Organic Agriculture in Development
- The need for integrated production for food security

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Organizers:

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SOAR, the research school for Organic Farming and Food Systems in Denmark,
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DARCOF, the Danish Research Centre for Organic Food and Farming, Claus Bo Andreasen on issues related to communication and media.

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CONTENTS

1. INTRODUCTION

Chemical fertilizers, synthetic pesticides, irrigation and improved cultivars were important ingredients of the Green Revolution that helped increase food production in Asia.

Today, chemical input intensive system of crop husbandry are widely perceived as not sustainable in the long term. Total factor productivity of crops such as wheat is now declining. Indeed second-generation problems, fall-outs of the Green Revolution, have now surfaced. Ever increasing cost of production due to costly inputs and the resultant reduced profit is another important issue affecting farmers and commercial farms.

There is increasing evidence that yield similar to that of conventional agriculture is possible by using biological approaches of crop production that will not need expensive inputs, and may be more sustainable in development aid strategies

Experience from research and development programmes in organic/integrated crop production will be the focus of the workshop, leading to discussion on future strategies. Among them the perspective for organic agriculture as a rural development strategy or pathway for smallholders in developing countries would appear to be a valid starting point for subsequent discussion.

Acknowledgements
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Box: Press Coverage

Danish DR1 “Miljømagasinet” 1 December and 3 December 2006 (
http://www.dr.dk/P1/Miljoemagasinet/Udsendelser/2006/11/30130349.htm)
U-landsnyt (http://www.u-landsnyt.dk/nyheder.asp?ID=10736)
Two articles “Økologisk Jordbrug”, 1 december 2006, nr 373, 26 årgang, p. 1

2. LIST OF ABBREVIATIONS

CGIAR	Consultative Group for International Agricultural Research
DANIDA	Danish International Development Assistance
DARCOF	Danish Research Centre for Organic Farming
EPOPA	Export Promotion of Organic Products from Africa
ICIPE	African Insect Science for Food and Health
IITA	International Institute for Tropical Agriculture
KU	University of Copenhagen
IFOAM	International Federation of Organic Agriculture Movements
KVL	Royal Veterinary and Agricultural University –now KU, Faculty of Life Sciences (see above)
NETARD	Danish Network for Agricultural Research for Development
GAP	Good Agricultural Practice
SOAR	Research School for Organic Agriculture and Food Systems

3. DESCRIPTION OF THEME

Organic farming methods provide tools which can help overall farm productivity for small-scale farmers who use very little, if any, fertilizers and pesticides. In addition there is strong emerging evidence that achieving yields similar to that of conventional agriculture is possible by using biological approaches of crop production that avoid or save on expensive inputs. Such approaches may be more sustainable in development aid strategies. The methods are low-input and aim to preserve natural farm resources such as soil fertility and natural enemies of insect pests. The same methods aim to avoid some of the costs and risks of conventional agriculture. This makes them well-suited for small scale farmers. However, organic and integrated farming methods are knowledge intensive. This is true both at the research, extension and farmer levels. Though growers can build on existing traditional knowledge, for example with respect to intercropping, training is no less and perhaps more important in organic than in conventional farming.

Certified organic farming is applied by a rapidly increasing, but still small segment of farmers. For them certified organic production provides access to an attractive and growing international market where high quality standards are required - and rewarded with higher prices. In addition, regional and national markets are beginning to demand food which meets higher quality standards (such as the European GAP) including organic foods. Certifying organisations and NGO’s may provide training for participating farmers.

Agricultural production relies on ecosystem services to succeed. 95% of the world’s potential pests are kept in check by natural enemies. In terms of avoided loss this ecosystem service alone is worth at least 400.000 mill USD annually (Constanza et al., 1997). Pest control targets the remaining 5000 species.

An example of the value of knowledge intensive and biodiversity based methods of pest management, is biological control. Introduction of natural enemies to the exotic pests cassava mealybug and cassava green mite have been vital to secure cassava harvest for small-scale farmers across Africa. It could not have been done without support from among others Danida. The research and development required years of continuous effort by researchers at IITA and elsewhere, but today benefit-cost ratios are very high (140-600 : 1) and comparable to those of classical biological control worldwide. Recent research at ICIPE is targeting sustainable production of high value vegetables often receiving 2-3 weekly sprays. For the individual farmer the success of biological control will depend on steep reductions of pesticide input to preserve the natural enemies.

One may perceive the above in three dimensions, a broad development dimension, a market dimension and a production oriented dimension. The workshop therefore embraced these three dimensions. The first of these aimed at presenting and discussing experiences with organic farming as a possible pathway to help smallholders achieve broader developmental objectives, including sustainable livelihood. The second focused on parts of the market framework within which organic farming in developing countries is seen to unfold. Finally, rationale of the last dimension was rooted in production oriented requirements or challenges facing any market lead strategy in developing countries: the weak capacity of both farmers and advisors to develop and provide knowledge intensive and yet organically certifiable solutions to the multitude of production system challenges facing resource poor smallholders aspiring to seize the opportunities presented by a rapidly emerging world market for organically certified, high quality food. As an example, the pest management challenge and biological control as an organically certifiable means of pest control was focused upon (section 3).

This workshop design therefore rested on the organisers' conviction that any success for smallholders adopting organic farming as a developmental pathway will critically depend on a range of factors in addition to its currently globalizing market framework. To augment its developmental appeal and role, for instance, organic farming may have to intensify its collaboration with the movements of fair trade. And to make production of a wide range of high quality foods possible in smallholders' fields in the tropics possible, there is no escape from developing and sharing with farmers a wider range of production methods and technologies, such as the use of biodiversity based or biological pest management technologies.

4. OBJECTIVES OF THE WORKSHOP INCLUDING TARGET GROUP

The objective of the workshop is to set focus on the renewed discussion on the necessity to invest in organic/integrated production systems, as new technology such as fertilizers and GMO do not solve the development problems. Specific goals are:

- Review the latest developments within the area
- Point out potentials and constraints for organic/integrated production systems to lead to development and improved livelihoods for resource-poor farmers

Target group

The target groups for the seminar were:

- Researchers within the Danish Environment, hereunder advanced MSc students and PhD students. The course will be announced to all Phd students enrolled in SOAR and to all students at the MSc study programme "Agricultural Development" at KVL.
- Development professionals at Danida. BFT will in particular be targeted.
- NGOs who are active in the field, including MS, Ibis, ADRA, ADDA.

There were no restrictions in the participation, the workshop extended an open invitation distributed through the above networks.

