

Technology Adoption and poverty alleviation among Cassava-based Farming Households in Southwest, Nigeria: case of RTEP Production technology

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Abstract: Poverty is one of the developmental problems facing Nigeria being endemic to rural areas where the main occupation is farming. Nigeria focuses on sustainable agriculture and rural development as a means of reducing rural poverty. However, agricultural growth and development is not possible without yield-enhancing technological options therefore, research and adoption of technological improvement are crucial to poverty alleviation. Among several agricultural programmes targeted towards poverty alleviation in Nigeria is the Root and Tuber Expansion Programme (RTEP) which was designed to consolidate the gains made under the Cassava Multiplication Programme (CMP) with the goal of increasing income and alleviating poverty. This study assessed the impact of Root and Tuber Expansion Programme (RTEP) improved production technology on the poverty status of cassava-based farming households in Southwest, Nigeria. The data were collected with the aid of structured questionnaire through a multistage sampling technique. A sample of 482 households were selected comprising RTEP beneficiaries (RTEP), Non-RTEP beneficiaries within RTEP LGAs (NRTEPW) and Non-RTEP beneficiaries living outside RTEP LGAs (NRTEPO). The data were analyzed using Propensity Score Matching, descriptive statistics and Foster-Greer-Thorbecke weighted poverty index. Out of the 482 households, 387 with similar characteristics were used for analysis in the study. The mean per capita household expenditure (MPCHHE) was ₦51709.49 while the poverty line was ₦34473.00 per annum. The poverty incidence of RTEP was lower than that of the non-beneficiaries, this reveals that RTEP improved production technology has the potential to reduce poverty. The FGT poverty indices of the beneficiaries declined due to participation in the programme. The poverty incidence reduced by 11.15%, 8.25% and 12.38% when compared with ANRTEP, NRTEPW and NRTEPO respectively. This suggests that the cassava production technology promoted under the programme is poverty reducing therefore, there should be further sensitization on this technology to alleviate poverty.

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1.Introduction

Poverty alleviation is the first target of the Millennium Development Goals (MDGs) and this has made poverty reduction the undisputed overriding goals of development and primary challenge facing the developmental community (Deaton, 2004; United Nations Millennium Project, 2005). In Nigeria, projects, programmes and policies targeted at reducing the problem of poverty notwithstanding, the country ranked 156 out of 187 countries and territories on the Human Development Index (HDI) (UNDP, 2011). In 2004, Nigeria's poverty incidence stood at 54.4%, implying that approximately 69 million Nigerians lived in poverty but increased to 69% (or 112.5 million Nigerians) in 2010 (NBS, 2012). Also, poverty in the south-western geopolitical zone increased to 59.1% in 2010 from 43% in 2004 which translates to about 16.5 million people living in poverty. It therefore remains a paradox however, that despite the fact that the Nigerian economy is growing, the proportion of Nigerians living in poverty is increasing every year.

Poverty is endemic to rural areas where the main occupation is farming (Fields, 2000; World Bank, 2008). According to the NLSS Report (2012), 73.2 percent of the rural population are described poor compared to 61.8 percent in the urban area. Furthermore, farming population comprises predominantly of resource-poor peasants, cultivating tiny plots of land with low and declining productivity (IFAD, 2007). However, escaping poverty traps depends on the growth and development of the agricultural sector (World Bank, 2008). Agricultural growth and development is not possible without yield-enhancing technological options because merely expanding the area under cultivation (except in a few places) to meet the increasing food needs of growing populations is no longer sufficient (IFAD, 2011). Therefore, research and adoption of technological improvement are crucial to increasing agricultural productivity and alleviating poverty.

