



Enhancing Potato and Cassava
Value Chains Performance

Voices from the Field



Vol. 2



Our Vision

Vibrant transformative universities to catalyse sustainable inclusive agricultural development to feed and create prosperity for Africa



Our Mission

To strengthen the capacities of Universities to foster innovations responsive to the demands of smallholder farmers and value chains through the training of high quality researchers, the output of impact-oriented research, and the maintenance of collaborative working relations among researchers, farmers, market actors, national agricultural research and advocacy institutions, and governments



Our Motivation

"Transforming agriculture in Africa requires innovative scientific research, educational and training approaches. The education sector needs to be more connected to the new challenges facing rural communities and needs to build capacity of young people to be part of the transformation of the agricultural sector". Reinforced by the Science Agenda for Agriculture in Africa



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The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Egerton University and Gulu University in partnership with the Mastercard Foundation are implementing the “Transforming African Agricultural Universities to meaningfully contribute to Africa’s growth and development (TAGDev) Project”. The overall objective of the project is to transform African agricultural universities and their graduates to better respond to developmental challenges through enhanced application of science, technology, business and innovation for rural agricultural transformation. Through TAGDev, several African universities are having an opportunity to increase their engagement with the communities and youth through the Community Action Research Programmes (CARPs). The CARPs provide opportunity to universities to undertake research whilst sharing and jointly generating knowledge with the communities, co-designing development interventions, and co-implementing community-based development processes and actions.

Egerton University has been privileged to implement a series of TAGDev based activities and shared lessons and interventions with

farming communities in Kenya. This publication shares lessons, practices and evidence of how Egerton University has been engaged in two key agricultural commodity value chains in Kenya; the potato value chain and cassava value chain. It highlights the effort taken by university research teams in facilitating quality seed potato production and increasing its uptake among smallholder farmers. This publication also points out the processes and engagements undertaken in catalysing cassava seed bulking and increasing farmer skills within Nakuru County.

Through this publication, you will find an example of university intervention at increasing agri-enterprise development within the potato value chain. This case is particularly critical because it points out how youth can be better engaged to take advantage of opportunities within the agricultural value chains as such it illustrates how best youth can be attracted to and retained in agriculture. Egerton University as a premier agricultural university also prides in itself as a learning institution and strives to deliver impact through the power of partnership, collaboration and networking. In this publication, a case on how deployment of multi-stakeholder collaboration can be utilised to galvanise change agents is provided. As a learning institution, the lessons from the community engagement and interactions provides opportunity for enhancing research skills and strengthening the experiential learning among students and academic staff.

It is my sincere hope that this compilation of case studies emerging from Egerton University’s successful implementation of the TAGDev project will provide learning points and reference illustrations to all of you as readers and practitioners!

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Enhancing Seed Potato Production

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Traditionally, farmers source potato seeds from their farms, local markets and neighbours. The seeds are of poor quality and susceptible to diseases which results in low productivity. This is largely because they do not know that potato seed quality reduces with each generation and that diseased seeds are transferred from one field to the next. Seed quality significantly contributes to the quantity and quality of produce.

Institutions such as Agricultural Development Cooperation (ADC), Kenya Agriculture Livestock and Research Organization (KALRO), International Potato Centre (CIP), private sector players and specialized farmers grow and sell certified seeds which are of high quality and high productivity.

The certifying body in Kenya is the Kenya Plant Health Inspectorate Services (KEPHIS). However, certified seeds are not affordable to

small scale farmers as a 50kg bag of seed ranges between KES 2,500 and 3,000. This implies that an acre of land would require 16 bags of seeds amounting to not less than KES 40,000.

Since certified seeds are costly and difficult to get, some suppliers sell clean seeds which are reproduced from the certified ones. Clean seed is farmer produced seed potato, that has been produced following most of the laid out seed production practices, but was not certified by KEPHIS (due to costs of certification).

Kenya Plant Health Inspectorate Services (KEPHIS) is the government agency who's responsibility is to assure the quality of agricultural inputs. Farmer saved seed potato is that which is kept by the farmer for replanting/recycling as seed tubers. They are normally undersized (<27mm diameter), but at times too big and not approved by KEPHIS either.



Potatoes are also susceptible to various pests and diseases such as cyst nematodes, early and late blight, bacterial wilt and black leg. This requires farmers to have good agronomic skills and working knowledge on land selection, planting and management.

Intervention

In order to solve the problem of availability of quality seed among small scale farmers, Egerton University through Community Action Research Project (CARP+) supported six farmer groups led by the following:

- Richard Mbaria: Elburgon;
- Joseph Karangathi: Turi;
- Pastor Terer: Mauche;
- Joseph Kinyanjui: Likia (Kiahiti B);
- Beatrice: Kasambara (Gilgil); and
- Darwin Kenai, Elite (youth group): Egerton, Njoro.

Community Action Research Project Support

Community Action Research Project (CARP+) provided the following support to all the farmer groups:

Seeds: All farmers groups were given two bags of 50kg each of the Shangi certified seeds, bought from ADC Molo and Jelly bought from Charvi Ltd. Shangi was selected because it is a common variety grown in the area and Jelly is preferred for its large size by markets for French fries (chips). Jelly is a new variety and has characteristic of long (>2.5 month) tuber dormancy.

Fertilizer: The groups were also provided with fertilizers-NP: 23:23:0 blended by Baraka fertilizer and DAP bought from Nakuru, MOAL&F.

Fungicides and herbicides: Farmers were given Ridomil, Revus and later Infinito to combat late blight infections which were severe in June 2017.

Training: During planting time, technicians from ADC Molo and Egerton University staff trained the farmers and students on good agricultural practice. The learning was experiential. The students and farmers on the six sites were shown how to space the plants in rows spaced at 75cm and plants at 25cm. The rows were made into raised ridges into which the tubers were placed at 6 inches depth to allow for proper spacing for optimum growth and earthing. In certain incidences, the tubers were placed within the furrows and then covered with the soil of the ridges to attain the same depth. Spraying was done immediately infections of late blight and pests were noticed.

Baraka Agricultural College (BAC) a Technical and Vocational Education and Training (TVET) institute in Nakuru also undertook similar training independently on their farms in Molo and Kuresoi North. The college uses experiential learning in training its students and it engages in outreach to farmers. Baraka Agricultural College is a valued partner of the CARP project.

How the groups were selected

The selection criteria for the farmer groups varied. For example, the Turi group was identified with the assistance of Nakuru Smallholder Farmers Association (NASFA), the farmer cooperative group and partner in the CARP+. Some groups were selected based on the initiatives of leaders who were personally growing and selling “clean” seed potato.

For example, leaders like Mbaria of Elburgon and Joseph Kinyanjui from Likia had experience in producing and selling seed potato. Lastly, two of the groups were included in the program after they had invested in their own resources such as purchasing of certified seeds and management of the crop. They include Kasambara and the Egerton University student’s youth group called Elite. All the groups were supported with fungicides, herbicides (after planting) and fertilizer. This was done by sending it through a youth farmer (Stephen Njihia) who was engaged as a casual and doubled up as a trainer too. Kasambara paid for all their own agronomic management, while Elite was partially supported. Groups were picked based on their past experience in seed potato farming (e.g., Elburgon and Likia groups of Mbaria and Joseph, respectively, and their individual initiative (e.g., Kasambara of Mwenja and Elite Youth group of Darwin), and recommendation by NASFA (Molo group of Karangathi and Mauche CBO group of Terer (recommended by one of the EU co-investigators).



Land preparation in Turi Molo, Kenya



Students demonstrating to farmers Planting potatoes in Likia Mau Narok, Kenya

Training

Training in Good Agricultural Practices (GAP) skills are given in the Table below.

Table. 1: Experiential learning by farmers, students and staff on GAP of seed potato production on six demo plots in Nakuru County

Activity	Group Name		Green Vision		Giteru		Chomoza		Kiahiti B		Elite		Kasambara Bidii		Cost of Production (KES)	Remarks
	Leader	Site	Mbariya	Elburgon	Karangathi	Turi	Terer	Mauche	Kinyanjui	Likia	Darwin	Njoro	Beatrice	Kasambara		
	Selection Criteria	Seed merchant	Seed merchant	NASFA	NASFA	Referred by Co PI	Seed merchant			Student youth group	NASFA					
	Training															
Land Preparation	Primary digging	1	0	1	1	1	1	1	1	1	1	1	1	1,500.00	Farmer operation	
	Making furrows	1	1	1	1	1	1	1	1	1	1	1	1	1,500.00	Farmer, students and staff	
Seeds	Shangi (50kg/bag)	2	1	1	1	1	2	1	2	1	1	2	2	2,500.00	Price per 50kg of seed- Provided by CARRP +	
	Jelly (50kg/bag)	1	1	1	1	1	1	1	1	1	1	0	0	3,000.00		
Transport	Of seed													2,000.00	Provided by CARRP+	
	Fertilizer													2,000.00		
	Agro chemicals													1,200.00		
Seeding	Planting	1	0	0	1	0	1	1	1	1	1	1	1	1,500.00	Mauche only 2 men were trained with Likia farmers. They planted one month later because they did not have the land.	
															Farmer, students and staff	
Fertilizer	DAP	1	1	1	1	1	1	1	1	1	1	1	1		Farmer, students and staff	
	NP (23:23)	1	1	1	1	1	1	1	1	1	1	1	1		Farmer, students and staff	
Spraying	Fungicide	6	3	3	5	3	5	6	5	6	5	5	5		Farmer	
	Pesticide	3	1	1	2	1	2	3	3	3	3	3	3		Farmer, students and staff	
Weeding	Herbicide	1	1	1	1	1	1	1	1	1	1	1	1		Farmer	
Harvesting															Farmer Harvested	
Yields	Shangi	526	70	0	400	0	400	477	0	477	477	0	0	463.00	Farmer harvested. We did not get any yields from Maucho due to insecurity challenges	
	Jelly	300		0	175	0	175		450			450	0			
Total		826	70	0	575	0	575	477	450	477	477	450	0	463.00		

As indicated above, training for all the groups included;

- i. Land preparation;
- ii. Provision and transportation of seed fertilizer and crop protection agro chemicals;
- iii. Planting methods: making furrows and ridges, planting depth, fertilizer application, weeding, earthing up; and
- iv. Crop protection.



