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Determinants of Adoption of Recommended Cassava Production Practices on Yield and Income among Farmers in Bwari and Kuje Area Council, Abuja, Nigeria

B. D. Adamu[1*], B. E. Sambo[2], T. M. Barnabas[1] and B. O. Ajibola[1]

[1]Department of Agricultural Economics and Extension Technology, School of Agriculture and Agricultural Technology, Federal University of Technology Minna, Niger State, Nigeria.
[2]Department of Crop Science, Faculty of Agriculture, Federal University Dutse, Jigawa State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author BDA, designed the study, wrote the materials and methods and supervised the work. Author BES contributed in interpretations, writing and editing of the manuscript and assisted in literature searches and updates. Author TMB performed the statistical analysis and interpretation of data. While author BOA contributed in writing the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The study was aimed at examining and determining the effects of adoption of the recommended cassava production practices (RCPPs) on the yield and income benefit among farmers; as well as the constraints faced by farmers in adoption of the recommended practices. The study used a multi-stage sampling procedure to select 120 registered cassava farmers. Frequencies, percentages, means, and z – test were employed for data analyses. Result of the Z-test revealed that the mean yield of cassava before and after adoption were 3,832 t/ha and 6,387 t/ha respectively; with a differential of 67%. The mean income of farmers before and after the adoption

**Corresponding author: E-mail: danbaba3@gmail.com;*

was ₦464, 642.00 and ₦714, 833. 00 respectively; and the differential mean was 54%. The identified major constraints for low and non-adoption of some of the recommended cassava production practices were limited scale and uneven distribution of farmland, insufficient funds and complex nature of technologies to farmers. It was recommended that technology developers should develop technologies that are simple, cost effective and easily adoptable by farmers. On the other hand, promoters of technology adoption should intensify efforts targeted at improving service delivery and the promotion of the adoption of recommended cassava production practices by the farmers especially those technologies that recorded low levels of adoption. But more than this, it is recommended that the applicable technologies should be appropriate, adaptive, adoptive and sustainable.

Keywords: Determinants; technologies; adoption; recommended cassava production practices; yield; sustainable.

1. INTRODUCTION

Nigeria is one of the world's largest producers of cassava; with about 37 million tons of cassava cultivated on 2.5 hectares of land; and with a national average yield of 14.8 metric tons per hectare [1]. However, a total output of 38.17 million metric tons was reportedly harvested from 4.118 million hectares of land and an average yield of 9.271 tons per hectares [2]. Nigeria's production account for 19% of the world output and 34% of Africa's output [3].

Priority extensive research on cassava by the International Institute of Tropical Agriculture (IITA) and National Root Crops Research Institute (NRCRI) over the years in Nigeria has led to the development of different varieties that are resistance to major disease. These varieties give over 50% higher yields compared to local varieties [4]. The persistent problem of food shortage in Nigeria has led to increasing agricultural productivity, which involves the use of improved high yielding crop varieties. These have been popularised among farmers through extension services of the ADPs. The multiplication, distribution and adoption of TMS varieties by farmers have led to tremendous yield increases over the years. For instance, presently Nigerian cassava production is reported to be by far the largest in the world. Indeed, the expansion of cassava production had been relatively steady since 1980 where production stood at about 12 million tonnes; and by between 1988 to 1992 productions increased to 15 and 26 million tonnes respectively; owing to the release of improved varieties. In fact, the Food and Agriculture Organization (FAO) of the United Nations in Rome estimated that Nigeria produced approximately 34 million tonnes of Cassava in 2002 for Nigeria [5,6]; and 39 million tons in 2003 [7].

The Nigerian economy is basically agrarian, with majority of the people living in squalor and very poor standard of living. Most of the farmers are subsistence small holders, producing on 1.2 hectares of land under a traditional system characterized by low technology and production efficiency. Besides, the farmers are also faced with problems of natural resource inputs, especially land, water, labour and managerial skills. Without doubt, poverty among farm families goes beyond material deprivation to insecurity, vulnerability, and exposure to risks, shocks and stress. These poor conditions of the rural communities have continued to deteriorate since independence due to severe neglect emanating from poor and inconsistent policies formulation and implementation by successive governments in Nigeria [8].

