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Use of New Technologies In Post Harvest Handling Of Maize In Mwenge North County Kyenjojo District

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Abstract*: Utilizing new technologies during the post-harvest handling of maize is primarily done to meet market and consumer expectations for volume, quality, and other product and transaction attributes like nutrition, food security, and product safety while making sure that the harvested product reaches the consumer. The majority of farmers, according to the study's findings, have access to information primarily through the media, extension agents, and academic facilities, which has highlighted their level of awareness. Most farmers are aware of shelling, processing, and a few drying technologies. The majority of respondents also valued the financial viability of the technologies for milling and shelling when it came to hiring, even though having purchased personal technologies is very expensive. As an outcome of the results, we reject the null hypothesis and arrive at the conclusion that processing technology significantly affected post-harvest handling since t-computed (1.980) was higher than t-tabulated (0.034). This is due to the fact that at the 95% confidence level, if the tabulated t-value is greater than the threshold value (0.05), we consider the variable to be significant, indicating a significant impact on the dependent variable. Farmers have embraced the usage of these technologies at various phases, such as shelling, where 80% of respondents utilize manual and engine-powered shelling machines. Farmers also use milling hardware to turn their maize into flour for human use and to obtain animal feeds. Farmers face challenges with these technologies because they require technical skills and this limits their use. The cost of acquiring personal technologies like milling machines and maize shellers is very high, making it very expensive to them and limiting their personal ownership of the innovation. Farmers have benefited from using these technologies such as increased grain quality that fetches higher prices in the market and this has contributed to increased household incomes and food security. Subsidizing the cost of the machinery lowers the end price, making technology more affordable for local producers. Other strategies include diversification, which allows farmers to engage in other pursuits once harvesting is complete, and gov't farmer training.*

Keywords: new technologies and post-harvest handling

Back ground of the study

Maize (Zea mays ssp. mays) belongs to the tribe Maydae, family Poaceae and was originated in Mexico (Lance and Garren 2002) and Central America (ACDIVOCA 2010). It possesses somatic chromosome number of 20, a genome size of 2.3 gigabase and more than 32,000 genes (Schnable et al. 2009).

The maximum production of key staple grains, maize is produced annually in the world in roughly 1016.73 million metric tonnes (FAOSTAT 2013). Because it provides billions of people in poor nations, especially in Africa, Mesoamerica, and Asia, with functional proteins and calories, a large fraction of maize produced worldwide is used for animal use (Shiferaw et al. 2011). It also supplies the body with vital minerals and vitamins. More than 4.5 billion people in 94 developing countries get at least 30% of their daily calories from maize, along with rice and wheat.

Although maize may be produced on a range of soils, it flourishes on deep, warm loams that are well-drained, well-aerated, and moist. It does well in hot climates, where the optimum temperature range for plant growth is between 30 and 34 degrees Celsius. Low and high temperatures of 10 and 40 degrees Celsius cause the maize plant to grow poorly and eventually die. The ideal range for maize rainfall is 500 to 600 mm, which should be evenly distributed all through the growing season. Together the first and second growing seasons produced roughly 1.2 million Mt of corn (MAAIF, 2013).

In Uganda maize is one the crops identified as apriority crops in Uganda .In agricultural year 2018 it was grown by 55% Agricultural households on land area of about 2.5 million hectare the production maize in 2018 was 3.4 million metric tonnes with 1.7 Mt/Ha in the second season and its grown in most parts of country but most intensely in eastern (Kapchorwa, Mbale, Kamuli, Jinja, Iganga), central (Masaka, Mubende) and western (Masindi, Kamwenge, Kyenjojo, Kasese, Kabarole)(Annual agriculture surveys 2018).

According to production and export, the Eastern Area generated the most maize, 2.9 Mt/Ha, compared to 2.6 Mt/Ha and 1.9 Mt/Ha in the Western and Northern Regions, respectively (UCA, 2008/2009).

The Central Area has the highest percentage of its production that has been sold (57.1%), followed by the Western Region (45.3%), and the Northern Region (26.7%), in terms of maize usage by regions. According to the Uganda Census of Agriculture 2008/2009, the Northern Area has the highest percentage of consumption (44.3%), followed by the Eastern Region with (35.4%), and the Central Region with (26.8%).