Among several agricultural programmes targeted towards poverty alleviation in Nigeria is the Root and Tuber Expansion Programme (RTEP) which was

designed to consolidate the gains made under the Cassava Multiplication Programme (CMP). The implementation of the project commenced in July, 2001 with the goal of increasing income, alleviating poverty and improving food security status of the farmers with less than 2.0 hectares of land, growing and processing cassava, yam, cocoyam, Irish and sweet potato in the project area. This study therefore assessed the impact of RTEP production technology adoption on poverty status of cassava-based farming households in Southwest Nigeria. This study reveals the suitability of RTEP production technology in terms of poverty reduction of the targeted population. It is further justified in that the findings provide relevant information concerning the level of achievement of RTEP as well as the gaps noticed in the achievement capacity of the programme which will be helpful in reorganising the programme to enhance performance in the second phase.

For the periods of implementation of RTEP, very little is known about the impact of the production technology package on poverty status of the farming households in Nigeria. The few studies on RTEP (Ater *et al*, 2006; Ibrahim and Onuk, 2010; Tijani and Thomas, 2010) were on the impact of the programme on productivity except Ater *et al*, (2006) that was on poverty. However, these studies have assessed the outcomes of the programme using only data from participants and by employing descriptive and inferential statistics which prevented them from getting the counterfactual outcomes that is the outcomes of the participant if he had not participated in the project. Therefore, this study assessed the impact of RTEP production technology on poverty status of cassava-based farming households in Southwest Nigeria by using propensity score matching (PSM) to address the evaluation problem and employed the counterfactual outcome framework to show the impact of the outcome defined in the modern policy evaluation literature as the average effect of the treatment on the treated (ATT) which helps to reduce biased estimates. It pursues a targeted evaluation of whether adopting RTEP improved technology causes resource-poor farmers to improve their income and decrease the propensity to fall below the poverty line (Mendola, 2007).

1.1 Objectives of the study

The main objective of the study is to evaluate the impact of RTEP production technology on poverty alleviation among cassava-based farming households in southwest, Nigeria. Specific objectives are to: (1) examine the socio-economic characteristics of cassava-based farming households in the study area (2) determine the poverty status of cassava-based farming households in the study area (3) examine the

impact of RTEP production technology on poverty alleviation among cassava-based farming households in the study area.

2. Methodology

The study was carried out in Southwest, Nigeria. South west is one of the six geopolitical zones in Nigeria. It falls on latitude 6⁰ to the North and latitude 4⁰ to the South while it is marked by longitude 4⁰ to the West and 6⁰ to the East. It is bounded in the North by Kogi and Kwara States, in the East by Edo and Delta States, in the South by Atlantic Ocean and in the West by Republic of Benin. The climate is equatorial with distinct wet (rainy) and dry seasons with relatively high humidity. The mean annual rainfall is 1480mm with a mean monthly temperature range of 18⁰-24⁰C during the rainy season and 30⁰-35⁰C in the dry season. Southwest Nigeria covers approximately an area of 114,271 kilometer square that is approximately 12 percent of Nigeria's total land mass and the vegetation is typically rainforest. The total population is 27,581,992 as at 2006 and the people are predominantly farmers. The climate in the zone favours the cultivation of crops like maize, yam, cassava, millet, rice, plantain, cocoa, kola nut, coffee, palm produce, cashew etc (NPC,2006). The zone comprises of six states namely: Ekiti, Lagos, Ogun, Ondo, Osun and Oyo states.

Primary data were collected for the purpose of this study using structured questionnaire. Some of the data include: socio-economic and demographic characteristics, participation in RTEP productive activities, cassava production, RTEP cassava production technology, and household expenditure details. The list of the RTEP participating LGAs and communities were collected from ADP and other relevant information were retrieved from RTEP programme implementation manual (PIM).

Multistage sampling technique was employed in this study. The first stage was the random selection of Ondo and Ogun states from the RTEP participating states in Southwest, Nigeria. The second stage involved the random selection of two RTEP participating and Non-RTEP participating LGAs from each state while in the third stage, three communities were randomly selected from each LGA. This resulted to 24 communities in the two states. The final stage involved a random selection of 30 households from each of the RTEP communities selected (comprising of beneficiaries and non-beneficiaries) and 15 households from each of the selected Non-RTEP communities resulting to a total of 540 respondents. However, a total of 482 were retrieved and completely filled from the field.

