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**Original Research Article**

# PROMOTING FOOD SECURITY AND SUSTAINABLE POST-HARVEST QUALITY AND SHELF LIFE OF TOMATO THROUGH DIFFERENT MEDIA COMMUNICATIONS IN SOUTHERN GUINEA SAVANNA OF NIGERIA


## ABSTRACT

The study investigates promoting food security and sustainable post-harvest quality and shelf life of tomato through different media communications in Southern Guinea Savanna of Nigeria. A structured questionnaire was used to collect data from 60 respondents. The results revealed that the respondents in the study area practice subsistence farming, age category of 31-40 years constitute the majority with 66.7% while 51-60 years were the least with 5%. Also 25(41%) had 11-15 years of experience, which contribute immensely toward quality production. Thirty (30) respondents with 50% had secondary levels of education, followed by primary 20(33.3%) that made them to be able to read and write. Radio broadcast was the best communication media to the farmers followed by television programs. The (r =0.535) recorded 53.5% of the variation in the output or quality. Two input variety and media were statistically significant in output and quality at 5% level of significance. Based on the result from the finding, it is recommended that more financial facility should be extended to farmers and training should be organized to farmers, to increase awareness, acceptance and embraced the new technology to boost productivity and quality.


*Key words: sustainable postharvest; promotion; shelf life; food security; communication*

## 1. INTRODUCTION

Media communication is considered as communication channels where information are being carried to the target audience (1, 2). Information dissemination is an important tool for promoting food security and National development. Information is an essential ingredient in agricultural development program. In Nigeria, as in many other developing countries, high poverty level, illiteracy, limited number of extension agents, lack of power supply (electricity) and high cost accessing media makes it impossible to reach most tomato farmers by different media communication means (3). For tomato farmers to respond to opportunity that will improved their agricultural productivity, knowledge and management information on tomato storage and preservation play a central role (4) and (5). In many tomato farming population or audience, access to information often differ, may be due to differences in tomato farmers circumstances

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and ability to adopt technological options and availability of communication channels. In some cases, information is not available at all or it is disseminated through specific communication channels to which many household tomato farmers have limited access (6) and (7). Effective communication will be of benefits to tomato farmers in the southern Guinea Savannah, this would make the farmers have confidence in the program, acceptance of the new technology or innovative farming practices that will promote food security sustainable post-harvest quality and shelf life of tomato product in southern Guinea agro-ecological zone (8), and (9).

Tomato (*lycopersicon esculentumm)* comes as one of the most important agricultural products among fresh vegetables in most countries in the world. It has become more popular in recent decades. Tomato belongs to the solanaceae family, as it is a relatively, short duration crop and gives a high level yield, it is economically attractive and the area under cultivation is increasingly daily (10). Tomato is one of important vegetable crops in Nigeria. It is mostly utilized for culinary applications in most homes and families in the country. Although tomato is faced with serious post-harvest constraints with respect to inadequate communication channels to farmers on storage conditions and use of certain preservatives that will improve post-harvest quality and shelf life so as to promote food security in the country (11) Tomato being an essential part in human diet with a high nutritional resources rich in vitamin c and other antioxidants. Therefore, a radical and urgent approach is needed to address food impediments posed by under-exploitation through effective media communication channels (12). Furthermore, there is an urgent need for systematic evaluation of storage conditions, anti-respirants and shelf-life under different media communication means (13) and similarly there is a need for application of preservatives to prolong the shelf-life of harvested products which has become urgent and necessary so as to meet up with the current food challenges in the country as well as promoting food security in the country (14); (15).

It is against this background that this research attempts to determine promoting food security and sustainable post-harvest quality and shelf life of tomato through different media communications in Southern Guinea Savannah of Nigeria.

## 2. MATERIALS AND METHODS

The study was carried out in 2016 and 2017 at center for food technology and Research (CEFTER) Benue State University Makurdi, Nigeria. The experimental location falls with the southern Guinea Savanna agro-

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ecological zone of Nigeria. The experimental area lies on latitude $7^0$ $41^1$N, and longitude $8^0 37^1$E, 185.9m above sea level (16). Meteorological data for the period of the study was obtained from Nigerian Air Force Base meteorological Station, approximately 300km away. The climate of the area is characterized by dry and rainy seasons. The dry season starts ending of October to early March while annual rainfall ranges from 1100mm-1500mm, the rain establishes between early April to early June and reaches a peak in August/September (17). The mean temperature increase from January onward reaching a peak of 30-38$^0$C.the hottest months were those preceding the rains February/ March. The coldest months were November to January that is characterized by the North-East wind when the temperature averages 26$^0$C. The relative humidity is about 65% to 75% during the rainy season and can be lower than 32-44% during the dry season.