Reality on ground

Timing of certain operations such as planting, earthing up or hilling-up and crop protection differed from site to site. It depended on the motivation and commitment of the lead farmer and his group in following up with the field operations. The season was characterized by high rainfall and low temperatures resulting in high incidence of late blight infections. This was particularly evident with Jelly, which is an imported variety in the higher elevations of Molo and Likia. Extra spraying to control late blight was necessary. Farmer groups in Turi, Likia and Mauche did not apply extra sprays of fungicides. They ended up having infected crops which lowered yields.

Germination of Jelly potato seed was not as good as that of Shangi. It also had high incidence of upward curling of leaves caused by leaf roll virus. Continuous rainfall hindered harvesting of potato tubers in Njoro and Turi. Jelly took four months while Shangi took three months to mature.

NPK fertilizer at rate of 23:23:0 was applied to boost the foliar at the time of planting.

The approximate average cost of production per group was 22,575 KES only. This was, exclusive of approximately 18,000 to 23,000 KES support towards costs for each group. This depended on the distances from Egerton and number of visits.

How we did it

1: Site Selection and Land Preparation

On 20th October 2017 Egerton University organized an awareness meeting to sensitize group members on key considerations for site selection. Non-previous use of land production in the last two years was important for breaking the cycle of pests and diseases. In addition, that land should be about 0.125 of an acre, preferably of good soil fertility and also good drainage to avoid water logging.

Land preparation involved slashing to clear the thick bush. Tilling was done to break down the clods using hoes to desired tilth for favourable growth of potatoes and rows made at a spacing of 75cm. Tuber spacing was 20 to 25 cm. Farmers used their feet to approximate the distance.

Characteristics and observations of farmer group operations and outcomes

Green Vision Group (Elburgon)

Leader: Richard Mbaria,

The group was started in 2011 through the help of Ministry of Agriculture to aid in collective marketing of ware potato and also to take part in environmental conservation. Green Vision is composed of 16 members: eight men, four

women and four youths (2 male, 2 female). Initially, the group's main activity was growing seed through positive selection.

This is the process of improving quality of seed potatoes whereby potato growers practice their traditional way of selecting healthy plants with desirable traits. The seed potato is then stored and used for the next growing season.

The group was engaged in the activity from 2011 to 2016. It was therefore easy for them to embrace the production of clean seed when CARP+ project was initiated. They believed that this would increase their potato production compared to positive selection. Farmers and the students of Egerton University planted the seed potato on 27th of April 2018. The farmers reported that the yields from certified seeds were better than the ones obtained from positive selection.

Giteru (Turi)

Leader: Joseph Karangathi

This group is made up of internally displaced persons (IDP) who were displaced following the post-election violence of 2007. They were not very well organized. At planting, they had not prepared the land as required. Very few of them (eight group members) and young people (not farm owners) came for the training. Weeding was poorly done and harvesting delayed due to rains and lack of labour.

The crop was highly infected by late blight. Only 250kgs of Shangi was harvested and no Jelly was harvested due to late blight susceptibility and white fly attack. Only one lead member participated in the CARP+ meetings. None of the members attended the field day in Baraka Agricultural College. Potatoes harvested were sold at the Egerton University cafeteria.

Chomoza group

Leader: Pastor Terer

The group in Mauche planted late by almost one month due to lack of land. The group was not very well organized. The follow-up was affected by insecurity and we were not able to get feedback on the production and sale of the potato. Insecurity can cause a devastating blow on agriculture production.

Shangi crop was observed to be of average yields. The Jelly variety was devastated by late blight just three weeks before harvesting.

Kiahiti B (Likia)

Leader: Joseph Kinyanjui

Kiahiti B has 16 members. The group harvested eight bags (400kg) of 50kg Shangi seed, while Jelly produced about 3.5 bags (50kg seed) giving a total of 175kg. There were about 17kgs of damaged tubers due to harvesting. These were consumed in the homestead of Mr. Kinyanjui, the team leader. He said: "Lower yields are due to low temperatures and high rainfall experienced during the growing season, leading to high incidence of late blight."

The Jelly variety was much more susceptible to late blight attack and suffered severely despite having sprayed up to three times a week with fungicides. Mr Kinyanjui sold the 575kg of tubers at 2,000 KES per 50kg bag. He kept 25 kgs as seed for future planting. He made 23,000 KES (230 USD) from the total 11.5 bags (of 50 kg seed) for the 3.5 and four months maturing period for Shangi and Jelly varieties, respectively.

The cost of production was approximately KES 22,000/-, giving a net profit of approximately 1,000 KES.

Elite youth group (Egerton, Njoro)

Leader: Darwin

This is a group composed of eight (6 males, 2 females) BSc students of Egerton University. This group was registered in January 2017. Each member contributed KES 5,000/- , raising the necessary investment money of KES 40,000. They bought their own seed and CARP+ assisted the group with agro-chemical sprays.

They were actively engaged in participating in all of the crop production practices as well as storage and field days. They even exhibited their potato at the Global Business Round Table Annual Meeting at the Kenyatta International Conference Centre June 2018. They got business opportunity to supply ware potato to schools in Nairobi by the Nairobi Women Rep.

However, the timing was not right as they are still students; the volumes were large and requires time and resources for production, which was challenging. They harvested good yields of over 450kg per bag of 50 kg seed potato planted. They had storage challenges, especially when they harvested during the rainy season. About 78 kgs of their jelly variety was also stolen from the stores.

Kasambala Bidii (Gilgil)

Leader: Beatrice

This group farmed in the relatively warmer, drier and rocky area in Gilgil sub-location. They did not have high incidences of late blight. However, they had high incidences of white flies demanding them to spray up to four times. This was higher than the other groups.

This group was highly motivated. They invested in buying an extra 100kgs of Shangi certified seed from ADC Molo. They harvested over 450kgs from each 50kg bag of Shangi seed

potato planted, giving a multiplicative ratio of 1:8, almost similar to that harvested by Green Vision of Elburgon.

Observation: Due to the cold weather and high rainfall in 2018, high incidences of potato late blight were observed throughout Nakuru. Production is estimated to have fallen by over 30% from previous production levels (as observed in 2016 and 2017).

Lessons

1. The groups that partially invested in the production process (Elite and Kasambala Bidii) performed better than those that had not made any investment.
2. Groups led by farmers having experience in seed production performed well for example, Green Vision and Kiahiti B.
3. Late blight can be a devastating disease in high rainfall (>800 mm seasonal) and low temperature (<11°C). This enhance late blight incidence and lowering of the surface leaf area. It demands use of extra fungicides that leads to increased cost of production.
4. Most Small holder farmers lack sufficient funds to purchase extra fungicides. They need to prepare beforehand or get emergency loans for purchase of the fungicides for use during a disease or pest outbreak.
5. Growing potato varieties that are highly susceptible to early and late blight diseases such as Jelly, can lead to up to about 75 percent loss of the crop.
6. Diligent hard working and resourceful farmers (who invest their own money), are

likely to have better yields than those that are resource poor and lack energy to follow-up on disease management.

7. Insecurity due to political unrest weakens the farmer group structure and community structures leading to low participation, poor learning outcome and lower yield.

Challenges

1. Delayed payments for ware potato supplied to customers, for example; the Egerton University catering.
2. Post-harvest losses caused by poor storage for the potatoes. This forces the farmers to sell off their potatoes at low prices, especially during glut periods. Post-harvest losses also happens due to crude harvesting methods that destroy the harvest.
3. Poor implementation of government policies, for example, government delays in implementation of the standard 50kg bags leading to exploitation of the farmers.
4. Unreliable weather patterns, characterized by unpredictable rainfall and temperature changes.
5. Inconsistent/insufficient quality seed supply.
6. Lack of market for the produce leading to low prices for the potatoes and exploitation of the farmers by middlemen.
7. Lack of emergency funds to control pests and disease attack, especially late blight and pests like potato tuber moth, cutworms and aphids. This affect the potato yields.

Way Forward

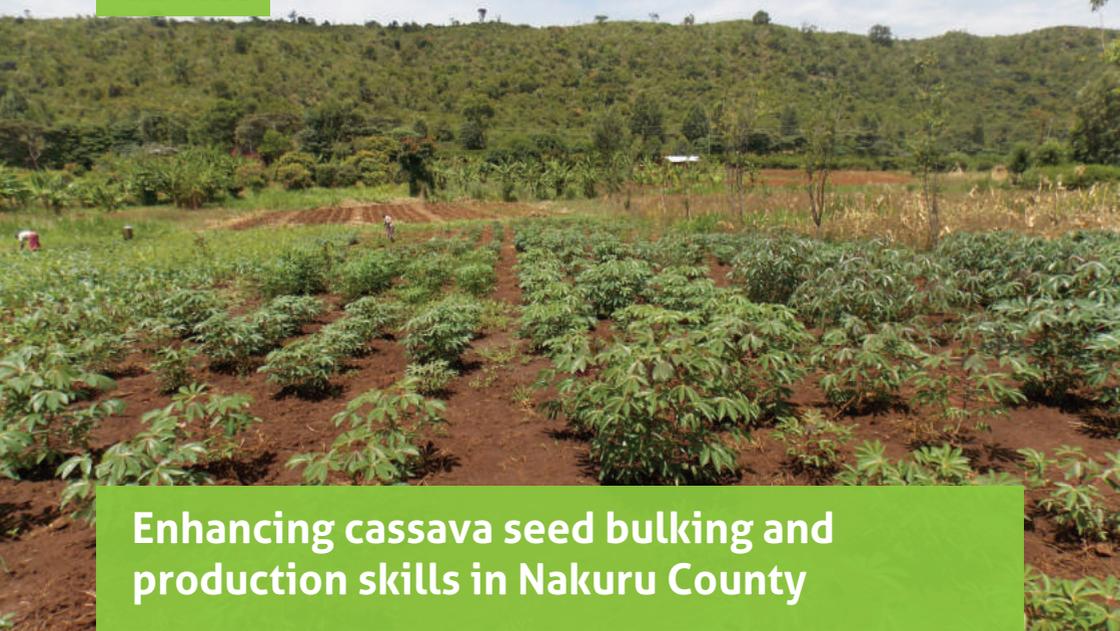
- Construct cold storage to enable farmers store their produce and wait for better prices.
- Adding value to potatoes to produce flour, crisps, etc., in order to circumvent the lack of markets at the end of rainy seasons, when every farmer harvests their tubers.
- Inculcate the discipline of keeping records. This will help in evaluations for enabling improvement.
- Mitigating risks of diseases and insecurity through planning, crop insurance, budgeting and provision of credit to support some climate variability challenges.



