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Determinants of Adoption of Improved Cassava Technologies among Farmers in Benue State, Nigeria

Juliet Ogadinma Onyemma[1], Nnaemeka Charles Onyemauwa[1], Uwandu Queen Chioma[1] and Solomon Chimela Nwafor[1*]

[1]National Root Crop Research Institute, Umudike, Nigeria.

Authors' contributions

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

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ABSTRACT

Aims: The study assessed the determinants of adoption of improved cassava technologies among farmers in Benue state, Nigeria
Study Design: Survey design was used for the study.
Place and Duration of Study: The study was carried out in Benue State, between February 2019 to November 2020.
Methodology: the study comprised all farm families in Benue State. Cluster and simple random sampling techniques were used in the selection of 336 respondents for the study.
Results: The result clearly showed that most of the respondents were in their active and productive age group, both male and female were involved in the production of cassava with the number of male slightly higher than female and that 90% of the farmers have had one form of formal education or another with mean farming experience of 14 years with limited access to extension services. There is high awareness of improved cassava technologies among farmers in Benue state but with moderate to low adoption of improved cassava technologies. The major factors that determined the adoption level in the area included characteristics of an innovation

**Corresponding author: Email: Solomonnwafor8@gmail.com;*

which are availability of inputs 100%, affordability 100%, storability 80.3%, quality of the processed products 81%, and acceptability of the products 95% (349). Others include farming experience 98%, adequate knowledge of the technology 83% (303), extension contact 86%, age 86%, income 85%, marital status 76% and gender 81%.

Conclusion: The major factors that determine the adoption level in the area included characteristics of an innovation which are availability of inputs, affordability, quality of the processed products and acceptability of the products. Others include farming experience, adequate knowledge of the technology, extension contact. It was recommended that extension agents should ensure that improved cassava technologies are accessible by farmers and that farmers acquire the necessary knowledge and skills in using such technologies.

Keywords: Adoption; improved cassava technologies; farmers.

1. INTRODUCTION

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 [1]. 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 [2]. 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 [3,4,5]. 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) [6]. 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 [7]. 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 [8]. There is a large literature on the adoption of agricultural technology [9,10,11]. 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 [14,15,16,17,18,19,20,21,22]. 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, [23,24,25] 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, [26,27] 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 [28]. They 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 [29]. 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 one of the main causes for farmers not to adopt improved technologies. Another problem affecting farmer's adoption of technology is due to lack of involvement of farmers in the planning process [30,31] 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 [19]. For instance, farmer with high level of income may be less risk averse than low income farmers [32]. 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 [33].

With the implementation of the cassava transformation agenda in the country, cassava adoption in Nigeria has come to the fore in the policy debate. Policymakers, donors, and research institutions have many questions about producers' adoption of modern cassava technologies, especially with regard to the use and diffusion of improved varieties. These questions include how farmers perceive improved cassava varieties and whether they will be willing to experiment with, evaluate, and adopt a new variety. In addition, policy interest has risen around constraints to adoption and the impact of improved cassava varieties on commodity production, poverty, and input use. The study will therefore ascertain the level of adoption of improved cassava technologies among farmers and estimate the determinants of adoption of improved cassava technologies among farmers in Benue State.

2. MATERIALS 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 [34]; its total land area is 34,059km^2 and it is among the 11th in the country. Benue State has its capital at Makurdi. The name Benue is named after the River Benue and the state was formed from Benue Plateau On the 3rd of February 1976 along with Igala and some parts of Kwara State which were carved out to become part of the present Kogi State. Some popular towns in this state include Vandeikya, Gboko, Ogbadibo Katsina-ala, Okpokwu, Obi, and Makurdi which is the state capital of Benue.

