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The Future of Smallholder Farms in Ethiopia

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Introduction

Peasants in tropical and subtropical countries confront numerous inter-related internal and external challenges. Is organic farming the solution? A conversion to organic confronts the following facts: Productivity is compromised by: extensive soil erosion, soils pH often-below 5, low soil fertility. Farmyard manure is often burned; animal density is nearly 100% above the carrying capacity of the land; a decline of natural forests; lack of crop rotation, ploughing with oxen up to five times; low seed bed quality; there is no application of lime; harvest and post harvest losses are up to more than 50%; there is inadequate or non-existent storage facilities and processing equipment. Land: farm size is limited with approx. 0,5-2,0 ha per farm; pressure on communal land through growing population and land grabbing; and finally, farmers' land rights are limited. Markets: weak value chains and linkages to markets; high fees demanded by market brokers; export crops like vegetables or flowers, or organic coffee or honey, currently do not offer an opportunity to seriously raise income. This snapshot describes the living conditions of rural farm households and documents the dramatic situation of the agricultural sector in Ethiopia.
Drawing on our fieldwork in Ethiopia, we argue that organic farming offers several systemic solutions to address some of these challenges, but also need further development. Without question, sustaining smallholder farming will require many fundamental transformations in the agrofood system as a whole and in their institutions and organisations. But, in this article we discuss how organic farming can be understood as a means to contribute to the sustainable development of smallholder farming in general.

Material and Methods

Our study took place in three regions around Dangla (rain fed) and Merawi (Koga irrigation scheme) / Amara Region and in the Awasha Region (semi-shadow coffee production) that illustrate many of the practices and challenges confronting smallholder farms in Ethiopia. From January to May 2016, we conducted a situation analyse (farm interviews, field walks, and field observations) on 10 smallholder farms.

The farming systems studied are diverse in their agro-ecological, climate, soil and socio-economic conditions. But the commonalities allow us to classify them into three smallholder model farms-local, high input and organic- in terms of their materialities and techniques that

serve as the decision situation for farmers adapting any practices now and in the future (Farr, 1985).

We sought to make visible the challenges smallholder farmers confront in establishing an environmentally friendly and economically viable farming system. We conclude with some observations about the complexity of a system change to organic farming.

Results and Discussion

(a) Farming systems

- Local farm around Dangla

This farming system is found in many villages in the Amara region. In general, it includes farms that have limited access to modern agricultural techniques, despite being confronted with numerous limitations. The farming system includes several inter-related subsystems: arable land; communal pasture land mainly outside the farm; the arable land using grain straw residues; diverse animal husbandry systems; some trees; and beehives (organic production). External inputs into these systems include: small amounts of mineral fertilizer and feedstuffs (residues from local breweries or nug oil seed cake), as well as animals. Outputs are cereals, heifers, honey and some milk and meat, primarily for subsistence or for the market during the non-fasting season. To sum up, as a result of crop production methods and a limited investment in agroforestry, the highly eroded soils have low levels of fertility with low humus content and low water holding capacity. In addition, insecure land tenure negatively influences the farming practices (Holden & Yohannes, 2002) and hinders longterm investments such as liming or tree planting in soil fertility.

This farm type clearly does not depend upon external inputs. Nutrient cycles are open and nutrients are lost via on-going water and wind erosion that negatively affects crop yields as well as both milk and meat production. The materiality's of the hand hoe, the oxen plough, or hinnies for transportation, on the one hand conserve traditional practice formations, on the other they are partly necessary and vital for the transformation process towards a more sustainable and resilient agro-food system.

- Intensified farm in Merawi / Koga irrigation scheme

This farm model is privileged due to its location in an irrigation system. This type follows post harvest management and animal husbandry activities, and has similar market access issues as the local farm type discussed above. While the irrigation scheme was originally reserved for vegetable production, a majority of the farmers are not vegetable growers. The dominating cereal production has led to increases in yields and incomes. But it is coupled with the inefficient use of fertilizers and pesticides. In the long run these practices risk the creation of plant resistance and diseases. Due to the lack of organic matter, these practices lead to soil degradation, compaction, acidification and ground water contamination through agricultural inputs.

For smallholder farmers in the irrigation scheme with approximately 1,5 ha, this farming system is able to increase the income, but it is not enough - neither the financial nor the human capital for taking a technologically or an environmentally positive step forward -. Going organic could be an option, but it would require a fundamental change in the production to include crop rotations, vegetables, cereals, potatoes, legumes and fruit trees, and mechanization, as well as organic matter and efficient irrigation management.

- Mixed organic coffee farm in the Awasha region

Our third model is a mixed organic coffee farm in Awasha region where certified organic coffee is cultivated under half shade. It also includes several elements primarily of the first model (some

crops, animals, fruit trees). Here we again only highlight those subsystems of the farm that differ from those discussed above. Because this coffee farm model is an organic example, we specifically focus on the strengths and weaknesses of organic performances and techniques.
Coffee production demonstrates a way forward toward biodiversity, healthy soils and plants. But natural resource management needs to be improved. Similar to the other farm types there is a lack of investment in technology and in several techniques that could improve productivity. We conclude that farm income based on approximately 2 ha in mixed coffee farms is enough to maintain the household. But even the higher organic prices for export coffee do not allow a serious step forward in their economic situation.

(b) Farm internal potential and related challenges to go organic
Based on the above farm models we explore the opportunity, and investment required for each farm model to convert to organic. This also sheds light on how conversion can be a means of adaptations at the farm level.