Students and farmers planting in a demonstration plot in Elburgon, Kenya

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Enhancing cassava seed bulking and production skills in Nakuru County

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Nakuru County has a robust ecological system for agriculture. The main food crops produced in the county include maize, beans, Irish potatoes and wheat. Climate change has affected the County's bimodal rainfall pattern making it difficult to predict the onset of the long and short rains. This has affected the farmer's timing of activities such as land preparation and planting, leading to a decline in agricultural productivity.

More specifically, climate change has highly affected the drier areas of Lare, lower Subukia and Solai, which are also resource poor and food insecure. This has increased the demand for drought tolerant crops in non-traditional growing regions.

Cassava is one such drought tolerant food security crop, mostly grown for subsistence and with limited commercialization in western,

eastern and coastal regions. In comparison, some West African countries such as Nigeria have large cassava industries.

The Problem

Previously, local institutions like Mtakatifu Clara Community Based Organization (CBO) with support from the World Bank had implemented a cassava project in Nakuru County. The CBO distributed cassava planting materials to the farmers. However, Nakuru farmers and CBO members were not well conversant with good agronomic practices for cassava. As a result, farmers planted without enough knowledge and skills. In addition, they did not know how to creatively use the crop apart from boiling the roots. Inexperienced farmers fear using cassava because of the poisonous nature of some varieties.



It is therefore a small number of farming families in Nakuru County who grow and consume the safe sweet varieties of cassava. Another major setback with cassava adoption in Nakuru is the long maturity period of the introduced varieties, which in some cases takes more than eighteen months to mature.

Cassava CARP+ Approach

The cassava value chain Community Action Research Project (CARP+) at Egerton University commenced in 2018. The project was funded by MasterCard Foundation through the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). CARP+ Project builds on previous cassava initiatives so as to promote cassava production and commercialization in Nakuru County. The partners include: County government of Nakuru, Mtakatifu Clara Community Based Organization, Rongo University in Migori and the East African Breweries. The goal of the cassava CARP+ is to improve food, nutrition and income security of smallholder farmers in the arid and semi-arid areas of Nakuru County through innovations in the cassava value chain.

The issue of disease tolerance was overlooked in the previous project. This community action research project bridges the gap by introducing disease tolerant and early maturing sweet

cassava planting materials for increased production. Smallholder farmers will be trained on seed bulking, production, value addition options and market linkage to East Africa Breweries will be created. The project will also support masters and PhD student's research projects.

Developing the Nakuru County Cassava Value Chain

The cassava CARP+ project targets the entire value chain starting from inputs, production and agro-processing. At local level, farmers will be trained on production, and domestic and cottage industry production of value-added products. Surplus cassava will be sold to East African Breweries Limited for beer-making. The project is also promoting agriculture among the youths by involving TVET students in the cassava value chain by providing training and value addition equipment to Baraka Agricultural College, a partner in the project. The equipment will include a cassava chipper and miller in order to make the process efficient and effective.

CARP+ Process

Establishment of Cassava Demonstration Sites

1. Community entry

From the onset, the CARP+ project sought to ensure community ownership and sustainability beyond the project cycle. The first step was to identify community leaders as an entry point to reach community members in areas where cassava was earlier supported. The project targeted local government administration staff, for example, chiefs and village elders. They played an important role of mobilizing interested farmers and stakeholders.

2. Baseline Survey

A participatory baseline survey was conducted in January and February 2018. The aim was to establish the farmers who were producing cassava and could be model farmers or cassava champions. Another aim was to establish gaps in the value chain so as to identify the most strategic entry points and find out how the project would engage for impact. The survey was purposive and focused on farmers that had been introduced to cassava production by Mtakatifu Clara CBO through the World Bank funded Kenya Agricultural Productivity and Agribusiness Project (KAPAP).

Interactive meetings with farmers and stakeholders in each site were held. During these meetings cassava baseline information was collected and potential bulking demonstration farms were identified. Through the participatory baseline activities, the project team identified varieties that the farmers had and the source of their planting material. Farmers also provided information on what they had learnt on cassava production in general and ways to use the crop.

3. Identification of demonstration farms

The baseline also helped to identify three most ideal demonstration sites in each location. A total of nine demo sites were selected. The demo sites have been planted with a collection of 27 sweet cassava varieties collected from various parts of the country for purposes of evaluation to select the most adaptable, early maturing and disease tolerant types for the various locations. Specifically, the varieties were sourced from Busia, Migori and Njoro (KALRO).

4. Enhancing farmers' production skills

Planting of the varieties took place in May 2018. Before planting, the target farmers were

practically shown how to plant cassava cuttings with regard to spacing, positioning of cuttings and fertilization. Farmers owned the project. They set demonstration plots in their farms and took care of the crop, monitored the growth of the cassava as well as maintained the records. Yields and other growth parameters will be recorded per variety so as to identify the varieties suitable for each of the three locations: Lare, Solai and Subukia. Based on their observations and data collected together with the project scientists, farmers are expected to give feedback and justify their choice of varieties selected to plant in their own farms.

5. Evaluating the best varieties

In its efforts to commercialize cassava and promote learning among farmers and stakeholders, the CARP+ project will carry out two major assessments of growth at six and 12 months. The aim is to identify early maturing cassava varieties that will be ready in 12 months. The six months assessment was conducted mid-February 2019. At 12 months, the varieties will be harvested, assessed and selected through a participatory process and mutually agreed criteria. The preferred varieties will then be bulked. The cassava cuttings will then be sold to farmers who will be supported to grow the crop on commercial basis. Support will be provided to the local agriculture extension staff, lead farmers and other local actors seeking drought tolerant crops with ready market.

6. Cassava marketing and processing

The primary market for cassava is local households to meet food security needs. For secondary markets, farmers will organize themselves into producer groups that will collectively market cassava to agro processors. The involvement of youth in value addition cottage industries will stimulate local demand

for cassava products and create jobs along the value chain. The involvement of East African Breweries as a large cassava buyer will create a ready market for cassava and increase farmers' income.

Sustainability

The project will promote farmer ownership by setting a commitment fee contribution within existing CBOs. This is to ensure the project is sustainable as farmers will be responsible for their seed-bulking costs. The seed cuttings will be sold to generate income for the seed producing households.

The cassava CARP+ project is building the capacity of farmers, Egerton University students, youth in two TVET institutions, local CBOs and other value chain actors. It aims to achieve the following results:

- Select at least three adaptable, fast maturing sweet cassava varieties through stakeholder participation.
- Develop one high value cassava-based food product.
- Develop one cassava-based animal feed product.
- Develop one cassava based industrial product.
- Develop at least three Cassava Brown Streak Disease (CBSD) tolerant advanced lines through a PhD study research project.

Challenges

The main challenge faced in terms of project timelines is that cassava takes long (12-14 months) to mature compared to fast maturing crops like potatoes that take three to four months. The first harvest of the early maturing varieties is expected in May 2019. This will be 15 months after project inception.

The project team recently learnt that there are no concluded studies on Cassava Brown Streak Disease (CBSD) molecular markers. As such, the project will adopt a different course of action to develop the CBSD tolerant lines envisaged in the PhD study.

Lessons

The project team learnt the following:

- Busia County has a good model on community managed cassava seed bulking
- The baseline was time consuming but it provided very useful information to the project team and helped create ownership among farmers.
- After the training on case study development, we plan to produce and share more case studies in this series. Be on the look out for these on our webpage.



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Developing the Nakuru County Potato Sector through Multi Stakeholder Collaboration

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Is food security a real problem in Kenya or is it just about shortage of one staple commodity - Maize? Whether real or imagined, the problem of food shortage is a national issue which has been a frequent talking point by the President of Kenya. It is one of the big four agenda of the current government alongside manufacturing, affordable health and housing. Food grain imports to meet the food deficit are now over 65 percent for wheat and rice, 20 to 30 percent for maize. Kenya has high potential to produce quality potatoes to address food security.

Growth of the potato sector in Kenya has been slow. This is attributed to lack of a conducive policy environment and effective regulations for actors along the potato value chain. The Kenya's National Potato Strategy 2016-2020 is general in nature and does not address county specific challenges.

In 2013, the Ministry of Agriculture services were devolved to county level necessitating development of policy instruments to guide local investment and implementation of interventions as well as give confidence to potato actors.

Constraints in production

Despite its many advantages, potato has a number of unique challenges that are associated with other vegetatively propagated crops (VPC) such as cassava, banana, arrow roots, and sweet potatoes. These include: perishability, bulkiness, high disease incidence, high cost of managing diseases and pests; and development of clean plant parts for propagation.

Nakuru has favourable weather conditions and fertile soils to produce potato. However, yield is still low at 9.7 t/ha compared to its potential of over 20 tonnes.

Some of the key causes of low productivity are:

- i. Recycling of seeds or use of poor quality seeds. Only 2.5 percent of the 600,000 small holder potato farmers in Kenya and Nakuru (29,000) in particular, have access to high quality (certified) seed. Certified seeds are clean for planting and of the varieties demanded by the market, that is, processors and restaurants. The issue of shortage and high cost of certified seed potato is yet to be fully addressed. This is largely because the Kenya Plant Health Inspectorate Services (KEPHIS) has certified only a few institutions. Majority of other seed producers sell clean seed or farmer selected seeds which sometimes have copyright issues.
- ii. Agro input suppliers lack storage capacity for the bulky seed potato that customers require for planting. Hence selling of potato seeds is left to farmers. Potato farmers have limited access to improved production technologies and little knowledge on how to improve productivity for example use of fertiliser, agro chemicals, soil testing and irrigation.
- iii. Lack of income. Farmers may not have adequate resources to do proper potato crop management such as moulding, spraying, weeding and crop rotation.
- iv. Potato storage and aggregation facilities. Farmers do not have proper storage that can extend the shelf life of the potatoes which forces them to sell at harvest time. Ware potato traders also lack storage facilities to increase potato shelf life so that markets like restaurants and processors can buy them in fresh condition. Construction and maintenance of cold storage facilities is costly.

Some facts about potato

In Kenya, potato produces more than five (10 t/ha) times per unit area over maize (1.7 t/ha) or wheat (2 t/ha), which are the main food grain crops in Kenya. Potato has one of the highest calorie levels per unit gram amongst the energy giving foods in the world. Nakuru is first in area under potato cultivation but second in total production after Nyandarua.