Benue State falls within longitude $7^0 47^1$, $10^0 0$E and latitude $6^0 25^1$, $8^0 8^1$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,

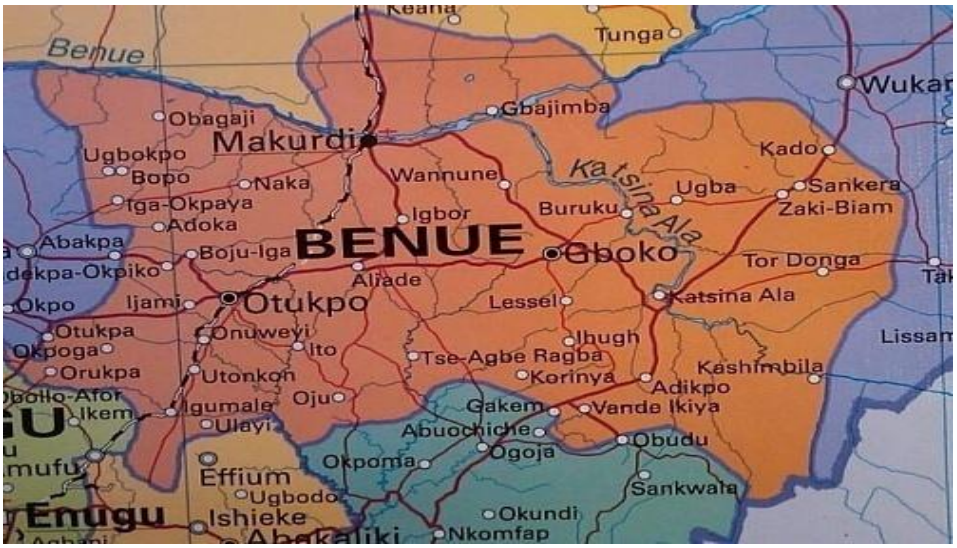

Fig. 1. Map of Benue State

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.

2.1 Sampling Procedure

The population for the study comprised all farm families in Benue State. According to the [34]), Benue State has a projected population of 5,741,800. A sample size of 400 respondents was however selected from the population. Cluster and simple random sampling techniques were used in the selection and distribution of respondents for the study. Benue State was 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 including Kastina-Ala selected from Zone A; Buruku selected from zone B; and Otukpo Local Government Areas selected from Zone C respectively.

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 figure therefore represents the sample frame. The sample size for each zone was determined by a mathematical formula given by Miller and Brewer (2003) 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 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;

2.1.1 Zone A

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

Mbajir (232) = $\frac{336}{2107} \times 232 = 37$

2.1.2 Zone B

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

Shorov (330) = $\frac{336}{2107} \times 330 = 53$

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

Adoka-haje (360) = $\frac{336}{12107} \times 360 = 57$

2.1.3 Zone C

The sample size for each community area was randomly selected from the sampling frame of that community. 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.

Table 1. Sample size selection

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

3. RESULTS AND DISCUSSION

3.1 Demographic Information

This section provides the background information of the cassava farmers. The variables analysed in this study were age of respondents, sex, marital status, education level, years of farming experience, extension visit and farm size.

The mean age of the farmers was 47 years. The implication is that majority of the respondents in the study area were young farmers. Young farmers are more energetic and eager to experiment with new farming technologies. The predominance of younger people in cassava production could further be due to the labour intensive nature of its production, which requires young and energetic farmers. This is in line with the general literature on technology adoption and has been explained by the fact that older farmers are usually more reluctant to change. It is expected that improved varieties of cassava will be adopted at a faster rate in this area.

