

# Exploring Farmers Attitude, Practice And Relationship With Adoption Of Improved Pearl Millet Technology In North-Eastern Nigeria

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**Abstract:** In Sub-Sahara Africa, Nigeria is one of the major pearl millet producing country with an average annual production of 4.8 million tons. Nevertheless, Pearl millet farming is mostly carried out in the North-eastern Nigeria. Although, the productivity is very low, resulting to low level of growers attitude and practices on the improved technologies despite all the efforts of the extension agents and the stakeholders in the region to improve the situation. Hence, growers in North-eastern Nigeria mostly rely on traditional method of production and this has created a gap for need of this study. Thus, this study is designed to explore on farmers attitude, practice and relationship with adoption of improved pearl millet technologies in the region. Purposive sampling techniques was used to select 3 states and 9 local governments areas that are actively involved in pearl millet farming. Stratified random and systematic sampling technique was used to select 477 pearl millet growers. Information were collected using a self-report validated questionnaire. Descriptive, Pearson Moment Correlation and Multiple linear-regression models were employed to analyze the data. From the findings, respondents level of attitude was moderate, practice and adoption were at higher level. It was also observed that significant relationship existed between attitude, practice at ( $p < 0.01$ ) towards adoption of improved pearl millet technologies. Regression results revealed that practice is a significant contributor to adoption. while, attitude did not contribute. The study suggests that, Pearl millet growers should be encouraged through government policies and strategies that focused on the development of positive attitude towards adoption of improved pearl millet technologies and subsequent increase in the farmers level of output and other relevant areas of improvement among growers in North-eastern Nigeria.

**Keywords:** adoption, attitude, Exploring, Farmers, Improved pearl millet, practice, North-eastern Nigeria.

## 1. INTRODUCTION

Pearl millet is a major crop produced and consumed by the populace. However, In Sub-Sahara Africa, Nigeria is one among the major pearl millet producing countries with an average annual production of 4.8 million tons (1). Hence, the nation is ranked second globally after India. Indeed, Pearl millet is ranked third after maize and sorghum, among the cereal food crops produced in Nigeria. According to (2) who suggested that research and development interventions resulting to higher uptake of improved pearl millet varieties among farmers may likely lead to increase in income, food security and welfare of the farmers. Based on this, the pearl millet production improvement programme in Nigeria is concerned with a higher yield for human food. Furthermore, a current report by International Crops Research Institute for Semi-Arid Tropics (3) revealed that Nigeria recorded over 150% productivity growth from the package of improved practices on Pearl millet.

Improved Pearl millet as the subject of this research is that type of variety, which has a higher yielding ability that matured earlier (60 to 70 days as against 70 to 100 days for local traditional varieties). They are resistant to Striga spp, drought, pest and diseases. They respond optimally to fertilizer and other management practices. More significantly the grain size is larger while the panicle is more compact. With all these potentials; yet, farmers' adoption level seems to be very low in the study area. Hence, farmers continue to use the traditional local varieties whose yield is low. Nonetheless, it is on record that in Nigeria, as from 1975 up to the present dispensation, different administration had focused on agriculture to diversify the economy and several strategies and policies have been designed in this regard. The policies and as well strategic programme include among others, Lake Chad Research Institute LCRI, which was established in (1975), aimed at assisting farmers by increasing their input and productivity and the subsequent increase in sustainable livelihood. The Lake Chad research institute in question has the national mandate for genetic improvement on Pearl millet in the country and had also made efforts by releasing promising millet cultivars through the Agricultural Development Programmes (ADPs). However, the varieties that were released to farmers, are open-pollinated millet such as LCIC MV-1 (SOSAT C-88) and LCIC 9702 MV-2 (LCIC 9702) SUPER SOSAT, particularly in North-eastern Nigeria. These two varieties were developed in collaboration with International Crop Research Institutes for the Semi-arid Tropics (ICRISAT) and both had a potential yield of 2.5 - 3.5t/ha on the farmers' fields under good and recommended management practices and one of these varieties were [(LCIC MV-1 (SOSAT-C88)] which has the potentials of producing 20% more grain than the farmers' local variety and 15% more than the earlier released Ex-Borno. Even though information on the adoption and the probability of future adoption is crucial to the improvement of hybrid varieties of pearl millet yet, available evidence on the adoption of improved millet varieties are still proving to be very limited (4). Furthermore, another policy known as New Nigerian

