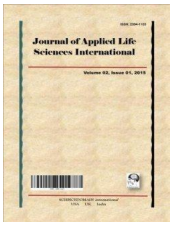

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Level of Adoption of Improved Cassava Technologies in Benue State

Juliet Ogadinma Onyemma[1], Koko Michael Tertsea[2] Nkem Kelechi Ogbonna[3] and Nwafor Solomon Chimela[3*]

[1]Cocoyam Programme, National Root Crop Research Institute, Umudike, Nigeria.
[2]Department of Sociology, Benue State University, Makurdi, Nigeria.
[3]Farming Systems Research and Extension, National Root Crop Research Institute, Umudike, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author JOO designed the study, wrote the protocol and wrote the first draft of the manuscript. Author NSC performed the statistical analysis, and managed the analyses of the study. Authors KMT and NKO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study aimed to determine the level of adoption of improved cassava technologies in Benue State.
Study Design: The Survey design was adopted for the study.
Place and Duration of Study: The study was carried out in Benue State, between September 2018 and March 2019.
Methodology: Cluster and simple random sampling techniques were used to select 336 respondents for the study. Primary data were collected using Semi-structured questionnaire. The objectives were achieved using descriptive statistics such as percentages, frequencies and means and Rank ordered analysis.
Results: The improved cassava technologies in Benue state were identified to include; TMS 0505, TMS 0581, TMS 30572, TMS 01/1368, TMS 96/1632, TMS 92/0326, TME 419, NR 8082.The result revealed that the percentage awareness for TMS 0505 was high 65% (238) but the adoption of

**Corresponding author: E-mail: solomonnwafor8@gmail.com;*

TMS 0505 was low 32% (78). There is moderate awareness level for TMS 0581 49% (179) and TMS 02/1368 56% (294) with moderate adoption 55% (98) and 53% (109) respectively. Also, the awareness level for TMS 92/0326 is high 72% (265) with moderate adoption 44% (116); TME 419 and NR 8082 had high awareness level 85% (311) and 88% (323) with high adoption 65% (201) and 68% (221) respectively. The result also revealed that famers complained that the improved cassava varieties cannot store for a long time in the farm 93% (342) and that there is no market to sale increased quantity of cassava roots.

Conclusion: Thus it was concluded that there is generally high level of awareness of improved cassava varieties in Benue state but with moderate to low adoption rate.

The study thus recommend that farmers should be consulted and their needs should always be considered in such development ventures. This will ensure high adoption and high impact as well.

Keywords: Adoption; technologies; cassava.

1. INTRODUCTION

Cassava is one of the world's most important food crops. Throughout the tropics, the plant's root and leaves serve as an essential source of calories and income. About 600 million people in Africa, Asia and Latin America depend on the cassava crop for their food and incomes. In Africa cassava production has more than tripled since 1961 from 33 million tons per year to 101 million tons. In countries like Nigeria and Ghana, wide adoptions of high-yielding varieties and better pest management have resulted in a sharp rise in production. Marketing cassava presents some unique challenges [1]. It is worthy of note that cassava technologies as used in this context refers to improved cassava varieties.

