

Research Application Summary

Challenges and opportunities of seed potato production in south Western Uganda

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Abstract

The potato crop has the potential to greatly contribute to the income and food security of Ugandans, but the yields have remained low at 7.5 t ha⁻¹. The low yields have been attributed to the use of poor quality seed potato recycled from previous harvests or bought from the ware potato market. This study was, therefore, undertaken to establish the challenges and opportunities of seed potato production in South Western Uganda. Data were collected from 160 respondents in Kabale and Kanungu districts using both focus group discussions and 11 key informant interviews. This was later analyzed using content analysis. The findings indicated that a limited supply of quality seed potato, insufficient land, limited supply of good quality inputs, weather vagaries, pests and diseases, and poor storage were key challenges limiting seed potato production. Overall, limited access to quality seed potatoes remains a key issue and it stems from the limited supply of seed potato produced by KAZARDI and the high cost of good quality seeds. It is for these reasons that the majority of farmers still use their farmer saved seed and seed from the ware market, whose quality is not guaranteed. It was, however, found out that several opportunities exist for the production of seed potato. These include; technologies for producing quality seed potatoes, NGOs' support of seed production, expansion of infrastructure at KAZARDI, upcoming bylaws, and ready demand for seed potato and ware potato. It is thus recommended that increasing production capacity at KAZARDI along with strengthening farmer institutional capacity through the formation of farmer groups and training them in community seed production, plus good farming practices together with favorable seed policy and bylaws would promote production and supply of quality seed potato. This in turn would enhance farmer income and food security status.

Keywords: Production constraints, seed potato, seed system, *Solanum tuberosum*, Uganda

Résumé

La culture de la pomme de terre a le potentiel de contribuer grandement au revenu et à la sécurité alimentaire des Ougandais, mais les rendements sont restés faibles à 7,5 tonnes par hectare. Les faibles rendements ont été attribués à l'utilisation de pommes de terre de semence de mauvaise qualité recyclées à partir de récoltes précédentes ou achetées sur le marché des pommes de terre de consommation. Cette étude a donc été entreprise pour établir les défis et les opportunités de la production de pommes de terre de semence dans le sud-ouest de l'Ouganda. Les données ont été recueillies auprès de 160 personnes interrogées dans les districts de Kabale et de Kanungu à l'aide

de discussions de groupe et de 11 entretiens avec des informateurs clés. Cela a ensuite été analysé à l'aide d'une analyse de contenu. Les résultats ont indiqué qu'un approvisionnement limité en pommes de terre de semence de qualité, des terres insuffisantes, un approvisionnement limité en intrants de bonne qualité, les aléas climatiques, les ravageurs et les maladies, et un mauvais stockage étaient les principaux défis limitant la production de pommes de terre de semence. Dans l'ensemble, l'accès limité aux pommes de terre de semence de qualité reste un problème clé et découle de l'offre limitée de pommes de terre de semence produites par KAZARDI et du coût élevé des semences de bonne qualité. C'est pour ces raisons que la majorité des agriculteurs utilisent encore leurs semences de garde paysanne et les semences du marché de marchandises, dont la qualité n'est pas garantie. Il a cependant été découvert qu'il existe plusieurs opportunités pour la production de pommes de terre de semence. Ceux-ci incluent; technologies pour produire des pommes de terre de semence de qualité, le soutien des ONG à la production de semences, l'expansion de l'infrastructure à KAZARDI, les règlements à venir et la demande immédiate de pommes de terre de semence et de consommation. Il est donc recommandé que l'augmentation de la capacité de production à KAZARDI ainsi que le renforcement de la capacité institutionnelle des agriculteurs par la formation de groupes d'agriculteurs et leur formation à la production de semences communautaires, ainsi que de bonnes pratiques agricoles ainsi qu'une politique et des règlements semenciers favorables favoriseraient la production et l'approvisionnement en pommes de terre de semence de qualité. Cela améliorerait à son tour le revenu des agriculteurs et la sécurité alimentaire.

Mots clés : Contraintes de production, pomme de terre de semence, système semencier, *Solanum tuberosum*, Ouganda

Introduction

Potato (*Solanum tuberosum* L.) has been identified globally as a crop of high economic importance, because of its potential to serve as both a food and cash crop (FAO, 2014; IPC, 2014). In terms of global annual production, over 300 million tonnes are produced from 19 million hectares (Muthoni *et al.*, 2011). It is further estimated that over a billion people feed on potatoes worldwide (Haverkort and Struik, 2015).