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Agricultural Policy NNAP, was Launched in (2001), aimed at achieving self-sufficiency in basic staple food production and comparative advantage in local expansion and export in the country, including pearl millet production. Similar policy or strategy was equally launched known as the National Special Programme for Food Security NSPFS, (2002), which was aimed to boost Agricultural production via improved technologies for adoption by farmers to obtain higher yield and income among farmers. Also, another policy and strategy employed by Nigerian government was the Traditional Crops Project TCP, which was launched in (2003), and whose mandate was to improve smallholder's income and food security, through the production of traditional food crops & Pearl millet inclusive. While in 2012, the Agricultural Transformation Agenda (ATA) was introduced to improve farmers income, increased food security, create employment and transform the country to a foremost player in the food market. The ATA was reported to have increased agricultural output by 11% to 202.9 million tons between 2011 and 2014. Also, the same scheme was reported to have boasted commercial banks' lending to agriculture from 0.1 in 2011 to 5% in 2014 and reduced import bill by ~~N~~466 Billion. A recent programme launched in the country in 2016, was the Agricultural Promotion Policy (APP) aimed at resolving food shortages and improving output quality and pearl millet is equally among the food crops that were at the center stage of the scheme (5). Though, despite the role played by Nigerian government through policies and strategies, as mentioned above, coupled with the efforts of research institutes, non-governmental organization and other relevant agencies to improved pearl millet technology adoption among smallholder farmers in the country as reviewed above, yet farmers level of adoption is very low because on the improved technologies. Indeed, Nigeria's Pearl millet farming is mostly carried out in North-eastern Nigeria, although the productivity is often below the anticipated outcome because, of the low level of adoption on the improved technologies by farmers; resulting from a low-level of attitudes and practice on the improved technologies, which could influence adoption. Hence, these and other unidentified factors have contributed significantly to the low food production and consequently food insecurity and malnutrition with the effect more obvious on women and children in the region. Hence, the recent armed insurgency which had displaced more than 3 million persons across Nigeria, particularly, North-east and rendered about three-hundred thousand people as refugees in the neighbouring countries also serve as an impediments to adoption (6). Thus, from the foregoing the objectives of the study are: 1). To determine the level of attitude, practice and adoption level of the improved pearl millet technologies among farmers in North-eastern Nigeria. 2). To determines the relationship between independent factors (attitude and practice) towards the dependent variable (adoption) among farmers in North-eastern Nigeria 3). To determines the most contributing independent factors towards adoption of improved pearl millet technologies among respondents in Northeastern Nigeria.

## 2. LITERATURE REVIEW

### 2.1. Conceptual Interpretations

#### 2.1.1. Concept of Adoption

The construct of Adoption in agriculture and as in the context of this study served as the dependent variable that is extensively studied in agricultural extension world-wide. Indeed, the adoption of modern agricultural technologies is always at the center of strategic policies in developing countries including Nigeria(7) & (8). Hence, agricultural growth and development depends mainly on adoption of improved, appropriate technologies, disease-resistant and climate-friendly seeds, modern management practices to mention but few. Hence, adoption of improved agricultural technologies is thus, at the centre of agricultural growth and consequently serve as rural poverty alleviation (9). However, adoption could be seen as an integration of a new agricultural technology into existing practice and is usually preceded by a period of 'trying' and some degree of adaptation (10 &11). Similarly, (12) suggested that, adoption could be described as a conscious decision to implement a new agricultural practice or apply a new technology on a continuous basis. Hence, during these decision-making processes the intended beneficiaries could reject a change and seek to re-establish the previous practice or technology. In addition, (13) conceive adoption as an act of accepting or starting to use something new. They further stated that, it is a cognizance choice to execute another training or apply another innovation or technology among clients. Indeed, adoption of innovations has remained the foremost yardstick for determining the success or otherwise of agricultural extension services on the intended beneficiaries. . Hence, this study used attitude and practices of farmers as an independent factor that could influence adoption of improved pearl millet technologies among farmers in North-eastern Nigeria. However, the adoption practices that were measured in this study, ranges from land preparation, sowing technology, thinning, fertilization, pesticides, herbicide and fungicides application technology, harvesting, threshing, grading, packaging technology to maintain high quality, modern transport technology to get high value and storage technology to get a better price during offseason. Hence, the adoption level of farmers was measured based on three levels; low, moderate and high level.

