Potato seed impact study report

Interim study report on the impact of adopting certified potato seed in Meru County, Kenya (2011-2014)

KISIMA

CENTRO INTERNACIONAL DE LA PAPA CIP

syngenta foundation for sustainable agriculture

Contributors

SFSA

Justin Ahmed (principal author; courtesy of GATD)
Yuan Zhou
James Wathiru
Samuel Gikonyo
Edwin Waihenya
George Osure
Dorcas Mugo
Linda Akinyi
Victoria Johnson-Chadwick
Ian Barker (SFSA contact)

CIP

Julius Okello
Sylvester Ogutu
Elly Atieno
Monica Parker
Elmar Schulte-Geldermann (CIP contact)

Kisima Farm

Martin Dyer
John Kibet
Shaun Miller
Charlie Dyer
Derek Roulston (WHEAT Foundation)
Jonathan Moss (Kisima Farm contact)

Acknowledgements

July 2014

Introduction

In the highlands of East Africa an estimated 2.5 million smallholder farmers depend on potato as both a cash and subsistence crop. Average yields persist around 7-8 tonnes per hectare, while the potential of the crop is above 30 tonnes per hectare. The lack of provision of quality disease-free seed of improved varieties is the principle cause of this yield gap.

The International Potato Centre (CIP) implemented a USAID/GIZ-funded initiative (known as the '3G' initiative) between 2009 and 2011. This initiative facilitated the successful entry of the private sector into potato seed production in Kenya, in partnership with relevant Kenyan government agencies. This project resulted in a new seed capacity which has continued to grow beyond the life of the project, supplying smallholders with quality seed of CIP/KARI-bred disease-resistant varieties through private sector investment.

In Kenya, SFSA subsequently assisted one of the original '3G' private sector potato seed multipliers (Kisima Farm) from 2011 to the present day and which grew from around 10 hectares to 60 hectares of production during this period. Most of the seed is sold locally to smallholder farmers but a proportion is bought by secondary seed multipliers, who are able to supply smallholder farmers in other parts of Kenya. More recently, a small proportion of the seed has been bought by Syngenta Africa Venture's team to successfully pilot an integrated input package farming solution for mainly smallholder farmers in Molo and Bomet. Private potato seed production from Kisima Farm now matches the total output of the Kenyan public sector capacity (ADC and KARI).

SFSA's continuing assistance included supplying technical consulting for seed production, arranging exchange visits with leading UK growers and support to training of local potato growers through the Kisima Foundation. SFSA also brokered a successful alliance between a Dutch private breeder (HZPC) and Kisima Farm, which permits the latter to commercially produce seed of modern processing varieties in Kenya in return for a royalty payment - the first of its kind in Sub-Saharan Africa. The agreement includes novel mechanisms to promote smallholder uptake of the new varieties and even to put them in an advantageous position over larger producers through waiving the right to collect seed multiplication royalties and ware-replant fees. These private-bred varieties with advanced processing traits should complement the existing CIP-bred varieties, which carry disease resistance and other important traits such as short dormancy which are favoured by smallholder farmers. SFSA also supports CIP's work in introducing varieties, which carry abiotic stress tolerance, such as heat stress. These varieties are expected to be offered for sale to smallholder farmers in the near future.

Furthermore, SFSA co-funded a USD $1.1. million investment by the Africa Enterprise Challenge Fund (AECF) which permitted the construction of a much needed 1,000 tonnes seed cold store (inaugurated in 2013) and other additional facilities. Plans for the next few years include expansion of the current area to approximately 100 hectares of production per season.

A recent Kisima Farm (2012) survey of 170 local smallholder farmers revealed that the supply of quality potato seed was cited by 41% of respondents as having increased their yields by between 2- and 10-fold. In May 2014, CIP and SFSA jointly carried out a statistically valid study of 408 smallholder farmers in Meru County to calculate the benefit and impact of purchasing and using Kisima Farm certified potato seed, compared with those farmers using old degenerated farmer-saved seed. This report is an interim analysis from data dawn from 280 of the respondents (data available at the time of writing).

Data sources and study design

The data presented in this report is drawn from a number of sources. Production and sales data was provided by Kisima Farm. SFSA conducted one study between July and October 2013, which consisted of surveys with purchasers of Kisima Farm potato seed, hereafter referred to as 'the customer survey.' SFSA enlisted the technical support of the International Potato Center (CIP) to administer an assessment of the impact of certified potato seed from Kisima within the greater Meru region between March and May 2014, hereafter referred to as 'the impact assessment.'

