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# Assessment of the Availability and Accessibility to Improved Cassava Varieties by Smallholder Farmers in Siaya County, Kenya

**Dorine Anyango*; Darius Andika and Matilda Ouma**
School of Agricultural and Food Sciences,
Jaramogi Oginga Odinga University of Science and Technology,
P. O. Box 210-40601, Bondo, Kenya.

**Abstract:- Cassava is significantly important as a staple food in numerous sub-Saharan regions. It is the third most vital calorie source and the second most crucial tuber crop. Cassava is capable of withstanding difficult growing conditions thus a suitable climate smart crop for arid and semi-arid areas. Globally, Nigeria produces the highest amount of cassava. In Kenya production stands at 1 million metric tons against a potential of 3 million metric tons annually. Western region contributes 60% of total Kenyan cassava. Unlike other staple food crops with a well-structured formal seed system, cassava with an informal seed system experiences several challenges including lack of access to improved varieties. A cross sectional research design was used with purposive sampling. Data was collected using a semi-structured questionnaire on a face to face interview. A total of 72 smallholder cassava farmers were selected using Cochran's formula. Chi-square test, logistics regression and Spearman's correlation were used to analyze the data, with the help of SPSS version 20. The results showed that 72.2% of the smallholder farmers had access to improved cassava varieties. Significant differences were observed between socio-demographic factors (age, education level, household head, marital status, total land size, land ownership, household head occupation, credit access, farmer group and training) on access to improved cassava varieties. However, seeds were of low quality and unclean as they were borrowed from fellow farmers. The recommendation is to discourage over dependence on free seed and sensitize farmers on the importance of purchasing high quality seed.**

***Keywords:-*** *Informal Seed System, Seed Quality, Seed Accessibility, Seed Affordability and Smallholder Farmers.*

## I. INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is an essential staple food crop in many Sub- Saharan communities where it plays a vital role in promoting food security. Cassava is the second most important tuber crop after irish potatoes the third most important source of calories, after rice and corn (Githunguri et al., 2013). Cassava is one of the most efficient producers of carbohydrates and energy among all food crops. Cassava has the ability to withstand difficult growing conditions (Nassar *et al.*, 2009).

Cassava production in Kenya stands at 1 million metric tons (Githunguri *et al.*, 2013) against a potential of 3 million metric tons. The Western region contributes 60% of the total Kenyan cassava (Githunguri *et al.*, 2017) . Other staple food crops like maize have a well-organized formal seed system. Cassava with an informal seed system experiences several challenges including unavailability of improved varieties (Casinga *et al.*, 2022) which hinder productivity hence increased food insecurity.

Many studies on cassava have concentrated more on the use of advanced technology to breed high yielding and disease resistant cassava varieties with little effort on sustainable delivery of healthy planting materials to framers (Souza *et al.*, 2018); (Efferth, 2019).

## II. MATERIALS AND METHODS

The study was conducted in Alego-Usonga Sub-County of Siaya County situated in Western Kenya. Alego Usonga Sub County has a surface area of 703.9km ² out of which 478 sq.km is arable cultivatable land while 120.3sq.km is non-arable land. Siaya was since it's one of the counties in Kenya plagued by seasonal food insecurity (Rarieya and Fortun, 2010). Further, there are arid and semi-arid regions in Siaya that have a lot of potential for cassava production (Siaya county development profile, 2013-2017).

- *Data Collection and Analysis*

A cross-sectional design was used to select respondents. A four stage sampling approach was used to select households growing cassava in Alego Usonga Sub-County. 8 sub-locations from Central and West Alego wards were identified. Cochran's formula was used to select 72 households and a semi-structured questionnaire administered.

Descriptive statistics was used to summarize data while Chi-square, logistic regression and Spearman correlation were used for analysis. Statistical Package for Social Scientists (SPSS) Version 20 was used. Thematic analysis was used to analyses the major themes from the qualitative data.

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## III. RESULTS AND DISCUSSIONS

### A. General Social Demographic Characteristics of Smallholder Cassava Farmers.

➢ *Gender of Respondents.*

Majority, 53 (73.6%) were women and 19 (26.4%) were men (Table 1). This suggests that women predominated in the cassava production industry. The results are consistent with those of (Hoa et al., 2023); (Awuor et al., 2021); (Lagat & Maina, 2017) and (Awotona et al., 2020) who noted that women predominate in cassava production, processing and selling.

➢ *Age of Respondents.*

Majority (45.8%) were aged between 34-54 years, 19.4% between 19-34 years while 34.7% were above 54 years. This implied that most farmers who engaged in cassava production were energetic individuals who had the ability to carry out the various farm operations required. This finding is similar to (Masamha et al., 2019); (OGUNJOBI et al., n.d.); (Fakoya et al., 2010).