Cassava is a year-round crop, with production levels that are steady but small. It is also a perishable and bulky product, which makes it very costly to transport without some initial processing. Poor subsistence farmers are the main growers of cassava, and women are largely responsible for the work of processing it to make gari, fufu, tapioca and other products The uses of cassava are expanding, as further processing can produce chips, pellets, flour, alcohol and starch. A wide range of industries use cassava in the production of livestock feed, textiles, confections, plywood and soft drinks. Many rural development efforts in Western and Central Africa have focused on how to improve poor farmers' yields. Technological improvement (such as improved cassava varieties) is the most important factor in increasing agricultural productivity and reduction of poverty in the long-term [2,3].To increase productivity, technology must be adopted in the production process and the rate of adoption of a new technology is subject to its profitability, degree of risk associated with it, capital requirements, agricultural policies and socioeconomic characteristics of farmers [4]. (Cassava technologies here refers to improved cassava varieties). The adoption of innovation is the last step in a decision process to make full use of an innovation having considered that such will impact positively on the livelihood of the adopter. Intensification of better agricultural production system is one of the ways of increasing the welfare of farmers. This can be achieved if farmers take advantage of improved crop variety such as cassava. Agriculture plays a unique role in reducing poverty through the use of new technologies [5]. Agricultural productivity growth is becoming increasingly difficult without developing and disseminating cost effective yield increasing technologies to meet the needs of increasing number of people to expand the area under cultivation or rely on irrigation [6,7,8] identified two general properties of technological improvement. The first is the development of a new production function such that a greater output is achieved from a given input level. The second property is that the technological improvement must monetarily increase the discounted profits (or decrease losses) of the firm. Adoption of new technologies normally involves two stages: the decision to either adopt or not and the second stage involves how much of the new technology to adopt or use (or extent of adoption) [9]. Farmers would never adopt an innovation if outputs are not increased from given resources, and/or if inputs are not decreased for a given output [10]. Agricultural technology adoption is often a sequential process. Farmers may adopt a new technology in part of their land first and then adjust in later years based on what they learn from the earlier partial adoption [11]. Adoption of improved agricultural technology apparently offers opportunity to increase production and income substantially [12] and reduce food insecurity [13].

Adoption of agricultural technology depends on a range of personal, social, cultural and economic factors as well as on the characteristics of the innovation itself. The impact of adoption of improved agricultural technologies on either poverty or welfare has a positive impact on poverty reduction and human welfare. For example, in Bangladesh reveals that the adoption of improved varieties of cassava has a positive impact on the richer households but had a negative effect on the poor, [14,15,16] studies on the impact of improved cassava technologies in Nigeria, Uganda and Cote d'Ivoire also found that the adoption of cassava improved technology has a positive and significant influence on farmers welfare, poverty reduction and yield respectively. Likewise, [17,18] adopting the Propensity Score Matching (PSM) method and Local Average Treatment Effect (LATE) respectively confirmed the positive effect on household wellbeing arising from the impact of agricultural technology adoption on productivity and rural cassava farmers' welfare in Bangladesh and Nigeria respectively.

Adoption of agricultural technologies, such as the high yielding varieties could lead to significant increases in agricultural productivity and stimulate the transition from low productivity subsistence agriculture to a high productivity agro-industrial economy [19]. Azillah [20] reported that, the adoption of cassava technologies is important in increasing household food security in Ghana, Nigeria and Malawi. Mtunda et al. [21] reported that improved technologies in cassava production include proper spacing, land preparation, timely weeding, use of fertilizers/manure, use of improved planting materials, use of manual and powered grater and chipper machines for cassava processing, use of insecticides and use of herbicides. Mkamilo and Jeremiah [22] asserted that the majority of farmers in Nigeria are still confined with traditional technologies such as use of local planting materials, improper spacing, no fertilizer application, land preparation, weeding and traditional cassava processing. Ojo and Ogunyemi [19] noted that if the demand for cassava and income generated from cassava production increase, farmers will be motivated to adopt productivity-enhancing technologies to increase yields and to expand cassava production.

The adoption of technologies by farmers is affected by socio-economic factors, institutional and intervening factors. Socio-economic factors include, age of the potential adopters, sex, education level, farming experience, farm size and labor availability. Institutional factors include market availability, access to credit facilities, extension service delivery mechanism and training of cassava production technologies [23]. Extension services tend to educate farmers and assist in solving their problems, thereby adopt improved cassava farming technologies hence increased production. However, the services are affected by inadequate number of extension officers and inadequacy of working facilities. Lack of transport for extension agents to reach farmers in remote areas affects delivery and adoption of technologies. Also, poor linkage between research, extension services and farmers is among the main cause for farmers not to adopt improved technologies. Another problem affecting farmer's adoption of technology is due to lack of involving farmers in the planning process. [24] found that communities with higher rates of adoption of improved agricultural technologies had higher crop yields and lower level of food insecurity. On the other hand intervening factors include risk aversion, infrastructure, assets and government policy [25]. For instance, farmer with high level of income may be less risk averse than low income farmers [26]. Moreover, the number of people in a household may influence the adoption of the technology, the bigger the size of the family in a household the higher the chance of adoption also as labor accessibility increases [27].

