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Analysis of Factors Influencing Adoption of Good Agronomic Practices (GAP) among Cassava Farmers under Nigeria Agricultural Transformation Agenda

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Authors' contributions

This work was carried out in collaboration among all authors. Author RAO designed the study, manage the literature search and reviewed the final draft. Authors EOA and SOO 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

This study investigated the adoption rate and factors influencing the adoption of cassava technologies among farmers under Nigeria Agricultural Transformation Agenda (ATA). A total of 60 participating cassava farmers were randomly selected through a multi-stage sampling approach. Data were collected with the aid of a well structured questionnaire and analyzed using descriptive statistics and Tobit regression model. The results showed that the mean age of participating farmers under the program were about 47 years. On the issues of gender of the farmers, 75% and 25% of the cassava farmers were male and female respectively. Farmers have adequate access to extension education with average visits of 15 times per annum. It was observed that several technologies on cassava had been disseminated and promoted among farmers under ATASP-1 project. Higher adoption rate was observed among the farmers which hold good promise for

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increased productivity. Only few technologies such as mechanization, conservation of stem, record keeping and yields assessment had low rate of adoption rate. It was equally discovered that the adoption of cassava technologies were influenced by socioeconomic characteristics of the farmers such as age, gender and education of the respondents. The study recommends a continuous training on the use and benefit of the technologies to facilitate farmers' understanding of the importance of these technologies as well as techniques behind their utilization with a view to sustaining adoption and productivity. Also, there is need to encourage women to participate in the project as well as encourage them to take up farming as a business.

Keywords: Adoption; good agronomic practices; cassava; Agricultural Transformation Agenda.

1. INTRODUCTION

Agriculture is a road map to attaining socioeconomic development. It is the bed rock of any economic development and poverty eradication in the developing countries. Nigerian economy in past decades strived on the Agricultural sector. The sector is reputed as the main stay of the Nigerian economy in the early 1960s and seen as the key driver of growth and development. In spite of these opportunities, the state of the Agricultural sector has continued to rely on primitive methods to sustain a growing population without concerted efforts to value addition. This has reflected negatively on the productivity of the sector, its ability to perform its traditional role of food production among others [1]. The major problem facing small scale agriculture in Nigeria is over dependent on traditional technologies characterized by poor yield and inefficiency. Agricultural development depends, to a great extent, on the willingness and ability of the small scale farmers to make use of new technologies as developed in research laboratories as well as on-farm experiments. New innovations in agricultural development are of little value until they can be put to use for the economic and social well-being of the people involved [2].

Cassava (*Manihot esculenta* Crantz) which has been described as an industrial crop of the future in Africa, with the potential to generate income for poor farmers and a huge number of jobs has enormous potential to improve food security and the livelihoods of people in Africa. Cassava is an important food crop both for urban and rural consumers in Sub-Saharan Africa. Cassava is a basic staple food in Nigeria, Mozambique, Zambia, Democratic Republic of Congo (DRC), Ghana, Malawi, and Tanzania. Recently, cassava has increasingly gained importance as a cash crop for smallholder farmers in the region. Africa is the largest cassava producing region in the world accounting for nearly 55 percent of the world's total cassava production. However, Africa's yields are the lowest in the world standing at only 10 tons per hectare compared to 26 tons per hectare in India [3].

The development and introduction of improved cassava varieties has long been recognized as one of the key strategies for transforming the cassava industry and for enhancing the wellbeing of Nigeria's rural population [4]. Recent innovations in cassava breeding have enabled new varieties to be released to address food inadequacy in Nigeria. Cassava can be a powerful tool to eradicate poverty in Africa. The cash income from cassava proves more egalitarian than the other major staples because of cassava's low cash input cost. Compared with other major staples, cassava performs well across a wide ecological spectrum. It therefore benefits farmers across broader swath of ecological zones. Cassava is, likewise, less expensive to produce. It tolerates poor soil, adverse weather and pests and diseases more than other major staples [5]. It is the most important root crop in Nigeria in terms of food security, employment creation and income generation for farm families [6]. However, most of the farmers still depend on local cassava varieties for their planting materials which in turn result in a very poor yield at harvest. Research has shown that cassava yield in farmers field stood at 5 – 10 tons per hectare [7]. This figure is considered to be very poor yield compared with those of India and Thailand that is around 26 tons/ha [3]. The main solution to this problem is adoption of improved cassava varieties and production technologies by the farmers [8].

