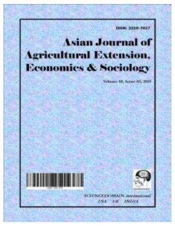

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Perceived Training Needs of Smallholder Rice Farmers on Urea Deep Placement Technology in Benue State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author BOA designed the study, performed the statistical analysis, wrote the protocol, managed the analyses of the study and wrote the first draft of the manuscript. Author CAO managed the data collection and literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

This study investigated the perceived training needs of smallholder rice farmers on urea deep placement (UDP) technology in Benue State, Nigeria. Data were collected from 162 rice farmers by using a well-structured questionnaire administered to the respondents. Descriptive statistics and multiple regression analysis were used for analysis of collected data. The results showed that respondents were predominantly male, married and had secondary education, with mean age of 46 years. The mean household size was 10 persons, average farm size and average number of rice plots were 1.1 ha and 1 plot respectively. Multiple regression analysis showed that extension visit, paddy rice output and training were positive and significant to the use of UDP technologies, while age, education level, farm size, access to credit and compatibility were negatively significant. The areas of priority for training are use of seed sorting box (99.4%), line transplanting (99.0%), USG

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application (89.4%), panicle harvesting (79.4%) and nursery establishment (60.0%). Majority (72.6%) of the farmers are willing to attend on-the-job training if given the opportunity. The study recommended that the government and non-governance agencies in Benue State should give utmost priority to the training needs of the smallholder rice farmers to improve their knowledge level and use of UDP technologies in the State for increased rice production.

Keywords: Training needs; UDP technology; smallholder; rice farmers; Benue State.

1. INTRODUCTION

At a time Nigeria is revamping her economy through diversification, agriculture especially rice production has been a focal point. This is to ensure that rice production is accelerated to the level where the country becomes self-sufficient. Improved rice production technology has been widely recognized as a critical input for increasing rice production in the country; since the development of rice production in Nigeria can contribute substantially to poverty alleviation, especially, for resource constrained households and can increase household food security [1].

In view of this, efforts have been made by the government of Nigeria, non-government agencies and the private sector actors to ensure that rice farmers across the country have access improved production technologies. Designed particularly for smallholder farmers cultivating lowland rice, urea deep placement (UDP) technology is one example of a production technology that increases yields, reduces quantities of urea applied, increases farmers' returns, and produces national savings due to reduction of urea imports.

The principal aim of UDP technology is to improve Nitrogen (N) use efficiency in rice production which in turn is expected to improve productivity. UDP technology consists of two key components. The first is a fertilizer 'briquette' produced by compacting commercially available urea fertilizer (e.g., which is then known as Urea Super Granules or USG weighing roughly 1-3 grams per briquette). The second key component of UDP is the placement of urea briquettes (USG) below the soil surface. When used to fertilize rice fields, the briquettes are centred between four plants at a depth of 7-10 centimetres within seven days after transplanting. Placement can be done either by hand or with a mechanical applicator. The briquette releases nitrogen (N) gradually, coinciding with the crop's requirements during the growing season [2]. Also, in this production process N fertilizer is required to be applied only once for the entire crop season unlike conventional urea production process when 3-4 applications are required (mainly broadcasting first and then topdressing subsequently).

According to Vargas [3], the use of UDP technology will also depend upon support from national and international institutions. This has been the case in other countries like Indonesia and Bangladesh, where UDP technologies have been successfully adopted. The use of UDP technologies among rice farmers in Nigeria is still relatively low partly because it is seen as a novel technology [4]; there is however ample opportunity for improvement. Such improvement can be achieved through training of smallholder rice farmers. Nevertheless, such trainings can only be effective if the training needs of the smallholder rice farmers are properly identified. Extension educators are responsible for helping farmers to accurately identify their training needs. Harris [5] opined that programmes are most often successful when they focus on clearly defined needs of the target group.