5. PROCESS AND DISCUSSIONS

The workshop was divided in three main sessions, with a total of seven speakers. Proceedings below follow the same sequence:

I. Organic Agriculture as a means to development for resource poor farmers
   a. Experiences with the use of ”Organic” as a development model by Brian Ssebunya, Amfri Farms Uganda
   b. Can organic farming contribute to a better livelihood of small scale farmers ? By Michael Hauser, BOKU

II. Certified organic products for the market to further development
   a. Trading of organic products as an export opportunity for developing countries by Andrew Stevenson, UNCTAD
   b. Export promotion of organic products from Africa by Gunnar Rundgren, EPOPA

III. Biological diversity for food security in integrated production systems
   a. Biological control and functional biodiversity in agricultural production – successful cases to improve food security by Peter Neuenschwander, IITA
   b. Growing vegetables in Eastern Africa – pest control in organic/integrated agricultural production, biodiversity, farmer economy and exports markets by Markus Knapp, ICIPE
   c. The need of diet diversity for family health and nutrition by Nanna Roos, KVL

Organic agriculture as a means to development for resource poor farmers, private sector perspective.

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Abstract: Globalization and increased international trade has a vast impact on agriculture and food systems all over the world. This presents a challenge of technological and structural modernization of the food production especially for low-income countries. Organic agriculture that promotes use of local resources without recourse to expensive inputs results in higher biodiversity, less damage to the environment while providing an opportunity for exporting high value food crops. This makes it a good tool for development in especially low-income countries. Amfri Farms has been involved in the production, processing and export of certified organic fruits, vegetables and spices for over 10 years working with small holder farmers in Uganda. These suppliers have benefited in a number of ways on top of getting access to this premium market. Other processors have also been linked to market and are now supplying high quality products. This interaction among these players is based on trust and transparency emphasized through organic inspection, a clear understanding of organic certification requirements and mutual recognition of each player's role in the chain through the Internal Control System. Other side partners in the chain, like NGOs, help in identification of weaknesses along the chain and give assistance to strengthen those chain linkages. Some challenges are still faced which include limited funding for investment, limited production capacities of suppliers/farmers, high cost of production and handling (certification and airfreight costs) and poor infrastructure (handling facilities and cool chain for highly perishable products). To further enhance the contribution of organic as a development tool, integrated efforts are needed to promote organic as a 'way of life' rather than simply for market access for sustainability, need for development and other partners to recognize each chain player's role and help develop their capacities at that level for better efficiency rather than stretching their abilities, more research, infrastructural development, creation of sustainable demand, and a proper regulatory framework.

Key words: organic farming, farmers, Amfri Farms, exports

Introduction

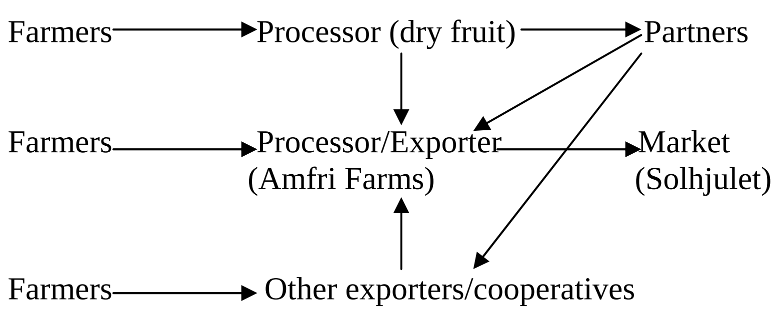
Uganda is already accessing international organic markets through export of coffee, vanilla, sesame, ginger and cotton, fresh and dried fruits with significant impacts on poverty reduction among participating farmers principally due to the reliability of the market and the price premium (15-30% of conventional market prices) which farmers obtain for organic produce (Grolink, 2002). This has been a result of the efforts of the private sector and NGOs with the support of donors like SIDA through its 'Export Promotion of Organic Products from Uganda' (EPOPA) programme (Forss and Sterky, 2000). Traditional farming practices in Uganda easily conform to organic standards, what is required is the organisation of smallholder farmers for organic agriculture (awareness raising, documentation and establishment of internal control systems). The National Organic Agricultural Movement of Uganda (NOGAMU) started as an NGO in 2001 and registered in 2002 brings together farmers/producers, processors, exporters and other organic promoters in Uganda. Besides export markets, the NOGAMU organic shop and supermarkets like Uchumi and Spinach have started reserving shelf space to organic products.

Uganda has more than half (122,000 hectares) of all certified organic land and around two thirds (33,900) of all certified farms in Africa (Walaga, 2003) and this land area under organic management represent only about1 % of the total agricultural land in the country. In Uganda besides the NOGAMU organic shop, supermarkets like Uchumi and Spinach have started reserving shelf space to organic products.

Company overview

Amfri Farms trading as African Organic is a private enterprise, registered in Uganda, involved in the production, processing and export of certified organic fresh, dried and frozen fruits, vegetables, herbs and spices. It's certified by the Institute for Marketecology (IMO), Switzerland since 1994 in compliance with EEC regulation 2092/91, USDA/NOP and recently inspected for Naturland certification. Furthermore, Demeter conversion for the company farm and HACCP implementation is in progress.

Amfri supply system



Under this supply chain, there are three recognizable levels each having its own advantages. Farmers have specific roles which mainly include production according to the standards while safeguarding the organic quality of the products, maintaining other quality aspects of the products and involvement in group activities as deemed important by the group.

This chain helps farmers to access the premium organic markets (with 30-100% premium); they receive free organic certification and extension services covering organic production, post-harvest handling, drying and other related issues.

Other processors/cooperatives are helped to easily access market information and improve their quality to meet market requirements. These operators become more specialized (especially on production/processing) hence more consistency in supply.

Such a supply chain is built on trust and transparency emphasized through organic inspection, a clear understanding of organic certification requirements and mutual recognition of each player's role in the chain through the Internal Control System.
Amfri as the chain leader has different roles which include final packaging and delivery to the clients, marketing (including identification of new clients), client service, brand manager, innovation and product development, supply chain management and overall quality management including certification. Other partners in the chain, like NGOs, help in identification of limitations along the chain and give assistance, for example, funding for farmer extension, ICS development and certification, marketing (e.g. trade show participation, product development), a case of the EPOPA programme.

Main challenges

Among the challenges includes;

- Limited funding to invest at different levels in the chain. Bank financing virtually unavailable interest rates up to 20-30%. No government support to the sector yet.
- Limited production capacities of suppliers/farmers; caused by 100% reliance on natural cycles, rudimentary tools and traditional production systems.
- High cost of production and handling (certification, airfreight costs)
- Poor infrastructure (handling facilities, cool chain for highly perishable products)

'Organic' as a development model

Agriculture in general is very important as a tool for development in low income countries like Uganda. Organic agriculture results in higher biodiversity and less damage to the environment, and is characterized by the use of local resources, thereby independency of expensive inputs like fertilizers, pesticides and other conventional inputs. It is therefore a feasible approach to provide food security and income, through export of these high value products, for resource poor small-holder farmers. In Uganda, organic farming is mainly practiced by small scale farmers and the impact on their standards of living is very significant. Women are actively involved and empowered. It is a highly adaptable production system that recognizes the role of indigenous knowledge in identifying solutions so farmers feel ownership of the eventual solutions which makes it a sustainable and cheaper option for these resource poor farmers.