The ATASP-1 is being implemented for a period of 5 years (2015-2019), and it is estimated to cost UA113.54 million (USD174.85 million), with UA98.78 million (USD152.12 million) and UA0.25 million (USD0.385 million) financed from ADF loan and grant resources respectively, in four Staple Crops Processing Zones (SCPZs) of

Adani-Omor in Enugu and Anambra States, Bida-Badeggi in Niger State of the north central zone, Kano-Jigawa in the north western States while Kebbi and Sokoto were not included since cassava was not part of the crops promoted in that zone. The Program was instituted to provide interventions in over 200 rural communities spreading across 33 LGAs in five States of Anambra, Enugu, Kano, Jigawa and Niger where the climatic condition is considered favorable for the cultivation of cassava. The study is therefore essential to gauge how far the project has met the set objectives underlining the conception and implementation as well as provide opportunity to take necessary measures to fine-tune achievement of set objectives.

There is no doubt about the need to increase agricultural productivity especially cassava which is accounts for more than two-thirds of staples grown in Nigeria. Moreso, a critical analysis of technology adoption among cassava producers under ATASP-1 project will positively inform policy makers regarding resources allocation for Agricultural growth and development in order to achieve rapid economic growth. This study examined the rate of adoption of agronomic practices among farmers and the underlining factors that influence farmers' adoption decisions.

Decision to execute this study was predicated on the need to take corrective measures that will facilitate the achievement of ATAPS-1 targets food crop production by generating adequate information on the adoption of Good Agronomic Practices (GAP) among farmers. This will provide a farm-level feedback for appropriate policy targeting at improving the status of crop production in general and cassava production in particular. The study examined the rate of adoption of good agronomic practices among farmers and the underlining factors that influence farmers' adoption decisions.

2. METHODOLOGY

The study was conducted in the three of the SCPZs across the country. These zones are: Adani-Omor covering Anambra and Enugu States in the south east, Bida-Badeggi SCPZ in Niger State in the north centralpart of the country and Kano-Jigawa SCPZ in the north western while Kebbi-Sokoto were left out since cassava was not included among the crops for this zone. The Kano-Jigawa is located in the north western part of the country. There is variation in climatic conditions across the zones with Adani-Omor located in the tropical rainforest in the South East, Bida-Badeggi located in the Guinea Savanna while Kano-Jigawa is located in the Sudan Savanna ecological zone of the country. The study focused solely on the program beneficiaries in ascertaining the rates of adoption of technologies disseminated on cassava production by ATASP-1.

2.1 Sampling Procedure and Sample Selection

The multi-stage sampling procedure was used in selecting respondents for the study. However, given the preponderance of production-based value chain actors, 60 samples comprising 20 respondents were randomly selected from in each of SCPZ zone. The sampling was done to cover all the 33 local government areas (LGAs) where the program is being executed across the country.

2.2 Methods of Data Collection

Data used for the study were primary data collected from respondents directly. These were solicited through the use of structured questionnaire. Data collected covered respondents' background information, specific details, institutional information, technologies disseminated, mode of practicing technology, rates of adoption and constraints to adoption of GAPs.

2.3 Method of Data Analysis

The study employed descriptive statistics and Tobit regression model in the analysis of data. Descriptive statistics such as mean, frequency, standard deviation and count were used. Tobit model was used to ascertain the factors influencing the adoption of good agronomic practices among ATASP-1 farmers. The model is specified as follows in the implicit form:

$$Yo^* = Xo\beta + \mu o$$

Where Yo is the latent (hidden) dependent variable for the O^{th} farm; Xo is the vector of independent variables, vector β comprises the unknown parameters to be estimated associated with the independent variables for the O^{th} farm, and μo is an independently distributed error term assumed to be normally distributed with zero mean and constant variance. The independent variables considered were gender, age, marital status, education, household size and farm size.