The need to improve their knowledge base on UDP technology through trainings is of paramount importance to rice farmers in Benue State. Training is accordingly very vital to improve skill, knowledge and practice of smallholder rice farmers. Owona et al. [6] defined training needs as skill, knowledge and attitude an individual requires in order to overcome problem as well as to avoid creating problem situation. Akinsehinde [7] also highlighted that training needs exists anytime an actual condition differs from a desirable condition in the human or people aspect of organizational performances. Training of farmers and the adoption of improved technologies can lead to increase in productivity and higher income to the farmers [8]. This study was therefore conducted to ascertain the perceived training needs of smallholder rice farmers on UDP technology in Benue State, Nigeria. Specifically, the study was designed to examine the socio-economic of the rice farmers, knowledge level and factors affecting UDP technologies use as well as training needs.

2. METHODOLOGY

2.1 Study Area

The study was conducted in Benue State, Nigeria. The State is one of the six states constituting the North Central region of Nigeria. The State is situated within the middle belt of Nigeria. It is located between longitudes 60 33E and 100E and latitudes 60 30 N and 80 10N. Benue State has 23 local Government Areas with its headquarters in Makurdi. The State has a population of 4,253,641 Million people [9] and covers a total land area of about 33,955 square kilometres. The major crops grown here include, rice, yam, cassava, groundnut, millet, soybeans, maize, citrus, mango, sorghum, sweet potatoes, cocoyam, guava, oil palm, tomatoes, cowpea, cashew and okra. Small ruminants such as goat, sheep, and non-ruminants such as swine, rabbits and poultry are also reared in the state. There are two distinct seasons here, the wet and the dry seasons. The wet season begins in April and ends in November while the dry season starts in December and ends in March. Farming is the major occupation of the Benue State indigenes.

2.2 Target Population and Sampling Technique

The target population for this study is rice farmers registered under the USAID/MARKETS II Nigeria Project in Benue State. The Project is being implemented in 12 LGAs out of the 23 LGAs in the State. About 257 rice farmer cooperative societies and a total population of 8,295 rice farmers were registered under the Project. Multi-stage sampling procedure was used to select respondents for this study. Firstly, all the intervention LGAs were purposively sampled in the State. This was followed by random selection of rice farmer cooperative societies using a proportionate sampling technique; thus, rice farmer cooperative societies were selected. Thirdly, since membership of the rice farmer cooperative societies was not the same, the proportionate sampling technique was also applied to randomly select the rice farmers, hence; a total of 162 rice farmers were selected. Only 160 questionnaires that were properly completed were used for this analysis.

2.3 Data Collection and Analysis

Data were collected on socio-economic characteristics of respondents and UDP technologies disseminated by USAID/MARKETS II Project which include; (1) land preparation (puddling and bund formation) (2) improved rice seeds (FAROs 44, 52, 57 or 61) (3) seed sorting/ germination test (4) nursery establishment (wet bed rice nursery) (5) line transplanting (20x20) cm at 1 rice seedling per hill) (6) USG application (40x40) cm per 4 rice stands) (7) harvesting (panicle harvesting). The knowledge level of the UDP technologies were determined by describing in the questionnaire how each technology was expected to be used so that the interviewers could check to ensure the validity of the recorded information. The knowledge level was therefore measured by scoring one point (1) = yes for each technology well explained and used by the respondent and (0) =no, if otherwise. The knowledge level was calculated as the number of UDP technologies well explained and used, divided by the total number of

Fig. 1. Map of Benue State, Nigeria

Table 1. Sampling procedure and sample size

LGA	Total number of rice farmer cooperative societies	Number of selected rice farmer cooperative societies	Total number of registered rice farmers in selected farmer cooperative societies	Sample size
Apa	19	6	629	12
Buruku	50	17	1010	20
Gboko	29	10	957	19
Guma	25	8	788	15
Gwer West	20	7	510	10
Kastina-Ala	24	8	858	17
Kwande	18	6	588	11
Makurdi	40	14	1164	23
Obi	13	4	338	6
Oju	11	4	520	10
Otupko	13	4	374	8
Tarka	13	4	559	11
Total	**275**	**92**	**8295**	**162**

