Gender, Membership In Farmers' Association And Adoption of Biofortification In Nigeria: The Case of Bio-Fortified Cassava

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Abstract

The study investigated the effect of membership in association on adoption of bio-fortified cassava by gender in South Western, Nigeria. A multistage sampling technique was used to select one hundred and fifty respondents in the study area. Data collected were analyzed using descriptive and double-hurdle model. The result of the study showed that the mean age of male cassava farmers were 49.32 (±16.73) while that of female were 47.18(±12.42) years. The mean years of formal education for male and female were 12.21(±6.45) and 12.04(±5.15) respectively. About 52% of the respondents were men while 48% were female. About 69.28% of male were members of association while 78.84% of female were members of farmers association. About 58.92% of male had access to extension agents while the percentage of female that had access to extension agents were 57.41%. Majority (64.96%) of the male bio-fortified cassava farmers adopted more of the second wave of bio-fortified cassava varieties distributed in 2016. The study revealed that among the male cassava farmers, access to credit (0.7528), landownership (0.0840), training (0.8452) and extension agent (0.9669) positively significantly influence the decision to adopt bio-fortified cassava at($p<0.10$), ($p<0.01$), ($p<0.05$) and ($p<0.05$) respectively in the study area while perception (1.5836) and training(1.0502) positively significantly influence the decision to adopt bio-fortified cassava at ($p<0.01$) and ($p<0.10$) respectively except age (-0.0660) that negatively significantly affect adoption of bio-fortified cassava at ($p<0.05$) among the female gender in the study area. The result of the study further revealed that among the male gender, access to bio-fortified cassava stem (planting material) (0.0677) and training (0.8881) at ($p<0.05$) and ($p<0.05$) respectively influenced the intensity of adoption of bio-fortified cassava in the study area. Among the female gender, access to credit (0.6763) and association membership (0.7742) at($p<0.10$) and ($p<0.10$) respectively influenced the intensity of adoption of bio-fortified cassava in the study area. In other to increase the production of bio-fortified cassava among the two genders in the study area, extension agents should ensure that they meet with the cassava farmers on regular basis and conduct training on monthly or quarterly basis for the two genders so as to improve the management practices which will boost their production. Also, government, agencies and stake holders in Nigeria should reach out to cassava farmers (both genders) through their respective association by providing them with basic inputs which will help them increase the production of bio-fortified cassava in the study area.

Keywords: *Gender, Membership in association, Bio-fortified cassava, Adoption, South-Western, Nigeria.*

INTRODUCTION

Vitamin A deficiency has been posing a threat to human survival for a very long time and the world has put a lot of measures in place to combat this threat. According to Rice *et al*. (2004), several international organizations in the world such as United States Agency for International Development (USAID), United Nations Children Education Fund (UNICEF), World Health Organization (WHO) among others have been tirelessly working on how to upsurge this menace for a long period of time till present. Many special intervention programs have been implemented in developing countries, Nigeria inclusive. One of such intervention programs is the more recently biofortification – a term used to describe a breeding

strategy that aims to increase the micronutrient content of staple food crops (Nestel *et al.*, 2006).

Through biofortification, staple food crops that are enriched with beta-carotene, a precursor of vitamin A in the body, have been bred. Bio-fortified cassava is one of these crops. The production of biofortified vitamin-A cassava started in 2011 with the intervention of the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA) which were funded by Harvest Plus program. Five years after the intervention program, statistics revealed that over 1million of Nigerian farming households grows yellow cassava varieties that contains substantial quantities of vitamin-A even after processing. In Nigeria diets today, yellow bio-fortified cassava represents additional source of vitamin A (Saltzman *et al*., 2014).

However, about six varieties of bio-fortified cassava have been introduced so far since 2011 when the first three set of the bio-fortified cassava were introduced. The adoption rate of these varieties of bio-fortified cassava is very low which had been ascribed to factors including, gender, age, access extension services, level of education, and income among others (Ayinde *et al*., 2017).

