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EXTENT TO WHICH IMPROVED CASSAVA VARIETIES INCREASES QUANTITY OF CASSAVA PRODUCTION IN BENUE STATE, NIGERIA.

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Abstract
Cassava farmers in Benue State are faced with challenges in cassava production such as low yield, cassava diseases, pest infestation and drought thus affecting their finance and investment opportunities. The paper examined the extent to which improved cassava varieties increases cassava production in Benue State, Nigeria. Diffusion of innovation theory was used as theoretical guide. The study used copies of questionnaire and Focus Group Discussions (FGD) as instruments of data collection. Data was collected among 381 respondents using multistage sampling techniques. The study found that improve cassava varieties increased the quantity of cassava production in the study area at high extent level, hence many cassava farmers increase their quantity of production from 11 to 20 tons, this translated in improving the living condition of the farmers especially the rural dwellers. Test of hypothesis revealed that; all the cross-tabulated variables showed the result of P – value = 0.00 < 0.05. Based on the above result, the study accepts Hi and rejects Ho. It then means that ICV increases cassava production at high extent level in Benue state. The study concluded that the adoption of ICV should be encourage hence it improve cassava production in the study area. The study recommends that; efforts should be made by agencies, and NGOs to educate farmers on improved cassava varieties. There should be also provision of extension service to help widen adoption process in the state, there should be also modification in some of the improve cassava varieties to improve on their quality.

Keywords: Improved cassava varieties, innovation, adoption, production, farmers

Introduction

The adoption of improved agricultural technologies should increase overall productivity and provide additional income for farmers. In doing so, technology adoption can accelerate economic growth, create marketing opportunities, and help farmers improve their production capacity (Wossen, Tahirou, Alene, Feleke, Haile, Olanrewaju & Manyong, 2017)

Cassava (*Manihot esculenta* Crantz) is a tuber crop propagated colonially. The crop is grown throughout the tropics by more than 800 million people (Nassar & Ortiz, 2010). There are two varieties of cassava, the sweet and the bitter varieties. The sweet varieties are grown as secondary crops for home consumption while the bitter one is used for animal feeds and starch after high processing technology (Olufunmilayo, 2017).

Globally, over 303.6 million tons of cassava storage roots are harvested from approximately 28.2 million ha (FAOSTAT 2020). The African continent cultivates more than half of the global fresh cassava 79.8% on 22.5 million ha. However, the continent's average yield (8.6 tons/ha) falls short of the global yield (10.7 tons/ha) FAOSAT (2020), and the maximum potential experimental yield is 20–50 ton/ha. Worldwide cassava production was increased by 12.5% between 2000 and 2015. In 2021, the average yield of cassava crop worldwide was 12.5 tons per hectare. The most productive cassava farms in the world were in India, with a nationwide average yield of 34.8 tons per hectare (FAOSAT, 2020). Nigeria is the world's largest producer of cassava. The total area harvested in 2020 was 3.13 million hectares (ha), with production estimated at 36.8 million metric tons and an average yield of 11.7 tons/ha–1 (Rahman, Toiba & Huang, 2021). However, based on the statistics from the FAO (2020) other major cassava producers include; Thailand, which is the largest exporting country of dried cassava, with a total of 77% of world exports in 2020. The second-largest exporting country is Vietnam, with 13.6%, followed by Indonesia (5.8%) and Costa Rica (2.1%) (Rahman et al, 2021). Otekunrin and Sawicka (2019) report that in Nigeria, Benue and Kogi state in the North Central Zone are the largest producers of cassava. Cross River, Akwa Ibom, Rivers, and Delta dominate state cassava production in the South-South. Ogun, Ondo, and Oyo dominate in the South West and Enugu and Imo dominate production in the South East, respectively.

In Latin America, cassava is used to prepare traditional food products and starch extraction (FAOSTAT, 2020). Malik, Kongsil, Nguy˜ên, Ou, and Srean (2020) report that in Asia particularly in China, cassava is used for fuel ethanol which is a substitute for gasoline and reduces oil imports. It is also used for one Joule of petroleum fuel, plus other forms of energy inputs such as coal. Wossen et al (2017) reports that in the 19th century, cassava became an important food crop in southern India, as well as on Java island of Indonesia and in the southern Philippines, while in Malaysia and parts of Indonesia it is also used for extraction of starch. In most countries, cassava is utilized domestically, but in Thailand it is used mainly for feed and industrial purposes (Spencer & Ezedinma, 2017; Waisundara, 2018).