The development and introduction of improved cassava varieties has long been recognized as one of the key strategies for transforming the cassava industry and for enhancing the wellbeing of Nigeria's rural population [28]. The other key strategies applied include value addition, as well as markets and an enabling policy environment. Cassava breeding programs in the country initially addressed viral disease epidemics. With close and strategic collaborations between the International Institute of Tropical Agriculture (IITA), the International Centre for Tropical Agriculture (CIAT), and national agricultural research programs, about 59 early-bulking, disease-resistant, and high-yielding cassava varieties have been officially released since 1977 [27]. These varieties include the Tropical Manioc Selection (TMS) varieties from the IITA and the National Root Crop Research Institute, Umudike (NRCRI) materials (or NR varieties). From 1990 to 1998, about 14 percent of the germplasm incorporated into the development of varieties released from IITA across Africa was sourced

from landraces, while 2 percent and 80 percent were sourced from CIAT and IITA, respectively [28].

Recent innovations in cassava breeding have enabled new varieties to be released to address food inadequacy in Nigeria. In close collaboration with Harvest Plus, IITA and NRCRI recently released six new bio fortified yellow cassava varieties that are conventionally bred to have high beta-carotene content (TMS 01/1371, TMS 01/1412, TMS 01/1368, TMS 07/593, TMS 07/539, NR 07/0220) as a strategy to address vitamin.

The study will therefore identify cassava varieties that Benue State farmers are aware of; identify cassava varieties adopted by farmers in Benue State; ascertain the level of adoption of improved cassava varieties among farmers in Benue state; and examine the constraint militating against farmer's adoption of improved cassava varieties in Benue State.

2. MATERIAL AND METHODS

The Survey design was adopted for the study

The study was carried out in Benue State. Benue is a State in the North Central zone of Nigeria, it has a population of about 5,741,800people [29]; its total land area is 34,059km^2 and it is among the 11th in the country. Benue State has its capital at Makurdi.

Benue State falls within longitude 7º47^1, 10º0E and latitude 6º25^1, 8º8^{1}N, the State shares boundaries with five other states in Nigeria. It share boundary with Nasarawa State to the North, Taraba State to the East, Cross River State to the South, Enugu State to the South-West and also with Kogi State to the west, hence it shares International boundary with the Republic of Cameroon to the South-East. Benue State is one of the biggest states in Nigeria, it is also seen as richest in the country in terms of food; it is blessed with a lot of food produce, hence the State is refers to as the food Basket of the Nation, since it is known for its large food production throughout the year.

Cluster and simple random sampling techniques were used to select the respondents for the study. Benue State were clustered into three senatorial districts including North East senatorial district (Zone A) North West Senatorial District (Zone B) and Benue South Senatorial district Zone (C). One Local Government Areas was randomly selected from each of the clustered senatorial districts: Kastina-Ala selected from Zone A; Buruku selected from zone B; and Otukpo Local Government Areas selected from Zone C respectively.

Fig. 1. Map of Benue State Adapted from Dzurgba (2012) Map of Benue State

Furthermore, two (2) council wards were randomly selected from each local government area with Mbacher and Mbajir Council Wards selected from Kastina-Ala Local Government Area, Binev and Shorov Council Wards selected from Buruku Local Government Area, Adoka-icho and Adoka-haje Council Wards selected from Otukpo Local Government Area respectively.