More important weight is attached to the gender of the farm owner or manager (Doss and Morris, 2001). In Nigeria, there is a substantial degree of gender bias in terms of access to land, credit and labor resources among others, which directly influence the adoption of agricultural technology. Women have very unequal access to agricultural land and resources, even though they are the main cultivators (Kerr, 2017). In addition, agricultural practices are deeply characterized by traditional gender roles that build up on existing patriarchal social and cultural norms that limit women's empowerment (Ingawa, 1999; Mwangi and Kariuki, 2015; Rahman *et al.*, 2004; Garcia and Wanner, 2017), even though, women are at the forefront of meeting the challenge of low crop productivity (Kerr, 2017). This could be the major reason for the large gap between potential yield and actual yield in production of bio-fortified cassava in Nigeria. It is obvious therefore that improving the access of females to agricultural land resources would substantially increase the country's bio-fortified cassava production.

Membership in association seems to be the best instrument to bring about such economic development of women. The access of females to bio-fortified cassava could successfully be improved by encouraging women farmers to be members of farmers' association which targets to promote gender equality. Better still, women-only cooperatives may help overcome social and cultural constraints which might limit access of female farmers to adopting bio-fortified cassava varieties.

Consequently, it is therefore important to know the effect of membership in association on adoption rates and intensity of adoption of these technology by gender. Although many studies have been undertaken on the topic of adoption of bio-fortified cassava, and even a few on the topic of gender differentials in adoption rates of certain improved technologies, nonetheless, there still exists a dearth of information on the membership in association and gender perspective of the adoption of bio-fortified cassava varieties in Nigeria. In order to address this, the study specifically described the socio-economic characteristics of the farmers in terms of gender; identified bio-fortified cassava varieties adopted by farmers in the study area; examined the adoption rates of these technology in terms of gender and examined the effect of membership in association on rates of adoption and intensity of adoption of the bio-fortified cassava varieties by gender.

Methodology

Area of Study

The study was carried out in South-Western region of Nigeria. The South-West region of Nigeria represents a geographical area covering latitude 6^0 North and 4^0 South. The South-Western region of Nigeria comprises of six states including Osun, Ekiti, Oyo, Ondo, Lagos and Ogun State. The region is bounded in the north by Kogi and Kwara States, in the South by Atlantic Ocean, in the west by Republic of Benin and in the East by Edo and Delta State. The South western region of Nigeria can boost of different varieties of arable food crops since the climatic conditions support the production of various food crops including cassava, maize, groundnut etc. A large proportion of the bio-fortified cassava were being produced in South Western region of Nigeria, since the region was a major target for the production of the bio-fortified cassava as the distribution of bio-fortified cassava planting materials (stem) started in South west, Nigeria in 2011 hence the choice of the study area for the study.

Sampling procedures and sample size

Multistage sampling procedures were employed for the study. The first stage involved purposive selection of two States including Oyo and Osun States due to concentration of bio-fortified Cassava farmers. The second stage involved the purposive selection of two Local Government Areas (LGAs) from each States

because of the concentration of bio-fortified cassava producers in the areas. The third stage involved random selection of three communities from each of the selected LGAs. At the fourth stage, twenty-five cassava farmers were randomly selected from each community to make a total of 150 (One hundred and fifty) respondents. Primary data were used for the study. The primary data were sourced from cross-sectional survey of cassava farmers in the study area with the aid of well-structured questionnaire to cover information about the socioeconomic characteristics of respondent, varieties of bio-fortified cassava grown and the degree of adoption of the bio-fortified cassava varieties.

Analytical techniques

The data were analyzed using descriptive and Cragg's (double-hurdle) model

Descriptive statistics

Descriptive statistics was used to summarize the socio-economic characteristics of the respondents and bio-fortified cassava varieties grown in the area, as well as the rate of adoption of bio-fortified cassava varieties among the farmers by gender.

The Cragg's model two-step estimation procedure

The Cragg's model was chosen for this study because it relaxes the restrictive assumption of the Tobit model that the factors influencing the discrete decision (adoption decision) and the continuous decision (intensity of use) as well as their effects are the same. Hence, in the Cragg's model, the coefficients of the dependent variables of the first and second hurdle are different.

The first step analyses the factors influencing the decision of farmers to adopt bio-fortified cassava varieties, while the second step deals with the intensity of use of the adopted bio-fortified cassava varieties by gender.

