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THE EFFECTS OF THE ADOPTION OF IMPROVED CASSAVA VARIETIES ON THE FARMERS IN BENUE STATE, NIGERIA.

1 MARGARET BAI-TACHIA,
2 ELIZABETH T. TAGHER,

&

Correspondence author; **3 GBATSE AUSTINE GBATSE,**
selugbats@gmail.com
+2348077653968

Abstract
The paper examined the effects of the adoption of improved cassava varieties on the farmers in Benue State, Nigeria. The study anchored on Diffusion of innovation theory by Roger (1968) as its theoretical guide. Structural interview and Key Informant Interview (KII) were employed as instruments of data collection. Data was collected among 381 respondents using cluster, purposive sampling, simple random sampling and proportionate sampling techniques. The study found that improve cassava varieties increased farmers' income which help them to improve on their standard of living condition such as payment of children/ward school fee, hospital payment and provision of food among others. Pearson correlation coefficient tested revealed that the P. value was 0.00< 0.05. Which statistically means that there are effects of adoption of improved cassava varieties on farmers in Benue State. Based on the findings, the study concluded that farmers in the study should adopt improve cassava varieties. The study recommends the following; that efforts should be made by agencies, those involved in Agric business to educate farmers on improved cassava varieties available in the state. Also, grants/credit should be given to farmer to aid them in adoption of improved cassava varieties. There should be also provision of extension service to help adoption of improved cassava varieties by farmers, farmers should also be supported to have more land to facilitate adoption process. Finally, there should be modification in some of the improve cassava varieties to improve on their quality.
Keywords: Innovation, adoption, production, farmers, Improved cassava varieties

Introduction

Cassava (Manihot esculenta), a root crop native to South America, has become a staple food in many tropical and subtropical regions across the world, particularly in Africa, Asia, and Latin America. Its ability to thrive in poor soils and under adverse conditions makes it a vital crop for food security and economic stability. In recent years, the development of improved cassava varieties has garnered significant attention as a means to enhance production and meet the growing global demand for food. This objective examines the extent to which improved cassava varieties increase the quantity of cassava production worldwide, comparing the experiences of developed and developing regions.

Climate change poses a significant threat to agricultural production worldwide. Improved cassava varieties often exhibit greater resilience to environmental stressors such as drought and flooding (Thangata & Alfsen, 2022). Studies have shown that drought-tolerant varieties can maintain yields even in arid conditions, crucial for regions facing climate variability.

In developed regions, improved cassava varieties have contributed to increased production efficiency. For example, Brazil has implemented advanced breeding programs that have resulted in high-yielding and

disease-resistant varieties. The adoption of these varieties has led to significant increases in cassava production, making Brazil one of the largest producers globally (Fregene et al., 2022).

The genetic improvement of cassava has led to the development of high-yielding varieties with traits that enhance productivity. Recent advancements in breeding techniques, such as marker-assisted selection (MAS) and genetic modification, have allowed researchers to introduce traits such as disease resistance, drought tolerance, and improved tuber quality (Nwafor et al., 2023).

Notable high-yielding cassava varieties include "TME 419" and "TME 204 TMS 98/0002, TMS 92/0057, NRS 87184, THS 96/1089 and NR 930199; others include Game-Changer, Hope, Obasanjo-2, Baba-70, and Pound able. The first improve cassava variety known as TMS- 130555 was introduced in the year 1976 by International Institute of Tropical Agriculture (IITA) with the following characteristics; High dry (25%), moderate CMD resistance, early bulking, high starch and high yielding (>25t/ha) (Wossen, et al, 2017; Malik et al, 2020).

It is worth to note that the improved cassava varieties were introduced in Benue state in the year 1987 by the Benue State Agricultural and Rural Development Authority (BNARDA). In the recent time between 2000 and date different organizations such as International Fund for Agricultural Development FGN/IFAD Value Chain Development Programme (VCDP), FADAMA Project, and Catholic Relief Services (CRS) in partnership with Benue State Cassava Seed Federation have been facilitating in disseminating of improved cassava varieties to cassava farmers all over the state. Based on the forgoing, this study seeks to examine the effect of adoption of improved cassava varieties on the farmers in Benue State, Nigeria,

Study hypothesis

Ho; There are no effects of the adoption of improved cassava varieties on the farmers in Benue State.