- Cropping and fertilizer systems
There is evidence that intercropping (Akande et al., 2006, Dwivedi et al., 2015, Fujita & Budu, 1994, Mpairwe et al., 2002, Nedunchezhiyan et al., 2011, Nnadi & Haque, 1986), the use of cow dung (Ayoola & Makinde, 2008), and the use of forage legumes, e.g., alfalfa, clover or desmodium combined with alley cropping has the potential to compete with systems based on mineral fertilizer (Birech et al., 2014, Shibabaw et al., 2016). Crop diversification with forage legumes (mandatory for organic farming) can also contribute to soil fertility and reduces weed pressure. Through the establishment of biogas, slurry can be sprayed to increase the cereal yield, the compost be applied for potato and vegetables and gas used in the kitchen that will contribute to a more efficient energy system, saving labour for collecting fuel wood and money for charcoal. Challenges are the availability of forage legume seeds, the knowledge for the management of alley cropping and the collection and transportation of farmyard manure and slurry.

- Animal husbandry and feeding strategies
Re-configuring the use of crop and pasture land will be central in each model to go organic. Overgrazing has led to significant yield declines in forage crops that can be compensated for only by cultivating improved forages (such as alfalfa, clover, napier grass etc.). But currently, these plants only covers 0.25 % of the animal nutritional need of animals in Ethiopia (CSA, 2010b) and 0.18 % of animal feed needs in the Amhara Region (Firaw & Getnet, 2010). Increased dairy productivity is linked to access to protein and starch rich green fodder and hay from leguminous plants with Napier grass as a starch rich plant (CSA, 2010a). Also for this adaptation education and training is needed.

Animal traction and threshing are one of the main reasons for keeping cattle on each of the farm models. However, reduction of the number of animals is needed to avoid soil erosion and compaction both, on arable and pasture land.

- Labour and mechanization – compost and weed control as examples
Without exception, the farms have to cope with significant demands on household labour. Consequently, the additional labour required in the move to organic always raises critical question. Alley farming and composting also demand a significant amount of labour.
Compost management and sprayers to reduce labour are only affordable with external financial support and with a cooperative approach through which farmers share the investment and maintenance costs of modern technology. Cooperatives would have the potential to invest into machinery.

Investment into zero grazing combined with a half-day pasture system would lead to an increase of farmyard manure. Compost sprayers and improved techniques for cutting and transporting clover from the crop rotation could be an investment by farmer groups or at a communal level; and mechanized weeding with a horse-, ox- or tractor-drawn weeder would significantly reduce the farm workload.

- Implementation phase of organic techniques

There is no question that these organic management methods need time to be successfully implemented on smallholder farms. Increased crop yields can be expected only after the second year from the following practices: direct pre-crop effects of legumes as pre-crops, the application of farm yard manure and the use of cuttings from alley trees. That is, this time gap between the investment in organic practices, and the economic return during the conversion period presents a key challenge for a systems change. The delayed impact on income is one of the main hurdles keeping farmers from investing in organic farming, i.e. intense organic matter management. Several types of incentives would be need to motivate farmers to move to organic, e.g. high support through advisory services, and technical support.

Conclusions and Outlook

Technology investment is one of the key factors going organic but also for the agriculture in general to optimize farmer's income. This investment cannot be done by a single farm, but in a cooperative or a community. Conversion toward organic is therefore not a question of one farm but a regional challenge. Conversion means also: to open a "repair shop" for soils and biodiversity; to adjust pH, crop rotation, alley and tree farming, humus, nutrient and fodder balances, etc. – or in other words resetting the farming system. Beyond the farm boundaries, it demands a fundamental transformation of the local and international market – current organic and fair trade systems alone cannot stabilize the farm economy -, including broader rural and urban development policies, educational, training and research.

We have shown that several organic system technologies and practices can help to solve some environmental challenges and increase meat, milk and crop production over the long term. Going organic means recognizing that this approach offers a means to address decades of natural environment damage. The analysis further makes clear that there is need for an intensification of the production. This will be not possible without investments in technology (e.g. adapted soil tillage, mechanical weed control or composting techniques). Effective investment strategies that would make these technologies affordable for farmer groups are also needed.

From a theoretical point of view, we conclude that the move from traditional materials and techniques to modern resources and practices involves two pathways that can be differentiated in terms of the origin of materiality, the material type, and the related material cycle. The first pathway can be characterized as an input based high-energy consuming approach through the application of mineral fertilizers, herbicides and pesticides that we call "industrial modernisation (IM)". The materiality comes mainly from off the farm, is costly, has a significant ecological footpath, and is unrelated to the production scheme of the farm. Moreover, it does not build on local knowledge and experiences.

The second pathway is what we call the "reflexive ecological modernisation (REM)" pathway. It is based on the farm's organic materiality or its capacity to produce some of its materialities within its own system. As a pre-condition, it involves high biodiversity and organic matter production on the farm. It includes organic farming practices combined with agroforestry and timber production, and leads directly to a closed energy system on the farm including the household.

While the first pathway tends to orient social interactions toward the input market and the local advisory and research services, the reflexive pathway integrates more local and regional sites of shared labour and social interactions due to the production and processing of organic matter and is asking an alternative advisory and research approach.

This short description indicates that the material base of farmers has to be changed fundamentally, in order to stop the current devastation of land and to overcome low productivity. Ethiopians agricultural policy currently does not include organic agriculture as a strategy (Anonym, 2015). The agricultural mainstream approach strengthened by the main agricultural institutions can be characterized as a kind of second green revolution while the organic pathway also partly contradicts the currently dominant neo-liberal policies and market strategies that are highly interested in agricultural investors with an export orientation, which in organic is not in the focus. Therefore, an "organic" program is equal to a paradigm shift for Ethiopian agricultural policies, market strategies, research and extension and advisory services, as well as for countries with similar cultural, material, socio-economic and agro-ecological conditions.

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