**Sample and sampling technique**

The data for the study was generated using multistage random sampling procedure. The first stage involves the random selection of 4 different villages out of 8 main villages of tomato production in the area (18) and (19). Also, 15 respondents were randomly selected from each village with the aid of a sampling frame of tomato farmers obtained from the chairman of tomato farmers association (TFA) of the Area.

**Method of Data collection**

The research data for the study were collected from both primary and secondary sources. The primary data were collected from tomato farmers in Tarka L.G.A. of Benue State; through personal interviews and well-structured questionnaires. Data elicited include information about their age, sex, marital status, educational level, house-hold size, income level, farm size experiences in farming, storage and use of storage anti-respirants. Secondary data were generated from literature materials.

**Method of data analysis**

The analytical tools used to analyze the data generated from the study include descriptive statistics (frequency distribution and percentage) which were used to analyze the socio-economic characteristics of the respondents. Other analytical tools used were gross margin and multiple regression analysis.

**Gross margin Analysis**

Gross margin is the difference between the gross returns and total variable costs. It is algebraically expressed as follows;

…….. (i)

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…….(ii)

Where Gm = Gross margin, GFI = Gross farm income (from sales of products

TVC = Total variable cost, E = Summation sign

Pi = Price of unit of ith output, Qi = Quantity of ith output

Pj = Price of unit of jth input, Qj = Quantity of jth input

n = Number of output, m = number of inputs

**The Empirical Model**

The implicit form of the empirical model for each farmer's group is specified thus:

……(iii)

Where Y = Total output of post-harvest tomato product (kg)

$X_1$ = Storage size (ha)

$X_2$ = Labour input (man-days)

$X_3$ = Varieties & number of fruits (Kg)

$X_4$ = storage anti-respirants (preservatives inputs in Kg)

$X_5$ = cost of different communication media

e = error term

**Measurement of resource use efficiency**

An aggregate production function was specified for each farmer group and estimated using ordinary least square (OLS) multiple regression analysis.

The explicit forms of the models are specified as:

Linear: ……..(iv)

Cobb-Douglas: ……(v)

Semi –log:…….(vi)

Exponential: In Y = ……(vii)

Where Y = Total output of post-harvest tomato products (kg)

$X_1$ = Storage size (ha)

$X_2$ = Labour input (man-days)

$X_3$ = Varieties & number of fruits (Kg)

$X_4$ = storage anti-respirants (preservatives inputs in Kg)

$X_5$ = cost of different communication media (Naira)

e = error term, In = Natural Logarithm

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$b_1$-$b_5$ = Regression coefficients to be estimated

$b_0$ = constant term

Four functional forms were utilized such as the linear, Cobb. Douglas (double log) exponential and semi-logarithmic were used for the data for each farmer groups and the model adjudged to be the best was chosen as the lead equation for further analysis.

The efficiency resources allocation was examined by equating MvPxi to $Px_1$ and computing the allocative efficiency index (Kj).

This was determined by the ratio of marginal value product (MVP) to marginal factor cost (MFC) of inputs based on the estimated regression coefficients (Rahman&Lawal, 2003).

Efficiency of resources

Therefore, MVPxi/Pxi = r, MFC = Pxi

When $MVPx_1/Px_1$ = r (Olukosi&Erhabor, 2005)

If r = 1, there is efficient use of resources

If r > 1, indicate underutilization of resources

r< 1, indicate over utilization of resources of the jth input

where; r = efficiency ratio

Pxi = unit price of input

**Socio-economic characteristics of respondents**

Result in Table 1 shows tomato farmers in the age category of 31-40 years are the majority (40) constituting 66.7% of the respondents, followed by 41 – 50 that were 12 (20%); 51-60, were the least with 3(5%). This implies that tomato farmers between the ages of 31-40 were more concern with the new innovation and technology adoption through different media communication channels. Table 1 also reveals that 83.3% of the respondents were married while 16.7% were single. It also shows that 66.7% of the respondents were male and 33.3% of tomato farmers were female. The respondents in Table 1 shows that 41.7% of the respondents had 11-15 years experiences in farming and using their local technology in storing tomato postharvest products, followed by 33.3% with 6-10 years. The least was 8.3% with 1-5 years respectively.

