

Adoption of Quality Seed Potato Among Smallholder Farmers in Kenya: Evidence from Molo Sub County, Nakuru

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Abstract— Potato yields in Kenya have been declining, largely due to the use of low-quality seed potato. Sustainable production depends on a reliable supply of quality planting material, yet smallholder farmers continue to rely heavily on informal seeds; with only about two percent of farmers using certified seeds. Previous studies have emphasized socioeconomic factors influencing adoption, but uptake remains limited despite government and international interventions. This study assessed the level of quality seed potato adoption, identified major seed potato sources, and examined factors influencing farmers' choices in Molo Sub County. A mixed-methods research design was adopted to collect data from a sample of 152 respondents using a semi-structured questionnaire. A focus group discussion (FGD) guide was used to gather data from 12 FGD participants. The 152 respondents were accessed from a population of 6,000 smallholder farmers in Molo Sub County through a multi-level sampling procedure. The results indicate that quality seed potato adoption remains low, with farmers opting for informal sources for seeds due to trust for the source, cost of seed potato, among other reasons. Findings are expected to inform policies aimed at strengthening sustainable seed systems and improving potato productivity among smallholder farmers.

Keywords— Adoption, Kenya, Molo Sub County, Smallholder farmers, Quality Seed Potato.

INTRODUCTION

Potato yields have been declining at a rate of 11 % per year in Kenya (Food and Agriculture Organization Statistics [FAOSTAT], 2020). This decline has been attributed, in part, to the use of low-yielding varieties and poor-quality seed potato (Kaguongo et al., 2008). Past studies draw a direct link between use of poor-quality seed potato and the low yields obtained by potato farmers (Amwine et al., 2019; (Perkins et al., 2015). Sustainable potato production depends on a constantly renewed supply of pest-free planting material, hence quality seed potato is key to successful harvest.

From formal experts, that is, from the view of government organizations and seed potato regulating bodies, quality seed potato encompasses production and distribution regulations of the tuber, yielding potential of the batch, disease resistance and physiological crop growth and developmental characteristics (Food and Agriculture Organization [FAO], 2006). Conventionally, however, quality seed potatoes can be defined on the basis of productivity, certified or locally produced under careful monitoring by experts. Seed potato can be produced by farmers under supervision of trained personnel from the government and seed certifying bodies with an aim of ensuring farmers have access to high-yielding and disease-free seed potato within their budget (Ministry of

Agriculture, Livestock and Fisheries [MoALF], 2019). These concepts bring about different seed potato systems among smallholder farmers in Kenya.

Broadly defining a seed system, it consists of an interrelated set of components including breeding, management, replacement and distribution of seed (Struik et al., 1999). Kenya seed potato industry consists of three systems: Formal, semi-formal and informal (Wachira et al., 2013). According to Wachira et al. (2013) formal seed system, or the certified seed system is characterized by official rules and guidelines from the Kenyan government. The basic seed is passed on to seed multipliers for bulking and distribution. The certified seed bulking farmers, farmer groups and private companies operate under one parastatal, the Agricultural Development Corporation (ADC).

Growers in the semi-formal system produce two different types of products: clean seed and positively selected seed. Clean seed comprises seed multiplied at the farm level which originates from certified seed. Production practices follow recommendations from farmer training conducted by KARI, Ministry of Agriculture, Deutsche German Agency for Internal Cooperation and Training of Trainers. Most guidelines used in production of certified seed are also used in clean seed production. Positively selected seed are seed potatoes produced from farmer seed through a process of selecting the best-looking plants during vegetative growth by farmers trained on seed selection and management. Although the process of production lacks the stringent procedure and inspection by Ministry of Agriculture, it offers an opportunity for farmers to control diseases and improve their yields (Devaux et al., 2020).

Farmer seed system, or the informal seed system comprises of seed potatoes obtained from own and neighbor farms and is mainly of very poor quality. In this system, no guidelines are followed and no systematic seed selection is done. This type of seed suffers from pest and disease (especially bacterial wilt and viral diseases) accumulation leading to low yields. It also contributes greatly to the spreading of diseases and low potato yield (Ebrahim et al., 2018). In this study, the formal and semi-formal seed systems are considered high quality seed potato.