Review

Effect of adoption of improve cassava varieties on the famers

One of the major reasons for the development of improved technologies and the release of high-yielding varieties are to reduce hunger, malnutrition and poverty. Also, it is expected to result in improved income and livelihood of poor people living in marginal areas. Interestingly, cassava production has been increasing in the past five years since 2019. In 2019, cassava's total production was a little over 10.2 million tons (MT). Currently, cassava production is estimated at 19.2 million tons, the highest among all food crops (FAO, 2020). The increase in production can be associated with the adoption of improved cassava varieties.

In terms of economic importance, cassava supports the livelihoods of millions of smallholder farmers, particularly in developing countries. The World Bank (2022) estimates result showed that about 100 million people depend on cassava cultivation for their income. Its resilience in marginal conditions makes it an attractive option for farmers facing climate change and food insecurity.

In Indonesia Agricultural productivity can be escalated by the adoption of improved varieties in three ways. First, improved varieties are more tolerant to climate changes, such as temperature fluctuation and drought. Second, improved varieties are more resistant to pests and diseases. Third, improved varieties produce higher crop yields (Otim-Nape & Thresh, 2014; Ariani, et al, 2017; Muhaimin, et al, 2020 & Missiame, et al, 2021). Besides rice and maize, the Indonesian government has also developed new improved cassava varieties (NICV) to maintain national and global food security. Cassava farmers in Indonesia may have benefitted from NICV because these varieties are resistant to pests and plant diseases, require shorter planting times, and taste better (Ariani, et al, 2017). This innovation provides benefits for smallholder farmers and enhances national economic growth (Acheampong, Nimo-Wiredu, Amengor, Nsiah-Frimpong, Haleegoah, Adu-Appiah & Adogoba, 2017).

Muhaimin etal, (2020) found in Indonesia showed that 111 farmers had adopted the NICV while 189 farmers did not. The mean test of variables was employed to estimate the propensity score in an unmatched sample, and showed that adopter and non-adopter groups had significant differences in land ownership, cooperative membership, access to credit, and internet access. In the matched sample, only two variables were significantly different cooperative membership and access to credit. In the unmatched sample, farmers who adopted the NICV tended to have certified land while those who did not adopt the NICV did not have certified land. However, adopter and non-adopter farmers in the matched sample did not show a significant difference in regard to certified land. Furthermore, adopter farmers were more likely to become cooperative members and have access to credit in unmatched and matched samples. Lastly, in the unmatched samples, adopter farmers were more likely to access the internet. However, in matched samples, adopter and non-adopter farmers did not show significant differences.

In Ghana, farmers' preference for the variety they choose for cultivation is based on; yield, in-soil storage (longevity) and disease resistance. For example, Inkoom, Dadzie and Ndebugri (2020) state that some farmers in the Brong-Ahafo and the Ashanti Regions have testified that the improved varieties of cassava yield three times more than the local varieties. Poverty alleviation is possible with the use of improved technologies. Kondo, Cacho, Fleming, Villano and Asante (2020) noted that higher adoptions can be achieved through the availability and distribution of planting materials and farmer participatory demonstrations. Ghana's national food security is time and again attached to the availability of root and tuber crops especially cassava. The food security role of Cassava is widely attributed to its availability during times of food shortages. Because cassava can provide multiple opportunities for poverty reduction and nourishment for poor people in Ghana, lots of research efforts have gone into the development and dissemination of it for increased production to meet increasing demand. To increase food production, policy objective and research emphasis have been on increased production and adaptability to diverse production systems and environments (Nweke, et al, 2015; Inkoom, et al, 2020). The rapid increase in improved cassava varieties will undoubtedly have significant implications on food security, employment creation, living conditions, and economic growth (Mbawini, 2020; Anaglo, Antwi, Manteaw & Kwapong, 2020). Food security is attained once the total available physical supplies of food are adequate and households have ample access to those food supplies through either their production, the market, or other sources, and the utilization of those food supplies is appropriate to meet the specific dietary needs of individuals (Wu, Ding, Pandey & Tao, 2015).