The total number of registered farm families in the twelve (6) selected council wards was 2,107. This Fig. therefore represents the sample frame. The sample size for each zone was determined by a mathematical formula given as;

$$n = \frac{N}{1+N(\alpha)^2} \quad (3.1)$$

where:

N is the sample frame for the twelve communities,
n is the sample size and
α is the margin of error (fixed at 5%).

$$n = \frac{2107}{1+2107(0.05)^2} = 336 \text{ farm families}$$

A simple proportion formula was then used to calculate the number of farmers who were interviewed in each selected local government as follows;

Zone A:

Kastina-Ala LGA:
Mbacher (441) $= \frac{336}{2107} \times 441 = 70$
Mbajir (232) = $\frac{336}{2107} \times 232 = 37$

Zone B

Buruku LGA
Binev (600) = $\frac{336}{2107} \times 600 = 96$
Shorov (330) = $\frac{336}{2107} \times 330 = 53$

Zone C

Otukpo LGA:
Adoka-icho (144) = $\frac{336}{2107} \times 144 = 23$
Adoka-haje (360) = $\frac{336}{12107} \times 360 = 57$

The sample size for each community area was randomly selected from the sampling frame of that community. This gave a total of 336 farm families. One farmer was purposively selected from each of the farm families, (these were farmers that have cassava as their major farm enterprise) and this gave a total sample size of 336 respondents for the study.Table 1 captures the details of the sample frame and the sample size for the selected local government areas in all the zones in the study area.

For the purpose of this research, Primary data were collected using Semi-structured question-naire. Objectives 1, 2 and 3 were achieved using simple descriptive statistics such as percentages, frequencies and means while Objective 4 was achieved using Rank ordered analysis.

3. RESULTS AND DISCUSSION

Improved Cassava Varieties Adopted by Farmers in Benue State

Awareness and knowledge of an improved variety is a prerequisite for its adoption. Information on level of awareness and adoption of improved cassava technologies is presented in Table 2. Meanwhile the improved cassava varieties in Benue state were identified to include;

- TMS 0505
- TMS 0581
- TMS 30572
- TMS 01/1368
- TMS 96/1632
- TMS 92/0326
- TME 419
- NR 8082

Source: BNARDA 2018

3.1 Level of Adoption of Improved Cassava varieties

The level of adoption of the various improved cassava varieties was determined by providing a list of the various improved cassava varieties available in Benue state. Then the farmers were asked to indicate whether they adopted or not and their responses converted to percentage.

The result in Table 2 showed the percentage awareness and adoption of the identified improved cassava varieties in the state. The result revealed that the percentage awareness for TMS 0505 was high as 65% (238) of the respondents averred to be aware of the improved cassava variety. But the adoption of TMS 0505 was low as only 32% (78) out of 238 farmers who were aware adopted the technology. This means that adoption of TMS 0505 is low in the area despite high awareness level.

There is moderate awareness level for TMS 0581 49% (179) and TMS 02/1368 56% (294) with moderate adoption 55% (98) and 53% (109) respectively. The result revealed that there is high awareness level for TMS 30572; 81% (298) and low adoption rate 26% (78). Also, the awareness level for TMS 92/0326 is high 72% (265) with moderate adoption 44% (116); TME 419 and NR 8082 had high awareness level 85% (311) and 88% (323) with high adoption 65% (201) and 68% (221) respectively. The result revealed that TME 419 and NR 8082 are very popular and widely adopted by farmers in the Benue state because of their thin stem and larger yield compared to other varieties introduced.

This corroborates the findings of Afolami et al. [30] which showed that only 10.3 % of the farmers adopted TMS 980505 cassava variety and most (89.7 %) of the farmers, did not. In the same vein, 2.9 % adopted TMS 980815 variety while 97.1 % did not. They also observed that none of the respondents adopted TMS 980326 in the study area. Meanwhile in in Ekiti State [21] reported that 60.6 % farmers were found to have adopted TME 419 among improved cassava varieties introduced to them in the state. The farmers also established the fact that TME 419 was the best technology introduced to them because of its disease resistance and low water moisture content compared to other varieties.