**Table 1. Socio-Demographic Characteristics of Cassava Farmers in Alego-Usonga Sub-County.**

| Variables | Total N (%) | Female n (%) | Male n (%) | Sig (p-value) |
|---|---|---|---|---|
| **Number of respondents (N= 72)** | **72 (100)** | **53 (73.6)** | **19 (26.4)** | |
| **Age (years)** | | | | 0.001 |
| 19-35 | 14(19.4) | 14(26.4) | 0(0) | |
| 36-54 | 33(45.8) | 33(62.3) | 0(0) | |
| >54 | 25(34.7) | 6(11.3) | 19(100) | |
| **Education level** | | | | 0.001 |
| Primary | 54(75) | 53(100) | 1(5.3) | |
| Secondary | 16(22.2) | 0(0) | 16(84.2) | |
| Tertiary. | 2(2.8) | 0(0) | 2(10.5) | |
| **Household head** | | | | 0.01 |
| Female | 22(30.6) | 22(41.5) | 0(0) | |
| Male | 50(69.4) | 31(58.5) | 19(100) | |
| **Marital status** | | | | 0.01 |
| Married | 50(69.4) | 31(58.5) | 19(100) | |
| Widowed | 22(30.6) | 22(41.5) | 0(0) | |
| **Land size(acres)** | | | | 0.01 |
| <1 | 8(11.1) | 0(0) | 8(42.1) | |
| 1-2 | 40(55.6) | 40(75.5) | 0(0) | |
| >2 | 24(33.3) | 13(24.5) | 11(57.9) | |
| **Land under cassava acres** | | | | 0.32* |
| <1 | 67(93.1) | 48(90.1) | 19(100) | |
| 2-3 | 5(6.9) | 5(9.4) | 0(0) | |
| **Household head occupation** | | | | 0.01 |
| Farming | 56(77.8) | 53(100) | 3(15.8) | |
| Off –farm business | 11(15.3) | 0(0) | 11(57.9) | |
| White collar job | 5(6.9) | 0(0) | 5(26.3) | |
| **Household size** | | | | 0.01 |
| <3 | 12(16.7) | 0(0) | 12(63.2) | |
| 3-5 | 42(58.3) | 42(79.2) | 0(0) | |
| >5 | 18(25) | 11(20.8) | 7(36.8) | |

➢ *Education Level of Respondents.*

From the study, no female progressed beyond primary school, although over 84% of males completed secondary education and beyond. This difference is supported by the cross tabulation results (Table 1) that showed a significant (P≤0.05) difference between education level and gender of the respondents. Males were more educated compared to females. This supported a research by (Masamha et al., 2019) that found men to be more educated than women.

➢ *Marital Status and Household Heads Of Respondents.*

Most (69.4%) of the respondents were married coming mainly from male headed households while 30.6 % of the households were female headed mainly by widows. From the cross tabulation results, significant (P≤0.05) differences were observed between gender of household head and marital status (Table 1). These findings corroborate those of (Masamha et al., 2019) which found that married families made up the majority of those involved in cassava production.

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➢ *Household Size of Respondents.*

Majority (58.3%) of the total households had 3-5 members, 25% had above 5 members while 16.7% had below 3 members (Table 1). Results of cross tabulation showed significant (P≤0.05) relationship with gender of the respondents. This is consistent with the Kenya Population and Housing Census (PHC) 2019 that the average household size in Siaya County has roughly 4.5 people.

➢ *Total Land Area and Land Under Cassava.*

Most (75.5%) of the female respondents had a total land area of 1-2 acres while the remaining 24.5% had above 2 acres. Majority of the males (57.9%) had land above 2 acres while the remaining 42.1% had less than 1 acre (Table 1). Results of cross tabulation showed (P≤0.05) significant differences between total land area and gender of the respondents. Males had larger land sizes compared to females. This is because males are entitled to land ownership through inheritance while the females own land through their spouses (Awuor et al., 2021).

However, no significant (P≥0.05) differences was observed between the males and females in terms of land under cassava.

➢ *Household Head Main Occupation Of The Respondents.*

All the female respondents reported farming as their main occupation. Majority of the males (57.9%) had off-farm businesses, 26.3% white collar jobs and only 15.8% had farming as their main occupation. Cross tabulation showed significant differences (P≤0.05) between the male and female respondents (Table 1) implying that most females had farming as their main occupation unlike the males. This supports a study by (Masamha et al., 2019), that female heads of households particularly the widows depended on cassava farming as their main source of livelihood.

*B. Thematic Analysis on Production of Cassava by Smallholder Farmers.*

➢ *Cassava Varieties Grown.*

Farmers in the study area were cultivating different cassava varieties ranging from improved to local, mostly as mixed crop in early phases of growth and then as a solitary crop stands later on. This supports a National Policy on Cassava Industry report from 2005 that found that cassava is mainly grown by smallholders in mixed cropping with many other crops, and lately in sole crop stands.

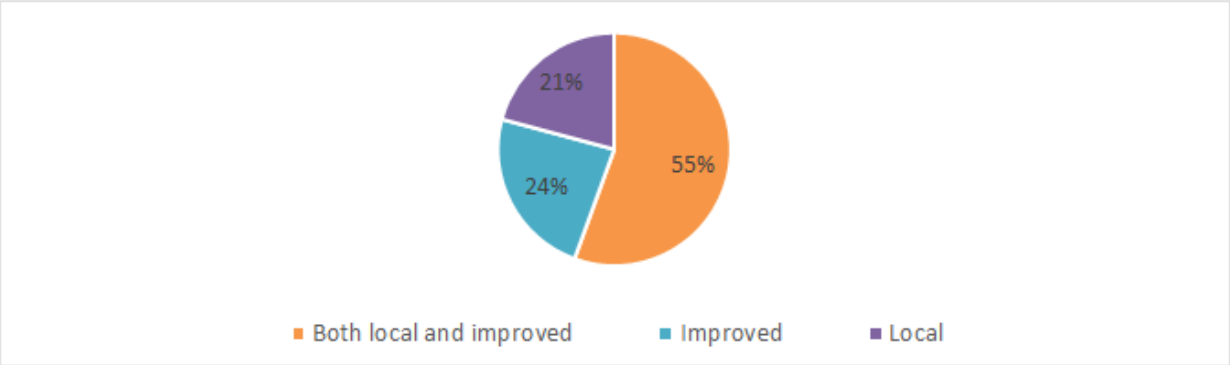


**Fig 1: Cassava Varieties Grown by the Smallholder Farmers.**

Most farmers (55%) were growing a mixture of local and improved varieties while 24% and 21% grew purely improved and local varieties respectively (Figure 1). Majority of the farmers (56.14 %) could not tell the names of the improved varieties they were growing except for features like the color of leaves and stem and the maturity period of the varieties.