The domination by male respondents among the farmers could be the result of males having greater access to farm land than females. It could also be as a result of the tedious nature of farming. This implies that cassava farming is mostly done by male farmers who have and could have access to land resource and are thus instrumental for cassava production than their female counterpart and thus agrees with the findings of [35] who reported that women were found to contribute less than half of the total labour inputs in the cassava productive system in five of the six collaborative study of cassava in Africa (COSCA) countries. The results indicated that married individuals dominated the cassava business in the study area. This implies that the respondents were dominated by married men and women who invariably contributed to increase in household size farm labour. Greater majority (90%) of the farmers have had one form of formal education or another which implies a relatively high level of literacy among the respondents. [36] noted that education is an important socio-economic factor that influences farmers' decision because of its influence on the farmer's awareness, perception, reception and the adoption of innovation that can bring about increase in production. Literacy probably influences adoption of improved cassava varieties and processing activities positively by predisposing the farmers and processors to adopt and use better cassava production and processing resources and technologies, and to cope with the intricacies involved in cassava production. The respondents were well experienced in cassava production. The mean farming experience of the cassava producers was 14 years implying several years of experience in farming. This is an important factor in the adoption process. Farming experience serves as a guide in combination and allocation of resources, farm management decision as well as in making forecast on the likely performance of a farm business. Similarly, the number of years a farmer has spent in his farming business may give an indication of practical knowledge he has acquired on how he could overcome certain inherent challenges in the farm. Access to extension services is very low amongst the farmers in the study area. Increased access to extension services is expected to increase the knowledge of the farmers on better production systems to adopt in terms of accepting improved technologies and farming practices which on adoption increases the producer's and processor's chance of having increased output and thereafter, improves his revenue generation capacity. It was observed that the low access to extension services existing among the farmers in the study area was as a result of lack of access roads, communities being too isolated or far from each other that extension agents cannot cover, that is, interiority of the study area. Farmers in the area are medium scale to large scale farmers with a few small scale farmers. The result also revealed that a good number of farmers in the area are big scale cassava farmers. The extent of land available to the farming households for cultivation is an important asset for their agricultural and livelihood activities. The farm size follows the land mass in the state. This contradicts the assertions of [37] who indicated that the majority of African smallholders cultivate less than two hectares of farmlands.

3.2 Level of Adoption of Improved Cassava Technologies

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

The result in Table 4 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)

Table 2. Demographic Information of respondents

Variables	Frequency	Percentages
Age		
20-29	44	12
30-39	72	20
40-49	106	29
50-59	69	19
60-69	49	13
70 and above	26	7
Total	366	100
Mean	47	
Sex		
Male	208	57
Female	158	43
Total	366	100
Marital status		
Married	256	70
Single	110	30
Total	366	100
Educational qualification		
No formal education	38	10
Primary school	88	24
Secondary school	96	26
Tertiary	144	39
Total	366	100
Years of farming experience		
1-5	100	27
6-10	160	44
11-15	70	19
16-20	10	3
21-25	20	5
25 and above	6	2
Total	366	100
Mean	14	
Extension visit/year		
None	197	54
Once	72	20
Twice	51	14
Trice	46	13
Total	366	100
Farm size		
1-5	206	56
6-10	105	29
11-15	20	5
16-20	10	3
Above 20	26	7
Total	366	100

Source: Field survey 2018

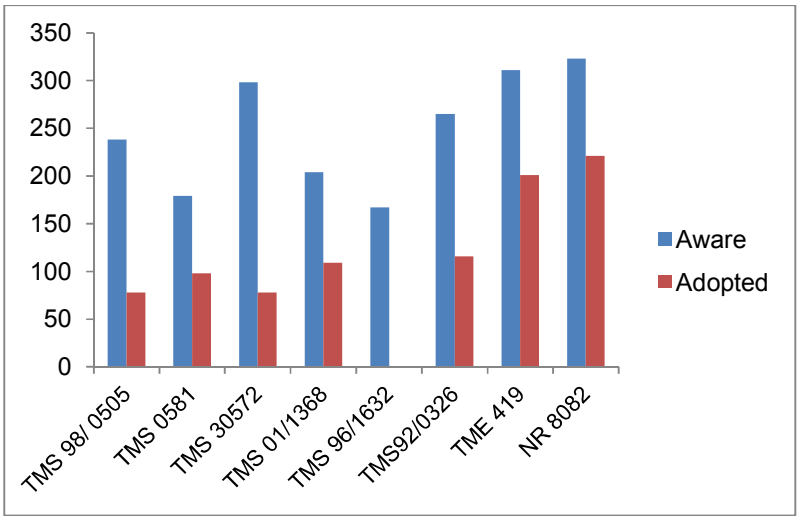

Fig. 2. Bar chart showing the level of awareness and adoption of improved cassava technology in Benue State