Cassava-based products in West Africa, Nigeria, and Benue State inclusive are; *gari, fufu, akpu*, cassava flour, edible starch, and tapioca. Detoxification of fresh cassava roots is partly achieved through cell rupture during cutting and grating, soaking in running or standing water in earthen pots for 3–5 days, heating, drying, and boiling. Cassava is also used as a staple food and for industrial purposes in Nigeria (Otekunrin & Sawicka, 2019).

Malik et al, (2020) report that the traditional cassava has challenges such as low yield as compared to improved varieties, prone to some tropical cassava diseases, such as cassava mosaic disease (CMD), cassava brown streak disease (CBSD), and cassava bacteria blight (CBB), and pests such as cassava green mites (CGM) and whiteflies. The above challenges led to the emergency introduction of improved cassava varieties.

Improved cassava varieties are genetically modified hybrid cassava which are resistance to cassava diseases pest, environment stress and have high yield as compares to the local variety examples include; TME 1632, TME 1070539, TMS 1011206, TME 419, NR-8082, TMS 92/0326, TMS 96/1632, 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).

The improved cassava varieties have overcome the challenges associated with the traditional varieties, as reported by Teeken, Agbona, Abolore, Olaosebikan, Alamu and Adesokan 2020; Rahman et al 2021; & FAOSTAT, 2020) as it's resistance to cassava diseases like CBSD, and CBB and can also produce high quality and quantity yield, nutritional value, adapting to a wide range of environments, improved plant type for mechanization; and end user characteristics, including processing, cooking, and organoleptic properties

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, the study hypothesis that; there is no extent in which improved cassava varieties improved cassava production in Benue State. The study also seeks to examine the extent in which adoption of improved cassava varieties increases cassava production in Benue State, Nigeria,

Statement of the Problem

Local variety of cassava is prone to diseases, pests, and low yield. The improved cassava varieties were introduced to reduce this problem in order to increase cassava yield, tolerant of environmental stress, and resistant to pests and diseases. Cassava serves as a commodity that could generate desired economic growth, fight poverty and improve food security hence the product is available almost every time of the year.

The adoption of improved cassava varieties is essential since the crop is cultivated by about 90% of the farming population in Benue State, making it the right target crop for reducing poverty, but also noted that the overall adoption rate of improved cassava varieties is only at 40% (Simon, Olufemi, Oluwasegun & Adetola, 2019)

In Benue State, it seems inadequate adoption of improved cassava varieties has constrained cassava productive efficiency therefore translating to inadequate cassava production as well as poor well-being of cassava farmers.

To reduce these constraints due to diseases, pests and increase productivity, output yield and improve the well-being of farmers, efforts have been made by extension agents and those involved in the agric business to disseminate the right adoption methods like spacing, encourage planting of different improve cassava varieties to cassava farmers to improve their production capacity.

Despite these efforts, in Benue State, it seems cassava farmers experience difficulty in accessing the improved cassava varieties due to the high cost of the stems and, the shortage of extension agents to reach the many cassava farmers in the state. Also, the adoption of improved cassava varieties in the study area seems to be a challenge hence most farmers are resistant to change preferring the local varieties. Similarly, adoption of improved cassava varieties in the study area seems to be low due to poor coverage of intervention programme on cassava production like the IFAD which covers only eight local governments out of the twenty-three local government areas across Benue State

There is an indication that some authors have written on some areas of improved cassava varieties such as; 'Welfare impact of the adoption of improved cassava varieties by rural households; Cassava breeding and agronomy and Catalogue of released and registered crop varieties (Afolami et al, 2015; MoFA, 2019; Malik, et al., 2020). Available information shows that much work has not been done to examine the adoption of improved cassava varieties and cassava production in Benue State. Specifically, past studies failed to examine the adoption of improved cassava varieties and cassava production in Benue state. This study therefore seeks to fill the knowledge vacuum by examining examine the adoption of improved cassava varieties and cassava production in Benue state, Nigeria.