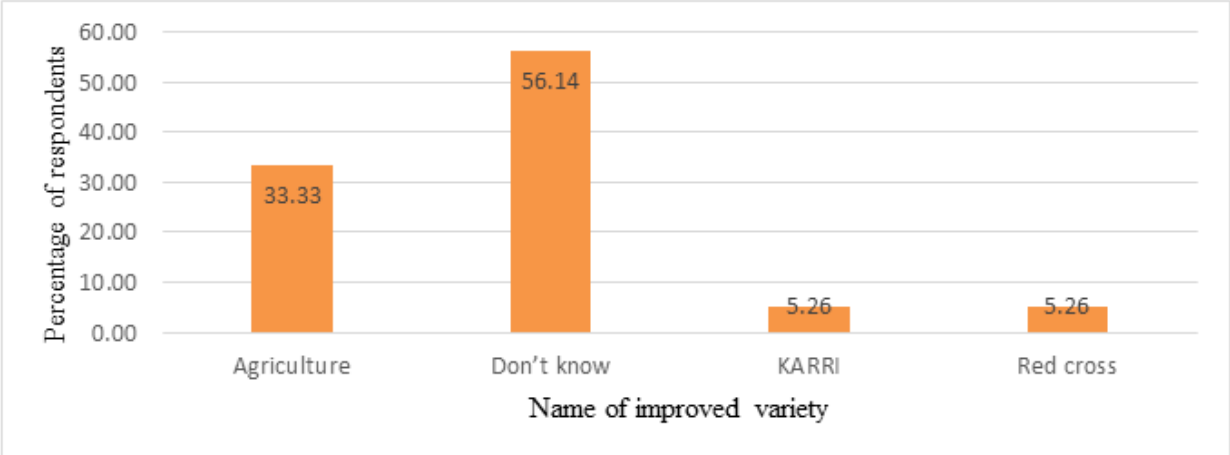


**Fig 2: Names of Improved Cassava Varieties as Told by Farmers.**

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Some (33.33%) of farmers called them "Agriculture", (5.26%) as KARI with another (5.26%) referred to them as Red Cross, some of which represented the names of the organizations that provided the seeds (Figure 2). According to a study by (J. Bentley et al., 2017) local farmers referred to most of the improved varieties as "Agric" because the varieties were released with long and difficult to remember serial numbers instead of names.

Farmers preferred most of the varieties they were growing because of various reasons including easy access to planting materials, sweet taste, early maturity and high yields (Figure 3). The results align with prior research findings by (J. Bentley et al., 2017) which indicated that farmers made judgments about which varieties to plant based on preferences related to disease tolerance, early maturity, high yields and taste.

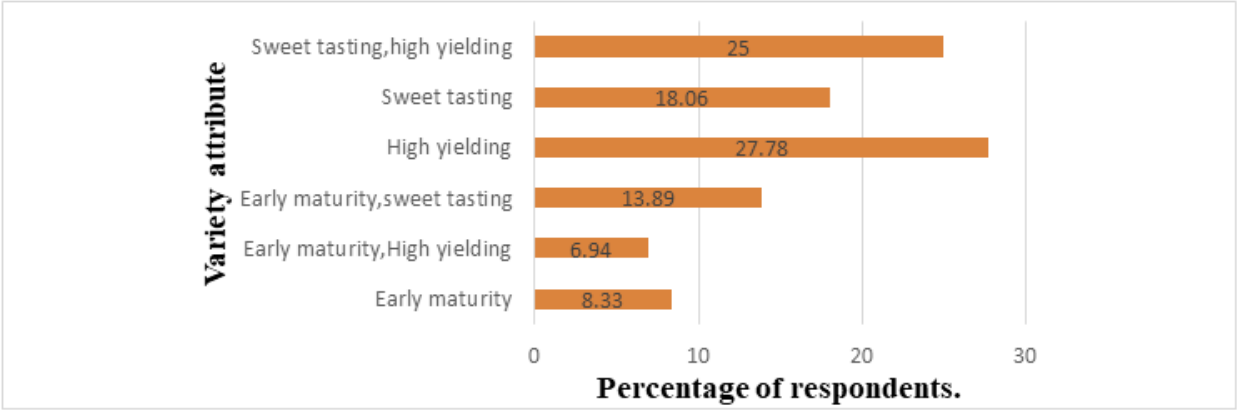


**Fig 3: Farmers Preferred Cassava Variety Attributes.**

Due to increased susceptibility to pests and diseases, long maturity period and the introduction of improved varieties, the cultivation of local varieties diminished (Nakabonge et al., 2018); (Osewe et al., 2021a).

