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ASSESSMENT OF THE INDIGENOUS KNOWLEDGE OF FARMERS ON POST-HARVEST STORAGE OF TOMATO IN JIGAWA STATE, NIGERIA

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ABSTRACT:
The study assessed farmers' indigenous knowledge on post-harvest handling/storage of tomato in Jigawa State, Nigeria. One hundred and twenty (120) respondents were randomly selected for the study. Most of the respondents were males (90.0%), Muslims (95.9%), married (89.2%), with average age of 34 years, average household size of 9 persons and farm size of 4.2ha. Average monthly income and farming experience were N26, 075.00 and 13 years. About 40% had no formal education (40.0%) while only 10.0% had primary, secondary or tertiary education respectively and most (84.2%) of the respondents had no extension contact. The highly practiced indigenous knowledge on tomato post-harvest handling/storage were; selective picking (M=1.017), dry within homestead (M=1.050) and spreading on sand free surface for drying (M=1.067) among others. Major constraints to post-harvest storage are; inadequate capital, government policies, inadequate infrastructures (M=3.78) and lack of equipments (M=3.70) and lack of current technologies on post-harvest storage (M=3.67). The Chi-square analysis shows significance between farming experience and household size with the indigenous knowledge on post-harvest storage of tomato. It was recommended that government should incorporate policies that would be focused on post-harvest storage to reduce wastage of the product in the national policy document, improved and adoptable technologies that are simple, cheap and compactable with the socio-cultural background of the farmers must be in place and extension should be employed to provide up to date technologies on post-harvest handling/storage of tomato to the respondents.

Keywords: Assessment, Indigenous, Post-Harvest, Storage, Farmer

INTRODUCTION

Fruits and vegetables contribute an immeasurable value to human diet because of their richness in vitamins (such as vitamins A and C), protein, minerals, and fiber. Tomato is one of such that has a very high economic importance to human diet and is the most popular and widely grown vegetable in the world (Asare *et.al*, 2017). Tomatoes contribute to a healthy, well-balanced diet, as they are rich in minerals, vitamins, essential amino acids, sugars, dietary fibres, vitamin B and C, iron and phosphorus (Agbo, *et.al*, 2013). They also aid in providing food variety and are particularly said to be important to the diet when eaten with little meat. But it is sad to note that many developing countries of Africa, such as Nigeria, though richly blessed in agricultural resources, have acute fruits and vegetable shortages - thus cannot met up with the food and nutrition requirements of the citizenry - due to improper post-harvest management of these fruits and vegetables (Sambo *et.al*, 2016). According to Ugonna *et.al* (2015), tomato as a vegetable belongs to the Solanaceae family (Solanum lycopersycum L), is one of the most important vegetables worldwide. It is a relatively short duration crop, high yielding under good management conditions and economically attractive. It can be processed into different products including; Ketchup, puree, powder and juice as can be seen in the establishment of Dangote

Tomato processing Industry along Kaduna Kano express way. Nigeria ranks as the 16th largest tomato producing nation in the world and has the comparative advantage and potential to lead the world in tomato production and exports (Yusuf, 2013).

The processing and storage of tomato in order to prolong the shelf life of the crop is a very important concern due to the fact that different crop has varying degree or extent of perish ability. Most rural farmers achieves this mostly through their indigenous knowledge on agriculture since the effectiveness and efficiency of the extension agents seemed not to be adequate in knowledge transfer from research to the clientele. Indigenous knowledge is local knowledge unique to a given culture or society. Indigenous Technical Knowledge (ITK) has immense potential for innovation, especially at the grassroots level. Many of these knowledge and technologies are at par with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies have played a significant role in the overall socio-economic development of the communities. A study on some of the aboriginal knowledge and technologies, with special reference to the concept of Indigenous Technical Knowledge (ITK), prevalent among a number of indigenous communities was carried out in the past and the significance of the same in innovation has been evaluated in order to compare its significance with modern technology in solving agricultural problems (Singh, 2013).