Step 1: Probit model for the discrete adoption decision

For the Probit model, we assume that the decision of the 'i'th farmer to adopt a technology or not depends on an unobservable utility index Y_i^*, that is determined by the explanatory variables, and that the higher the value of this utility index the higher the probability that the farmer will adopt the technology. The adoption probability (dependent variable) Y_i is limited between the values of 1 and 0.

$$Y_i = \begin{cases} Y_i^* \text{ if } Y_i^* > 0 \\ 0 \text{ if } Y_i^* \leq 0 \end{cases}$$

The Probit model is expressed as:

$$\text{Prob}(Y^* > 0) = F(X'\beta) = \Phi(X'\beta) = \int_{-\infty}^{X'\beta} \emptyset(Z)dZ$$

Where; $F(X'\beta)$ = cumulative degree of freedom of the standard normal distribution.

$$Y_i^* = X'\beta + e_i$$

$$X'\beta = \beta_0 + \beta_1 AGE + \beta_2 EXP + \beta_3 EDUYRS + \beta_4 ACCCRE + \beta_5 FINCOME + \beta_6 HHSIZE + \beta_7 LNDWNSHP + \beta_8 ASSN + \beta_9 PERCEPTN + \beta_{10} ACCBIO\text{-}FSTM + \beta_{11} AWARE + \beta_{12} TRAINIING + \beta_{13} EXTN$$

Where; AGE = Age (years)
EXP = Experience (years)
EDUYRS =Years of Education (years)
ACCCRE = Access to credit (1=access; 0=no access)
FINCOME = Farm income (₦)
HHSIZE = Household size (#)
LNDWNSHP = Land ownership (3=purchased; 2=leased; 1=borrowed; 0=inherited)
ASSN = Association membership (1=member; 0=non-member)
PERCEPTN = Perception (1=good; 0=otherwise)
ACCBIO-FSTM = Access to bio-fortified cassava stem (1=access; 0=no access)
AWARE = Awareness (1=aware; 0=not aware)
TRAINIING = Training (1=yes; 0=no)
EXTN = Extension contacts (#)

Step 2: Model for the continuous decision (intensity of use using uncensored observations)

$$E(Y|Y^* > 0) = X'\gamma + \sigma\lambda\left(\frac{X'\gamma}{\sigma}\right)$$

Here the Cragg's model makes use of uncensored observations i.e. the observations with zero adoption level were not cut out of the observation, thus giving a better representation of the population.

$$X'\gamma = \gamma_0 + \gamma_1 AGE + \gamma_2 EXP + \gamma_3 EDUYRS + \gamma_4 ACCCRE + \gamma_5 FINCOME + \gamma_6 HHSIZE + \gamma_7 LNDWNSHP + \gamma_8 ASSN + \gamma_9 PERCEPTN + \gamma_{10} ACCBIO\text{-}FSTM + \gamma_{11} AWARE + \gamma_{12} TRAINIING + \gamma_{13} EXTN$$

Where; Y = Intensity of Adoption
Where; AGE = Age (years)
EXP = Experience (years)
EDUYRS = Years of Education (years)
ACCCRE = Access to credit (1=access; 0=no access)
FINCOME = Farm income (₦)
HHSIZE = Household size (#)
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TRAINIING = Training (1=yes; 0=no)
EXTN = Extension contacts (#)

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents by gender

Presented in Table 1 is the socio-economic characteristics of the respondents by gender. The results revealed that the mean age of male were 49.32 (±16.73) while that of female were 47.18(±12.42) years. This implies that the male cassava farmers in the study area were slightly older than their female counterparts although the two genders were in their productive and active age and were expected to be open to new innovation as regarding their enterprise. The mean years of formal education for male and female were 12.21(±6.45) and 12.04(±5.15) respectively. This shows that cassava farmers in the study area were literate. This result is similar to the findings of Gracious *et al.* (2015) but differs from numerous literatures reporting large gaps in years of education between the two genders. About 52% of the respondents were men while 48% were female. This shows that production of bio-fortified cassava farmers were more common among men than women in the study area. From Table 1, the mean years of farming experience was 17.72(±11.23) for male while that of female was 16.24(±10.62). This shows that cassava farmers in the study area had been into the production of cassava for many years and thus it could help them open to adoption of new innovation and increase their productivity. About 69.28% of male were members of association while 78.84% of female were members of farmers association. This result implies that women were more involved in association than their female counterparts in the study area. This corresponds to the findings of Awotide *et al.* (2015) who also found the percentage of females belonging to farmer related associations to be higher than the males. About 58.92% of male had access to extension agents while the percentage of female that had access to extension agents were 57.41%. This implies that the two genders considerably had access to extension agents at one time or the other in the study area. The mean annual income of male cassava farmers were ₦525000(±312826) while that of female were ₦482900(±297202). This shows that the male cassava farmers in the study area had more annual income than their female counterparts. This might be due to fact male gender have access to resources like land, capital, farm inputs more than the female gender hence might have produced more than female which subsequently led to higher income. This result is similar to the results of Awotide *et al.* (2015) that household income of males to be higher than the females.