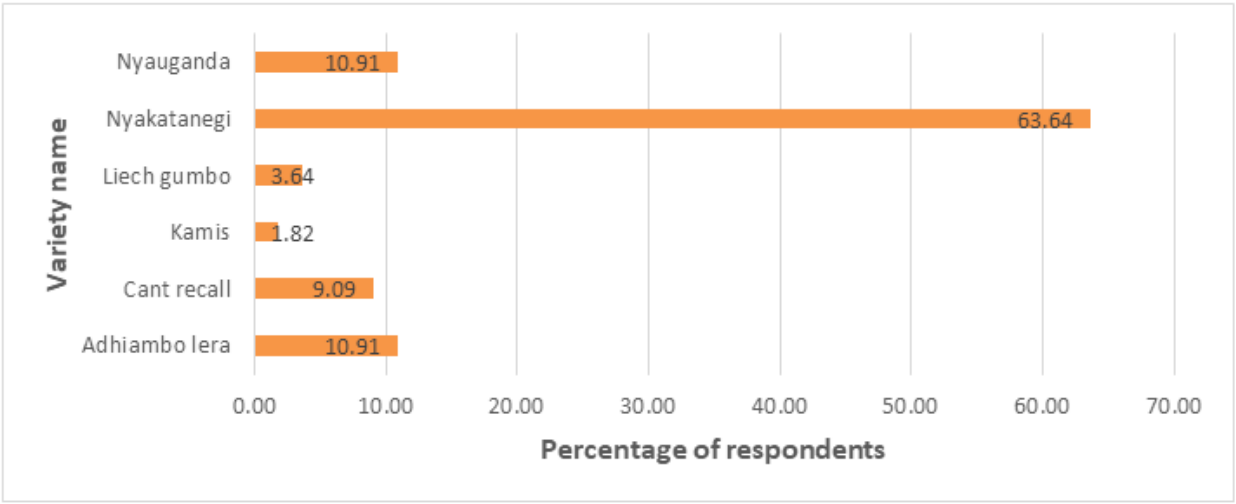


**Fig 3: Names of Local Cassava Varieties Grown by Farmers.**

Local varieties grown included Nyakatanegi (63.4%), Nya Uganda (10.91%), Liech Gumbo (3.64%), Adhiambo Lera (10.91%) and Kamis (1.82%) as shown in Figure 6. Unlike the improved varieties whose names farmers couldn't tell, most farmers (90.91%) could correctly identify the names of the local varieties they were growing except for a few (9.09%) who could not.

Farmers reported that their main reason for growing the local varieties were high yields (Nyakatanegi and Nya Uganda), inadequate access to improved varieties and bitter taste. The bitterness was an important attribute as it allowed farmers to keep their cassava on the farm for extended periods of time without fear of theft. According to studies by (Nakabonge et al., 2018); (Akintunde & Obayelu, 2016) and (Mtunguja et al., 2019a), farmers tend to hold on to some indigenous cultivars due to their high yield and bitter taste ,which deters thieves and is therefore beneficial for food security.

- *Farmer's Source of Seed and Seed Acquisition.*

From the study, (72.2%) of the farmers had planted improved cassava varieties which they acquired through borrowing from fellow farmers. This implied that the improved varieties were available and accessible to most farmers. A similar study by (J. Bentley et al., 2017) on

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"Cassava farmers preference for varieties and seed dissemination system in Nigeria" found that more than 75% of farmers had access to improved varieties. Another study on "Characterizing cassava farmer typologies and their seed sourcing practices to explore opportunities for economically sustainable seed business models in Rwanda" also found that majority of the farmers (85%) grew one or more improved varieties with 67% acquiring borrowing the seeds from fellow farmers(Kilwinger et al., 2021).

Farmers over-reliance on local cassava varieties and informal seed sources of low quality has for a long time contributed to and exacerbated the spread and impact of cassava viral diseases (Alicai et al., 2007); (J. P. Legg & Fauquet, 2004); (Tumwegamire et al., 2018); (Kilwinger et al., 2021) resulting in decreased productivity (Onyango, 2019); (Patil et al., 2015) and food insecurity.

Timely access to high quality, adequate supplies of low – cost seed is critical for reducing disease outbreaks and increasing food and nutrition security (Kerr & Patel, 2014); (Parmar et al., 2017); (McGuire & Sperling, n.d.). It is therefore crucial to make available improved varieties that are clean and resistant to diseases (Night et al., 2011).

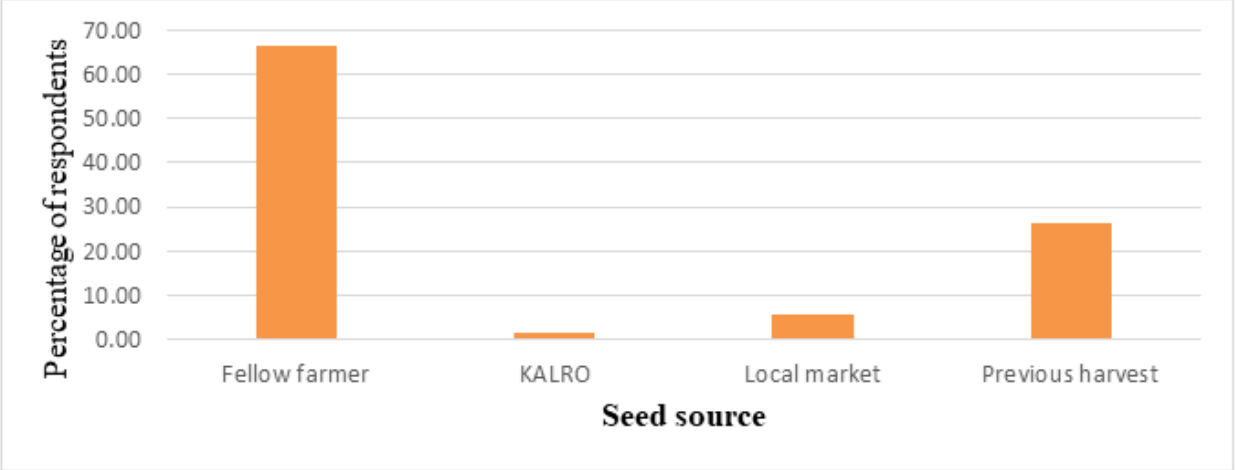


**Fig 4: Farmers Sources of Cassava Seed.**

Nevertheless, majority (98.61%) accessed the improved varieties via informal channels mainly through borrowing of few stems from fellow farmers and farm saved seed with only a few (1.39%) making a one-time cash investment in seed to acquire an improved variety (Figure 4) .This is consistent with the findings of (Kilwinger et al., 2021), which revealed that, while the varieties grown by farmers were improved, access to them was through informal channels, resulting in inadequate low quality seed that were prone to pests and diseases.

Practically over 98% of farmers reported to have no idea where they could obtain the improved varieties other than borrowing (Figure 5).