UDP technologies and expressed in percentage. The overall knowledge level was calculated by adding the percentage knowledge level of all the UDP technologies and dividing them by 7, which is the total number of UDP technologies. A respondent who scored 5points or 71.2% and above was regarded to have high knowledge of UDP technologies (having explained and used at least five out of seven technologies as recommended) and one who scored less than 5 points or 71.2% was has low knowledge. Data were collected by means of structured questionnaire administered to the respondents and analysed with IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp. Descriptive statistics such as frequencies, percentage was used to achieve objectives one and two while inferential statistics (Multiple Regression Analysis- MRA) was employed to analyze objective three.

The MRA model was expressed explicitly as

$$Y = a + b_1X_1 + b_2X2 + b_3X_3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots b_{14}X_{14} + U$$

Where,

Y = Adoption of UDP technologies
X_1 = Sex (male=1, female= 0)
X_2 = Farmers age (years)
X_3 = Household size (number)
X_4 = Education (years)
X_5 = Rice farming experience (years)
X_6 = Extension visit (Yes=1, No=0)
X_7 = Access to credit (Yes=1, No=0)
X_8 = Rice farm size (hectares)
X_9 = Paddy rice output (Kg)
X_{10} = USG source (number of sources)
X_{11} = Training (number of trainings received)
X_{12} = Affordability of UDP technology (Expensive to use=1, Otherwise= 0)
X_{13} = Compatibility of UDP technology (Meet needs with existing values=1, Otherwise= 0)
X_{14} = Complexity of UDP technology (Difficult to use=1, Otherwise= 0)
$b_1 - b_{14}$ = Regression coefficient
a = constant term
$X_1 – X_{14}$ = Independent variables
U= error term

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Respondents

The socio-economic characteristics of the respondents studied include Sex, Age, Marital status, Household size Educational Level, Rice farming experience, Farm size, and number of rice plots. These are presented in Table 2. The result indicated that majority (73.8%) of respondents were male and only 26.2% were female. The data suggested that male farmers were mostly the ones engaged in rice farming activities. The finding also agrees with Afolami et al. [10] in Ekiti and Ogun States of South-West, Nigeria, who reported dominance of male folk in paddy rice production. Also, the average age of the respondents was 46 years, implying that majority of the rice farmer were within the active productive ages to cope with the rigours of rice farming and UDP technologies. This finding is in corroboration with Usman et al. [11] that the active productive ages of an individual is the period in which the person is more capable and energetic to carry out agricultural activities.

Table 2 as well presented that greater proportions (91.9%) of the respondents were married. The result is in line with Dimelu et al. [12] who reported that majority of the rural farmers are married people. The mean household size was 10 people inferring that most of the respondents have large family size. This might also mean high supply of farm labour by family members, with the assumption that members of the household worked on the farm, all things being equal. Thereby reducing the cost of labour in using UDP technologies. A significant proportion (42.5%) of the respondents had secondary school education. This depicts that a great proportion of the respondents had at least gone through secondary school education. Likewise, the mean rice farming experience in the area was 14 years. The result revealed that the respondents had a reasonable experience. This is line with Mustapha et al. [13] who reported that respondents in Borno State, Nigeria had a practical experience in rice farming.

Furthermore, findings from this study also showed that rice farmers were small-scale farmers with average rice farm size of 1 1ha, a pointer to that fact that rice farming in the study area is still at subsistence level in the State. Coker et al. [14] revealed that 65% of rice farmers cultivated between 0.5 and 2 hectares of land in Niger State, Nigeria. Table 2 additionally revealed that average number of rice plots owned by respondents in the study area is 1.5. This situation, where many farmers cultivated only small plots of land would not promote paddy rice production beyond subsistence level. This might be attributed to the fact that land tenure systems, which normally results into excessive fragmentation of land is still a problem in the study area. This directly or indirectly could affect farmers' extent of adoption of UDP technologies. Apata et al. [15] presented that land fragmentation in Nigeria has a strong negative effect on net farm productivity and income per hectare.

