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COMPARATIVE ANALYSIS OF THE PROFITABILITY OF LOCAL STORAGE SYSTEMS FOR ROOT AND TUBER CROPS IN BENUE STATE, NIGERIA.

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Abstract

A comparative analysis of the profitability of local storage systems for root and tuber crops in Benue State of Nigeria was investigated. The specific objective was to determine and compare the profitability and effectiveness of the local storage systems. Data were collected from 288 root and tuber crop producers in eight Local Government Areas and 32 wards, using a multi-stage sampling technique. Structured questionnaire was used to collect the data. Data collected were analysed using ANOVA and budgetary techniques. The findings reveal that barn, delayed harvesting techniques, and perforated carton have the highest return on storage investment per kg for yam, cassava, and sweet potato respectively. The results further show that sweet potatoes, yam, and cassava have a longer shelf life when stored in storage house structure, conical protective roof and barns, heaps and water techniques respectively. It was recommended that workshops aimed at educating root and tuber producers on the most effective storage techniques be encouraged as well as intensification of research to improve already existing root and tuber crops storage techniques.

(**Key words**: Comparative, Profitability, Local Storage Systems, Root and Tuber Crops, Benue State, Nigeria)

Introduction

Post-harvest storage losses have been of concern even to the United Nations which brought it to international focus when it declared in 1975 that further reduction of post-harvest food losses in developing countries should be undertaken as a matter of priority (FAO and UNEP 1981). According to Okoedo-Okojie and Onemolease (2009), this declaration led many national governments to take seriously the problems of storage of agricultural produce.

In order for storage to be effective, crop losses must be minimized. Though improved methods of storage of root and tuber crops are available, with attempt to minimize crop losses and reduce the causes of post-harvest deterioration, there has been a wide spread and continued use of traditional storage practices by small-scale and subsistence farmers in Benue State.

Although there are several studies on traditional methods of storing root and tuber crops

(Akangbe, Oloruntoba, Ayanda and Komolafe, 2012; Dandago and Gungula, 2011; Ofor, 2011; Ravi, Aked and Balagopalan, 1996) in different parts of Nigeria, no study determined the economic aspect of local storage methods for these crops. This study was an attempt to bridge the research gap.

The main objective of the study was to conduct a comparative analysis of the profitability of local storage systems for root and tuber crops in Benue State of Nigeria. Specifically, the study sought to determine and compare the profitability and effectiveness of the local storage systems.

Methodology

Study Area

The study was conducted in Benue State, Nigeria. The state lies between latitudes $6^0 25^/$N and $8^0 8^/$N and longitudes $7^0 47^/$E and 10^0E. Benue State is the nation's acclaimed food basket because of the abundance of its agricultural resources. The state is a major producer of food and cash crops (BNARDA, 2004). Farmers who are engaged in arable crop production like yam, cassava, sweet potato, maize, rice, vegetables, soybeans as well as livestock like poultry, goat, sheep, piggery, cattle and fish abound. Also, agribusiness entrepreneurs who are involved in yam distribution/marketing, yam chip and flour production abound in the State (Okeke, Nto and Mbanasor, 2015)

Sampling Technique and Data Collection

The population for the study consisted of root and tuber crop farmers in Benuethe State. As a result of the enormity of the population for the study, a sample of 288 root and tuber crop farmers from eight Local Government Area and 32 wards known for root and tuber crops production were selected, using multi-stage sampling technique. The data for the study were collected using a well-structured questionnaire

Data Analysis

Analysis of Variance (ANOVA) and budgetary technique like Gross margin analysis were used to determine and compare the profitability and effectiveness of the local storage systems.

Model Specification

The model (ANOVA) for comparing the effectiveness of the local storage methods was specified as follows:

$Y_{ij} = \mu + T_i + \varepsilon_{ij}$ where:

Y_1 = cost involved in the various storage methods

Y_2 = shelf life of stored root and tubers

T_1 = Barns effect

T_2 = Elevated horizontal pole effect

T_3 = Conical protective roof effect

T_4 = Delayed harvesting effect

T_5 = Heaps and water effect

T_6 = Pit effect

T_7 = Storage house structure effect

T_8 = Perforated cartons effect

μ = common effect

ε_{ij} = random error

The model (Gross Margin Analysis) for comparing the profitability of the storage methods was expressed as follows:

GM = TR-TVC where:

GM = gross margin of produce stored (₦/100kg)

TR = total revenue (₦)

TVC = total variable cost (₦)

The GM was used on the proxy that the fixed costs of storage systems were negligible (Iheanacho and Onor, 2002).

