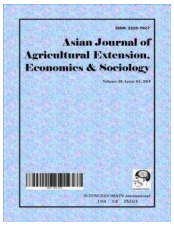

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Effects of Marketing Extension Services on the Control of Postharvest Losses of Root and Tuber Crop Produce in Abia State Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study assessed the effect of agricultural marketing extension on control of post-harvest losses of root and tuber crop produce in Abia State.
Study Design: This study employed a public opinion survey.
Place and Duration of Study: This study was conducted in Abia State, Nigeria between March 2017 and January 2018.
Methodology: Using the multistage sampling technique and a structured questionnaire as an instrument, data were collected from a sample of three hundred and eighty (380) respondents in the study area. Percentages, mean scores, and regression analysis were used as statistical tools for data analysis.
Results: The overall mean score of the farmers on the effects of marketing extension services on

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the control of postharvest losses of root and tuber crop produce was 2.858. Marketing extension services had significant effect on the volume of postharvest losses of root and tuber crop produce in the study area given that the F- statistics of 102.569 is significant at 1% level of significance and that computed F- value was higher than the F-tabulated value of (1.94) at 5% level of significance and (2.51) at 1% level of significance.
Marketing of root and tuber crop produce/products are adversely affected by poor linkages within the marketing, processing and production chains, poor market-orientation and inadequate processing facilities leading to high levels of produce wastage.
Conclusion: Therefore organizations and agencies providing marketing extension services (ADPs, Research Institutes, Universities, NGOs etc.) should do so in accordance with farmers' needs. Rendering marketing extension services requires sets of skills that extension workers may not have needed in the past and reduction of post-harvest losses through marketing of produce and also the transition to a greater market orientation cannot be achieved without developing those skills. Extension workers should be trained. The Government should develop, support and promote training in marketing skills and services for agricultural marketing extension workers.

Keywords: Marketing extension service; post harvest losses; root and tubers.

1. INTRODUCTION

1.1 Agricultural Marketing Extension

Agricultural marketing extension is the provision of farmers with the know-how regarding activities from production to sale, to enable them to get their output to market most effectively [1]. In this regard, it includes activities related to rural credit, insurance, agricultural input, transportation, processing and storage of agricultural products, quality control, subsidies and collective activities of farmers such as cooperatives and farmers organisations. Agricultural marketing extension provides marketing intelligence, information on government policies, advice on post-harvest practices, strategies of product marketing and prices. Marketing extension redirects agricultural extension and advisory services from a limited focus on increasing production to improving farm management, market access and agribusiness. It also implies new roles for extension services that move beyond technology dissemination to the facilitation of innovation, knowledge brokerage and promoting dialogue among stakeholders.

Agricultural marketing extension services are knowledge services which assist small- to medium-scale farmers and other actors in agricultural value chains to increase their access to markets and secure benefits from commercialisation [2]. They are series of activities that assist farmers to gain better access to markets and reduce losses by making informed production decisions, prime of which is produced according to market requirements, including products, specifications, varieties, time of planting, and profitability of selected crops [3]. Marketing Extension services focus on the enhancement of knowledge, awareness and skills of different stakeholders of the sector on different aspects of marketing of agricultural produce. The farmer has to know what to produce as per the demand, where to sell, when to sell, whom to sell his produce et cetera (National Institute of Agricultural Extension Management: [4]. It is the total effort of advising and supporting farmers to produce profitable market-oriented commodities and adopt appropriate technologies and practices, collecting and communicating market-related information, identifying profitable markets and buyers, and linking of farmers to buyers, building marketing capacity of farmers, and facilitating organization of farmers to conduct collective marketing of their produce [5]; which the Agricultural Development Program (ADP) extension service make available to their clientele through the use of extension education process. In other words, agricultural marketing extension services are part of the overall services of the ADPs to their clientele.

According to Yankson et al. [6], millions of smallholder farmers in developing countries such as Nigeria face incredible challenges marketing their farm produce. He identified a lack of market information, collusion among middlemen, and thus price determination, and lack of transportation facilities as the main challenges facing smallholders in many developing regions. Similarly, Food and [7] identified poorly developed marketing channels caused by poor transport facilities; few marketplaces with inadequate facilities, to facilitate and direct the movement of produce, and absence of grades

and standards for the produce or standard weights and measures, little or no guidance on market information, and little commercial outlook to co-ordinate segments in the chain in respect to changes in volume, costs and prices. If Nigerian farmers have to withstand the possible onslaught of international competitors, both in domestic as well as overseas markets, marketing extension would be an effective instrument to safeguard farmers' interest through proper education and guidance on regular basis. The marketing extension services to assist small and marginal farmers in solving the problems faced in marketing their produce is, therefore, a *sine-qua-non* in the free trade environment.