Table 3. 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

Table 4. Factors that determine the adoption of improved cassava technologies in Benue State (n 366)

Determining factors	Frequency	Percentage	Rank
Availability of inputs/material	366	100	1st
Affordability of the technology	336	100	1st
Farming experience	357	98	3rd
Acceptability/marketability	349	95	4th
Age	313	86	5th
Extension contact	313	86	5th
Income	314	85	7th
Adequate knowledge	303	83	8th
Gender	296	81	9th
Quality of products	297	81	9th
Storability of products	298	80	10th
Marital status	278	76	11th

Source: Field Survey, 2018 (Multiple Response)

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 were 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 [38] 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 [28] 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.

Furthermore, result showed that generally there is high awareness of improved cassava technologies in Benue state but with moderate to low adoption rate. The relatively low adoption of some cassava varieties by farmers in the area could be due to the unfamiliarity of the farmers with the varieties or lack of the planting materials. According to [39] the major constraints to smallholder farmers are scarcity of affordable and environmentally appropriate technologies. [28] noted that if the demand for cassava and income generated from cassava production increases, adoption of productivity-enhancing will increase as well. The decision of whether or not to adopt a new technology 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 technologies 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 [40].

3.3 Determining Factors of Adoption of Improved Cassava Technologies in Benue State

Availability of inputs 100% (366), affordability 100% (366), storability 80.3% (293), quality of the processed products 81 (297), acceptability of the products 95% (349), farming experience 98% (357), adequate knowledge of the technology 83% (303), extension contact 86% (313), age 86% (313), income 85% (314), marital status 76% (278) and gender 81% (296) were found to be the major determinants of adoption in the area. The result agrees with [41] who found that adoption can be seriously hampered by poor distribution of technological inputs. [42] also found that lack of access to certified seeds, farmers' limited knowledge and lack of sufficient funds were a serious constraint. [43] attributed unavailability of seeds and adulteration as constraints to adoption. Also, [44] reported that when farmers find recommended farm innovations not technically feasible, economically viable and culturally compatible, they often reject such innovations.

Farming experience of the farmers 98% (357) indicated that farmers rely on the past encounters to decide to adopt or not to adopt improved technologies. The farming experience of most farmers in Nigeria is usually long. This is because majority of the farmers were born by farmers and they therefore grew up in farming environments. [45] reported that majority of the cocoa farmers in Oyo State had over 10 years' experience in farming. This experience of farming over a long period of time sometimes acts as impediment to change. However, it is advantageous in many respects as younger farmers do benefit from the elderly farmers where there is a change in farming techniques and extension officers are not readily available. Farming experience has been recognized by [46] to play a vital role in the adoption of any particular technology or farm practice. The longer the farmer is in farming, the more is his experience and the quicker his adopting new practices. This is because it is assumed that the farmer knows the benefits of such improved practices. This can affect the level of use of technologies in terms of quality of management decision on the technology in question.

The result revealed that age 86% (313) was among the factor considered before adopting improved cassava technologies in the area. This could be because the age of an individual is believed to be capable of influencing the perception views, interest and conduct of the person [47]. Age can be regarded as the youthful and active period when farmers can make vital impact in agricultural production and technology development generally [48]. The result is consistent with many studies which have linked innovativeness with young age [49,50,51]. Young people are thought to be more receptive to modern ideas than older ones which imply a negative relationship between age and adoption. [52] have also found that adoption of genetically

modified maize increased with age for younger farmers as they gain experience and increase their stock of human capital but declines with age for those farmers closer to retirement.

