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Strengthening MDGs Progress through Collaborative Research Efforts: Some lessons from Organic Agriculture with Trees (OAT) project in East Mau catchment, Kenya

Rhoda Birech[1]*, Eric Bett[2], Daniel Kyalo[3], Bernhard Freyer[2], Kibet Ngetich[4] and Hadijah Murenga[4], Frank Place[5]

1. Department of Crops, Soils and Horticulture, Egerton University, Kenya. 2. Institute of Organic Farming, University on Natural Resources and Applied Life Sciences (BOKU), Austria. 3. Department of Agricultural Economics, Egerton University, Kenya. 4. Department of Economics, Sociology and Anthropology, Egerton University, Kenya. 5. World Agroforesty Centre (ICRAF), Nairobi *Corresponding author rhodajerop@yahoo.com

Abstract

Forests and tree resources are rapidly declining in many tropical regions, yet they play a core role in achieving Millennium development goal (MDGs). A collaborative research effort- OAT (Organic Agriculture with Trees) was designed to identify strategies to re-establish trees and sustainable farming systems in smallholder farms in the degraded Mau catchment, chiefly through the integration into organic farming methods.

A three phase study was done in the East Mau catchment area with an aim of evaluating the potential of organic Agriculture and Forestry and Agro forestry to provide basic livelihood needs. Organic crop production potential was obtained through experimentation at Egerton University in 2004-2006, while that of farmers' practice was obtained through field surveys of 292 smallholder farmers within the Mau catchment carried out in early 2007. Results indicate that the agricultural system done in Mau East is producing food at below optimal levels when compared to researcher managed organic systems. This is mainly attributed to sub-optimal use of soil additions- fertilizer due to economic reason. Organic and sustainable agricultural was therefore seen as a potential strategy to address the first MDG on reducing hunger and poverty. Agroforesty adoption was found to be lower among indigenous tribes living in or close to water catchment forests ($P<0.05$), the less educated education, the young, and in female headed households ($P<0.01$). It was concluded that promotions and education of sustainable farming and forest and agroforesty conservation could empower marginalized groups such as youths and women and meet Millennium Development Goal number 3, which seeks to promote gender equality and empower women. A marketing survey of organic produce, traders, consumers and foreign tourists in Nakuru and Nairobi mapped a chain of activities and products for the local and international markets. An aspect that promotes the achievement on MDG-8 on partnership development.

Introduction

Many forests in the tropics and have encountered tremendous degradation due to over-harvesting of forest resources and land use changes. Mau forest complex is not an exception, as 18% of the forest in now under discriminate agriculture. Ecosystem degradation in many parts of the tropics has led to food insecurity, poverty, lack of water (quantity and quality), and diseases, soil erosion, loss of biodiversity, increased hunger and poverty.

Farmers at Mau and similar regions in Kenya grow food crop and cash crops during the long rains, particularly maize, and sometimes wheat and potatoes, with or without legume intercrops. During the short rains, fast-growing food crop (like potatoes) or grain legumes are grown although in most cases, the land the land is often left fallow and livestock allowed to graze freely on natural vegetation re-growth.

A tree-year project was aimed at identifying strategies to re-establish trees and sustainable farming systems in smallholder farms. The existence/ adoption of three main sustainable farming practices among Mau communities were evaluated through three research themes; farming systems, social systems and marketing systems. Project outcomes included an elucidation of the social and economic matrices of communities that depend on and conserve resources within and near a protected catchment environment. Other results are capacity building of farmers through participatory knowledge transfer, and that of researchers and students from participating institutions. This paper reports the potential of sustainable farming systems vis-à-vis current farmers' practices to meet the MDGs.

Methodology

Two field trials (maize/potato and wheat organic systems) and two field surveys (farmers in the Mau catchment and stakeholders in the organic market chain) were conducted as shown:

1. *Wheat trial*: A three year study was conducted to test appropriate pre-crops for organic systems. During the short rains, the following precrops were established: lablab (*Dolichos lablab*), garden peas (*Pisum sativum*) and natural fallows. Six months later the biomass was chopped, incorporated, rock phosphate was applied at a rate of 20Kg P/ha and wheat was planted at the onset of the long rain season.

2. *Maize/potato trial*: A three year study was conducted to assess the biomass and grain yield production of lablab (*Dolichos lablab*) grown during the short-rains. The influence of incorporating lablab biomass or farm yard manure (FYM) (5 t/ha) on subsequent organic maize, potatoes and legume intercrops were evaluated.

3. *Mau catchment survey*: a field survey of 292 farmers residing in East mMau catchment was conducted to evaluate their farming and social systems affecting sustainable farming. Poverty studies were done by applying a two stage method that takes into account the *endogeneity* of organic farming technology adoption into account to estimate the effect of adoption of organic farming technology of the level of household absolute poverty.