Other counties with high potato production are Uasin Gishu, Elgeyo Marakwet and Bomet. Potato matures in three to four months compared to maize (five to eight months) and wheat (four to six months), making it easier to cultivate in short seasons. It is a high value crop providing income to farmers and other value chain actors when consumed fresh or processed. Potatoes are easy to cook and process compared to other grains. This ensures a ready market demand in both rural and urban areas.

The County has three factories processing potatoes: Njoro Cannery, Sereni fries and Kenya Defence Forces factory. Twiga Foods is a social enterprise that sources potatoes and other crops from the County. These agro processors have created market opportunities for small scale potato producers.

- v. Inadequate potato processing factories. This has led to losses due to the perishable nature of potato tubers. Ready markets are therefore necessary for the producer to minimize wastage and guarantee higher income.
- vi. Preference of processors. Some processors prefer varieties that are not commonly produced by farmers, while some fast food restaurant chains import potatoes arguing that local producers do not meet required standards. The seed potatoes for these varieties are expensive to buy and are only available from select seed merchants.



Photo: An extended potato bag Cutter

Unstructured markets: Potato traders locally known as ‘brokers’ are middle-men. They work in cahoots with transporters to form market gatekeeper cartels. A farmer cannot sell his produce directly in the fresh produce market. These brokers buy by size and not weight at farm gate. The more potatoes they can pack in a bag, the cheaper it is for them. They pack potatoes in extended bags weighing more than 100 kg called cutter 1, cutter 2, cutter 3, which increases the volume and weight of the potato beyond the standard 90 kg bags. These extended bags damage tubers and leads to rotting.

Some progressive traders and processors now buy by weight which is more profitable for farmers. The policy to have potatoes sold in 50kg bags was stopped when traders went to court and got a court injunction, stopping its implementation. But they have lost the petition and the government has gazetted the Crops (Irish potatoes) Regulations 2019 that limits the packaging & marketing of Irish potatoes by weight, to a maximum of 50kg.

Intervention

In September 2017, Egerton University and partners launched the seed potato Community Action Research Project plus (CARP+). The Seed Potato CARP+ is a four-year project funded by MasterCard Foundation through the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). It aims to:

- Enhance access to high quality seed potato,
- Improve productivity and income of small-holder farmers in Nakuru County; and to
- Develop a multi-stakeholder platform in the County to develop a Nakuru Potato Strategy to help improve value chain governance and performance and address the constraints identified above.

The design of the CARP+ project was unique and innovative in that it included key policy making and regulatory institutions as strategic implementing partners. These included the National Potato Council of Kenya (NPCK), Nakuru County Government (Ministry of Agriculture), Agriculture Development Center (State seed

potato merchant), Baraka Agriculture College and Nakuru Small Holder Farmers Association (NASFA).

In January 2018, Egerton CARP+ project signed a Memorandum of Understanding (MOU) with NPCK whose mandate is to develop national and county strategies, policies and regulations and support potato farmers and their groups to access markets. The Council is also expected to develop policy briefs on emerging issues, lobby and advocate for inclusive policies and participate in reviewing training modules. It has an online platform where farmers can access information related to potato and seed potato production and markets. There is a well-connected group of farmers and other actors in the potato sector vital for networking. In May 2018, Egerton University signed a collaboration MOU with new County government of Nakuru to support agriculture development.

The potato strategy development process

Since 2018, CARP+ has collaborated with stakeholders to draft the Nakuru County potato strategy. The stakeholders include National Potato Council of Kenya (NPCK), Nakuru County Governments; SNV; farmer groups represented by NASFA, cooperatives and other interest groups and organizations. Development of the Nakuru County potato strategy was a participatory process. CARP+ has been instrumental in mobilising stakeholder forums to ensure its completion.

The policy making process began with a meeting between the County Executive Committee Member (CECM) for agriculture and the CARP+ project team led by the principal investigator. The meeting agreed to have the County director of agriculture prepare an initial draft. This was adopted as a first draft. A subsequent two-day



meeting chaired by NPCK chief executive officer was held in Naivasha to prepare the second draft. The national potato and Nyandarua County potato strategies were used as references to structure the Nakuru draft. Stakeholder groups were assigned sections which they developed for inclusion in the draft. Amendments were made to align the draft to the aspirations of stakeholders. Another workshop was held in Agriculture Training Centre (ATC), Nakuru to further improve the document to a third draft. This draft was further reviewed on 27th February 2019 at ATC, Nakuru.

Upholding Seed Potato Standards

From the beginning, the project engaged KEPHIS which is mandated to ensure that seed potato producers meet all requirement stated in the seed and varieties Act Cap 326 and plant protection Act Cap 324. KEPHIS inspected the seed potato production processes at ADC Molo, Baraka Agricultural College and Egerton University to ensure that standards were met. Egerton University and Baraka Agricultural College are undergoing the certification process as seed potato producers by KEPHIS. They have both successfully made the first bulking of seed potato.

The strategy identified the need to:

- Strengthen institutional, legal and regulatory framework.
- Establish and/or strengthen potato production platform that coordinates potato value chain development initiatives in Nakuru County (public-private sector linkages).
- Increase funding for seed and ware production, research, extension, storage, processing and marketing.
- Allocate adequate land for seed bulking and enhance seed potato multiplication by producer groups to make seed affordable.
- Improve infrastructure to lower transportation cost.
- Promote the construction of appropriate on-farm seed and ware potato storage facilities.
- Increase production by promoting good agricultural practises (GAP) e.g., fertilizer use, irrigation, planting high quality seed potato, effective management of diseases and pests etc.
- Develop market information systems for all key actors along the value chain.
- Promote formation of producer and marketing organizations to compete effectively in marketing.
- Enhance skills capacity of farmers and other actors.
- Improve and strengthen research-extension-client training linkages.
- Improve harvesting and post-harvest handling management.
- Promote potato value addition and improve marketing.

Building capacity of seed potato producer groups

In February 2019, CARP+ project staff and students were trained by NPCK on how to conduct organization capacity assessment of seed potato producer groups. The training included a field level assessment of the Kasambara Bidii producer group in Gilgil. It is expected that the team will assess the other producer groups and support them to develop capacity development plans.

Market system development

CARP+ project uses the value chain development approach. Hence several strategies were used to create market linkages for seed and ware potatoes. Seed farmers were linked to ware potato producers. The partnership with NPCK enabled farmers to learn about and access Twiga foods, while SNV Kenya created a link to Sereni Fries processors. Egerton University's catering department also bought ware potatoes from some of the seed producers.

Policy dialogue platforms

The CARP+ project team members participated in several policy dialogue platforms at local, national and regional levels. The project has supported various County level education and trade fairs to improve knowledge and skills of farmers and actors while creating business linkages. Below is a highlight of some of the events.



Local level platforms

Nakuru Potato Stakeholder Platform

On 24th June 2018, the Nakuru County, Chief Executive Committee Member (CECM) Ministry of Agriculture, Livestock and Fisheries convened a Nakuru potato stakeholder's forum at Egerton University. This was a round table forum at the end of the Farmer Education day on potato and irrigation cropping systems. The forum shared information, mapped out actors in County and what they were doing, identified gaps and priority issues in potato value chain and tasked the County to coordinate the stakeholders.

In October 2018, Nakuru potato stakeholders held a meeting to plan on joint potato demonstration sites to be established in eight sub-counties. Each of the sites would use the farmer field school methodology and activities would culminate in a farmer field day. In February 2019, the 17 partners: four seed merchants, three fertilizer companies, eight agrochemical companies, County government and Egerton University formed a private sector driven platform that committed to contribute to the demonstrations and field days. Seven committee members were nominated to guide the process. Egerton was asked to chair the team based on its experience in facilitating the Nakuru Irrigation platform.

Irish potato regulations policy forums

By working closely with NPCK and the County government, CARP+ partners have participated in the County public participation forums on the packaging of the national potato regulations, 2019. The regulations provide for: registration of potato producers (small and large), aggregators, traders and processors, food safety and

traceability standards, potatoes to be sold in bags of not more than 50kgs. The final public consultation meeting for Nakuru County took place on 27th February 2019 endorsed the regulations and appointed five delegates to the national forum.

The team consists of Nakuru Smallholders Farmers Association, a potato cooperative and three private sector players. After the national forum, the regulations were gazetted by the Cabinet Secretary for Agriculture and Irrigation in April 2019 and submitted to parliament for legislation. The Crops (Irish potato) Regulations 2019 were gazetted in June 2019.

Stakeholder's annual planning meeting

Nakuru County government convened an agriculture sector stakeholder meeting on 23rd January 2019 for members to share their annual plans to help create synergy and avoid duplication. During the meeting, SNV Kenya announced that it was launching a five-year climate smart agriculture project with a focus on potato value chain in the County.

National level platforms

The CARP+ project teams have participated in several national level events to promote the importance of potato as a food security crop.

National Food Security Task Force

The Vice Chancellor of Egerton University appointed Prof. A. Kibe, Principal Investigator of the seed potato CARP+ to the Presidential National Task Force on food security. Potato is a priority crop alongside maize and rice under the big four agenda on food security.

The team has sensitized value chain actors on the government's plan to promote and enhance potato production to meet the country's food security gap. The task force guided by County department of Agriculture held sensitization forums for farmers and stakeholders in Elburgon, Molo and Mau Narok and the Nakuru agricultural market.

Online Platforms

CARP+ project has generated various knowledge and policy products that have been disseminated on the Egerton website and the NPCK platform. In December 2018 CARP+ produced an article that was published in the Potato magazine by NPCK. The CARP+ project teams were trained by Hope Consult on case study development in February 2019. They produced six case studies that will be published on the online platforms. The cases will also be used as teaching and learning aids. It is expected that additional cases will be produced in future.

Regional level platforms

The CARP+ project has pushed the potato agenda beyond the Kenyan borders through partnerships and participation in various forums for example: RUFORUM Bi-Annual Conference 2018: The CARP+ project team participated in the 2018 Ruforum Bi-annual conference held in Nairobi in October 2018. The conference theme was "Aligning African Universities to Accelerate Attainment of Africa's Agenda 2063". The CARP+ students presented 11 posters and five extended abstracts from the baseline survey, field days and potato fairs, seed potato activities with farmers and students' research activities.