1.2 Post-harvest Losses

Postharvest losses (PHL) refer to measurable quantitative and qualitative food loss in the postharvest system [8]. This system comprises interconnected activities from the time of harvest through crop processing, marketing and food preparation, to the final decision by the consumer to eat or discard the food. Postharvest food loss occurs within the farm-to-market period during harvesting, handling, storage, and distribution of food. These losses contribute to global hunger by decreasing both the supply of locally produced foods and purchasing power by reducing financial gains from crops. Food waste and loss is a large and increasingly urgent problem and is particularly acute in developing countries like Nigeria where food loss reduces income by at least 15% for 470 million smallholder farmers and downstream value chain actors [9]. It is estimated that 1.2 billion people are food insecure. Globally, food waste and loss use a quarter of global freshwater and a fifth of farmland on unconsumed food (9). While it is widely acknowledged that data on food waste are difficult to come by [10], available estimate suggests that approximately 30% of the annual global harvest is never consumed by human beings [11].

Root and tuber crops are a staple food and main source of calories for an estimated 700 million poor people in Africa, Asia and Latin America. The commodities that make uproot and tuber crops include cassava (*Manihot esculenta*), potato (*Solanum tuberosum*), sweet potato (*Ipomoea batatas*), yam (*Dioscorea spp.*), edible aroids (*Colocasia esculenta* and *Xanthosoma spp.*), and (several genera). In Africa, crops such as fruits, vegetables and root crops, being less hardy than cereals, post-harvest losses can reach 50% [12]. In Nigeria, it is estimated to be between 20 and 40% [13]. An efficient marketing extension system ensures supply of goods all year round, with little variation in prices. This can make both the producers and consumers better off. Therefore, the study assessed the effect of agricultural marketing extension services on post-harvest losses of root and tuber crop produce in Abia State, Nigeria.

Hypotheses

HO_1: Marketing extension services have no significant effect on the volume of postharvest losses of root and tuber crop produce in Abia State.

2. MATERIALS AND METHODS

This study employed a public opinion survey.

This study was conducted in Abia State. Abia State was created in 1991 and is in the humid forest Agro-ecological zone of Nigeria. It has a population of 2,833,999 made up of 1,454,195 males and 1,599,806 females. The State has a population density of 578 persons per square kilometre [14]. The population is predominantly rural (62.25%) with only 37.75% urban population [15]. Abia State lies within longitude 7^0 23'E and 8^0 2'E, and latitude 4^0 47'N and 6^0 12'N. The State is situated East of Imo State with which it shares common boundaries on its western areas. On the North and North East, Anambra, Enugu and Ebonyi States bound it. Cross River and Akwa-Ibom States bound it on the East and South East while it shares its Southern borders with Rivers State where the Imo River demarcates the two States.

A combination of cluster sampling, random sampling, and purposive sampling was used to select the respondents. Abia State is divided into three agricultural zones, namely Aba, Ohafia and Umuahia agricultural zones. These three agricultural zones formed the three clusters selected for this study. In each of the clusters, two Local Government Areas (L.G.As) were randomly selected and two communities were randomly selected from each of the L.G.As. The total number of registered farm families in the twelve (12) selected communities was 12075. This figure, therefore, represents the sample frame. The sample size for each zone was determined by a mathematical formula given by Miller and Brewer (2003) as;

$$n = \frac{N}{1+N(\alpha)^2} \quad (3.1)$$

Where:

N is the sample frame for the twelve communities,
n is the sample size and
α is the margin of error (fixed at 5%).

$n = \frac{12075}{1+12075(0.05)^2}$ = 387 farm families

A simple proportion formula was then used to calculate the number of farmers who were interviewed in each selected local government.

The sample size for each community area was randomly selected from the sampling frame of that community as shown in Table 1. This gave a total of 387 farm families. One farmer was purposively selected from each of the farm families, (these were farmers that have root and tuber crops as their major farm enterprise) and this gave 387 respondents. Study limitation includes the supply of village market infrastructure through private sector investment and or partnerships with local indigenes for enhancing root and tuber crop market oriented production. The possibility of expanding the market size and price increase will encourage the establishment of agro-processing industries.