Smallholder farmers account for the majority of potato production in Kenya, with an estimated 800,000 households involved in potato farming (Muthoni et al., 2013). Smallholders are those farmers who farm on land smaller than two hectares (FAOSTAT, 2020). Smallholder farming is often rain-fed. The farmers depend predominantly on family labor and they produce relatively small food volumes on small plots of land. Shangi, Sherekea, Dutch Robijn, Kenya Karibu, Kenya Mpya, Asante, Desiree, Kenya Mavuno, Kenya Sifa and Tigonini are common seed potato varieties utilized in Kenya (Muthoni et al., 2013).

Only two percent of the 800,000 smallholder potato farmers in Kenya use certified seeds. About ninety-five percent use farmer-saved seeds, and four percent use clean seeds. This is despite bilateral agreements between the Government of Kenya and the French, Dutch, and British governments to avail modern, high-yielding seed potato varieties in Kenya (KIPPRA, 2022). Most of research work on factors that influence quality seed potato adoption has documented socioeconomic factors that influence smallholder farmer's choice of seed potato, and have majorly concentrated on the conventional experts' opinions on these socioeconomic elements (Thomas-

Sharma et al., 2015). However, quality seed potato adoption among smallholder farmers remains low as stated earlier. Therefore the study attempted to determine the level of quality seed potato adoption among smallholder farmers in Molo Sub County; to explore the main sources of seed potato among smallholder farmers in Molo Sub County and to explore the reasons for the choice of the source of seed potato among smallholder farmers in Molo Sub County. The information from this study will be important in informing policy guidelines on enhancing sustainable seed systems among smallholder farmers.

MATERIAL AND METHODS

Research Design

Mixed-methods research approach (survey and focus group discussion, [FGD]) was used to collect both qualitative and quantitative data in Molo Sub County. Mixed-methods research draws from the strengths of qualitative and quantitative data collection methods. It allows for a holistic information gathering, where information on attitudes, beliefs and behaviors can be gathered as well as facts with figures (Regnault et al., 2018). Further, a FGD was conducted with a smaller group of farmers. FGD are valuable for gathering knowledge within communities, which would be challenging to acquire through individual interviews alone (Barbour, 2014).

Study Area

The study was conducted in Molo Sub County, Kenya. Molo Sub County is located in Nakuru County, Kenya. The area is located in the Mau Escarpment and it is characterized by deep fertile soils, warm summer climate with low average temperature of 18.6°C, and typically receives about 117.68 millimeters of precipitation per year. These parameters make potato growing in Molo Sub County a vibrant agricultural activity. Potato is one of major crops grown in this area, whose productivity has been declining due to the use of poor-quality seed potato.

Study Population

In this research, the study population was mainly smallholder potato farmers in Molo Sub County. Although there is no precise documentation of total smallholder potato farmers in Molo Sub County, Chepkoech et al. (2022) notes that there are about 6,000 smallholder farmers that operate on less than five acres of land and depend on family and friends to provide labor in the production of potatoes. This population fits the description of smallholder potato farmers, and therefore, this figure was used as the target population from which the sample of the study was drawn.

Sampling Procedure and Sample

Molo Sub County was selected purposely because it is a potato producer region in Kenya. Proportionate stratified sampling was used, where the four wards were used to distribute the sample proportionately. Accidental convenience sampling was then used to recruit respondents to the study, where those who were available at their homesteads and farms during the period of data collection and willing to participate were included in the survey.

The appropriate sample size for the survey was established using the Nassiuma (2000) sample size formula, which is given by;

$$n = \frac{NC^2}{C^2 + (N-1)e^2}$$

Where;

n is the required sample size;

N is the population size, which is 6,000;

C is the Coefficient of variation;

e is the Standard error value.

The formula asserts that for most survey researches the coefficient of variation is ≤ 30 and the standard error margin value is $\leq 5\%$. Therefore, a coefficient variation of 25% and 2% margin error was used. The 25% variation coefficient and 2% margin error falls within the stipulated limits and were used so as to ensure low variability in the sample and minimize the degree of error.

$$n = \frac{6,000(0.25)^2}{(0.25)^2 + (6000 - 1) 0.022}$$

$$n = \frac{6,000 (0.0625)}{0.0625 + (5999) 0.0004}$$

$$n = \frac{375}{2.4621} = 152.3$$

Therefore, the sample size for the survey was 152 respondents.

For the FGD, purposive sampling method was used to select 12 farmers from the four wards of Molo Sub County. This involved selecting smallholder potato farmers who were knowledgeable and experienced in potato production and who could provide in-depth insights into quality seed potato adoption in Molo Sub County.