3.2 Knowledge Level of UDP Technologies among the Respondents

Identification of the knowledge level of the rice farmers will help in determining where trainings are necessary to be conducted to the farmers to improve UPD technology uptake in Benue State. The results showed that farmers have low knowledge level on UDP technologies (Table 3). However, all (100%) the rice farmers had good knowledge of land preparation and the use of improved rice seeds. In addition, this study established that no respondent used the seed sorting box technology because the technology was not readily available in the study area; instead, majority (75%) of the rice farmers resulted to carrying out the simple seed germination test. This result implies that the respondents' knowledge on the use of the seed sorting box technology is very limited. The farmers could not also explain correctly the processes of line transplanting (25.4%), USG application and panicle harvesting (35%). This finding is in agreement with the observation of Onumadu and Osahon [16] that farmers embrace new farm production technologies if they are knowledgeable.

3.3 Factors Affecting the Use of UDP Technologies

The selection was based on the values of R^2 (coefficient of multiple determination), F-statistics, the signs of the coefficients of the regression. The coefficient of multiple determinations (R^2) was 0.36 indicating that the explanatory variables in the model explain about 36% of the total variation in the use of UDP technology in the study area was explained by the independent variables included in the model. The results in Table 4 suggest that sex, age, education level, farm size, access to credit, extension visit, paddy rice output, number of training and complexity were the significant factors affecting the use of UDP technologies.

Table 4 showed that age of the respondents was also negative and statistically significant with the use of UDP technologies at 10% probability level. This implies that as the farmers grow older, they tend to resist the adoption of UDP technologies. This corroborates with the findings of Abdullahi and Tashikalma [17] on factors influencing the adoption of gum arabic production technologies in Gombe State, Nigeria. Education was negative and significantly related to the use of UDP technologies at 10% level of probability. This suggests that in spite of the farmers' educational level, inadequate knowledge of UDP recommended practices could probably decrease use. This is as well, a pointer that the respondents have need of more training on UDP technologies. The finding agrees with Bello et al.

[18], who did not establish any significant relationship between education and adoption of agro-chemical technology in Abuja FCT, Nigeria.

Farm size was statistically significant at 10% level but had a negative coefficient, meaning that an increase farm size will not result in an increase in the use UDP technologies. This may be because of the additional labour requirement and the laborious task of line transplanting and USG application. This finding is consistent with Vargas [3] in Lucia, Ecuador where rice farmers

Table 2. Distribution of respondents on socio-economic variables

Variables	Percentage (n=160)	Mean
Sex		
Male	73.8	
Female	26.2	
Age (years)		
20-30	1.3	46
31-40	33.1	
41-50	31.3	
51- 60	28.8	
>60	5.6	
Marital status		
Single	-	
Separated	0.6	
Married	91.9	
Widowed	5.0	
Divorced	2.5	
Household size		
1 – 5	11.9	10
6 – 10	50.6	
11- 15	16.9	
16 – 20	19.4	
>20	1.3	
Educational level		
No formal education	5.0	
Adult education	10.6	
Quranic education	0.6	
Primary education	14.4	
Secondary education	42.5	
Tertiary education	26.9	
Rice farming experience		
1 – 5 years	13.8	14
6-10 years	21.9	
11-15 years	12.5	
16-20 years	15.0	
21-25 years	15.0	
>25 years	21.9	
Farm size		
< 1.0 ha	1.3	1.1
1.0-1.5 ha	53.1	
1.6- 2.0 ha	25.6	
2.1-2.5 ha	2.1	
2.6-3.0 ha	11.9	
>3.0 ha	6.9	
Number of rice plots		
1 plot	55.6	1.5
2 plots	37.5	
3 plots	3.1	
>3 plots	3.8	