Review of Related Literature and theorical framework

Extent to which Improved Cassava Varieties increases Cassava Production

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.

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." Research has shown that these improved varieties can yield between 30% and 50% more than traditional varieties under optimal conditions (Onyenweaku et al., 2022). For instance, field trials in Nigeria have demonstrated that TME 419 consistently produces yields of 25 to 35 tons per hectare, compared to 10 to 15 tons for local varieties (Akinyemi et al., 2023).

Recent studies have demonstrated that some newly developed varieties can produce yields exceeding 30 tons per hectare under optimal conditions, compared to traditional varieties that often yield 15-20 tons (Author et al., 2021). This genetic enhancement is crucial for meeting the growing food demands in developing countries.

Genetic improvement is at the core of developing high-yielding cassava varieties. Through selective breeding and modern biotechnological approaches, researchers can introduce desirable traits into cassava. Marker-assisted selection (MAS) has emerged as a key technique, enabling breeders to identify and select plants with specific genetic markers linked to traits like high yield and disease resistance (Elias, 2022).

Akongo, Otim, Turyagyenda, Bua, Komakech and Obong (2021) conducted a study on the extent to which improved cassava varieties contribute to improvement in cassava production among smallholder farmers in the Northern agro-ecological zone of Uganda. In order to achieve the objective, data was collected from PRELNOR supported farmers' fields, other farmers' fields and baseline cassava fields. Consequently, descriptive statistics, gross margin and stochastic frontier analysis were adopted during analysis. Results from the analysis revealed that higher yields per hectare were registered within PRELNOR supported farmers' fields and yield from NAROCAS1 surpassed all the varieties (37.3 tons per hectare). Location specific results revealed that Gulu had better yields (34.5 tons per hectare) while Kitgum registered the lowest average yield (24.1 tons per hectare).

Soil health directly impacts cassava yield potential. Improved varieties often require better soil fertility to realize their maximum yield. Practices like crop rotation, organic amendments, and soil testing can enhance nutrient availability. Research has shown that investing in soil health can lead to yield increases of up to 40% for high-yielding cassava varieties (Elias, 2022). Maintaining soil structure and fertility is essential for sustaining high yields over multiple cropping cycles, ensuring long-term productivity. Field trials are crucial for demonstrating the benefits of improved cassava varieties. Comprehensive trials conducted across various ecological zones provide farmers with the evidence needed to adopt new varieties. In Nigeria, for instance, large-scale trials have shown yield increases from 15 to 25 tons per hectare, confirming the potential of improved varieties. The success of these trials has led to increased adoption rates among farmers, who report higher income and food security when cultivating these varieties (Ajala, 2021).

Diseases like cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) severely affect production. CMD can reduce yields by up to 90%, while CBSD can significantly impair both quality and quantity (Elias et al., 2023). Improved varieties are bred for resistance to these diseases, thereby enhancing yield potential. Research indicates that the adoption of CMD-resistant varieties can lead to yield increases of 30-40% in affected regions (Nwafor et al., 2023). Additionally, integrated pest management (IPM) strategies that combine resistant varieties with cultural practices can further enhance production.

The economic implications of adopting improved cassava varieties are profound. Higher yields translate to increased marketable surplus, allowing farmers to sell more produce and stabilize their incomes. Economic analyses indicate that farmers growing improved varieties can experience income increases of 20-30% compared to those cultivating traditional varieties (Ajala et al., 2021).

For the benefits of improved cassava varieties to be fully realized, access is crucial. Strengthening seed distribution systems ensures that smallholder farmers can obtain quality seeds. Research suggests that effective seed systems can significantly improve adoption rates, leading to widespread production benefits (Nwafor et al., 2021).