Africa lags behind Europe and Asia in potato production, but of late there is an increase in production by African countries (FAOSTAT, 2013). In Uganda, potato is among the priority crop in the Development Sector Investment Plan and Agricultural Sector Strategic Plan 2015-2019 (MAAIF, 2015; van Campenhout *et al.*, 2017) but its production and productivity is still low at 7.2 MT/ha compared to the potential 22 MT/ha (FAO, 2014). This low production is attributed to, among others, the use of poor quality seeds (IPC, 2011; Byarugaba *et al.*, 2013) and existing inefficient seed system plus weak regulatory and policy framework (Janssens, 2012).

With the increasing population and the growth in food chains, the demand for the potato in Uganda is likely to increase threefold (Bonabana *et al.*, 2013). This calls for an increase in seed potato supply which currently remains low and meets only 13% of the total demand for seed (KAZARDI, 2014). According to Mbowa and Mwesigwa (2015), three key producers manage seed potato production in Uganda. These include KAZARDI, which is responsible for producing various varieties of seed potatoes, but due to institutional and financial challenges, it only meets 2% of the demand. It is, for this reason, that majority of the farmers (over 90%) have continued to use recycled seed potato from their gardens or buy from conventional market. Such recycled seeds

often result in poor quality seed potato and low-yield seed potatoes (Kinyua *et al.*, 2011). Seed multipliers, who are farmers guided by Non-Governmental Organisations (NGOs) to produce seed potato at the community level are also key actors in Uganda. There have been efforts nationally and internationally to increase seed potato production in Uganda, such as the development of seed potato production technologies like seed plot, tissue culture, and positive seed selection, training farmers in seed potato production and good farming practices, building screen houses and stores by NGOs. Even then, the supply and distribution of good quality seed potato remain one of the central limitations in supply of potato seed to farmers in the country. This study was conducted to establish constraints limiting farmers' seed potato production capacity, as well as identifying potential opportunities existing within the seed system that need to be utilized to promote quality seed potato production and distribution.

Materials and Methods

A qualitative case study was conducted in Kabale and Kanungu districts in South-Western Uganda focusing on in-depth understanding (Yin, 2014) of constraints and opportunities to seed potato production. The two districts were selected based on their potato production capacity since South Western Uganda supplies over 80% of the potato in the country. Specifically, Kabale was selected because it is where the national research station (KAZARDI) for breeding seed potato varieties is found. Purposive sampling was used to select two sub-counties from the two districts, considering the highest and lowest producing sub-counties based on production capacity. In Kabale, Muko and Bukinda sub-counties were selected while in Kanungu, Rutenga and Kanyantorogo sub Counties were selected. From the highest producing sub-counties, two villages were selected and one village was selected from the lowest producing sub-county. The participants for Focus Group Discussions (FGD) and Key informants' interviews were selected through systematic random sampling in the chosen villages, while FGDs were conducted with all the key actors in the seed potato system. These included: ware farmers, seed potato producers, seed potato multipliers, traders, input dealers, and processors to give their insights and knowledge on what they regard as key constraints to seed potato production. In addition, key informants from the District Local Government, the Sub County, Farmer organization, and Key institutions like Kachwekano Zonal Agricultural Research and Development Institute (KAZARDI), Uganda National Seed Potato Producer Association (UNSPPA), International Fertilizer Development Centre (IFDC), and AFRICAN 2000 Network were also consulted to provide in-depth information on the main subject, as well as verification of farmers' views from FGDs. Institutions were selected purposely depending on their engagement in seed potato production and the support given to the general potato subsector at large.

Overall, Eight FGDs were conducted; of which six were selected by sex while two FGDs were of mixed gender, and each was attended by 10 members. In total 80 members were from Kabale and 80 from Kanungu. In addition, 11 key informants were interviewed and these came from farmer group leaders, District local government officials, KAZARDI, UNSPPA, support institutions like IFDC and African 2000Net work. Additional data were obtained through secondary data from Kachwekano Zonal Agricultural Research and Development Institute (KAZARDI), PASIC documents, and MAAIF to supplement the primary data.

Raw data were analyzed using the thematic analysis guided by the study objective from which similar patterns were drawn and explained. This helped to generate useful information on key bottlenecks and opportunities to seed potato production.

Results and Discussion

Constraints to seed potato production. The study established key constraints to seed potato production in Kabale and Kanungu Districts in South Western Uganda. This was necessary if any improvement is to be done. The major constraints to seed potato production included; insufficient land, fake agro-inputs, insufficient seeds, expensive good quality seeds, pests, and diseases, as well as weather vagaries as highlighted in Table 1.