Other variables in the model were farmers' experience, extension visits, credit and membership of association.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of the Respondents

Results presented in Table 1 showed the socio-economic characteristics of the cassava farmers under ATASP-1 project. It was found that about 12% of cassava farmers were within age 21-30. The average age of cassava farmers was 46 years. The implication of this is that cassava farmers who are under ATASP-1 are still in their active productive age group. This has a great implication for agricultural production and adoption of innovation. Age has a significant influence on the decision making process of farmers with respect to risk aversion and other production-related decisions. About 75% of the people involved in cassava production under the project were male, while 25% were female nationally. The non involvement of women in cassava production particularly in the northern parts of the country may be possibly due to cultural-religion factor as well as the fact that the crop is relatively not as popular as grain crops where women are very much involved in their production and processing. Three quarter of the respondents were married while 25% were

Table 1. Structure of farmer's household in the ATASP-1 Project

Socio-economic characteristic	Frequency	Percentage
Age	7	11.67
21-30	12	20.00
31-40	17	28.33
41-50	18	30.00
51-60	6	10.00
Mean	-	46
Gender		
Male	45	75.00
Female	15	25.00
Marital Status		
Married	41	68.33
Single	19	31.67
Education		
None	8	13.33
Koranic	2	3.33
Primary	4	6.67
Junior	14	23.33
Senior secondary	22	36.67
Tertiary	10	16.67
Household size		
1-5	18(30)	30.00
6-10	15(25)	25.00
11-15	12(20)	20.00
>15	15(25)	25.00
Average	7	
Total farm size		
0.1-0.5	14(23.33)	23.33
0.51-1.0	11(18.33)	18.33
1.1-1.5	11(18.33)	18.33
1.51-2.0	10(16.67)	16.67
>2.0	18(30)	30.00
Average	2.77	
Farming Experience		
1-10	26(43.33)	43.33
11-20	26(43.33)	43.33
21-30	7(11.67)	11.67
>30	7(11.67)	11.67
Average	12.67	
Extension visit		
Yes	59	98.33
No	1	1.67

single. The less participation of single participants in cassava farming could mean that youths are showing apathy to cassava farming as a business and there is need to do more to encourage them so that we can have sustainability in farm business in the country. About 13% of cassava farmers are illiterate. It is very significant that farmers participating in cassava farming have one form of education or the other and surprisingly, of the total participants in cassava, over 60% have secondary and tertiary education. The implication of this is that these participants are better positioned to understand and adopt innovations that will facilitate productivity and better livelihood as opposed to when we have illiterate participants. These educated farmers will equally be able to act as opinion leader to influence non literate farmers around them. The average number of household member was also 7 people. This is an indication that size of household is fairly large and in cases where the members are over 18 years old, they could give helping hands in farming particularly during planting, weeding and harvesting of crops. The average land possessed by all cassava participants was 2.77 ha. This showed that cassava is being produced on a small scale level. Contact by farmers with the extension workers is very important as this is an important source of technology diffusion to farmers particularly farmers in the rural communities. As shown in Table 1, 98% of cassava participating farmers claimed they have contact with extension agents while less than 2% claimed they do not.

3.2 Technologies Disseminated on Cassava Production

The technologies disseminated to farmers on cassava by the ATASP-1 program are given in Table 2. Technologies disseminated to enhance improved productivity in cassava production are the introduction of improved varieties which all the cassava farmers claimed they are aware of. Others are site selection with full awareness by all, land preparation known to about 98%, plant spacing/population, known to all farmers in the project, weed management known to over 98% of the farmers in the project, soil fertility management also known to about 92% of the farmers, harvesting and marketing, known to about 62% of the participant, yield assessment, known to about 55% of the farmers, conservation of stem, known to about 67% of the farmers and record keeping also known to about 82% of the participating farmers. The level of awareness of farmers involved in the dissemination of these technologies was found to be very high and this might help to facilitate speedy adoption of these technologies in these SCPZ.

