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# Adoption of bio fortified cassava varieties among cassava farmers in Ibadan/Ibarapa agricultural zone, Oyo state, Nigeria

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**Abstract -** Cassava (*Manihot esculenta)* is a staple crop found in the family of *Euphorbiaceae* that produces tapered edible roots. Those whose diets consist mostly of cassava (and cassava by-products) are potentially at risk of vitamin A deficiency, leading to efforts being intensified to develop and distribute vitamin-A-enriched cassava varieties across Nigeria through a process known as bio-fortification. Therefore, this research aims to describe the socio-economic characteristics of the respondents, identified the sources of information on bio – fortified cassava to the cassava farmers, examine the cassava farmers' level of knowledge on the attributes of bio –fortified cassava varieties, assess the constraints associated with adoption of bio – fortified cassava. The data for this research was collected using structured interview schedule. Multi-stage sampling technique was used to select 138 respondents (cassava farmers) from the study area. Descriptive statistical tools such as frequency counts, percentages, weighted mean score and ranking were used to analyse objectives of the study. Pearson Product Moment Correlation (PPMC) analysis was used to establish the relationship between socio economic characteristics of the respondents and the adoption of bio – fortified cassava varieties. The study found that radio (WMS = 1.71) was the major source of information ranked 1st. A large proportion of cassava farmers displayed a high knowledge that bio – fortified cassava is more nutritious than local cassava variety (WMS = 1.94) while the major constraints associated with adoption of bio-fortified cassava was high moisture content with WMS of 1.98. it could be concluded that most of the cassava farmers had low knowledge on the attributes of the bio – fortified cassava varieties. Thus, more awareness of the benefits and good attributes of biofortified cassava varieties be created among the cassava farmers.

**Keywords:** Adoption, knowledge, bio-fortified, cassava.

## INTRODUCTION

Cassava (*Manihot esculenta)* is a staple crop found in the family of *Euphorbiaceae* that produces tapered edible roots (Sahel, 2016). It is a hardy crop that is extremely adaptable to harsh weather conditions like drought and can grow well on soils of low fertility (Adeola, Ogunleye, and Bolarinwa, 2017). As the most important crop by production and second most important crop by consumption, the edible tuber is the most desirable product (Sahel, 2016). The tubers produced are consumed locally as traditional meals in different processed food forms like fufu, cassava flour, cassava chips and garri (Davidson, Ene-Obong and Chinma, 2017). It is also used industrially in the production of starch, confectionaries and adhesive materials. The significant role of cassava in poverty alleviation, food security and rural employment cannot be overemphasized. Cassava is a starchy crop which contributes to the staples of millions in sub-Saharan Africa (SSA). Otekunrin and Sawicka (2019) reported that about 177,948 million tonnes of cassava were produced in Africa. Nigeria is regarded as the world's largest producer of cassava with a total of about 20.4 percent of the world export in year 2017 (Otekunrin and Sawicka, 2019).

Bio-fortification is an innovative process of enhancing the micronutrient composition of food crops (Olatade et al., 2016; Saltzman et al., 2016). Since local staple foods dominate the food consumption of the rural poor, bio-fortification of such local staples serves as an effective micronutrient deficiencies reduction strategy (Glopan, 2015; Rao and Annadana, 2017). Nigeria currently has a high Vitamin A Deficiency (VAD) problem; over 20% of pregnant women and children under five years are reportedly vitamin A deficient (Aghaji et al., 2019; Ayinde and Adewumi, 2016). Furthermore, Nigeria has a high incidence of impaired vision such as night blindness and xerophthalmia linked to vitamin A deficiency (Ayinde and Adewumi, 2016; Aghaji et al., 2019). Poor diet is an important cause of vitamin A deficiency in Nigeria, where rural dwellers consume mostly local staple food crops with relatively low micronutrients. The objective of the study examine the cassava farmers' level of knowledge on the attributes of bio –fortified cassava varieties while the specific objectives were to; describe the socio-economic characteristics of the respondents, identified the sources of information on bio – fortified cassava to the cassava farmers, examine the cassava farmers' level of knowledge on the attributes of bio –fortified cassava varieties, assess the constraints associated with adoption of bio – fortified cassava. . The hypothesis stated that there is no significant relationship between socio-economic characteristics of the respondents and the adoption of bio – fortified cassava varieties.