#### 2.1.2. Concept of Attitude

Conceptually, attitude is seen as a mental position which serve an independent factor influencing the behaviour change in human society. It thus, has the ability of predicting the behaviour when it is not a problem to the person and it has social acceptance to its expression in action (14). While, (15) viewed attitude as a mental and neutral state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations which is often related. Indeed, attitude is crucial if the agricultural farmers assume sincerely that, the adoption of innovation is going to be useful for the group or community. Therefore, a higher understanding of farmers' attitudes towards new technology being introduced is crucial for understanding the implementation behaviour of those farmers (16). It ought to be noted that attitudes are often robust predictors of behaviour or the acceptance of concepts (17). Indeed, (18) suggested that, the more favourable persons

attitude is towards behaviour the better is the persons performance towards that behaviour. While, having unfavourable attitude is unlikely to substantially tilted towards behaviour. In the case of this study adoption behaviour. Thus, in this study, farmers' level of attitude was used to measure his feelings on the improved technologies via the attitude constructs, using hypothetical statements developed by the researcher to account for a body of the phenomena. Hence, in this context, level of farmers' attitude towards improved pearl millet varieties is considered as the farmers' feelings or inclination with regards to improved pearl millet; such feeling among farmers were incline to feelings about the technology itself, contact with extension workers, cultural suitability of the technology, feelings about yield, quality of the technology, labour requirement of the technology, feeling about whether or not the technology is for rich farmers than otherwise, feeling about the yield differences between improved varieties and local.

### 2.1.3 Concept of Practice

Practice is typically referring to farmers practices on the improved technologies. Practices could also be referred to as the production method or techniques utilized by farmers to produce the insured crop and allow it to make normal progress towards maturity and produce at least the yield that could determine the production guarantee (19). Hence, practice depends on economic stability and socio-financial condition of farmers. Indeed, practice is finally a matter of realizing what was planned. Once farmers adopt a new technology themselves and apply it in their native context, the potential of successful and sustained adoption can increase(20). The mission for the extension services is thus, to disseminate information and analyze the necessities and expectations of the farmers and as well regulate the offer of services to be delivered, which supported the opinion of the teams of resource farmers. (21) confirmed that the use of practical demonstration method in the training of farmers on new technology results into a higher level of innovation adoption among farmers. Indeed, numerous connected studies conducted on farmer's adoption practices have suggested different views. However, in the context of this study, practice refers to the farmer's level of adoption practicing activities inclined to improved pearl millet varieties as popularized to them by stakeholders in the study area. Hence, such activities are restricted to land preparation, sowing, thinning, weeding and herbicide application, pesticides, harvesting technology, threshing, packaging, grading, transportation and storage technology.

## 3. MATERIALS AND METHODS

### 3.1 Study Location

Nigeria is a Federal state comprising of thirty-six states, and its Federal capital territory Abuja. The country is however categorized into six geo-political Zones namely: South West Zone, South East, North West, North East, North Central and South-South Zone. Thus, for this research, North East Zone of Nigeria was chosen as the primary study area. The area is located in the "Sudano-Saharan" zone of Nigeria, comprising of six States (Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe). Hence, Bauchi, Borno and Yobe were purposively selected as the sample state to represent the zone because of their higher participation on pearl millet production. The

population of the zone stood at an estimated population projections of twenty-six million, two hundred and sixty-three thousand, eight hundred and sixty-six persons (26,263,866) as at 2016 by the National Bureau of Statistics (NBS) and National Population Commission (NPC) respectively.(22). The land area of the zone covers close to one third and recording about 280, 419 km<sup>2</sup> out of Nigeria's land area of (909,890km<sup>2</sup>) as confirmed by (23). Hence, the zone also has an arable land of about 7.9 million hectares with an average farm size of about 1.59 hectares among farmers. Indeed, the average annual rainfall distribution in the zone is about 1500mm and may be as low as 500mm and the weather is often, dry and hot for the most part of the year (24).Indeed, the climatic condition in the North-eastern zone of Nigeria, favours the production of a wide variety of crops, among which include legumes (groundnuts and beans); Cereals (maize, millet, sorghum and rice), solanecious crops (peppers, tomato, garden eggs). The zone also provides a large animal market for cattle, camel, sheep, goats, and poultry. The zone is also known for their rich fishing activities and mineral deposits. However, the zone is composed of diverse ethnic groups with majority been Fulani and Hausa.

