Executive Summary: Creating Wealth with seed potatoes in Ethiopia

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Project name	Wealth creation through integrated development of potato production (WCPP)
Date	2008-2012
Project funder	Common Fund for Commodities (CFC)
Project implementers	In the evaluated areas: CIP, EIAR and Holetta research centre
Evaluating agency	Royal Tropical Institute, Amsterdam (KIT)
Evaluation date	April 2014
Country	Evaluation carried out in Ethiopia (project also undertaken out in Kenya & Uganda)
Geographical areas	West Shewa, South West Shew, Guragie and Tigray zones
Project objectives	 To increase the availability of high quality potato seed at affordable prices; To improve farmers' knowledge of crop husbandry and access to high quality seed, leading to improved yields and increased income and food security; And to improve market linkages and communication between potato value chain stakeholders, leading to increased income

Executive summary

The CFC project 'Wealth creation through integrated development of potato production' has brought a wide range of positive livelihood changes for potato farmers in the highlands of Ethiopia.

The project began in 2008 and was aimed at addressing constraints faced by potato producers in Ethiopia and improving the wealth and livelihoods of potato producers. Implementing partners CIP, EIAR and Holetta research centre undertook the project in the zones of West Shewa, South West Shew, Guragie and Tigray, with three main objectives:

- To increase the availability of high quality potato seed at affordable prices;
- To improve farmers' knowledge of crop husbandry and access to high quality seed, leading to improved yields and increased income and food security;
- And to improve market linkages and communication between potato value chain stakeholders, leading to increased income

The Royal Tropical Institute (KIT) in Amsterdam, was commissioned to carry out a rapid independent evaluation of the project in April 2014 to measure change and document lessons from the intervention. A mixed methods research design was implemented in three woreda (districts) – Gumer, Geta and Wonchi. This included 190 quantitative surveys, focus group discussions at four locations based on the PADev methodology, interviews with key informants, and a review of available project literature.

Background to the potato sector in Ethiopia

The project was found to be highly relevant to highland farmers. Improvements in the potato production system can be a pathway out of poverty in Sub Saharan Africa, including Ethiopia. It is an excellent smallholder farmer crop, suited to the highlands, with a short cropping cycle, potential for large yield per hectare, and serves as both a cash and food security crop.

The potato sub-sector in Ethiopia is relatively undeveloped and is faced with low productivity. Constraints include a shortage of good quality seed tubers, a lack of adaptable and disease resistant varieties, sub-optimal production practices, a lack of storage facilities and inefficient marketing systems. The project was effective in alleviating these constraints in the project areas. Furthermore, the project was found to be well targeted to areas where potato production was either happening already on a limited scale, or had excellent potential through good climatic conditions.

Most of the changes that were identified since the project began were directly attributed to the project by beneficiaries. One can have confidence in attributing many of the changes to the project due to the fact that no other agricultural project (let alone potato project) was reported by farmers to have been undertaken in the research areas in the past 10 years or so.

Characteristics

Land sizes are relatively small in the research areas, averaging 1.2 hectares per household and rarely over two hectares. Land availability is a major constraint for farmers wanting to improve their livelihoods. Improved potato seed production is thus an excellent choice as high value cash crop in the highlands, for which there is considerable market demand.

The land size farmers grew ware potatoes on increased from 0.41 hectares to 0.77 hectares from when the project began until today. Furthermore, the number of farmers growing potatoes in the areas appear to have increased substantially from the project - only 37 farmers in the sample (19%) grew *ware* potatoes before the project, whereas 182 (96%) in the sample do now. Seed potatoes are a higher value crop than ware potatoes and require specialised skills to produce. Virtually no farmers in the sample were growing specialised seed potatoes before the project, whereas now 101 farmers in the sample (53%) grow seed on a separate plot, averaging around 0.45 hectares. The project's introduction of professionalised seed potato production has changed household income sources. Before the project only 4% of farmers cited potatoes as their biggest source of income. Now, farmers cite seed potatoes as their biggest source of income in 24% of cases, and ware potatoes in 16% of cases. This is a positive change, as before the project 65% of farmers depended on enset (false banana) as their major source of income and food security, which while being culturally and economically important, was described by farmers as a poor cash crop choice compared with potato. Other common income sources for farmers are barley, faba bean, dairy, sheep and wheat, but ware and seed potatoes have now become a more popular crop choice than all of these.

