing legumes. In a long term trial (since 2003),[3] they tested the legume 'lablab' as green manure in a number of different treatments. The trial follows the IFOAM guidelines. The crop rotation concept is based on a rotation of legumes and different cash crops (maize, wheat, potato, sorghum).

The results showed that lablab yield and biomass development was variable and depended on the amount of rainfall received during the growth period. In comparison with the above mentioned decreasing yield level of the last 30 years and an additional survey on farmers' practice in 2006/2007, the green manure approach with legumes and the intercrop approach results into increasing yields in the long rain season, even if there is little rainfall during the short rainy season (see table 1).*

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b Egerton University, Njoro, Kenya

The combination of pre-cropping and intercropping provides more secure yields even in times of limited rainfall, because when the investment in soil fertility during the fallows is low because of limited rainfall, the intercropping nitrogen fixing plant integrated in the long rain will add nitrogen still and vice versa.

Table 1: Crop yields in comparison of organic and farmer practice4 in the Kenyan Rift Valley between 2003 and 2006

Cropping system / management	Organic trials with legume green manure (kg/ha)*	Ø Farmer Practice (FP) (non – organic) (kg/ha)	Difference in yields between organic and FP (kg/ha)	Relation between organic and FP (%)
Maize sole**	3934	1900	2034	207,1
Maize / legumes intercrop	3197/ 261	2360	836	135,5
Potatos sole**	16885	11240	5645	150,2
Wheat sole**	3700	2500	1200	148,0

* to compare experimental data with farmer practice, listed yields of field trials are 30% below the real measured data; ** organic trial cultivation

Conclusion

Organic agriculture contributes to an increase of soil fertility and carbon storage, which has a positive impact on water holding capacity to balance drought periods, increases nitrogen fixation and allows notably higher crop yields in the following main season (long rain). Precondition for this positive performance of the organic system is the permanent cover of soils to use rain efficiently and to contribute to optimal carbon storage and nitrogen fixation. Key is the cultivation of legumes in the short rains, e.g. lablab, cow pea and others.

Maize in long rains

Lablab in short rains

1 Okalebo, J.R., C. A. Othieno, P. L. Woomer, N. K. Karanja, J. R. M. Semoka, M. A. Bekunda, D. N. Mugendi, R. M. Muasya, A. Batino and E. J. Mukhwana. (2006). Available technologies for replenishing soil fertility in Africa. Nutrient Cycling in Agroforestry Systems 76:153-170.

2 Brown, O., A. Hammill and R. Mcleman, (2007). Climate change as the 'new' threat: Implications for Africa. International Affairs 83(6):1141-1154.

3 Birech R.J. (2008). Evaluation of organic farming strategies for sustainable crop production in Kenya. Ph.D. thesis, University of Natural Resources and Applied Life Sciences, Austria.

4 Birech 2008; internal intermediate report BOKU / ICRAF / EGERTON: project: Organic agriculture with trees (OAT), Mau catchment, Kenya

Egypt

Case Study by Boki Luske[a]

Increasing water use efficiency

Due to climate change and technical interventions like river dams, water availability in many dryland regions in Africa is becoming more and more problematic. At the same time and in the same areas, land degradation takes place at an alarming rate. Farmers in these regions need to adapt to the changing circumstances to halt and reverse the loss of soil fertility and to improve water use efficiency. This case study demonstrates that the application of compost on degraded soils is an effective measure to adapt to this changing environment.

Land degradation is induced by unsustainable land use and leads to the loss of organic matter in the soil. Soil organic matter is the basis of the soil food web and together with clay particles enables the formation of stable soil aggregates. These aggregates are important for soil structure and water holding capacity. With degradation, the soil loses its structure and the buffering capacity for water and nutrients.

With smaller amounts of water available in dry land regions, land degradation leads to a negative feedback loop that threatens food security if no action is taken:

- Due to climate change and infrastructure less water is locally available for agriculture
- Due to soil degradation agricultural soils need more irrigation water
- Water shortages and droughts cause yield losses.

Decreasing water usage while maintaining sufficient production is one of the major challenges for agriculture in dry regions. To reach this goal organic management practices are necessary. One of the organic practices that can help dryland farmers adapt to limited water availability is the use of compost (Figure 1).

Compost is able to repair the soil structure and therefore reduces irrigation water needs. This is due to the increase of organic matter in the soil that enhances its water-holding capacity. Numerous studies document the beneficial effect of compost on the hydro-physical properties of sandy soils[1234].