### 3.2 Research design

This research employed descriptive correlational survey design in a bid to explore on farmers level of attitude and practice and their relationship towards adoption of improved pearl millet technologies in North-eastern Nigeria. Data for the study was directly sourced from the cross-section of respondents (active pearl millet growers) in North-eastern Nigeria with the aid of self-report validated questionnaire. The questionnaire and its scales were partly adapted from previous studies including(25; 26 & 27). Hence, the instrument was carefully reviewed and accordingly modified by experts to enhance content validity. Only questions relevant to farmers level of attitude, practice and adoption level on the improved pearl millet technologies among farmers were retained in the modified scales.

### 3.3. Reliability and Validity of the Questionnaire

The reliability and internal consistency of the research instrument as performed on the relevant variables (attitude, practice and adoption) were determined or measured by Cronbach alpha ( $\alpha$ ) test which is most commonly used in reliability tests. Hence, internal consistency is thus, use to determine the consistency for the sections on farmer's level of attitude, practice and adoption of improved pearl millet technologies. The test results were as follows: 10 statements on growers level of attitude towards improved pearl millet technology recorded ( $\alpha$ ) value of 0.978; 10 statements on growers level of practices on improved pearl millet technology scored 0.961 and adoption level was 0.963. From the results, level of attitude returned highest reliability coefficient of 0.963 while, growers level of practice recorded the lowest reliability coefficient of 0.961. However, a scoring system was applied to determine the level of variables attitudes, practice and adoption of improved pearl millet technologies by growers in the study area. Thus, attitude, practice and adoption score were calculated as a continuous variable by summing up the participant's number of correct responses to 10 statements each for attitude, practice and adoption. One point is awarded for each correct response (strongly agree or agree for correct statement and strongly disagree or disagree for incorrect

statement), and zero for each wrong or uncertain response, with a maximum obtainable correct score of 5.0 for each respondent. The attitude, practice and adoption level score were categorized into three levels indicated by low (1.00-2.33), moderate (2.34-3.66), and high (3.67-5.0) respectively.

**Table 1. Pilot Test Results for Reliability**

Construct	Number of sub-items	Cronbach's Alpha ( $\alpha$ )
Attitudes	10	0.978
Practice	10	0.961
Adoption	10	0.963

Field Survey; 2017

### 3.4 Sampling Method and Sample Size

This study used descriptive cross-sectional correlational design as very little is known regarding attitude and practices among farmers on the improved pearl millet technology in North-eastern Nigeria. To obtain the sample size of pearl millet growers from the region, the study used purposive sampling technique to select three (3) states (Yobe, Bauchi and Borno) and three (3) local government each from these states making a total of nine (9) areas, in North-eastern region of Nigeria. However to calculate the appropriate sample size, Yamane (1967) sample size determination formula was used to get the desired sample size for the study at (95%) confidence interval (CI) respectively. Thus, the formula and calculation of appropriate sample size is seen below:

$$n = \frac{N}{1+N(e)^2}$$

Where

n = Sample Size;

N = total population of pearl millet farmers (100700)

e = Precision (at 95% confidence interval)

$$\text{Thus, } n = \frac{100700}{1+100700(0.05)^2} = \underline{\underline{398 \text{ sample size}}}$$

Nevertheless, to avoid missing and unreturned questionnaires, 20% was added to the relative sample of each state and therefore, in Yobe state, 196 were randomly selected as relative sample from the population of 49700 and 20% of the sample is systematically added and a sample size of 235 was obtained. Similarly, in Bauchi, 140 was randomly selected as relative sample out of 35,500 and 20% of the sample was systematically added making a total of 168. Finally, in Borno State, 62 respondents were randomly drawn as relative sample from the population 15600 and 20% of the sample was systematically added making a total of 74 respondents. Thus, the final total sample size of the study stood at 477 respondents. Hence, sampling design outlay is hereby portrayed in Table 1. Below