Source, Field survey, 2016

Table 3. Knowledge of UDP technologies among respondents

UDP technologies	*Percentage (n=160)	Level
Land preparation (puddling and bund formation)	100.0	High
Improved rice seeds (FAROs 44,52, 57 or 61)	100.0	High
Germination test	75.0	High
Nursery establishment (wet bed rice nursery)	35.4	Low
Line transplanting and seedling rate (20x20) cm at 1 rice seedling per hill)	25.4	Low
USG application (40x40) cm per 4 rice stands)	25.4	Low
Harvesting (panicle harvesting)	35.0	Low
Overall knowledge level of UDP technologies	56.6	Low

Source, Field survey, 2016
** Multiple responses provided*

Table 4. Factors affecting the use of UDP technologies

Variables	Coefficient	Standard error	't' -value
Sex	- 0.033	0.335	- 1.00
Age	- 0.006	0.002	- 2.70*
Household size	0.005	0.003	1.33
Education level	-0.006	0.002	- 2.35*
Rice farming experience	0.001	0.001	0.40
Farm size	- 0.091	0.044	- 2.04*
Access to credit	-0. 053	0.029	- 1.78*
Extension visit	0.002	0.001	1.71*
Paddy rice output	0.000	0.000	2.94**
USG source	0.016	0.079	0.22
Training	0.083	0.022	3.74***
Affordability	0.008	0.051	0.16
Compatibility	-0.073	0.357	- 2.03*
Complexity	- 0.073	0.511	- 1.42
Constant	2.705	0.112	24.04
F-Value			5.78
R-squared			0.36

*Source, Field survey, 2016 *** = significant at 1%, ** = significant at 5%, *= significant at 10%*

with the smallest land size category expressed the highest willingness to adopt the UDP technology. Access to credit was also negative and significant at 10% probability level, which implies that the rice farmers had little or no access to credit and this affected the use of UDP technologies. This result conforms with the findings of Ijioma et al. [19], who reported that cocoyam farmers had no access to credit and this affected adoption in Abia State, Nigeria.

Extension visit was however positive and significant at 10% probability level, suggesting that the use of UDP technologies would increase as the number of visits of extension staff increases. This concurs with the findings of Kudi et al. [20] who showed a direct relationship between adoption of improved maize varieties and extension visit in Kwara State, Nigeria. Furthermore, paddy output was positively significant at 5% level of probability. This implies that the output of the respondents increased with the use of UDP technologies. This agrees with the findings of Ojo et al. [21] who stated that the adoption of appropriate improved rice production technologies by the farmers increased their rice yields per hectare. Training was positive and the most significant at 1% level of probability in the study area. The results suggested that rice farmers with relatively more exposure to UDP technologies trainings would be more equipped in terms of the technical knowledge required for the use of UDP technologies. In their study also, Azumah et al. [22] found that rice farmers who attended trainings on the UDP technology had a greater probability of adopting the technology in the Northern Region of Ghana. Compatibility was negative and significant at 10% level of probability, signifying that it is inversely proportional to the adoption of UDP technologies in the study area.

3.4 Training Needs among the Respondents

Table 5 shows the perceived training needs of rice farmers in Benue State in the order of priority. Use of seed sorting box (99.4%), line transplanting (99.0%), USG application (89.4%), panicle harvesting (79.4%) and nursery establishment (60.0%) were the most important areas where farmers need training. This may be due to the fact that these technologies are the 'back bone' of UDP technology. There is therefore need for the rice farmers to be more acquainted with the basic trainings for better performance on USG application, line transplanting and seed sorting box as these practices form the core component of UDP technology. This implies that future training content must therefore be in line with these areas of priority, seeing that the respondents have indicated their willingness to attend more training if given the opportunity in order to increase their knowledge and paddy rice yield. This is in concurrence with the findings of Mohd Noor and Dola [23] in Malaysia where 45% of the respondents indicated that the benefit of the training they received led to increase in knowledge and farm productivity.