Contact with extension agents 86% (313) which is the frequency of contact between farmers and with extension workers was identified as one the factors considered before adoption of improved cassava technologies. This is because new technologies need the intervention of extension agents to make them known and understandable by rural farmers. Extension contact determines the information that farmers obtain on production activities and the application of innovations through counseling and demonstrations by extension agents. Thus, extension services create the platform for acquisition of the relevant information that promotes technology adoption. 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. The effect of exposure to extension programmers is thus, enormous. This is because increased farmers' interaction with extension personnel in the form of multiple visits by extension agents, and technical support to farmers greatly increases farmers' knowledge of available technologies and their potential benefits, hence acting as a trigger for intensive adoption. The result agree with the findings on adoption of improved maize in northern Tanzania [53].

The result revealed that the income of farmers 86% (314) was a determining factor of adoption of improved cassava technologies in the area. The finding confirms the study by [54] which revealed that the ability of farmers to adopt new farm practices depended on their financial position and nearness to extension personnel. [55] also discovered that income level, family size, social participation, extension contact, number of information sources used to introduce improved practices and extent of awareness were significantly related to adoption of recommended practices. This is so because processors with high income, and who have access to processing inputs will be more willing to adopt new technologies and accept higher risks.

The result showed that adequate knowledge of the technology 83% (303) to be adopted is a factor that farmers consider critically before taking decision. Knowledge about improved cassava technologies is usually acquired during demonstration and on-farm trials**.** This is because knowledge acquisition is one of the basic means through which behavioral patterns in agriculture can be changed. Thus, governments and authorities use promulgation of laws, decrees and other subtle methods such as subsidies to achieve their goals under different conditions, but according to [9] farmers will only change their practices or behavioral pattern if they are sufficiently knowledgeable about a new practice and are convinced of its superiority, compatibility and profitability. It was observed that local farmers have developed numerous farming systems through a process of trial and error; innovation and adaptation with each system fitting into their ecological economic, socio-cultural and political environment, current demands have necessitated that some of these practices be changed. This anticipated change cannot take place if farmers are not knowledgeable about the new practices. [56] opined that knowledge can be gained either directly by abstracting the defining traits of a subject or phenomenon or by deducing new facts from those already known in accordance with the rules of logic. Knowledge is the process by which attempts are made to pass an idea from one person, institution or nation to another. In his study on the effect of television farm program on farmers 'knowledge of improved farm practices in Oyo state, Nigeria, [57] identified some areas in which he tested the farmers 'knowledge and discovered a significant relationship between knowledge and adoption.

Marital status 76% (278) was also identified as one the factors determining adoption of improved cassava technologies in the area. This implies that it is a major factor to consider in the adoption of improved cassava technologies in Benue State. It has been observed that most farmers in Nigeria are married; this is mainly due to the fact that farming requires the provision of labor for attending to the various farm operations. This led credence to the fact that farmers prefer to be married and have children that will provide large labor than to remain single [58,59]. It is thus, preferable to get large household which can serve as proxy to cheap family labor in the farm.

4. CONCLUSION

The major factors that determine the adoption level in the area included characteristics of an innovation which are availability of inputs, affordability, and quality of the processed