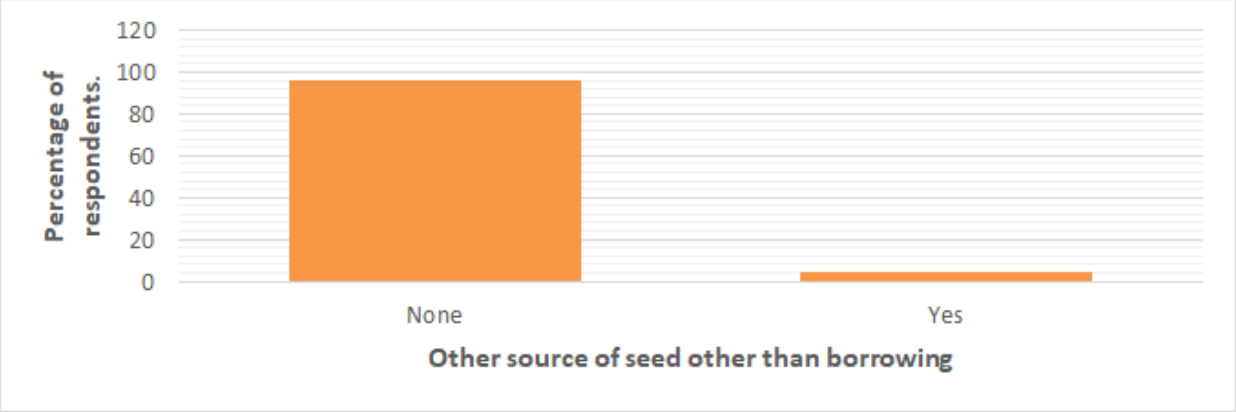


**Fig 5: Awareness on Other Sources of Improved Varieties Other than Borrowing.**

➢ *Challenges Faced by Smallholder Cassava Farmers in Alego-Usonga Sub-County.*

Cassava farmers reported a number of challenges including inadequate supply of quality improved varieties (36.1%), inadequate land (15.2%) inadequate labour (12.5%), low yields (12.5%) and high incidence of pests and diseases (23.7%) especially the cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) (Figure 6).

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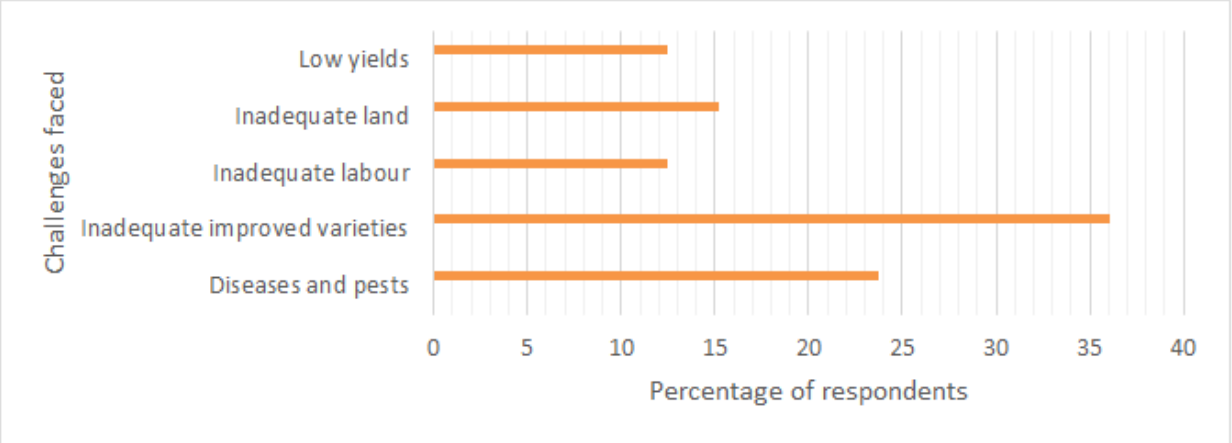


**Fig 6: Challenges Faced by the Smallholder Cassava Farmers.**

Majority (37.5%) of the farmers were not able to identify disease symptoms in their cassava plants. Others were able to tell when their cassava were infested with pests and diseases through symptoms like yellowing of leaves (6.9%), rotten tubers (5.6%), tunnels made by moles (8.3%), curled leaves (26.5%), flies on the leaves (8.3%) and drying of the leaves at the tip (6.9%) as shown in Figure 10. However, none of the farmers could tell the exact name of the disease. In as much the farmers could not tell the exact names of the diseases.