Regional Seed Systems Forum: Through the CARP+ project, Egerton University has developed partnership with the International

Potato Center (CIP). The Centre recognizes the University's contribution to policy reform and innovation in the seed potato value chain. On 11th and 12th February 2019, CIP invited Egerton to a stakeholder forum which brought together regional (Kenya, Tanzania, Malawi, Mozambique, Zimbabwe & USA) stakeholders. They deliberated on "Opportunities for shaping the future of seed systems for vegetatively propagated crops: Policy, regulation and gender considerations."

Results

Policy making is a complex process that takes time. Fortunately for the CARP+ seed potato project, through partnerships we realized some early results over the last 16 months.

- As at the time of developing the CARP+ potato project in 2017, potato was not one of the priority crops in Nakuru County. The engagement of key County staff in the research and development of the proposal, generated evidence that the sector had great potential to increase farmer incomes and food security. Today, potato is one of the five priority value chains of the County alongside pyrethrum, dairy, fish and avocado.
- In addition to the six seed potato demo plots that the project has supported, the County government has supported additional demo plots.



- The County included construction of two potato storage facilities in its 2018/19 budget.
- Egerton University gave NPCK a sub-grant to facilitate participatory development of the Nakuru County Potato draft strategy. This has been subjected to three stakeholder drafting and review processes and a validation workshop and is now being finalized. The draft potato strategy and investments in the potato value chain have given new investors confidence to invest in the sector. In late 2018, SNV (Netherlands Development Organization) made a strategic decision to support the potato value chain through its new five-year climate smart agriculture program.
- The public participation review process of the potato packaging draft regulations allowed for the public to interrogate the draft and give inputs. This has paved way for draft regulations on producing, packaging, trading and processing of potatoes now awaiting legislation by parliament. These public discussions have inspired the need to develop a similar policy for sweet potato.
- Market development process has started and some farmers have sold potatoes by kilograms to Twiga foods, Sereni Fries and the KDF factory. These companies have contracted some farmers in 2019.
- Participation in county, national and regional platforms created awareness on the potential of the potato value chain and enhanced knowledge and skills of farmer and students.
- CARP+ project created synergy with the irrigation platform to hold events quarterly platform meetings and events.
- Egerton University is developing partnerships and proposals to set up commercial seed and ware potato production units in its Agro Science Park to scale up CARP+ project work.
- CARP+ project team through partnership with the irrigation platform now have a strong network of financial service providers that can be leveraged to support the potato value chain.

Challenges

The CARP+ project team faced few challenges in the policy forum agenda.

- AgriProFocus Kenya had been identified as a strategic partner through its online platform that would have enabled the project team to reach and influence more farmers to consider potato farming as a business. However, the available budget was not sufficient for the AgriProFocus team to travel to Nakuru. Hence the project team contracted NPCK to provide the national platform which they did effectively. AgriProFocus Kenya have raised funds to host a youth forum in the County in May 2019.
- The development of strategy and policies is a time-consuming process. Balancing the time demand of external processes with regular faculty work is difficult.

Lessons

The lessons shared in this section are useful for community action research projects that plan to engage in policy dialogue, institutional reforms and seed value chain development.

- By tapping on partner expertise, CARP+ has developed a draft strategy in eight months, participated in more events than targeted and set up additional potato demo sites.
- By creating synergy between the CARP+ and irrigation acceleration platform project, CARP+ held platform meetings and events to reach more farmers and stakeholders.
- With good coordination, one project can be used to complement another. Using the irrigation platform funds, a demo plot (20x20 meters) was set up and was used by 4th year students to grow potato apical rooted cuttings for their final year project.
- The Nakuru Potato strategy draft is a good reference document that sub-national stakeholders can use to develop their own.
- The seed potato value chain development experience at Egerton is useful for research teams interested in developing seed systems for vegetatively propagated crops in Africa.

What remains to be done?

- The Nakuru County Potato Strategy draft needs to be finalized and adopted. It will be translated into action and proposals enforced through the establishment of county level systems and structures.
- The National Assembly legislation of potato regulations needs to be fast tracked through lobbying to ensure it is passed.
- Potato market system development that includes; construction of cold storage facilities, processing industries and formal farming contracts, will encourage higher production. This will also reduce exploitation of farmers and post-harvest losses. Linking farmers to markets outside the county will spur growth in the sector, creating employment at various stages along the value chain. This will eliminate brokers and increase incomes at producer level. Increased incomes of ware potatoes will empower farmers to buy quality seed.
- There is need to explore ways to certify more seed merchants and especially small holder seed potato farmers to increase access of quality seeds in rural areas. Egerton and its stakeholders will continue engaging KEPHIS and other stakeholders on this process
- Quarterly stakeholder platforms and other fora will be used to enhance synergy among value chain actors to promote increased potato production for improved food security and income.

- In partnership with the County and other stakeholders, CARP+ project plans to scale out training through the demo sites using farmer field school approach and support more farmers to be seed merchants.
- CARP+ project team will use its networks to partner with financial institutions to improve seed potato enterprises' access to financial services. From July 2019, the national and County government will launch a potato insurance scheme where the state will pay 40% of the premium and the farmer 60%. CARP+ project will collaborate with this initiative.



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Agri enterprise opportunities in potato value chain: A case of CMS Agropriees, Egerton University

Redempter Mbula Mutinda and John Atsu Agbolosoo

Graduates in Kenya move from one office to another and send several job applications after graduation. This was not different for Gad Sambrumo who graduated from Jomo Kenyatta University of Science and Technology (JKUAT) while Redempter from Jaramogi Oginga Odinga University of Science and Technology (JOOUST). Having both graduated with Bachelor of Science degrees in Agribusiness Management in 2016, they had expectations that they would be absorbed in the job market. This did not happen.

There is a disparity between the number of graduates from Kenya's higher learning institutions and those being absorbed in the job market. Institutions are producing graduates who are not ready for the job market in terms of skills. To reduce the unemployment gap, Egerton University in collaboration with Regional Universities Forum for capacity building in agriculture (RUFORUM), introduced a Masters in Agri Enterprise Development. The course

emphasizes on experiential learning and equips the graduates with entrepreneurial skills. The course has four main components; coursework, farm visits, agri enterprise businesses and research.

As part of the requirement for the award of the degree, Chima, Mbula and Sambrumo (CMS) Agropriees was formed by three students; John Chima, Redempter Mbula, and Gad Sambrumo. The enterprise processes potato crisps, trains farmers on value addition opportunities and provides direct market to the potato farmers as well as linking them with other buyers.

During Seed Potato Community Action Research Project Plus (CARP+) baseline survey in Nakuru, the students interacted directly with potato farmers. CARP+ is a project at Egerton University funded by MasterCard Foundation through RUFORUM. One of its objectives is to enhance students agribusiness skills.

The baseline report identified challenges in the potato value chain namely; shortage of clean seed potato, market access, price fluctuations, inadequate production skills and storage facilities. Under market access, farmers lamented how glut seasons affect potato prices. They sell as low as 800 KES for a 110kg bag, mainly to intermediaries. Farmers do not sort and grade their potatoes after harvesting, which leads to high losses. The baseline survey was an eye opener for CMS to create an enterprise that would address the market access problem for farmers in Elburgon and Njoro.

Process

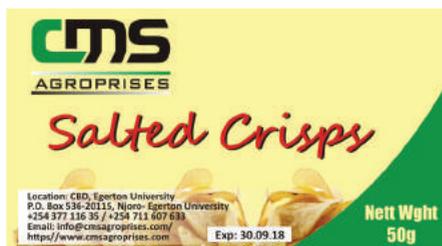
Through Transforming African Agriculture Universities to meaningfully contribute to Africa's Growth (TAGDev) program, the owners of CMS Agroprises were trained on core business subjects including entrepreneurship skills, business plan writing, financial and marketing management. The team prepared a potato value addition business plan to produce potato crisps. The plan was presented and defended before a panel of experts.

The group received a loan of 400,000 KES at 5% interest rate and payback period of one year to start and manage the enterprise. Part of the loan was used to purchase an electric fryer, drying mats, potato slicers, hire business premise, chairs, cooking cutlery, printing of fliers and labels, raw potatoes, oil and spices. The partners also underwent a medical test to be certified as food handlers.

The business was launched on 15 June 2018 at Egerton University Central Business District (CBD). Crisps samples were given to potential customers who liked the unique taste. They said that the crisps were different from those stocked in supermarkets and other outlets. The customers, who are mainly students, preferred the smaller packets that were being retailed for 20 KES. The positive feedback gave CMS the motivation to engage in the agri enterprise.



The production takes place in Department of Food Science, Egerton University. CMS Agroprises produces three times in a week, an average of 73kg per production. Processing include peeling, washing, slicing, spicing, frying, cooling, packaging, labeling and storing. We use either knives or a potato peeler to peel the potatoes. After peeling, the potatoes are washed thrice to ensure they are clean. They are then sliced into crisps size using a small slicer that is available in supermarkets.



We blanch the sliced potatoes using warm water to fix its colour then add lemon, ginger, garlic and salt. To make them crispy, we then put them directly into hot cooking oil. When ready they are cooled, packaged, weighed, labeled and sealed. We use airtight polythene bags of different sizes to package 30g, 50g and 100g packets. For sealing, we use an electric sealer that can seal two packets at a time. We have a shop outlet provided by the university where we sell the products to the students.

CARP+ intervention in marketing and potato stakeholders' linkage

The CARP+ helped us to gain more agribusiness skills and linkages by exposing us to interact with different potato value actors in Kenya. The actors include ADC-Molo, MOALF, NPCK, ECLOF, Agri Wallet, CIP, Syngenta and AgriCo East Africa among others. The key events where we marketed our products included the following; Potato Field Day at Egerton University, South Rift Potato Fair at Baraka agricultural College, Sixth RUFORUM Biennial Conference at Kenyatta International Conference Center (KICC) and Agritech Talks and Exhibitions, Nakuru.

The Egerton potato field day was the first display and selling of potato products to many stakeholders. We got feedback from customers and experts in potato value chain. International Potato Centre (CIP) representative gave insights on how to select potatoes to improve crisps quality. CMS Agroprises also got links with farmers willing to produce Unica and Markies variety specific to processing. CMS Agroprises offered training services to Tumaini Women Group (11 members), which is located in Njokerio. We trained them the importance as well as how to sort and grade since buyers require different sizes. We also made them to understand different varieties are for different

uses. Farmers should not be fixed only to Shangi, which is a table variety. The business owners networked with Agricultural Technology and Development Centre (ATDC) for crisps and potato flour processing machines. Apart from networking and exchanging ideas with different people, we would sell our products.