Simple descriptive statistics were used to describe the socio-economic characteristics of root and tuber crop farmers in Abia State. Frequency count, percentages and mean were used to describe the socio-economic characteristics of the farmers and to determine the effect of agricultural marketing extension services in the state. The mean was calculated from a four point likert-type scale w. The four point likert-type scale was given as strongly agree (4), agree (3), disagree (2) and strongly disagree (1). The benchmark for decision was 2.5 (4+3+2+1/4= 2.5). This meant that scores less than 2.5 were rejected while a score greater or equal to 2.5 were accepted. The hypothesis was tested using multiple regression analysis. The variable regression co-efficient indentified and estimated how independent variable included in the model best explained the variability in the dependent variable. The implicit model used for the analysis was given as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8) \quad (3.2)$$

Where:

Y = volume Post harvest losses of root and tuber crop produce (kg);
X_1 = Co-operatives extension services
X_2 = Credit extension services
X_3 = Information extension services
X_4 = Market Linkage extension services
X_5 = Storage extension services
X_6 = Processing extension services
X_7 = Programme to expand consumption extension services
X_8 = Grading and standardisation extension services

Table 1. Sample selection plan

Zones	LGAs	Communities	Sampling frame	Sample size
Aba	Osisioma	1.Urata umueze	540	17
		2.Amasato umungasi	1260	40
	Obingwa	1. Umuohia	421	14
		2.Umuobasiukwu	502	16
Ohafia	Bende	1.Amankwo-umueze	520	17
		2.Eluoma-amuda	418	13
	Ohafia	1.Amudu-obia	1865	60
		2. Etiti-ama-ijeukwu	2005	64
Umuahia zone	Isialangwa south	1.Mbutu-ukwu	1140	37
		2. Ikaa-umuikaa	601	19
	Umuahia south	1.Umuopara ogbodiukwu	911	29
		2. Ezeleke umuekwele	1893	61
Total			**12,075**	**387**
Returned Questionnaire				**380**

Four functional forms of Linear, exponential, double-log and semi-log were tested to estimate the relationship between the dependent variables and the set of explanatory variables. Explicitly, the four functional forms of Linear, exponential, double-log and semi-log that were used to estimate the relationship between the dependent variables and the set of explanatory variables identified for the study was fitted below:

Linear functional form

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \cdots + \beta_8 X_8 + \beta_9 X_9 + \mu_i \quad (3.3)$$

Exponential functional form

$$LnY = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \cdots + \beta_8 X_8 + \beta_9 X_9 + \mu_i. \quad (3.4)$$

Double-log functional form

$$LnY = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \cdots + \beta_8 X_8 + \beta_9 X_9 + \mu_i . \quad (3.5)$$

Semi-log functional form

$$Y = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \cdots + \beta_8 X_8 + \beta_9 X_9 + \mu_i . \quad (3.6)$$

Where

Y = dependent variable
X's = independent variables
Ln = Natural Logarithm
$\beta_0 - \beta_0$ = Parameters to be estimated
μ_i = Error term

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Respondents

The result on age showed that majority 47% (178) of the farmers were within the age bracket of 31 -45 years old. This was closely followed by the age bracket of 46-55 which represents 41.5% (158). Farmers that were in the minority were the age bracket of above 55years which represent 11.5% (44). This indicates that about 88.4 percent of the farmers were in their most economically active age bracket (31-55) years.

About 53% (201) of the farmers' respondents were male while female farmers represent 47% (179) of the sampled population. This implies that there were more male than female in the production of root and tuber crops in the area. This could be because of easy access to land for the male folk in the area. This was supported by Agom et al. [16] in their study on gender roles in cassava production in Cross River State in Nigeria, due to cultural setting of the area which allows males to have easy access to land especially, where a majority of them are the heads of households.

The result showed that 82% (312) which constituted the majority of the farmers were married while 18% (68) of them were single. This implies that married farmers dominated the study confirming the assertion of Jibowo [17] that majority of the rural farmers consisted of married people. Being married has implication for labour supply and for commitment in a given responsibility.

Larger proportions of the sampled farmers had secondary education this represents 53%, (202) of the sampled population, a good proportion of the farmers had tertiary education which represents 41% (156) percent while a few proportions of the farmers had primary education which represents 6% (22) of the sampled population only. This means that most of the farmers are literate since they have had one form of formal education or the other. The high proportion of literate people among the farming population implies that majority of them are in a better position to be aware of, understand and utilise updated information about agricultural marketing required for good farm accounting, record keeping and post-harvest control. Education is considered to be a very important factor influencing innovation and adoption of new technologies [18].