3.3 Rate of Adoption of Technologies Disseminated to Cassava Farmers

There were good levels of adoption of technologies disseminated to cassava farmers in the SCPZs across the country (Table 3). Improved varieties and site selection witnessed about 97% and 97% respectively while land preparation was at about 98% level of adoption. On the other hand, plant spacing and weed management recorded 100% level of adoption while soil fertility management recorded 95% level of adoption. Moreover, stem conservation and record keeping recorded 60% level of adoption while the two that have the least records of adoption were yield assessment technique and harvesting techniques at about 47% and 48% respectively. There is therefore the need to redouble efforts on these low areas so as to maximize output by farmers under the programto achieve the desired outcome. It is also believed that good outcome will definitely spread to farmers within the communities and beyond.High rate of technologies adoption in cassava production is an indication that these technologies enjoyed wider acceptability and adaptability. One is therefore expectant of improve crop productivity arising from the adoption of these technologies.

3.4 Factors Influencing Adoption of Cassava Technologies

The results in Table 4 present factors influencing adoption of technologies disseminated to cassava farmers under ATASP-1 project. From the table, there were ten technologies disseminated to cassava farmers under the project. The first technology labeled ‘A’ is improved crop variety and three of the variables fitted into the regression were found to have significantly influenced adoption of improved variety of crop. Age was found to be significant at 1% level of significance, and age a time is a measure of experience and so the more the age of the farmer the more they will be ready to adopt improved crop variety. Marital status was equally found to be significant at 1% level of significance. This is so because in our traditional culture, married people are considered to be more responsible and ready to ensure they succeed in whatever they do. So a married person will set

his mind in realizing maximum yields and as such will be willing to use improved seed that will give him that yield. Lastly, membership of association empowers members to adopt innovation that could bring about improve in productivity and hence membership of association will motivate farmers to adopt planting of improved crop variety.

The second technology labeled 'B' is the selection of good site for planting of cassava. Gender, marital status and household size were found to have statistically significantly influenced adoption of site selection by cassava farmers under the project. Any gender be it male or female will be interested in profitable production and selecting good site for production will facilitate good crop development and yields and therefore the relevance of gender in good site selection for cassava production. Married individuals are known to always pursue business with dedication to ensure the best output and hence the significance of marital status in selecting good site for cassava production. Moreover, the household size was found to be significant and this stem from the fact that a man with large household will be interested in profitable production that will enhance availability of food to feed his family and therefore the larger the household the more the willingness to select good location for cassava production.

The third technology labeled as 'C' is land preparation technology. Six variables were found to have been statistically significant in influencing the adoption of land preparation technology among cassava farmers under the project. Gender was found to be significant at 1% level and it showed that in either side, any practice capable of facilitating good harvest will be adopted by either of the gender and so there is tendency for either male or female and even youth to adopt land preparation technology that will help to achieve good harvest. It is also to be noted that age is related to experience and hence the older a farmer, the more he will be willing to adopt land preparation technology. Also, married individuals are readily willing to adopt productive technologies and so the response of married person in the study was highly expected. Household size also played significant role in adoption of land preparation as

Table 2. Technologies disseminated on cassava

Technologies	Frequency	Percentage
Improved variety		
Yes	60	100
No	-	-
Site selection	60	100
Yes	-	-
No		
Land preparation		
Yes	59	98.33
No	1	1.67
Plant spacing/population		
Yes	60	100
No	-	-
Weed management		
Yes	59	98.33
No	1	1.67
Soil fertility		
Yes	55	91.67
No	5	8.33
Harvesting market		
Yes	37	61.67
No	23	38.33
Yield assessment		
Yes	34	54.67
No	26	43.33
Conservation of stem across		
Yes	40	66.67
No	20	33.33
Record keeping		
Yes	48	81.67
No	11	18.33