Results

CMS Agroprises process an average of 220kgs of potatoes weekly. They package crisps in 30g, 50g, and 100g packets selling at 20, 30 and 50 KES respectively. This earns the business an average net profit of 16, 000 KES every week amounting to 64,000 KES per month. Through this business, CMS Agroprises provide direct market to the farmers who supply the potatoes. The enterprise also provides casual employment to two youths in the university. The employment enables the casuals to pay fees and upkeep.

In 2018, CMS Agroprises exhibited in different conferences, trade fairs and field days including Potato field day at Egerton University, Agricultural show of Kenya, Nakuru, South Rift potato fair at Baraka Agricultural College, 6th RUFORUM Biennial conference at KICC, Nairobi and Agritech Talks and Exhibitions, Nakuru. Through the exposure, the young entrepreneurs from CMS were networked with different stakeholders from different parts of Africa. The exhibitions were also an avenue for selling the crisps, interact with like minded youth who were interested in potato value addition as a business opportunity

After six months of operation, we introduced new marketing outlets in the "Central Business District" of Egerton University and Njokerio trading center. To date, we have been able to repay 120,000 KES which is 50% of the loan obtained. Currently, we have physical assets worth 100,000 KES and some cash at the bank.

Analysis

Selling one kilogram of raw potatoes earns the farmers on average 15-40 KES depending on supply and demand. One kilogram of potatoes can produce crisps that can earn marginal income of 70 KES. This justifies why potato value addition can significantly increase farmers' income.

Challenges

Despite all the successes, CMS Agroprises business journey has not been smooth. Some of the challenges include;

- Crisping varieties such as Unica, Markies and Dutch Robijn are not available in the market. Although some farmers have shown interest in growing the varieties, the adoption rate is very low.
- Potato price fluctuation affects production cost for instance in November, 2018, potato price increased from 2,000 to 7,000 KES per 110kg bag. In addition, shortage of potatoes during off-season period has been a major setback. During December 2018, CMS only got small sized potatoes from farmers that were not suitable for processing. The CMS partners planted potatoes (Markies variety) on a quarter acre under irrigation to test performance. They also wanted to learn the agronomic practice of producing quality potatoes as well as to understand the cost of production.
- Balancing academic activities and business priorities was difficult but CMS partners all passed their course work successfully.
- John Agbolosoo will return to Ghana on completion of his course in June 2019.

Therefore, the enterprise owners are considering various options to ensure business continuity and sustainability. The other two partners have offered to buy out his shares. The other option is to sell the business as a going concern to interested investors. They are in the process of evaluating the business value to assess the best way forward.

Lessons

- There are many agri enterprise opportunities in potato value chain from input and agri enterprise provision, production, transporting, processing and marketing. Unfortunately, most agripreneurs tend to ignore such opportunities. They focus on production aspects of the value chain forgetting other aspects.
- It is possible to start and manage an enterprise.
- One needs to be equipped with financial and marketing skills before entering into any business ventures. Business faces risk, entrepreneurs need to have mitigation measures, for example, insurance policies.
- There should be written contracts between the enterprise and farmers to ensure continuous supply of potatoes, CMS Agroprises has not been able to get Kenya Bureau of standards (KEBS) certificate. This limited us from selling outside the university. The business was still in its early growth stage but we have applied to get the products certified.

Recommendations

The Agri enterprise model has been useful in transforming the business mindset of CMS partners. Other institutions of higher learning in Africa should adopt the model. This is because the model enables students to have an entrepreneurial mindset.

Apart from the project's enterprise, students are able to set up other personal businesses and expanding them. This is a solution to the unemployment crisis among graduates. The students are also recommending that the coursework should be reduced from three to two semesters so that the students can balance course work, business and research.

More youth should invest in the potato value chain to harness the untapped opportunities. This will reduce the high unemployment rate in Kenya. They can purchase inputs and resell to potato farmers, train them about basic production and marketing skills or add value to potatoes.

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- ❖ Integrity
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Quality Seed Potato: Making it available to small holder farmers

Dr. Mariam Mwangi and John Ng'ang'a

Planting quality seed material is the answer to improving productivity of potato crop in Kenya. Quality seed potato is material for planting that is free of pests and diseases, it is of good size and well sprouted to give uniform germination. One of the major challenges among the potato growing small holder farmers in Kenya is lack of adequate quality seed potato for planting. Where available, farmers are unable to access it due to transport challenges because they order in small quantities.

Community Action Research Project plus (CARP+) is project funded by Mastercard Foundation through Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and hosted by Egerton university, Nakuru. The project started in July 2017 and will run for four years up to 2021. The project aims to enhance availability and accessibility to high quality seed potato and improve income of smallholder farmers in Nakuru County. The project is being implemented in partnership with the NPCK, BACTVET, ADC-Molo and NASFA.

Before the intervention

The project team conducted a baseline survey in Nakuru County in November 2017. The project targeted four potato growing sub counties in Nakuru namely Molo, Kuresoi North, Gilgil and Njoro. The purpose was to establish the status of seed potato production within the county and identify small scale seed potato producers and potential producers, especially those already in groups. As the team interacted with the farmer groups, they discovered the following:

- Many farmers grow potato for consumption and not for seed. Even though potato is a common staple food crop in Kenya, second only to maize, productivity is only 8t/ha against a potential of 20 t/ha. The low productivity is attributed to lack of quality seed potato.

- Smallholder farmers in the surveyed sub counties sourced seed potato by saving the small sized tubers which were the left over after sale and consumption. Although the formal system of seed potato started in 1958, more than 96.3 percent of seed potato used in Kenya is farmer saved seed while both clean and positively selected seed contribute 2.6 percent and certified seed contribute 1.1 percent only.
- Smallholder farmers grow potato continuously in the same field leading to low yields.. Smallholder farmers rely heavily on their own saved “seeds” which they have recycled for many years. These seeds have carried over a lot of diseases and pests and their yield potential has degenerated. As a result, they get very low yields and subsequently get meagre income which cannot sustain them.

No more begging for seed potato

Wanjiku a farmer in Elburgon ward, Molo sub-county of Nakuru owns about 0.5 acres of land. The main crops she grows to sustain her family are potatoes, maize, beans and vegetables. During the planting season, Wanjiku prepared the land hoping to get quality seed from Mbaaria, a fellow farmer trained on positive selection of seed potato. However, she was often disappointed to find he did not have enough seed to sell to her.

Wanjiku belongs to the Green Vision Self-help group. It was through this group that she was introduced into the Community Action Research Project (CARP+). She was very happy to hear about this project because she would get quality seed potato to plant. Through the intervention of the project team members she was enlightened on the growing of seed potato, positive seed selection and storing of quality seeds for planting. There are several other smallholder farmers who are hoping to get enough seed potato.

- Most of the farmers would like to grow good quality seed potato but it is not easily available and it when it is available it is very expensive. Only about 4 percent of farmers have received training on seed storage and diffused light stores nationally, while more than 60 percent do not renew their seed regularly. In addition, certified seed potato is sold at minimum 2500 KES per 50kg bag which is the minimum packaging. A farmer would require approximately 40,000 KES to acquire seed for planting one acre. This is in addition to other costs of production such as ploughing, management, chemicals and fertilizers, transportation, harvesting and storage. These production costs are way above what smallholder farmers can afford.

Most of the farmers would love to use high quality seed potato to improve their yields but it is not only expensive but difficult to access. Farmers from Nakuru County willing to pay premium for quality seed travel an average of 124 km to source for certified seed from ADC or the other few existing multipliers; spending a minimum of 5 cents per kilogram of certified seed on transport charges.

The aim of CARP+ is to enhance accessibility by building the capacity of smallholder farmers to multiply their own quality seed in farmer groups or cooperatives. They can then distribute to members and sell excess supplies to other farmers thus making extra money.

Five farmer groups were selected from the baseline survey namely Greenvision Selfhelp Group (Elburgon), Giteru Potato Growers (Turi), Chomoza Cooperative (Mauche), Kasambara Bidii Selfhelp Group (Gilgil) and Kiahiti B Selfhelp Group (Likia).

Baraka Agricultural College:

Committed to setting aside 20 acres for seed potato project where seed bulking, demonstration plots and training are conducted. This is a good opportunity for staff and students from both BAC and EU to participate actively through experiential learning.

Nakuru Smallholder Farmers Association:

Uses its farmer's network to help farmers access quality seed and marketing opportunities. They have so far mobilized farmers to take part in Good Agricultural Practices (GAPs) training and attend quarterly meetings and undertake various project activities. The association has provided seed multiplication fields through its members.



Inspecting the established seed potato demos at Egerton University

National Potato Council of Kenya:

To support farmer groups access markets, develop a Nakuru County potato strategy and lobby for inclusive policies in the seed potato value chain.

Agricultural Development Corporation (Molo complex):

To supply certified seeds to farmers and institutions that are involved (Baraka Agricultural College and Egerton University). The Corporation is also offering technical assistance in training and seed potato production. Students attached to the CARP+ project were offered attachment and internship opportunities at ADC Molo and NPCK.

An established sweet potato demonstration plot at Egerton university



Intervention

Through the initiative of various partners in the project, interventions were done at three levels. Baraka Agricultural College (BAC) and Egerton University (EU) were tasked with multiplication of seed potato of different status (Breeders, prebasic, Basic, Certified 1 and 2). At Egerton University, high status seed was to be multiplied under tissue culture and rapid multiplication on aeroponics and hydroponics. The mini-tubers and lower status seed (basic and C1) from these systems would be made available to Baraka Agricultural College (BAC) and to organized farmer groups ready to invest in seed potato production for further multiplication and bulking. Smallholder farmers would then access the certified and clean material from EU, BAC and farmer groups either as members of those particular groups or as individual farmers.

The Agricultural Development Corporation together with the International Potato Centre (CIP) were to provide breeders material and germplasm for further cleaning. In addition, the two institutions would offer technical support in tissue culture, rapid multiplication and apical rooted cuttings technology.

The CARP+ was also mandated to train farmers in seed potato production and building their capacity in developing seed potato multiplication enterprises. The farmers would then produce their own seed in organized groups and make the materials available to other potato farmers in their localities and beyond.

