

Research Application Summary

Production and adoption of clean seed potato (*Solanum tuberosum*) by small scale farmers in Njoro Sub-county, Kenya

Amwine, L.¹, Nkurumwa, A.O.², Mulu-Mutuku, M.W.²

¹Department of Applied Community Development Studies, Egerton University, P.O. Box 536 20115, Njoro, Kenya

²Department of Agricultural Education and Extension, Egerton University, P.O.Box 536-2115, Njoro, Kenya

Corresponding Author: lamex19887@gmail.com

Abstract

Potato (*Solanum tuberosum*) is the world's most important root and tuber crop. It is a staple food crop for many families in East Africa, both in rural and urban. This is partly due to its competitive advantage over other food crops. For example, potato fits in the double cropping seasons common with the rainfed systems in most African countries. The potato value chain in Kenya employs over 3.3 million people as growers, traders and processors. However, potato production in Kenya has continued to face a number of challenges despite its increasing importance in terms of consumption and income. Most potato farmers in Kenya rely on farmer saved seed potato which they either save from the previous harvests, or buy from nearby open markets and neighbours. In most cases these seeds are highly degenerated, infested with pests and diseases and with low yielding capacity which keeps productivity below the optimum. In order to increase potato yields in Kenya and ultimately improve food security and incomes of farmers, there is a need for farmers to access and use high quality clean seed potato. However, there is generally low adoption of clean seed in Kenya. This study examined production and adoption of clean seed potato using a case study of Njoro Sub-county, Kenya. Data were collected using a researcher-administered questionnaire containing closed ended dichotomous and polytomous questions as well as open-ended items. Prior to data collection, reliability of the questionnaire was determined through pilot testing with 33 small scale potato farmers from Lare Ward. Changes were made to the questions after piloting for ease of understanding guided by the experience during the piloting exercise. Cronbach's alpha reliability test, α , was used to measure reliability which was accepted at a correlation coefficient of 0.7038 (2.7). Cleaned data was organized and coded according to study objectives and analysed using descriptive statistics that included percentages, frequencies, measures of central tendency and standard deviation. Only 12 percent of the respondents were considered as adopters of clean seed potato while over three quarters (88%) were considered as non-adopters of clean seed potato. Factors associated with adoption were level of formal education attained by respondents, distance between the farms and the source of seed potato, and belonging to farmer groups. The study recommends training of farmers in commercial clean seed potato production which would reduce the distances traveled by farmers in search of seed potato. This might increase adoption of growing clean seed potato. The study also recommends that agricultural extension officers help farmers to form groups for collective action. Belonging to farmer groups might help farmers to adopt clean seed potato that may help them improve potato productivity and enhance their standards of living.

Key Words: Adoption, Kenya, Njoro, potato seed, *Solanum tuberosum*

Résumé

Potato (*Solanum tuberosum*) is the world's most important root and tuber crop. It is a staple food crop for many families in East Africa, both in rural and urban. This is partly due to its competitive advantage over other food crops for example; potato favours the double cropping seasons common with the rain-fed systems in most African countries. The potato value chain in Kenya employs over 3.3 million people as growers, traders and processors. Potato productivity in Kenya has continued to face a number of challenges despite its increasing importance in terms of consumption and income. Most potato farmers in Kenya rely on farmer saved seed potato which they either save from the previous harvests, or buy from nearby open markets and neighbours. In most cases these seeds are highly degenerated, infested with pests and diseases and with low yielding capacity which keeps productivity below the optimum. In order to increase potato yields in Kenya and ultimately food security and incomes of farmers, there is a need for farmers to access and use high quality seed like the clean seed potato. However, there is generally low adoption of clean seed in Kenya. This study sought to describe production and adoption of clean seed potato using a case study of Njoro Subcounty, Kenya. Data was collected using a researcher-administered questionnaire containing closed ended dichotomous and polytomous questions as well as open-ended items. Prior to data collection, reliability of the questionnaire was determined through pilot testing with 33 small scale potato farmers from Lare Ward. Changes were made to the questions after piloting for ease of understanding guided by the experience during piloting exercise. Cronbach's alpha reliability test, α was used to measure reliability which was accepted at a correlation coefficient of 0.7038 (2.7). Cleaned data was organized and coded according to study objectives and analysed using descriptive statistics that included; percentages, frequencies, measures of central tendency and standard deviation. Only 12 percent of the respondents were considered as adopters of clean seed potato while, over three quarters (88%) were termed non adopters of clean seed potato. Factors associated with adoption were level of formal education attained by respondents, distance between the farms and the source of seed potato, and belonging to farmer groups. The study recommends training of more farmers in commercial clean seed potato production which may reduce the distances traveled by farmers in search of seed potato and hence might increase adoption of clean seed potato. The study also recommends that agricultural extension officers help farmers to form groups for collective action. Belonging to farmer groups might help farmers to adopt clean seed potato that may help them improve potato productivity and enhance their standards of living.