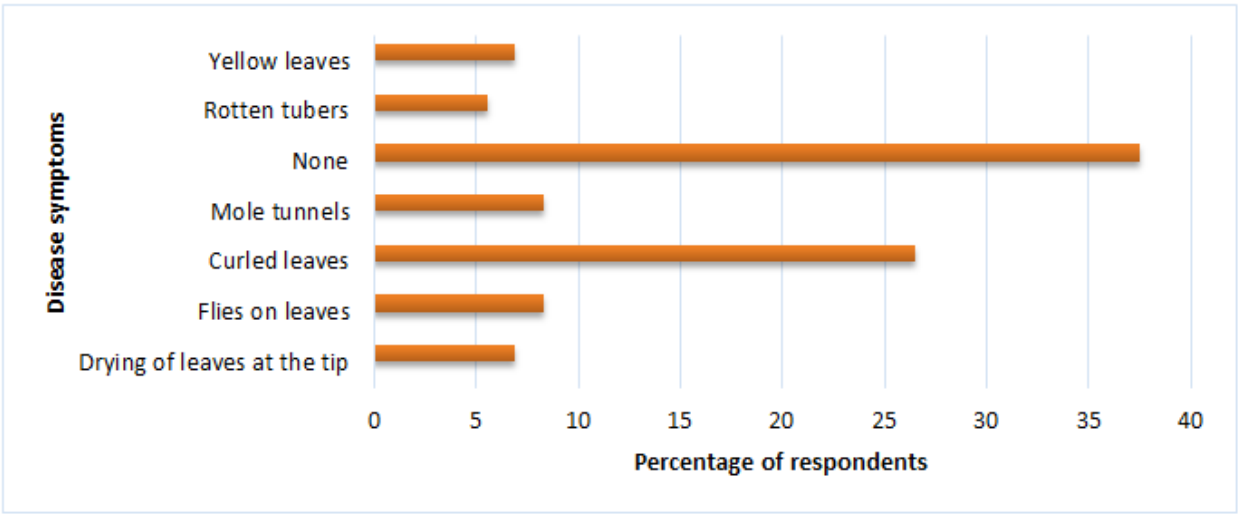


**Fig 7: Disease Symptoms as Identified by the Smallholder Farmers.**

The practices farmers used to control the disease were mainly rogueing (27.8%) and crop rotation (16.6%). Majority (55.6%) had never controlled diseases in their farms (Figure 7). None of the farmers considered use of chemical or sourcing new quality seed as a way to combat the diseases. This therefore shows that in as much as the improved varieties were accessible to most farmers, the seeds were of low quality as envisaged by the disease symptoms (Kilwinger et al., 2021).

*C. Factors Influencing Access to Improved Cassava Varieties by Small Holder Farmers in Alego-Usonga Sub-County.*

➢ *Age and Access to Improved Cassava Varieties.*

Among the 52 respondents who had access to improved varieties, majority (51.9%) were between the ages of 36 and 54, with the remaining (48.1%) being above the age of 54. For the farmers who had no access to improved varieties, (70%) were under the age of 35, while (30%) were between the ages of 36 and 54 (Table 2). No respondent over the age of 54 lacked access to improved varieties. Chi-square results revealed a significant ($P \leq 0.05$) difference between age and access to improved varieties.

Farmers above 35 years of age had more access to improved cassava varieties than those below the age of 35.

A study by (Olupona & Kehinde, 2022) holds that increase in age increases years of farming experience ; as a result such farmers possess information and knowledge that aids in access improved varieties that have a multitude of advantageous features.

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**Table 2. A Chi-Square Test on Access to Improved Cassava Varieties.**

| Independent Variable | Total N (%) | Lack Access | Have Access | Chi-Square | P-Value |
|---|---|---|---|---|---|
| **Age** | **72(100)** | **20(27.8)** | **52(72.2)** | | |
| 19-35 | 14(19.4) | 14(70) | 0(0) | 47.530 | 0.01 |
| 36-54 | 33(45.8) | 6(30) | 27(51.9) | | |
| >54 | 25(34.7) | 0(0) | 25(48.1) | | |
| **Level of education** | | | | 9.231 | 0.01 |
| Primary | 54(75) | 20(100) | 34(65) | | |
| Secondary | 16(22) | 0(0) | 16(31) | | |
| Tertiary | 2(3) | 0(0) | 2(4) | | |
| **Household head** | | | | 62.937 | 0.01 |
| Female | 22(31) | 20(100) | 2(4) | | |
| Male | 50(69) | 0(0) | 50(96) | | |
| **Household head occupation** | | | | 7.912 | 0.02 |
| Farming | 56(78) | 20(100) | 36(69) | | |
| Off farm business | 11(15) | 0(0) | 11(21) | | |
| White collar job | 5(7) | 0(0) | 5(10) | | |
| **Total land area (acres)** | | | | 13.970 | 0.01 |
| <1 | 8(11) | 0(0) | 8(15) | | |
| 1-2 | 40(56) | 20(100) | 20(38) | | |
| >2 | 24(33) | 0(0) | 24(46) | | |
| **Access to credit** | | | | 4.467 | 0.04 |
| Yes | 10(14) | 0(0) | 10(19) | | |
| No | 62(86) | 20(100) | 42(81) | | |
| **Belong to farmers group** | | | | 9.927 | 0.01 |
| Yes | 19(26) | 0(0) | 19(37) | | |
| No | 53(74) | 20(100) | 33(63) | | |
| **Attended training** | | | | 3.956 | 0.05 |
| Yes | 9(13) | 0(0) | 9(17) | | |
| No | 63(87) | 20(100) | 43(83) | | |

- *Level of Education and Access to Improved Cassava Varieties.*

Most (65%) of the respondents with access to improved varieties had up to primary education, with the remaining (31%) having gone up to secondary school and only (4%) had tertiary education. None of the responders who lacked access progressed beyond primary. Table 2 shows significant (P≤0.05) differences between education level and access to improved varieties.

Farmers with access to improved varieties had a higher level of education than those without access. Education provides farmers with the knowledge they need to understand the advantages of improved varieties. The findings are consistent with those of (P. P. Acheampong et al., 2022), who found that educated farmers were more likely to understand and make informed decisions regarding an innovation due to their ability to investigate and appraise relevant facts.

- *Household Head and Access to Improved Cassava Varieties.*

All the 96% of households with access to improved varieties were male headed whereas female heads made up only 4 %. All the households without access to improved varieties were female headed (Table 2). Chi-square test results showed that access to improved varieties differed significantly (P≤ 0.05) with gender of the household head, with male headed households having greater access than female headed households.

A study by (Ssajjabbi et al., 2023) found that adopting improved cassava varieties rose when the household head was male attributed to availability of complementary inputs such as land and labour (P. Acheampong & Owusu, 2015).

- *Household Head Occupation and Access to Improved Cassava Varieties.*

As demonstrated in Table 2, the majority of respondents (69.2%) with access to improved varieties had farming as their main occupation, with 21% active in off-farm businesses and 5% working in white collar jobs. None of those who lacked access had an off-farm business or a white collar job as their primary occupation. The chi-square test results demonstrated a significant (P≤0.05) difference between household head occupation and access to improved varieties.