Cassava is also an income generation crop for many farming households in Malaysia. Cassava yields improved from 13 to 16 t/ha to 18–20.1 t/ha between 2009 and 2012 and 2013–2018, respectively because of improved varieties (FAO. 2017). This resulted in an average benefit–cost ratio of 1: 0.59 and 1: 1.54 for 2009–2012 and 2013–2018, respectively. Thus, a profit or returns of about Gh ₵ 0.54 would be accrued in addition to the Gh ₵ 1.00 invested capital for cassava production. Improvement in the adoption of improved cassava varieties by farmers might increase productivity (yield) after 2012.

In Zambia, FAO (2017) posit that higher adoption rate of improved cassava varieties is associated with increased income, poverty reduction, and household food security. Khonje, Mkandawire, Manda and Alene (2015) note that improved cassava varieties had significant poverty-reducing impacts in Zambia.

Simon, et al (2019) on the study on the impact of adoption of improved cassava variety on household food insecurity in Oyo State, Nigeria, revealing an increase in income of cassava farmers where the impact is more realized in female farmers than male farmers. Their Average treatment effect (ATT) estimates suggested that participation in improved cassava varieties increased total crop incomes of women by ₦3,173 whilst that of men was increased by ₦149 per hectare. In stimulating agricultural growth by using improved cassava varieties; household food security is also ensured as most farmers can use food from their production rather than food purchases (Curran & Cook, 2019; Simon, et al, 2019). Cassava provides farmers with additional income-earning opportunities and enhances their ability to contribute to household food security (Andoh & Bosiakoh, 2016). This is beneficial to alleviating poverty as Nguyen et al (2016)

reiterated that the adoption of agricultural technology by women is significant as it can generate large gains in alleviating poverty. Also, the increase in its production through the adoption of improved cassava varieties of high-yielding and disease-resistant characteristics can improve rural welfare (Acheampong, et al, 2017). FAO (2017) viewd that cassava consumption aids in the nutrition of its consumers due to its nutrient traits. In the study, he stated that cassava produces remarkable energy quantities per day, even compared to cereals.

Increasing farm productivity is one way to alleviate poverty in developing countries. Afolami, et al (2015) opined that one essential factor in reducing long-term rural poverty is adopting agricultural technology innovations, such as enhanced varieties that can reduce farmers' poverty by providing higher agricultural productivity and income.

Previous studies have documented how NICV have been applied internationally to alleviate farmers' poverty. For example, Afolami et al. (2015) revealed the welfare impacts of adopting an improved variety in Nigeria and showed that adoption raised farmers' annual income and purchasing power. Amao and Awoyemi (2018) testet the correlation between adopting an improved variety and farmers' poverty level. The results showed that farmers who did not adopt the variety had a higher poverty level than those who did. Several studies have also shown that an improved variety produces better yields (Afolami et al., 2015), helps improve food security (Donkor, et al, 2017; Simon, et al, 2019), and enhances asset ownership (Awotide, et al, 2015). In addition, one direct indicator by which to understand agricultural productivity is to examine the correlation of technical efficiency levels with farmers' poverty levels. Ma, Renwick, Yuan, and Ratna (2018) opined that the increasing farmers' technical efficiency can be a key strategy to alleviate poverty in rural areas of developing countries because it can improve agricultural production. However, smallholder farmers usually face several barriers to achieving technical efficiency, such as lack of input availability (i.e., seeds, fertilizers, and labor), waste of input usage due to environmental threats, and unavailability of technology innovation.

Amao and Awoyemi (2018) opined that improved cassava varieties will be adopted if the yield gain from adoption is higher than the cost of adoption. As such by capturing yield differences between adopters and non-adopters through a production function and cost differences through a cost function, one can then capture the benefits from adoption.

According to Khonje etal (2015) the decision to adopt improved cassava varieties) is endogenous (as farmers self-select into adoption. In fact, there are several reasons for the adoption decision to be endogenous. First, governments may target households that are more/less productive. Hence, it is likely that adoption decision is correlated with initial productivity levels, poverty status, household income, or underlying features that influence these outcome variables. Second, there is a possibility that adopters share common intrinsic characteristics, such as poor/better farming skills and management abilities, which are likely to be related to poverty status and productivity levels. As such, causal identification of adoption impacts requires an instrument that satisfies the orthogonally condition (a variable that is strongly correlated with adoption decision but that does not directly affect productivity and welfare outcome indicators).