According to Asea et al. (2014), post-harvest handling procedures such as harvesting, drying, shelling, treatment, and storage are crucial for minimizing losses in both quality and quantity. This has prompted various stakeholders, including the government through the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), the National Agriculture Research Organization (NARO), the World Food Program (WFP), and the Food and Agriculture Organization (FAO), to take action.

Once the grain reaches physiological maturity, the majority of farmers harvest their grain crops (moisture content is 20–30 percent). At this point, pest attacks on the grain are highly likely. Unexpected rains can also dampen the crop at this stage, which raises the danger of mold growth and the contamination of the crop with aflatoxin or other mycotoxin. The weather at the time of harvest has a significant impact on PHL. As a plant is ready to be harvested, two significant signs occur: it turns from green to a light brown or yellowish color. (USAID 2013) The level of aflatoxin contamination is strongly affected by harvest timing, and prolonged field drying of maize enhanced insect infestation and fungal contamination (Hell et al., 2008).

Some farmers use mechanized harvesting techniques like using machines (e.g., combine harvesters) and is suited for large commercial farms. Machines simultaneously harvest and remove ears, shells and do partial cleaning of the grain. It has an advantage of ensuring quality, reducing losses in addition to time and labor-saving.

Crop moisture is progressively decreased through drying to levels suitable for storage. It is a crucial post-harvest process that guarantees the quality of the maize grain. Grain has a moisture level of 18 to 24 during harvest; this should be decreased to 12 to 13% for handling safely (CTA and EAGC, 2013) The process of drying, known as sun drying, keeps corn cobs' quality by lowering the risk of rotting and germination of the grains. Cobs are dried outside on tarps, in a drying yard, using a collapsible drier, drying racks, and in cribs (MAAIF, 2013). Machine drying Under controlled conditions, hot air is forced into the grain to reduce excessive moisture. Solar, electricity, burning fuel, and biomass are all used to produce hot air.

Several technologies are utilized during shelling, ranging from the use of hands, manual shellers, and motorized shellers (ACDI VOCA, 2010). Hands clapping Hands are used to shell maize cobs. When shelling a lot of maize, it takes time and is highly unpleasant on the thumb. This is the greatest method for farmers using OPV seed since it retains the germ and enables for seed sorting into the best from the cobs. Mechanical. This involves the use of a manual sheller. It is done with a Sheller that is pedal- and hand-operated. The maize needs to be dry (13–14% MC) for the machine to operate at its best. It has a limited ability utilized by farmers with extremely little volume, Maize smellers with motors.

Grain storage refers to the process of keeping grains until they may be used. The big objectives of grain storage are to maintain quality, ensure food security and nutrition, preserve seed, and obtain better prices (Okoruwa et al, 2012).

For example, silos, canisters/drums, woven bags, plastic bags, insect-controlled bags, refrigerated containers, and adaptations to conventional technologies have all been created as storage systems to lower post-harvest loss. Many of these goods have undergone small-scale pilot projects to better the lives of Ugandan small - scale farmers. From this introduction, a research on the use of innovative technologies to the post-harvest handling of maize in the Mwenge north county Kyenjojo area will be done.

Problem statement

Kyenjojo district, one of the primary maize-growing regions in western Uganda, produces 24620 metric tons of the crop on an area of 19559 hectares (Uganda annual agriculture survey 2018). Most compact holders of maize Farmers in the Kyenjojo district use outmoded post-harvest handling strategies, such as drying corn on the ground, which causes the grain to be become mixed with soil and lowers grain quality, and using insufficient storage facilities, which raises the risk of pest attack and lowers grain quality, resulting in poor market prices and a limited amount of household income for farmers (MAAIF, 2013).

In order to reduce post-harvest losses, a variety of stakeholders including the government supplied farmers with post-harvest handling equipment like tarpaulins for drying on and covering maize during inclement weather like rain, gunny bags, wire mesh for construction of improved maize cribs, motorized maize shellers, and to farmers and youth farmer groups (MAAIF 2019). Due to the lack of investigation in Mwenge North County, this study was conducted to determine the adoption rates of new technologies among smaller holder farmers during post-harvest handling of maize. Farmers continue to suffer high post-harvest losses despite efforts to reduce them, and this raises the concern of whether farmers are aware of and have adopted these new technologies.