Farming as a primary occupation provided more access to improved varieties. This is consistent with findings by (Lagat & Maina, 2017); (Faturoti et al., 2006) that households that depend on farming as a major occupation had more years of experience and are flexible to acquire new technologies like improved seed.

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- *Total Land Area and Access to Improved Cassava Varieties.*

Most farmers (46.2%) who had access to improved varieties had land larger than 2 acres, 38% had between 1- 2 acres, and 15% had less than one acre. None of those who lacked access possessed more than two acres. Chi-square test results on Table 2 displayed significant difference (P≤0.05) between total land area and accessibility to improved cassava varieties.

Farmers with larger acreage had better access to improved varieties than. Because improved varieties are high yielding, farmers with larger plots of land are more inclined to plant them because the returns are high in relation to the labor required (Nderitu, 2020).

- *Credit Availability and Access to Improved Cassava Varieties.*

Most (81%) of responders with access to improved varieties lacked access to credit, whereas only 19% did. On the other hand, all respondents who lacked access to improved varieties had never taken any credit (Table 2). Significant differences (P≤0.05) existed between access to credit and access to improved varieties.

Although the majority of farmers obtained their seeds at no cost by borrowing, those with credit had greater access to improved varieties. Research by (Nderitu, 2020) confirms that having credit makes improved varieties more accessible since it makes it more affordable. The majority of farmers in the research area obtained credit mainly through 'chamas'. Furthermore, the agriculture industry has limited access to commercial lending institutions as most banks are hesitant to offer loans based on agriculture because of the perceived dangers involved (Afolami et al., 2015).

- *Farmer Group and Access to Improved Cassava Varieties.*

Only 37% of those who had access to improved varieties belonged to farmer groups while the majority (63%) did not belong to any farmer group. None of those who lacked access belonged to any farmer group (Table 2). Being a member of a farmer organization and having access to improved varieties differed significantly (P≤0.05).

Access was greater for those who belonged to farmer groups than those who didn't. Despite the fact that these groups saw themselves as farmer groups, only a few were involved in farming operations. The rest primarily participated in table banking, saving, and borrowing, which explains why they had minimal effect over access to improved varieties.

Through groups, farmers can obtain information about the source of the improved varieties. This supports the research by (Nderitu, 2020), which found that when farmers come together, they tend to make decisions as a group and have a tendency to persuade one another to adopt particular agricultural methods, such as improved seed, which results in more access.

- *Training And Access To Improved Cassava Varieties.*

Majority (83%) of farmers who had access to improved varieties had not received any training on cassava production, whereas all (100%) of those who lacked access had received no cassava production training. Only 17% of farmers who had access to improved varieties had been trained on cassava production. Chi- square test found significant difference (P≤0.05) between training and accessibility to improved varieties (Table 2).

More improved varieties were available to people who received training on cassava production than to those who did not. According to a study conducted by (Kessy, 2005), training motivates farmers to engage in a particular practice as they acquire the expertise and know-how.

- *Socio-Demographic And Economic Characteristics That Influence Farmers Access To Improved Varieties.*

To further delineate the differences in socio-demographic and economic and institutional characteristics that may have influenced farmers access to improved varieties, conditional logistic regression, based on either having access to improved varieties or not was used to estimate univariate odds ratios (ORs) for each characteristic.

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**Table 3: Univariate Odds Ratio for Access to Improved Varieties.**

| Variables | Lack access n (%) | Have access n (%) | 95% Confidence Interval | | ODDS RATIO (OR) |
|---|---|---|---|---|---|
| | | | Lower | Upper | |
| **Farmers (N)** | **20(27.8)** | **52(72.2)** | | | |
| **Gender** | | | 0.505 | 0.768 | 0.623 |
| Male | 0(0) | 19(36.5) | | | |
| Female | 20(100) | 33(63.5) | | | |
| **Household head** | | | 0.024 | 0.341 | 0.091 |
| Male | 0(0) | 50(96.2) | | | |
| Female | 20(100) | 2(3.8) | | | |
| **Marital status** | | | 0.478 | 0.752 | 0.600 |
| Married | 20(100) | 30(57.7) | | | |
| Widowed | 0(0) | 22(42.3) | | | |
| **Tittle deed** | | | 6.930 | 105.197 | 27.000 |
| Yes | 2(10) | 52(100) | | | |
| No | 18(90) | 0(0) | | | |
| **Training** | | | 0.577 | 0.808 | 0.683 |
| Yes | 0(0) | 9(17.3) | | | |
| No | 20(100) | 43(82.7) | | | |
| **Farmer group** | | | 0.505 | 0.768 | 0.623 |
| Yes | 0(0) | 19(36.5) | | | |
| No | 20(100) | 33(63.5) | | | |
| **Credit** | | | 0.571 | 0.804 | 0.677 |
| Yes | 0(0) | 10(19.2) | | | |
| No | 20(100) | 42(80.8) | | | |
| **Farming method** | | | 0.393 | 0.699 | 0.524 |
| Mono crop | 0(0) | 30(57.7) | | | |
| Intercrop | 20(100) | 22(42.3) | | | |
| **Land under cassava** | | | 2.860 | 6.976 | 4.467 |
| <1 acre | 15(75) | 52(100) | | | |
| 2-3 acres | 5(25) | 0(0) | | | |

As shown in Table 3, there were no significant differences in socio-demographic factors (gender (OR = 0.623; 95% CI) = (0.505-0.768), P≥0.05, household head (OR = 0.091; 95% CI) = (0.024-0.341), P≥0.05, marital status (OR = 0.600; 95% CI) = (0.478-0.752), P≥0.05, training (OR = 0.683; 95% CI) = (0.577-0.808), P≥0.05, farmer group(OR = 0.623; 95% CI) = (0.505-0.768), P≥0.05, credit access (OR = 0.677; 95% CI) = (0.571-0.804), P≥0.05 and farming method (OR = 0.524; 95% CI) = (0.393-0.699), P≥0.05 between those who had access to improved varieties and those who lacked access.