To measure overall welfare effects of technology adoption, indirect effects of adoption need to be accounted for. To capture indirect effects, first need to look into the different pathways through which adoption may affect welfare of adopters and non-adopters. Generally, there are three pathways through which an exogenous change in agricultural productivity (such as adoption) may affect the distribution of outcomes such as productivity, income and poverty (Amao & Awoyemi, 2018).

These include according to Amao and Awoyemi (2018).

i. Effects through output price changes: If adoption increases productivity, it affects local supply and hence reduces local prices. However, such changes in food price benefits only net-food buyers
ii. Effects through farm profits: If outputs expand faster than price fall, then adoption increases the income level of net-food sellers

iii. Effects through rural wage general equilibrium effect for now, we focus on the first two cases, ignoring the effect of wage adjustments. Estimating the aggregate effect of adoption in the above two cases requires the following steps:

i. Estimating treatment effects in terms of yield and cost changes due to adoption

ii. Estimating income effects (producer and consumer surplus changes) based on yield and cost treatment effects and allocate the resulting income changes (producer and consumer surplus) to households

iii. Estimating the counterfactual distribution based on changes in producer and consumer surplus

From the above discussion two points are apparently crucial: Accurate estimation of the treatment effects and allocation of effects (producer and consumer surplus) to appropriate farm households. Estimation of treatment effects was discussed in the previous section. This section focus on how the allocation of changes into appropriate households is done.

Allocation of adoption induced income changes to farm households largely depends on the nature of market the farm-households face (open/closed economy) and the market position of a given farmer (net buyer/seller) of the product under consideration. Following Simon, et al (2019), considered two scenarios for allocating adoption induced income changes to appropriate households: The small open economy and closed economy case. In the small open economy case, the price that prevails at the local market would be the same as the prevailing world market price for cassava. Therefore, any productivity shock (increased in production of cassava due to adoption) would not affect the price that the consumers and producers face in the local market. In this case, welfare effects will only be accrued to producers (simply due to productivity gains). In the closed economy case; local supply shocks will necessarily affect the local market price. As such, the price of cassava would undoubtedly decline as a result of adoption due to supply shifts; leading to potential benefits (loses to both producers and consumers (Zeng et al., 2015). These benefits from adoption can however be different for consumers and producers (adopters). For producers (net-sellers), the effects can only be positive if the per-unit production cost reduction is larger than the price fall. However, consumers (net-buyers) will always benefit due to lower prices (higher purchasing power).

According to FAOSTAT (2020) poverty level effects adoption of improved cassava requires estimating the counterfactual distribution the income level of adopters had they not adopted improved cassava varieties. One of the most innovative aspects of this project was the use of DNA finger printing to credibly identify adoption status. As such we estimated the poverty reduction effects for alternative measures of treatment (adoption status). These include:

i. Adoption status based on DNA-finger printing and assuming a small open economy and closed economy

ii. Adoption status based on self-reported adoption status and assuming a small open economy and closed economy

The unmatched sample showed that the use of organic and chemical fertilizers was significantly different. Farmers who adopted the New Improved Cassava Varieties (NICV) used higher levels of organic fertilizers and chemical fertilizers than those who did not adopt. After controlling for farmers' characteristics, the matched sample showed three significantly different variables: seeds, organic fertilizers, and chemical fertilizers. Adopting farmers tended to use more seed by a factor of 0.208, organic fertilizers by 0.434, and chemical fertilizers by 0.156. Lastly, we concluded that production in the unmatched sample was insignificantly different, but it was insignificantly different in the matched sample. Farmers who adopted the NICV had significantly higher cassava production (by 5%) than farmers who did not adopt it (FAOSTAT, 2020).