The land problem as a constraint to seed potato production relates to having insufficient land, limited virgin land, and land being too expensive. In Kabale, this was the main problem that farmers faced in producing seed potatoes. The problem of scarcity of land for seed potato production is attributed to the high population density in the area, and also the need to use fresh and disease-free land for seed potato production. This condition requires that the used land is left for at least 2 years to fallow, but with an average of about 0.5 hectares, the fallowing may not be possible. This makes farmers use the land without rest resulting in the accumulation of soil-borne diseases that greatly reduce seed potato yields. Limited access to quality seed potato was also cited as a key constraint to seed potato production, especially in Kanungu District. This constraint originates from the fact that the National Research Station cannot produce enough seed potato for the farmers, as it can only supply about 2% of the total demand for seeds (Mbowa and Mwesigye, 2014). In support of this, the Director of Kachwekano Zonal Agricultural Research and Development Institute (KAZARDI) was stated:

‘We produce seed potato because there are no private seed producers that have expressed interest to produce seed. We lack infrastructures and have both institutional and financial challenges that limit us to produce enough seed potatoes’ (KII Kabale, 2017).

The above suggests that due to the scarcity of good quality seeds from KAZARDI and the high prices, farmers have no option but to resort to the use of their saved seeds. Aheisibwe *et al.* (2015) reported that over 90% of the farmers in South Western Uganda use low-quality seed potato recycled from the previous season or bought from the ware potato market. Recycled seed potato from the previous seasons have been negatively cited to be associated with poor quality and diseases (Gilmarcher, 2014), and so affect potato yields and farmer income (IPC, 2014).

Table 1. Constraints to seed potato production in South western Uganda

Challenges Limiting production of seed potato	Rank of challenges per district	
	Kabale	Kanungu
Insufficient land	1	4
Limited supply of quality seed potato	3	2
Fake inputs and limited supply of quality seed potato	2	3
Pest and diseases	4	5
Natural vagaries	6	1
Poor storage	5	5
Limited capital	5	6

Source: Kabale and Kanungu Focus Group Discussion with the farmers (2017)

The study findings also revealed that farmers had limited supply of quality inputs. Averagely about 80% of all the focus group responses indicated that access to quality inputs like fertilizers, pesticides, and good seeds was a key challenge.

Participants alluded that pests and diseases, soil infertility, and land exhaustion are among the central problems in seed potato production. As such, there is a great need to use quality inputs like fertilizers and pesticides to deal with issues of diseases and fertility loss so as to increase both production and productivity. On the whole, the majority of the participants in the FGD and KII alluded that input dealers sold fake, expired, and mismatched inputs:

“Input dealers are untrusted, they sell us fake inputs that do not work yet they sell them expensively” (Female seed multiplier FGD, Kanungu, 2017).

“Some input dealers mismatch inputs because they do not know what they sell but just look at profit. For example, when you ask for fertilizers for potato, they give you for pumpkin and because we also do not know the specific types of fertilizers and their use, we end up using whatever they give us, and sometimes their inputs have damaged our potatoes.....”(Nkwasiabwe (pseudo name) FGD, Kabale 2017).

In line with the above, high disease incidents, particularly potato bacterial wilt, was found to be a major challenge. This confirms Lemega *et al.* (1999) reported that potato bacterial wilt is the second most important yield-reducing biotic factor in Kabale after late blight and caused up to 26% yield losses. This finding is also in agreement with Turfa (2009) and Gildemarcher (2014) who reported that pests and diseases were the most common and important potato yield-reducing factor Uganda, Kenya, and Tanzania. The increase in disease and pest incidents is attributed to overusing the soil without fallowing, leading to the accumulation of some soil-borne diseases. Also weather changes have led to the accumulation of pests some of which have become resistant to pesticides that exist on the market.