➢ *Area Under Cassava and Access to Improved Varieties.*

All farmers who had access to improved varieties grew cassava on less than one acre of land, as opposed to those who planted on two to three acres. Table 3 shows that the difference in proportions was statistically significant (OR 4.467; 95% CI 2.860-6.976), P≤0.05.

This meant that people who planted cassava on less than one acre were more than 4.467 times, or 367.7%, more likely to have access to improved varieties than those who planted on 2-3 acres. This is because, in the research area, farmers who planted improved varieties reported borrowing only few stems from fellow farmers, which was insufficient for planting on a big piece of land.

According to (Owusu, 2015), while seed sharing is a traditional practice to encourage community solidarity, farmers who borrow cassava seeds often receive only a modest number, limiting the area that may be planted.

➢ *Tittle Deed and Access to Improved Varieties.*

All the farmers who had access to improved varieties had tittle deeds as opposed to those who lacked access to improved varieties. The difference in proportions were statistically significant (OR = 27.000; 95% CI) = (6.930-105.197), P≤0.05 (Table 3).

This study found that farmers who had title deeds were over 27 times more likely to gain access to improved varieties than those who did not. According to the FAO 2021, stable land tenure not only provides economic incentives but also creates social networks and institutional support, all of which contribute to increased agricultural productivity through better resource allocation and technology uptake.

➢ *Correlation Coefficient on Access to Improved Cassava Varieties.*

Pairwise correlations coefficients were described for strength and direction of association between the variables.

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**Table 4: Spearman Correlation Coefficient on Access to Improved Cassava Varieties.**

| Variable | Spearman correlation | p-value |
|---|---|---|
| Age | 0.709 | 0.000 |
| Education level | 0.357 | 0.002 |
| Credit access | 0.249 | 0.035 |
| Land under cassava | 0.440 | 0.000 |
| Household head | 0.935 | 0.000 |
| Farmer group | 0.371 | 0.001 |
| Training | 0.234 | 0.047 |
| Total land area | 0.537 | 0.000 |

There was a significant positive correlation between access to improved varieties and age $r_s(70) = 0.71, P \leq 0.01$, level of education $r_s(70) = 0.36$, $P \leq 0.05$, access to credit $r_s(70) = 0.25$, $P \leq 0.05$, land under cassava $r_s(70) = 0.44$, $P \leq 0.01$, household head $r_s(70) = 0.94$, $P \leq 0.01$, belonging to a farmer group $r_s(70) = 0.37$, $P \leq 0.01$, training $r_s(70) = 0.25$, $P \leq 0.05$ and land under cassava $r_s(70) = 0.54$, $P \leq 0.01$ (Table 4).

➢ *Relationship between Socio-Demographic and Institutional Factors and Access to Improved Varieties*

Logistic regression was carried out to assess the effect of age, level of education, household head, and training, belonging to a farmer group, having access to credit, total land area and land under cassava on the likelihood of having access to improved cassava varieties.

**Table 5: Logistics Regression on Accessibility to Improved Cassava Varieties.**

| Variable | B | SE | Wald | df | Sig | Exp (B) |
|---|---|---|---|---|---|---|
| Age | 19.472 | 9551.292 | 0.000 | 1 | 0.998 | 273681891.5 |
| Level of education | -0.085 | 53436.146 | 0.000 | 2 | 1.000 | 0.919 |
| Household head | 22.273 | 9223.463 | 0.000 | 1 | 1.000 | 4708654079 |
| Training | -0.664 | 44742.159 | 0.000 | 1 | 1.000 | 0.515 |
| Farmer group | 18.650 | 42539.797 | 0.000 | 1 | 0.998 | 125796756.8 |
| Access to credit | 0.000 | 42631.082 | 0.000 | 1 | 1.000 | 1.000 |
| Total land area | -0.748 | 13521.655 | 0.000 | 1 | 1.000 | 0.473 |
| Land under cassava | 0.677 | 20354.905 | 0.000 | 1 | 1.000 | 1.968 |

The overall model was statistically significant when compared to the null model ($x^2$) (9) = 76.084, P≤0.05, explained 94.1% of the variation of access (Nagelkerke$R^2$) and correctly predicted 97.2% of cases.

Age (P>0.05), education level (P>0.05), household head (P>0.05), training (P>0.05), belonging to a farmer group (P>0.05), having access to credit (P>0.05), total land area (P>0.05), and land under cassava (P>0.05) were insignificant. The odds of having access were 4708654079 (Table 5).

## IV. CONCLUSIONS AND RECOMMENDATIONS

*A. Conclusions*

- Majority (72.2%) of farmers had access to improved cassava varieties, the quantities were limited since it involved borrowing of few stems from neighbors. Also, the cutting were unclean and of low quality as evidenced by the disease symptoms.
- Different improved cassava varieties like MM96/2480, MH95/0183, MM06/0138, MM96/1642, Selina (MM96/4466) and Mygera (TMS 30572) were in existence. However, none of the farmers could tell the name of the varieties.

*B. Recommendations*

- Project partners and research organizations need to facilitate awareness campaigns to farmers on the importance of quality planting materials by providing information on seed degeneration accompanied by adequate data on yield differences and market prices to show farmers that investments in clean seed is profitable.
- Giving local names alongside the serial numbers to improved varieties to help farmer recall the names and avoid confusion between the different varieties and their attributes.

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