Key Words: Adoption, Kenya, Njoro, potato seed, *Solanum tuberosum*

Introduction

Potato (*Solanum tuberosum*) is the world's most important root and tuber crop (FAO, 2009). It is the world's fourth most grown and used food crop after rice, wheat and maize (Muthoni *et al.*, 2013). It is grown on more than 20 million hectares of land globally with an estimated annual production of close to 300 million metric tons (Husseins and Nayef, 2013). Hence potato is a staple food crop for many countries including being the second in the United states of America (Hong *et al.*, 2017). Potato is a staple food crop for many families in East Africa, both in rural and urban areas. This is partly due to its competitive advantage over other food crops. For example, potato fits well in the double cropping seasons common with the rain-fed systems in most African countries. It is also a short cycle

crop that can be produced for up three times in a year hence improving food accessibility (Sanginga and Mbabu, 2015).

With a production of 2-3 million metric tons, potato is the second most important food crop in Kenya after maize (Muthoni *et al.*, 2013). It is grown on about 161,000 hectares in Kenya by an estimated 800,000 farmers (Mumia *et al.*, 2018). The potato value chain in Kenya employs over 3.3 million people as growers, traders and processors (Okello *et al.*, 2016). About 97% of the potato farmers in Kenya are small scale farmers owing less than five acres (2 ha) of land devoted to potato production (Ministry of Agriculture, 2016).

Potato productivity in Kenya has continued to face a number of challenges despite its increasing importance in terms of consumption and income (Ebrahim *et al.*, 2018). These challenges include; use of poor quality seed potato, pests and diseases and poor farming methods (Schulte-Geldermann, 2012). Use of poor quality seed potato by farmers is a major challenge and a major yield reducing factor to potato productivity in Kenya. Apart from agro ecological factors, the quality of seed potato used by farmers is a major yield determinant.

Most potato farmers in Kenya rely on farmer saved seed potato which they either save from the previous harvests, or buy from nearby open markets and neighbours. In most cases these seeds are highly degenerated, infested with pests and diseases and with low yielding capacity. The consistent use of farmer saved seed potato maintains productivity below the optimum. Average potato productivity in Kenya is about 7-10 tons per hectare compared to achievable 20 and 40 tons per hectare in Egypt and Netherlands, respectively (Janssens *et al.*, 2013).

In order to increase potato yields in Kenya and ultimately food security and incomes of farmers, there is a need for farmers to access and use high quality seed potato. Among the high quality seed potato types that can be used by farmers to increase yields is the clean seed potato also known as quality declared seed potato. This type of seed is produced under the semi-formal seed system or the quality declared seed system (Wachira *et al.*, 2014). It is produced from certified seed and has the same qualities as certified seed, for example, high yielding capacity, resilience to pests and diseases and fast maturity but lacks inspection, sample testing and certification thus making it less expensive than certified seed potato (Kaguongo, *et al.*, 2013). Trained farmers multiply it at farm level and is intended to bridge the gap for insufficient supply of certified quality seed to the farmers (Wachira *et al.*, 2014). The output from clean seed potato is quite good as compared to farmer saved seed (National Potato Council of Kenya, 2009). According to Kaguongo *et al.* (2014), clean seed potato is disease free and drought resilient. It matures faster and can increase potato yields by 30% through reducing disease incidents hence increasing farm productivity and incomes (Kamuyu *et al.*, 2017). According to FAO (2017), clean seed potato has been so instrumental in increasing the potato yields in Ethiopia where 99% of the farmers used to rely on informal seed sources like the farmer saved seed and seed from the open markets.