Table 1: Socio-economic characteristics of respondents by gender

Variables	Male	Female	Pooled
Age	49.32 (±16.73)	47.18(±12.42)	47.36(±14.92)
Years of formal education	12.21(±6.45)	12.04(±5.15)	12.11(±5.26)
Gender (%)	52.00	48.00	
Years of farming experience	17.72(±11.23)	16.24(±10.62)	18.35(±10.51)
Association membership (%)	69.28	78.84	74.82
Extension contact	58.92	57.41	57.16
Farm income	525000(±312826)	482900(±297202)	494238(±291016)

Figures in parenthesis are standard deviation
Source: Data Analysis, 2019

Specific farm characteristics and varieties adopted by gender

Presented in Table 2 is the farm characteristics and adoption rate by gender. About 43.36% of the male gender inherited their farm land while 38.39% of the female gender inherited their farm land. This implies that men had access to family properties more than women in the study area. This might be attributed to the law of property allocation in Nigeria where larger percentage of property is normally been allocated to the male gender. About 31.94% of the male gender purchased their farm land while 29.81% of the female gender purchased their farm land. This implies that men had more purchasing power than women as regarding farmland in the study area. Also, 14.70% and 12.20% of the male and female gender respectively rented their farmland for cassava production in the study area.

About 10% and 19.60% of the male and female gender respectively accessed their farmland through communal/gift. This implies that access to farmland through communal/gift were more common among women cassava farmers in the study area. As regarding the agricultural system practiced by cassava farmers in the study area, 26.53% of male gender practiced sole cropping while Majority (64.37%) of the female gender practices sole cropping. Majority (73.47%) of the male gender practices intercropping while 35.63% of the female gender practices intercropping. This implies that the practice of intercropping was more common among the male gender in the study area.

Furthermore, the adoption rate of bio-fortified cassava by gender were presented in Table 2. About 12.33% and 26.23% of the male and female gender respectively adopted TMS 01/1371 variety, 11.21% and 18.42% of the male and female gender respectively adopted TMS 01/1412 variety, 11.62% and 21.85% of the male and female gender respectively adopted TMS 01/1368 variety, about 23.91 and 9.21% of the male and female gender respectively adopted TMS 01/0593 variety. Also, 19.23% and 13.36% of the male and female gender respectively adopted TMS 01/0593 while 21.82% and 10.85% of the male and female gender respectively adopted TMS 01/0220. According to Ilona *et al*. (2017), the first wave of bio-fortified cassava varieties which include TMS 01/1371, TMS 01/1412 and TMS 01/1368 were distributed in 2011 while the second wave which include TMS 01/0593, TMS 01/0593 and TMS 01/0220 were distributed in 2016. However, even though the two genders in Table 2 adopted bio-fortified cassava varieties, it might still be ascertain that the male gender adopted more of the recent bio-fortified cassava varieties distributed in 2016 as 64.96% of the male gender adopted the recent varieties of bio-fortified cassava compared with 33.5% of the female gender who adopted the recent varieties of the bio-fortified cassava in the study area. The recent varieties of bio-fortified cassava distributed in 2016 was found to contain about 57% of vitamin A compared with the first wave released in 2011 that contain about 17% vitamin A. This further confirm findings in literature that established that men were prone to adoption of improved agricultural technology before women do.

TABLE 2: Farm specific characteristics and Adoption of Bio-fortified varieties by gender

Variables	Male (%)	Female (%)	Pooled (%)
Mode of land acquisition			
Inherited	43.36	38.39	42.38
Purchase	31.94	29.81	31.23
Rent	14.70	12.20	16.94
Communal/Gift	10.00	19.60	11.39
Varieties Adopted			
TMS 01/1371	12.33	26.23	23.48
TMS 01/1412	11.21	18.42	19.31
TMS 01/1368	11.62	21.85	20.74
TMS 01/0593	23.91	9.29	21.46
TMS 01/0539	19.23	13.36	26.48
TMS 01/0220	21.82	10.85	17.75
Agricultural system practiced			
Sole cropping	26.53	64.37	49.47
Inter cropping	73.47	35.63	50.53

Source: Data analysis, 2019

Effect of membership in association on adoption of bio-fortified cassava by gender

Presented in Table 3 is the effect of membership in association on adoption of bio-fortified cassava by gender in the study area. Among the male cassava farmers, access to credit, landownership training and extension agent positively significantly influence the decision to adopt bio-fortified cassava in the study area while perception and training positively significantly influence the decision to adopt bio-fortified cassava except age that negatively significantly affect adoption of bio-fortified cassava among the female gender in the study area.