## METHODOLOGY

The study was carried out in two Local Government Areas of Oyo State, specifically in Ido and Akinyele LGAs. Ido LGA has an area of 986km$^2$ and a population of 103,261 at the 2006 census. Ido was among the five in Ibadan district before it was

cancelled in 1956. Other four LGAs that were in existence at that time were Mapo, Akinyele, Ona Ara and Olode Olojumon. The Local Government with its headquarter in Ido town, was carved out of the former Akinyele Local Government. The area has also tremendously gained from industrialization process with the presence of industries such Nigeria Wire and Cable Ltd, Nigeria Mining Corporation and the NNPC among others. Equally, Akinyele Local Government is one of the eleven local governments that make up Ibadan Metropolis. Akinyele LGA was created in 1976, and it shares boundaries with Afijio Local Government to the North, Lagelu Local Government Area to the east, Ido LGA to the west and Ibadan North LGA to the south. It occupies a land area of 464.892 square kilometers with a population density of 516 persons per square kilometer. The estimated population for the Local Government is 239,745 and majority of the inhabitants are agrarian. Cassava is one of the major crops cultivated in Ido and Akinyele LGAs, Oyo State. It is locally called *Ege* in Yoruba. It grows well under poor soil, and it can be grown with other crops such as vegetable, oil palm, coconut, groundnut and melon.

For collection of quantitative information for bio- fortified cassava farmers, multi- stage sampling procedure was used to select sample using Oyo State Agribusiness Development Agency (OYSADA) extension structure in Oyo State in order to get registered bio – fortified cassava farmers. The OYSADA has four (4) zones. The first stage involved 25% random selection of one agricultural zone (Ibadan/ Ibarapa) from the four agricultural zones (Ibadan/Ibarapa, Oyo, Ogbomoso and Saki) in Oyo state. The second stage involved purposive sampling of two blocks (Ido and Akinyele) from nine blocks in Ibadan/ Ibarapa zone. This is due to the high concentration of bio-fortified cassava farmers that had access to the IITA distributed bio-fortified cassava planting materials in these blocks (Ido and Akinyele) than others. The third stage involved random selection of three cells each from the selected blocks. This was also due to high population of bio-cassava farmers in the communities in recent times. In the fourth stage, 95% of bio – fortified cassava farmers were sampled from each cell, using proportionate sampling to size to give a total of 138 respondents from the sampling frame of 145.

Both descriptive and inferential statistics were used to analyse the data. All stated objectives –were analysed using descriptive statistics (frequency, percentage and mean) while the hypotheses were analysed using inferential statistics tool such as Pearson Product Moment Correlation (PPMC).