Adopting improved cassava varieties can lead to substantial economic benefits for farmers. Higher yields translate into increased marketable surplus, allowing farmers to sell more produce and stabilize their incomes. Economic analyses suggest that farmers growing improved varieties can experience income

increases of 20-30% compared to those cultivating traditional varieties (Ajala et al., 2021). Increased production creates opportunities for value addition through processing. The growing demand for cassava-based products, such as flour and chips, has the potential to drive economic growth in rural areas. Establishing local processing facilities can create jobs and enhance the livelihoods of community members (Ojo et al., 2022).

Improved cassava production contributes to community resilience against economic shocks. By diversifying income sources and enhancing food availability, communities become less vulnerable to fluctuations in global food prices and climate-related challenges (Elias et al., 2023).

The broader socio-economic impacts of improved cassava production extend to food security and nutrition. Enhanced production not only benefits farmers but also improves access to food in local communities. Studies indicate that countries adopting improved cassava varieties have experienced reductions in food insecurity levels, particularly during lean seasons (Thangata & Alfsen, 2022).

In addition to yield, genetic improvement has also focused on enhancing tuber quality. Improved varieties often have better nutritional profiles, including higher levels of vitamins and minerals. For example, some new varieties are bred to contain higher levels of provitamin A, which can help combat malnutrition in regions where cassava is a staple food (Fregene et al., 2021).

The increased production of cassava also creates opportunities for value addition through processing. As production rises, the demand for cassava-based products such as flour, chips, and starch increases, further driving economic growth. Establishing local processing facilities can create jobs and enhance the livelihoods of community members, fostering sustainable development.

Method

The study area was Benue state, Benue State was clustered in three agricultural zones corresponding to the three geographical districts found in the state. The three (3) zones are; Zone A, zone B, and Zone C agricultural zones. The study employed applied Smith's (2013) formula for the determination of sample sizes for unknown population and arrived at the sample size of 384 respondents. The study employed cluster, purposive sampling techniques, simple random sampling and proportionate quote sampling techniques to select respondents for the study. Structural interview and Key Informant Interview (KII) were employed as instruments of data collection. Pearson correlation coefficient was used to test the study hypothesis at a 0.05 level of significance.

Results

Table 1: Characteristics of Respondents

Options	Frequency (n= 381)	Percentage (% = 100)
Sex of Respondents		
Male	178	46.7
Female	203	53.3
Age of Respondents		
18-20	90	23.6
21-26	96	25.2
34-40	107	28.1
41 and above	88	23.1
Education attainment		
No formal education	89	23.4
Primary education	97	25.5
Secondary education	113	29.7
Tertiary education	82	21.4
Marital Status		
Married	171	44.9
Single	90	23.6
Divorced	76	19.9
Others specify	44	11.6
Farm Size		
0-5 Acres and below	58	15.2
0.6-1 Acres	40	10.5
1.1-1.5 Acres	93	24.4
1.6-2 Acres	91	23.9
2.1 Acres and above	99	26.0
Annual Income		
0,000-91,999	90	23.6
N101,999-111,987	96	25.2
N201,560-211,789	97	25.5
N299,241 above	98	25.7

Source: Field survey, 2024

The information in Table 1 presented a summary of the socio-demographic variables of respondents where the sex shows that 178 (46.7%) respondents were males, while 203 (53.3%) respondents were females. In terms of the age distribution of respondents, data collected from the field indicates that 90 (23.6%) respondents were within the age bracket of 18-20 years, 96 (25.2%) were within the age bracket of 21-26 years, Also 107 (28.1%) respondents were within the age bracket of 34-40 years while 88 (23.1%) were 41 years and above., The distribution of respondents by educational attainment indicates that 89 (23.4%) respondents had non-formal education, 97 (25.5%) respondents attained primary education, the data also shows that 113 (29.7%) respondents attained secondary education and 82 (21.4%) respondents had tertiary education.

Concerning the marital status of respondents, a significant proportion of 171 (44.9%) respondents were adult married men and women, also 90 (23.6%) respondents were single probably young men and women who have not decided to marry. The study further shows that 76 (19.9%) respondents were divorced. Finally, 44 (11.6%) respondents belong to other categories. Data on respondents according to

farm size also indicates that 58 (15.2%) respondents had between 0-5 acres and below. The data also revealed that 40 (10.5%) respondents had 0.6-1 acres of farm size. The study further revealed that 93 (24.4%) respondents had between 1.1-1.5 acres of farm size. Furthermore, the study showed that 91 (23.9%) respondents had between 1.6 to 2 acres of farm size. Lastly, 99 (26.0%) respondents had between 2.1 acres and above farm size. Finally, the distribution of respondents on approximate annual income showed that 23.6% (90) of the respondents earned approximately 0,000-91,999 annual income in naira, 25.2% (96) respondents earned approximately N101,999-111,987 annual income. Also, 25.5% (97) respondents earned approximately N201,560-211,789 annual income. Finally, 98 (25.7%) respondents earned approximately N299,241 above annual income.