Food security

Major changes in food security can be attributed to the project. Potato helps households to bridge the hungry season from August to October when existing grain stocks may be low and grain crops are not yet ready for harvest. This is because potato has a relatively short growing cycle of around 3-4 months.

Before the project, households endured on average 1.5 months of the year with only one meal a day. Since the project this hungry season has been all but eliminated, with virtually all households having at least 2 meals a day all year round.

Furthermore, before the project households reported having 3 meals a day for only 3.9 months of the year on average. Now, households are having 3 meals a day for an average of 7.6 months of the year. This change was stressed as important by farmers in the focus group discussions (unprompted), and they directly attributed this change to the project, due to potato being a short season crop that can be harvested before the grain crop is ready, even for those producing on small plots of land.

Cooperative formation

Beneficiary farmers (89%) were organised into a potato farmer group or cooperative by the project implementers. Cooperative members described how they contributed land and labour and grew seed potatoes together as well as individually. The cooperative would pay out members when the crop was sold based on members contributions, with a set price put on the land leased from cooperative members, and for labour contributions. The cooperatives have played an important role in consolidating farmer knowledge, gained through the project trainings. The cooperative also plays a role in ensuring good practices are followed by member farmers, and perform quality control of seed potatoes stored in cooperative DLS stores. Finally, the cooperative is able to effectively market fairly large volumes of seed potatoes to formal buyers on behalf of its members.



Seed potatoes stored in a diffused light store

Seed Varieties

Before the project, very few farmers were using improved varieties of seed. However, through the project farmers received the improved varieties Jalene or Gudene and now virtually all seed and ware potato farmers grow these as their main varieties.

Yields

Ware potato yields have significantly improved by roughly 80% in all of the research areas from an average of around 9 tonnes to 16 tonnes per hectare. Seed potato growers too report yields upwards of 16 tonnes per hectare. Many reasons were given for this significant change in yield, including the much improved use of fertilizer, new seed varieties, improved cultivation practices and improved use of fungicides and insecticides. The main reasons cited for this change was the project training, followed by the improved seed varieties supplied by the project. The significant profits made from seed potato farming were able to be reinvested in fertilizer and other inputs both for potatoes and other crops. This was validated by the focus group discussions.

Refreshing seed stock

To maintain the quality of their seed stock, farmers must flush out older generations of seed after about three seasons and replace this with new first generation (basic) seed produced by the Holetta research centre or some private companies. Many farmers and cooperatives are now overdue to refresh their seed stock, and it was found that virtually no farmers had purchased new basic seed from Holetta research centre or another company since the project began. Farmers demonstrated perfect understanding that they must refresh their seed soon, as the issue has been affecting their yields for several seasons already. Farmers say that they are willing to buy new basic seed for 600 Birr or so, however seed from the research centres are believed to be 2 or 3 times this. Cooperatives appear to be not organized sufficiently or have a strategy in place to approach research centres or private companies and buy new seed and begin multiplying basic seed within their membership. It is also a serious challenge for individual farmers to transport bulky potato seed they may purchase, as each hectare requires around 2 tonnes of tubers. Cooperatives are probably best placed to be making bulk purchases of new seed, rather than individuals.

Farmers clearly understand that not refreshing their seed is lowering their yields season on season – they have seen the results themselves. What they seem less aware of is that there is also a reputational issue at stake. The project areas have developed a reputation with certain institutional buyers such as NGOs who are buying improved seed from project beneficiary farmers. However, if individual farmers and cooperatives fail to refresh their seed very soon, they could suffer reputational damage that would lose them their hard-to-find formal buyers, who would likely look elsewhere.

Crop rotation

Another serious issue is crop rotation, which is important for soil quality and reducing a build-up of diseases and pests such as bacterial wilt and nematodes. Potatoes should not be grown on same land 2 seasons in a row and should not return to the same plots for at least 3 more cycles. While focus group discussions demonstrated a farmer understanding of this, survey data shows that only 51% of respondents rotate after a single season. It is somewhat concerning that just over 20% of farmers continue growing potatoes on the same plot for 3 or more seasons. So while there appears to be farmer awareness of the importance of rotation, the small land sizes typical of the project areas make crop rotation a particular challenge.