The following interventions were carried out at Baraka, Egerton and at farmers' level;

1. Baraka Agricultural College, Molo

The project facilitated the college to establish three acres of land for seed potato. This was made possible by giving them USD 6,400 to buy basic seed and inputs needed for establishment. The money also enabled them to construct a diffuse light seed potato storage facility that can handle up to 50 tonnes of seed potato at a time. This means that they can plant up to six acres of land at any given time without storage hassles. This continues to be a big boost for students and farmers training. The college planted the first crop of seed potato in November 2017.

The startup was accelerated by ADC Molo who are partners in the project and who provided basic seed for multiplication at Baraka. In the first season, BAC planted 49.5 bags of basic seed potato (50kg) per bag. Even though there was a dry spell between December 2017 and March 2018, the production was good considering the prevailing conditions. In nutshell they managed to get 210 bags of certified seed potato (10.5 tonnes) of 50kg from the 3-acre plot. This means they got about 70 bags per acre (3.5 tonnes) of certified (C1) seed potato. This was a high yield considering the dry spell. Baraka Agricultural College and Egerton university students and staff learnt a lot through this initiative because of the practical attachment and training. During each production cycle, KEPHIS were involved in inspection of the crop and in certification of the seed potato.

2. Egerton University, Njoro

At Egerton University, CARP+ project focused on establishing a rapid multiplication unit for seed potato through tissue culture, aeroponics and hydroponics system. This was to create a high status seed potato that BAC and farmer groups can access for further multiplication for certification.

Egerton university also established demonstration plots at five farmer locations for the purpose of training farmers, students and staff on seed potato good agricultural practices. At Likia, Mauche, Elburgon, Turi and Kasambara, farmers offered small sections of their farm measuring about 25mx15m where demos were established. The partners involved during demos establishment were ADC Molo, MOA, NASFA and Egerton university.

The CARP+ project provided inputs such as seed, fertilizers and chemicals. The farmer group in each site got about 100kg of certified seed potato (C1) which they established in a clean field (without a current history potato production). CARP+ conducted a series of trainings on these demo sites focused on land preparation, planting, fertilization, pests and disease management, dehauling and post-harvest handling.

3. Farmer group organization

Kiahiti B Self Help Group, Likia The group was given a 50kg bag of certified seed potato (C1) which was sourced from ADC Molo through the CARP+ project. They planted the seed potato in April 2018 season. From the 50kg bag, they harvested eight bags of 50kgs. They planted the seed sized potato tuber in a quarter acre in November 2018. Despite the prevailing dry spell in the season, they were expecting about 20 bags, 50 kg of seed sized potato in March 2019. The group has sold 15 bags of 50 kg clean seed potato to farmers who knew about the project. They sold the bags for between 2000 and KES2500 and have enough quantities to plant on their farms.

Results

Since the project started in July 2017:

- Three out of the five farmer groups have successfully grown and managed to harvest quality seed potato for planting. Each of the farmer group were given two 50 kg bags of Shangi and Jelly varieties of seed potato.
- Trainings were conducted where over 140 farmers in the five farmer groups gained skills in identifying and managing pests, diseases and weeds.
- The farmers learnt to embrace the practice of Dehauling (removal of vegetative growth after flowering of potato crop) to restrict the size of tuber to seed size, and crop rotation in the production of seed potato. They were also trained on the different grade sizes of seed potato. The large sized potatoes were not to be used as seed as they take a smaller land area increasing cost of production. The tuber smaller than the size of an egg were considered as chats which are not suitable for propagation.
- Kiahiti B self-help group in Njoro got eight bags of 50kg seed potato from one bag of 50kg.
- Baraka Agricultural Colleges site has managed to bulk seed potato variety Shangi twice, with three acres of Basic seed planted in season I (Nov–Feb 2018) and later five (5) acres of Certified 1 seed in season II (June–Sept 2018). This basic seed was bought from ADC Molo. They have been certified by KEPHIS.

Baraka students (150) and staff were actively involved in potato multiplication where they learnt a lot of skills. They have had two farmer field days where they have exposed up to 500 farmers. Through the project, the college established a store where they store their seed before sale.

- Egerton University planted tissue cultured apical root cuttings from Stokman Rozen. They planted 2,000 cuttings of UNICA, Sherekea and Shangi variety for multiplication, which is at pre-basic level. Egerton university organized an open day at Egerton in June 2018 where more than 300 farmers were exposed to different potato varieties and the apical rooted cuttings in the field.

Challenges

The team encountered challenges such as;

- Access to initial certified material since there was a high demand and low supply which delayed planting.
- Acquisition of certified seed was expensive and the project had to buy for the farmers the initial planting material.
- Accessibility to some of the demo sites during the rainy season.
- Procurement procedures through government institutions delayed purchase of agro inputs and in some cases, chemicals were not availed on time. Due to this, preventive measures for diseases and pests were not possible. Two farmer groups (Turi and Mauche) lost about 80 percent of the crop to late blight disease. Requirement for suppliers to deliver goods before payment was difficult as most are

not willing to take the risk of having to wait so long to get paid.

- Lack of team work and participation from team members due to lack of motivation. The members were concurrently teaching and running other administrative duties.
- Coordinating farmers, partners, faculty and students was difficult due to the different schedules of each in their respective organizations.
- Certification of seed potato by KEPHIS at farmers level was complicated and was not practical. The farmers have small parcels of land below three-acres on which they have been growing uncertified potato for years. Certification of this size of farms especially with potato history is not allowed by KEPHIS.
- Lack of proper storage structures after harvesting of the seed potato. Farmers were forced to plant in the short rainy season of November 2018. Due to this, they experienced the dry spell and, like in the case of Kasambara Bidii Self Help group, lost their entire second season crop to drought. Lessons
- Workable procurement regulations for inputs for research projects of this nature are necessary for government/academic institutions.
- It is important to know the whole list of materials to be supplied by the contractors. They should always be clearly listed in the quotations before signing the contract.
- Coordination of staff, students and farmers: it's impossible for one person to coordinate all activities and team members should

take active roles in managing farmer groups in their specialties.

- The TVET partner (BAC) was able to run its activities more efficiently due to few procedures in the decision-making process and a more practical approach they took to involve their own students in the management of the farm activities.
- Farmer group needs assessment should be done to inform what the needs of the groups are so as to focus future trainings on only identified areas.
- Farmer groups where members made their contribution in terms of investing in the enterprise performed better than those who were provided with agro inputs. There is a sense of ownership and motivation observed where farmers invested in their own resources in the project.
- Flexibility in procurement procedures for projects dealing with field crops/fresh produce to allow timely interventions.
- There should be motivation and allowance in the schedule of university calendar where the researcher is allowed time to undertake research and outreach activities away from classwork and administrative duties.
- The certification for seed potato by KEPHIS should be tailor-made to suit the smallholder farmer group organizations.
- Farmer groups should be supported to establish cost effective structures so they can store their produce for better handling and marketing.

Recommendations

- Farmer groups should organize to book seed potato well in advance from seed companies due to shortage. This can also help them transport the seed in bulk together and reduce the cost of transportation.
- Funding from County government should be available to improve infrastructure such as roads to access the farms.

Planting of demonstration sites with farmers of Likia group



The Story of Joseph Kinyanjui

Joseph Kinyanjui is a potato farmer from Likia in Mau-Narok. He has depended on potato farming as source of food and income since 1995. He is a father of eight children. He was experiencing losses in potato production because he was depending on traditional farming methods without considering spacing, use of clean seed, right amount and type of fertilizers. He was using farmer saved seeds which were of poor quality. He did not have knowledge on good farming practices and record keeping. His production level was 40 bags per acre and he was earning a gross income of KES 59,500 per acre. However, he is not quite sure of the figure due to lack of proper record keeping.

He is the chairperson of Kahiati B Self Help Group. He has undergone several trainings on potato production. He produces and sells seed potato, though he does not have access to high value certified seeds material for multiplication. He recycles seed potato on the same piece of land due to lack of adequate land. Despite the poor returns, he continued to produce for subsistence. Often, Kinyanjui would apply less or no fertilizer and chemicals to control pest and diseases hoping to earn more money. All these did not bear fruits for him as the soil fertility level declined with each planting.

He looked for someone to provide solutions to his problems. Kinyanjui joined the CARP+ project through the County government of Nakuru in September 2017. He did not hesitate to take up the idea of the Egerton-based project because he trusted the County government staff. He

offered a demonstration plot to CARP+ Project. Kinyanjui received training on good agricultural practices to produce seed potatoes from the demonstration site. Seed potato CARP+ project trained farmers in Kinyanjui's home in Likia location Mau-Narok Ward. This training was conducted cording along different potato growth stages. The crop took three and a half months to mature.

"I was happy when Egerton University seed potato CARP+ project approached me in 2017, to provide a 25mx15m demonstration plot for teaching me and other farmers in my village how to produce clean seed potato", says Kinyanjui. A group of 15 farmers were trained for a period of three and a half months. "After the trainings, I implemented what I had learnt. This has increased my income, and I am able to meet the needs of my family. I can also buy farm inputs for my potatoes without depending on the government subsidized fertilizer, which delays most farmers", says Kinyanjui. He went ahead and planted his own seed potatoes in one-acre land with a total cost of production of KES 114,300. Egerton University provided 80% of the cost of production to him. He earned a gross income of KES 196,000 per acre which was 71% increase from his earlier earnings. In addition, the farmer is adopting new farming techniques. He is planting potatoes using quality seed and good agricultural practices.

More information

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Enhancing Research Skills and Experiential Learning: A Case Study of Egerton University Staff and Students

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Research is a systematic way of filling existing knowledge gaps and finding solutions to society's problems. It is a key mandate of universities because it helps to build practical research skills of students, especially at the postgraduate level. Traditionally, university students and faculty have relied heavily on published literature to establish knowledge gaps and formulate interventions, expecting to implement their research recommendations within communities.

Consequently, there are often mismatches between what communities need and what research endeavours to provide as solutions. This model of research practice has created a "project syndrome" scenario in communities, where people become dependent on handouts from researchers, and are always waiting for the next project to engage.

A paradigm shift is needed where by communities are involved in research undertakings right from the conceptualization stage through to planning, implementation and evaluation. With this shift, communities will be involved in problem identification and investigation of interventions. They can then decide on viable solutions and the final implementation through a participatory learning process. Such inclusive processes enable community members to learn together with students and faculty, document lessons, jointly collect data, analyse it and interpret results, hence creating ownership of the research process and results.