Table 2 showed that larger proportions of farmers in the study area had 11-20 years of farming experience; this was represented by 52% (199) of the farming population. This implies that the respondents have several years of experience in their respective fields and may be considered quite experienced and therefore are expected to obtain higher technical efficiency. Years of experience are an essential factor for successful extension services and farming business. The implication is that the number of years a farmer has spent in the farming business may give an indication of practical knowledge he has acquired on how he could overcome certain inherent farm production challenges or those challenges associated with rendering extension services.

Larger proportion of the farmers 70% (268) had farm sizes of at most five (5) hectares. This was followed by 24% (90) of the farmers with farm sizes of at most one (1) hectare. The least proportion of the respondents 6% (22) had farm sizes of at most ten (10) hectares. The implies that farmers in the study area had only little land to cultivate their root and tuber crops which could be because of the geographical location of their domain and this means that access to land is limited in the study area.

3.2 Effects of Marketing Extension Services on the Control of Postharvest Losses of Root and Tuber Crop Produce in the Study Area

The result indicated that marketing extension services have helped the respondents to join farmers' co-operative with a group mean of 3.293 (SD=1.01). This was adjudged by the majority 82% (313) of the sampled population who attested that marketing extension services of the Abia ADP have helped them to join farmers' co-operatives. Other researchers [19;20] have asserted that membership in farmers' associations increased the probability of receiving production, postharvest and market information. This is expected to increase farmers' market participation.

The result also showed that respondents have been able to access loan due to marketing extension services rendered to them ($\bar{x}$=2.860, SD=1.13). This was adjudged by most 53% (201) of the sampled respondents who have accessed credit facilities through the help of marketing extension agents contrary to 47% (179) who have not been able to assess credit from credible sources in the study area. This is an indication that a good proportion of the farming population has not been able to access credit for their farming activities through the help of marketing extension agency in the study area. This implies that access to credit facilities is a major challenge to farmers in the study area. The result is consistent with the assertions of Machete [21] that Poor access to markets is a major problem in poor rural communities.

The result revealed that farmers were informed of the changing market prices and this has helped them to plan their sales and also to minimize losses ($\bar{x}$=3.297, SD=0.61), this was adjudged by majority 82% (313) of the sampled respondents who averred that they are always informed about changing market prices which has helped them to plan their sales and also to minimize losses. The result also revealed that farmers sales are on the increase because they are informed about available markets and new market locations ($\bar{x}$=3.240, SD =0.77), this was confirmed by 82% (131) of the sampled respondents who attested that marketing extension services have enabled them to increase their sales and avoid losses. This could be due to the increasing availability of information and communication technologies particularly the GSM.

It found that a woman in Ghana could receive prices from 380 African markets for her products through the cell phone. Reduction in post-harvest losses of roost and tubers can be effective when farming communities are being sensitized to marketing intelligence, prevailing prices of commodities and comparatives prices in the nearby markets, as well as extension activities undertaken by the government, efficient market information provision have been shown to have positive benefits for farmers, traders and policy-makers [22]. It is expected that farmers who receive price information are more likely, keeping other factors constant, to receive higher prices, increased sales and reduced losses than do farmers without information.

The result showed that farmers produce specified varieties for their customers ($\bar{x}$=2.98, SD=1.03), this was confirmed by 71% (268) of the sampled population that marketing extension services of the Abia ADP have helped them to produce specified varieties for their clients (or for different purposes). This agrees with the assertions of Aker [23] that the starting point of a number of extension marketing initiatives is production. This is because to market successfully, farmers need to produce and sell what is in demand, at a profit.

The result indicated that farmers now sell beyond the farm gate and have been able to maximise profit ($\bar{x}$=3.00, SD=0.78**).** This was adjudged by 71% (269) of the respondents who posited that they have been able to sell beyond the farm gate and have thus maximized profit.

The result showed that different storage methods and how to protect root and tuber crop produce from pest and disease infestation was very effective in reducing losses ($\bar{x} =$ =3.348, SD=1.08) as confirmed by a greater majority 88% (334) of the sampled population who averred that the marketing extension services of the Abia ADP on the different storage methods

and how to protect their produce from pest and disease infestation have helped them to effectively reduce losses of their root and tuber crop produce.