3.5 Types of Training Respondents are Willing to Attend

Table 6 shows the type of training the farmers are willing to attend. For training to meet the needs of rice farmers, their status and conditions must be taken into consideration. The training types farmers are willing to attend in order of preference are on-the-job training (72.6%), field visitation and observation (15.6%) and farmer field day (11.9%). On-the-job training is one of the best methods of training since it is planned, organized and conducted at the farmers' field. On-the-job training will generally be the primary method used for broadening farmer's knowledge to increase the use of UDP technology in the study area. Visiting of UDP demonstration plots by farmers can also help as a source of training. Farmers' regular visit to demo plots around their field can go a long way to improve their knowledge on UDP technology. During visits, questions on UDP recommended practices can be asked by the rice farmers thereby improving farmers knowledge. In addition, attending field day in sites of successful adoption by farmers can improve their knowledge of UDP technology. Farmers' field days provide an opportunity for hands-on learning. Farmers from across various locations have a chance to learn practical skills, get answers to their questions and meet other likeminded folks during farmers' field days.

Table 5. Perceived training needs among the respondents in order of priority

Training Areas	*Percentage	Rank
Use of seed sorting box	99.4	1st
Line transplanting and seedling rate (20x20) cm at 1 rice seedling per hill)	99.0	2nd
USG application (40x40) cm per 4 rice stands)	89.4	3rd
Panicle harvesting	79.4	4th
Wet bed rice nursery establishment	60.0	5th
Use of FAROs 44,52, 57 or 61	10.0	6th
Puddling and bund formation	05.0	7th

Source, Field survey, 2016
** Multiple responses provided*

Table 6. Types of training respondents are willing to attend

Training types	*Frequency	Percentage
On the job training	116	72.6
UDP demonstration plots	25	15.6
Farmers field days	19	11.9

Source, Field survey, 2016
** Multiple responses provided*

4. CONCLUSION AND RECOMMENDATION

Based on the findings of the study, factors affecting the use of UDP technologies are age, education level, farm size, access to credit, extension visit, paddy output, training and compatibility. The areas of priority for training are use of seed sorting box, line transplanting, USG application and nursery establishment. Farmers are willing to attend on-the-job training if given the opportunity. Base on the findings, the study recommends that on-the-job training should be organised for the rice farmers. Also, extension agents in the LGAs where UDP technologies has been disseminated should be trained on the rudiments of UDP technology to serve as the change agent in their areas, assist the trained contact farmers and to be able to train other farmers since they are close to these farmers. Training content must also be in line with the priority of the farmers use of seed sorting box, line transplanting, USG application and nursery establishment. Therefore, the government and non-governance agencies in Benue State should give utmost priority to the training needs of the smallholder rice farmers to improve their knowledge level and use of UDP technologies in the State for increased rice production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ajijola S, Usman JM, Egbetokun OA, Akoun J, Osalusi CS. Appraisal of rice production in Nigeria: A case study of North Central States of Nigeria. Journal of Stored Products and Post-Harvest Research. 2012;3(9):133-136.
2. International Fertilizer Development Center (IFDC). USAID/MARKETS II Urea Deep Placement (UDP) Technology/Farmers Manual. 2012;3-12.
3. Vargas SAM. Cost-benefit analysis for the adoption of the urea deep placement technology by the rice farmers of Daule and Santa Lucia, Ecuador. A thesis presented to the graduate school of the University of Florida for the degree of Master of Science University of Florida; 2012.
   Available:http://repositorio.educacionsuperior.gob.ec/handle/28000/297
   (Accessed December 29, 2015)
4. Kuku O, Liverpool-Tasie S, Ajibola A. Guiding Sustainable Intensification in Sub Saharan Africa (GISAIA); Nigeria Launch Abuja, Nigeria – June 17; 2013. (PowerPoint Presentation).
5. Harris E. Project definition is critical for success-5key elements you ignore at your own peril. Practical business process and performance improvement information, for today's business operating environment; 2011.
   Available:http://blog.ssqi.com/2011/08/12/project-definition-project-charters
   (Retrieved on May 12, 2016)
6. Owona NPA. Nyaka NA, Ehabe EE, Chambon-Poveda B, Bruneau JC. Assessment of training needs of rubber farmers in the south-west region of Cameroon. African Journal of Agricultural Research. 2010;5(17):2326-2331.
7. Akinsehinde OA. Elements of Agricultural Extension Administration, Bounty Press Ltd. Ibadan; 2007.
8. Tsado JH, Ojo MA, Ajayi OJ. Impact of training the trainers' programme on rice farmers' income and welfare in North Central, Nigeria. Journal of Advanced Agricultural Technologies. 2014;1(2):157-160.
9. National Gazette. Federal Republic of Nigeria. 2016;96:2.
10. Afolami CA, Obayelu AE, Agbonlahor MU, Lawal-Adebowale OA. Socio-economic analysis of rice farmers and effects of group formation on rice production in Ekiti and Ogun States of South-West, Nigeria. Journal of Agricultural Science. 2012;4(4): 233-244.
11. Usman T, Ango AK, Barau AA. Evaluation of adoption of improved rice varieties among small-scale farmers: A case of Goronyo local government area of Sokoto State, North-Western Nigeria. Journal of Agriculture Innovations and Research. 2013;2(3):2319-1473.
12. Dimelu MU, Enwelu IA, Attah CP, Emodi AI. Enhancing performance of farmers' cooperative in rice innovation system in Enugu State, Nigeria. Journal of Agricultural Extension. 2014;18(2):206-219.
13. Mustapha SB, Undiandeye UC, Sanusi AM, Bakari S. Analysis of adoption of improved rice production technologies in Jeer local government area of Borno State, Nigeria. International Journal of