Table 3. Rate of adoption of cassava technologies

S/No	Technologies	Frequency*	Percentage
1	Improved variety	58	96.67
2	Site selection	58	96.67
3	Land preparation	59	98.33
4	Plant spacing/population	60	100
5	Weed management	60	100
6	Soil fertility	57	95
7	Harvesting market	29	48.33
8	Yield assessment	28	46.67
9	Conservation of stem across	36	60
10	Record keeping	36	60

** Multiple responses were allowed*

higher size of household will translate to higher adoption of this technology since people with higher household size will be willing to adopt costless technology that will result in higher output. The more the farming experience, the more the prospect of adoption of technology and hence the significant of the adoption of land preparation technology with farming experience. Finally, access to credit facilitates adoption of technologies and hence the more access these farmers have to credit, the more their willingness to adopt good land preparation technology.

The fourth technology disseminated to cassava farmers was plant spacing labeled as 'D'. Only gender was the variable found to have been significant determinant of adoption of this technology. Gender be it male or female or youth are interested in higher yield and since appropriate spacing will help to achieve this hence the significance of this variable in adoption determinant.

The fifth technology disseminated to cassava farmers was weed management labeled as 'E'. Good control of weed is very important to the realization of good harvest and six variables significantly influenced the adoption of this technology. Gender of which ever divide will adopt technology that will result in better output and hence the adoption of weed controls technology by gender in this project. Age is related to the level of experience and hence the older a farmer is the more he will be willing to adopt weed management control measure that will help to increase his output and hence the significance of age variable to this technology. Household size equally significantly influenced adoption of weed management technology since labor in the household could have played a role in executing the technology, so the more member there are in the household the more the capacity to implement weed management technology. Credit availability is very important in technology adoption and the higher the access to credit, the more the likelihood of adoption and hence the significant of credit to the adoption of weed management technology by the project participants.

The sixth technology is soil fertility management and soil is very important input in productive activity and if the soil is not properly managed, production output will be poor or non existence. Soil fertility technology is labeled 'F' and four variables were significant in the model fitted to this technology. Gender was significant and whether male, female or youth, gender is interested in better yield and since good soil will enhance this, gender of any type will be willing to adopt soil fertility management technology. Similarly, the more education, household size and the more farming experience a farmer has, the more the likelihood of adopting soil fertility management technology that will results in better yields.

The seventh technology disseminated to cassava farmers under the project is harvesting for market labeled as 'G'. the variable age was significant but carries negative sign showing that the more the age of the farmer, the less his knowledge about current day marketing process will be while farmers will lesser age will be better in marketing process. Household size was found to significantly influenced marketing as the more people in the household will drive the demand for money to meet other family needs and there is likelihood of younger members of the household to be more involved in marketing and hence the support of larger household for harvesting and marketing. Finally farmers that have access to credit are more likely to be market oriented in their production approach and hence the more credit a farmer use, the more his orientation to harvesting for market.

Table 4. Analyses of factors influencing adoption of disseminated technologies to cassava farmers