The result is consistent with the findings of Ojo and Ogunyemi [19] who assessed the adoption pattern of six improved varieties of cassava in Abia State; the bio-fortified pro-vitamin A variety (TME 419) among these emerged as one of the highest adopted variety across the state (36.7%), besting the local variety by a large margin. Also, [38] estimated the adoption levels of the pro-vitamin A bio-fortified cassava varieties in Akwa Ibom where they reveal a high rate of adoption by farmers within the State. [19] estimated the average adoption rate of pro-vitamin A bio-fortified cassava varieties to be about 38.72%.

Table 1. Sample size selection plan

Zones	LGAs	Council wards	Sampling frame	Sample size
A	Kastina-Ala	Mbacher	441	70
		Mbajir	232	37
B	Buruku	Binev	600	96
		Shorov	330	53
C	Otukpo:	Adoka-icho	144	23
		Adoka-haje	360	57
Total			**2,107**	**366**

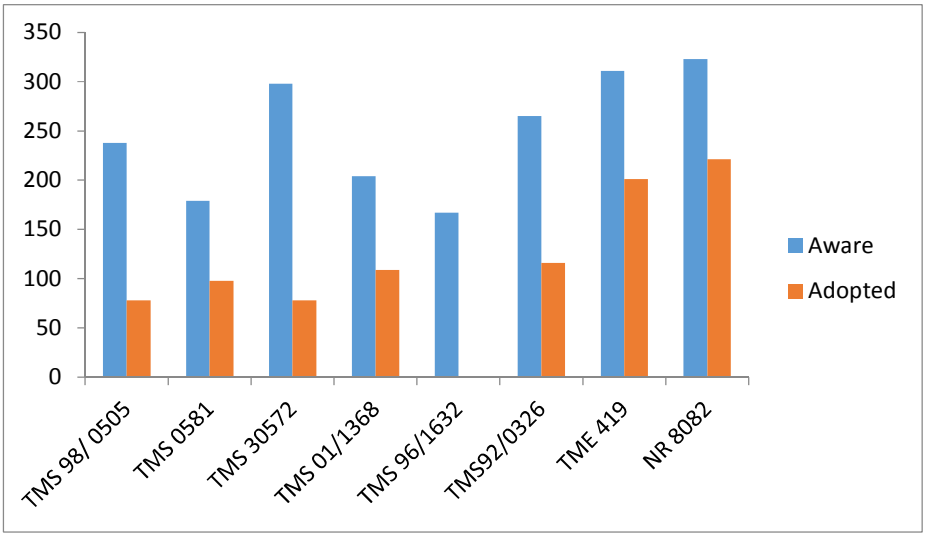

Fig. 2. Bar chart showing the level of awareness and adoption of improved cassava technology in Benue State

Table 2. Awareness and adoption level of improved cassava technologies in Benue State

Technologies	Aware	%	Not aware	%	Total	Adopted	%	Not adopted	%	Total
TMS 98/ 0505	238	65	128	35	366 (100)	78	32	160	67	238 (100)
TMS 0581	179	49	187	51	366 (100)	98	55	81	45	179 (100)
TMS 30572	298	81	68	19	366 (100)	78	26	220	74	298 (100)
TMS 01/1368	204	56	162	44	366 (100)	109	53	95	47	204 (100)
TMS 96/1632	167		242		366 (100)	87	52	80	48	167 (100)
TMS92/0326	265	72	101	28	366 (100)	116	44	149	56	265 (100)
TME 419	311	85	55	15	366 (100)	201	65	110	35	311 (100)
NR 8082	323	88	43	12	366 (100)	221	68	102	32	323 (100)

Source: Field Survey 2018

Furthermore, result showed that generally there is high awareness of improved cassava technologies in Benue state but with moderate to low adoption of improved cassava technologies. The relatively low adoption of some cassava varieties by farmers in the area could be due to the unfamiliarity of the farmers with them or lack of the planting materials. It could also be that they do not possess desirable characteristics or that they are relatively new in the area thus making the farmers to plant a little of them just to try out their desirability.