Specific objectives

1) To find out whether farmers are aware about the new technologies used in post-harvest handling of maize.
2) To determine the adoption levels of new technologies in post-harvest handling of maize among maize Farmers in Mwenge north county Kyenjojo district.

Research questions

1) What are the new technologies used by maize farmers during postharvest handling of maize?
2) What are the adoption levels of the new technologies in post-harvest handling of maize?

METHODOLOGY

Study design

The study design used a Cross sectional study design for finding out the use of new technologies in post-harvest handling of maize in Mwenge north county Kyenjojo district. The method was effective and quick and it collected adequate data at a specific time.

Sample Size and Sampling Procedure

Farmers were chosen from households using a simple random sampling technique. But, if the sample size grows gradually over time, the bias tends to vanish, and as it grows forever, the sample size tends to reflect the true population parameter (P). The local council chairs were deliberately chosen since the researcher presumed that they had in-depth knowledge of the subject under examination. Farmers from households were chosen using a simple random sampling technique, giving each household an equal chance of being included in the sample. 50 respondents made up the entire study population. Ten were gathered from county farmer groups and local leaders, compared to 40 collected from homes.

Data collection and analysis

Data collection procedure

After developing a research proposal with the help of his supervisor, the researcher received an introductory letter from the research coordinator of the department of Agriculture at Metropolitan International University. This letter introduced him to various Sub Counties to request permission to conduct the study within their counties. This enabled the researcher's presentation to the relevant responders. The researcher reassured the respondents that any information they provided would be kept private and used only for study. The researcher then went on to disseminate surveys and hold interviews with members of the target population. The researcher himself administered the questionnaires and filled them out based on the responses provided by the respondents.

The face-to-face interviews that were carried out in accordance with an interview guide and the structured questionnaires that were used to collect the respondents' sociodemographic characteristics as well as their awareness and adoption of the new technologies used during post-harvest handling of maize were the primary data sources for this study.

Before adding the data into the spreadsheet, any potential errors were eliminated from the information. Version 17 of the statistical software for social scientists received the data for import. Tables, percentages, and frequencies were used to present the results after descriptive statistics analysis.

Methods of Data Collection

Various data collection methods were used to obtain both primary and secondary data. These were selected basing on their applicability in terms of nature and where the data was collected.

These include the following;

Face-to-face interviews were used by the researcher to obtain data in-depth by examining the respondents (respondents). While some of the local farmers are allegedly illiterate and unable of writing, the researcher conducted these interviews with them. When I wrote down the answers using the interview guide, I read the question to them. As noted in appendix 1 in the appendices, the sequence of questions employed during the study is attached.

Questionnaires

Both open-ended and closed-ended surveys were used. Because there were no limitations on the respondent, open-ended questions allowed the respondents to provide as much information as possible in all possible various forms, minimizing any potential for prejudice.

RESULTS

Social demographic characteristics of the respondents

Table 1 below lists the socio demographic features of the study's respondents. 53% of the respondents in the research were between the ages of 18 and 35. Also, it was found that 30 (58.8%) of the 50 sample farmers were men. Of of the 50 sample farmers, 29 (56.9%) were married, and just one (2%; 1 farmer) had divorced. The average household size was 5 to 6 people, and the plurality (62.7%) of the homes were headed by men. It was also revealed that no homes were headed by children, proving that children's absence of involvement in decision-making does not have an impact on how new technology are used.

Table 1 : Socio demographic characteristics of the respondents

Social demographic characteristics of the respondents	Percentage (%)
Age	
18-35	53
36-53	31.3
54-71	11.8
71-above	3.9
Gender	
Males	58.8
Females	41.2
Marital status	
Single	31.4
Married	56.9
Divorced	2.0
Widowed	9.8
Household heads	
Child headed	0
Man headed	6.7
Woman headed	37.3
Number of per household	
1-2	4.0
3-4	29.4
5-6	37.1
7-8	23.6
9-10	5.9

Table 2 shows the effect of marital status on post harvest handling using the chi-square test

CHI-SQUARE	t-computed	t-tabulated
Sigma squared	9.0456	0.657

Since t-computed (9.0456) is greater than t-tabulated (0.657), we fail to reject the null hypothesis and conclude that marital status had an insignificant effect on post harvest handling.