Way forward

- The challenge ahead of us is the need to promote organic as a 'way of life' rather than simply for market access.
- There is a need for development and other partners to recognize each chain player's role and help develop their capacities at that level to achieve more efficiency rather than stretching their abilities.
- More research is needed in organic agriculture to identify solutions to threatening production related constraints like pests and diseases.

- Development of the necessary infrastructure for certification, quality improvement and value addition
- Creation of the ‘demand pull’ for sustainability of especially trade initiatives
- Recognition of organic agriculture under the mainstream agriculture so it receives a share of the budget; this calls for a favourable regulatory framework.

Acknowledgement

I would like to extend my sincere thanks to Prof. Henning Høgh Jensen for inviting me to this workshop, Sofie Kobayashi, all the organizers and everybody involved in one way or the other.

Can organic farming contribute to a better livelihood of small-scale farmers?

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Abstract – In less developed countries, organic farming has a theoretical potential for contributing to better livelihoods of small-scale farmers. Several institutional barriers, however, keep this livelihood potential unlocked. Against this background, a comprehensive institutional innovation and change process that empowers farmers to become active decision-makers during the transition to organic farming is needed. Experiences with from western and eastern Uganda suggest that farmer empowerment is an important precondition when aiming for better livelihoods of small-scale farmers.

Key words: organic farming, sustainable livelihoods, Uganda

Introduction

Organic farming has become an important issue in the development debate, and it is frequently argued that transitions to organic farming contribute to better livelihoods of small-scale farmers in terms of improved natural resources, household income and food security (Pretty and Hine, 2001; Parrott and Marsden, 2002). Paradoxically these contributions are not always fully acknowledged by policy decision makers and distant observers of the organic sector. This discussion paper examines some of these arguments along with three propositions. First, we argue that organic farming has a tangible potential for contributing to better livelihoods and hence increased well-being of small-scale farmers in developing countries. Second, we note that the full potential of organic farming has not yet been fully realised due to a range of institutional issues that tend to disempower organic farmers. Third, we argue that if the full livelihood potential of organic farming shall be unlocked, then a broad institutional innovations and change processes is needed that alters prevailing 'rules of the game' as they determine interactions between and opportunities of actors within the organic sector.

Proposition 1: Organic farming has a potential for contributing to better livelihoods. Both random observations and systematic research reveal that organic farming has a potential for making positive contributions to small-scale farmers livelihoods. These contributions are expressed in terms of increased ecological sustainability of natural resource management, new income opportunities of farmers through access to markets that offer premium prices for organic commodities, and improved food security that results from higher levels of a more diverse agricultural production portfolio as well as increased financial capabilities to purchase food (for a recent review see e.g. IFAD, 2003). Our own observations in countries such as Uganda (which stands out for a remarkable growth of the organic sector) suggest that organic farming certainly has a potential to increase farmers' assets and capabilities required for a means of living. Increased access to or ownership of livelihood assets support farmers in coping with and recovering from stress and shocks (Scoones, 1989). In theory, organic farming enhances farmers' production and marketing capabilities, and hence provides sustainable livelihood opportunities for these farmers today and in the future.

Proposition 2: The potential of organic farming is not fully unlocked due to institutional barriers. Due to a range of factors and processes, notably institutions (i.e. rules that govern the organic sector), the full livelihood potential of organic farming is not realised everywhere. Many of these institutions have been subject to debates in the literature (e.g. Barrett et al., 2002). Among others they comprise the following aspects: (a) organic production standards and guidelines tend to be determined by players in the north (and not organic farmers in less developed countries), (b) many organic farmers in less developed countries lack market information and are advised what type of organic products to grow by exporters and traders, (c) organic exporters and traders tend to view farmers as passive producers of organic commodities and not so much as active and innovative agriculturalists, (d) organic certificates are owned by traders and farmers can only sell to the owner of the certificate, (e) monitoring and evaluation of farm management is done through regular visits of organic inspectors and does not necessarily support farmers' learning about new agronomic practices that would strengthen natural resource management, (f) the use of research products play an insignificant role, and (g) in many less developed countries there the lack of trained and skilled service providers hinders small-scale farmers to transition to organic farming. In sum, unequal power structures limit farmers' capabilities and future opportunities to improve their livelihoods through organic farming.

Proposition 3: Unlocking the full potential of organic farming requires a broad institutional innovation and change process. In order to fully realise the livelihood potential of organic farming, it is not enough of contract farmers as out-growers who then grow organic commodities for exporters with business links into international organic markets. In the long run, this would keep farmers dependent on outsiders and even limit farmers' capabilities to improve their livelihoods sustainably. There is hence a need for institutional frameworks that empower farmers to become more active organic agriculturalists. This comprises approaches that strengthen the competitiveness of organic farmers' vis-à-vis new market opportunities as well as empowerment strategies that allow farmers to make well informed production and marketing decisions. Production decisions need to consider food security and poverty implications of organic farming strategies prior to broader investments. This is of particular importance where farmers have limited access to livelihood assets (e.g. natural capital). In western and central Uganda, the Enabling Rural Innovations (ERI) process (see Sanginga et al., 2004) employed by farmers who transition to organic farming supports respective institutional innovations and change processes.

Development outcomes

The ERI process, which was tested at a pilot scale, guides farmers through the transition to organic farming and helps them to move from selling surplus production to informed demand and market-oriented production ('produce what you can sell, not sell what you produce'). Farmers themselves collect market information and test profitable organic enterprises before investing into production at larger scales. Training of farmers in conducting market research and on-farm experiments is an important human capital investment with an explicit empowerment dimension ('we can do it'). This

(coupled with group formation and group strengthening) results in a reduction of transaction costs through increased social capital.
Experiences from western and Eastern Uganda have shown that partnerships (among farmer groups, NGOs, private sector, NARS, IARCs) during the transition to organic farming are an essential backup for farmers.

Conclusion

In our opinion organic farming can contribute to a better livelihood of small-scale farmers, but only when farmers are recognised as active and creative organic agriculturalists. It is however important to bring control closer to farmers and allow farmers to take informed, autonomous production and marketing decisions. Nevertheless, future challenges remain. These include more effective linkages between organic certification and participatory monitoring and evaluation so that the first become farm management and decision support tools, the development of organic farmer associations that link organic farmer groups in a given area, and transferring ownership of organic certificates to these farmer associations.