The finding is consistent with that of Afolamiet al. [30] which revealed that, only 22 % of the sampled respondents were actually adopters of improved cassava varieties in the study areas, while the majority (78 %) were non- adopters. This might probably be due to their strong believe or trust of the traditional cassava varieties they are used to planting or non-availability of improved stem cuttings for planting. On the contrary, the findings contradict the finding of Ojo and Ogunyemi [19] that adequate knowledge and awareness significantly affect adoption and delivery pattern. The low level of adoption of improved cassava varieties by the respondents implies that the traditional or local varieties are still prevalent in the study area.

Reasons for this ranges from high level of uncertainties, rejection at the trial stage for reasons of unsatisfactory performance, convenience with the old/traditional/local varieties, limited or unavailability of planting materials, high moisture contents , among others. According to Oluwasola [31] the major constraints to smallholder farmers are scarcity of affordable and environmentally appropriate technologies. Scarcity of appropriate technologies makes smallholder farmers to depend mainly on natural systems for sustenance. The result is also consistent to Adeoye et al. [18] who asserted that the majority of farmers in Tanzania were still confined with traditional technologies such as use of local planting materials, improper spacing, no fertilizer application, land preparation, weeding and traditional cassava processing. Ojo and Ogunyemi [19] noted that if the demand for cassava and income generated from cassava production increase, farmers will be motivated to adopt productivity-enhancing technologies to increase yields and to expand cassava production.

A number of previous studies have examined the adoption of various crop production technologies. Among these is adoption of improved cassava varieties: NR-8082, TME-419 and TMS-980505; in which the factors that negatively influence adoption were identified as household size, too small farm size, and unfavourable land tenure system. Similar evidences were provided by Datt and Ravallion [7] who stressed that the main reasons for non-adoption of improved cotton production technologies in Katsina State include inadequate knowledge and non-availability of most of the technologies within the local communities. the low adoption of chemical weed control technology among cassava farmers in south eastern Nigeria can be attributed to problems relating to lack of training on chemical weed control, low income, and high cost of chemicals. Similarly, factors influencing adoption of alley farming technology in Nigeria include farmer characteristics such as gender of the farmer, contact with extension agents, years of experience and tenancy status in the village; and economic factors, proxied by village-level characteristics that condition resource use incentives.

The decision of whether or not to adopt a new variety hinges upon a careful evaluation of a large number of technical, economic and social factors. Adoption of technology is a decision that should be made by an individual. However an individual may decide to continue or discontinue the adoption of varieties for a variety of personal, technical, economical, institutional and social factors focusing on the availability of an idea or practices that is better in satisfying his or her needs [32].

3.2 Constraint Militating against Farmer's Adoption of Improved Cassava Technologies in Benue State

The frequencies were based on multiple response because any of the respondent might face two or more constraint militating against his/her adoption of improved cassava varieties in Benue State. The result in Table 3 revealed that famers complained that the improved cassava technologies cannot store for a long time in the farm 93% (342) and that there is no market to sale increased quantity of cassava roots 93% (342). These were ranked first among all the constraints. Poor extension contact 88% (321) was ranked as one of the prevalent factor (3^{rd}) hindering the adoption of improved cassava varieties in Benue State. This was followed by lack of access to credit facilities 87% (319) as number two (4^{th}) factor militating against the

Table 3. Ranking of constraint militating against farmer's adoption of improved cassava technologies in Benue State