Training

Training and capacity building for farmers was a major component of the project, given that many had little prior experience in potato farming, and especially in seed potato production.

The project began by helping farmers to form groups and manage groups, write a constitution for the group to function and to assign leadership roles. After some time, many of these groups came together to form and register small cooperatives.

Training began by Holetta taking one 'elite' farmer from each area and bringing them to the Holetta research centre to gain first hand insight on what clean seed is and what improved varieties constitute. Those farmers then returned to their groups and reported back, which was soon followed by Holetta researchers and staff who delivered a series of practical on site trainings. Farmers first received training on what clean seed actually is, how to plant it, how to use various inputs for productivity increases. Those who received trainings had to be members of the cooperative, and to make training sessions manageable, only one member per household attended. These farmers were then to pass on this new knowledge and skills to household and hired labourers.

The penetration of training was quite high – 74% of respondents who declared that they had received training through the project. Farmers received an impressive range of trainings, the most frequently cited being fertilizer application, cultivation, land preparation, storage, harvesting, pesticide use and crop rotation, seed and seed varieties, group formation, storage and marketing. An interesting training component was that women were given training on potato recipes for local dishes, to enhance the local acceptance of potato in the area. and consumption of the crop.

Not only were large numbers of farmers trained in a wide variety of subjects, but the quality of the training received was perceived to have been either 'good' or 'very good' by 86% of the respondents who received training. Farmers perceived their knowledge to have increased substantially. Around 80% of farmers rated their knowledge before the project as either 'very poor' or 'poor' whereas now 80% of farmers rated their knowledge as either 'good' or 'very good'. This indicates both the very low base that these potato farmers started from, and the excellent job the project has done in building farmer capacity in a relatively short amount of time.

Most importantly, the training was perceived to have had an impact on yields - 61% of trained respondents said that the training had a 'high impact' on yield, while a further 35% percent described the impact as 'moderate'. The training contributed to changes in production methods of farmers, and the project generally encouraged farmers to reinvest in their production. Large increases were found in the number of beneficiary farmers using fertilizers, insecticides and fungicides (200-300%), as well as oxen (75%).

However, record keeping among farmers is still very low, with only 12% saying that they keep detailed records, and 67% saying that they keep no records at all. While 45% of trained respondents said that they had received training in record keeping, it is clear that this is one training type which has not had good penetration. Work remains in this area if farmers are to plan properly and manage their farms as a business.

Storage

A further component of the training was storage. Holetta trained farmers on how to construct a diffused light storage facility (DLS) by building a demonstration store with farmers at each cooperative. The project paid for the iron sheet roofing for one demonstration store in each kabele, while farmers contributed Eucalyptus from their lands for the walls and flooring. This model store was then replicated by farmers using their own investments of time and materials. Most of the DLS stores are cooperatives stores, with very few individuals having their own.

5 years ago, farmers reported a range of different storage types, none of which are optimal for seed storage even under local conditions. These included leaving potatoes in the ground or covered in the field which often resulted in them being eaten by wild animals, rotting, or inflicted with diseases. Seed was also stored in the house, either covered or uncovered but usually in piles. Piling seed in this way can result in damage to the tubers, and also the dark storage conditions retard the sprouting of seed before planting. Following training and the construction of demonstration DLS by the project, now 52% of respondents reported storing their seed in DLS stores. After sorting and grading the seed, only 'medium' sized tubers of 25-55mm are stored as seed potatoes.

In all woredas, farmer cooperatives successfully replicated the project demonstration stores, which were observed by the research team at many sites. Exact numbers of stores built were not able to be verified, but it is clear that the method of building demonstration stores with local materials and with available local skills and technologies has resulted in substantial replication and a spread of the technology, because farmers were able to observe the benefits of the demonstration DLS.

One gap in farmer's knowledge of storage technology is how to store ware potatoes using locally available materials. Farmers have only received training on seed potatoes but want to store harvested ware potatoes in order to prolong their shelf life. This would enable them to be sold after the market glut that typically occurs at harvest times, when the oversupply causes prices to drop considerably. This technology is important to even out the ware supply in the market, and would possibly encourage more farmers to take up ware potato production because of potentially higher prices, which in turn would lead to more demand and good prices for quality potato seed.