The customer survey was intended to deliver insight into the characteristics of individual customers and transactions. The questions pertained to consumer demographics, land use, purchase information, seed utilisation and marketing of both seed and ware potatoes. In total, 67 individuals obtaining Kisima Farm potato seed were interviewed. Of the 67 surveys administered, 47 were conducted in person at the point-of-sale. The rest were interviews with farmers who had obtained seed from Syngenta Africa Venture, a bulk purchaser of Kisima. Many of these took place in person while seed was being distributed, but others were conducted over the phone with seed recipients. Though we were given contact information for 37 farmers who were provided Kisima seed by Syngenta Africa Venture, only 25 were able to be contacted, given the restrictive timeframe of the study and the farmers' spatial distribution.

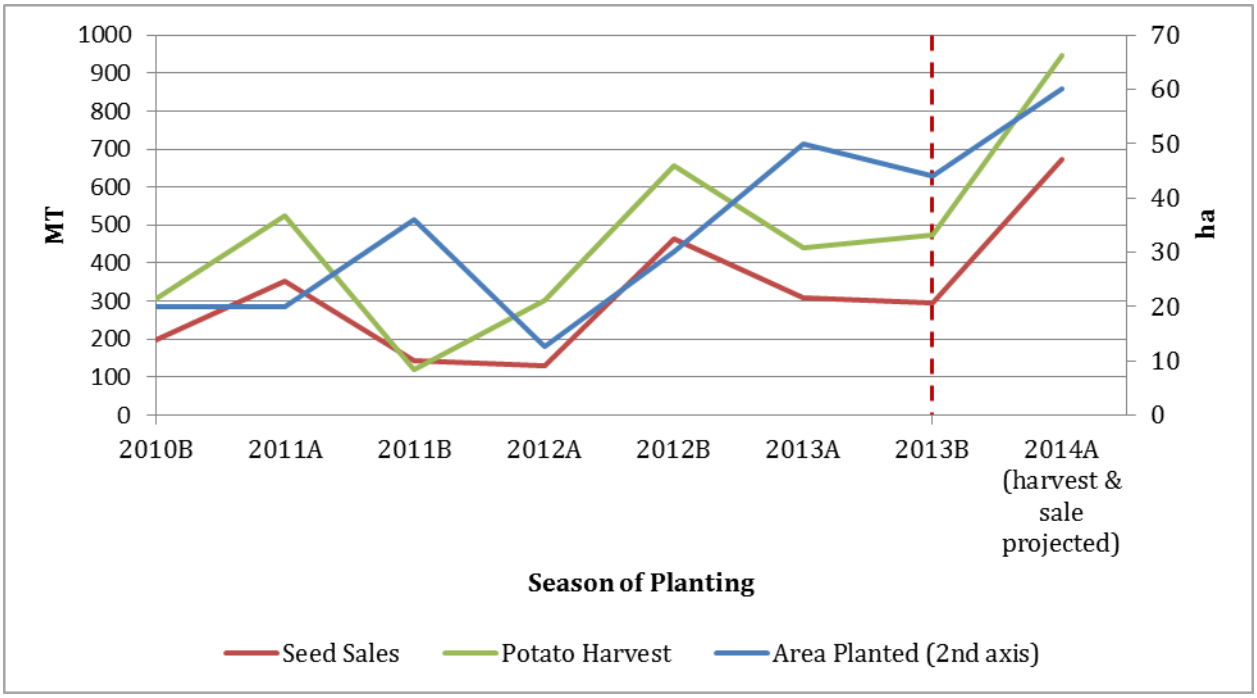
The impact assessment included a survey of 408 potato farmers, distributed across 34 selected villages in greater Meru District. To generate the sampling frame for the study, we drew from the consumer survey villages to which Kisima Farm seed had spread and contacts therein. We followed up with listed farmers and local administrators to construct a complete list of potato farmers, stratified as 'adopters' of Kisima Farm potato seed (those who had purchased Kisima Farm seed at any point) and 'non-adopters' of Kisima Farm potato seed. The 34 villages selected were those that contained the highest total number of adopters. From the lists populated by the generation of the sampling frame, we opted to interview a proportionate number of adopters and non-adopters in each village. Through this comparison, we could garner an understanding of the effects of adoption of Kisima Farm seed on yields and household incomes. The impact assessment also assisted in identifying patterns of seed movement, changes in farm management practices resulting from adoption, factors affecting adoption decisions and even efficacy of current extensions services.