The result further revealed that farmers can conveniently process their produce to new products ($\bar{x}$= 3.231, SD=0.94), this was adjudged by majority 82% (313) of the sampled respondents. The result also indicated that there is a higher demand for root and tuber crop produce and products (such as cassava flour, yam flour, odourless fufu flour, chips among others) as a result of marketing extension services ($\bar{x}$= 3.055, SD=0.83) as posited by 76% (290) of the sampled population.

However, the result revealed that respondents did not have readily available buyers as the group mean ($\bar{x}$= 2.35, SD=0.56) was below the benchmark of 2.5, although about 53% (201) of the respondents agreed to have readily available buyers, a reasonable proportion of 47% (179) posited that they do not have readily available buyers in the study area. This confirms the fact that farmers are in need of market linkages.

Table 2. Socioeconomic characteristics of root and tuber crop farmers in the study area

Socio-economic characteristics	Frequency	Percentage
Age of respondents		
Below 30	-	-
31-45	178	47
46-55	158	41.5
56-65	44	11.5
Total	**380**	**100.0**
Gender		
Female	179	47
Male	201	53
Total	**380**	**100.0**
Marital status		
Married	312	82
Single	68	18
Widowed	-	-
Total	**380**	**100.0**
Educational level		
Primary	22	6
Senior secondary school	202	53
Tertiary	156	41
Total	**380**	**100.0**
Years of Experience		
1-10	113	30
11-20	199	52
21-30	46	12
31-40	22	6
Total	**380**	**100.0**
Farm size		
<1	90	24
1 -5	268	70
6-10	22	6
Total	**380**	**100.0**

Source: Field Survey, 2017

Table 3. Mean response of farmers on the effects of marketing extension services on the control of postharvest losses of root and tuber crop produce in Abia State

S/N	Effects of marketing extension services	Frequency	Percentage	M ($\bar{x}$)	SD
	Co-operatives				
1	Activities MES has helped you to join farmers' co-operatives	313	82	3.293	1.01
	Credit				
2	Activities of MES have helped to access credit from credit sources.	201	53	2.86	1.13
	Information				
3	I am always informed about changing market prices and it has helped me to plan my sales and also minimise losses	313	82	3.297	0.61
4	My sales are on the increase because am always informed about available markets and new market locations	313	82	3.24	0.77
5	I produce specified varieties for my customers	268	71	2.98	1.03
6	I now sell beyond farm gate and I have been able to maximise profit	269	71	3.00	0.78
	Market linkage				
7	I have readily available buyers	201	53	2.35	0.56
	Storage				
8	The different storage methods and how to protect my produce from pest and disease infestation is very effective in reducing losses	334	88	3.348	1.08
	Processing				
9	Farmers can conveniently process your produce to new products	312	82	3.231	0.94
	Programme to expand consumption				
10	There is higher demand for your product/ products	290	76	3.055	0.83
	Packaging				
11	The way you design your package and the type of packaging materials you use has increased your sales and reduced losses	110	29	2.236	0.84
	Grading and standardization				
12	I can now use the weighing machine and my products are being sold based standard measurement	268	71	3.058	0.83
	Overall mean score			**2.858**	**0.82**
	Number of Respondents			**380**	
	Decision Mean score			**2.50**	

Source: Field Survey, 2017
Note: M=Mean; SD=Standard deviation

Table 4. Ordinary least square regression result of effect of marketing extension services on the volume of postharvest losses of root and tuber crop produce in Abia State

Variable	Linear	Exponential	Semi-log+	Double-log
Constant	77940.65 (4.307)***	7.541 (6.812)***	12.615 (2.470)**	-2105596 (-5.628)***
Co-operatives extension services	-43531.06 (-0.170)	-4.051E-04 (-0.160)	-0.190 (-2.320)**	-14480.32 (-3.090)***
Credit extension services	-8.680 (-5.620)***	-4.166 (-5.200)***	-1.203 (-5.040)***	-3946.73 (-2.880)***
Information extension services	13695.849 (6.367)***	-0.250 (-6.866)***	-1.277 (-5.417)***	-25175.144 (-1.756)*
Market Linkage extension services	-65721.02 (-5.386)***	8.696E-04 (4.209)***	-1.886 (-5.789)***	104163.25 (6.941)***
Storage extension services	67450.4 (4.358)***	-2.112E-05 (-2.511)**	-1.963 (-4.817)***	-4736.963 (-3.719)***
Processing extension services	-34904.02 (-6.340)***	5.521E-04 (1.924)*	-1.266 (-5.147)***	-12335.072 (-3.253)***
Consumption expansion services	-51582.316 (-1.528)	-1.350 (-7.000)***	-1.468 (-4.047)***	-4802.078 (-0.567)
Grading and standardization extension services	-64711.10 (-3.720)**	2.123 (4.480)***	-1.694 (-6.530)***	-38.845 (-5.430)**
R^2	0.829	0.884	0.978	0.891
Adj. R^2	0.815	0.878	0.969	0.887
F-statistic	79.283***	84.063***	102.569***	65.936***