In Nigeria, adoption rates further reveals that the intensity of adoption rate is the highest in the South-West region. The lowest intensity rate is reported in the South-East. These results are not surprising as IITA is located and has been operating in the south-western part of the country for the last 50 years. The South-South region of the country has the second highest adoption rate. This might be due to the presence of national research centers in the region (Simon etal, 2019; Wordofa etal, 2021). Distribution of yield based on self-reported adoption status. Intensity of adoption is calculated by considering the area under improved cassava varieties out of the total cassava area. The result shows that despite high rates of adoption the intensity of adoption is very low. In Indonesia, Muhaimin etal, (2020) explained that adoption rate, based on intensity of adoption, stands at 38% while using farmers' self-reported data.

Khonje etal, (2015) observed that adoption implies that the utility of expected net-return from adoption is higher than from non-adoption: The net return from adoption depends on the structure of the return and the cost. On the revenue side, it assumes that the final output price of improved and traditional cassava varieties will be the same. However, productivity is expected to be higher with adoption. Therefore, on the revenue side, adoption decision depends on expected yield.

Khonje etal (2015) encourage that farmers should adopt improved cassava varieties when the utility of expected benefit from adoption is higher than the utility of expected returns without adoption, adoption decision implies, with some algebraic manipulation and taking price as a numeracy, it can be deduced from these review that adoption decision depends on yield and cost differences between improved and traditional cassava varieties.

This invariably shows that improved cassava varieties represent a critical tool in enhancing cassava production, addressing food security challenges, and promoting economic stability. Through genetic advancements, disease resistance, adaptability to environmental stressors, effective agronomic practices, and socio-economic benefits, these varieties can transform cassava cultivation. As climate change and population pressures continue to rise, the importance of developing and disseminating improved cassava varieties cannot be overstated. Future research should focus on integrating these varieties with sustainable practices to ensure long-term viability and resilience in cassava production.

Theorical Framework

Diffusion of Innovations Theory

The diffusion of innovations theory is a hypothesis outlining how new technological and other advancements spread throughout societies and cultures, from introduction to widespread adoption. The diffusion of innovations theory seeks to explain how and why new ideas and practices are adopted, including why the adoption of new ideas can be spread out over long periods (Clay, 2023).

The diffusion of innovations theory was developed by E.M. Rogers, a communication theorist at the University of New Mexico, in 1962. Diffusion happens through a five-step process of decision-making. The five steps are awareness, interest, evaluation, trial, and adoption. Rogers renamed these knowledge, persuasion, decision, implementation, and confirmation (Clay, 2023).

The basic tenant of the theory according to Clay (2023) include;

- The diffusion of innovations theory describes the pattern and speed at which new ideas, practices, or products spread through a population.
- The main players in the theory are innovators, early adopters, early majority, late majority, and laggards.
- In Agriculture, this diffusion of innovations theory is often applied to help understand and promote the adoption of new farming methods/cutting stems and new seeds.

- The diffusion of innovations theory can also be used in areas such as public health to encourage populations to adopt new, healthy behaviors.

Criticisms of the theory; at any point in the decision-making process, an individual might decide against adopting an innovation, usually due to some kind of barrier. These barriers are usually the usage or value of the innovation, the risk associated with adopting something new, or psychological factors such as cultural stigma.

Despite its criticism, the theory seems fit to explains the relationship between adoption of improve cassava varieties and cassava production among the farmers in Benue State using the five stages of diffusion of innovation which include; awareness, interest, evaluation, trial, and adoption and the main people in the diffusion of innovations theory which include; innovators, early adopters, early majority, late majority and the laggards.

Innovators; are venturesome, approach to change, quickly take up new ideas, knowledge, and technologies, cope with uncertainty and failure, risk-takers, play an important role in introducing innovations into the system and plays a gatekeeper role in the flow of information in a social system. For this study, these are farmers who first adopt improve cassava varieties and who later introduced them to other farmers. This person belongs to awareness stage of in the theory of diffusion of innovation theory.

Early Adopters; respected members of the social system, represent opinion leaders and are more integrated into the social system than innovators, provide advice and information to others about innovations, are already aware of the need to change and so are very comfortable adopting new ideas, early adopters help trigger the critical mass when they adopt an innovation (i.e. considered a “stamp of approval”) and has a central position in the social system (communication network). Like the case of this study, these are farmers who create the awareness of the improve cassava varieties to other farmers in the study area. These categories of the farmers developed interest on the innovation like the case of improved cassava varieties in this study.