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Export promotion of organic products from Africa

Gunnar Rundgren, EPOPA

EPOPA folder included as separate appendix

Organic Agriculture - A Trade and Sustainable Development Opportunity for Developing Countries

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Abstract: Developing countries have some advantages in organic production. They have large supplies of cheap labour and the costs of agro-chemicals mean many smallholders already farm without using them. Organic agriculture can also build on the wealth of traditional knowledge and crop varieties used by developing country farmers. Organic agriculture can provide various benefits to developing countries, and smallholder farmers in particular. These include: economic benefits - including higher prices for certified organic produce and comparable or improved crop yields; environmental benefits - including less pollution, less soil erosion, enhanced biodiversity, and reduced greenhouse gas emissions; and social and cultural benefits - including reduced injuries from pesticides, revitalized rural communities and improved food security.

However, organic farmers in developing countries also face serious obstacles, such as the high costs of gaining organic certification, the lack of information about organic methods and market opportunities, and competition from subsidised developed-country products.

Key words: developing countries, sustainable development, exports, certification, traditional knowledge

Introduction

Increasing environmental and health concerns in developed countries, as manifested in the growing number of environmental and health-related Government regulations and private sector standards, can pose new burdens on developing countries wishing to export to these markets. Yet these concerns may also lead to some opportunities for developing-country exporters. The organic agriculture sector (OA) is one such example.

Developed-country markets for certified OA products have been growing much faster than overall food markets over the past two decades. This presents some promising export opportunities for producers and exporters of organic products in developing countries. In addition to income generation, OA can offer an array of positive effects at home, related to the environment and to sustainable natural resource use (improved soil fertility, reduced soil erosion, enhanced biodiversity), and in the social sphere in terms of rural employment generation, lower urban migration, improved household nutrition, local food security and greater self-reliance.

Recommmendations

Developing country governments could help foster OA in their countries by carrying out national assessments of their organic sector and identifying the main barriers preventing growth. Governments could also raise awareness of the benefits of organic farming among consumers and farmers and include organic agriculture as part of agricultural education and research programmes.However, in order to take advantage of the possibilities embedded in the organic production it is essential to develop agricultural systems adapted to local conditions, and to supply the technical and biological knowledge indispensable for a sustainable development.

It is recommended that certifying bodies drop as many barriers as possible to accepting the results of each others' inspections and evaluations. Moreover, they should drop as many of their additional requirements as possible. In this context, efforts made under the multilateral agreement of IFOAM-accredited certifiers are important steps in the right direction, and further progress is called for. Certifying bodies should also consider allowing their label to be affixed to products that have been inspected by other certifying bodies that are party to the multilateral agreement, particularly where the certifying body enjoys a monopoly-like position in terms of consumer recognition in the national market.

Developed-country governments and other stakeholders can take a range of measures to facilitate sales in their countries of OA products from developing countries. These include implementing transparent and easily understandable rules and procedures governing OA imports, and pursuing harmonization, mutual recognition and equivalence in the organic guarantee system. In addition, agricultural subsidies for products competing with developing-country exports should be reduced, and developed countries ought to support technical assistance/capacity-building programmes that encourage developingcountry OA production and export, especially of high value products.

Acknowledgements

This material is based on 'Organic Agriculture: A Trade and Sustainable Development Opportunity for Developing Countries' by Dr Sophia Twarog of UNCTAD, in UNCTAD's *Trade and Environment Review 2006.*

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Biological control and functional biodiversity in agricultural production – successful cases to improve food security in Africa

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Abstract: Because of the introduction of two arthropods from South America into Africa in the mid-1970s, cassava production fell precipitously and food security was endangered on a continental scale. Biological control of the cassava mealybug by the introduced wasp *Anagyrus lopezi* (Hym., Encyrtidae) and of the cassava green mite by the predatory mite *Typhlodromalus aripo* (Acari, Phytoseiidae) lowered the mean population level of both pests to acceptable levels. Total savings that accrued to the mostly poor small-holders are estimated at $10 billion (over 27 countries) and 2 billion (over 3 countries), respectively. Differences in the outcome of the two programs, actions needed where and when infestation levels still are above the threshold, as well as non-monetary gains in avoided pollution and biodiversity preservation are discussed.

Key words: cassava pests, biological control agents, integrated control

Cassava was introduced into Africa by the Portuguese in the 16th century and has become the main staple food for about half the population of sub-Saharan Africa. Up to today, almost all cassava is produced without insecticides and fertilizer, because the value of the crop is relatively low. The label 'organic', though correct, is, however, never used. Productivity on subsistence farms, even with new, higher yielding and virus-resistant varieties, is still only about a fourth of the on-station yield. Cassava is processed and detoxified, mostly by women, into a dry, cyanide-free powder, 'gari', which can be stored and easily commercialized.

Up to recently, few indigenous insects and pathogens attacked this crop. In the mid-1970s the situation changed, when two arthropod pests in short succession invaded the continent. Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero (Hom., Pseudococcidae) was observed first in the Congo, then in Nigeria/Benin, Senegal/Gambia and later spread across the continent at the speed of about 150 km per year, leaving a trail of destruction. The mealybug caused cassava buds to curl and the stems to twist, and tuber production fell 10 fold. Because no planting sticks were available for the next season, cassava production was sometimes abandoned over vast areas (Neuenschwander, 2001). Around the same time, cassava green mite, *Mononychellus tanajoa* (Bondar) (Acari, Tetranychidae) was introduced in the area of Lake Victoria and spread across the entire continent, so that today only Madagascar is free of both pests. In response to these invasions by alien arthropods, two interconnected biological control projects with extensive international collaboration between IITA, CIAT, FAO, CAB International, the Inter-African Phytosanitary Council, National development agencies and universities in Europe and America, as well as universities and national programs of over 20 African countries were launched.

Mealybug parasitoids were first imported from northern South America, but did not attack the cassava mealybug in Africa. Their host was later identified as a new mealybug species, and the search started again. The original home of the cassava mealybug was later discovered in southern South America and by 1981 the parasitic wasp *Anagyrus (Apoanagyrus, Epidinocarsis) lopezi* (De Santis) (Hym., Encyrtidae) was introduced to Nigeria – and later to Benin - via quarantine in England.. In quarantine, this exotic species was tested for diseases, for being specific to the mealybug, and for not attacking other insects, particularly parasitoids as a hyperparasitoid. Mealybug predators, mainly coccinellids, followed, but they never became important. Foreign exploration for predators of the cassava green mite also started in Columbia, yielding a plethora of predatory phytoseiid mites, 10 of which were passed through quarantine in the Netherlands and introduced into Africa; none established, however. The search for natural enemies then moved to climatically matched areas in Northeastern Brazil which eventually yielded six species that were introduced into Africa after passing through quarantine in the Netherlands. Initially, two species – *Typhlodromalus manihoti* Moraes and *Neoseiulus idaeus* Denmark & Muma - established in Africa, though their dispersal and impact remained limited and *N. idaeus* later became extinct (Yaninek and Hanna 2003). It was only four years later, when *Typhlodromalus aripo* DeLeon was introduced that the control project took off.