The first Agriculture Medium Term Sector Strategy-MTSS was prepared in 2011 for 2012-2014, and was subsequently rolled over to 2014 – 2015 in Nigeria. This was done with a view to discovering the general knowledge of keeping vegetables especially tomato. This was the second rollover of the Agriculture MTSS in Jigawa State northwest Nigeria as one of the high potential areas where tomato is mostly cultivated. In August 2013, the third rollover was undertaken for 2014-2016 and the ultimate goal is to look at the value chain addition to the production of some perishable vegetable in which case tomato is among the prime target of the crops (MTSS, 2016). For tomato in particular, a number of State governments and private companies is currently investing in area of product post-harvest handling, processing, preservation and storage. The success of these ventures requires critical appraisal of tomato in order to remove barriers to production, processing, storage, marketing and distribution of the product. Such studies have been done in Nigeria for potato, Shea, spices and cashew. Related studies on tomato in Nigeria were reported by Federal Ministry of Agriculture and Rural Development (FMARD), (2014) and Adegbola *et.al*, (2012) and in too by Kenya by Sigei *et al* (2014). Not much published work is available on value chain analysis and effective post-harvest handling of tomato in Nigeria (Ugonna *et.al*, 2015). The general objective of the study is to assess the indigenous knowledge of farmers on post-harvest storage of tomato in Jigawa State, Nigeria. The specific objectives are to:

1. Describe the socio-economic characteristics of the tomato farmers in the study area.
2. Examine the available perceived indigenous technical knowledge (ITK) on post-harvest storage of tomato.
3. Examine the constraints of the tomato farmers on post-harvest storage

METHODOLOGY:

Study Area;

The study was conducted in Jigawa State Nigeria. The population for the study was mainly all the tomato farmers in the state. Jigawa State is one of thirty six states that constitute Federal Republic of Nigeria. It is situated in the north-western part of the country between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E.The state has a total land area of approximately 22,410 square kilometers with twenty seven (27) Local Government (National Population Commission, NPC,2006). The topography is characterized by high land areas which is almost 750meters above sea level. Soil tends to be fertile ranging from sandy-loamy with many pockets of fadama and alluvial plains suitable for the cultivation of rice, sugar-cane, millet, vegetables and sorghum etc. The state share common boundaries with four states (3) states (Kano, Bauchi Katsina and Yobe)Niger Republic. There are usually two seasons in the state viz the rainy season lasting from June through October and dry season spanning from November to May. The mean annual temperature ranges from 35°c in October to about 50°c in May, while mean annual rainfall varies from 700mm to over 1000mm and can last up to 200days in some lowland parts of the state. Jigawa state is predominantly an Agrarian state with over 80% of the population involved in Agriculture. The major rain fed crops grown in the state includes millet, sorghum, cowpea, groundnut, cocoyam, soya beans. Dry crops include sugarcane, Hot pepper, okra, tomatoes, onions and spinach (MTSS, 2016). The major livestocks kept in

the state includes, small ruminants (sheep and goat), poultry, cattle etc. The Hadejia-Nguru river has the largest fadama area in Nigeria. Jigawa state is divided into four Agricultural Development Program (ADP) Zones 1, 2, 3 and 4

- Zone 1. With headquarters in Brinin kudu comprises of Dutse, Kiyawa, Jahun, Buji, Brinikudu, Gwaram, and Miga.
- Zone 2. With headquarters in Gumel comprises of Gumel, Maigatari, Ringim, Taura, Gagarawa.
- Zone 3. With headquarters in Hadejia comprises of Briniuwa, Kirikasamma, Kafin-Hause, Auyo, Guri, Malamadori, Kaugama, Hadejia.
- Zone 4. With headquarter in Kazaure comprises of Kazaure, Yankwashi, Gwiwa, Roni, Suletankarkar, Babura, Garki.