Early Majority; deliberate need to see evidence, think about and be convinced by others before being willing to adopt, adopt innovations before the average person, rarely perform leadership roles, serve as important links in the diffusion process as they are the connection between very early and the relatively late adopters. In this study, they draw the attention of other farmers educating them on the merits and demerit of improve cassava varieties after having (interest, evaluation and trailing on their farm) and explaining the need to adopt the innovation by other farmers.

The late Majority; are skeptical, cautious about change, and have a questioning attitude to innovations, adopt new ideas just after the average person, adoption may result from peer pressure or economic necessity rather than motivation for change, innovation must be well supported by social norms to be desirable, possibly have few resources therefore most of the uncertainty of the innovation must be removed before the late majority feel comfortable with adopting innovations. These of the categories of farmers who adopt improve cassava varieties after considering the interest, evaluation, trial of farmers and decide to adopt in order to obtained the merits like income gotten by adopters.

Laggards; traditional in character, they are bound by tradition and are very conservative, they are not opinion leaders and mostly considered ‘isolates’ in a social network sense (not connected strongly or to many other system members, the points of reference for laggards is the past, they are very skeptical of change and are the hardest group to motivate to adopt innovations, they take a lengthy amount of time to adopt in association with awareness of innovation, they demonstrate resistance towards innovations and are risk averse, they are in a vulnerable economic situation, therefore access to resources is constricted and blame for not adopting can be located at the individual and system level.

Based on the above, the adoption of improved cassava varieties in Benue state might be the function of the rate of the adoption and the various stages involved in the diffusion of innovation process.

Methodology

Benue State was clustered in three agricultural zones according to the three geographical districts found in the state. The three (3) zones are; Zone A, zone B, and Zone C agricultural zones respectively. The study employed applied Smith's (2013) formula for the determination of sample sizes and arrive at the sample size of 384 respondents. The study employed multistage sampling techniques to select respondents for the study. Data was collected using copies of questionnaire and Focus Group Discussions (FGD). The hypothesis was tested with Chi square (x^2) at a 0.05 level of significance.

Findings of the study

Table 1: Social Demographic Variables of Respondents

Variable	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
Respondent's Status		
Adopter	381	99.3
Non-adopter	3	0.7
Farming Experience		
1-5 years	94	24.7
6-10 years	99	26.0
11-15 years	107	28.1
16 years and above	81	21.2
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

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. Also, on the respondent's status revealed that 381 (99.3) respondents adopted one form of improve cassava varieties while 3 (0.7) respondents do not adopt any variety in the study area. The distribution of respondents according to farming experience indicates that 94 (24.7%) respondents had between 1 to 5 years of farming experience and 99 (26.0%) respondents had between 6-10 years of farming experience. The findings further revealed that 107 (28.1%) respondents had between 11-15 years of farming experience. Lastly, 81 (21.2%) respondents had between 16 years and above farming experience.

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; How Improved Cassava Varieties increases the Quantity of Cassava Production in Benue State

Variable	Frequency N= 381	Percentage % = 100
Tones of Cassava produced before the Adoption of Improved varieties in a farming season		
0-5 tones	169	44.4
6-10 tones	153	40.2
11- 15 tones	43	11.3
16- 20 tones	16	4.2
Tones of Cassava produced After the Adoption of Improved Varieties in the Farming Season		
0-5 tones	42	11.0
6-10 tones	49	12.9
11- 15 tones	133	34.9
16- 20 tones	157	41.2

Source: Field survey, 2024

Table 2 presented bags of cassava produced before improved cassava varieties were introduced in a farming season in Benue State, 169 (44.4%) farmers produced from 0 – 5 tons in a farming season. It was observed that the quantity produced before the adoption of improved varieties was low farmers produced small bags. This might be attributed to the effect of CMD and other cassava diseases and pests. 153 (40.2%) cassava farmers produced from 6 – 10 tons before the adoption of improved cassava varieties. This is also considered low hence many farmers produced between 6 – 10 tones. 43 (11.3%) farmers produced 11 – 15 tones before the adoption of improved cassava varieties while 16 (4.2%) farmers produced 16 – 20 tons. The data showed that the frequency of farmers decreases as the tones of cassava produced increases, invariably showing that before the adoption of improved cassava varieties the quantity produced by farmers in the study area was low. Table 1 on social demographic variables earlier indicated that the majority 26% of farmers' farm size was above 2.1 acres and above, this shows that farmers own many acres of land, but the quantity of cassava production was low before the adoption of improved cassava varieties in the study area.