The exotic agents were reared in glass houses and laboratories first in Ibadan, IITA-Nigeria, and since 1988 in Cotonou, IITA-Bénin. National program staffs were trained in rearing and monitoring, and rearing facilities were established in many countries, though most releases were still made with biological control agents out of IITA. On request by national programs, which provided the import permits, the following releases were made in collaboration with national scientists: about 150 releases of *A. lopezi* (sometimes together with two species of coccinellids) between 1981 and 1995 in over 20 countries of sub-Saharan Africa (Neuenschwander, 2001), and 524 releases of three species of predatory mites, mainly *T. aripo*, between 1989 and 2004 in 19 African countries.

Releases were followed up, sometimes over many years, in surveys covering most release countries. Data on the presence and abundance of the exotic agents, their indigenous counterparts, their hosts and other members of the food-webs, as well as on weather, soil conditions, cassava varieties and weeds, cassava yield, and market prices (of cassava and replacement crops) were obtained to quantify establishment, spread, and impact on the pest populations, on plant growth, yields, and the economy. These were complemented by on-station experiments, using different exclusion and other techniques to determine details of impact and of the biology (host finding, reproductive behaviour, migration, alternate hosts, etc.).

Compared to other exotic and indigenous natural enemies, *A. lopezi* proved to be the superior competitor (Neuenschwander, 1996). The female is capable of ovipositing already into 2nd instar hosts, but reserves the bulk of female eggs for the bigger 3rd and 4th instar hosts. Though the host tries to encapsulate and kill the parasitoid larva within its coelom, this immune reaction is overcome by almost all larvae. The adult wasp emerges after only 2 weeks, which is half the generation time of the host, and has an astonishing host finding capacity, based on olfactory cues from mealybug infested plants. Egg laying capacity is rather limited and females have a tendency to leave the host patch immediately, without exploiting it fully. This early dispersal is probably the reason for the relatively slow impact, which makes itself fully felt only about 2 years after release, presumably when immigration matches emigration. The parasitoid reduces host population peaks by about 10 times (depending on the cassava variety), whereas local predators, mainly coccinellids, contribute to a 20% reduction of peak mealybug populations. Since cassava mealybug (at least at low population densities) is essentially monophagous and hardly ever attacked by indigenous parasitoids, and *A. lopezi* does not attack indigenous mealybugs, there are no non-target effects (Neuenschwander and Markham, 2001).

The economic impact of this project (Table 1) has been calculated to be in the order of $10 billion, with a benefit:cost ratio of 1:140 to 1:600, all figures depending on the assumed scenario (loss replacement by more cassava planting, cassava or maize import or food-aid) (Zeddies *et al.,* 2001). This benefit corresponds to the benefit of 20 years of cassava breeding with all the institutional support at international and national levels that this activity commands.

Table 1. Economic impact analysis for two biological control projects in Africa (Neuenschwander, 2004)

Invasive pest species	Cassava mealybug	Cassava green mite
Typical mean, area-wide yield losses	40%	35%
Biological control agent	*Anagyrus lopezi*	*Typhlodromalus aripo*
Start of campaign	1981	1983
Area under economic analysis	27 African nations	Nigeria, Ghana, Benin
Reduction in loss attributed to this pest species	90-95%	80-95%
Estimated savings in US$ million	7971-20226	2157
Source	Zeddies *et al.*, 2001	Alene *et al.,* 2005

The cassava green mite biological control campaign has resulted in a similar continent-wide success, largely through the establishment of Brazilian populations of the predatory mite *T. aripo*. This predator is now established in at least 20 countries in sub-Saharan Africa (Hanna and Toko, 2003; Yaninek and Hanna, 2003). Repeated surveys in at least 12 countries and a total of 18 predator exclusion trials have shown that the predators have reduced cassava green mite densities by 60% and increased cassava root yield up to 80% depending on location and cassava variety (Yaninek and Hanna 2003; Hanna *et al*. 2005), and notably without any negative non-target effects (Zannou *et al*. 2007). For three countries in West Africa where the economic analysis of the benefits have been completed, cassava green mite biological control with *T. aripo* has provided enormous economic benefits at no cost to the farmers: over $2.2 billion from 1983 to 2020 for Benin, Ghana and Nigeria (Table 1; Alene *et al*., 2005). In the remaining countries where cassava green mite biological control has been achieved similar benefits continue to be generated. Evaluation of the socioeconomic impact of this project in East and Southern Africa is underway.

Parallel to the use of exotic predatory mites, exotic isolates (also from Brazil) of the entomopathogenic fungus *Neozygites tanajoae* Delalibera Jr., Humber & Hajek (Entomophthorales: Neozygitaceae) was released in Benin. For the evaluation, molecular diagnostic tools had to be developed to distinguish African and Brazilian isolates of *N. tanajoae*. The fungus has contributed to further reductions in cassava green mite densities (Hountondji *et al*., 2002; Hanna and Toko, 2003). It has also been released in two areas in Tanzania, where the exotic predators have, however, not been able to establish and control cassava green mite. Efforts are underway to evaluate the fungus in other countries.

Overall, *A. lopezi* led to complete control in 90-95% of all fields. The rest of the fields, where control was not satisfactory, invariably concerned fields on pure sand without mulch. Under these conditions, the host plant was specially favorable to the mealybug and hostile to the wasp, so that *A. lopezi* was not able to contain its host populations. By contrast, *T. aripo* efficiency proved to depend to a larger extent on environmental (low relative humidity as a limit) and plant factors. Of particular significance are the interactions between cassava clones and *T. aripo*. This predator inhabits the apex (Onzo *et al.*, 2003) of the plant and prefers apices that are 'hairy' over those that are 'glabrous'. Cassava genotypes have been shown to have a considerable effect on *T. aripo* abundance and, by extension, on its potential to control cassava green mite (Hanna *et al.*, 2007). The predator was also shown to feed on cassava extrafoliar exudates, which have a synergistic positive effect on its reproduction. When *T. aripo* was offered a mixed diet of cassava green mite and exudates, a higher level of biological control of cassava green mite was achieved (R. Hanna *et al.*, unpublished data). Moreover, germplasm surveys showed that hairiness and exudates are positively correlated and that hairiness is a heritable trait that can be bred into cassava clones. This offers a novel perspective to cassava breeding and calls for a paradigm shift: cassava improvement should go beyond traditional breeding traits and include suitability of a clone to natural enemies. The information on the effect of apex hairiness has been widely disseminated and presently numerous cassava improvement programs routinely incorporate the hairiness trait in their clonal selection.

The biological control project against cassava mealybug is essentially finished and the natural enemy cultures are maintained at IITA-Benin only in case the mealybug invades Madagascar or Asia. The project against green mite, however, continues with emphasis on selecting and distributing cassava varieties that are suitable for the predatory mites. Releases of *N. tanajoae* and monitoring of its establishment and impact are still executed in areas where climate matching modelling has suggested a good likelihood of success.