Level of education and main occupation

The study further considered the highest level of education of the respondents and their main occupation as presented in table 2 below Majority (29.4%) of the respondents attained tertiary education as their highest level of education and only 13.7% (7) respondents did not attain any level of education. From table 2also it has been found that 49.0% (24) respondents out of the 50-sample size are practicing farming as their main occupation and this is key on use of new technologies.

Table 3: showing the levels of education attained and main occupation of the respondents

Response	Percentage (%)
Highest Level of education	
None	13.7
Primary	23.5
O level	9.8
A level	23.5
Tertiary	29.4
Main Occupation	
Farmer	49.0
Business	25.5
Civil servants	23.5
Others	2.0

Table 4 shows the effect of education level on post harvest handling using the chi-square test

CHI-SQUARE	t-computed	t-tabulated
Sigma squared	3.236	0.002

Since t-computed (3.236) is greater than t-tabulated (0.002), we reject the null hypothesis and conclude that education level had a significant effect on post harvest handling.

Accessibility and source of information about affordable technologies

Accessibility to affordable information and their sources and shown in table 3 below, most (82.4%) accounting to 45 out of the 50 respondents have access to information about the new technologies and their main source of information was extension workers (31.4 %) and only 2% of the respondent's got information through NGO field workers implying that non-governmental organizations are key in information dissemination to farmers.

Table 5: Accessibility to information and sources of information.

Response	Percentage (%)
Access to affordable information	
Have access	82.4
No access	17.6
Sources of information	

Neighbors	9.8
Extension workers	31.4
NGO field workers	2.0
Education institution	27.5
Media	23.5

Awareness about the new technologies at various stages of postharvest handling

Shelling technologies

Findings about awareness of the shelling technologies is presented in table 4 as shown below. From table 3 it has been found that 45farmers (88.2%) out of 50 respondents are aware of the manual maize shellers and 74.5 % (38 respondents) are aware of engine powered Sheller and this has an influence on the use of these technologies.

Table 6: Awareness of the shelling technologies

Responses	**Percentage (%)**
Shelling technologies	
Manual maize Sheller	
Aware	88.2
Not aware	11.8
Engine powered shellers	
Aware	74.5
Not aware	25.5

Table 7 shows the effect of shelling technology on post harvest handling using the chi-square test

CHI-SQUARE	t-computed	t-tabulated
Sigma squared	1.675	0.00

Since t-computed (1.675) is greater than t-tabulated (0.00), we reject the null hypothesis and conclude that shelling technology had a significant effect on post harvest handling.

Drying technologies

Various improved and efficient drying technologies have been developed in order to improve the quality of maize grains. From the study it was discovered that majority (80.4%) equaling to 41 respondents out of 50 respondents are not aware of the mechanical, electric and solar driers.it was further discovered that farmers are only aware of sun drying maize spread on tarpaulins and concrete slabs as a new technology.

Table 8 shows the effect of drying technology on post harvest handling using the chi-square test

CHI-SQUARE	t-computed	t-tabulated
Sigma squared	2.054	0.067

Since t-computed (2.054) is greater than t-tabulated (0.067), we reject the null hypothesis and conclude that drying technology had an insignificant effect on post harvest handling.

Processing technologies like milling and improved storage facilities

Table 5 below summarizes the results regarding the knowledge of improved processing technologies and improved storage facilities. It was discovered that the majority of respondents, or 45 out of 50 respondents, or 90.2%, are aware of processing technologies like

milling machines, whereas 56.9% of respondents were completely ignorant of improved storage facilities like airtight bags, silos, and improved maize cribs, which limits the use of these improved storage facilities.

Table 9: Awareness about processing technologies and improved storage facilities

Processing technologies like milling machines	**Percentage**
Aware	90.2
Not aware	9.8
Improved storage facilities	
Aware	43.1
Not aware	56.9

Adoption of new technologies used at various stages of post-harvest handling of maize

Improved Shelling and drying technologies

Table 6 below contains information about the use of new and improved shelling and drying technologies. It demonstrates that the majority of respondents (84.3%) utilize both manual and engine-powered maize dryers. In addition, it was found that most (70.6%) of the farmers, or 36 out of the 50 respondents, sun dry their maize spread on plastic tarps and concrete slabs, while 29.4% sun dry their produce spread on the ground. This has increased the risk of grain contamination and, as a result, increased post-harvest losses.