Instruments

Printed, semi-structured questionnaires containing close-ended and open-ended questions were used to collect quantitative data and qualitative data that was supplemented by data from FGD. The questionnaires were self-administered and only researcher-administered to respondents who could not read or write. The questionnaires are preferred where a large number of respondents is expected (Krosnick, 2017). Questionnaires are easy to administer and also easy to analyze the data that it yields, as information is systematically collected. A FGD guide was used during the discussion sessions.

Data Collection Procedure

The researcher sought clearance by the Egerton University Ethical Committee through the Graduate School, and obtained a research license from the National Commission for Science, Technology, and Innovation (NACOSTI). Afterwards, a reconnaissance study was conducted in Molo Sub County to map out the smallholder potato farmers.

With the aid of community leaders, farmers were notified about the research. During the actual data collection process, the researcher conducted home/farm visits to meet smallholder farmers for the survey and FGD. Informed consent from all the participants was sought prior to data collection. Questionnaires were then availed to the respondents to provide the information required. With the help of translators, the questionnaire items were translated to local languages for proper understanding by the respondents who were not able to comprehend the English language. FGD was facilitated by the researcher in a round table discussion with the farmers. The discussion was also recorded (audio record) with permission from the participants.

Data Analysis Procedure

Collected data was cleaned and categories were established and coded. The data was then analyzed using descriptive statistics. With the aid of SPSS, descriptive statistics was used to provide insights on the population of study in form of percentages, charts and tables.

RESULTS AND DISCUSSION

Quality Seed Potato Adoption among Smallholder Farmers in Molo Sub County

Two data categories—adopters of quality seed potatoes and non-adopters—were created in order to assess the adoption of quality seed potatoes among smallholder farmers in Molo Sub County. Those who produced seed potatoes under expert supervision or obtained seed potatoes from Molo ADC and other authorized seed suppliers at least twice in their previous three planting seasons and were prepared to continue using pest and disease-free seed potatoes were classified as adopters, while the remaining individuals were classified as non-adopters. The results are presented in Figure 1.

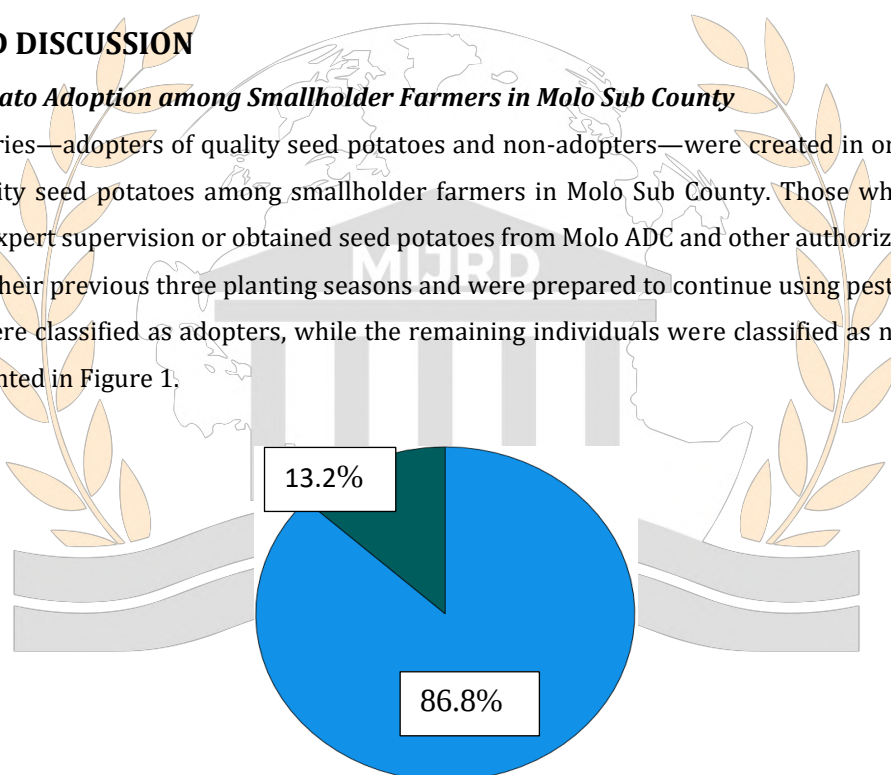


Figure 1: Adoption of Quality Seed Potato among Smallholder Farmers in Molo Sub County

From the study, 86.8% of the respondents did not adopt high-quality seed potato, whereas the remaining (13.2%) respondents did. While the percentage of adopters was higher (13.2%) than the national average of 6% (KIPPRA, 2022), the adoption of quality seed potato is still low.