Long farming experience has advantage for increase in post-harvest quality and shelf due to the fact that it encourages adoption of farm innovation through media education (20). In Table 1 also, 50% of the tomato farmers had secondary education and 33.3% with primary education, 3.3% attained the tertiary level of education while 13.4% of

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them had not attended any formal education. The low level of education among the respondents could have a negative influence on agricultural information adoption and information broadcasts to be consumed by the farmers due to their educational levels might also hinder the productive capacity of the farmers and poor quality production of tomato post-harvest products. This agreed with the findings of (13) who said that higher educational level of the farmers increased their potentials and enhanced productivity.

**Information dissemination to the farmers on different media communication channels**

Responses by the farmers on information dissemination on the different media as to educate the tomato farmers on the good varieties, storage conditions and storage anti-respirants towards postharvest quality production clearly reveals that farmers were interested on new technology that will facilitate quality tomato production in the area (Table 2).It also shows in table 2, Radio broad cast were more utilized with the higher percentage of (93.3, 80, 80%) while not utilized with (6.7, 20, 20%).

Television had (83.3, 75;78.4%) utilized and 16.7, 25, 21.6%) not utilized. This may be due to absent of electricity or broadcasting time when the farmers may only listen to it in the evening, but for the radio most farmers take their small radio to their farmers, and some time the information may be disseminated using their languages for easy understanding. The Agric-magazine gave the least information to the farmers with (50,46.7, 41.7%) utilized and (50, 53.3, 58.3%) not utilized.This could be due to their educational levels and also the difficulties in purchasing or getting assess to this communication media. This conformed with the opinion of (6) and (21) who expressed that the educational levels of farmers is great factor in the adoption of new innovations and post-harvest quality production. It also tally with the findings of (22) that literature means of disseminating information to farmers, gives a snail speed to create awareness which further deprived and discourages farmers in embracing new technology and innovations.

**Production Function Analysis**

Influence of production input media communication on tomato variety output was determined with the aid of production, having ran different function forms. The Cob-Douglass production function appeared to be the best fit and therefore used as the lead equation. The result of the estimation is presented in table 3.

Result in table 3 gives an R square value of (r = 0.535) which means that 53.3%

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of the variation in the output (quality and shelf life) in the area were explained by the independent variables considered in the model. Moreover, two of the inputs (initial/no of tomato fruits or varieties and cost of the media, significantly affected the output (quality & shelf life) of tomato at 5% level of significance. While other two (storage conditions and storage anti respirants) were not significant. This implies that a unit increase in number of fruits with an efficient media communication channels will bring about an increase in the output (quality) of the tomato produced by 2.265 and 2.413 respectively. This agreed with the findings of (23) who observed that good communication synthesized the farmers on good cultivars and other farming practices that enhances quality ad shelf life of tomato.

Marginal analysis is one of the ways used to determine the efficiency with which each production input is utilized in a production process. In the case of Cobb-Douglas production function, the marginal value product of each input is the regression coefficient multiplied by the average output all over average input, multiply by the price of the output. (biY/Xi). Py

**Recourse use efficiency**

Estimated efficiency ratio (r) shows that storage conditions, storage anti-respirants through different media communication channels in the model were underutilized. Table 4, this implies that the resources were not efficiently utilized. They need for the use of media as a channel to educate or disseminate new techniques for post-harvest storage of tomato need to be more efficient in order to attain optimality in quality output of tomato products. This agreed with the findings of (24) who stated that information dissemination to farmers appropriately at the right time dispelled ignorant and gives the farmers a good opportunity to understand, accept and utilized as to increased productivity and quality of the product.

**Conclusion**

It is evident from the study that, farmers in the study area practice subsistence farming, age category of 31-40 years constitute majority with 66.7% while 51-60 years were the least with 5%. Also, 25 (41%) had 11-15 years of experience, which contributed immensely toward quality production. Higher number of respondents (30) had 50% secondary level of education followed by primary 20 (33.3%) which make them to read and write. Radio broadcast was the best communication media to the farmers followed by television programs. The $R^2$-value recorded 0.535 with 53.5% of the variation in the output or quality. While two inputs (variety & media) showed a significant effect on the output and quality at

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5% level of significance. Based on this findings, it is recommended that more financial facility should be extended to farmers and training should be organized to farmers, so as to boost productivity and quality.