products and acceptability of the products. Others include farming experience, adequate knowledge of the technology, extension contact. it was therefore recommended that research scientists and extension agents should ensure that these factors are put into consideration in development of improved cassava technologies for farmers. Extension personnel should ensure that improved cassava technologies are accessible by farmers and that farmers acquire the necessary knowledge and skills in using such technologies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Shideed KH, Mohammed E. Adoption and Impact Assessment of Improved Technologies in Crop and Livestock Production Systems in the WANA Region. The Development of Integrated Crop/Livestock Production in Low Rainfall Areas of Mashreq and Maghreb Regions (Mashreq/Maghreb Project). ICARDA, Aleppo, Syria. 2005;viii+160 pp.
2. Adofu I, Shaibu SO, Yakubu S. The economic impact of improved agricultural technology on cassava productivity in Kogi State of Nigeria. International Journal of Food and Agricultural Economics. 2010; 1(1):63–74.
3. Pender J, Gebremedhin B. Determinants of agricultural and land management practices and impactsin crop production and household income in highlands of Tigray, Ethiopia. Journal of Africa Economics. 2006;17(1):395–450.
4. Datt G, Ravallion M. How Important to India's Poor is the Sectoral composition of Growth? World Bank Economic Review. 1996;10(1):1–26.
5. Hossain S, Alamgir M, Croach R. Patterns and Determinants of Adoption of Farm Practices: Some evidence from Bangladesh. Agricultural Systems. 1992; 38(1):1–15.
6. Mercer E, Pattanayak SK. Agroforestry adoption by smallholders. Forests in a market economy. Forestry Sciences Series. 2003;72(1):283–299.
7. Heady EO.Economics of Agricultural production and Resource Use. Prentice-Hall, INC, Englewood Cliffs; 1952.
8. Xingliang M, Guanming S. ADynamic Adoption Model with Bayesian Learning:An Applicationto U.S. Soybean Farmers., Selected Paper prepared for presentation at the Agricultural and Applied Economics Associations 2011 AAEA and NAREA Joint Annual Meeting, Pittsburgh, Pennsylvania, July 24-26; 2011.
9. Rogers EM. Diffusion of innovations, 3rd edition. Rev. ed. of: Communication of innovations. The Free Press, New York, USA; 2003.
10. Sunding D, Zilberman D. The Agricultural Innovation Process: Research and Technology Adoption in a Changing Agricultural Sector. In: Gardner B, Rausser G (eds) Hand book of Agricultural Economics., Vol.1, Elsevier Science B.V; 2001.
11. Feder G, Umali DL. The Adoption of Agricultural Innovations:A Review. Technological Forecasting and Social Change. 1993;43(1):215–239.
12. Nweke FL, Akorhe IA. Adoption behavior of Farmers towards yam mini sets technology in Imo State Nigeria.A paper presented at the 25th annual conference of Agricultural Science Society of Nigeria. Federal University of Technology Oweri,5–6th September 1989. 2002;18–21.
13. Nata JF, Mjelde JW, Boadu FO. Household adoption of soil-improving practices and food insecurity in Ghana. Agriculture & Food Security. 2014;3(1): 17.

    Retrieved online November 12, 2014 Available:http://www.agricultureandfoodsecurity.com/content/3/1/17
14. Pannell DJ, Marshall GR, Barr N, Curtis A, Vanclay F, Wilkinson R. Understanding and promoting adoption of conservation practices by rural landholders. Australian Journal of Experimental Agriculture. 2006;46(1):1407–1424.
15. Omonona BT, Oni OA, Uwagboe AO. Adoption of Improved Cassava Varieties and its Welfare Impact on Rural Farming households in Edo State, Nigeria. Journal of Agricultural and Food Information. 2006;7(1):39–35.
16. Prokopy LS, Floress K, Klotthor W, Baumgart G. Determinants of agricultural best management practice adoption: Evidence from the literature. Journal of Soil and Water Conservation. 2008;63(5):300–311.