Involving communities as active partners in practical research processes and tracking results accruing from the research process Nkurumwa A., Mulwa R. (Faculty) Cheruiyot J., Amwine L. (MSc. Students) Bundi D. (PhD Student) A Case Study of Egerton University Staff and Students is

the idea envisaged in the concept of Community Action Research. The concept seeks to involve community members in participatory knowledge development through a structured research process and the implementation of attendant solutions to the researched problems.

Further, the concept seeks to involve students and faculty in the research process through experiential learning, which is a “learning by doing” model. It enables learners to both apply theory into practice, as well as reflect on practice to inform theory.

About Community Action Research Project Plus

In early 2017, the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) proposed the adoption of Community Action Research Project Plus (CARP+) model for implementing projects in Africa, as a component of the Transforming African Agricultural Universities to meaningfully contribute to Africa’s Growth and Development (TAGDev) program.

The program is funded by the MasterCard Foundation through a partnership with RUFORUM. The CARP+ project development and selection was done through a competitive call for proposals for pilot projects at Egerton University, Kenya and Gulu University based in Uganda.

The CARP+ projects, were expected to enhance research skills and experiential learning among students and faculty in collaboration with technical, and vocational education and training (TVET) institutions and other actors using a market driven approach. Two CARP+ projects were awarded to Egerton University targeting the seed potato value chain and cassava value chains in Nakuru County.



The Problem

There is a lot of research going on in universities, most of it involving conventional approaches. Research gaps are identified mostly from the available literature, without community involvement. Community members simply serve as subjects in the research process. Students and faculty formulate hypotheses and go on to collect and analyse data and then make recommendations. As a result, most of the recommendations lack impact as they do not effectively address societal problems.

This is why problems persist in our society while research reports continue to accumulate and gather dust on our shelves. Furthermore, students and faculty often lack sufficient exposure to ‘hands-on’ practical research experience.

This is mainly due to the tendency by faculty to use theoretical approaches in teaching because they lack adequate resources to expose their students to action research. The students struggle in carrying out their research work while the faculty lack sufficient practical skills and confidence to effectively guide students. This results in ‘half-baked’ graduates who lack adequate practical skills and competency.

The CARP+ model emphasizes on stakeholder participation through an action research approach that enables all stakeholders to learn through experiential learning. Implementation of the two CARP+ projects at Egerton University therefore involves high stakeholder participation. Farmers (beneficiaries), academic institutions (students and faculty), state agricultural extension staff, input suppliers, market off-takers, processors and other development partners are involved in participatory problem and solution identification, implementation of the solutions and evaluation of results. Using the community action research approach, the cassava and seed potato CARP+ projects at Egerton University conducted baseline surveys at their inception. The students and faculty worked closely with farmers and other partners to identify and prioritize problems and interventions. The cassava CARP+ project used the participatory approach to collect cassava varieties from key growing areas and brought them for experimentation in Nakuru County.

The cassava seed trials will evaluate and select adaptable, fast maturing varieties (12 months) and those suitable for farmers' consumption (food security) and those with potential for up scaling into value addition businesses. Nine demonstration plots were identified and established in three sub-counties namely; Solai, Subukia and Njoro. These plots were established jointly with farmers in selected farms. The farmers provided labour and the partners supported with training and cassava cuttings. Farmers were responsible for taking and recording data for analysis during the implementation. They learnt with the students and staff and together they made collective decisions. The Seed Potato CARP+ team identified availability of quality seed as the weakest link in the potato value chain.

The multi-stakeholder project team led by Egerton University consists of the Nakuru Small holder Farmers Association (NASFA), the National Potato Council of Kenya, Agricultural development Corporation (ADC) Molo, the State Department of Agriculture and Baraka Agricultural College. The team identified five farmer groups in different locations, and supported them to establish demonstration farms for seed potato multiplication. The groups provided land and labour. They were supported with inputs like fertilizers, certified seed potato and agro-chemicals. Practical trainings were conducted on farms with students, farmers and faculty. All participants learnt as farmers and students collected and recorded data for analysis during implementation.

"Not our problem"

Jane is an MSc student at Egerton University. She completed her coursework and successfully defended her research proposal. Jane and her supervisor were happy that she could go ahead with data collection as scheduled. On arrival at her study area in Molo sub- County in Nakuru, she found the farmers ready to participate in the research.

However, she encountered challenges in administering the data collection tools as most of the community members could not relate with her stated problem and therefore could not participate effectively. She struggled through the data collection exercise and somehow managed to complete it. Following the poor reaction by the community members, Jane was discouraged and considered changing her study area.

However, she realized that a lot of time had already been lost and that this option wouldn't work. Just like Jane, many postgraduate students find themselves in this same dilemma. Some get stranded and frustrated leading to abandonment of their research.

Their need, their solution

Fortunately, this was not the case for Lamech, another Masters student at Egerton University. He had been involved in the seed potato value chain Community Action Research Project (CARP+), where he gained research and community engagement skills, through experiential learning. When he went to collect data for his research, the community members embraced his study since they had been involved in a baseline survey that identified the problem he was addressing. Lamech sailed smoothly through his data collection, and was optimistic that the findings of his study would help solve some of the community's problems.

CARP+ projects may be the way to go in building practical research skills of postgraduate students. By using the community action research approach, more students like Lamech will be able to complete their research studies with ease and produce results that are relevant to solving practical community problems.



Challenges

There are a number of challenges facing the CARP+ projects. The students and faculty in the project are also engaged in their normal activities of teaching and learning at the University, which leads to competing demand for their time. Sometimes they are unable to participate in project activities. In addition, action research and experiential learning are more demanding on the researchers' time since they have to personally participate in most of the project activities.

Results

- Through involvement in the CARP+ projects, the students have gained knowledge and skills in the development of data collection tools, administering questionnaires and conducting interviews, data collection, data analysis, report writing, and dissemination of research results.
- They have also developed skills and confidence in engaging with communities in a participatory way. The students from science and business backgrounds have come to appreciate the social science research methods of engaging with communities through changed perceptions and paradigm shift.
- Through CARP+ projects, faculty have also come to appreciate the importance of involving farmers as research partners and not consumers of research products. They have sharpened their community engagement skills. Their capacity has been enhanced to conduct innovative research in both laboratory and social research as well as cope with unexpected field happenings that call for flexibility.

- Faculty capacity to supervise students' research effectively has also been enriched. Students and faculty have changed their perceptions towards research processes; moving from expert opinions givers to co-creators of knowledge by embracing farmer guided perspectives.
- Five of the six potato farmer groups after training and facilitation grew high quality seed potato, some of which they stored as seed and the rest bulked and sold to neighbours. In the second season, they expanded the acreage and plan further expansion in the 2019, long rain season.

The CARP+ activities being implemented among the communities are going on well because of good support and participation of the community members who feel part and parcel of the project. For example, cassava farmers greatly appreciated increased availability of more cassava varieties (germplasm). Farmers used to grow only one variety known as 'michericheri' but were introduced to 27 cassava varieties to select from the best, depending on their suitability.

Lessons

The CARP+ projects have achieved success in enhancing research skills. This is because CARP+ emphasizes on participatory action research approach involving farmers as partners in the research process. There is ownership for the projects among the beneficiaries.

In addition, since the projects will take four-years, the activities will happen over a long period, which provides many opportunities for students and staff to learn experientially. Another success factor is sufficient funding from the MasterCard Foundation. This means that project activities are not hampered due to financial constraints. Other stakeholders have joined or showed interest to

be part of the project consortia, which will lead to scaling up of student and farmer participation, as well as the impact realized.

Faculty Perspective

Dr. Mariam Mwangi is a faculty staff from the Crops, Horticulture and Soils Department at Egerton University. Her engagement in the Seed Potato (SPVC) CARP+ project started when she was involved, as a team member, in writing a grant proposal to RUFORUM. The proposal writing involved literature review, consultation meetings and writing sessions. She took part in this process, as it was essential criteria for her promotion at the university and to gain new skills. The news that the project proposal was selected and funded for four years (2017-21) brought great joy. It was a result of hard work, team effort and an answer to prayers.

The SPVC CARP+ learning journey began with a training for team members at the RUFORUM head office in Kampala, Uganda in October 2017. She was enlightened by the outcome of the community action research project as a life changing experience for communities. It uses participatory approaches to identify needs and interventions to solve their problems and bring meaning to research. The training motivated and changed her attitude on doing community action research.

The entry point to the community was through the baseline survey. It was interesting to work with colleagues from the Department of Applied Community Development Studies and

the Department of Agricultural Education and Extension and to support the students to pre-test the questionnaire. The rehearsal exercise before interviewing the farmers was interesting and useful practice. Some of the things she learnt were that when conducting an interview or administering a questionnaire in the farmer's house, one should prepare the setting and ensure a relaxed mood for the farmer to answer the questions as it is sometimes lengthy and time consuming.

Her research skills on developing and pretesting questionnaires were improved and led her to be more inquisitive to analyse the findings and interpret the data. This was answered through a data analysis workshop that was held by the project. In this workshop, she gained skills in coding, data entry, cleaning and analysis using SPSS and STATA soft wares.

Dr. Mwangi's has a background in pure sciences. However, through the SPVC CARP+ project, she now incorporates social

science and action research approaches. She learnt new techniques in proposal writing as certain topics were different from the scientific writing of proposals, for example, analytical framework, conceptual framework, sustainability and others. It was exciting to guide and supervise students from the Applied Community Development Studies and Agricultural Economics and Agribusiness Management departments, which broadened her knowledge base. She further attended a case study development workshop that sharpened her writing-for-development skills.

She has been able to document experiences and lessons learned from SPVC CARP+ stakeholders. Before the end of the project she is looking forward to see smallholder farmers moving from being subsistence farming to agripreneurs with improved livelihoods. Dr. Mwangi, says a big thank you to her team members, RUFORUM and MasterCard Foundation for the unique opportunity to work in the SPVC CARP+ project.

Recommendations

- There should be early planning and communication of project activities to all project partners and staff to enable them to organize their schedules and manage their time well. The combining of different research approaches (social and scientific) has not been easy for some of the researchers.
- The community action research and experiential learning approach should be scaled up beyond the two projects to other faculties, projects and institutions to enhance student and faculty research skills. This will lead to better research results, greater community impact and sustainability.

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Design and Layout:

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Photographs per story were supplied by the authors.



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