Source: Field survey, 2017

*Note: ***, **, and * indicates statistically significant at 1 percent, 5 percent and 10 percent level of significance respectively. + stand for the lead equation and the values in parenthesis are t-values*

Furthermore, the process of designing and the type of packaging materials did not have any effect on the control of root and tuber crop production in the study area as the group mean ($\bar{x}$= 2.236, SD=0.84) was lower than the mean benchmark of 2.5. This was confirmed by majority71% (270) of the respondent who posited that the process of designing and the types of packaging materials have not helped them in the control of root and tuber crop products. This could be because most root and tuber crop produce are sold at the raw state by the farmers who do not process for market and may not need to be packaged.

Majority of the farmers 71% (268) opined that they can now use the weighing machine and that their products are being sold based standard measurement (($\bar{x}$= 3.058; SD=083). This implies that farmers have been through the use of weighing machines and standard measurement which is a major factor always considered in the marketing of agricultural produce and products.

The overall mean score of the farmers was 2.858. This indicates that marketing extension services have impacted positively on the control of postharvest losses of root and tuber crop production in the study area. The average standard deviation of 0.82 implies that individual responses of the respondents are close to each other.

3.3 Hypothesis Three

Four functional forms – linear, exponential, semi-log and double-log were tried for the choice of a lead equation. F-ratio of the four functional form tried were significant at 1.0% risk level indicating that any of the four could be used for predictive purposes. But the semi-log functional form was chosen based on the magnitude of the coefficient of multiple determinations (R^2), the significance of the regression coefficients, the number of significant variables and the signs of the significant variables as they conform to *a priori* theoretical expectations as well as the substantial of the entire model as shown by the F- statistic. The value of the coefficient of multiple determinations (R^2) was 0.978, implying that about 97.8% of the variations in the volume of postharvest losses of root and tuber crop produced in the study area was explained by the explanatory variables (AMES) included in the model. The F- statistic was significant at 1% implying that the entire model was well specified.

The coefficient of cooperative extension services (-2.320) was negative and significant to at 5% alpha level. The coefficient of credit extension services (-5.040), information extension services was negative (-5.417), market linkage extension services (-5.789), storage extension services (-4.817), processing extension services (-5.147), consumption expansion services (-4.047) and coefficient of grading and standardization extension services (-6.530) were negative and significant to volume of postharvest losses of root and tuber crop produce in the study area at 1.0% alpha level respectively. This implies an indirect relationship with the volume of postharvest losses of root and tuber crop produced in the study area. Therefore, it means that an increase in any of the variables cooperative would lead to a decrease in the volume of postharvest losses of root and tuber crop production in the study area.

Given that the F- statistics of 102.569 is significant at 1% level of significance, it implies that the computed F- value was higher than the F-tabulated value of (1.94) at 5% level of significance and (2.51) at 1% level of significance. Therefore, the null hypothesis that marketing extension services have no significant effect on the volume of postharvest losses of root and tuber crop production in the study area was rejected and the alternative hypothesis which states that marketing extension services have a significant effect on the volume of postharvest losses of root and tuber crop produce in the study area was accepted. Therefore, the study concluded that the reduction in the volume of postharvest losses of root and tuber crop production is dependent on the agricultural marketing extension services available to farmers in the study area.

4. CONCLUSION

The result has shown that marketing extension services have impacted positively on the control of postharvest losses of root and tuber crop produce. The study, therefore, concludes that although marketing extension services offered to farmers by extension workers in Abia state have helped them reduce postharvest losses of root and tuber crop production, more effort is needed to further decrease the volume of postharvest losses of roots and tubers in the state. The future studies on development, support and promoting marketing

skills and services for agricultural marketing extension should be implemented to verify the conclusion.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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