Data Collection:

The population for the study comprised of all the tomato farmers in the state as the sample unit. A multi-stage (three stage) sample technique was employed for the study. The first stage, was a random selection of two Local Government area from each of the ADP Zones as follows: Zone 1; Dutse and Kiyawa, Zone 2; Gumel and Ringim, Zone 3; Kafi-Hausa and Hadejia and Zone 4; Kazaure and Babura respectively. The second stage was a random selection of four communities each from the Government area selected. The third stage was also the random selection of fifteen farmers from each of the communities (based on the list of registered farmers obtained from the Jigawa Ministry of Agriculture) to give a sample size of 120 respondents for the research. The statistical analyses employed are descriptive statistics (percentages mean, frequency counts, standard deviation), Likert Type Scale and inferential statistics (chi-square).

Results and Discussion:

Table 1: Socioeconomic Characteristics of the Tomato Farmers

As depicted in Table 1, on socioeconomic characteristics of the respondents, most (95.8%) of the respondents were within the ages of 31-50 years (M=34years). This suggests that respondents were very much in their active productive age range. This is similar to the findings of Bello *et al*. (2016); Ehien, *et.al*, (2017); Ibitoye (2013) and Apantaku (2016) who observed the average age of farmers involved in agriculture in Jigawa State to be 33.5 years and that of tomato farmers in Ghana are in a range of 30-59 years. Majority of the respondents are males (90.0%) married (89.2%). Marriage confers responsibility according to Vogelstein (2013) and Akinbile (2007). The average farming experience was 12.8years meaning that majority has experience in tomato production. It has been reported that farmers' experience in farming count more than educational attainment in order to increase productivity (Apantaku *et.al*, 2016). Asare *et. al.*, (2017) also stated that apart from the formal education being a source of information to farmers, experience in farming or number of years in farming can also serve as a means through which farmers get information. Majorities were Muslims (95.9%) and had no formal education (40.0%), while only 10.0% were having either Primary, Secondary or Tertiary education respectively. This is in line with the findings of Asare *et. al.*, (2015) that the level of education of tomato farmers in Ghana was low. Average monthly income is N26, 075=00; an average household size is 9 persons and mean farm size is 4.2ha. This implies that they are smallholder farmers. This is in line with the findings of Afari-Sefa *et. al*., (2015) that the majority of vegetable farmers in the Western and Ashanti regions of Ghana have small farm holdings, ranging from less than 0.4ha up to 4.0ha. Also Ajagbe *et.al*, (2014) agreed that most of the vegetable farmers in Abeokuta Ogun State, Nigeria are small holders with about 3.5ha. There is no presence of extension contact in the study area (84.2%). This implies that current practices and innovation may be far from the reach of the respondents in the study area.

Table 1: Distribution of the respondents based on socioeconomic characteristics of the tomato Farmers

Variables	Frequency	Percentage	Mean (X) ± S.D
Age (Years)			
≤ 20	2	1.7	33.5 ±6.24
31-40	25	20.8	
41-50	90	75.0	
51-60	2	1.6	
≥ 61	1	0.8	
Sex			
Male	108	90.0	
Female	12	10.0	
Marital Status			
Singled	11	9.2	
Married	107	89.2	
Widowed	1	0.8	
Divorced	1	0.8	
Farming Experience (Years)			
1-5	7	5.8	12.8±2.9
6-10	10	8.3	
11-15	89	74.3	
16-20	13	10.8	
≥ 21	1	0.8	
Educational Qualification			
No Formal Education	48	40.0	
Primary Education	7	5.8	
Secondary Education	3	2.5	
Tertiary Education	2	1.7	
Islamic Education	60	50.0	
Average Monthly Income (N)			
1-10,000	2	1.7	N26,075±5,845.78
11,000-20,000	5	4.2	
21,000-30,000	102	85.0	
31,000-40,000	7	5.8	
41,000-50,000	3	2.5	
≥ 51,000	1	0.8	
Farm Size (Ha)			
1-5	96	80.0	4.2 ± 1.5
6-10	20	16.7	
11-15	3	2.5	
≥ 16	1	0.8	
Household Size (Person)			
1-5	6	5.0	8.9 ± 2.9
6-10	91	75.8	
11-15	22	18.3	
≥ 16	1	0.9	
Presence of Extension			
Yes	19	15.8	
No	101	84.2	