There is low adoption and use of clean seed potato by farmers in Kenya. Kaguongo *et al.* (2014) conducted a study on the value of seed potato from the different seed systems in ten major potato producing counties in Kenya, that is, Nyandarua, Nakuru, Bomet, Kiambu, Nyeri, Meru, Narok, Mount Elgon, Taita Taveta, and Keiyo-Marakwet. The study found out that only 1.4% of the respondents used clean seed potato while 1.1% of the respondents used certified seed potato, and 96.4% used farmer saved seed. Gichuru and Dijk (2015) also conducted a study on low potato yields in Kenya in the counties of Nyandarua, Meru and Nakuru (Njoro and Kuresoi sub-counties) and found out that only 4.48% of the respondents used clean seed potato. This is despite the fact that clean seed potato increases yields, and can be easily accessed by the farmers.

There is low adoption of clean seed potato in Njoro Sub-County. Farmers continue to use farm saved seeds and seeds bought from neighbours and nearby open markets, which are highly degenerated and infected with pests and diseases resulting in low yielding capacity. This has kept potato productivity in Njoro Sub-County at only 9.10 tons per hectare which is far below the optimum yield leading to food and nutritional insecurity and low incomes to farmers (Nakuru County, 2018). Use of clean seed potato can result in higher yields as compared to farm saved seed. The purpose of this study was to describe the adoption of clean seed potato by small scale potato farmers in Njoro Sub-County Kenya.

Materials and methods

The study was carried out in Njoro Sub-County of Nakuru County, Kenya, in June 2019. Njoro Subcounty lies in the Mau escarpment at an altitude of 2100-2800 m above sea level and receives an annual rainfall of 1600-2200 mm. This area receives a bimodal rainfall with long rains received between March to August while short rains are received from October to December. Maize and potatoes are the major crops grown in this area with agriculture being the main source of livelihoods for people in the area. Factors that have favoured potato production in this area include the rich volcanic soils, reliable rainfall, readily available labour force, and the availability of ready market for crop produce in both locality and the urban centers such as Nakuru, Nairobi, Naivasha, Gilgil, and Narok. These offer incentives for the potato sector to flourish.

The target population of the study were 34,062 small scale farmers in Njoro Sub-County. The study was descriptive and data were collected through a cross-sectional survey. Simple random sampling technique was used to select 130 respondents who participated in the survey. Data were collected using a researcher-administered questionnaire containing closed ended dichotomous and polytomous questions as well as open-ended items. Prior to data collection, reliability of the questionnaire was determined through pilot testing with 33 small scale potato farmers from Lare Ward. Changes were made to the questions after piloting. Cronbach's alpha reliability test, α , was used to measure reliability which was accepted at a correlation coefficient of 0.7038 (2.7).

Cleaned data were organized and coded according to study objectives and variables and were analysed using SPSS version 20. Data analysis relied on descriptive statistics that included; percentages, frequencies, measures of central tendency and standard deviation.

Results and discussions

Types of seed potato used by small scale farmers in Njoro Sub -County. Only 35.4 percent of the respondents produce seed potato that they use and sell to the neighbours while over a half of the respondents (64.6%) did not produce seed potato. It was also found out that of those respondents who produced seed potato, only 12.5 percent of them produced clean seed potato while 87.5 percent produced positively selected seed potato. In this study, positively selected seed potato was included among the farmer saved seed potato because it is produced at farm level without supervision of any authorities. The study also sought to understand the types of seed potato used by respondents to produce ware potato. It was found out that over three quarters (81.5%) used the low quality farmer saved seed potato, 11.5 percent used clean seed potato, 4.6 percent used certified seed potato while 2.3 percent bought seed potato from open markets and from neighbours as shown Figure 1.

These results confirm the problem that there is low adoption of clean seed potato in Njoro SubCounty Kenya. These results are in agreement with the finds of Kaguongo *et al.* (2014), who reported that farmer saved seeds were the most used by farmers in Nakuru County followed by clean seed potato, positively selected seed potato and certified seed potato being the least used. According to Kaguongo *et al.* (2014), clean seed potato is not recognised for formal trade, a factor that may hinder its adoption

despite its potential to reduce pest and disease incidences hence increasing yields. The farmer saved seed potato is often degenerated, infested with pests and diseases and exhibit low yielding capacity.