Marketing

At present, the Ministry of Agriculture (MoA) of the Woreda plays an important role in facilitating trade between the potato seed cooperatives and buyers such as World Vision, CRS, GIZ, AGP and others, without taking a cut on the sale. The buyer deals with the cooperative rather than individual farmers. The cooperatives' chairman, secretary, treasurer and board facilitate the sale. Cooperative records are kept of these deals and were viewed by the research team at the cooperative offices. When cooperative seed stocks are low, individuals can also sell improved seed (which has been quality approved by the cooperative) through the cooperative with a levy of 10birr per quintal (100kg bag) collected by the cooperative. Farmers identified seed marketing as a growing challenge for them, as there are now an increased number of farmers growing seed potatoes, and a dependence on the MoA to continue to facilitate the large sales.

Prices for seed potatoes ranged between 300 and 700 birr per quintal (100kg) in recent seasons, with the common price being around 400 birr per guintal. Ware potatoes receive lower prices than seed potatoes, and the price ranges between a high of 300 birr per quintal and a low of 100 birr, with 180 birr being the common price cited in focus group discussions. Farmers expressed a preference for selling ware potatoes through traders rather than at the district markets because there is no transport cost to the farmers and little needed in the way of coordination. However, recognising that traders buy in bulk and cover transport costs, farmers said they found it difficult to know what a 'good' price should be when negotiating with traders, suggesting a lack of information. In most cases farmers do not personally know the traders operating from year to year.

Gender

The project worked with and trained the heads of households, which were men in roughly 80% of cases. In general, men were said to be more involved in the heavy work of land preparation and ploughing with oxen. Women are more likely to contribute their family labour to planting and harvesting, where they collect the potatoes behind the oxen driven by men. However, the project did require that at least 20% of cooperatives members should be women and at least one woman should hold a leadership position in each of the cooperatives. This was found to have been achieved. Women involved in the cooperatives tended to be widows or unmarried, as they were the head of their respective households. The household head was then required to disseminate the training knowledge to other household labourers and hired labourers. How well this was done was not able to be determined.

Women tended to own smaller plots of land for ware potatoes than men, but did have about the same amount of land under seed potatoes. One training that was specifically targeted to women was cooking. Before, women said they only knew about boiling potatoes, but have now been trained in twelve recipes. While this might seem as small detail, this was reported to be quite important to the acceptance of potato in the community. It might be hoped that this component of the project will help with sustainability because potatoes can be grown both as a cash crop and for household consumption.

Changes in income

The project was clearly perceived by beneficiary farmers to have had a substantial impact on their livelihoods and also on the wider community, through revitalized rural economies. Furthermore the project has had an impact on the chain level, where the potato sub sector has been considerably strengthened by greater availability of improved seed.

Before the project few farmers grew potatoes, and those who did so grew mainly for household consumption. The project introduced changes in farmer knowledge and skills related to both ware and seed potato farming, which can be directly attributed to the project. This led to improved potato farming practices which resulted in higher yields, fewer losses, higher quality seed produce and commercialisation of produce. For beneficiary farmers, this translated into substantially higher incomes from seed potatoes than they were earning before with other traditional crops such as enset, or barley, wheat, beans and peas.

By modelling the data, it was found that costs of production for one hectare of seed potatoes was approximately 44000 Birr and that revenues from sales amounted to approximately 104000 Birr. This leaves farmers with a very good profit of 60205 Birr per hectare (US\$ 3204, EUR 2416). Seed potato farmers had an average of 0.45 hectares under potato seed last season, meaning that an 'average' farmer made 27092 Birr from seed potatoes per 0.45 hectares last season (USD\$1380, EUR1016). Furthermore, roughly half of the respondents were growing potatoes two seasons per year (long 'Meher' rains and shorter 'Belg' rains), meaning that their annualised income from seed potatoes could be up to double this figure if the short rainy season was good and there was some supplementary irrigation.

The crops that seed potatoes typically replaced were enset, barley, wheat and faba bean which were described by farmers as being far less profitable than seed potatoes. Working with the assumption that profits from other agricultural produce are less than half that of seed potatoes, it can be reasonably argued that the project contributed upwards of 13500 Birr in *additional* income last season alone (US\$687, EUR504).

