



CAPACITY BUILDING NEEDS OF FARMERS ON POST HARVEST STORAGE OF TOMATO IN JIGAWA STATE, NIGERIA

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ABSTRACT

The study examined the information needs of farmers on post-harvest storage of tomato in Jigawa State, Nigeria. A total of one hundred and 120 tomato farmers were interviewed for the purpose of eliciting information through a 4-stage sampling procedure. Majority (75.0%) of the respondents were males (90.0%), married (89.2%), Muslims (95.9%) with Islamic education (50.0%). The respondents' average ($\bar{x}$): household size is 9 persons, farm size of 1.6ha, monthly income of ₦30,916.67 and age of 41.6 years. Primary occupation of the majority is farming (96.7%) with mean farming experience of 13 years. Main source of labor is family labor (86.7%). Greater proportions source their funds through personal savings (77.5%). Land ownership is through inheritance (66.7%) and no extension service involvement (97.5%). The most needed information on post-harvest storage is lack of current information, techniques for record keeping and sustainable market (100.0%, $\bar{x} = 3.50$), respectively. They were only aware of post-harvest storage like basket cooling (91.7%), sorting and grading (80.8%) and refrigeration storage (59.2%) among others while severe constraints were: lack of capital for post-harvest activities, government policy and infrastructure (99.2%, $\bar{x} = 3.78$). The result of the Pearson Correlation showed positive relationship with educational level, household size, average monthly income and farming experience. The research recommended the recruitment of more competent extension officers for more farmers' contact, structured and focused government policies on tomato post-harvest practices and periodic training of farmers.

Keywords: Capacity building, Farmers, Jigawa, Post-harvest, Storage, Tomato.

INTRODUCTION

Agriculture remains the main dependable option for the Nigeria economy as it provides all the industrial raw materials, employment opportunities and food for the ever-increasing population of human both in the rural and urban settlement all over Africa (Bello, *et al.*, 2016; Yusuf, 2013). Tomato is one of the most popular and widely grown vegetables globally. It is grown throughout the world, either as outdoors or indoors, because of its wide adaptability and versatility (Asgedon *et al.*, 2010). According to FMARD (2014), fruits and vegetables contribute a lot to human diet because of their richness in essential vitamins (such as vitamins A, C and D), protein, minerals, and fiber (they also aid in providing varieties and are particularly said to be important to the diet when little meat is eaten). But it is disheartened to note that in many developing countries of Africa, like Nigeria, though richly blessed in agricultural resources, yet they 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 and lack of improved current storage practices on storage (FAO, 2010; Sambo *et al.*, 2016). Tomato (*Solanum lycopersicum* L.) has been seen as one of the short life vegetable crops that suffer spoilage after harvest before reaching the final end users due lack of infrastructural facilities, experience of storage and equipment requirement (Bello *et al.*, 2016). According to Ugonna *et al.* (2015),



tomato as a vegetable belonging to the Solanaceae family, as it is one of the most important vegetables worldwide most used in all domestic households. It is relatively short duration crop, economically attractive and gives a very high yield (Agbo, 2013). Tomatoes contribute to a healthy, well-balanced diet, as they are rich in minerals, vitamins, essential amino acids, sugars, dietary fibres, iron and phosphorus (Sigei, *et al.*, 2014).

According to Hussieni (2020), lack of post harvest storage, ailing processing industries and poorly developed marketing channels are responsible for the loss of about 50 percent of the tomatoes produced in Nigeria. Also same from a research document obtained from the Raw Material Research and Development Council (RMRDC). According to the document in the Daily trust, a recent analysis of the importation of tomatoes and tomato products from 2010 to 2015 carried out by the Council using data obtained from the Nigerian Customs Service (NCS) database, it revealed that between 2010 and 2015, Nigeria spent ₦141.08 billion to import tomato and tomato products. This was at the expense of the local production due to wastage from post harvest storage inefficiency. Of this amount, tomato paste ready to use (finished or canned tomato paste) accounted for 70.1% of total imports amounting to ₦98.93 billion. This was followed by tomato pastes or concentrates that are not retail (i.e., not ready for use or semi-finished product) amounting to ₦31.98 billion (22.7%). In essence, the finished and semi-finished tomato products accounted for 92.8% (₦130 billion) of imports within the period reviewed.

The importation of triple concentrate tomato which is the major raw material for the production of tin or can tomatoes in 2015 alone was about 553,715.12 tons which amounted to ₦4.41 billion while that of ketchup and other sauces between 2010 and 2014 was over ₦2.96 billion (or USD 14.82 million) for 8,333 tons. This importation can be reduced if sustainable solution is given to post harvest storage of tomato in Nigeria. According to Freshplaza (2020), without adequate post harvest storage facilities and an efficient means of transporting them to the markets, about 45% of harvested tomatoes go to waste. This Africa's most populous country imports about 1.3 million tons of the red vegetable to fill the gap, mostly from China and other parts of Asia. Nigeria is the third largest importer of this commodity in Africa. It can be processed into different by-products including: Ketchup, Puree, Powder and Juice (Olayemi *et al.*, 2012; Yusuf, 2013). Nigeria ranked 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 if better post harvest storage potential is developed and implemented by farmers (Oni and Obiakor, 2002; Olayemi *et al.*, 2012).