Adoption of clean seed potato in Njoro Sub-County. The study sought to describe the adoption of clean seed potato in Njoro Sub County. Two categories were created from respondents that is adoptors and non adoptors. Respondents who planted using clean seed potato consistently for three or two times in the previous three planting seasons were termed as adoptors while those respondents who used clean seed potato once or none were considered as non-adoptors. Only 12 percent of the respondents were considered as adoptors of clean seed potato while, over three quarters (88%) were considered non adoptors of clean seed potato.

Belonging to farmer groups and adoption of clean seed potato. Of the respondents who were adoptors of clean seed potato, 75 percent of them belonged to farmer groups while only 25 percent did not belong to farmer groups. There was a positive but non-significant relationship between belonging to farmer groups and adoption of clean seed potato [$r(13) = 0.75$, $P=0.789$]. These results are consistent with the findings of Mmbando and Baiyegunhi (2017), who concluded that farmers who are members of farmer groups/associations are two times more likely to adopt improved maize varieties compared to their counterparts who do not belong to farmer groups. These findings also agree with those of Sulo *et al.* (2012), who found out that belonging to farmers groups favourably influences farmers to adopt agricultural technologies including improved high yielding varieties like the clean seed potato. This they argued is due to reduced cost of inputs due to collective group action. This suggests that belonging to farmer groups might influence farmers to adopt clean seed potato in Njoro Sub-County. However, this result disagrees with the findings of Kiplagat *et al.* (2016), who found out that belonging to a farmer group or association was not significant in influencing potato farmers to adopt clean certified seed potato in Baringo County Kenya.

Formal education level attained and adoption of clean seed potato. It was observed that all those respondents who use clean seed potato, had at least completed primary level of education. More than three quarters (86.7%) of the respondents who had adopted clean seed potato had attained primary and secondary education levels while only 13.3 percent only had a University/college education. There was a positive and significant correlation between education level completed by the respondents and adoption of clean seed potato [$r(129) = 0.183$, $P=0.037$]. These results agree with those of Mmbando and Baiyegunhi (2017) who found out that increasing number of years of education by the farmer statistically and significantly influenced maize farmers in Hai district of Tanzania to adopt improved maize varieties. Ahmed (2015) and Deepa *et al.* (2015) also found education to have a positive influence on farmers in adopting new agricultural technologies especially in developing countries.

Adoption of clean seed potato and distance from the source of seed potato to the farms. Spearman's correlation test results between distance to the source of seed and farms, and adoption of clean seed potato revealed a statistically significant positive relationship [$r(129) = 0.433$, $P=0.000$]. Results revealed that for 86.7% of the respondents who used clean seed potato, their farms were located less than 10 kilometers away from the sources of the seed. This indicates that the long distance between the source of seed and the farms reduces the likelihood of the farmer from adopting clean seed potato. These findings agree with those of Kiplagat *et al.* (2016) who concluded that the distance between the farmers' farms and the source of the seed influences the decision of the farmer to adopt certified seed potato. Similarly, Burke *et al.* (2015) reported that farmers located far away from the input markets are less likely to adopt such inputs due to increased transactional costs.

Conclusions and recommendations

This study concluded that the level of formal education attained, belonging to farmer groups and

distance between the farms and the source of seeds influences adoption of clean seed potato among small scale potato farmers in Njoro Sub-County, Kenya. The study therefore recommends training of farmers in commercial clean seed potato production. This will reduce the distances traveled by farmers in search of seed potato. This would increase adoption of clean seed potato. The study also recommends that agricultural extension officers help farmers to form groups for collective action. Belonging to farmer groups might help farmers to adopt agricultural innovations like growing of clean seed potato that may help them improve productivity and enhance their standards of living. In fact forming more farmer groups, and training them in commercial clean seed potato production will increase production, clean seed accessibility and adoption of clean seed potato for increased potato productivity, food and nutritional security and incomes of the farmers.

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