Table 2: Effect of Adoption of Improved Cassava Varieties on Farmers in Benue State

Effects	**Frequency N= 381**	**Percentage %=100**
Improvement in income;		
Income in naira before adoption of improved cassava varieties	113	29.7
below ₦70,000 - ₦101,000	108	28.3
₦101, 000 - ₦170, 000	100	26.2
₦171, 000 - ₦270, 000	60	15.7
₦271, 000 above		
Income in naira after Adoption of improved cassava varieties	52	13.6
below ₦70,000 - ₦101,000	93	24.4
₦101, 000 - ₦170, 000	117	30.7
₦171, 000 - ₦270, 000	119	31.2
₦271, 000 above		
Improvement in other conditions		
Enhance provision of food	103	27.0
Enhance buying of farming inputs	3	8.0
Facilitate in payment of hospital bills	26	6.8
Enhance payment of school fee	29	7.6
Enhance buying of cloths	93	24.4
All of the above	127	33.3

Source: Field Survey, 2024

Table 2 presents the effect of the adoption of improved cassava varieties on farmers in the study area. The first variable indicated that improved income was one of the effects of adoption of improved cassava varieties. The income is presented in naira, which is the official currency used in the study area. before adoption of improve cassava varieties by farmers. The data revealed that 113 (29.7%) respondents earned below ₦70,000 - ₦101,000, the data also revealed that 108 (28.3%) respondents earned ₦101, 000 - ₦170, 000

Only from the sales of local cassava whether as products or as fresh harvest roots. Furthermore 100 (26.2%) respondents earned as much as ₦171, 000 - ₦270, 000 income. Finally, 50 (15.7%) respondents earned as much as ₦271, 000 above as income from the sale of cassava in a farming season.

On the other hand, income obtained from the sale of cassava in a season after adoption of improve cassava varieties was express as follows; 52 (13.6%) respondents mentioned that they earned below ₦70,000 - ₦101,000, 93 (24.4%) respondents earned ₦101, 000 - ₦170, 000, 117 (30.7%) respondents earned ₦171, 000 - ₦270, 000 as income from the sale of cassava after adoption of improve cassava varieties in a

farming season.119 (31.2%) respondent earned up to ₦271, 000 above as income from the sale of cassava after adoption of improve cassava varieties in a farming season**.**

The above Table also revealed ways in which adoption of improved cassava varieties positively affect farmers in Benue Stat**e,** the data showed that 103 (27.0%) respondents have access to provision of food. Also 3 (8.0%) respondents believe that the adoption of improved cassava varieties has led to enhance buying of farming inputs in the study area. Farmers in the study area believe that the adoption of some improved cassava varieties has helped them generate income and manage some of the life challenges apart from providing them with food. The study also found out that 26 (6.8%) respondents reported facilitating in payment of hospital bills and 29 (7.6%) respondents mentioned helping to pay wards/children's school fees. 93 (24.4%) respondents mentioned that the adoption enhance buying of cloths . Respondents view that the adoption of improved cassava varieties has provided them with more income to take care of their daily needs. 127 (33.3%) respondents also maintained that the adoption of improved cassava varieties has helped farmers with all of the above-mentioned variables.

Key informant interview (KII) with farmers on the effect of the adoption of improved cassava varieties on farmers in the study area revealed different reactions, some farmers explained that the adoption of improved cassava varieties is a welcome development as it increased revenue generated from the sales of cassava products and that the income are used to pay ward/children's school fees where the society is dominated by private schools.