Constraint	Frequency	Percentage	Rank
Cannot store for a long time in the farm	342	93	1st
Lack of market to sale increased quantity	342	93	1st
Poor extension contract	321	88	3rd
Lack of access to credit	319	87	4th
Crude implement	316	86	5th
Improved varieties are too watery	300	82	6th
The products from the improved varieties are of low quality	298	81	7th
Poverty	293	80	8th
Inadequate technical knowledge	287	78	9th
High cost of labour	287	78	9th
Scarcity of inputs	212	58	11th

Source: Field Survey, 2018 (Multiple Response)

adoption of improved cassava technologies in the state. others are the use of crude implement 86% (316) as (5th), high cost of labour and inadequate technical knowledge 78% (287) and 78% (287) ranked 9th respectively, while scarcity of inputs 58% (212) was the least constraint ranking 11th. The result corroborates with [33] who have shown the socio-economic, demographic and institutional factors constraining the adoption of new technology. Cost of production and lack of access to extension services have been cited as the factors affecting adoption [34]. In any event, the relationship between cost of production and adoption level of farmers has been found to be negative.

It was observed that farmers who had tried some of the improved varieties did not adopt because they complained that the varieties though high yielding but were too watery. Respondents also averred that the improve varieties does not store long in the farm; hence they decay easily thereby ensuring losses for the farmers.

Extension contact is expected to enhance the adoption of new and improved agricultural technologies.]Extension contact is very essential to the improvement of farm productivity and efficiency among farmers. Umar, [35] also argued that higher extension contacts would increase adoption of improved farm production technologies. He further asserted that the frequency of extension contact is very essential as it guides the farmers from awareness to the adoption stage. The result is consistent with the finding of Mwangi and Kariuki [36] who found that availability and access to extension services are key aspects in technology adoption. Mwangi and Kariuki [36] opined that access to extension services can counteract the negative effect of lack of formal education of farmers which hinders technology adoption. Thus, extension services create the platform for acquisition of the relevant information that promotes technology adoption. Moreover, information received through the extension services reduce the uncertainty about a new technology's performance, helping to make a positive change in the individual's decision on adoption. Therefore, access to extension services was also found to be positively related to the adoption of modern agricultural production technologies [36]. Farmers usually become aware of new technologies through the extension officers in developing countries. In addition, the extension agent acts as a link between the innovators of the technology and end users of that technology. Therefore, extension services help reduce the transaction cost associated with information sharing among the larger heterogeneous farming population [36]. Many authors have reported a positive relationship between extension services and technology adoption [37;38]

However, the poor performance of extension service as among the constraints to the adoption of innovations in developing countries has been identified. Limited budget is one of the contributory factors to the failure of extension service in sub-Saharan Africa. Limited budget will restrain public extension organizations from undertaking some activities like staff recruitment and training. Training is necessary for manpower development in the extension service. Training serves as a motivation for staff. A staff that is adequately trained will be more fulfilled in doing that job unlike one that is not. This situation will

lead some staff deserting their job for more fulfilling ones.

Access to credit was also identified as a constraint factor to adoption of improved cassava varieties. It is also implies that availability of credit contributed significantly to technology adoption because credit is necessary for the purchase and use of new technologies by low capital base farmers. This finding agree with Akpoko [39] who reported that amount of credit received by farmers positively and significantly influenced the adoption of recommended soil management practices in Kaduna state. The availability of credit is essential to the adoption of innovation and enhancement of productivity. Agricultural production is capital intensive and farmers in developing countries like Nigeria need to inject money into it. Credit makes it easy for farmers to use new machines, improved seeds and livestock breeds, fertilizer and even extension services. He however observed that women small-holder farmers in Africa face many obstacles in obtaining loans than their male counterparts owing to such reasons as lack of information on the availability of loans, lack of collateral and low literacy level. One of the mechanisms governments use for promoting cassava production by smallholder farmers in Nigeria is the Agricultural Credit Support and Inputs Subsidy Programme (ACSISP). The inability of the smallholder cassava farmers to obtain credit at subsidized rate has been a serious problem militating against viable approaches to promote worthwhile agricultural-oriented programmes that will enhance cassava production in Nigeria. Extending credit to genuine smallholder cassava farmers is an effective approach to promote cassava production in the country. Indeed, this call for a careful administration, as the efficiency of credit delivery process largely depends on the adopted institutional framework of the programme