## RESULTS AND DISCUSSION

### Socioeconomic characteristics

Result on Table 1 revealed that the mean age of the respondents was 53 years. This result implies that the bio-fortified cassava farmers in the study area are mature, productive, and still economically active. The mean age of the respondents is an indication that the respondents are still agile and might have accumulated experience that could have aided the adoption of bio-fortified cassava. This is because age is a major factor that influences adoption of innovation by farmers. This result is in line with the findings of Adeniran *et al*., (2021) who reported the mean age of farmers that cultivate bio-fortified cassava to be 54 years, an indication that above 50 years of age farmers are likely to adopt the innovation in cassava cultivation. This finding agrees with Awotide et al., (2011), that as farmers advance in age, they tend to gain more experience, which could enhance their productivity and managerial ability. The mean number of years spent in acquiring formal education was 7 years and this is expected to influence their level of knowledge of attributes, benefits and adoption of vitamin A cassava and its products. This is in line with Sofoluwe et al. (2011), that education influences people's perception and adoption of innovations. The finding reveals mean of 6 members in the households of respondents in the study area. The result indicates that respondents in the study area have a fair large household size, and this is expected to influence the size of bio-fortified cassava variety cultivated in the study area. Large household size is assumed as an indicator of labour availability in the family. Considering the fact that labour is a major factor of crop production (Mbuk *et al*., 2011), the findings imply that the presence of a considerable large household size, which could be used as source of labour for production, processing and marketing activities of bio-fortified cassava. Also, the household size of the farmers might influence their cultivation of the cassava variety. The fair large household size might influence the cassava farmers to adopt the bio-fortified cassava variety as they will provide nutrients to aid the well-being of the family members. The mean years of experience accumulated by cassava farmers in the study area was revealed to be 18 years. With long practicing mean of 18 years as farmers implies that the farmers are veterans in cassava production and could be able to effectively use the opportunity to have acquired requisite knowledge, skills and experience in deciding whether to adopt biofortified cassava or not. The finding is similar to the findings of Odediran and Ojebiyi (2017), who found that more than one- third (35%) of the cassava farmers in Southwest Nigeria had between 21 and 30 years of experience.

**Table 1: Distribution of Respondents by Socio-economic Characteristics, n=138**

| Socio-economic characteristics | Frequency | Percentage | Mean |
|---|---|---|---|
| **Age (years)** | | | |
| 35-42 | 8 | 5.8 | 53 |
| 43-50 | 67 | 48.6 | |
| 51-58 | 23 | 16.7 | |
| 59-66 | 31 | 22.5 | |
| 67-74 | 8 | 5.8 | |
| 74 and above | 1 | 0.7 | |
| **Years spent in school** | | | |
| 1-4 | 22 | 15.9 | 7 |
| 5-8 | 80 | 58.0 | |
| 9-12 | 31 | 22.5 | |
| 13-16 | 2 | 1.4 | |
| 16 and above | 3 | 2.2 | |
| **Household size** | | | |
| 3-4 | 22 | 15.9 | 6 |
| 5-6 | 88 | 63.8 | |
| 7-8 | 26 | 18.8 | |
| 8 and above | 2 | 1.4 | |
| **Years of experience** | | | |
| 8-14 | 34 | 24.6 | |
| 15-21 | 57 | 41.3 | 18 |
| 22-28 | 31 | 22.5 | |
| 29-35 | 13 | 9.4 | |
| 36-42 | 2 | 1.4 | |
| 42 and above | 1 | 0.7 | |

Source: Field survey, 2024

**Respondents' source of information on bio–fortified cassava production**

Table 2 reveals the source of information available to the respondents on bio-fortified cassava in the study area. From the responses gotten, it was affirmed that the cassava farmers have access to various sources of information. The result reveals that radio, family and friends, IITA, fellow farmers and extension agents were ranked 1st, 2nd, 3rd, 4th and 5th with a Weighted Mean Score (WMS) of 1.71, 1.62, 1.36, 1.30 and 1.17 respectively. This result is an indication that the respondents got information from reliable sources, and this might have influenced their adoption of the bio-fortified cassava tubers. The validity of the source of information is an indication of the acceptance level which the cassava farmers displayed in the adoption of the bio-fortified cassava variety. This result implies that farmers are liable to adopt innovations in agriculture if the information is dispersed to them through reliable and professional bodies.

**Table 2: Distribution of sources of information on bio–fortified cassava among cassava farmers, n=138**

| Source of information | Always | Sometimes | Never | WMS | Rank |
|---|---|---|---|---|---|
| Family and friends | 89 (64.5) | 46 (33.3) | 3 (2.2) | 1.62 | 2nd |
| Extension agent | 37 (26.8) | 88 (63.8) | 13 (9.4) | 1.17 | 5th |
| IITA | 51 (37.0) | 85 (61.6) | 2 (1.4) | 1.36 | 3rd |
| Fellow farmers | 83 (60.1) | 14 (10.1) | 41 (29.7) | 1.30 | 4th |
| Mobile phone | 11 (8.0) | 12 (8.7) | 115 (83.3) | 0.25 | 7th |
| Television | 0 (0.0) | 8 (5.8) | 130 (94.2) | 0.06 | 8th |
| Markets | 12 (8.7) | 22 (15.9) | 104 (75.4) | 0.33 | 6th |
| Radio | 106 (76.8) | 24 (17.4) | 8 (5.8) | 1.71 | 1st |