It also creates a value chain for those who are engaged in agricultural business, especially with the establishment of Pure Biogas Company Limited at *Tyomu* in Makurdi, Benue state. Some farmers are engaged in the production, transportation, and marketing of cassava products in the study area. Also, some farmers expressed that although it has improved the production yield, it didn't translate to an increase in farmers' income in the study area as a result some farmers have resulted discontinuation of totally depending on them but only planted some of the varieties to support them in times of needs;

An interview with some farmers from the Gwer-east cluster on the 17th of January, 2024 ominously reported that;

> We are experiencing a shift from cassava production in our area, there are many actors in cassava production. It has created a value chain as follows. At the production level, youths are engaged in providing labor for the production of cassava, also at the production level it brings agrochemicals provide their services for pay, and processing, youths, and women produce many products from cassava such as *gari, and akpu* for income; transportation; transporters are engaged in evacuating raw materials or products while marketing of cassava products are all done to improve the wellbeing of not just the cassava farmers but the society at large. Indeed, I can proudly say the adoption of improved cassava varieties has positive effects on the farmers and the society at large (KII. Female, 2024).

Also, interviews with some leaders of cooperative societies on the effect of the adoption of improved cassava varieties on farmer's wellbeing revealed mixed responses, some were of the view that it positively affects their members while some expressed disappointment as the product of improved varieties is not good and durable as compared with the local varieties.

An interview with a cooperative leader in Kwande cluster on the 22nd of February, 2024 reveals that;

> To me oh, everything that has advantages also has disadvantages too, the improved cassava varieties produced well, have better yield it provide cassava all year round but some of the products obtained from them are not good for *gari* and *akpu,* as you know most of our rural women used to produce these products to help generate income, but from the look of things there is the general outcry from farmers as regards the products from the improved cassava. Marketers don't have so much demand for them. I may say

> categorically that the adoption of the improved cassava varieties didn't translate to 100% effect on the wellbeing of farmers (KII. Female, 2024).

Similarly cooperative leader from the Ogbadigbo cluster on the 18th of January; 2024 revealed that;

> Improved cassava varieties provide our farmers with income because cassava products are available at almost every time. What I observed is that most of our traders from the south who come to buy some cassava products like *gari* and *akpu* are discriminating and asking questions about the type of cassava used for the production of the product. There is a low demand for improved cassava products in our area now, but still, I may conclude that it provides farmers with both food and income which helps the farmers to manage their lives thank you Sir (KII,. Male, 2024).

Another interviewee reported from Obi cluster on the 25th January revealed that;

> To me oh, I may say the varieties are good because they produced fast but cause hunger to us. Where is our woven basket that we used to preserved chips for more than two years? Gone permanent. Again, one has to buy the stems every farming season which are so cost (KII. Female, 2024).

The data on the effect of the adoption of improved cassava varieties on farmers demonstrated that many farmers improve their earning from the sale of cassava either as fresh harvest products or after processing into finish goods. It was clearly observed that majority 29.7% of the farmers earned below ₦70,000 to ₦101,000 before adoption but after adoption of improve cassava varieties majority 31.2% of the farmers earned up to ₦271, 000 above as income. Before the adoption of ICV in the study area, the method of selling freshly harvested cassava was minimal, most rural women sell their cassava product in the form of *Akpu*, *gari*, *chips* and so on. The study clearly demonstrated that with the adoption of the ICV farmers earned more income which translate into their wellbeing in the study area. The quantitative data showed areas where improved cassava varieties had positively impacted the lives of farmers like payment of wards/children's school fees, payment of hospital bills, provision of income, and so on. On the other hand, qualitative data emphatically reported that although it provides income for farmers most of its products are rejected by marketers complaining that the products are not good for *gari akpu* and other products thus planting both varieties. It is also observed in the study that as the demand for cassava increases as a result of high income from the sale of cassava, it degenerates into another social issue in the society as many farm families are now competing for land thus causing communal crisis in the society. Despite this controversial data, it can be deduced from the study that improving cassava varieties has a positive effect on the lives of farmers in the study area as it provides them with food and income to solve their needs.