For ware potato growers, yield has improved 7 tonnes per hectare as a result of the project. This amounts to an *additional* 12600 birr per hectare for potato growers than before the project. Those growing potatoes had on average 0.77 hectares, meaning a typical ware beneficiary farmer is now generating 9702 Birr more per season. After accounting for extra input costs such as additional labour, fertilizers and fungicides, this would amount to roughly an *additional* 6000 Birr more per season (US\$305, EUR224).

Farmers used this income in various ways, such as purchasing corrugated iron sheets for their houses, buying mobile phones, radio, and TVs or connecting to the electricity grid. Farmers spoke of being now able to afford school fees, whereas before this was a serious struggle for most households. Income from potatoes enabled farmers to invest in oxen, dairy cattle, horses, sheep, and other small livestock. It is clear farmers are now seriously investing their production through purchases of fertilizer, seed and other inputs – although not yet new clean seed. Beneficiary farmers also reported improvements in yields of *other* crops because they now applied better practices to their other crops too, such as fertilizer use, and crop rotation.

Of course, farmers who were *non*-beneficiaries also stood to benefit from the project, as the beneficiary farmers have produced improved seed which non-beneficiaries can buy and use on their potato farms. It is difficult to estimate how much this improved seed alone can add to yields, however one potato expert estimated this at 25% for the first year the seed is bought and a further 17% when it is recycled by the ware grower the second season. Taking the baseline yield figure of 8.8 tonnes per hectare, this means an approximate improvement of 2.2 tonnes per hectare in the first year for non-beneficiary farmers using improved seed produced by beneficiary farmers. This translates to an *additional* 3960 Birr more per hectare per season for nonbeneficiaries (US\$202, EUR 148).

Displacement

In focus group discussions, groups frequently recalled how before the project there were few employment opportunities in the area, that local economies were seriously depressed economically, and that it was very common for households to send one or more members to work seasonally in the nearest towns to earn money through petty trading or services. This had negative impacts, such as on household cohesion, hardships and risk of violence in the towns, and risks of exploitation and 'diseases'. However, project beneficiaries strongly believe that the project has revitalised local economies and stopped, or even reversed, outward migration. This is because local people now believe that now there are better prospects in the area because households now have significantly more money due to potatoes. While this is very difficult to verify, this change was mentioned unprompted by all focus groups in the research areas.

Recommendations

The CFC project 'Wealth creation through integrated development of potato production' has clearly brought a wide range of positive livelihood changes for potato farmers in the highlands of Ethiopia. It has brought new potato related knowledge and technologies, helped to organise farmers, and has significantly improved food security and household incomes. The project was well targeted and well implemented and applied a strategy which, rather than focussing on one or two production issues, took a systematic approach to transforming the seed and ware potato value chains. Overall, the project can certainly be regarded as a success story.

Nevertheless, there are of course aspects which the project funders, implementers and other actors should be aware of to ensure the sustainability of these gains. While the project has now wound up, there is a good opportunity for CFC or another donor to invest in a phase 2, to build on the gains made and take the sector to the next level. The following are recommendations are offered:

Project trainings have successfully built farmer capacity and professionalized seed production. It is recommended for this to be built on in other areas, as there remains a big demand for improved seed throughout Ethiopia. Furthermore, it would be wise to continue supporting project beneficiary farmer groups with, say, annual training follow-ups to ensure best practices become normalized by all farmers.

The capacity of farmer cooperatives has been built to a good level in a short time – some better than others. However, it should be kept in mind that these cooperatives are still relatively nascent and can be expected to require a degree of ongoing support to carry out business operations and support their farmers. Up until recently they have enjoyed the support of the project, and the energy of new farmers coming into the potato sub-sector for the first time. However, it is in the next phase of a cooperative's development that governance challenges can arise due to changing expectations of members, changes in leadership, changes in market conditions, or poor environmental conditions.