Table 10: Adoption of shelling and drying technologies.

Response	**Percentage (%)**
Shelling technologies	
Improved shelling technologies like maize shellers	84.3
Other means	15.7
Drying technologies	
Sun drying grain spread on tarpaulin and concrete	70.6
Mechanical, solar and electric drying technologies	29.4

Transportation and processing

Table 7 below shows how the sample farmers implemented newer technologies for processing and shipping. Table 7 shows that, of the 50 farmers questioned, 31 employ motorized vehicles, motorcycles, and tractors with trailers to transport their corn from the field to drying yards, corn collecting centers, and markets, whereas 37.3% of respondents use bicycles and head-carrying baskets. Out of the 50 respondents, 44 farmers, or 88.2%, process their maize into parquet and related goods like maize bran for animal feeding. This means that 44 farmers out of 50 use upgraded processing machines such milling machines.

amilling

Table 11: Adoption of improved transport and processing technologies like milling

Transportation	**Percentage**
Use of motor cycles, motor vehicles tractors mounted with trailers	62.7

Baskets carried on heads and bicycles	37.3
Processing technologies	
Improved processing technologies like use of milling machines	88.2
Traditional technologies like use of motor and pestle, grinding stones	11.8

Table 12 shows the effect of marital status on post harvest handling using the chi-square test

CHI-SQUARE	t-computed	t-tabulated
Sigma squared	1.980	0.034

Since t-computed (1.980) is greater than t-tabulated (0.034), we reject the null hypothesis and conclude that processing technology had a significant effect on post harvest handling.

Factors that enabled the use the technologies

Figure 1 below shows the results of the study's consideration of the variables that paved the way for new technologies to be adopted and deployed at various stages of handling maize after harvest. In the study, it was found that the majority (43.9%) of respondents said that these new technologies are highly sustainable and that they can be used for a long time. Additionally, 31.2% of the respondents, or 17 farmers out of 50, said that the cost of hiring them is affordable, and 24.9% said that they have lower risks than previous technologies, which has urged their use.

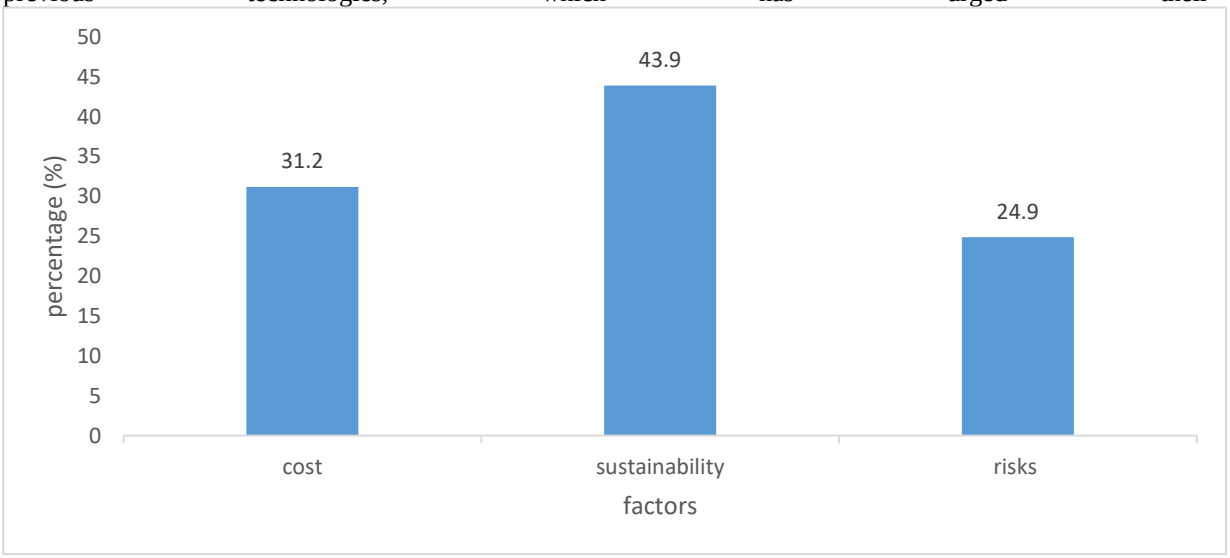

Figure 1: Factors that enabled the adoption of technologies.