Impact of SFSA seeds programme on smallholders

Trends in production and sales

With the support of SFSA, the acreage of land being utilised by Kisima Farm for multiplication of seed potato has tripled in the seasons since 2010 (see Figure 1). Hereafter, seasons are referred to by their season of planting: 'A' refers to the Sorgi season, in which planting usually commences in March and 'B' refers to the Kamiti season, in which planting usually commences in October. Uniquely in Meru, the Sorgi season is denoted 'short rain' and the Kamiti season 'long rains,' although no notable difference in regional rainfall and/or productivity has been identified.

Figure 1: Trends in production and sale of certified seed at Kisima Farm



The discrepancy between total harvest and sales is a result of the intersection of three different phenomena. Firstly, a small portion of potato is lost each year in the grading of seed. Secondly, a portion of the potato produced is too large to be sold as certified seed, and is thus utilised as ware potato. Lastly, a portion of the harvest must be saved each year for multiplication. The estimations for harvest and seed sale in 2014A were projected from the 60ha of land on which potato was planted this season, under assumptions of a 15.7 MT/ha yield and the loss of 29% of harvest (both seasonal averages thus far) to the three phenomena explained previously.

A recently constructed potato store, with a capacity of 1,000 MTs, is expected to smooth cycles of production and sale. Farmers may purchase seed throughout the year. Particularly those with irrigation systems installed are therefore afforded the opportunity to plant off-season to take advantage of more favourable output markets. Seed generated during a highly productive season can be stored to meet additional demand the following season.

Florence Akethi has served as the chairperson for the Endemwe Self Help Group in Mpakone since its inception in 2006. This group of fifty-two mothers has its hands in all aspects of the community - from public seminars on health issues, to orphans' and children's mentoring activities – even the purchase of livestock. While the communal spirit is strong, capital is often low, limiting the capacity of the group to sustain their activities and accommodate new members. For this reason, Florence and the group turned to production of certified potato seed from Kisima Farm last season.

Thus, in Mpakone, where few farmers plant potatoes at all, the group planted their certified Kisima seed potatoes together on a group shamba. They harvested 53 bags, enough to sell clean seed to 80 potato farmers in the area and to save seed for multiplication. The income generated has helped to make possible a new 'table banking' activity within the group, by which savings and agricultural inputs can be issued to group members on credit.

Florence says that the success with certified potato seed from Kisima Farm is enabling the group's central activities to reach more community members. The group plans to buy more seed from Kisima Farm this September to bolster their multiplication activities. Many of Mpakone's farmers are reorienting their crop rotations to make room for the group shamba's clean potato seed.

Customer survey

The customer survey revealed a wealth of information about the customer base for Kisima Farm's potato seed. Over 60% of the purchasers identified were farmers utilising less than five acres of land in total for the year 2013, displaying that even smallholders are willing to pay a premium for certified-quality seed. Additionally, over 10% of the respondents hailed from distances more than 30km away from Kisima Farm. Some seed purchasers were intentionally left out of the survey because of their purchasing seed on behalf of others. Notably District Agricultural Officers bought seed on behalf of groups as far away as Nyandarua (>125km) and Farm Input Promotions Africa (FIPS - Africa) bought seed for potato farmers in Kiambu (>200km).

Table 1: Demographic characteristics of study sample (N=67)

Characteristic		Frequency	Percentage
Gender	Male	53	79.10%
	Female	14	21.90%
Age	< 40 years	17	25.37%
	40 - 60 years	33	49.25%
	> 60 years	15	22.39%
	Unspecified	2	2.99%
Highest level of education	Primary	23	34.33%
	Secondary	33	49.25%
	Tertiary	10	14.93%
	Unspecified	1	1.49%
Total land area (owned/rented)	< 5 acres	42	62.69%
	5 - 10 acres	16	23.88%
	> 10 acres	9	13.43%
Main source of employment	Farming	56	83.58%
	Other	11	16.42%
Distance from your shamba to Kisima Farm	0 - 10 km	22	32.84%
	11 - 20 km	22	32.84%
	21 - 30 km	16	23.88%
	> 30 km	7	10.45%

Clearly, the 'certified' status of Kisima Farm potato seed adds value for customers. While more than 10% of respondents list certification as the central reason for their adoption of Kisima Farm potato seed, nearly 95% of respondents expressed a direct and unprompted link between the purchase of certified seed and expectations of increased yield or disease-tolerance.