**Table 2: Sample Design Outlay for the Study.**

State	Population	Local Government	Relative Sample	Final Sampl
Yobe	49,700	Bade	94	113
		Nangere	61	73
		Damaturu	41	49
Bauchi	35,400	Darazo	67	80
		Kirfi	43	52
		Gamawa	30	36
Borno	15,600	Kaga	30	36
		Jere	19	23
		Konduga	13	15
Total	100,700	9LGAs	398	477

## 4. RESULTS AND DISCUSSION

### 4.1 Results

This section capture the descriptive and inferential statistics on the data obtained from the study. Descriptive statistics such as frequency tables, percentage, mean and standard deviation were used to present respondents' level of attitude, practice and adoption level among farmers in the study area. while, Correlation analysis was used to determine the relationship of the independent factors attitude and practice towards adoption. while, simple linear regression was used to determine the contribution of the independent factors attitude and practice towards adoption of improve pearl millet technologies by farmers in North-eastern Nigeria, using Statistical Package for Social Sciences (SPSS) version 23.0 respectively.

#### 4.1.1 Farmers Level of Attitude

Result in Table 4 below showed level of attitude among respondents, which revealed that more than half about 81.9% of respondents had moderate level of attitude and having a mean score of 3.44. That means most of the respondents in North-eastern Nigeria had a moderate level of attitude towards adoption of improved pearl millet technology. followed by the second category of respondents with about 17.9% recording high level. Whereas, the third and the least category fall into the low level of attitude representing 0.2% among respondents.

**Table 3: Respondents level of Attitude**

Level	Frequency	Percentage. %	Mean	SD
Low (1.00 -2.33)	1	0.2	3.44	0.298
Moderate (2.34-3.66)	362	81.9		
High (3.67-5.00)	79	17.9		

Source: Computed from field survey, 2017

#### 4.1.2 Farmers Level of Practice

Table 5 below, showed the result on respondents' level of practice on the improved pearl millet technology. The findings revealed that most of the respondents, representing 53.2% recorded high level of practices with a mean score of 3.71 on the level of practice. Followed by respondents that were categorized as having a moderate level of practice, representing 42.5% among respondents. while, the remaining few respondents representing 4.3% of falling within the low level of practice on the improved pearl millet varieties

**Table 4: Respondents level of Practice**

Level	Frequency	Percentage.%	Mean	SD
Low (1.00-2.33)	19	4.3	3.71	0.704
Moderate (2.34-3.66)	188	42.5		
High (3.67-5.00)	235	53.2		

Source: Computed from field survey, 2017

#### 4.1.3 Farmers Level of Adoption

In Table 6 which showed Respondents' level of adoption on the improved pearl millet technology revealed that, the adoption level of respondents on the improved pearl millet technology recorded high level, which represent 64.5% among respondents with a mean score of 4.20, followed by respondents that fall within the moderate level of adoption representing 29.2% of the respondents. while the least category falls into the low level of adoption, representing 6.3% among respondents. This implies that most of the pearl millet farmers in North-eastern Nigeria have adopted improved pearl millet varieties.

**Table 5: Farmers Level of Adoption**

Level	Frequency	Percentage. %	Mean	SD
Low (1.00 -2.33)	28	6.3	4.02	0.734
Moderate (2.34-3.66)	129	29.2		
High (3.67-5.00)	285	64.5		

Source: Computed from Field Survey, 2017

#### 4.2 Pearson Correlation Analysis on Relationship between Attitude, Practice towards Adoption

From Table 7 below, results for correlational analysis revealed that all predictors had a positive correlation with Adoption at ( $p < 0.01$ ) level of probability. Hence, the practice had moderate correlation while attitude had a weak relationship. Hence, relationship of the variables with Adoption was ( $r = 0.151$ ,  $p = 0.001$ ) and ( $r = 0.578$ ,  $p = 0.000$ ) for attitude and practice respectively.

**Table 6: Relationship between Attitude, Practice towards Adoption**

Variables	X1	X2	Y
X1 Attitude	1		
X2 Practice	.145	1	
Y Adoption	.117	.587	1
Significant	.014	.000	
Mean	3.44	3.71	4.02
Standard Deviation	0.29	0.70	0.73

\*\* Correlation is significant at  $p < 0.01$  Level (2 tailed)

#### 4.3 Regression Analysis on the contributions independent factors Attitude, Practice towards Adoption as dependent variable

The study used the regression model to determines the most contributing independent factors with a higher  $\beta$  value that contribute more to the dependent variable adoption of the improved pearl millet technologies among farmers in North-Eastern Nigeria. Thus, the model consists of two independent variables which were analyzed namely; Attitude (X1), Practice (X2). Therefore, the prediction equation is as follows:

$$Y = b_0 + b_1(X_1) + b_2(X_2) + e_i$$

Where:

Y = Adoption,  
 $b_0$  = Constant,  
 $b_1$ - $b_2$  = Estimates (regression coefficients),  
 $X_1$  = Attitude  
 $X_2$  = Practice,  
 $e$  = Error.