Source: Field survey, 2024
WMS: Weighted mean score

In addition, markets, mobile phones and television were all indicated as sources of information available for the bio-fortified cassava farmers with a weighted mean score of 0.33, 0.25 and 0.06 and ranked 6th, 7th and 8th respectively. Generally, this result implies that majority of the farmers in the study area obtained information particularly on their planting materials and had

contact with IITA, family and friends, extension agents and fellow farmers, which may easily expose the farmers to new technologies, how to go about them and the benefit. The greater the contacts with IITA, extension agents and fellow farmers who already experienced, the better the farmers are informed about new technology. This result corroborates with the findings of Oseni et al. (2015) who posited that farmers, through extension visits become better informed about farm management planning and new technologies.

**Farmers' knowledge on attributes of bio–fortified cassava varieties**

Result in Table 3 reveals the knowledge level of the cassava farmers on the adoption of bio-fortified cassava varieties which might have influence their decision to adopt the cultivation. An average score of 1.56 was gotten from the responses on the respondents on their knowledge about the adoption of bio-fortified cassava and this was used as benchmark to categorize their knowledge about the cassava variety. Using the mean score, the result reveals that majority of the cassava farmers have higher knowledge level that bio-fortified cassava are more nutritious than local cassava variety with a mean score ($\bar{x}$) of 1.94 tanked 1st; it is resistant to disease and pests, bio-fortified cassava has low level of cyanide acid, thrives in all weather conditions and it has high nutritional content and a potential for food security were all ranked 2nd with each having a mean score of 1.93. In addition, they acknowledged that they have a higher knowledge that bio-fortified cassava attracts premium price compared to other varieties; it requires less irrigation and water saving with both having a mean ($\bar{x}$) score of 1.88 were ranked 6th while bio-fortified variety gives more yield than the local variety ($\bar{x}$=1.62) was ranked 9th based on the mean score ranking. The higher knowledge level of the respondents on bio-fortified cassava is an implication that extension services is well grounded in the study area because it has aided the dissemination of information and enlightenment needed to enable farmers to embrace the new variety of cassava. Their level of higher knowledge about it is an indication that they have adopted it and have affirmed the benefits that comes along with the cultivation, consumption and economical aspect of the bio-fortified cassava variety. Meanwhile, the cassava farmers also indicated their knowledge about other attributes that the bio-fortified cassava is characterised with though on a low level of knowledge based on the mean score gotten from the responses indicated by the respondents. The respondents indicated low level of knowledge on the early maturing characteristics of the cassava variety with a mean score of 1.40; it tastes better ($\bar{x}$=1.38); planting can be done at any season in the year ($\bar{x}$=1.37) and bio-fortified cassava does not need nutrient rich soil or extensive land preparation with a mean score of 1.35 were ranked 10th, 11th, 12th and 13th respectively. In addition, the respondents indicated their lesser low-level of knowledge about bio-fortified cassava attribute such as having high dry matter content compared to local varieties ($\bar{x}$=1.08); there is high market demand for bio-fortified produce ($\bar{x}$=1.04); bio-fortified can be stored for a long time compared to local varieties ($\bar{x}$=1.02) and were all ranked 14th, 15th and 16th respectively while knowledge about it having low moisture and non-lodging was ranked least (17th) with a mean score of 1.01. This result is an indication that the respondents still have inadequacies in knowledge on some attributes about bio-fortified cassava. This result implies that extension agents and other stakeholders involved in the bio-fortified cassava project still have services to render to enable the farmers to have a well-rounded knowledge about the cassava variety. Generally, the result implies that cassava farmers in the study area are informed about bio-fortified cassava variety and them being informed is a major factor that influenced the cultivation of the cassava variety in the study area. Also, it is worthy to note that innovations in agriculture can only be successful if it is transmitted by the researchers and research agency to the extension services to aid the dissemination of such innovation to the consumers who are the farmers. In lieu of the responses gotten from the farmers, the extension agents and agency are also implored to consolidate in the use of appropriate teaching methods as this will enhance the knowledge level of their target audience. This result is in consonance with the findings of Anugwa *et al.*, (2021) where majority of the respondents had a high knowledge about bio-fortified cassava variety. Their knowledge about the bio-fortified cassava is linked to their experience in cassava farming which is an age-long practice in the cultivation of other cultivars of cassava.