Source: Field Survey, 2018

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The Respondents' Indigenous Technical Knowledge on Tomato Storage and Preservation

As depicted in Table 2, the respondents indigenous technical knowledge on post-harvest storage was measured using a three (3) point likert type scale of 1-3; highly practiced (HP), undecided (U) and Not practiced (NP) with value 1, 2 and 3 respectively. Mean value of 2 and below indicates highly practiced while values above the mean value indicates not practiced. The most practiced indigenous post-harvest knowledge on tomato storage by the respondents was selective picking on the field to remove damaged and infected

tomato (M=1.017) as these are the vulnerable carriers of deteriorative pathogens. The next was drying within their residence to keep away birds and other pests (M=1.050). They also practiced spreading of tomato on a sand free surfaces to allow free passage of fresh air (M=1.067). Spreading on mats made from fibre to avoid heat buildup on the tomato is another option mostly used in the study area (M=1.075). Then followed again by bagging into big sized sacks after storage moisture content is attained (M=1.083). Provision of adequate ventilation, temperature/humidity during storage (M=1.100) and slicing for drying under sunlight (91.7%, X=3.58) to expose the internal content to solar drying in order to deactivate any microbial infestation were also mostly used in the study area. Significant proportion of the respondents (81.7%, X=3.14) resorted to quick selling immediately after harvesting, Staking the bagged of tomato on per let free from the floor and wall are done to avoid growth of microbes that may possibly survive previous methods (M=1.267) and finally fairly among the respondents practiced quick selling after harvesting to keep away post harvest losses completely although this would be at the disadvantage of the respondent as lower prices would be offered (M=1.558). This implies that the respondents mostly used all the identified means to prevent their tomato from post-harvest spoilage and wastage and to prolong the shelf life of the tomato. This is in line with the work of Muhammed *et. al.*, (2012) who reported that farmers are availed with a lot of indigenous technical knowledge on the post-harvest technologies of fruits and vegetables in Kano State, Nigeria.

Table 2: The Respondents' Indigenous Technical Knowledge on Tomato Post-Harvest Handling for Storage.

Variables	HP	U	NP	Mean (X)	Ranking
Slicing to expose the inside for drying to reduce moisture and microbial infestation	111	5	4	1.108	7th
Spreading on a sand free surface to allow fresh air passage.	114	4	2	1.067	3rd
Spreading on mat made of fibre to avoid heat buildup on the tomato	111	9	0	1.075	4th
Quick selling to customers after harvesting to reduce post-harvest losses during storage.	98	37	15	1.558	9th
Bagging into 100kg sacks when the required moisture content is attained	114	2	4	1.083	5th
Staking on pellets free from floor and wall to avoid growth of microbes	68	12	10	1.267	8th
Provision of adequate ventilation, temperature and humidity during storage using personal initiatives	110	8	2	1.100	6th
Selective picking on the field after harvesting and store to remove damaged and infected tomato pods	118	2	0	1.017	1st
Drying within their abode to keep away pest and birds	115	4	1	1.050	2nd

Source: Field Survey, 2018. The Knowledge was measured on a mean scale of Highly Practiced (HP=1), Undecided (U=2) and Not Practiced (NP=3), Mean X=2. Values below 2 is very practiced while above is not practiced.