Kanungu ranked weather vagaries as the number one challenge in the production of seed potatoes. Participants argued that they have seen great changes in weather conditions in the last six years and these have greatly affected their production. A key informant revealed that:

“In 2013, I planted 40 bags of seed and harvested 10 bags. It was a total loss.” The rains destroyed all the plants in the gardens and I have never seen a bad season like that. Between September – January, the bag of Rwangume seed potato costs 70000 UGX, a price that is too low and so I am hesitant to go and harvest”

This implies that poor weather conditions in form of drought or too much rain not only affect the quality of seed potato planted but also the seed supply in the market. This results in fluctuations in seed potato prices, making it too expensive, thereby limiting farmer access to quality seed potato. This in turn leads to low yields in ware potato production. Furthermore, poor storage was also highlighted as a challenge in producing seed potatoes. This largely affects the quality of harvested seed potatoes. Key informants' interviews conducted in the two districts showed that only about 40 % of those engaged in seed potato production had stores, of which some of the stores were group-owned. This is consistent with what Aheisabwe *et al.* (2014) found where about 52% of the farmers in South Western highlands of Uganda stored seed potato in conventional stores together with other produce. Such practice is attributed to limited knowledge in post-harvest handling of seed potato which affects the yield of ware potatoes (CIP, 2011). During the discussions, farmers made several suggestions on how the above seed potato production challenges could be minimized.

These included training in the use of inputs and good farming practices, expanding the capacity of KAZARDI to produce good seed potato and training more framers in seed potato production, Government giving out idle land for seed production, soil testing, building farmer institutional capacity, and building storage and road infrastructure.

Expanding capacity at KAZARDI. It was indicated that the use of poor quality seed potato by farmers was largely attributed to the shortage of clean seed potato from KAZARDI. Hence the farmers suggested that the Government should help KARZADI to expand its capacity to produce enough seed potato of different varieties required in the market by the farmers. The KAZARDI Director confirmed that the Government had already built for them another screen house and they expected seed production to increase to some extent, but still it can not fully close up the seed potato supply gap. Hence there is the need to train more seed producers and multipliers, as well as encouraging the private sector to participate in potato seed production.

Training on the use of inputs and monitoring and inspecting input dealers. Participants in the FGDs emphasized the need to increase training on the use of pesticides, herbicides, and fertilizers by NGOs, like African 2000Net work, IFDC, and continuous monitoring of input dealers to make sure that they sell quality inputs. Mugisha (pseudo name) also re-echoed the need for the District to inspect and close all input dealers' shops that are not formally registered if they are to deal with the problem of fake inputs. One key informant from Kabale District Administration said:

'We know we are supposed to regularly monitor and register input dealers but because of limited facilitation, we have not been doing it well. We have however been trained by IFDC and the Ministry and advised to register all input dealers and those in seed production, something that will change the situation and we are now prepared to do it.'

Increasing land under seed potato and increasing intensification. As a way of dealing with land challenges, six participants out of the 10 in the six FGD held indicated that there was a need for the Government to give out its idle land for seed potato production, like the one in Kisoro. They also recommended that research be conducted to identify suitable crops that can be grown during the fallow period, without affecting seed production for the next season. Further, it was proposed that NGOs should help strengthen farmers' institutional capacity. This would help farmers expand assets and capital base that they could use jointly to buy group land for seed production.

Pests and disease management. Key informants emphasized the need for farmers to use fresh land to reduce disease intensity while the participants in the FGDS voiced out that there is a need for the Government to carry out soil testing to identify diseases affecting their soils. Farmers should also be trained on good farming practices that reduce the occurrence and spread of diseases on their lands.

Provision of Extension Services. To remedy weather vagaries that lead to changes in supply and prices of both ware and seed potatoes, respondents suggested that extension workers need to inform them of the right time for planting. This should be supplemented by guidance from the Ministry of Disaster Preparedness. A respondent in the Kanyantorogo FGD added that:

'I recall that long ago, extension workers used to announce the starting date for planting, which was 25th of January every year and this used to help us. Nowadays we lack such communication and no wonder we have failed to time our planting season and have landed into more problems.'

Additionally, for the dry spell, they suggested that NGOs together with the Government should provide water tanks and boreholes. They asserted that if they continued using wetlands, it might

even result in worse climatic conditions which would affect their agricultural productivity and incomes.

Opportunities in Seed Production. Despite the challenges, it was found out that there existed opportunities for seed potato production in South Western Uganda which need to be tapped into to increase seed potato production. These were categorized under four themes namely; market or business-oriented opportunities, policy opportunities, institutional capacity, linkage oriented opportunities, and climatic or geographic related opportunities (Table 2). Most of the opportunities related to the market since many participants confirmed that there was a ready market for seed potato both internal and external. This is attributed to the increasing population that demands more food production (Bonanabana *et al.*, 2013) One of the key informants emphasized the market opportunity by saying that:

“The return rate for seed is high. It is 1:7 under normal conditions. Also where a seed producer sells 1 bag of seed potatoes, the ware producer has to sell like 3 bags of ware potatoes to get the money of one bag of seed potato and so the market is not an issue. The issue is that there is low supply amidst high demand”

Institutional linkage also offered opportunities for expanding seed potato production in Kabale and Kanungu Districts. A good number of respondents in the two Districts agreed that NGOs like IFDC, IRR, ISSD, UNSPA, and NAADS have facilitated seed potato production in their areas by giving farmers free inputs like seed and fertilizers, trained them and built stores and screen houses. They, however, noted that some of these NGOs have closed up their operations in Kanungu and others operate from Kabale that has better infrastructural facilities and services, something that can explain the variation in seed production between Kabale and Kanungu.

Other seed potato production opportunities were found to relate to geographical factors. Almost all the key informants noted that three sub countries that are high producers of seed potato in the Kanungu district were Rutenga, Kinaba, and Mpuga. These sub countries are found on high altitudes, with relatively acidic soils and low temperatures hence making them suitable for potato production while low producing sub countries like Kanyantorogo and Ngenga that lie in the western Rift valley and in low altitude, the climatic conditions do not favor potato production but cereals like rice and maize. It was however noted that despite the variations in production capacities due to geographical and climatic conditions difference, at least all areas in Kanungu and Kabale can grow potato to some extent which presents a great opportunity for seed potato production in the two areas.

An in-depth interview with the KAZARDI Director indicated that there were also opportunities related to increasing seed potato production and distribution. He mentioned that the Government has already given them a greenhouse to expand production capacity but also the NGOs have come on board to build screen houses within communities, something that would increase seed potato distribution and supply. Also, the research station had developed many seed potato varieties to meet different farmer needs, however, farmers indicated that some of the varieties were not suitable for their needs and did not meet market needs for example there were only a few varieties suitable for processing. However, the development of seed potato production technologies like seed plot technology and aeroponics technology offered an opportunity for increased seed production since these technologies achieve up to 3 times higher land productivity than under conventional ware production systems (Kinyua *et al.*, 2011).

Table 2. Opportunities for seed potato production in south western Uganda

Opportunity type	Description
Business / market oriented opportunities	<ul style="list-style-type: none"> • There are many districts venturing into potato seed production like Zombo and are looking at South Western Uganda as the source of supply of quality seeds • The increasing population and growth of food chains. • Higher profit from seed potato than ware potatoes as the return rate is 1:7 • The demand for potato in Rwanda and DR Congo presents an opportunity for external trade
Policy opportunities	<ul style="list-style-type: none"> • The seed policy that provides an enabling environment for seed production and increased farmer access and use of quality seeds • The upcoming potato by-law by IITA and MAAIF
Institutional capacity and linkages among system actors	<ul style="list-style-type: none"> • Many NGOs coming up to support seed and ware potato production • Farmer organizational development and empowerment • Presence of supportive institutions for advocacy and monitoring the seed sector • Increasing farmer knowledge and access to inputs through support organizations and private organization • Presence of KAZARDI (Research Institute) • Increasing partnership between NGOs and Government bodies like NAADS in the distribution of seed
Geographical related opportunities	<ul style="list-style-type: none"> • Presence of high altitude • Presence of at least two cropping seasons • Presence of adequate arable land • Conducive acidic soils in some areas like Kinaba and Mpungu sub counties in Kanungu District
Opportunities related to increased production, distribution and supply of quality seed	<ul style="list-style-type: none"> • Development of many seed potato varieties by KAZARDI • Development of tissue culture technology, seed plot and other seed production technologies • Training of community based seed producers and multipliers

Conclusion

Limited supply of quality seed potato from KAZARDI together with high transaction costs, limited land, inadequate supply of quality inputs, weather vagaries, and pests and diseases are the key constraints limiting production of quality seed potato in South Western Uganda. Despite the challenges, the study found out that there exist some opportunities for seed production. These include, among others; seed production technologies like seed plot and positive selection, high demand for both seed and ware potato within and outside Uganda, and presence of supporting institutions like UNSPPA and KAZARDI. Such opportunities need to be optimized and scaled up to deal with the problem of both limited supplies of seed potato and poor quality seed potato. Overall, there is a need to strengthen production capacity at KAZARDI through providing appropriate infrastructure, financial and institutional support while strengthening farmers' institutional capacity through training in community-based seed production and multiplication as well as promoting an enabling environment for seed potato production majorly through seed policy and bylaw development and implementation to ensure quality seed potato production and productivity.

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