**Constraints associated with adoption of bio–fortified cassava**

The result in Table 4 reveals the constraints associated with the adoption of bio-fortified cassava in the study area. The constraints were measured on 3-point rating scale of severe, mild and not a constraint which were ranked 2, 1 and 0 respectively. Based on the Weighted Mean Score (WMS), high moisture content, lack of ready market for sales and socio-cultural restrictions were ranked 1st, 2nd and 3rd with WMS of 1.98, 1.96 and 1.95 respectively.

**Table 3: Distribution of respondents according to farmers' knowledge on attributes of bio–fortified cassava varieties, n=138**

| Knowledge | True | False | I don't know | WMS | Rank |
|---|---|---|---|---|---|
| Bio fortified cassava has low level of cyanide acid | 133 (96.4) | 0 (0.0) | 5 (3.6) | 1.93 | 2nd |
| Thrives in all weather conditions | 128 (92.8) | 10 (7.2) | 0 (0.0) | 1.93 | 2nd |
| Planting can be done at any season in the year | 55 (39.9) | 79 (57.2) | 4 (2.9) | 1.37 | 9th |
| It is more nutritious | 134 (97.1) | 0 (0.0) | 49 (2.9) | 1.94 | 1st |
| Bio fortified cassava does not need nutrient rich soil or extensive land preparation | 52 (37.7) | 82 (59.4) | 4 (2.9) | 1.35 | 10th |
| It reduces the need for fertilizer usage | 86 (62.3) | 52 (37.7) | 0 (0.0) | 1.62 | 6th |
| The bio fortified variety gives more yield than the local variety | 122 (88.4) | 12 (8.7) | 4 (2.9) | 1.86 | 5th |
| It has high dry matter content compared to local varieties | 15 (10.9) | 119 (86.2) | 4 (2.9) | 1.08 | 11th |
| It tastes better | 52 (37.7) | 86 (62.3) | 0 (0.0) | 1.38 | 8th |
| It is early maturing | 55 (39.9) | 83 (60.1) | 0 (0.0) | 1.40 | 7th |
| There is high market demand for bio fortified produce | 9 (6.5) | 125 (90.6) | 4 (2.9) | 1.04 | 12th |
| The biofortified cassava attracts premium price compared to other verities | 125 (90.6) | 9 (6.5) | 4 (2.9) | 1.88 | 4th |
| It is resistant to diseases and pests | 128 (92.8) | 10 (7.2) | 0 (0.0) | 1.93 | 2nd |
| It contains low moisture and non-lodging | 6 (4.3) | 128 (92.8) | 4 (2.9) | 1.01 | 14th |
| It has high nutritional content and a potential for food security | 132 (95.7) | 2 (1.4) | 4 (2.9) | 1.01 | 2nd |
| It requires less irrigation and water saving | 122 (88.4) | 16 (11.6) | 0 (0.0) | 1.88 | 4th |
| Bio fortified can stored for a long time compared to local verities | 7 (5.1) | 127 (92.0) | 4 (2.9) | 1.02 | 13th |