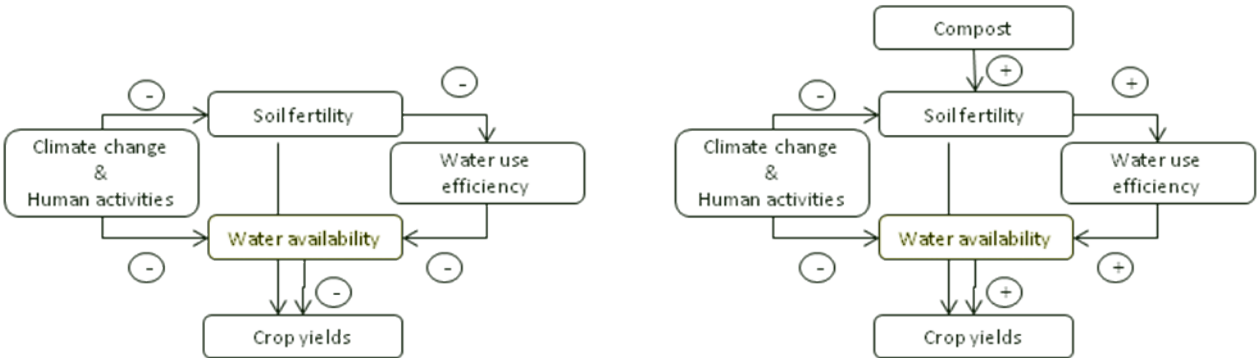

Figure 1. Compost use can help farmers in dry regions to adapt to climate change and break the negative feedback loop of climate change and water availability

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In the Egyptian desert, water availability is the limiting factor for agriculture. SEKEM, an organic farm 60 km northeast of Cairo, has invested in soil quality development by the use of compost since its foundation 30 years ago,. It was found that compost had a tremendously beneficial effect on soil quality and productivity. For many years, most farmers in the region did not invest in soil quality and were confronted with many problems related to low soil fertility. In the region there was hardly any recycling of organic material, although the agricultural soils needed that material. Therefore, SEKEM expanded their composting facility to a much larger scale, to enable the neighbouring farms to start to use compost and improve their soils. The project was implemented in 2007 and currently 60.000 tons of compost are produced annually. In 2008, a second composting facility was set up near Alexandria.

In June 2009, several agricultural fields of different ages were sampled to investigate the effects of compost use on the soil. It was found that a significant increase in organic matter levels is already reached within a few years of organic farming. Within 30 years the organic matter level in the topsoil increased from 0,14% to 2,05% (table 1)[5].

This case study shows that an ancient technique like composting can be a powerful measure to improve soil organic matter levels. Especially in dryland regions where soil fertility levels are low and climate change is increasing the problem of drought, the technique is of great importance to increase soil fertility levels and to adapt to climate change: with healthy soils one also needs less water.

Table 1. Percentage of organic matter in dryland soils with and without compost treatments.

	0-10 cm depth	10-30 cm depth
Desert	0,14%	0,13%
4 year old soil	0,99%	0,67%
5 year old soil	1,36%	0,54%
30 year old soil	2,05%	0,61%

SEKEM soil in 1987

SEKEM soil in 2009: exactly the same field, but very much has changed after thirty years of organic farming.

1 Wahba, M. M., 2007. Influence of Compost on Morphological and Chemical Properties of Sandy Soils, Egypt. Journal of Applied Sciences Research 3 (11): 1490-1493.

2 Wahba, M. M. & K. M. Darwish, 2008. Micro-morphological Changes of Sandy Soils Through the Application of Compost Manure. Journal of Applied Sciences Research 2 (3): 95-98.

3 Wanas, S. A. & W. M. Omran, 2006. Advantages of Applying Various Compost Types to Different Layers of Sandy Soil: 1. Hydro-physical Properties. Journal of Applied Sciences Research 2 (12): 1298-1303.

4 Wesseling, J.G., C.R. Stoof, C.J. Ritsema, K. Oostindie & L.W. Dekker, 2009. The Effect of Soil Texture and Organic Amendments on the Hydrological Behavior of Coarse-Textured Soils. Soil Use and Management 25, 274-283.

5 B. Luske & J. van der Kamp. Carbon sequestration potential of reclaimed desert soils in Egypt. In press. Louis Bolk Institute & Soil and More International, The Netherlands.

Ghana

Case Study by Merijn Bos[a]

Sustainable cocoa agroforestry

In tropical countries, the main effect of climate change will be less predictable weather fluctuations. This poses a threat to agricultural productivity and accelerates effects of ongoing deforestation such as increased land erosion and floods. Because of their tree cover, agroforestry systems can play an important role for smallholder farmers throughout the tropics in adaptating to climate change.

In the past 50 years, almost one-third of all tropical rainforests have been destroyed or severely degraded . This drastic change in land cover is a main driver of threats to livelihood sustainability, such as soil erosion, drought, floods and landslides. In recent years it has become evident that these effects of deforestation are even further worsened by global climate change, which in the tropics is most clearly represented by stronger and less predictable weather fluctuations with more extreme periods of drought and rainfall[2].