Challenges of using these technologies

The study also took into account the challenges that come with utilizing these new technologies, and this is illustrated in figure 2 below. From the study, it was found that the majority (54%) of farmers, or 27 out of 50, reported that owning these technologies is too expensive because the initial cost is high and this makes them unsustainable to smaller holder farmers, limiting their use. The

study also discovered that 30% of the respondents have struggles using them because they require skills, and 16% of the respondents, or 8 out of 50, only use them every once in a while.

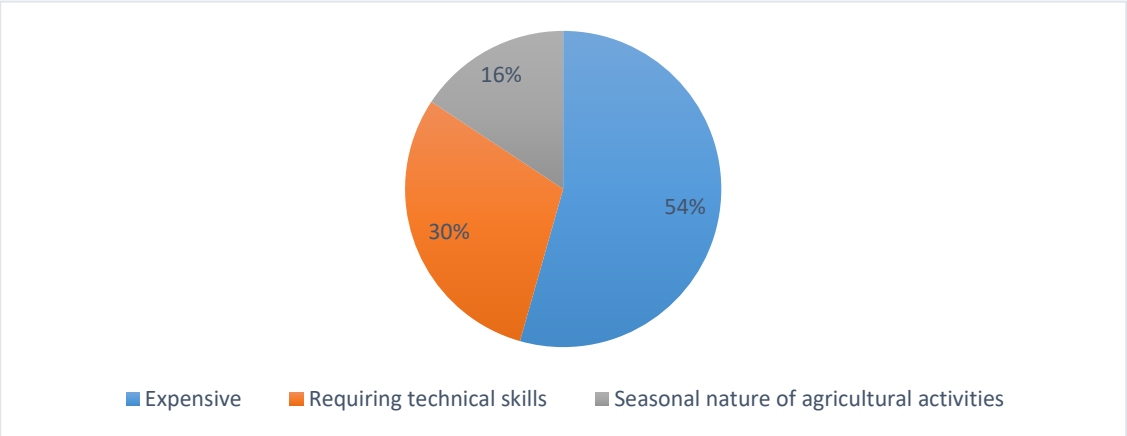

Figure 2: showing the challenges associated with using these technologies

easures to overcome the challenges

Quite apart from the challenges described above, the study also identified some strategies for overcoming them, which are shown in figure 3 below. Out of 50 respondents, 21 were farmers, making up the majority (40.56%), who suggested that incentives for these technologies could reduce their overall cost and thereby address the issue of their high cost. Additionally, 21.74% of respondents said that training farmers could give them the skills necessary to use some technologies.