Like many small-scale potato farmers in Kenya, Phylis Karimi has suffered through her share of issues with low-quality potato seed. Persistent blight occurrence presents a regular challenge to her efforts on her shamba in Kongoacheke. But when it comes to Kisima Farm potato seed, Phylis issues commendation rather than complaint.

In January of this year, Phylis allotted just a tenth of an acre to the production of a single bag of Kisima Farm's certified Asante potato seed, to be harvested in time for her regular cabbage rotation. From the 50kg, Phylis harvested 1.43 MTs, generating USD $281 (KSH 24,200) in revenue. With this return alone, Phylis bought a sheep for milking, paid for her children's school fees, and even gave a generous tithe to her church. Furthermore, she was afforded the capital to start another business with a new angle on potatoes, selling French fries in Meru town.

Table 2: Kisima Farm and certified seed (N=67)

Question	Answer	Frequency	% of sample
Have you bought potato seed from Kisima Farm previously?	Yes	18	26.87%
	No	48	71.64%
	Unspecified	1	1.49%
What is the main reason you are purchasing potato seed from Kisima Farm? (n=62)	Because Kisima seed is certified	7	11.29%
	Heard/observed increased yield	43	69.35%
	Disease-resistance	4	6.45%
	Other	8	12.90%
Why are you purchasing certified seed? (n=35)	Issues with diseased crop	21	60.00%
	Expected higher yield	12	34.29%
	Other	2	5.71%
Do you purchase certified seed for other crops? (n=39)	Yes (variety specified)	30	76.92%
	Yes (variety unspecified)	7	17.95%
	No	2	5.13%

Information pertaining to yields and seed movement were also collected in the customer survey; while the quality of data was limited by the low number of respondents – specifically respondents who had previously planted Kisima Farm seed. The data proved very useful in designing the subsequent questionnaire for the impact study.

Impact assessment

We originally attempted to classify respondents for the impact assessment as 'adopters' or 'non-adopters' based on whether they had purchased seed from Kisima Farm at any point. However, we found it reasonable to make the distinction between 'direct beneficiaries,' those who had obtained certified potato seed from Kisima Farm in the season(s) for which data was taken, and 'indirect beneficiaries,' who had planted 'clean seed.' Clean seed was considered to be any potato seed generated from certified Kisima Farm seed stock, up until the third season of planting outside of Kisima Farm. Indirect beneficiaries, therefore, had obtained the clean seed in one of two ways: either they saved their certified Kisima Farm potato seed for up to two seasons, or they purchased clean seed from a farmer or seed multiplier that had planted either certified seed or first-generation clean seed the previous season. The impact assessment sought to model the current number of direct and indirect beneficiaries from certified seed production at Kisima, and impact on both groups.

Table 3: Characteristics of impact assessment respondents (N=280)

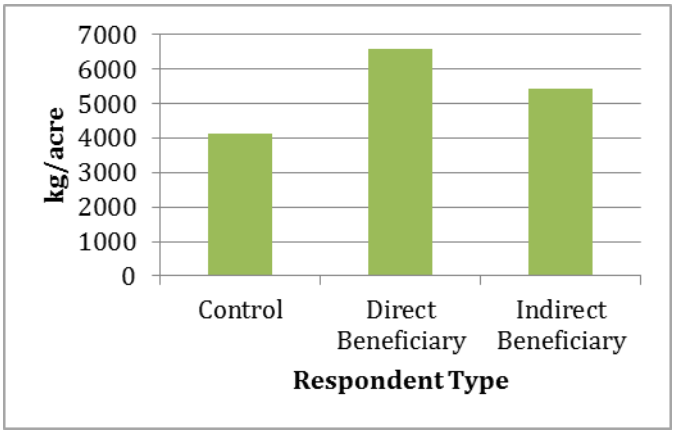
Characteristic	**Control**	**Adopter***
Number of respondents	204	76
Number of plots for which data was recorded	409	93
Average age for head of household	51	51
Average number of members in household	4.41	4.07
Average number of acres utilized	2.95	3.85
Average number of acres on which potato was cultivated	0.75	0.93
Average plot yield (kg/acre)	4538	5786
**Adopter is inclusive of both those utilizing 'certified' seed and those utilizing 'clean' seed*		

Substantial results were able to be drawn from the 280 respondents for which clean data has been entered for thus far. While plot data was collected for both seasons in the year 2013, data analysis is not stratified by season, as no consistently significant differences in the data were perceived between seasons. Table 3 displays descriptive statistics for the data from all respondents, but we limited our plot analysis to areas of greater than or equal to 0.2 acres. This was intended to minimise the effects of potentially inaccurate plot size estimation, which is especially likely on very small plots.