17. Shiferaw B, Kebede TA, You L. Technology adoption under seed access constraint and the economic impacts of improved pigeon pea varieties in Tanzania. Agricultural Economics. 2008;39(1):1–15.
18. Eze C, Ibekwe U, Onoh P, Nwajiuba C. Determinants of Adoption of Improved Cassava Production Technologies Among Farmers In Enugu State of Nigeria. Global Approaches to Extension Practice: A Journal of Agricultural Extension. 2008; 2(1):37–44.
19. Kassie M, Zikhali P, Manjur K, Edwards S. Adoption of Organic Farming Technologies: Evidence from Semi-Arid Regions of Ethiopia. Working Papers in Economics.; 2009.
20. Yesuf M, K¨ohlin G. Market imperfections and farm technology adoption decisions: a case study from the highlands of Ethiopia. Environment for Development Discussion Paper Series 4, Gothenburg; 2008.
21. Owusu V, Donkor E. Adoption of improved cassava varieties in Ghana. Agricultural Journal. 2012;7(2):146–151.
22. Challa M, Tilahun U. Determinants and Impacts of Modern Agricultural Technology Adoptionin West Wollega: The Case of Gulliso District. Journal of Biology, Agriculture and Healthcare. 2014;4(20): 63–77.
23. Dontsop-Nguezet PM, Diagne A, Okoruwa VO, Ojehomon VET. Impact of Improved Rice Technology Adoption (NERICA varieties) on Income and Poverty among Rice Farming Households in Nigeria:ALocal Average Treatment Effect (LATE) Approach. Quarterly Journal of International Agriculture. 2011;50(3):267–291.
24. Kijima Y, Otsuka K, Sserunkuuma D. Assessing the impact of NERICA on income and poverty in Central and Western Uganda. Agricultural Economics. 2008;38(1):327–37.
25. Diagne A. Diffusion and adoption of NERICA rice varieties in Cote d'Ivoire. The Development Economics. 2006;44(2):208–231.
26. Mendola M. Agricultural technology adoption and poverty reduction: A propensity score matching analysis for rural Bangladesh. Food Policy. 2007; 32(3):372–393.
27. Adeoye BK, Olaore Y, Aliu B, Adeoye AO. Family Size, Income and Marriage Types as Predictors of Healthy Living: ACase Study of Families in Ogun State. Greener Journal of Social Sciences. 2012;2(6):191–196.
28. Ojo SO, Ogunyemi AI. Analysis of Factors Influencing the Adoption of Improved Cassava Production Technology in Ekiti State, Nigeria. International Journal of Agricultural Sciences and Natural Resources. 2014;1(3):40-44.
29. Anderson JR, Feder G. Agricultural extension: Good intension and hard realities. World Bank Researcher Observer Journal. 2004 ;19(1):41- 60.
30. Feder GL, Just RE, Zilbernran D. Adoption of Agricultural Innovation in Developing Countries: A Survey. Economic Development and Cultural Change. 1985; 32(2):137-140.
31. Minten B, Barret C. Agricultural technology productivity and poverty in Madagascar. World Division Journal. 2008;36(5):779-822.
32. Ogunlana E. The technology adoption behavior of women farmers: The case of alley farming in Nigeria. Renewable Agriculture and Food Systems. 2004;19(1): 57-65.
33. Asmelash Y. Determinants of adoption of upland rice varieties in Fogera District, South Gondar, Ethiopia. Journal of Agricultural Extension and Rural Development. 2014;8(12):332–338.
34. National Bureau of statistics; 2016.
35. Nweke FI, Spencer OSC, Lynam JK. The Cassava Transformation: Africa Best-Kept Secret. East Lansing, Michigan State University Press. 2002;105.
36. Ojuekaiye EO. Economic Analysis of Cassava Production in Three Local Government Areas of Kogi State. Unpublished M.Sc. Thesis, Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria; 2001.
37. Ruben R, Slingerland M, Nijhoff H. Agro-food Chains and Networks for Development. Aad Van Tilburg, Wageningen University. 2006;115.
38. Afolami CA, Obayelu AE, Vaughan II. Welfare Impact of Adoption of Improved Cassava Varieties by Rural Households in South Western Nigeria. Agricultural and Food Economics. 2015; 3:18.