The return on investment (ROI) which estimates the return per every Naira spent on the storage system was specified as follows:

ROI = TR/TVC where:

ROI = return on investment/100kg of produce

Results and Discussion

Profitability and Effectiveness of Local Storage Systems

The profitability and effectiveness of the various local storage systems for yam, cassava, and sweet potatoes are presented in Table 1.

Analysis of Table 1 shows that for yam storage techniques, barn has the highest return on storage investment per kg (₦55.12), and profit per kg of stored produce of ₦55.28. This implies that for every ₦1.00 spent on storing yams in barns, a return of ₦55.12/kg is obtained. This high return in storing yam in barns is attributed to the availability and accessibility of materials used in constructing the barns and the shelf life of stored produce. Other local storage systems identified were use of elevated horizontal poles and conical protective roof with returns on storage investments of ₦11.73 and ₦47.62, respectively. In a study on minimizing postharvest losses in yam, Osunde (2008) revealed that the yam barn in the guinea savannah zone is constructed from

guinea corn stalk, sticks, grass and yam vines which are readily available with little or no cost involved. According to Ofor, Oparaeke and Ibeawuchi (2010), the maximum storage life of yams in the barn is six months with 10% to 15% losses during the first three months and up to 30% to 50% after six months. Furthermore, Nwaigwe, Okafor, Asonye and Nwokocha (2015) revealed that the clay and straw used in constructing barns create a favourable temperature for stored produce, thus translating to increase produced stored.

Table 1: Costs and Returns (? /kg) and Shelf life (Months) of Local Storage Systems in Benue State, Nigeria.

Local storage systems	Total output stored (kg)	Total cost of storage (?)	Total revenue (?)	Total profit (?)	Profit/ kg (?)	Return on storage investment (?)	Mean shelf life (Month)	Mean cost of storage (? /100kg)
Yam								
Barns*	1,061,480	1,064,560	58,678,520	57,613,960	54.28	55.12	7	3.72
Elevated horizontal pole**	144,000	13,000	152,500	139,500	0.97	11.73	5	27.08
Conical protective roof*	911,180	226,540	10,787,400	10,560,860	11.59	47.62	7	3.49
Cassava								
Delayed harvesting	1,269,375	7,641,940	40,718,950	33,077,010	26.06	5.33	8	9.71
Heaps and water	27,000	8,500	5,000	-3,500	-0.13	0.59	7	15.74
Sweet potatoes								
Pit	36,950	187,700	973,710	786,010	21.27	5.19	5	46.18
Storage house structure*	469,500	231,800	7,569,112.71	7,337,312.71	15.63	32.65	6	15.43
Perforated cartons	9,300	1,000	575,000	574,000	61.72	575.00	3	5.38

Source: Field survey data, 2017

* Straight line depreciation for 5 years; ** Straight line depreciation for 3 years

For cassava storage techniques, delayed harvesting technique has the highest return on storage investment (₦5.33). The implication is that for every ₦1.00 spent on utilizing delayed harvesting technique for cassava, a return of ₦5.33 is obtained. The higher return in storing cassava through delayed harvesting technique is due to the zero cost associated with this technique, as the technique entails leaving the cassava roots underground after maturity and harvesting in piecemeal when needed. According to Abass, Towo, Mukuka, Okechukwu, Ranaivoson, Tarawali and Kanju (2014), harvesting cassava roots too early results in a low yield. Furthermore, Nwaigwe, Okafor, Asonye and Nwokocha (2015) revealed that the advantage of delayed harvesting technique is that no transport cost is associated with it as the produce are only harvested as the need for consumption arises.

Furthermore, the result in Table 1 reveals that for sweet potatoes storage techniques, perforated carton has the highest return on storage investment (₦575.00). This implies that for every ₦1.00 spent on storing sweet potatoes in perforated cartons, a return of ₦575.00 is obtained. Storing sweet potatoes in perforated carton has the highest return on storage as the cartons used in such storage are easily accessible with little or no cost as well as its capacity of decreasing sprouting of the stored produce. This is corroborated by Ossom, Nxumalo and Badejo (2003) in a study on evaluating different traditional storage methods on the shelf life of sweet potato tubers in Swaziland. They reported that carton and platform methods of storing sweet potato recorded no sprouting compared to pits and bagged saw dust during 20 weeks of the experiment. Thus, perforated cartons increase the number of produce stored. Uses of pit and storage house structure are the other local storage systems for sweet potatoes identified, with return on investments of ₦5.19 and ₦32.65, and profit/kg of ₦21.27 and ₦15.63 respectively.