Same Table 2 also revealed tones of cassava produced after the adoption of improved varieties in the farming season. Data revealed that majority 157 (41.2%) farmers produced 16- 20 tons of improved cassava varieties in a farming season which is considered high compared with the quantity produced before adoption whereas the majority 44.4% produced between 0-5 tons of improved varieties only. 133 (34.9%) farmers produced 11- 15 tons of improved cassava varieties after adoption. This is also considered high because, before the adoption of improved cassava varieties, 11.3% of farmers produced only 11- 15 tons of cassava in the study area but after the adoption, 34.9% had increased the quantity to 11 -15 tones, this invariably shows that adoption of improved cassava varieties has a significant effect on cassava production. 49 (12.9%) farmers produced between 6-10 tons after the adoption of improved cassava varieties in the study area. Compared with the production level before the adoption when 40.2% produced 6-10 tones (low production), the percentage of production from 6 – 10 tons after the adoption have decreased to only 12.9% of farmers which means only a few farmers produce from 6 – 10 tons after adoption but about 40.2% increase their production capacity in the study area after the adoption of improved cassava varieties while 42 (11.0%) farmers produced between 0-5 tons of cassava in the study area. This is also observed that before the adoption majority, 44.4% produced 0 – 5 tons low quantity but after the adoption majority, 41.2% produced 16 - 20 tons of very high quantitate as reviewed by the farmers.

Focus Group Discussion (FGD) also aver that before the introduction of improved cassava varieties in the study area, farmers produced small quantity of cassava because of low yield, inadequate land, activities of pests and diseases, and so on, but with the introduction and adoption of improved cassava varieties farmers increase their yield as seen from the above data.

Despite these success stories some farmers express dismay over the improved cassava varieties. Some cassava farmers reported that the improved varieties seem to be a way of creating food insecurity and over dependence on the western societies pointing out that with the introduction of the improved varieties our local cassava varieties which provide us with food and cassava stem year-round is going into extension. The stems of ICV are not good for preservation for next farming season, it easily spoilt. Although farmers express their feelings and views as regards improved cassava varieties and cassava production which are presented below;

Discussion with farmers from the Logo cluster on the 13th of January; 2024 revealed that;

> Cassava has come to stay, before now we planted different local varieties and it was producing well. If you plant local varieties on twenty (20) lines of 50 hips you may likely produce at least two bags of chips or three bags of fermented cassava *akpu* but after the adoption of improved cassava varieties (20) lines of 50 hips produce at least 4 - 5 bags of chips or 6 - 7 bags of fermented cassava *akpu* especially 419 cassavas, also call *Cotonou.* I can quite agree with you that the adoption of improved cassava varieties leads to an increase in the quantity of cassava produced (FGD Male, 2024).

Discussion with farmers from Obi cluster on the 25th of January, 2024 revealed that;

> There is a significant improvement in the quantity of cassava produced these days. Different varieties are planted here such as Vit-A is yellow and produces many flowers it is described as *banada, cipi* and 419; as *Dandoo*, the maturity rate is very fast some between 6 – 8 months. It produced better than the local varieties. It gives more quantity when planted on the same landmark with the local varieties (FGD. Female, 2024).

Similarly, discussions with farmers from the Logo and Gboko cluster on the 17th of January; 2024 revealed that;

> Our experience with improved cassava varieties, like TMS 30572, TME 419 have been very positive. Since we started growing them about three years ago, we have seen a noticeable increase our yields. On average, we used to harvest about 10 bags per hectare with local varieties, but now we get around 15 to 18 bags. This has significantly boosted

> our income. The primary motivation was the potential for higher yields. We also heard from other farmers about the improved varieties' resistance to diseases, which has been a major issue with traditional cassava. Additionally, agricultural extension workers provided training and information on the benefits of these varieties, which encouraged us to make the switch (FGD Female, 2024).