Apart from technical training, higher degree training in collaboration with African, European and American universities was undertaken. Among the dozens of PhD, MSc and hundreds of ing. agr. students trained, many occupy now important positions in their respective countries. Together with assistance to the national programs, this institutional impact enabled many countries to develop south-south collaboration and to tackle new biological control projects, removing their countries at least partially from the grip of powerful insecticide companies. The leader of the cassava mealybug project until 1994, Hans Herren, received the World Food Prize, which brought the project to international attention. Today, biological control is an acknowledged integral part of IPM, recognized as its basis, and there are strong efforts to avoid insecticide abuse. Among the accepted livelihood assets, the projects thus improved the natural capital (avoided pollution), financial assets (documented savings on national bases), human capital (training) and social capitals (continent-wide network of biological control workers). Thus, biological control was (re-) established as an efficient, non-polluting technology with gender-neutral equal impact on poor and wealthy farmers. The costs of the projects were borne by the international donor agencies, which had the opportunity to invest in a long-term, high-interest and corruption-free enterprise.

Do the farmers know this? Throughout the projects, care was taken to inform the farmers wherever possible. Since classical biological control hardly needs any input by farmers, the real clients are the national program and extension officers. In the case of cassava mealybug, the first region-wide official recognition for impact was given at two international conferences in the mid-1990s, i.e., many years after we had quantified impact in these countries in collaboration with our collaborators. Up to today, we receive calls for so-called resurgences and apparent failures of biological control from our colleagues, even from IITA. And in each case, when we follow up, this turns out to be a short, local and relatively small peak in abundance of the pest, representing rather erratic fluctuations around the ten-time lower mean compared to the condition before the introduction of the exotic natural enemies. Infestations of cassava mealybug are, however, higher where farming practices are bad, e.g., under stress conditions when cassava grows on pure sand without mulch. To correct this, better soil conservation practices are needed and the often asked for additional release of the already established natural enemies is only a political palliative. The conclusion is that biological control and functional biodiversity cannot replace good farming.

For Africa this also means that in addition to manual labour, more inputs are needed to replace the nutrients of the depleted soils. To nourish the increasing human populations, we need more productivity on the already farmed land, so that agriculture does not have to expand ever more onto marginal and/or unproductive, but often biodiversity rich land, like the last forests and official nature reserves. The millennium goal of long-term food security and sustainable agricultural production preserving the natural resources, including biodiversity, poses a great challenge, particularly to Africa. Biological control projects like the ones described here are at least moving agriculture in the right direction of sustained food security by increasing agricultural productivity, reducing poverty and protecting the environmental (Neuenschwander *et al.*, 2003). They remain, however, insignificant if the political vision to work towards these goals is not backed by actions, which can be expected to hurt some segments of the population on national, continental, and global scales.

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Growing vegetables in Eastern Africa – pest control in organic/ integrated agricultural production, biodiversity, farmer economy and export markets

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Abstract Vegetable production for local and export markets is an important source of income for many small-scale farmers in East Africa. *Icipe* has developed Integrated Pest Management (IPM) and biological control strategies for export French beans and cabbage, kales and tomatoes for local markets. To keep small-scale vegetable farmers in the export sector, *icipe* has trained private sector extension service providers advising farmers on inputs, IPM as well as EurepGAP and other standards. In economics research icipe assesses the economic impact of biological control and EurepGAP standards on vegetable farming systems in East Africa.

Key words: integrated pest management, biological control, economic impact assessment

Introduction

Vegetables for home consumption are grown in nearly every backyard garden in East Africa and vegetable production for local and export markets is an important source of income for many small-scale farmers in the region. Cabbage, kales and tomatoes are the most important vegetable crops for local markets and are grown everywhere where conditions are favourable and rainfall is sufficient or irrigation is possible.

Export of horticultural products was the second most important source of foreign exchange for Kenya in 2005 after tourism and the European Union (EU) is the most important export market. Cut flowers contributed 71% of the value of exported horticultural products in 2005. Vegetables contributed 25% with a total production of 61,000 tons at a value of 13.57 billion Kenya Shillings (US$ 188 million). Beans is by for the most important vegetable grown for export.

Pesticide use in vegetable production is usually high and in many cases ineffectual due to factors like wrong product choice, under-formulation and under-dosage as well as sub-standard application techniques. Pesticide use is also harmful to farmers, consumers and the environment. In addition EU has introduced stringent rules on products allowed and Maximum Residue Levels (MRLs).

Icipe has been developing biological control and Integrated Pest Management (IPM) strategies for key pests of several important vegetable crops in East Africa. *Icipe* is also helping farmers to adhere to regulations introduced by importing countries (MRLs, EurepGAP) and assessing the economic impact of biological control and EurepGAP standards.

Integrated Pest Management (IPM) strategies

IPM system for French beans

The major pests and diseases of French beans in Kenya are bean flies (*Ophiomyia phaseoli*, *O. centrosematis*, *O. spencerella*), flower thrips (*Magalurothrips sjostedti*, *Frankliniella occidentalis*, *F. schultzei*), bean rust (*Uromyces appendiculatus*) and aphids (*Aphis fabae*). The French bean IPM system is based on pest risk during the different crop growth stages rather than on damage thresholds. This concept is much more easily understood by small-holder farmers. The IPM system does not include pesticides that are in WHO toxicity class I, avoids foliar pesticide treatments wherever possible and only includes pesticides that are available in rural areas. Pesticide applications are based on scouting and the frequency of foliar applications could be reduced from 14 to a maximum of 4. The contribution of pest management to overall production cost was reduced from 15.9% to 10.4 percent and the gross margin increased from 58,000 to 63,000 Kenya Shillings per acre (Löhr, 2004).

Pruning and staking to improve mite control, yield and quality in tomatoes

The semi-determinate variety Rodade is the most common tomato variety grown in Zimbabwe. Tomatoes are staked in some major tomato growing but not in others. Red spider mite (*Tetranychus evansi*) is the most serious pest. Control of this pest with contact acaricides in unstaked tomatoes is difficult because the mites prefer the lower surface of the leaves and farmers frequently complain about ineffective chemical control.

Pruning and staking of tomatoes together with careful application of contact acaricides reduced mite numbers significantly from 37.7 to 4.6 motile stages per leaf and increased yield from 37.4 to 59.7 t/ha. The proportion of Grade A tomatoes increased from 50% to 90% and estimated gross margins from 33,100 to 55,200 US$/ha (Saunyama & Knapp, 2003).

Biological control

Biological control of diamond backmoth (DBM)

The diamond backmoth (DBM), *Plutella xylostella*, is the most important pest of cabbage and kales worldwide. Farmers in Kenya estimated that the will loose between 88 and 100% of their cabbage crop if they to not control DBM. Chemical control is difficult because of widespread pesticide resistance.