The analytical techniques used in this study include: propensity score matching (PSM) descriptive statistics and Foster- Greer- Thorbecke (1984) class of poverty measures (FGT).

Propensity Score Matching, one of the most commonly used quasi-experimental methods was used to address the evaluation problem (Mendola, 2007; Nkonya *et al.*, 2007; Akinlade *et al.*, 2011). The sample collected was matched using PSM; the aim of PSM is to find the comparison group from a sample of non-participants that is closest to the sample of programme participants so as to get the impact of the project on the beneficiaries. Though, the beneficiary and comparison groups may differ in unobservable characteristics even if they are matched in terms of observable characteristics, however, it has been put forward that selection on unobservable is empirically less important in accounting for evaluation bias (Baker, 2000). Also in a situation where the same questionnaire is administered to both groups (so that outcomes and personal characteristics are measured in the same way for both groups) and the participants and controls are placed in a common economic environment (such as the case in this study), matching substantially reduce bias (Heckman *et al.*, 1996).

Main steps involved in the application of statistical matching to impact evaluation are: estimating the propensity score, matching the unit using the propensity score, assessing the quality of the match and estimating the impact and its standard error.

Out of 482 only 387 beneficiaries and non-beneficiaries that had comparable propensity scores were matched which includes 157 RTEP participants (RTEP), 123 Non-participants within RTEP LGAs (NRTEPW) and 107 Non-participants outside RTEP LGAs (NRTEPO). After matching, the testing of comparability of the selected groups was done and the result shows statistically insignificant difference in the explanatory variables used in the probit models between the matched groups of RTEP participants and non-participants.

Since the match has been deemed of good quality, this study then used the matched sample to compute the Average Treatment Effect for the Treated (ATT) to determine impact of the programme. This is defined by Rosembaum and Rubin (1983) as follows:

$$E(Y^1 - Y^0 / D = 1) = E(Y^1 / D = 1) - E(Y^0 / D = 1) \quad (1)$$

where, $E(Y^1 / D = 1)$ is the observed outcome of the treated, that is, the expected income earned by programme beneficiaries while participating in the

programme and $E(Y^0 / D = 1)$ is the counterfactual outcome - the expected income they would have received if they had not participated in the project. The counterfactual outcome represents outcome of the non-beneficiaries since they have similar characteristics with beneficiaries. Standard errors were computed using bootstrapping method suggested by Lechner (2002) to generate robust standard errors in light of the fact that the matching procedure matches control households to treatment households with replacement.

Changes in poverty of RTEP and Non-RTEP households were achieved by using the Foster- Greer- Thorbecke (1984) class of poverty measures (FGT) which include the Headcount Index (P_0), the Poverty Gap Index (P_1), and the severity of Poverty Index (P_2). The three indices can be expressed into one general form and distinguish themselves for the different weights attributed to the distance between expenditure of the poor and the poverty line. P_0 attributes equal weight to all expenditure of the poor while P_1 and P_2 attribute increasingly more weight to distance of expenditure of the poor from the poverty line. They are widely used because they are consistent and additively decomposable (Verme, 2003). The FGT is presented below:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left[\frac{Z - y}{Z} \right]^\alpha \quad (2)$$

Where,

Z = the poverty line defined as 2/3 of Mean per capita expenditure
 Y = the annual per capita expenditure – poverty indicator/welfare index per capita
 q = the number of poor households in the population of size n ,
 α = the degree of poverty aversion;
 $\alpha = 0$; is the Headcount index (P_0) measuring the incidence of poverty (proportion of the total population of a given group that is poor, based on poverty line). $\alpha = 1$; is the poverty gap index measuring the depth of poverty that is on average how far the poor is from the poverty line; $\alpha = 2$; is the squared poverty gap measuring the severity of poverty and inequality among the poor.