Yield and harvest

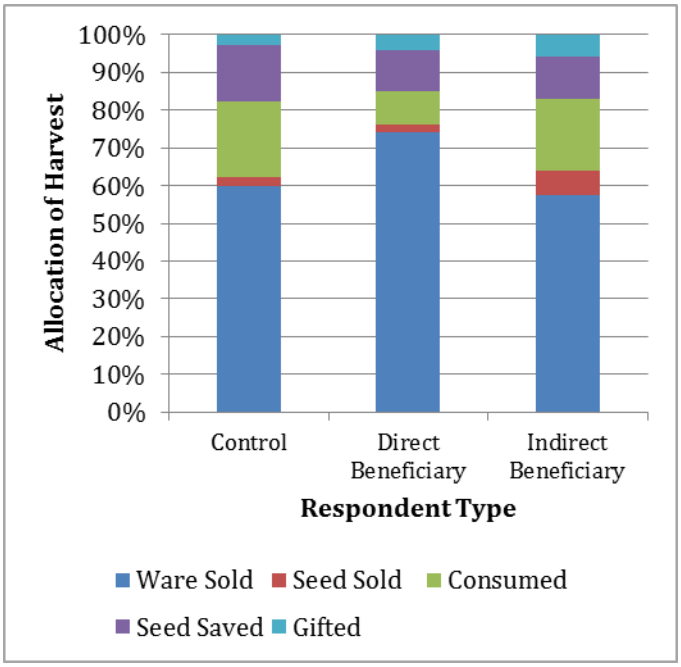
Interestingly, we found that direct beneficiaries planted on average 16% less potato seed per acre than the control group. Still, their average yield was 6,588kg per acre, surpassing those of the control group by 60%. In fact, for every kg of seed planted, certified seed from Kisima Farm yielded 15.66kg of potato – a multiplication rate 2.15 times that of the control group. Plots maintained by indirect beneficiaries maintained a higher planting rate those of direct beneficiaries, roughly equal to that of the control group. It is expected that a modest degeneration rate would be found, as clean seed would have been exposed to disease in its first season of planting. Still, plots maintained by indirect beneficiaries with clean seed achieved on average 31% higher yields than plots managed by the control group.

Figure 2: Plot yields



The impact assessment recorded the utilisation of potato harvests across five different categories: sold as ware, sold as seed, saved as seed, consumed and gifted. On average, direct and indirect beneficiaries sold clean seed to 0.76 and 0.83 people each, respectively. 62% of direct beneficiaries and 68% of indirect beneficiaries saved their seed for the next season. Many also gifted potatoes to one or more sources, including family members, neighbours and local churches.

Figure 3: Seasonal allocation of harvested potatoes



In the hills of Machenge village, where miraa plantations roll on for acres at a time, George Ntombura describes his pioneering efforts in cultivating clean seed potato: "For five years, I was the lone ranger in this game." He is the village elder trusted with the mediation of conflict between neighbours and is heavily relied on by the sub-chief. He is also known to farmers as a provider of disease-free potato seed, multiplied from certified Kisima Farm stock.

Since 2009, Ntombura has been purchasing potato seed from Kisima Farm to multiply and sell to others. Because Machenge is over 100 kilometres away from Kisima Farm by road, his clean seed is often the only seed of trusted quality available to potato farmers in the area. Since starting this enterprise, demand for the seed has only grown, which led him to form the Nkinyaga Potato Growers and Agribusiness Self Help Group last season. Through this group, 39 members have gained direct access to certified potato seed from Kisima Farm.

The benefits are evident in Ntombura's own household. In addition to increased food security for his family, income from the sale of clean seed generated the capital necessary to launch a cabbage brokerage business. Ntombura harvested 1.65MTs of potatoes from just 100kg of potato seed in the short rain season. In the long rain season, he harvested 2.1MTs of potatoes from just 200kg of potato seed in the face of excessive rainfall. With these yields, Ntombura estimates that he provides clean seed to 50 farmers each season. Though the individual benefits Ntombura has derived from the use of Kisima Farm potato seed have been exceptional, he tells us that the greatest benefit has been the newly-afforded access to certified potato seed for the community as a whole.