Major factors that hinder the adoption of recommended practices are the expensive nature of farm inputs and use of crude implements. New technologies need the intervention of extension agents to make them known and understandable by rural farmers. Moreover, some improved technologies require the application of other inputs to be effective. However, the lack of some facilities such as credit would hinder farmers from affording these complementary inputs and eventually preventing the adoption of the technology. However the results are in line with the findings of a study by Nsoanya and Nenna [40] that high cost of inputs and unavailability of mechanized tools are the constraints to the adoption of improved cassava varieties. Obeta and Nwagbo [41] have similarly found that adoption can be seriously hampered by poor distribution of technological inputs. Ifeanyi et al. [42] also found that lack of access to certified seeds, farmers' limited knowledge and lack of sufficient funds are a serious constraint. I.A.R [43] attributed unavailability of seeds and adulteration as constraints to adoption found that failure to provide continuous sources of supply of seeds and other inputs like fertilizers limits maintenance of adopted innovations.

The process of increasing the efficiency of agricultural production through agricultural modernization depends mainly on the extent to which farmers can incorporate improved agricultural practices into their farming operations [44]. Perceived cost and compatibility of innovations are key determinants in the innovation decision process model. Abalu et al. [45] reported that when farmers find recommended farm innovations not technically feasible, economically viable and culturally compatible, they often reject such innovations. [46], in a similar view stated that when innovations are inappropriate or unrelated to their needs and problems of farmers, the adoption will be very low. [47], went further to add some constraints to adoption as absence of the problem to be solved, inappropriate innovations, incorrect identification of adoption domains, local practices being better and poor extension.

High cost of labour was also identified to be a major constraint affecting the adoption of improved cassava technologies in Benue state [19], opined that the high cost of labour could be as a result of able bodied and energetic youths leaving agriculture in search of white collar job and thereby leaving agriculture for old and feeble men, women and their children. The few who may not be opportune to go to the urban centres for white collar job, resort to charge high costs to meet up with the urban counter pact.

Poverty is also a constraint in the area. most persons will adopt a new idea if they have the resources and are not hampered by physical social and organizational constraints as observed by Although several policy measures such as subsidization of input prices have been adopted by successive government, yet in recent time the trend in the use of improved inputs especially mineral fertilizer has turned to its former status. The findings suggests that undercapitalization as a major factor inhibiting smallholder farmers from

adopting modern inputs. There is abject poverty among the majority of farmers as they do not have the required amount of financial resources with which to embark on agriculture profitably. Previous studies have also revealed that farmers' socio–economic indices do play a great role in awareness, knowledge and adoption of new practices. Fertilizer particularly inorganic fertilizer is important for most of the improved varieties for the potentials to be achieved. Nevertheless, this resource is expensive and not readily available to the farmers at farm level, especially poor resource small holder farmers.

4. CONCLUSION

The improved cassava varieties in Benue state include; TMS 0505, TMS 0581, TMS 30572, TMS 01/1368, TMS 96/1632, TMS 92/0326, TME 419, NR 8082. There is high awareness and low adoption level TMS. There is moderate awareness and adoption level for TMS 0581 and TMS 02/1368. But for TMS 92/0326, the awareness level was high with moderate adoption while TME 419 and NR 8082 had high awareness and adoption level with high. Thus it was concluded that there is generally high level of awareness of improved cassava varieties in Benue state but with moderate to low adoption rate. it was therefore recommended that farmers should be consulted and their needs should be properly identified and considered in such development ventures. Extension should ensure that improved cassava technologies are accessible by farmers and that farmers acquire the necessary knowledge and skills in using such technologies. These will ensure high adoption and high impact as well.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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