While the introduction of technologies to a social system is designed to achieve certain outcomes, whether this is achieved or not would depend on changes that are noticed among the target groups (FN Adun, University of Ibadan, Nigeria. Unpublished). Studies by [9], revealed that improved farm equipment enables farmers to increase land area under cultivation and achieve higher incomes. Similarly, [10] reported that the adoption of improved farming equipment for crop production resulted in an increase in total yields, expanding the agricultural land area under production, increasing land use intensities and changing the nature of crop enterprises. [11-13] noted that income is likely to increase, especially if production expands as a result of increases in yield per hectare and the adoption of production practices which sustain soil fertility over time.

A number of constraints to the adoption of Recommended Cassava Production Practices (RCPPs) have been identified by many researchers. For instance, [14], reported that

untimely weed control and wrong application of herbicides affect growth and development of cassava tubers. [15] revealed that 95 percent of the respondents indicated high labour cost as a major constraint to cassava production. [16], found that a large potential exist for the adoption of improved cassava varieties if farmers can obtain more cassava stems suitable for planting. While, [17], opined that the factors limiting improved cassava production are uneven supply of suitable planting materials and other farm inputs such as fertilizer, herbicides, pesticides and processing facilities.

The problem limiting the production of cassava in the Federal Capital Territory (FCT), Nigeria, is the over dependence on traditional methods of production by farmers. Traditional method in this study refers to the farmers' old ways of cultivating cassava such as: Close or wide spacing, shallow planting depth, and the continuous use of local varieties such as; "Nwanye" and "Dan Warri" with low yield potentials. The RCPPs is package is aimed at the improvement on cassava yield. (O Osuagwu, University of Nigeria, Nsukka, Nigeria. Unpublished), stated that cassava yield can be increased by adoption of recommended practices or by expanding the land area under cassava cultivation. The process of increasing cassava yield through modernization is depended on the extent to which farmers become aware of the existence of such recommended practices, develop interest, evaluate, try them and become convinced of their relevance. It is only then that it can be expected that the farmers would adopt completely all the components of the recommended production practices.

Several studies [GAA Okoosi, Obafemi Awolowo University, Ile-Ife, Nigeria. Unpublished, 15, 8] revealed that farmers in the study area have access to different improved cassava production practices and cassava hybrid cultivars thus: TMS 30572, TMS 4 (2) 1425, TMS 99/2132, TMS 98/0581, NR 8032, MS6. The Federal Government of Nigeria through the Cassava Multiplication Programme (CMP), the Root and Tuber Expansion Programme (R-TEP) and the Abuja Agricultural Development Project (ADP) have all made a lot of commitment in promoting the adoption of these recommended cassava production practices. However, in spite of all these efforts, farmers in the study area still practice the traditional cassava production methods [18]. Consequently, the production of cassava in the study area in terms of its yield is relatively low [19]. Therefore, the objective of this study is to evaluate the determinants militating against the adoption of recommended cassava production practices on yield and income among farmers in Bwari and Kuje area council Abuja, Nigeria.

2. METHODOLOGY

The study was conducted in the Federal Capital Territory (FCT), Abuja, Nigeria. Abuja was created and carved out in 1976 from Kaduna, Niger, Kwara and Plateau States. The FCT is centrally located, lying within latitudes 8°25′N and 9°20′N, and longitudes 6°45'E and 7°39'E. Abuja shares a boundary with Kaduna State to the north and with Kogi State to the south. It is also bounded to the east and west by Nassarawa and Niger States respectively. What is referred to as a "Local Government Area" in states are designated "Area Councils" in Abuja. There are six Area Councils in Abuja namely: Abaji, Bwari, Gwagwalada, Kuje, Kwali and Abuja Municipal Area Councils (AMAC). Abuja covers an area of 8,000 square kilometres with a total estimated population of 1,899,622 in 2012 [20]. The people are predominantly peasant farmers cultivating crops such as yam, cassava, maize, sorghum, rice, groundnut, beans and vegetables. They are engaged in small, medium and large-scale livestock production as well as marketing their produce. The people live mostly in organised settlements, towns and cities [21].

For this study, a multi-stage sampling technique was used to select the study area and sample size. Two Area Councils (Bwari and Kuje) were purposively selected in the first stage. In the second stage, two (Kuduru and Igu) out of the ten districts were randomly selected from Bwari using a table of random number technique. Three districts (Rubuchi, Gwagwalada and Gudunkarya) were also selected from the fifteenth district of Kuje giving a total of five districts. This selection was based on the intensity and concentration of farming activities, particularly cassava production, in the study area. In the third stage, assigned value number of random selection method was employed to select two villages (Gutau and Kuduru) from Kuduru district; three villages (Igu, Panunike and Tokolo) from Igu; two villages (Rubochi and Kujekwa) from Rubochi; two villages (Gwargwada and Gidan Bawa) from Gwargwada and one village from Gudunkarya. In the fourth stage, the list of farm villages and households from ward councilors revealed that a total number of registered farmers in these five

districts were one thousand, two hundred (1,200). This formed the sample frame for the study. In the fifth stage, one hundred and twenty (120) of the respondents, about 10% of this population, were randomly taken because the farmers in the study area were homogeneous in their mode of operations.