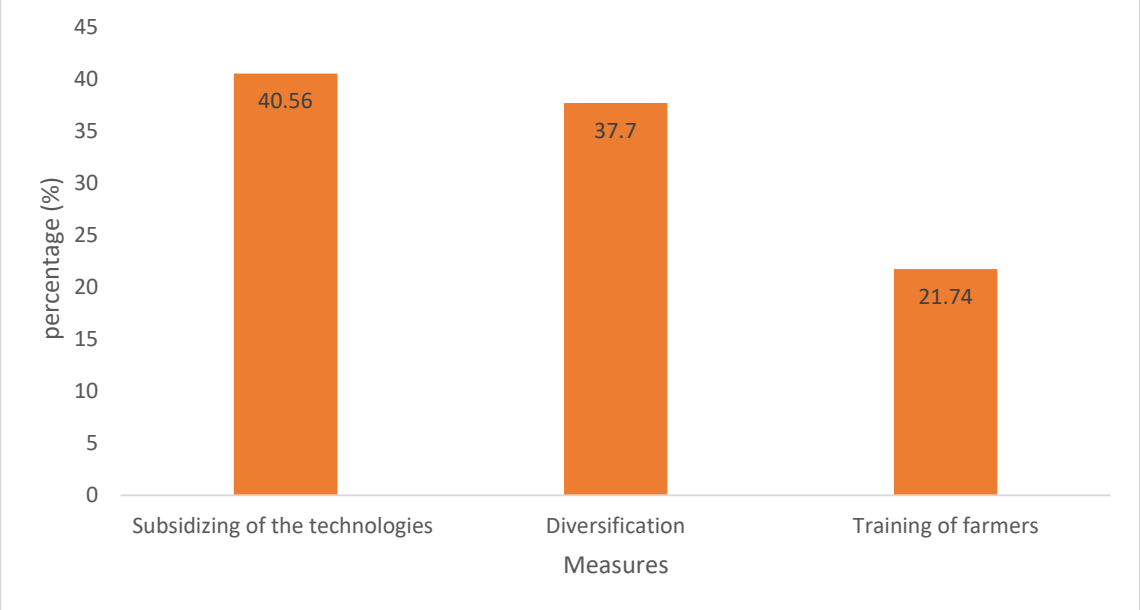

Figure 3: showing measures to overcome the faced challenges

Conclusion

It is now evident from the successfully meet that farmers are aware of some new technologies used during post-harvest handling of maize, such as shelling technologies like the use of both manual and engine powered Shellers, processing technologies like milling machines that convert maize grains into floor, and other related by products like maize bran for animal feeding. The study shows that farmers have access to knowledge about these new technologies through extension workers, local media, such as radio stations that air farming programs at least once a week and raise smallholder farmers' awareness of these new technologies.

The study makes it clear that farmers have adopted these new technologies at various stages of post-harvest handling for mainly during shelling and processing. During drying most farmers depend on natural sun and atmospheric air to dry their produce spread on tarpaulin and concrete slabs, farmers have not adopted improved storage facilities and this makes them to sell their produce very early at a lower price and this has greatly contributed to high post-harvest losses. An

The study continues to show that farmers face a number of challenges when utilizing these new technologies, such as their high cost, particularly when trying to purchase personal technologies, their need for technical expertise to use them, and the seasonal nature of agricultural activities, which makes them free when it's not in season.

Recommendations

1) Government can subsidize post-harvest technologies such that the final price can be low thus enabling farmers to own personal technologies.
2) Farmers can form cooperative groups so that they save money and accumulate savings/money to purchase these technologies.
3) Government can launch and implement awareness campaigns about these technologies so that farmers can be informed about these technologies.
4) Other researchers can find out the influence of media on awareness and adoption of the new technologies used during post-harvest handling of maize.

REFERENCES

Aulakh J, Regmi A (2013). Post-harvest food losses estimation development of consistent methodology. Scientific Review Committee of the Food and Agricultural Organization of the UN

Basavaraja H, Mahayanistic SB, Udagatti NC. Economic Analysis of Post-harvest Losses in Food Grains in India: A Case Study of Karnataka. Agricultural Economics Research Review 20(June):117-126 (2007)
UBOS (2018) Annual agriculture survey

UBOS 2008/2009 Uganda census of Agriculture

UBOS Uganda national households Census 2014
MAAIF 2013 Maize training manual for extension workers in Uganda.

Christopher Mutungi Dan, Adebayo Abass (2019) Physical Quality of Maize grain harvested and stored by smallholder farmers in the Northern highlands of Tanzania

Hodges R, Bernard M, Felix R. (2014) APHLIS – Postharvest cereal losses in Sub-Saharan Africa, their estimation, assessment and reduction. https://doi.org/10.2788/19582
Asea, G., Serumaga, J., Mduruma, Z., Kimenye, L., Odeke, M., (2014). *Quality protein maize production and post-harvest handling manual,* Association for Strengthening Agricultural Research in East and Central Africa (ASARECA).

APHLIS. (2013). *The African post-harvest losses information system. How to assess post-harvest cereal losses and their effects on grain supply*. European Commission Joint Research Centre, Institute for Environment and Sustainability

ACDI /VOCA. (2010).*Maize Handbook*. ACDI VOCA- Kenya Maize Development Programme

. FAO. (2013). *Food security indicators*

. PMA. (2009). Maize Value Chain Study in Busoga Sub-region. Plan for Modernization of Agriculture (PMA) Secretariat. Kampala, Uganda.

Private Sector Foundation Uganda. (2005); Identifying improvement opportunities and diagnosing prospects for Uganda maize Foodnet 2004. Back ground information on Masindi, Hoima and Kabarole districts