Sources of Seed Potato among Smallholder Farmers in Molo Sub County

The study explored the sources of seed potato among the smallholder farmers in Molo Sub County. The participants were asked to indicate where they obtained their seed potato in their last three planting seasons. Table 1 presents descriptive statistics.

Table1: Sources of Seed Potato Preferred by Smallholder Farmers in Molo Sub County

Source	Frequency	Percentage
Farm saved seed potato from previous harvest	115	75.7
Family and friends	76	50
Molo ADC and other authorized seed suppliers	51	33.6
Own produced seed potato without any expert monitoring	34	22.4
Own produced seed potato under expert monitoring	7	4.6
Open markets	6	3.9

From the data, majority of the respondents, 75.7% (n= 115), 50% (n=76), 22.4% (n= 34) and 3.9% (n= 6) used farm saved seed potato from previous harvests, family and friends, own produced seed potato without any expert monitoring, and from open markets; at least once in their last three planting seasons respectively. Also notably, some respondents, 33.6% (n= 51) and 4.6% (n= 7) acquired their seed potato from Molo ADC and other authorized seed suppliers, and from own produced seed potato under expert monitoring respectively; at least once in their last three planting seasons. This information confirms findings by Taiy et al. (2017), who found out that a majority of smallholder farmers select smaller tubers from their previous harvest to use as seeds, exchange seed potato among friends and family or buy seed potato from open markets.

Reasons for the Choice of Sources of Seed Potato.

Respondents gave varied reasons for choosing sources of seed potato. Table 2 gives a summary of the frequencies and percentages of what respondents gave as main reasons for choosing the sources of seed potato.

Table 2: Reasons for the Choice of Sources of Seed Potato

Source	Frequency	Percent	Cumulative Percent
Trust for the source	34	22.4	22.4
Good quality seed potato	75	49.3	71.7
Cost of seed potato	19	12.5	84.2
Seed potato availability	24	15.8	100.0
Total	152	100.0	

The main reasons that respondents gave were trust for the seed potato source, seed potato quality, cost of seed potato, and seed potato availability. From the research, 22.4%, 49.3%, 12.5% and 15.8% of the respondents selected their sources of seed potato because of trust for the source, good quality seed potato from the source, cost of seed potato, and seed potato availability respectively. Among those who selected seed potato from a particular source because of trust, 94.1% (n= 32), obtained their seed potato from non-formal sources. Also, 76% (n=57) of

the respondents who chose the source of seed potato because of good quality of seed potato, obtained their seed potato from non-formal sources.

This data backs up information from a FGD that was held with 12 smallholder farmers from Molo Sub County, that points to the fact that most farmers were reluctant on acquiring seed potato from Molo ADC and other authorized quality seed potato suppliers because the farmers believed that the seed quality from these sources has been tempered with. The participants in the FGD claimed that seed potato is bought from local farmers and repackaged as certified seeds without thorough inspection. Also, the FGD participants alleged that seed potato from Molo ADC is produced in farms where the farmers are not able to visit and see the process of production. Therefore, the farmers preferred to select seeds from previous harvests or buy from their neighbors and friends where they can actually see the potato production process and ascertain the seed potato quality on the basis of potato growth characteristics and yielding potential. Although the farmers might not have the scientific knowledge of testing the quality of the seed potato, the farmers relied on observation, trust, and their vast experience in seed selection and potato production.

CONCLUSION

Quality seed potato adoption remains low among smallholder farmers in Kenya. In Molo Sub County, majority of farmers prefer to use seed potato from neighbors and from their previous harvests because of trust for the source, the cost, quality seed potato availability, and the belief that the quality of seed potato that they have observed the process of production is better than seed potato from authorized suppliers. The results imply that trust for the source of seed potato is an important considerations when selecting a source of seed potato. Therefore, the results imply that by ensuring that smallholder farmers participate and are included in the process of quality seed potato production will cultivate trust for the seed potato and will eventually enhance quality seed potato adoption and a sustainable seed potato system.

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