A well-structured questionnaire was use to collect information from the farmers. The data included information on the socio-economic, institutional and technological characteristics of the respondents. Interview method, informal observation and pictorial information were also gathered; more appropriately, as means of eliciting adequate information on the study area.

The study made use of eight recommended production practices and these are: Recommended planting material; healthy stem cutting with 4 – 5 nodes; recommended planting time - April and June, then August or September; recommended method of planting; planting on ridges at an angle; recommended planting depth (5 cm – 10 cm); recommended plant spacing (1 m x 1 m) for sole cropping; recommended fertilizer rate (NPK 15:15:15, 4 – 8 bags per hectare) and weeding (herbicide application); Pre-emergence herbicide - Alachlor (Lasso) at 300 ml/ CP15 knapsack pump; Selective post – emergence herbicide - Round-up at 4-5 liters per hectare; harvesting (cassava lifters).

Descriptive statistics was used to analyze the general constraints faced by farmers on adoption of Recommended Cassava Production Practices (RCPPs) and the Z-statistic was used to examine the effect of adoption of RCPPs on income and yield of the respondents.

The z-test model was used to compare the differences in yield and income of the farmers before and after adoption of recommended practices. This was used to achieve the objective of the study.

$$z = \frac{|\bar{X} - \mu|}{S\bar{X}} \quad (1)$$

Where:

Z = calculated Z value
$\bar{X}$ = Mean of the sample
$S\bar{X}$ = Standard error of the mean

$$S = \sqrt{\frac{\sum(x_1 - \bar{x})^2}{n-1}} \quad (2)$$

Where:

x_1 = individual observation
$\bar{x}$ = mean of the distribution
n = sample size.

3. RESULTS AND DISCUSSION

3.1 Effect of Adoption of Recommended Cassava Production Practices on Yield and Income

Table 1 gives the results of the z-analysis showed the effect of adoption on the output and income of the respondents before and after the adoption of recommended cassava practices – RCPPs. The average yield was estimated at 3,832.4 t/ha before the adoption of recommended cassava practices and 6,387.33 t/ha after the adoption; giving a 67% percent increase. The minimum yield before and after the adoption of recommended cassava practices were 1,800 and 3,000 t/ha respectively. The maximum yield before and after the adoption of recommended practices were 9,330 and 15,550 t/ha respectively. The z- calculated was 21.25 above the z-critical of 1.96 at 1% level of probability. This implies that there was significant difference between the yield of cassava farmers before and after the adoption of recommended cassava production practices. The results revealed that the yield of farmers after adoption of the cassava recommended practices was higher than the yield before adoption. The result further showed that, an average income of N464, 641.67 before the adoption of recommended cassava practices and ₦714, 833.00 after the adoption of recommended cassava practices were obtained. The minimum income per hectare obtained before and after the adoption of cassava recommended practices were ₦260, 000.00 and ₦400, 000.00 respectively. The maximum income per hectare obtained before and after the adoption of recommended practices were ₦1, 222,000.00 and ₦1, 880,000.00; giving a 54% percent mean increase. The z- calculated was 5.38 and this was significant at 1% level of probability. These findings revealed that the income of farmers after adoption of the cassava recommended practices was higher than the income before its adoption.

The finding was consistent with the report of [10], who noted that the adoption of improved farm practices resulted in an increase in total production by improving yields and income. The mean percentages for both yield and income

were higher and this implied that the adoption of cassava recommended practices had a significant influence on the yield and income of the cassava farmers.