Development and Sustainability, 2012;1(3): 2186-8662.
14. Coker AA. Ninalowo SO. Effect of post-harvest losses on rice farmers' income in Sub-saharan Africa: A case of Niger State, Nigeria. Journal of Agricultural Science and Food Technology. 2016;2(3):27-34.
15. Apata T, Sanusi A, Olajorin V. Small farms and agricultural productivity in Nigeria: Empirical analysis of the effects of land tenure, fragmentation and property rights. Paper prepared for presentation at the "2016 World Bank Conference on Land and Poverty" The World Bank - Washington DC; 2016.
16. Onumadu FN, Osahon, EE. Socio-economic determinants of adoption of improved rice technology by farmers in Ayamelum local government area of Anambra State, Nigeria. International Journal of Scientific and Technology Research. 2014;3(1):308-314.
17. Abdullahi M, Tashikalma AK. Factors influencing adoption of gum arabic production technologies in Gombe State, Nigeria. International Journal of Agricultural Extension and Rural Development Studies. 2016;3(2):15-25.
18. Bello M, Ibrahim HI, Salau ES, Kaura AG, Age AI. Factors influencing the adoption of agro-chemical technology by small-scale farmers in Kwali area council of Abuja FCT, Nigeria. Journal of Environmental Issues and Agriculture in Developing Countries. 2010;2(1):176-190.
19. Ijioma JC, Effiong JB, Ogbonna MO, Onwuamaoka EA. Determinants of adoption of selected NRCRI cocoyam technologies among farmers in Umuahia South local government area of Abia State, Nigeria. American International Journal of Contemporary Research. 2014;4(6):181-189.
20. Kudi TM, Bolaji M, Akinola MO, Nasa'i DH. Analysis of adoption of improved maize varieties among farmers in Kwara State, Nigeria. International Journal of Peace and Development Studies. 2010;1(3):8-12. Available:http://www.acaderniciournals.org/IJPDS
(Accessed October 21, 2016)
21. Ojo MA, Osadumo D, Olaleye RS, Ojo AO, Tsado JH, Ogaji A. Perceived relevance of improved rice production technologies in Katcha local government area of Niger State, Nigeria. Nigerian Journal of Rural Sociology. 2010;11(2):58-63.
22. Azumah SB, Tindjina I, Obanyi S, Wood TN. Productivity effect of urea deep placement technology: An empirical analysis from irrigation rice farmers in the Northern Region of Ghana. International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering. 2017;11(3):194-199.
23. Mohd Noor KB, Dola K. Investigating training impact on farmers' perception and performance. International Journal of Humanities and Social Science. 2011;1(6): 145-152.

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