Shade agroforestry is resilient against effects of climate change

Agricultural land-use in the tropics varies widely in resilience to the effects of climate change. The organic agricultural practice of agroforestry (the plantation of perennial tree crops in a farming field) is one of the practices that are most resilient to, and can even act as a buffer against the increased fluctuations that accompany climate change:[3]

- Deep roots of trees protect soils against erosion and allow deeper lying nutrients and water to reach the crop, also in times of drought.
- The litter layer and the canopy cover of trees protect soils against heavy rainfall and buffer fluctuations in temperature and humidity.
- Tree canopies intercept and re-evaporate large amounts of rainfall that could otherwise erode soils and cause floods further downstream.
- The permanent cover crop combination and reduced or no tillage stabilizes soil quality.

Sustainable and diversified agroforestry is also a robust source of income to farmers, because it is less labor intensive and produces higher-value crops. The cocoa tree is one of the most important crops grown in agroforestry systems. Often, management of cocoa plantations is intensified to maximize short-term productivity. This intensification usually includes the removal of shade trees, which has been reported in all major cocoa exporting regions.[4] Such secondary forms of deforestation are a potential threat to the economic and ecological sustainability of cocoa agroforestry, particularly in the light of increasing climatic changes.

Organic certification sets minimum shade requirements for cocoa agroforestry

In the Ntobroso region of central Ghana, 2500 smallholder cocoa farmers are involved in a project to maintain and restore heterogeneous, shaded agroforestry systems. The region of Ntobroso is characterized by fragments of forest reserves surrounded by large areas of cocoa agroforestry owned by smallholders. Through training programs and technical assistance offered by the project, the farmers have been able to obtain organic certification for their cocoa production systems. Furthermore, they are now adding certification according to the Rainforest Alliance scheme. The requirements of this double certification include the maintenance and restoration of at least 40% shade by tree stands with local tree species that provide habitat to local flora and fauna and form corridors between rainforest frag-

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ments. The extra income resulting from the higher market prices of certified cocoa is an important incentive for farmers to use the environmentally friendly agroforestry systems.

The Ghana agroforesty case underlines that the use of organic agricultural practices, such as shade agroforestry, makes farms and farmers more resilient to the effects of climate change. Shaded cocoa plantations are a great adaptation to the adverse effects of global climate change for the following reasons:

- In shaded cocoa agroforests, root systems and soil biomass can be up to twice as high as in zero-shade plantations, stabilizing soils against erosion and increasing nutrient and water uptake in drier periods .
- Canopy cover in shaded cocoa agroforests protects lower vegetation layers and soils against erosion caused by heavy rainfall, and can even intercept and re-evaporate up to 19% of rainwater during periods of heavy rain , which is four times as much as in non-shaded plantations.
- Shaded cocoa agroforests are commonly intercropped with various other crops, spices and timber. This stabilizes farm revenues as up to 20% of the income from such systems can be from non-cocoa products[7].
- Farmers with sufficient income through agroforestry of perennial tree-crops are less likely to continue slash and burn practices with arable crops, which in the area is the least sustainable form of land-use.

Reduced shade cocoa agroforest

Dense shade cocoa agroforest

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IFOAM position on the full diversity of organic agriculture

Any system using the methods of organic agriculture and being based on the Principles of Organic Agriculture is regarded by IFOAM as 'organic agriculture' and any farmer practicing such a system can be called an 'organic farmer'. Organic agriculture brings valuable contributions to the farmer and to society outside the market place. IFOAM supports the adoption of organic agriculture regardless of whether the products are marketed as organic or not.

IFOAM regards third party certification as a reliable tool for guaranteeing the organic status of a product, and one that appears to be most relevant in an anonymous market. But IFOAM does not see this as 'universal' and not the only tool to describe organic agriculture. Apart from third party certification there are other methods of organic quality assurance for the market place. These can be in the form of self-declarations or participatory guarantee systems. There are also situations where the relation between the consumer and the producers are strong enough to serve as a sufficient trust building mechanism, and no other verification is needed.

IFOAM definition of Organic Agriculture

Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. 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.

IFOAM principles of Organic Agriculture

Health

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

Ecology

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

Fairness

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities

Care

Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

IFOAM'S MISSION IS LEADING, UNITING AND ASSISTING THE ORGANIC MOVEMENT IN ITS FULL DIVERSITY. OUR GOAL IS THE WORLDWIDE ADOPTION OF ECOLOGICALLY, SOCIALLY AND ECONOMICALLY SOUND SYSTEMS THAT ARE BASED ON THE PRINCIPLES OF ORGANIC AGRICULTURE.

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