Among the male gender, access to credit was positive and significant at 10% level of probability. This implies that male cassava farmers who had access to credit have higher chances of adopting bio-fortified cassava in the study area. Thus, access to credit increases the probability of adopting bio-fortified cassava by 0.7% among the male gender in the study area. Land ownership was positive and significant at 1% probability level among the male gender. This implies that male cassava farmers who had access to land will likely adopt bio-fortified cassava in the study area. Thus, adoption of bio-fortified cassava among the male gender increases by 0.08% with land ownership status in the study area. Furthermore, training was positive and significant at 5% among the male gender. This implies that training contributed positively to the adoption of bio-fortified cassava among the male gender, thus, adoption of bio-fortified cassava by the male gender increase by 0.8% in the study area. Also, access to extension agent was positive and significant at 5% level of probability among the male gender. This implies that access to extension agent increases the adoption of bio-fortified cassava in the study area as access to extension agent increases adoption rate by 0.96% in the study area.

As regarding the female gender, age was negative and significant at 5% probability level. This implies that an increase in age will decrease the adoption rate among the female gender, thus as age increases, adoption rate among the female gender decreases by 0.06% in the study area. Also, perception was positive and significant among the female gender. This implies that as the female cassava farmers perceived the technology to be good and productive, the adoption rate tend to increase among them in the study area. Thus, perception increases adoption of bio-fortified cassava among the female gender by 1.58% in the study area. Furthermore, training was positive and significant among the female gender. Thus, training increases the adoption of bio-fortified cassava among the female gender by 1.05% in the study area.

Table 3. Effect of membership in association on the adoption of bio-fortified cassava by gender

Variables	Males		Females	
	Coefficients	**Std. Err.**	**Coefficients**	**Std. Err.**
Age	-0.0052	0.0166	-0.0660**	0.0277
	(-0.31)		(-2.39)	
Experience	0.0300	0.0214	0.0063	0.0261
	(1.40)		(0.24)	
Years of education	0.0608	0.0374	-0.0352	0.0514
	(1.63)		(-0.69)	
Access to credit	0.7528*	0.4055	0.6025	0.4326
	(1.73)		(1.39)	
Farm income	-0.1518	0.4517	-0.3338	0.4181
	(-0.34)		(-0.8)	
Household size	1.01e-06	8.29e-07	-0.00559	9.14e-07
	(1.22)		(-0.61)	
Land ownership	0.0840***	0.0311	-0.0039	0.0252
	(-2.70)		(-0.16)	
Association membership	0.6517	0.4209	0.0567	0.4910
	(1.55)		(0.12)	
Perception	-0.5341	0.5139	1.5836***	0.5849
	(-1.04)		(2.71)	
Access to bio-stem	-0.0041	0.0346	-0.0389	0.0549
	(-0.12)		(-0.71)	
Awareness	0.0241	0.4053	-0.3313	0.5147
	(0.06)		(-0.64)	
Training	0.8452**	0.4246	1.0502*	0.5670
	(2.11)		(1.85)	

Extension	0.9669**	0.4919	0.6378	0.5904
	(1.97)		(1.08)	
Constant	-0.7005	1.1355	3.7001*	2.1137
	(-0.62)		(1.75)	
	Number of observations = 71		Number of observations = 64	
	Prob > chi2 = 0.6201		Prob > chi2 = 0.4930	
	Log likelihood = -56.372528		Log likelihood = -42.472902	

Figures in parentheses are t-values;***= significant at 1%, **= significant at 5%, *= significant at 10%.
Source: Data Analysis, 2019

Effect of membership in association on the intensity of adoption of bio-fortified cassava by gender

The effect of membership in association on the intensity of adoption of bio-fortified cassava by gender in the study area was presented in Table 4. Among the male gender, access to bio-fortified cassava stem (planting material) and training influenced the intensity of adoption of bio-fortified cassava in the study area. Among the female gender, access to credit and association membership influenced the intensity of adoption of bio-fortified cassava in the study area.