Source: Field survey, 2024
WMS: Weighted mean score

This implies that the perishability nature is such unforeseen circumstance and severest of the constraints facing the adoption of the bio – fortified cassava varieties in the study area. It is however a technical and laboratory problem that has to do with the genetic composition, and it is an undesirable trait among other undesirable traits known with the bio-fortified cassava varieties as asserted by Onyeneke *et al.,* (2019). Equally, lack of market or demand for the produce threatens the adoption of bio - fortified innovation in the study area and farmers consider acceptability of the produce as a major factor before adoption of innovation. Adoption of an innovation is fast when there is available market as well as demand for the product. In a similar way, socio-cultural norms place threat to many innovations by restricting access to information about the innovation and in extreme cases, forbid members of the society from adopting the technology. The hierarchical structure in the rural area is a major factor that aids adoption and non-adoption of innovation in the rural area as they play a major in getting their members convinced, hence innovation should be done in accordance with the culture of the to be users of the innovation. Also, lack of post-harvest technology for processing, high cost of acquiring stem cuttings, high degradation and discoloration, unavailability of stem cuttings for planting and unavailability/high cost of labour were ranked 4th, 5th, 6th, 7th and 8th with WMS of 1.84, 1.62, 1.61, 1.60 and 1.30 respectively. This result is an indication that the cultivation of bio-fortified cassava requires financial investment which is more than what is needed to cultivate the existing cassava variety. The high cost of acquiring stem cuttings limits the adoption of the technology in the study area since farmers in most cases may have to travel wide to research institutes just to get bio- fortified stem cuttings. Availability of planting materials makes the usage of the materials easy and hence facilitates adoption. Furthermore, the result reveals that root start decaying immediately after maturation (WMS=1.05); lack of extension training to improve production skills (WMS=0.65); unpleasant taste (WMS=0.62); low stems viability with WMS of 0.46 were ranked 9th, 10th, 11th and 12th respectively. This result implies that extension services, viability of the innovation, taste and viability of the stems poses lesser constraints to the adoption of bio-fortified cassava in the study area, an indication that extension services and research work done on the cassava variety is satisfying to an extent. Lastly, close weeding intervals and problem of pests and diseases were ranked 13th and 14th with weighted mean score of 0.28 and 0.25 respectively. This result is an indication that the modification done to the cassava variety gives little or no room for the growth of weeds and infestation of the cassava tubers. Generally, this result implies that despite the adoption of bio-fortified cassava variety and

obvious benefits been derived from the cultivation, farmers in the study area still encounters constraints in the cultivation of the cassava variety though on a varied level of severity. The study is consistent with the findings of Olaosebikan et al., (2019) which states that high cost of inputs is a serious constrain to bio-fortified cassava production. In addition, Uwandu, Amadi and Igwe (2019), and Onyeneke et al., (2020) confirmed that high cost of cassava stems is responsible for lack adoption of bio-fortified pro-vitamin A cassava varieties.

**Table 4: Distribution of respondents according to the constraints associated with adoption of bio fortified cassava**

| Constraints | Severe | Mild | Not a constraint | WMS | Rank |
|---|---|---|---|---|---|
| Low soil fertility | 3 (2.2) | 9 (6.5) | 126 (91.3) | 0.11 | 15th |
| Unavailability of stem cuttings for planting | 107 (77.5) | 7 (5.1) | 24 (17.4) | 1.60 | 7th |
| High cost of acquiring stem cuttings | 111 (80.4) | 2 (1.4) | 25 (18.1) | 1.62 | 5th |
| Close weeding intervals | 4 (2.9) | 31 (22.5) | 103 (74.6) | 0.28 | 13th |
| Root start decaying immediately after maturation | 61 (44.2) | 23 (16.7) | 54 (39.1) | 1.05 | 9th |
| Unavailability/high cost of labour | 62 (44.9) | 55 (39.9) | 21 (15.2) | 1.30 | 8th |
| Lack of post-harvest technology for processing | 116 (84.1) | 22 (15.9) | 0 (0.0) | 1.84 | 4th |
| High moisture content | 135 (97.8) | 3 (2.2) | 0 (0.0) | 1.98 | 1st |
| High degradation and discoloration | 86 (62.3) | 50 (36.2) | 2 (1.4) | 1.61 | 6th |
| Lack of extension training to improve production skill | 5 (3.6) | 80 (58.0) | 53 (38.4) | 0.65 | 10th |
| Unpleasant taste | 2 (1.4) | 81 (58.7) | 55 (39.9) | 0.62 | 11th |
| Lack of ready market for sales | 133 (96.4) | 4 (2.9) | 1 (0.7) | 1.96 | 2nd |
| Socio-cultural restrictions | 133 (96.4) | 3 (2.2) | 2 (1.4) | 1.95 | 3rd |
| Problems of pests and diseases | 4 (2.9) | 27 (19.6) | 107 (77.5) | 0.25 | 14th |
| Low stems viability | 0 (0.0) | 64 (46.4) | 74 (53.6) | 0.46 | 12th |