3. Results and Discussion

3.1 Distribution of Respondents by Socio-economic Characteristics

Table 1 shows the distribution of the respondents by socio-economic characteristics across the three types of respondents considered which are:

RTEP beneficiaries (RTEP), Non-RTEP beneficiaries within RTEP LGAs (NRTEPW) and Non-RTEP beneficiaries outside the RTEP LGAs (NRTEPO). The average values of their socio-economic characteristics are within the same range due to propensity score matching (PSM) used in selecting the respondents with similar observable characteristics. The male respondents constitute the larger percentage across the three types of respondents with RTEP beneficiaries having 74.63% which shows that more males were involved in the programme. The average household size was 6 for RTEP, all NON RTEP beneficiaries (ANRTEP) and NRTEPO while the household size for NRTEPW was 5. The majority of the respondents have their

household sizes falling within the range of 5 to 9 people, with the average age of the respondents being 44 and 45 for RTEP and NRTEP respectively. Implicit in these findings is that a large proportion of the respondents were middle aged and can therefore be regarded as active, agile and with more energy to dissipate and concentrate on productive effort. The average years of experience in cassava farming was 16 years for all respondents. The average area of land cultivated was about 1 hectare for all the respondents. Accessibility to credit facility and participation in off-farm activity was higher among RTEP beneficiaries compared to non-beneficiaries.

Table 1: Distribution of Respondents by Socio-economic characteristics

Characteristics	Categories/ Statistics	RTEP Percentage	ANRTEP percentage	NRTEPW Percentage	NRTEPO percentage	
Gender	Female	24.37	22.17	17.07	28.04	
	Male	74.63	77.83	82.93	71.96	
	Total	100	100	100	100	
Household size	0-4	16.25	26.09	30.89	20.56	
	5-9	77	68.26	63.41	73.83	
	>9	6.75	5.65	5.70	5.61	
	Total	157	230	123	107	
	Mean	6	6	5	6	
	SD	1.9942	1.9576	1.96	1.91	
Age	≤30	13.12	6.09	10.57	9.36	
	31-40	30.25	26.09	34.96	15.89	
	41-50	35.63	36.95	34.96	39.25	
	>50	21	30.87	19.51	34.50	
	Total	157	230	123	107	
	Mean	44.2685	45.1913	45.07	44.97	
Level of education	SD	10.1317	10.7219	10.99	10.84	
	No formal	35.67	26.09	25.20	17.11	
	Primary	51.59	36.52	40.65	31.78	
	Secondary	12.74	37.39	34.15	41.12	
	Yes	82.50	48.26	54.47	50.47	
	No	17.50	51.74	45.53	49.53	
Area of land cultivated(ha)	≤0.5	26.75	22.17	22.76	14.95	
	0.6-1.0	64.33	50.00	54.47	53.93	
	1.1-1.5	8.92	28.63	22.76	31.12	
	Total	157	230	123	107	
	Mean	0.98	1.01	1.03	1.01	
	SD	0.35	0.56	0.47	0.59	
Off-farm activity	Yes	73.13	67.78	68.67	66.88	
	No	26.87	32.22	31.33	33.12	

Source: Field Survey, 2011

RTEP beneficiaries (RTEP), All Non-RTEP beneficiaries (ANRTEP), Non-RTEP beneficiaries within RTEP LGAs (NRTEPW), Non-RTEP beneficiaries outside RTEP LGAs (NRTEPO).

3.2 Poverty Status of RTEP and Non-RTEP Households

This section focuses on household expenditure on food and non-food items, the estimation of poverty line, expenditure pattern by poor and non poor and the impact of RTEP improved production technology on the poverty status of cassava farming households. Table 2 presents the summary statistics of the expenditure profile of the households. The table shows that the estimated annual household expenditure on food consumed was ₦172726.53 which constitutes 58.40% of the total household expenditure. Other non-food items such as clothing and footwear, health and medicare, education, fuel and lightning, transportation, remittances (to dependants, gift to friends and family members), rent and other unlisted consumption goods accounted for the remaining 41.60%. The result indicates that the mean expenditure of households in the study area is ₦295764.60 while the mean per capita household expenditure (MPCHHE) is ₦51709.49. The poverty line was computed for respondents using the two-thirds MPCHHE, the poverty line was ₦34473.00 per annum.