This finding is in agreement with Mbawini, (2020) who finds that the rapid increase in improved cassava varieties will undoubtedly have significant implications on food security, employment creation, living conditions, and economic growth of farmers. FAO (2017) supported that a higher adoption rate of improved cassava varieties is associated with increased income, poverty reduction, and household food security for farmers. This invariably means that despite the shortcoming of improved cassava varieties it has a positive effect on farmers in the study area. This led us to examine the challenges that farmers faced in their effort to adopt these improved cassava varieties in Benue state Nigeria.

Table 3: Pearson Correlation Coefficient showing the Effects of Improved Cassava Varieties on Farmers' Benue state.

Correlations

		1	2	3	4	5	6
Sex of Respondents	Pearson Correlation	1	.020	.063	-.835**	.839**	.820**
	Sig. (2-tailed)		.695	.220	.000	.000	.000
Age of Respondents	Pearson Correlation	.020	1	-.689**	-.406**	.477**	.418**
	Sig. (2-tailed)	.695		.000	.000	.000	.000
Educational Attainment of Respondents	Pearson Correlation	.063	-.689**	1	.243**	-.211**	-.127*
	Sig. (2-tailed)	.220	.000		.000	.000	.013
Marital Status of Respondents	Pearson Correlation	-.835**	-.406**	.243**	1	-.932**	-.920**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
Farm Size of Respondents	Pearson Correlation	.839**	.477**	-.211**	-.932**	1	.942**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
Income in Naira after Adoption of Improved Cassava varieties	Pearson Correlation	.820**	.418**	-.127*	-.920**	.942**	1
	Sig. (2-tailed)	.000	.000	.013	.000	.000	
	N	381	381	381	381	381	381

Note **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Source: Field Survey 2024.

Note that Figure 3 on the heading represents income in naira after the adoption of improved cassava varieties. All the social demographic variables are correlated with income in naira after the adoption of improved cassava varieties.

Table 3 above showed that there is a strong correlation between improved cassava varieties and farmers in the study area as represented by 820** and .000. It then means that one sex may determine his/her income from the sales of improved cassava varieties. This may be probably because men have an advantage in deciding on the kind of crops to produce while in most African cultures women only follow their husband decision. Based on the fact the strong correlation is represented by 820** and .000.

The Pearson correlation coefficient on the age of the respondents shows that age correlates with

income in naira after the adoption of improved cassava varieties represented by .418** and .000. This means that young energetic farmers have the potential to get more income after the adoption of improved cassava varieties.

Table 3 further shows that the educational attainment of farmers correlates with income in naira after the adoption of improved cassava varieties although a weak and negative one as represented by -.127* and .013. The .013 shows that farmers can still earn high from the adoption of improved cassava varieties. The .013 shows that there may be intervening variables like the size of land purchasing power of the farmers and his/her access to extension services. These variables can help the farmer improve his income from the sale of cassava.

On marital status, the data shows that marital status correlates with income in naira after the adoption of improved cassava varieties represented by -.920** and .000 although a negative one. This is to interpret that farmers can earn income from whether they are married or not so far, he or she can afford to hire land. On the other hand, married couples can earn more income after the adoption of improved cassava varieties when their labor and resources are put together for production purposes.

On the size of the farm, the data shows that it correlates with income in naira after the adoption of improved cassava varieties represented by .942** and .000. This shows a strong correlation this means that farmers with large farms can earn higher income after the adoption of improved cassava varieties. This clearly shows that the size of the farm can lead to an increment in the quantity yield translating to improvement in the well-being of the farmer in the study.

A conclusion could be drawn from this analysis that improved cassava varieties have a positive effect on farmers hence most of the social demographics show a good relationship with income in naira after the adoption of improved cassava varieties, it then means that improved cassava varieties have positive effects on farmers in the study area. The study also rejects the Ho and Accept the Hi that there are effects of improved cassava varieties on farmers in Benue state.

Conclusion and recommendations

Based on the findings, the study concluded that farmers in the study should adopt improve cassava varieties. The study recommends the following; that efforts should be made by agencies, those involved in Agric business to educate farmers on improved cassava varieties available in the state. Also, grants/credit should be given to farmer to aid them in adoption of improved cassava varieties. There should be also provision of extension service to help adoption of improved cassava varieties by farmers, farmers should also be supported to have more land to facilitate adoption process. Finally, there should be modification in some of the improve cassava varieties to improve on their quality.

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