Source: Field survey, 2024
WMS: Weighted mean score

**Test of hypothesis**

Pearson's Product Moment Correlation analysis revealed that there is a positive and significant relationship between socio economic characteristics of the bio-fortified cassava farmers such as age (r=0.269**, p=0.000) and years of experience in cassava production (r=0.266**, p=0.000) and the level of adoption of bio-fortified cassava varieties. This result implies that as the age of the cassava farmers increases the more experienced and courageous, they are to adopt innovations introduced to them, knowing fully that innovations are aimed to improve the production level of farmers. Economically active and matured farmers are liable to take more risks in agricultural production due to the anxiety to accumulate more wealth in their chosen enterprise. The reason for this might be that the expertise and resources of the older farmers may provide them with greater opportunities to experiment the bio- fortified cassava varieties. Other the other hand, younger farmers are more inclined to accept new technologies than older farmers since they have received more education than older group (Rajendran et al. 2016). This result is consistent with the findings of Singh and Park (2018), who reported that the older the farmer is, the less likely he is to adopt new technology. In addition, years of experience in cassava production and experience in the cultivation of bio-fortified cassava varieties significant relationship on the level of adoption of bio-fortified cassava varieties might be attributed to the level of knowledge accumulated hence; the more experienced they are, the more the probability they adopt new cassava varieties so as to optimally have an increased output on the cassava farm. This is in conformity with Mittal and Mehar (2016), who asserted that knowledge which might be in form of experiences gained, influences the behaviour of farmers to adopt innovation, resulting from better understanding and appreciation of benefits of innovations, and increased accessibility to information that will enable adoption.

**Table 5: PPMC analysis showing relationship between socio economic characteristic and adoption of bio-fortified cassava varieties**

| Socio-economic characteristics | Correlation coefficient | p- value | Remark |
|---|---|---|---|
| Age | 0.269** | 0.000 | Significant |
| Household size | 0.152 | 0.076 | Not Significant |
| Years spent in school | 0.099 | 0.247 | Not significant |
| Farm size | 0.164 | 0.054 | Not Significant |
| Years of Experience in cassava production | 0.266** | 0.000 | Significant |

Source: Computed Data, 2023

**: Correlation is significant at 0.05 level {2-tailed}

## CONCLUSION AND RECOMMENDATIONS

The study found that most of the respondents were young, active and married with large household size. The study also found out that most of the cassava farmers had low knowledge on the attributes of the bio – fortified cassava varieties. The benefits derived from the bio –fortified cassava varieties among the farmers also turned out to be low. Only three out of the bio –fortified cassava varieties were adopted by the farmer, while two of the three adopted varieties were cultivated by the farmers. It is worthy of note that the level of use of the adopted varieties was high. In line with hypotheses, the study established that significant relationship exists between selected socioeconomic characteristics such as (age, years of experience in cassava production and educational level) and the adoption of bio-fortified cassava varieties. Also, the PPMC results established that significant relationship exists between farmers' knowledge on the attributes of cassava production practices and adoption of bio-fortified cassava varieties. Thus, more awareness on the benefits and good attributes of biofortified cassava varieties be created among the cassava farmers.

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