Biological control of DBM with the larval parasitoid *Diadegma semiclausum* has been successful in southeast Asia. The parasitoid was imported into Kenya from AVRDC (Taiwan) and released in 2002. In the two pilot release areas in Kenya, Werugha and Tharuni, the average number of DBM per cabbage plant decreased from 5.4 (Werugha) and 5.9 (Tharuni) before release to 0.8 and 2.4 three years after release, respectively. Overall parasitism increased from 14.4% before release to 52.5% three years after release in Werugha and from 4.2% before release to 40.6% three years after release in Tharuni (Löhr et al., in press). In Werugha the number of pesticide applications per crop decreased from 4.5 before release to 1.3 after release, gross margins were calculated as 686 US$/ha and 1,124 US$/ha before and after release, respectively. The benefit cost ratio was 28:1 (Macharia et al., in press).

Biological control of tomato red spider mite (RSM)

The red spider mite (RSM), *Tetranychus evansi*, an invasive species in Africa is currently the most important pest of tomatoes in east and southern Africa causing total yield loss in many cases. The mite is probably of South American origin and no natural enemies were found in Africa. Farmers are exclusively relying on synthetic pesticides to control the pest.

Surveys for candidate natural enemies for classical biological control in Africa were conducted in areas in Brazil that are climatically similar to areas in Kenya and Zimbabwe where *T. evansi* is a problem (Fiaboe et al., 2005). The predatory mite *Phytoseiulus longipes* and a strain of the entomopathogenic fungus *Neozygites floridana* were identified as the most promising candidates. *Phytoseiulus longipes* develops equally well on *T. evansi* and the two-spotted spider mite *Tetranychus urticae* but clearly prefers *T. evansi* when it has a choice (Furtado, 2006). It was imported into Kenya and is currently kept at *icipe*'s quarantine facilities awaiting a release permit from the Kenyan authorities.

Training and economics research in horticulture

Private sector extension service providers

The government extension service is not in a position to provide appropriate services to small-holder farmers producing vegetables for export due lack of qualified extension staff and essential infrastructure. *Icipe* has trained private service extension providers to offer advice to small-scale outgrower groups producing vegetables for export in Kenya. These service providers are paid by farmers and exporters and provide inputs, scouting and pest control services as well as advise on farm business development, marketing, group development, and infrastructure development. They also help to develop and implement appropriate internal control systems to lead to group certification for EurepGAP.

Economic impact assessment

Icipe is currently conducting an ex post economic impact assessment of the biological control of DBM. The economic impact of EurepGAP standards on small scale and large farms as well as the welfare of farm workers is also assessed.

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The significance of dietary diversity for nutrition in developing countries

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Linking organic farming and human nutrition

A major underlying reason for widespread malnutrition in developing countries is monotonous diets dominated by few staple foods and low dietary diversity. Making a more diverse diet accessible to the poor populations vulnerable to malnutrition relies on a local agriculture production which supplies a variety of foods to the local markets.

Conservation of biodiversity is an integrated principal of organic farming and a necessity for obtaining sustainable agriculture production systems without use of pesticides and external input of fertilisers. An agriculture production system with a high diversity of crops is more robust against pest attacks and available plant nutrients can be utilised and recycled more efficiently compared to production based on monocropping or a few crops. Integration of plant- and animal production us particularly important for optimising the recycling of plant nutrients.

The shared focus between organic farming and nutrition on diversity in food production could form the base for increased multidisciplinary research and development leading to synergistic development of programmes and interventions which promote sustainable farming and improved nutrition.

The challenge to combat global malnutrition

Along with general undernutrition following insufficient intake of energy, an extended number of people in developing countries suffers from various micronutrient deficiencies, with children and women being particularly vulnerable. Micronutrient deficiency in children causes retarded growth and impaired cognitive development and in women, deficiencies have serious impact on health and increased risk of maternal death. In the poor populations, the major nutrients being deficient are vitamin A, iron, iodine, zinc and calcium (SCN, 2004). It is estimated that more than half of the children in the developing countries are suffering from micronutrient malnutrition. Combating micronutrient malnutrition has been on the international agenda for decades, and specific targets for the reduction of vitamin A, iodine and iron deficiencies have been set. Intervention strategies have been developed, at present with a focus on supplementation and post-harvest fortification of foods with these nutrients. The achievements of these approached are significant in terms of reduction of certain deficiency disorders in certain populations groups. However, supplementation and food fortification have limitations. The supplementation and food fortification strategies address only one or a limited number of nutrients and there are logistic constraints for efficiently reaching the most vulnerable population groups. In addition, it become increasing clear that supplementation with particularly iron may have negative health impact. Therefore micronutrient deficiency disorders remains as major public health problems in most developing countries.

The main reason for the high prevalence of micronutrient deficiency in developing countries is the insufficient intake of bioavailable nutrients thought the daily diet. The typical diets among the vulnerable population groups in developing countries are dominated by one or few staple foods, such as rice in Asia and maize and cassava in Africa, providing the cheapest available source of food to meet energy needs. The poor segments of the populations lack money to buy enough meat, fish, fruits and vegetables to provide a sufficiently diverse diet to secure intake of micronutrients to meet the requirements. Animal foods and non-staple plant foods are in general micronutrient dense, and particularly important sources of the nutrients known to be in deficiency. The poverty related poor quality of diets available for the poor make vulnerability to micronutrient deficiencies endemic to most developing countries.

There is strong evidence for that dietary diversity is positive associated with child nutritional status. An analysis of dietary diversity and child nutritional status in 11 countries showed that dietary diversity was significantly associated with the antropometric indicator for nutritional status height-for-age, either as a main effect or in an interaction, in all but one of the countries analyzed. These findings suggest that there is an association between child dietary diversity and nutritional status that is independent of socioeconomic factors (Arimond & Ruel, 2004). In developing countries, the majority of rural households rely on their immediate environment to provide dietary diversity to satisfy micronutrient needs (Halwart, 2006). Thus, the conservation of biodiversity and securing or promoting the accessibility of a diverse local food supply accessible to the poor households is an important contribution to improve nutrition.

Food-based strategies to enhance the intake of micronutrients in vulnerable populations are recognised as the long-term sustainable solution to alleviate micronutrient deficiencies in developing countries (Demment el al. 2003). Of particular importance is to increase access to animal foods. In addition to supplying specific nutrients, adding just small amounts of animal foods to a diet stimulate physical growth (Grillenberger et al. 2006) and cognitive development in children (Whaley et al. 2003).

Bridging agricultural development and nutrition

The production successes of the Green Revolution provide strong evidence that substantial investments in agricultural research can change food production patterns worldwide. However, the nutritional consequence of this production success has been a reduced diversity of traditional cropping systems, and farmers adopted simpler rotations of more profitable cereal crops and abandoned protein- and micronutrient-dense crops (Roos et al. 2004). It has contributed greatly to solution of one problem, namely low energy intakes, but at the same time has exacerbated another, namely micronutrient deficiencies.