	Factors influencing adoption of cassava technologies									
Variables	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Gender	0.091(1.09)	0.252(3.6***)	0.240(4.3***)	0.251(3.6***)	0.205(3.5***)	0.187(1.9*)	0.162(1.0)	0.237(1.6)	0.127(0.79)	0.115(0.7)
Age	0.005(2.3**)	0.002(1.2)	0.003(1.9*)	0.003(1.7)	0.002(1.7*)	-0.003(-1.2)	-0.009(-2.1**)	-0.014(-3.2***)	-0.007(-1.62)	0.005(1.01)
Marital status	0.329(3.4***)	0.171(2.2**)	0.255(4.0***)	0.253(2.9)	0.289(4.4***)	0.107(1.0)	0.147(0.9)	0.014(1.0)	0.169(0.91)	0.091(0.5)
Education	0.025(1.1)	0.029(1.6)	0.017(1.3)	0.037(2.0)	0.033(2.2**)	0.065(2.6***)	0.017(0.5)	0.064(1.8)	0.009(0.23)	0.053(1.2)
Household size	-	0.012(3.6***)	0.008(2.9***)	0.002(0.6)	0.006(2.0**)	0.017(3.3***)	0.029(3.8***)	0.033(4.6***)	0.029(3.51***)	0.004(0.5)
Farm size	0.004(0.2)	0.005(0.4)	0.007(0.7)	0.002(0.2)	0.004(0.3)	0.010(0.6)	0.005(0.2)	0.023(0.9)	0.019(0.63)	0.072(2.4**)
Farming experience	0.002(0.5)	0.002(0.5)	0.006(2.1**)	0.001(0.5)	0.002(1.0)	0.010(2.0**)	0.005(0.7)	0.011(1.5)	0.005(0.59)	0.004(0.5)
Extension contact	-	0.001(0.5)	0.001(0.5)	0.002(1.1)	0.002(1.5)	0.004(1.5)	0.003(0.6)	0.007(1.7*)	0.002(0.55)	0.412(3.1***)
Access to credit	-	0.030(1.1)	0.041(1.9*)	0.024(0.9)	0.048(2.2**)	0.059(1.6)	0.095(1.7*)	0.120(2.2**)	0.048(0.78)	0.027(0.4)
Association	0.009(1.73*)	0.001(0.2)	0.001(1.3)	0.003(0.5)	0.001(0.2)	0.006(0.9)	0.004(0.4)	0.005(0.6)	0.002(2.04**)	0.024(2.0**)

****, **, * = Significant at 1, 5 and 10 percent*

Note: A= Improved variety, B= Site selection, C= Land preparation, D= Plant spacing/population, E= Weed management, F= Soil fertility, G= Harvesting/market, H= Yield assessment, I= Conservation of stems across, J= Record keeping

The eighth technology disseminated to these farmers was yield assessment labeled as 'H'. Age was negatively significant showing that the more the age, the less insight the farmer will have about how to assess yield from his farm. Household size increase knowledge about yield assessment because the younger members of the household could become better in knowing how to handle this and hence the significance of this variable. The more extension contact a farmer has the better he will be in yield assessment technology because he must have been taught this during extension visits. Finally, the more access a farmer has to credit the more his knowledge in various technologies because some credit agencies also have extension arm that educate farmers on various technology and hence the significance of this variable to yield assessment technology.

The ninth technology disseminated was conservation of stem labeled as 'I'. Household size was significantly related to the adoption of this technology as members of household could be handy in providing labour to support this conservation technology and hence the positive correlation between this technology and household size. Also, membership of association was significant and this could be as a result of peer influence because members of association do things together, they receive training together and they also have access to credit and input at cost and as such the positive correlation between adoption of this technology and membership of association.

The tenth technology disseminated on cassava production was Record keeping labeled as 'J'. Farm size was significant here and it showed that the bigger the farm, the more probability that a farmer will keep record since farmers that have bigger farms will want to be extra careful to establish production history to guide future production activities. Extension contact was also significant and this means the more the extension contact, the more the record keeping ability is enhanced since education on record keeping must have been part of the training given to farmers by extension agents. Finally, membership of association was equally significant since association members usually have training organized for their members where good production practices are taught to them and hence membership of association must have encouraged the record keeping ability of these farmers.

4. CONCLUSION AND RECOMMENDATIONS

The studies revealed that majority of ATASP-1 participating farmers are still in their active age group having one form of education or the other. The study showed that a number of technologies on cassava had been disseminated and promoted among farmers under ATASP-1 project. Higher adoption rate observed among the farmers is a good pointer to increased productivity to be realized. Only few technologies such as mechanization, conservation of stem, record keeping and yields assessment had low rate of adoption rate. It was equally discovered that the adoption of cassava technologies were influenced by socioeconomic characteristics of the farmers such as age, gender and education of the respondents. It was recommended that efforts should be intensified by the project to ensure that there is improvement in technologies that currently have low adoption rate to boost overall productivity in cassava production nationwide.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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