39. Oluwasola O. Stimulating rural employment and income for cassava (Manihot spp.) Processing farming households in Oyo State, Nigeria through policy initiatives. Journal of Development and Agricultural Economics. 2010;2(2):18 –25.
40. Rogers EM, Shoemaker FF. Communication of Innovation: A Cross - cultural Approach, Second Edition. Free Press, New York. 1995;450.
41. Obeta ME, Nwagbo EC. The Adaptative of Agricultural Innovation in Nigeria; A Case Study of Improved IITA Technology Package in Anambra State in Olukosi J.O., Ogungbile A.O. and Kalu B.A. (eds.) Appropriate Agricultural/Technologies for Resource poor Farmers, A Publication of the Nigeria National Farming Systems Research Networks. 1999;231-245.
42. Ifeanyi N, Angus N, Chidebelu N. Appropriate agricultural technologies for resource poor farmers. In: Olukosi, J.O; Ogungbile, A.O. and kalu, B. A. (ed). Proceedings of farming systems research work workshop, Calabar, Cross River State, Nigeria. A publication of the Nigerian National Farming Systems Research Network. 1990;47:95–204.
43. I.A.R. Institute for Agricultural Research (I.A.R), Ahmadu Bello University, Zaria (2001): Adoption of improved cowpea technologies in the severe ecology of Nigeria‖. A report of survey conducted on PEDUNE/PRONAF project in Nigeria; 2001.
44. Abalu GOT, Ega I, Karishnaswan MD, Raza MS. An economicy of Kaduna State Agriculture. Report to the Ministry of Economic Development; 1979.
45. Adeogun SO, Oluyole KA. Assessment of Awareness and Adoption level of Cocoa Farmers of CRIN by-product Technology in Oluyole LGA of Oyo State. Nigeria Journal of Rural Sociology. 2004;4(1&2) 64-67.
46. Bamire AS, Fabiyi YL, Manyong VM. Adoption pattern of fertilizer technology among farmers in the ecological zones of South-Western Nigeria: A Tobit analysis. Austr. J. Agric. Res. 2002;53:901-910.
47. Chianu, Tsuji, Chianu JN, Tsuji H. Determinants of Farmers to Adopt or not to Adopt Inorganic Fertilizer in the Savanna of Northern Nigeria. Nutrient Cycling in Agroecosystem. Kluvert Academic Publication, Netherlands. 2004;293-301.
48. Fapojuwo OE. Influence of Socio-economic Characteristics on Use of Modern Cassava Processing Technologies among Women Processors in Ogun State, Nigeria. Journal of Social Science. 2010; 24(1):43-50.
49. Voh JP. A Study of Factors Associated with the Adoption of Recommended Farm Practices in Nigerian Villages. Journal of Agricultural Administration. 1982;9(1):5.
50. Atala TK. Factors affecting adoption of agricultural innovations, usage of source of information and level of living in two Nigerian villages. Unpublished M.Sc. Thesis, Iowa State University, USA; 1980.
51. Akpoko, Akpoko JG. (2004): Factors affecting adoption of recommended soil management practices for sustainable agriculture in Kaduna State. Nigeria Savannah Journal, 19 No. 2 pp. 24 – 36. Published byAhmadu Bello University, Zaria; 2004.
52. Alexander C, Van Mellor T. Determinants of corn rootworm resistant corn adoption in Indiana. AgBioForum. 2005;8(4):197-204.
53. Nkonya E, Schroeder T, Norman D. Factors affecting adoption of improved maize seed and fertilizer in northern Tanzania. Journal of Agricultural Economics. 1997;48(1):1–12.
54. Osuji I. Institutionalized Factors Associated with Adoption of New Techniques Among Farmers in Eastern Nigeria. The Nigeria Journal of Agricultural Extension. 1983; I(2):45–53.
55. Laogun E. Evaluation of University–based extension system: A Case study of Rural Development Project. Nigerian Journal of Rural Extension and Development. 1993; 1(2 & 3):29–38.
56. Audi R. Epistemology. A contemporary introduction. 2nd Edition Routledge; 2003.
57. Olowu TA. The effect of television farm programme on farmers knowledge of improved farm practices in Oyo State‖: In Olowu, T.A. and Akinwumin, J.A. (eds) Development strategies in 21st century, Nigeria University of Ibadan. 1991;152–155.
58. Ndanitsa MA, Umar JS. The method of storage of farm produce by farmers in Niger State of Nigeria. Proceedings of the 10th Annual Conference of Nigeria Association of Agricultural Economists (NAAE) held at Abuja, October 7th –10th 2008.

59. Nwaru JC. Rural credit, market and resource use in arable crop production efficiency in Imo State of Nigeria. Ph.D Thesis Michael Okpara University of Agriculture, Umudike, Abia State; 2004.

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