Table 2 shows that there was no increase in the amount of money spent on Cookers; after adoption of recommended production practices - RCPPs. However, the result indicated that there was an increased in the amount of money spent on grinding machines, livestock, televisions, radios and telephones. Still, the amount of money spent on motorcycles, cars, sprayers, houses, cushion chairs and generators after adoption of the RCPPs doubled the amount spent on the aforementioned items; implying a general preference for the later. It is worthy to note that the money spent on the purchase of bicycles decreased after the adoption of the RCPPs. This implied that the farmers had extra money with which they could buy motorcycles for their comfort. Definitely, respondents were able to purchase most household property after the adoption of the recommended practices improved their yields and incomes greatly – a clear indication of the change in the respondents' standard of living. This is in conformity with the reported observation of (A Isah, Ahmadu Bello University, Zaria, Nigeria. Unpublished); who highlighted that money generated from the adoption of recommended rice practices was use to purchase more household properties.

Table 1. Effect of the adoption of improved cassava recommended practices on output and income in Nigerian Naira (₦)

Variable	Before	After	Difference	Differential % (2011)
Output (t/ha)				
Mean	3832.4	6387.33	2554.93	67%
Maximum	9330	15550	6220	
Minimum	1800	3000	1200	
Standard deviation	180.31	300.51	120.2	
z – calculated	21.25***			
z – critical	1.96			
Income (Naira)				
Mean	464,641.67	714,833.33	250191.66	54%
Maximum	1,222,000.00	1,880,000.00	658000	
Minimum	260,000.00	400,000.00	140000	
Standard Deviation	199,622	307,111.9	107489.9	10,748,900.00
z – calculated	5.38***			
z - critical	1.96			

*** *P<0.01*

Table 2. Distribution of money spent on household properties by respondent before and after adoption of RCPPs; in Nigerian Naira (₦)

Household properties	Average amount spent before adoption	Average amount spent after adoption	Difference	Differential %
Bicycles	3,166.67	2,375.00	-791.67	-33.33
Motor cycles	7,500.00	23,333.33	15,833.33	211.11
Cars	8,750.00	24,500.00	15,750.00	180.00
Grinding machines	2,500.00	4,950.00	2,450.00	98.00
Livestock	7,950.00	14,400.00	6,450.00	81.13
Sprayers	800.00	2,933.33	2,133.33	266.66
Houses	11,666.67	45,500.00	33,833.33	290.00
Cushion chairs	1,500.00	4,216.67	2,716.67	181.11
Cookers	500.00	500.00	0	0
Televisions	3,800.00	5,366.67	1,566.67	41.22
Radios	1,470.00	7,908.33	6,792.67	85.87
Generators	825.00	2,933.33	2,108.33	255.55
Telephone sets	2,650.00	3,266.67	616.67	23.27
Total	**₦ 52,399.17**	**₦ 135,745.00**	**₦ 83,345.83**	

Table 3. General constraints faced by farmers on adoption of recommended cassava production practices

Constraints	Frequency	Percentage	Ranking
Limited scale and uneven distribution	93	77.50	1
Insufficient extension agents	33	27.50	2
Insufficient capital	19	15.83	3
High cost of farm inputs and affordability	10	8.33	4
Lack of access roads	9	7.50	5
Processing, storage and marketing problems	9	7.50	6
Problems of root/tuber pests and diseases	8	6.67	7
Poor information network	8	6.67	8

3.2 Constraints to Adoption of Recommended Cassava Production Practices by Farmers

The major constraints faced by farmers in the adoption of recommended cassava production practices are presented in Table 3. Scarcity of farmlands as indicated by majority (77.50%) of the respondents ranked as the foremost constraint; followed by insufficient extension agents (27.50%); and the least being harmful effects caused by pests and diseases and a poor information network (6.67%).

4. CONCLUSION AND RECOMMENDA-TIONS

The findings of this study have revealed that cassava farmers are handicapped by a scarcity of farmland suggesting their inability to expand the current level of cassava production. Also, inadequate funds were is a limiting factor on adoption of Recommended Cassava Production Practices (RCPPs) among farmers. However, the study noted that the adoption of RCPPs increased the yield and income of the farmers. This is reflected in the ability of the farmer to meet up with their socio-economic responsibilities; and improvement in their living conditions. But, in spite of the fact that the aadoption of RCPPs had positive and significant effects on yield and income of farmers, and holds great potential, there was low level of adoption of this technology due to the high cost attributable to it.

Hence, it is recommended that appropriate technologies, which should be made available to the farmers, must be affordable and timely availed by the agencies and stakeholders involved. Furthermore, since the major constraint on adoption of recommended cassava production practices was limited scale and uneven distribution of farmlands, it is recommended that appropriate adaptive and adoptive sustainable technologies that would suit the fragmented nature of farmlands should be developed by research institutes and made available for use by the farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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