Costs and returns

Revenue includes imputed benefits for potatoes 'saved as seed' and 'consumed.' The revenue added per kilogram of potatoes 'saved as seed' was the average price of potatoes 'sold as seed' computed for the village. In villages where no respondent sold any part of their harvest as seed, the average price for potatoes 'sold as seed' across all respondents was used. For potatoes 'consumed,' the revenue added per kg was made equal to the price of potatoes 'sold as ware' (see Figure 4).

Plot costs include non-labor input costs, labor costs, and transaction costs. Though the data includes imputed price of saved seed, all saved seed was priced arbitrarily at KES 10 per kilogram. Also, all counts of hours worked on plot activities were converted to KES at a standard rate of KES 250 per eight hours worked (see Figure 5).

Figure 4: Plot revenue

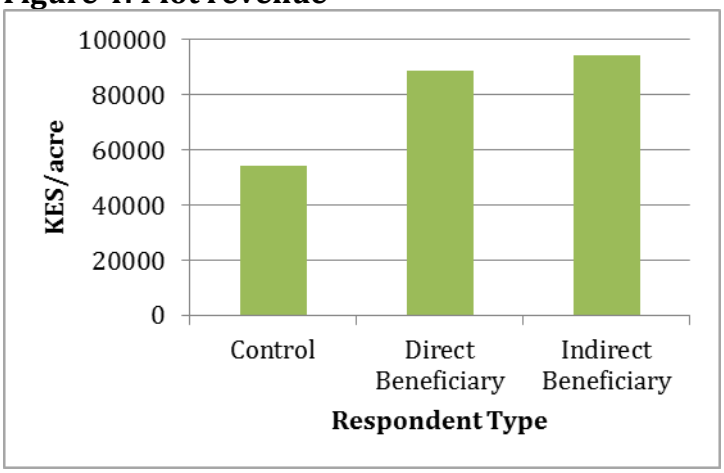
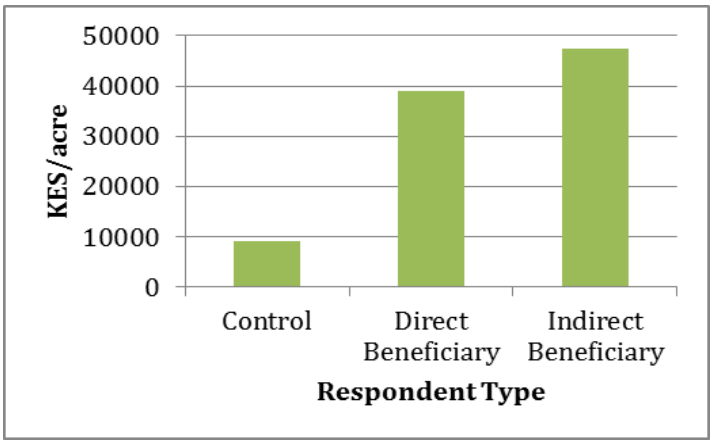
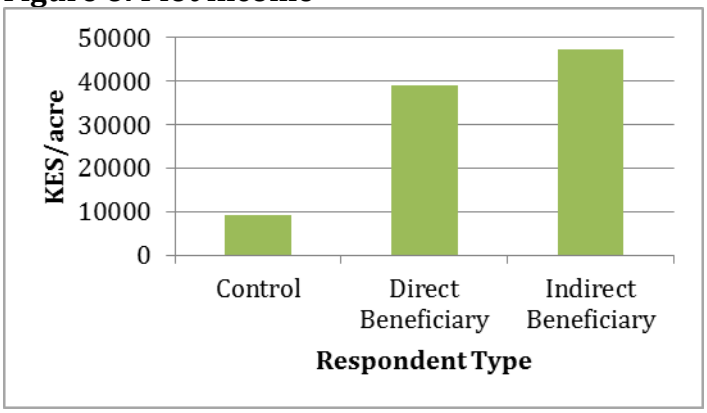


Figure 5: Plot cost



Plot income was KES 29,731 per acre above that of the control for direct beneficiaries and 38253 KES per acre above that of the control group for indirect beneficiaries. On average, land on which potatoes are grown was 1.08 acres for direct beneficiaries and 0.98 acres for indirect beneficiaries. 91% of direct beneficiaries' land under potato was sown with Kisima seed and 81% for indirect beneficiaries. This translates KES 29,219 of income above control for direct beneficiaries and KES 30,365 for indirect beneficiaries. The lower income per acre for direct versus indirect beneficiaries may be linked to: firstly, the lower planting rate, which is 13% lower for direct beneficiaries than indirect, and; secondly, the high cost of certified seed for direct beneficiaries, which amounted to an average of 38% of the total cost of production for respondents who had purchased seed from Kisima (see Figure 6).