The proposed hypothesis to test, which examine the validity of the model was expressed below:

$$H_0: Y = \beta_0 + e_i$$

$$H_A: Y = b_0 + b_1X_1 + b_2X_2 + e_i$$

From Table 8, the regression results revealed that practice contributed significantly to the adoption of improved Pearl millet varieties where, the coefficients for practice  $\beta = 0.493$ ,  $p = 0.000$  while, attitude was not significant with a value of ( $\beta = 0.047$ ,  $p = 0.623$ ). Thus, Practice was considered the strongest independent factor that contribute most to adoption due to its higher Beta value of 0.493. Hence, Adjusted  $R^2$  value was 0.366 which indicates that practice contributes 36.6% of the variance on adoption. More so, based on the data in Table 8, the estimated coefficient for respondent performance model as shown below, it revealed that Practice is highly significant with adoption with a t- value of 0.000 while, the attitude was not significant since the t-value was 0.623 which is more than 0.05 but it has a relationship with adoption. The highest Beta value was 0.493 which was obtained from practice. Thus, practice was found to be the highest contributing independent factor towards respondents' adoption behaviour on the improved pearl millet technologies in the North-eastern Nigeria, as seen below and thus, to portray the outcome well, below is an equation to buttress the explanations and the data in Table 8 below.

$Y = .812 + 0.493 (\text{Practices}) + e^* - 0.584$  Increase in 1 unit of practices, will therefore increase the dependent variable adoption by 0.493.

**Table 7: Regression of farmers Attitude, Practice towards Adoption**

Predictors	Unstandardized Coefficients		Standardized Coefficients		
	B	Std.Err	Beta	T	Sig.
Y Constant	812	.375	-	2162	.031
X1 Attitude	.047	.095	.019	.492	.623
X2 Practice	.493	.049	.473	10.159	.000

$R = 0.609$ ,  $R^2 = 0.371$ ,  $Adj.R^2 = 0.366$ , Std. Error of the Estimate = 0.584  
 Significant; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

## 5. DISCUSSION

From the results presented in Table 4,5 and 6 above on the level of attitude, practice and as well as adoption level of farmers, the study has clearly revealed that the higher the level of attitude and practice as independent factors, the better in the uptake of improved pearl millet technology and subsequent adoption by farmers in the study area. However, based on the result of the descriptive analysis, the data in Table 4, showed that, majority of pearl millet farmers in North-eastern Nigeria, falls within the category of moderate level of attitude, followed by the second category recording high level of attitude. Whereas, the least group falls on the low level. Thus, based on the findings, the researchers established that