The Respondents' Constraints to Tomato Post-Harvest Storage

Table 3 presents array of constraints facing the respondents on the post-harvest handling and storage of tomato, but interestingly the most among them are; lack of capital, infrastructural problem of electricity and government policies on tomato which has not been firmly directed toward post-harvest handling and storage of tomato (M=3.78), followed by lack of storage and processing equipment (M=3.70) with lack of current technologies for storage of tomato (M=3.67). Since majority of the respondents were not educated and exposed as seen in their degree of Cosmo-politeness (M=3.63), ability to take new ideas and innovations would be very difficult. Extension services delivery is also scarce in the study area (X=3.11) and this is the major medium where improved practices could get to the respondents. This is in line with the submission of Isaac, *et.al*. (2016); Achoja and Okoh (2013) on constraints to post-harvest practices on tomato in developing countries. While lack of effective and sustainable market outlets (M=2.30) where they can sell tomato at reasonable prices, transportation bottleneck (M=2.17) probably due to bad road networks and finally lack of improved and resistant varieties better than the existing local varieties of tomato (M=1.77) were not seen as a major challenge by the farmers since the local varieties being planted is acceptable in the market all year round.

Table 3: The Respondents' Constraints to Tomato Post-Harvest Storage

Variables	Mean(X)	Ranking
Lack of storage equipment	3.70	2nd
Lack of Capital for storage	3.78	1st
Lack of current technologies for post-harvest storage	3.67	3rd
Dearth of extension service delivery	3.11	5th
Lack of improved and resistant varieties of tomato	1.77	8th
Lack of transportation facilities	2.17	7th
Lack effective and efficient market system	2.30	6th
Government policies	3.78	1st
Lack of education and Cosmo-politeness of the farmers	3.63	4th
Lack of Infrastructural facility like electricity	3.78	1st

Source: Field Survey, 2018. Mean Value of ≥ 2.5-3.0 indicates serious constraints while ≤ 2.4 indicates not serious.

Chi-square Analysis between the Socio-economic Characteristics and the Indigenous Knowledge on Post-Harvest of Tomato

It can be seen from Table 4 that only farming experience and household size showed positive relationship with the respondents' indigenous knowledge on tomato post-harvest storage. The implication of this is that the higher the farming experience and household size, the higher the respondents' seeks for more indigenous knowledge on post-harvest storage of tomato in the study area. The higher the household size the more the available man power to implement the indigenous technical knowledge on post-harvest storage of tomato. Finally the higher the farming experiences the more the respondents are abreast of more indigenous knowledge to tackle storage of tomato. Agbo *et al.*, (2015) and Umunna (2010), in the same opinion also agreed that household size, off-farm income and farming experience had significant relationship with storage and preservation knowledge of crops in Owerri Agricultural Zone of Imo State, Nigeria.

Table 4: Chi-square Analysis between the Socio-economic Characteristics and the Indigenous Knowledge on Post-Harvest Storage of Tomato

Variables	X2-value	d.f	P-value	Remarks
Average Monthly Income	0.311	5	0.232	Not Significant
Educational Qualification	0.211	4	0.317	Not Significant
Household Size	0.198 *	3	0.011	Significant
Farming Experience	0.246 *	4	0.029	Significant
Age	-0.109	3	0.657	Not Significant
Marital Status	-0.213	3	0.511	Not Significant

Source: Field Survey, 2018 P≤ 0.05

CONCLUSION

Based on the findings of the research the following conclusions can be inferred; the most common indigenous post-harvest storage of tomato used by the respondents were; Selective picking on the field after harvesting and store to remove damaged and infected tomato pods, drying at the homestead away from birds and insects and spreading on a sand free surface to allow fresh air passage among others, while major constraint were lack of capital, government policy and infrastructural problem (X=3.78) to storage and preservation equipment (X=3.70).

RECOMMENDATIONS

The following recommendations were made in line with the study:

1. Because there was no improved tomato post-harvest storage technologies in the study area more extension agent, solving matter specialist should be employed to bridge the farmers and extension agent ratio to aid spread of research findings to clientele.
2. The indigenous technical knowledge is only option used by the respondents and as such government should explore ways into this

indigenous technical knowledge with a view to improving and making them better.

3. Improved technologies that are simple, cheap and compactable with the socio-cultural background of the farmers must be in place. It should be supported with constant advisory services program through the ADP extension harm.
4. Government should incorporate policies that would be focused on post-harvest storage of crops like tomato in the national policy document to reduce wastage.

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