From Table 4, access to bio-fortified cassava stem was positive and significant at 5% level of probability among the male gender. This implies that increase in access to bio-fortified cassava stem (planting material) increases the intensity of adoption of bio-fortified cassava among the male gender in the study area. Thus, access to bio-fortified cassava stem increase intensity of adoption of bio-fortified cassava by 0.06% among the male gender in the study area. Training was positive and significant at 5% probability level among the male gender. This implies that increase in training increases the intensity of adoption of bio-fortified cassava among the male gender in the study area. Thus, training increases the intensity of adoption of bio-fortified cassava by 0.88% among the male gender in the study area. Although not significant, experience positively influence the intensity of adoption of bio-fortified cassava among the male gender in the study area. This implies that as the male cassava farmers accumulate experiences, it tends to increase the intensity of adoption of bio-fortified cassava in the study area.

Among the female gender, access to credit was found to be positive and significant at 10% level of probability. This implies that access to credit increases the intensity of adoption of bio-fortified cassava among the female gender in the study area. Thus, access to credit increases the intensity of adoption among the female gender by 0.6% in the study area. Also, membership in association was positive and significant at 10% level of probability among the female gender. Thus, membership of association increases the intensity of adoption of bio-fortified cassava among the female gender by 0.77% in the study area.

Table 4. Effect of membership in association on the intensity of adoption of bio-fortified cassava

Variables	Males		Females	
	Coefficients	Std. Err.	Coefficients	Std. Err.
Age	-0.0251	0.0181	0.0080	0.0197
	(-1.38)		(0.41)	
Experience	0.0152	0.0236	0.0156	0.0229
	(0.65)		(0.68)	
Years of education	-0.0486	0.0378	-0.0453	0.0461
	(-1.28)		(-0.98)	
Access to credit	0.4022	0.4074	0.6763*	0.3856
	(0.99)		(1.75)	
Farm income	-0.7370	0.4611	0.3170	0.4325
	(-1.6)		(0.73)	
Household size	-7.48e-07	8.25e-07	0.00012	8.65e-07
	(-0.91)		(1.39)	
Land ownership	0.0045	0.0272	0.0334	0.0267
	(0.17)		(1.25)	
Association membership	-0.3770	0.4479	0.7742*	0.4712
	(-0.84)		(1.83)	
Perception	0.6910	0.4953	0.3944	0.5073
	(1.4)		(0.78)	
Access to bio-stem	0.0677**	0.0336	0.0814	0.0531
	(2.02)		(1.53)	

Awareness	0.5949	0.4461	-0.5544	0.5035
	(1.33)		(-1.1)	
Training	0.8881**	0.4287	0.0486	0.4614
	(2.07)		(0.11)	
Extension	0.1082	0.4387	0.7786	0.5607
	(0.25)		(1.39)	
Constant	2.1592*	1.2104	-4.5669**	2.1711
	(1.78)		(-2.1)	

Figures in parentheses are t-values;*** significant at 1%, **significant at 5%, * significant at 10%.
Source: Data Analysis, 2019

Conclusion

The study concluded that production of bio-fortified cassava were common among the two genders with men slightly higher than women in the study area. Majority of the male bio-fortified cassava farmers adopted more of the second wave of bio-fortified cassava varieties distributed in 2016. The study concluded that Among the male cassava farmers, access to credit, landownership training and extension agent positively significantly influence the decision to adopt bio-fortified cassava in the study area while perception and training positively significantly influence the decision to adopt bio-fortified cassava except age that negatively significantly affect adoption of bio-fortified cassava among the female gender in the study area. The study further concluded that among the male gender, access to bio-fortified cassava stem (planting material) and training influenced the intensity of adoption of bio-fortified cassava in the study area. Among the female gender, access to credit and association membership influenced the intensity of adoption of bio-fortified cassava in the study area. In other to increase the production of bio-fortified cassava among the two genders in the study area, extension agents should ensure that they meet with the cassava farmers on regular basis and conduct training on monthly or quarterly basis for the two genders so as to improve the management practices which will boost their production. Also, government, agencies and stake holders in Nigeria should reach out to cassava farmers (both genders) through their respective association by providing them with basic inputs which will help them increase the production of bio-fortified cassava in the study area.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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