**Table 1 Distribution of the respondents according to Socio-economic characteristics**

| **Ages** | **Frequency** | **Percentage(%)** |
|---|---|---|
| 21-30 | 5 | 8.3 |
| 31-40 | 40 | 66.7 |
| 41-50 | 12 | 20.0 |
| 51-60 | 3 | 5.0 |
| **Marital status** | | |
| Married | 50 | 83.3 |
| Single | 10 | 16.7 |
| **Sex** | | |
| Male | 40 | 66.7 |
| Female | 20 | 33.3 |
| **Farming & Storage experience** | | |
| 1-5 | 5 | 8.3 |
| 6-10 | 20 | 33.3 |
| 11-15 | 25 | 41.7 |
| 15-20 | 10 | 16.7 |
| **Level of education** | | |
| None | 8 | 13.4 |
| Primary | 20 | 33.3 |
| Secondary | 30 | 50.0 |
| Tertiary | 2 | 3.3 |

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| | | |
|---|---|---|
| **Household size** | | |
| 1-5 | 10 | 16.7 |
| 6-10 | 20 | 33.3 |
| >10 | 30 | 50.0 |

**Source: Field survey 2017**

Table 2: Distribution of respondents according to different communication channels on varieties, storage conditions and storage anti-respondents.

| **Media** | **Varieties** | | **Storage Conditions** | | **Application of Anti-Respirants** | |
|---|---|---|---|---|---|---|
| Radio broadcast | (F) | (%) | (F) | (%) | (F) | (%) |
| Utilized | 50 | 83.3 | 30 | 50.0 | 28 | 46.7 |
| Fairly utilized | 6 | 10.0 | 18 | 30.0 | 20 | 33.3 |
| Not utilized | 4 | 6.7 | 12 | 20.0 | 12 | 20.0 |
| **Television** | | | | | | |
| Utilized | 30 | 50.0 | 25 | 41.7 | 25 | 41.7 |
| Fairly utilized | 20 | 33.3 | 20 | 36.7 | 22 | 36.7 |
| Not utilized | 10 | 16.7 | 15 | 21.6 | 13 | 21.0 |
| **Agric Magazine** | | | | | | |
| Utilized | 20 | 33.3 | 18 | 25.0 | 15 | 25.0 |
| Fairly utilized | 10 | 16.7 | 10 | 16.7 | 10 | 16.7 |
| Not utilized | 30 | 50.0 | 32 | 53.3 | 35 | 58.3 |

**Source: Field survey 2017.**

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Table 3: Regression coefficients and t-values of input (media used) to tomato farmers production in the area(N=60).

| Variable | coefficient | SE | t-value | $R^2$ F- value |
|---|---|---|---|---|
| Initial No. of tomato fruits(Variety) | 0.426 | 0.192 | 2.265** | 0.535 4.886 |
| Storage conditions | -0.069 | 0.167 | -0.390ns | |
| Storage anti respirants | -0.105 | 0.121 | -0.622ns | |
| Cost of media | 0.457 | 0.105 | 2.413** | |

**Source: Field survey 2017 ns=not significant** significant at P<0.05**

**Table 4: Resource use efficiency; MVP.MFV and MVP/MFC ratio**

| Resource | MVP | MFC | MVP/MFC | Efficiency ratio |
|---|---|---|---|---|
| Initial/No of tomato fruits (variety) | 5590 | 4500 | 1.24 | Over-utilized |
| Storage conditions | 1.85 | 62 | 0.029 | Underutilized |
| Storage ant-respirants | 0.35 | 100 | 0.0035 | Underutilized |
| Cost of media | 15.25 | 6100 | 0.0025 | Underutilized |