Table 2: Annual Household Expenditure Profile

Item	Average annual expenditure	% of total expenditure
Food	172726.53	58.4
Clothing and footwear	20111.99	6.8
Health and medicare	7098.35	2.4
Education	14196.70	4.8
Fuel and lightning	21886.58	7.4
Transportation	10351.76	3.5
Remittance	19816.23	6.7
Rent	14196.70	4.8
Others	15379.76	5.2
Total Expenditure	295764.60	100
Mean per capita household expenditure (MPCHHE)	51709.49	
Poverty line(2/3 MPCHHE)	34473.00	

Source: Field Survey, 2011

3.2.1 Poverty Status by Type of Respondents

Based on the poverty line, 55% of cassava farming households that are beneficiaries of RTEP live below the poverty line (poor) (Table 3). The poverty status by type of respondents is presented in Table 3, the poverty incidence of RTEP was lower than that of the non-beneficiaries, this reveals that RTEP improved production technology has the potential to reduce poverty. The poverty incidence was 0.5500 for RTEP beneficiaries compared to 0.6113, 0.5954 and 0.6181 for ANRTEP, NRTEPW and NRTEPO respectively. The poverty gap and severity of poverty indices shows that the non-beneficiaries are farther away from the poverty line and that poverty is more severe among them compared with the beneficiaries. RTEP improved production technology has a negative impact on the poverty incidence of the beneficiaries when compared with non-beneficiaries. The poverty incidence of RTEP beneficiaries reduced by 11.15%, 8.25% and 12.38% when compared with ANRTEP, NRTEPW and NRTEPO respectively. Considering the spill over effect of the programme, the reduction was deeper on the beneficiaries when compared with NRTEPO than NRTEPW. This suggests that the NRTEPW have benefited from the spillover effect of the programme. For example, non-beneficiaries could get the improved cultivars from the beneficiaries and the beneficiaries could also offer on-farm employment to the non-beneficiaries. Furthermore, the result also shows that poverty gap and the severity of poverty indices dropped when compared with non-beneficiaries. The poverty gap of the beneficiaries reduced by 28.91%, 16.33% and 32.54% while the poverty severity dropped by 47.53%, 20.37% and 49.26% when compared with ANRTEP, NRTEPW and NRTEPO respectively. This is an indication that RTEP improved production technology has reduced the average gap between poor households' standard of living and poverty line.

4. Conclusion and Policy Implication

There is reduction in the poverty indices of the beneficiaries this indicates that the technology has impacted poverty negatively suggesting that the technology promoted under this programme is good enough for alleviation of poverty. Also, that this programme is poverty decreasing. Hence, there should be further sensitization on this technology to alleviate poverty. The programme should also be reorganized in the second phase to maximize its poverty decreasing potentials in order to enhance performance.

Table 3: Poverty Status by Type of Respondents

Type of Respondents	Statistics	Poverty status	ATT	Impact(%)
RTEP	P ₀	0.5500		
	P ₁	0.1463		
	P ₂	0.0810		
ANRTEP	P ₀	0.6113		-11.15
	P ₁	0.2442	-0.0423	-28.91
	P ₂	0.1281	-0.0385	-47.53
NRTEPW	P ₀	0.5954	.	-8.25
	P ₁	0.2273	-0.0239	-16.33
	P ₂	0.1024	-0.0166	-20.37
NRTEPO	P ₀	0.6181		-12.38
	P ₁	0.2664	-0.0576	-32.54
	P ₂	0.1345	-0.0399	-49.26

Source: Field Survey, 2011

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