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 to help tomato production. 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 the country (Bello, 2015). 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 crops like 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 are currently investing in areas of product post harvest handling, processing 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 (Jamieson, 1981; FAO, 2010). Such studies have been done in Nigeria for crops like Potato, Shea, Spices and Cashew (FMARD, 2014). Related studies on tomato in Nigeria were reported by Abba and Musa (2004), Adegbola *et al.* (2012) as well as Sigei *et al.* (2014) in Kenya. Not much published work is available on post harvest storage and handling of



tomato in Nigeria making economic wastage proportion on the highest level (Ugonna *et al.*, 2015). The general objective of the study is to assess the information needs of farmers on post-harvest storage of tomato in Jigawa State, Nigeria. The specific objectives were to:

- vi. describe the socioeconomic characteristics of the tomato farmers in the study area;
- vii. identify the respondents' information needs on post harvest storage of tomato;
- viii. examine the available technologies on post-harvest storage of tomato;
- ix. ascertain the constraints of the tomato farmers on post harvest storage of tomato;

Hypothesis: Ho₁: Some selected socioeconomic characteristics of the respondents have no significant affect on the information needs of the farmers on post harvest storage of tomato.

MATERIALS AND METHODS

The Study Area

The study was conducted in Jigawa State Nigeria. The population for the study was mainly all the tomato farmers in the state cutting across the four Agricultural Zones of state. Jigawa State is one of 36 States that constitute Federal Republic of Nigeria. It is situated in the Northwest 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 27 local governments (National Population Commission [NPC], 2006). The topography is characterized by high land areas which is almost 750 meters 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. The state shares common boundaries with three (3) States and 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 yearly. The mean temperature ranges from 35°C in October to about 50°C in May, while mean annual rainfall varies from 700 mm to over 1000 mm and can last up to 200 days 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 season crops include sugarcane, hot pepper, okra, tomatoes, onions and spinach (MTSS, 2016). The major livestock kept in the state includes, Small Ruminants (Sheep and Goat), Poultry, Cattle etc. Jigawa State is divided into four ADP Zones: 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; and Zone 4 with headquarter in Kazaure comprises of: Kazaure, Yankwashi, Gwiwa, Roni, Suletankarkar, Babura, Garki.

Sampling Procedure

The population for the study comprised of all the tomato farmers in Jigawa State, Nigeria. A multi-stage (4-stage) sample procedure was employed in the study. The first stage was a purposive selection of Jigawa State due to high population of tomato farmers and the presence of some tomato intervention programs (MTSS, 2016). The second stage, was a purposive selection of two local governments each from the four ADP Zones where production of tomato is highest as follows: Zone 1; Dutse and Kiyawa, Zone 2; Gumel and Ringim, Zone 3; Kafi-Hausa and Hadejia and Zone 4; Kazaure and Babura. The third stage was a random selection of one community each from the local government selected. The fourth stage was a random selection of fifteen tomato farmers from each of the communities to give a sample size of 120 respondents for the study. The statistical tools employed were descriptive statistics



(percentages, mean, frequency counts, standard deviation) while the inferential component was Pearson Correlation.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Tomato Farmers

The result of the socioeconomic characteristics of the respondents is depicted in Table 1. The respondents were of an average age of 41.6 years (87.5%). This suggests that respondents were very much in their active productive age range. This corroborated the findings of Bello *et al.* (2016) who observed the average age of farmers involved in groundnut processing in Jigawa State was 43.5 years. It is an active age where energy will be well dissipated for productive purpose which in this wise for tomato production. This is in line with the work of Obisesan *et.al.* (2013) who pointed out that the active age is regarded as agile age with more energy to dissipate and concentrate on productive activities.

Greater proportion (75.0%) were males, married (89.2%) with average farming experience of 13.3 years (Table 1). Marriage confers responsibility according to Vogelstein (2013) and Akinbile (2007) and they are highly experienced farmers judging from the year of tomato farming experience. The farming experience corroborates the ascertain of Nwanu (2004) that, the higher the farming experience the more the farmers would have gained more knowledge and technological ideas on how to tackle issues on tomato production problems and the higher would be their output and income.