In terms of shelf life, perforated carton has the least mean shelf life of three (3) months, while storage house structure has a mean shelf life of six (6) months. This implies that sweet potatoes have a longer shelf life when stored in storage house structure than pits or perforated carton.

Also, the mean shelf life of storing yam in barns and conical protective roof was found to be seven (7) months while for elevated horizontal pole it was found to be five (5) months. This result implies that yam has the longer shelf life using conical protective roof and barns.The mean shelf life of cassava using delayed harvesting was found to be eight (8) months while for heap and water it was seven (7) months, implying that their mean shelf life are almost the same.

ANOVA Test for Significant Difference in Mean Cost of Local Storage Techniques

The F- value of the ANOVA test in Table 2 shows a significant difference at 1% in the mean cost of the local storage techniques for sweet potatoes but insignificant for yam and cassava. The pit has the highest mean cost while the least cost method for storing sweet potato was the storage carton technique. The high cost is attributed to the expenses made on the

chemical used in preserving the stored produce. This result contradicts the findings of (Awojobi, 2004) who reported in his work that the pit storage method is the cheapest to use.

Table 2: ANOVA Test for Significant Difference in Mean Cost of Local Storage Techniques

Items	Sweet potatoes	Yam	Cassava
Between groups sum of squares	2.453E10	1.781E9	2.744E10
Within groups sum of squares	3.483E10	2.608E12	1.722E13
Total sum of squares	5.936E10	2.610E12	1.725E13
Between groups degree of freedom	2	3	1
Within groups degree of freedom	26	166	62
Total degree of freedom	28	169	63
Between group mean square	1.226E10	5.936E8	2.744E10
Within group mean square	1.340E9	1.571E10	2.778E11
F – value	9.154***	0.038^{NS}	0.099^{NS}

Source : Field survey data, 2017

***** Significant at 1%, NS = Not significant**

ANOVA Test for Significant Difference in Mean Shelf Life of Local Storage Technique

The F- value of the ANOVA test shows that there was no significant difference in the mean shelf life of the local storage techniques used for sweet potatoes, yam and cassava in (Table 3). Most of the produce stored with the techniques used has a shelf life of 3 – 6 months. This contradicts the findings of Oloayemi, Adegbola, Bamishaiye and Awagu (2011) in a study on assessment of post harvest losses of selected crops in eight LGAs of Rivers State, Nigeria, which revealed that storage for root and tuber crops ranges from 1- 4 months.

Table 3: ANOVA Test for Significant Difference in Mean Shelf Life of Local Storage Technique

Items	Sweet potatoes	Yam	Cassava
Between groups sum of squares	0.108	0.040	0.001
Within groups sum of squares	0.592	5.727	4.796
Total sum of squares	0.700	5.767	4.797
Between groups degree of freedom	2	2	1
Within groups degree of freedom	22	141	53
Total degree of freedom	24	143	54
Between group mean square	0.054	0.020	0.001
Within group mean square	0.027	0.041	0.090
F – value	2.017^{NS}	0.492^{NS}	0.011^{NS}

Source : Field survey data, 2017

NS = Not significant

Conclusion and Recommendations

Evidence from the study reveals that barns, delayed harvesting technique, and perforated carton have the highest return on storage investment per kg for yam, cassava, and sweet potato respectively. In terms of shelf life, sweet potato, yam, and cassava have a longer shelf life when stored in storage house structure, conical protective roof and barns, heaps and water respectively.

The study also reveals a significant difference in the mean cost of the local storage techniques for sweet potatoes but insignificant difference for yam and cassava, with pit having the highest cost when used to store sweet potatoes, while the least cost method is the storage carton technique. The results further reveal insignificant difference in the mean shelf life of the local storage techniques used for sweet potatoes, yam and cassava respectively.

On the basis of these findings, it was recommended that workshops should be organized in collaboration with local government extension staff to educate the root and tuber producers on the most effective storage techniques for their produce, while effort aimed at improving the effectiveness of the already existing root and tuber crop s storage techniques using locally sourced materials should be encouraged.

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