Figure 6: Plot income



Beatrice Gikunda has spent a substantial portion of her life working to improve the lives of those around her. After being widowed before the age of 30 she spent 15 years as the national representative for the Kenya National Teachers Union (KNUT). While she has stepped away from the national stage, her activist spirit has taken root in her home village, largely thanks to certified potato seed from Kisima Farm.

In Beatrice's village, Mworoga, nearly all farmers grow tea for the Kenya Tea Development Agency. But farmers cultivate potato, cabbage, and other vegetables as well, mostly on a subsistence basis. Beatrice and her village cohort have been proactive in their effort to scale up their production of these alternatives. Beatrice currently serves as the secretary for Katheri Commercial Village, a 52-member group of farmers who procure and cultivate Kisima Farm potato seed for commercial sale. She also chairs and founded Katheri Capacity Builders, a group of 20 women aiming to improve livelihoods through horticulture. Specifically, she multiplies Kisima Farm potato seed to provide to the members. Because of the significant transport costs involved in the procurement of Kisima Farm potato seed from the farm gate, multipliers such as Beatrice play a key role in buffering the amount of clean, quality seed available to small farmers, adding to the indirect benefits of Kisima Farm's potato seed production.

The benefits of Kisima Farm potato seed have proven significant for Beatrice and her family as well. In fact, Beatrice attributes the scaling up of her cabbage business from subsistence to commercial, the introduction of poultry production, and the purchase of a sheep for milking, all to increased revenue from production of Kisima Farm certified potato seed. But most important, she says, is the ability to pay for her grandchildrens' school fees.

Total benefit

Having determined the proportion of beneficiaries using Kisima Farm's certified seed, and those saving clean seed and selling clean seed, the total number of direct and indirect beneficiaries can be estimated. 3,754 smallholders are estimated to have gained access to certified seed from Kisima seed generated from 2010B to 2013B. An additional 12,351 farmers gained access to clean seed generated from certified Kisima Farm seed stock. With the indicated average net benefit for direct beneficiaries being KES 29,220, the estimated total additional benefit (increase in gross margin) from seed generated over this timeframe is USD $1,290,355 (KES 109,680,163). The estimated total benefit for indirect beneficiaries for seed generated over this timeframe equates to USD $4,412,163 (KES 375,033,860). Thus, the total benefit derived from the production of certified potato seed at Kisima Farm, in the seven seasons between 2010B and 2013B, is estimated to have been KES 484,714,023 (USD $5,702,517).

Under the assumptions for characteristics of direct and indirect beneficiaries generated through the impact assessment, the projected sale of 672 MT from 60 ha this season will provide access to certified seed for another 1,336 Kenyan potato farmers. Over the next two seasons, this certified seed will be multiplied, saved, and sold to provide access to clean seed for another 4,397 farmers. If these projections are correct, the total cumulative benefit of certified seed generated at Kisima Farm up to the current season will come to an estimated KES 657,289,557 or USD $7,732,818.

Looking forward

The capacity built and impact achieved thus far has given impetus for plans to increase production and sale of certified potato seed for the coming years. Kisima Farm aims to continue the incremental expansion of hectares for multiplication, aiming to cultivate on 100 hectares by 2019. Based on this experience, Kisima expects fields to increase to 25MT/ha and the proportion of harvest sold as seed to increase by 75%. The projected benefit to Kenya's potato farmers is immense. Considering the projections from nine seasons 2014B to 2018B, an additional 13500 MT of seed will reach 5,824 seasonal direct beneficiaries and 20,092 seasonal indirect beneficiaries. The total additional benefit to be generated from Kisima Farm certified seed over these nine seasons is estimated at USD $9,179,890 (KES 804,158,350). The estimated total benefit for the whole period (16 seasons) is USD $16m (KES 1bn).