The above data shows that the adoption of improved cassava varieties has a positive and negative relationship as regard cassava production in Benue state. Table 3 showed the quantity of cassava obtained before the adoption of improved cassava varieties and the data revealed that farmers produced a small quantity before the adoption of improved cassava varieties but increased production levels after the adoption. The qualitative data shared the same view that improved cassava varieties increase cassava production in the study area but added that it has numerous disadvantages compared to the local varieties. This finding is in line with Khonje et al, (2015) who observed that adoption implies that the utility of expected net return from adoption is higher than from non-adoption: The net return from adoption depends on the structure of the return and the cost. On the revenue side, it assumes that the final output price of improved and traditional cassava varieties will be the same. However, productivity is expected to be higher with adoption. The conclusion could be drawn from this analysis that improved cassava varieties have a positive effect on cassava production, it leads to an increase in the quantity of cassava production in the study area and this leads to investigating how the adoption of improved cassava varieties translates to improvement in the wellbeing of cassava farmers in the study area.

Test of Hypothesis

Table 3; Chi-square (x^2) showing the extent in which improved Cassava varieties increases Cassava Production in Benue State, cross-tabulation

			Tons of cassava produced after adoption of ICV				
			0-5 tons	6-10 tons	11- 15 tons	16- 20 tons	P-value
Improved Cassava Varieties plant in Farming Season	TMS 30572	Count	42	0	0	0	42
		% within Bags of Cassava produced After Adoption of Improved varieties in Farming Season	0.0%	8.0%	20.0%	78.0%	0.00
	TMS 92/0326	Count	3	46	0	0	49
		% within Bags of Cassava produced After Adoption of Improved varieties in Farming Season	0,1%	0,0%	6.0%	93.9%	0.01
	TME 419	Count	0	50	83	0	133
		% within Bags of Cassava produced After Adoption of Improved varieties in Farming Season	0.0%	0.6%	37.0%	62.4%	0.00
	Vit A	Count	0	0	14	143	157
		% within Bags of Cassava produced After Adoption of Improved Varieties in Farming Season	0.0%	0.0%	8.9%	91.1%	0.00

	TMS 4(2) 142	% within Bags of Cassava produced After Adoption of Improved Varieties in Farming Season	0 0.0%	50 0.0%	83 35%	0 57%	133 0.00

Sources. Field Survey, 2024
Note: Chi-square is tested at 0.05 significant levels.
$x^2 < 0.05$ (2-tailed tested).
Table 3 showed influential statistic chi-square (x^2) cross tabulation was used to determine the association between improved cassava varieties and extent in which improve cassava varieties improved cassava production in Benue state. On cassava variety TMS 30572, findings showed the P value of 0.00 < 0.05, this invariably showed that the above variety increases cassava production in the study area. On TMS 92/0326, the data revealed the P value of 0.01 < 0.05, this invariably showed that the above variety increases cassava production in the study area. Although a significance value of 0.01 < 0.05 has not proven perfect association, still it has the significant association with increase in cassava production hence the 0.01 is less than 0.05. Cross tabulation information on TME 419 revealed that it increases cassava production at very high extent and it was also proven by the P value of 0.00 < 0.05. Most farmers who adopt them increase their yield to 16 to 20 tons in a farming season. Farmers reported that the variety is widely adopted in Benue state. Also, cross tabulation on Vit A variety revealed the test of Chi-square showed as P value of 0.00 < 0.05. It then means that the variety improved cassava production at high extent. On TMS 4(2) 142, the study revealed, it improves cassava production at high extent as many farmers in the study area increases their production level to about 11 to 20 tons in a farming season. The test of Chi-square cross tabulation showed a P value of 0.00 < 0.05. It also showed that the TMS 4(2) 142 increases cassava production at high extent in the study area.

Conclusion and Recommendations
Based on the findings, the study concluded that the adoption of ICV should be encourage hence it improve cassava production translating to the improvement in the standard of living of farmers in the study area. the study recommends following; efforts should be made by agencies, and NGOs 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. farmers should also be supported to have more land to facilitate adoption process.

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