4. Marketing survey: A marketing survey was conducted with 31 organic produce buyers, 240 local consumers and 110 tourists in Nakuru and Nairobi, which gave us insights into the national, regional and international potential for the development of a market for organic products

Results

In the wheat trial, legume pre-crops grown in the short rains accumulated high biomass, which recycled more nitrogen (N) for plant nutrition compared to the natural fallow. This nutrient was readily available to crops and was reflected as high grain yield and protein content in wheat (Table 1). In the humid tropics where biomass growth and nutrient recycling rate is enhanced, organic biomasses and particularly those from N fixing legumes can recycle substantial amounts of nutrients to support plant growth, grain yield and quality of subsequent crops. Under these conditions, nutrients from organic sources are cheaper than those from the imported synthetic fertilizers.

Table 1: Nitrogen (N) concentration of lablab, garden pea and natural fallows (g/kg DM) estimated nitrogen (kg/ha) and their subsequent influence on soil properties, wheat yield and quality

Precrops	Plant tissue Nitrogen (%)	Average supply (kg/ha) for the 3 years	Soil Available N (mg/kg), at 30 DAS in 2006	Soil Total N (g/kg), 160 DAS in 2006	Soil organic carbon (%) 160 DAS in 2006	Average Wheat grain yield for the 3 years (t/ha)[a]	Grain protein content (% of on DM wheat) in 2006
Lablab	31.44c	63.93	117.60c	1.898a	2.56a	5.681	15.40b
Garden pea	23.57b	36.43	99.47b	1.959a	2.78a	5.195	13.29a
N. fallow	10.75a	30.67	76.53a	2.033a	2.65a	4.923	13.75a
P values	***	-	***	Ns	Ns	-	***
Mean	21.92	43.68	97.88	1.964	2.69	5.266	14.07

ns, **** -Treatments are not significant, or significant at P<0.001
Means followed by the same letter in a column within a factor are not significantly different at P<0.05

In the maize/potato trial, legume precrops followed by incorporation and application of FYM registered high maize and potato yields (Table 2). The Mau catchment survey found that farmers apply an average of 10 kg Nitrogen/ha/year; 26 kg Phosphorus (Diammonium phosphate)/ha/year with limited application of farm yard manure (approx. 1 t/ha/year). This is far below the 125 kg ha^{-1} recommended by conventional agriculture (KARI, 1994). The average organic manure applied was 987.7 kg dry matter $ha^{-1.}$ Herbicides and pesticides are applied at an average rate of 1.9 litres /ha/year. Main crops are grown mainly without legume pre-crop. Though 50% of the land surveys was converted from virgin forest less than 20 years ago, the yields are dismal and just above the national average (Table 2). Even when the yields of the managed organic systems were reduced by 30%, the yields from the farmers practice are still lower.

Table 2: Average Actual and reduced (30% less) yields of organic maize, potatoes, wheat and legume intercrops (2004 – 2006) in comparison of organic and farmer practice (2006)

Cropping system	Actual organic yields (A-Org) (Kg/ha)	30% less organic yield (L30-Org) (kg/ha*)	Ø Farmer Practice (FP) (kg/ha)	L30-Org minus FP (Kg/ha)	L30-Org/FP (%)
Maize sole (	5615	3931	1900	2034	207,1
Maize / legumes intercrop	4567/373	3197/ 261	2360	836	135,5
Potatos sole **	24122	16885	11240	5645	150,2
Potatos/legumes intercrop	18646/396	13052/277	-	-	-
Wheat sole **	5438	3807	2500	1200	148,0

Based on data collected from Mau farmers at different levels of organic farming adoption, 48.7 % were below the absolute poverty line of Ksh. 70 (1 US$) per person per day. Results confirm the premise that adoption of the technology is correlated to the level of poverty and improves the probability of the household to ascend out of poverty. We conclude organic farming is one option for poverty alleviation.

Some studies have shown that even in the absence of price premiums, farmers have turned to Organic and sustainable agriculture because of lower production costs. Studies in Uganda certified organic export production obtained significantly higher yields, higher gross and farm income earnings and were significantly more profitable than those that engaged only in conventional production. In addition, certified organic farmers had high food self-sufficiency. Conversion to organic export farming was fairly easy, involved little risk and required few, if any (Gibbon and Bolwig, 2007).

Finally, the marketing survey indicated that farmers, processors, retailers, distributors and restaurants/hotels exporter, and consumers operate the organic market chain in Kenya. The main organic products for the local, regional and international markets are: vegetable, fruits, coffee, tea, nuts, honey, spices, oils, essential oils, herbs, spices. It was observed that organic marketing is growing in Kenya. As food and environmental safety concerns increase, organic principles are likely to increase the comparative advantage of Kenya as a support the already existing export marked and likely to meet the MDG- 8 on development of global partnership.

Conclusion

There are many benefits from sustainable farming systems that build and utilize renewable resources. They increase food security and impact positively on the environment through improvement in water, soil, carbon and nitrogen sequestration, agro biodiversity, reduced energy consumption and reduced pollution. They contribute to meeting the MDGs. However, there is need for institutional support to establish sustainable farming systems, being sensitive to inclinations of different ethnics, gender and ages.

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