An investment in agricultural research and development for the promotion of an economical sustainable organic agriculture farming sector in which conservation of biodiversity is an integrated principal, could be a bridging entrance for increased collaboration between agriculture and nutrition research directing towards the development of more diverse food systems in developing countries to the nutritional benefit of the targeted populations.

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6. MAIN CONCLUSIONS

Organic farming –*certified and non-certified* - seems to have a development potential, i.e. to possibly contribute to better livelihoods for poor farmers under certain conditions. This potential is based on broadening options for use of local resources, contributing to improved sustainability in terms of production and food security, and – as far as cash crops are concerned – on exports of organic products helping to gain foreign exchange, while saving on imports of agrochemicals.

Organic farming methods have proved ability not only to yield better than traditional farming methods, but to provide the same or improved yields compared to conventional farming methods, in many cases. One important factor in that is that most smallholders have limited use of external input of pesticides and fertilizer, but are still able to gain from use of innovative and environmentally sound farming techniques such as the use of biological control and mulching.

In addition, organic farming has social and cultural benefits. Traditional farming methods can easily conform to organic standards, at least in principle. Also organic farming recognizes the role of indigenous knowledge in identifying solutions, a feature improving the opportunities for farmers to feel ownership.

In principle, therefore, certified organic farming seems to offer a possible livelihood strategy for African smallholders, including an economically attractive possibility for smallholders to gain higher prices for their produce and thus perhaps help poverty alleviation.

However, certified organic farming in Africa is yet a fragment of the total production. In Uganda, which has the largest production, organic production still only covers 1% of the total agricultural land. Without the attention of African policymakers and donor agencies, therefore, it is not likely that the full potential of African smallholders as sustainable agricultural producers can be harvested.

Organic farming and farmers in Africa

Among the more particular findings, the workshop suggested that with regard to the African cases, organic farming has demonstrated potential, but still faces various challenges including: limitations of traditional production systems in terms of efficiency; high costs of production and handling (certification and air freight); poor infrastructure (handling facilities, cool chain); limited production capacity, from the viewpoint of the private sector, corporate responsibility issues and other institutional challenges.

Developing country governments could help foster OA in their countries, as part of a strategy of environmentally sustainable poverty alleviation. Where pesticide use is high and inefficient such a strategy would help reduce human health problems and pollution, help conserve and sustainably use biodiversity and help conserve soil nutrients. In addition, in many cases introduction of – knowledge intensive - certified organic farming methods, leads to improved management which can help farmers increase net gains considerably.

Currently, however, standards and guidelines for organic farming are mainly determined in developed countries. Certification adds to high production costs, and is not always effectively done. Therefore, certifying bodies may need to consider adapting certain rules presenting themselves as barriers to developing country smallholders, i.e. the bodies may wish to consider accepting each others results and use IFOAM international agreements.

Long-term investments in education, training and research

Successful biological control of cassava pests required three decades of continuous dedicated research and extension work relying upon continued funding by among others DANIDA.. The investment has been highly rewarded with cost-benefit rates of 1:140 up to 1: 600. Calculated gains surpass 2 bill USD, not including reduced pollution and biodiversity preservation. These gains would not have been possible without long-term continued research investments. There is a need for involvement of the CG-centres in development of organic farming methods, as well as training. ICIPE demonstrated the potential in taking up training of private sector extensionists for integrated production of vegetables.–in return high cost: benefit rates are attained of 1:140 to 1:600.

7. EVALUATION

ORGANIZERS

Organic farming in development is gaining increasing public attention as demonstrated by the high number of participants attending the workshop. Experts and participants from different disciplines including a number of students were brought together allowing a discussion of three major and highly interdependent dimensions of organic farming in developing countries, a broad development dimension, a market dimension and a production oriented dimension. Both presenters and participants showed interest and enthusiasm in communicating across disciplinary barriers, and it must be recognized that addressing an audience with a diverse background, poses special challenges. The Auditorium made available by Geography at KU was very well suited for the workshop. Acoustics was good, and the auditorium was full, favouring a lively debate after each presentation.

The workshop was much favoured by the assistance from SOAR, the research school for Organic Farming and Food Systems in Denmark, Sofie Kobayashi on organisatorial matters and DARCOF, the Danish Research Centre for Organic Food and Farming, Claus Bo Andreasen on issues related to communication and media. It would not have been possible to invite the international panel of presenters without the combined funding from NETARD, SOAR and DARCOF.

PARTICIPANTS

No formal interviews with participants regarding workshop evaluation were made, but we got positive feed-back during and after the workshop from participants. The workshop was well covered by the press.

The workshop in the press:

The workshop was covered in a 45 min programme on environment on the Danish DR1 “Miljømagasinet” 1 December 2006, which was broadcasted again 3 December 2006 link: http://www.dr.dk/P1/Miljoemagasinet/Udsendelser/2006/11/30130349.htm

The internet magazine on development issues U-landsnyt sent an article on the workshop 1 December, link: http://www.u-landsnyt.dk/nyheder.asp?ID=10736

Finally the workshop provided the basis for two journal articles in the national journal of the organic agriculture movement “Økologisk Jordbrug”, on the theme of production potential for organic products in the developing countries, 1 December 2006:

Anon. Afrikas bønder kan levere økologi til Vesten. Økologisk Jordbrug 1 december 2006, nr 373, 26 årgang, p. 1

Bech, Gustav. Økologi er en oplagt chance for Afrikas bønder. Økologisk Jordbrug 1 december 2006, nr 373, 26 årgang, section 2, p 2-3.

Annex 1 PROGRAMME

9.10	General welcome by Lene Sigsgaard, KVL
9.15	Opening by Judith Kyst, Max Haavelar
9.25 Organic Agriculture as a means to development for resource poor farmers : chair Henning Høgh Jensen, KVL	
9.30	Experiences with the use of ”Organic” as a development model by Brian Ssebunya, Amfri Farms Uganda
9.55	Can organic farming contribute to a better livelihood of small scale farmers ? By Michael Hauser, BOKU
10.20	Discussion
10.45	Break
11.00 Certified organic products for the market to further development : chair Erik Steen Kristensen, DARCOF	
11.05	Trading of organic products as an export opportunity for developing countries by Andrew Stevenson, UNCTAD
11.25	Export promotion of organic products from Africa by Gunnar Rundgren, EPOPA
11.45	Discussion
12.05	Lunch
13.00 Biological diversity for food security in integrated production systems : chair Lene Sigsgaard, KVL	
13.05	Biological control and functional biodiversity in agricultural production – successful cases to improve food security by Peter Neuenschwander, IITA
13.30	Growing vegetables in Eastern Africa – pest control in organic/integrated agricultural production, biodiversity, farmer economy and exports markets by Markus Knapp, ICIPE
14.00	The need of diet diversity for family health and nutrition by Nanna Roos, KVL
14.20	Discussion
14.50	The debate in a DANIDA perspective by Hanne Carus, TAS, DANIDA
15.15	Closure by Henning Høgh Jensen, KVL

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