**Source: Field survey, 2017**

## REFERENCES


1. Yahaya Y, Echekwu C, Mohammed S. Yield stability analysis of pearl millet hybrids in Nigeria. African Journal of Biotechnology. 2006;5(3):249-53.
2. Saud MS, Shuaibu B, Mohrsquo L, Buntat Y, Yarsquo A. Applicability of information and communication technologies (ICTs) in the administration of technical and vocational education and training (TVET) in a knowledge-based society. International Journal of Physical Sciences. 2011;6(28):6513-20.
3. Yahaya MK. Measuring the impact on farmers of agricultural radio and television programs in southwest Nigeria. Journal of Applied Communications. 2002;86(3):2.
4. May J, Karugia J, Ndokweni M. Information and Communication Technologies and Agricultural Development in Sub Saharan Africa: Transformation and Employment Generation. 2007.
5. Garvelink WJ, Wedding K, Hanson S. Smallholder Agriculture: A Critical Factor in Poverty Reduction and Food Security in Africa. Center for Strategic and International Studies. 2012.
6. Mgbakor M, Iyobor O, Okezie U. Contributions of Mass Media to the Development of Agricultural Extension in Ika North East LGA of Delta State, Nigeria. Academic Journal of Plant Sciences. 2013;6(3):127-33.
7. FAO W. IFAD, 2012: The State of Food Insecurity in the World: Economic Growth is Necessary but not Sufficient to Accelerate Reduction of Hunger and Malnutrition. Food and Agriculture Organization of the United Nations, Rome, Italy. 2015.

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8. Pinheiro J, Alegria C, Abreu M, Gonçalves EM, Silva CL. Use of UV-C postharvest treatment for extending fresh whole tomato (Solanum lycopersicum, cv. Zinac) shelf-life. Journal of food science and technology. 2015;52(8):5066-74.
9. Young CK. Accommodating Housing in India: Lessons from Development Capital, Policy Frames, and Slums: University of California, Berkeley; 2016.
10. Waldrip HM, He Z, Erich MS. Effects of poultry manure amendment on phosphorus uptake by ryegrass, soil phosphorus fractions and phosphatase activity. Biology and Fertility of Soils. 2011;47(4):407-18.
11. Azad A, Ali M, Akter MS, Rahman MJ, Ahmed M. Isolation and characterization of pectin extracted from lemon pomace during ripening. Journal of Food and Nutrition Sciences. 2014;2(2):30-5.
12. Omoke NI. Childhood pyogenic osteomyelitis in Abakaliki, south east Nigeria. Nigerian Journal of Surgery. 2018;24(1):27-33.
13. Oyinbo O, Rekwot GZ. The relationships of inflationary trend, agricultural productivity and economic growth in Nigeria. CBN Journal of Applied Statistics. 2014;5(1):35-47.
14. Sarkar S, Roy DKD, Alomoni SM, Das K, Rahman M. Effect of chemical preservatives and storage conditions on the nutritional quality of tomato pulp. American Journal of Food and Nutrition. 2015;3(4):90-100.
15. Rahman S. Women's labour contribution to productivity and efficiency in agriculture: empirical evidence from Bangladesh. Journal of Agricultural Economics. 2010;61(2):318-42.
16. Hess T, Stephens W, Maryah U. Rainfall trends in the north east arid zone of Nigeria 1961–1990. Agricultural and Forest meteorology. 1995;74(1-2):87-97.
17. Davis MB, Botkin DB. Sensitivity of cool-temperate forests and their fossil pollen record to rapid temperature change. Quaternary Research. 1985;23(3):327-40.
18. Phiri A, Chipeta GT, Chawinga WD. Information needs and barriers of rural smallholder farmers in developing countries: A case study of rural smallholder farmers in Malawi. Information Development. 2018:0266666918755222.
19. Elu JU, Loubert L. Earnings inequality and the intersectionality of gender and ethnicity in Sub-Saharan Africa: The case of Tanzanian Manufacturing. American Economic Review. 2013;103(3):289-92.
20. Maruapula SD, Jackson JC, Holsten J, Shaibu S, Malete L, Wrotniak B, et al. Socio-economic status and urbanization are linked to snacks and obesity in adolescents in Botswana. Public health nutrition. 2011;14(12):2260-7.
21. Dim C, Ezenekwe U. Does agriculture matter for economic development? Empirical evidence from Nigeria. Journal of Finance and Economics. 2013;1(1):61-77.
22. Angelucci F, Balié J, Gourichon H, Mas Aparisi A, Witwer M. Monitoring and analysing food and agricultural policies in Africa: FAO; 2013.
23. Chapota R, Fatch P, Mthinda C. The Role of Radio in Agricultural Extension and Advisory Services–Experiences and Lessons from Farm Radio Programming in Malawi–. MEAS Case Study,(8). 2014.
24. Agona S, Otim JS. Readiness of Uganda for Analog to Digital Migration by December, 2012. International Journal of Computing & ICT Research. 2011;5(2).