Marketing was highlighted by farmers themselves as their biggest challenge now. Prices have begun to fall as supply increases, and farmers have expressed a concern about how they can best access new markets. At the moment, some feel dependent on the brokering role that the woreda MoA plays to bring NGOs and other formal buyers to them. This assistance from the MoA is certainly appreciated, however cooperatives and individual farmers feel they need to reach new markets – either more ware farmers in the area or linking with buyers further away. With the new road highway networks observed being built in the vicinity of the research areas, this would seem to be



Demonstration diffused light store (DLS), replicated by farmer groups

a real opportunity.

The DLS storage for seed is perceived to have been a big success. However, now seed and ware growers are interested in locally appropriate technologies for ware storage too (i.e. not electricity dependent). This is an issue for enabling ware farmers to prolong the period in which they can store and market ware potatoes, outside of the glut that occurs around harvest time. This is relevant to seed potato growers too, because they often also grow ware. Furthermore, seed producers believe that if ware potato growing is more profitable then more farmers will grow ware, resulting in higher demand for their seed.

Financial literacy is an issue for farmers – very few are keeping records, despite them reporting that they have had training. This makes it difficult for them to judge the levels of investment that they should make on inputs, and what the return on investment would likely be from yield gains. In focus group discussions no farmer actually knew their costs or *how much* they were profiting, although it was widely believed that they were profiting a lot.

The need for investment in clean basic seed (generation 1) is probably the biggest and most urgent challenge to the sustainability of seed potato production by beneficiary farmers. Virtually no farmers have flushed out and refreshed their seed stocks since the project began. So while seed production and storage practices are good, the inevitable degeneration of the improved seed varieties is catching up with farmers. Yields are decreasing, resulting in reduced profits. Furthermore, there is a reputational issue at stake – project beneficiary farmers and their cooperatives are currently perceived by formal buyers such as NGOs as having desirably high quality seed. Unless farmers buy new basic seed to improve the quality of their harvested seed, they can expect to lose these hard to find formal buyers. The issue here is two-fold:

First, farmers said that new basic seed from Holetta (either 'Gudene', 'Jalene' or the favoured 'Belette') costs roughly 3-4 times what they currently sell their own multiplied seed for. Farmers have expressed that they would happily pay around 600 birr per guintal, but the reality of market prices for basic seed are putting off farmers. Nevertheless, while this is expensive for farmers, the participatory budgeting exercises done during this evaluation show that even if farmers buy new seed at these prices, they will still comfortably return a profit that same season, with costs offset by the higher yields of new seed. Furthermore, farmers will of course benefit through higher yields in the following 3 seasons of multiplication. Assuming a cost of 1200-1500 birr per quintal (100kg) for new basic seed, and that farmers use 20 guintal per hectare (2 tonnes), this amounts to 24000-30000 birr in increased costs per hectare when renewing their stocks.

Second, access is an issue. Farmers and their cooperatives feel far away from Holetta and seed companies, both geographically and relationship wise. Potato seed is bulky and therefore difficult and expensive to transport. A seed distribution marketing arrangement between Holetta and potato seed cooperatives would be interesting to look into. Farmers also feel that they do not know who to approach to access new clean basic seed, and how to negotiate such a deal. Therefore, it would be wise to strengthen the linkages between farmer cooperatives and Holetta and/or companies to improve access to basic seed. For example, farmers expressed interest in a revolving seed fund. After all, beneficiary farmers are now playing an important role in the chain, multiplying improved seed in numbers, on a scale that Holetta and companies cannot do on their own.

Finally, there would appear to be an emerging opportunity for investment in a medium-large potato processor in the sector, as there is in Kenya. The demand already exists and is currently met through imports. Consumption of potato chips (French fries) in East Africa is rapidly increasing due to urbanisation, the proliferation of fast-food restaurants, growing tourism, and a significant change in eating habits among both high- and low-income groups in urban areas. It is understood that there is no such company operating in Ethiopia at present. Such an enterprise has been calculated as being profitable in other research¹. It would also help to absorb increases in ware potato supply to the market, as more farmers look to grow potatoes and realise higher yields from the use of improved seed and better ware production practices. Beneficiary farmers would be excellent candidates to supply such an enterprise through an outgrower arrangement.

¹ Haverkort, A., Koesveld, F., Schepers, H., Wijnands, J., Wustman, R., Zhang, Z. (2012) Potato prospects for Ethiopia: On the road to value addition. Wageningen UR. Available at http://edepot.wur.nl/244969