most of the farmers in North-eastern Nigeria had a moderate level of attitude towards improved pearl millet varieties. These findings are in line with the previous outcomes obtained by (28) & (29) who found that respondents had a moderate level of attitudes based on their earlier separate studies conducted. From the data in Table 5, the descriptive analysis further revealed that more than half of the farmers recorded high level of practice on the improved pearl millet technology, followed by the next group that falling within the moderate level. Whereas, the least category recorded a low level of practice. The researchers, therefore, conclude that pearl millet practising farmers in North-eastern Nigeria had a high level of practice. These findings were in line with the findings of (21) and (30) which suggested that, a higher level of practice result into a change in adoption behaviour by respondents. Furthermore, Table 6 capture descriptive result on farmer's level of adoption. The outcome revealed that more than half of the active pearl millet farmers fall into the category of high level of adoption on improved pearl millet technology. Whereas, the next group falls within the moderate level and the least group falls under low level of adoption. These findings agreed with the findings of (31);(32), (30),(33) (34), (35) & (36) which confirmed that, respondents recorded a high level of adoption on their separate studies conducted. Thus, the overall result on the level of attitude, practice and adoption obtained in this study were in line with earlier findings of (37). Similar studies were also carried out and reported by (38), (39) & (40) which indicated that high level of attitude and practice are determining factor that influences the outcome variable adoption. Findings on the relationship between independent factors attitude, practice and the dependent variable adoption were investigated and the findings were portrayed in (Table 7), the results revealed that there is a positive relationship between attitude towards the outcome variable adoption, this was also supported by correlation coefficient value obtained on the attitude of farmers as revealed in the data ( $r=0.151$ ,  $p=0.001$ ), which showed positive relationship with the outcome variable adoption. These findings were supported by the previous studies conducted by (41),(39), (38) & (42) which confirmed that, there was a positive relationship between attitude and the outcome variable adoption. More so, positive and significant relationship was also found between farmer's practices and adoption as captured in (Table 7). This relationship was also supported by correlation coefficient for practice ( $r = 0.578$ ,  $p=0.000$ ) and the previous findings of (21), (38), (39),(30) and (43). The findings were also supported by (44) on his stages of adoption, where he confirms that Triability or farmers practices are directly related to the adoption of technology, which is also in agreement with the findings of this study. From the data in Table, 8 the findings on regression analysis of this study revealed that farmers practice contributed significantly to the adoption of improved Pearl millet technology. Hence, farmers practice recorded the highest coefficients. While, the attitude of farmers was not significant to adoption, with a ( $\beta=0.047$ ,  $p=0.623$ ). These finding is in agreement with the findings of (38),(45),(29)(46) Thus, Practice was considered the strongest independent variable influencing adoption due to its higher ( $\beta= 0.493$ ). The Adjusted  $R^2$  value was 0.366 which indicates that practice contributes 36.6 % of the variance on adoption. Thus, based on the findings, the research established that farmers level of practice and adoption level was high while, the attitude was moderate. The results further indicate that the independent

factors attitude, practice had positive correlation with Adoption at ( $p<0.01$ ) level of probability. Hence, regression results further revealed that practices contribute more to the dependent variable adoption while the attitude did not contribute. The result confirmed that practice had the highest contribution to farmers level of adoption with ( $\beta=.493$ ). Adj R value 0.366 implies that practice contributed 36.6% of variance towards adoption of improved pearl millet technologies among farmers in North-eastern Nigeria.

### 5.1 Conclusion

In conclusion, the study established that, farmers adoption level is conditioned on their level of attitude and practice. Hence, the findings confirmed that, the level of the attitude of the respondents is categorized as moderate. While, farmers practice and adoption level were both at high level which stemmed from their preference on the improved pearl millet technologies due to the higher yield. More so, the study found that attitude and practice had a positive relationship with adoption at ( $p<0.01$ ). Hence, practice had moderate correlation with adoption. While, attitude recorded a weak relationship. More so, from the findings, practice was noticed to have contributed significantly to the adoption of improved pearl millet technologies. While attitude did not contribute to adoption. Thus, the higher the level of attitude and practice, the more an individual farmer succeed in the uptake of improved pearl Millet technologies and subsequent adoption. Hence, based on the findings, attitude of the farmers needs to be encouraged through prompt extension services coupled with educational campaigns and on-farm trials thereby intensifying awareness creation among respondents through the guidance of extension agent (s) and other relevant stakeholders in the region.

### 5.2 Recommendations

i) (2) Based on the finding Farmers should be encouraged towards developing positive attitude in the cultivation and adoption of improved pearl millet varieties, by intensifying their efforts towards awareness programme, thereby eroding their socio-cultural belief on their preference to Traditional local varieties over the improved varieties of pearl millet which has the potential of making a difference of 40% yield if adopted by farmers.

(3) More so, based on the findings, Farmers practices on improved varieties of pearl millet recorded the highest contribution to adoption and therefore, active pearl millet farmers in North-eastern Nigeria should further be encouraged towards improving the adoption propensities and management practices on the improved pearl millet technologies through farm exhibitions, annual farming festivals, field demonstration canters to show case in practice, on-farm trials for subsequent adoption among farmers.

(4) Farmers should also be encouraged by government and other relevant agencies, using policies and strategies through the ADPs who are the soul public extension organization in collaboration with their extension agents by organizing relevant motivating programmes for subsequent adoption. This will not only help to win the trust of the farmers on government programmes, but also help guarantee optimal productivity.

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