Majority were Muslims (95.9%) with no formal education (40.0%), while only smaller proportions (10.0%) were having either Primary, Secondary or Tertiary education respectively. This is contrary to the submission of Ogunlade *et al.* (2010) who agreed that literate respondents stand a chance of understanding the general information on tomato and assisting their information seeking habits. Margaret and Samuel (2015) asserted, that increase in education of farmers positively influence adoption and utilization of improved agricultural practices. This may not be unconnected with the fact that education plays a predominant role among farmers. Amaza and Tashikalma (2003) noted that education offers the opportunities to earn better and could impact significant variation in skill acquisition and adoption of innovation. Average monthly income is ₦30,916.67 (85.0%), mean farm size is 6.6ha and household size of 13 persons (93.4%). The average monthly income from tomato seemed very low compared to other vegetables as well as current inflation rate. The high household size implies that more family labor would be available to reduce the wages spent on hired labor. This implies that tomato farmers could draw some level of family labor from their household considering their mean household size leading to reduction in the cost of labor. Family labor is considered the most important and predominant component of labor in subsistence farming in Nigeria and most part of Africa. Elizabeth and Ana (2014) declared that small scale farmers could be successful if they were married especially when they had to rely on family labor.



Table 1: Distribution of the respondents based on socioeconomic characteristics

Variables	Frequency	Percentage	$\bar{x} \pm \delta$
Age (Years)			
≤ 30	2	1.7	41.6 ± 6.45
31-40	55	45.8	
41-50	50	41.7	
51-60	12	10.0	
≥ 61	1	0.8	
Sex			
Male	90	75.0	
Female	30	25.0	
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	13.3 ± 3.65
6-10	14	11.7	
11-15	68	56.7	
16-20	30	25.0	
≥ 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 (R)			
1-10,000	4	3.3	R30,916.67 ± 175.83
11,000-20,000	7	5.8	
21,000-30,000	56	46.7	
31,000-40,000	46	38.3	
41,000-50,000	9	7.5	
≥ 51,000	2	1.7	
Farm size (ha)			
0-2	96	80.0	1.58 ± 1.21
3-4	20	16.7	
5-6	3	2.5	
≥ 6	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	

Note: $\bar{x} \pm \delta$ = Mean ± S.D Source: Field Survey, 2021



The Respondents' Information Needs on Tomato Post Harvest Storage

According to Table 2 on the capacity building needs of the tomato farmers on post harvest storage in the study area, it was found that; lack of current information on post harvest handling, techniques for record keeping of activities and sustainable market for harvested were seen as the major areas where the capacity of the tomato farmers needs to be improved (100%, $\bar{x} = 3.50$). These were followed by awareness of improved technologies that will be simple, appropriate, cost effective and compactable with the socio-cultural background of the clientele (99.2%, $\bar{x} = 3.34$). There is lack of research on varieties of tomato (97.5%, $\bar{x} = 3.31$) on tomato post-harvest storage and adequate training of the farmer on post-harvest storage (95.8%, $\bar{x} = 3.30$). Media advocacy on post harvest storage of tomato (95.0%, $\bar{x} = 3.29$) is also necessary as well as periodic information on tomato post-harvest storage (83.3%, $\bar{x} = 3.10$). Finally, provision of improved resistant varieties better than the indigenous varieties (46.7%, $\bar{x} = 1.37$) was not seen as constraints, probably due to the fact that the local varieties were well accepted in the market because opinion poll confirmed that they were not sowed to taste like other local varieties. This is in agreement with the work of Oguntuase (2019) that the information needs of tomato farmers on post harvest storage are mainly in area of improve storage technologies, training on post harvest handling and farm record keeping of activities on post harvest storage among others.

Table 2: Respondents based on Information Needs on Tomato Post Harvest Storage

Variables	Frequency	Percentage	Mean ($\bar{x}$)	Ranking
Media Advocacy on post harvest storage of tomato	114	95.0	3.29	5 th
Advisory services from ADP on post harvest storage	115	95.8	3.30	4 th
Awareness of improved technologies on post harvest storage	119	99.2	3.34	2 nd
Provision of Improved disease resistant variety	56	46.7	1.37	7 th
Information Flow on post harvest Storage and Market	100	83.3	3.10	6 th
Lack of research on tomato, e.g., GM tomato	117	97.5	3.31	3 rd
Sustainable market for harvested tomato	120	100	3.50	1 st
techniques of record keeping of activities	120	100	3.50	1 st
Lack of current information on post-harvest handling	120	100	3.50	1 st

Source: Field Survey, 2021

The Respondents' Available Post Harvest Technologies on Storage of Tomato

As depicted in Table 3 on the respondents' available posts harvest technologies on storage of tomato. The variables were analyzed using a binomial scale of yes or no against some technologies in the storage of tomato. Post harvest quality of tomato cannot be enhanced by any technology but it can be maintained to increase shelf-life. As far as tomato is concerned all effort on post harvest losses is geared towards reduction of Ethylene production from damaging fruits and diseases fruits which can affect adjacent fruits (Issac *et al.*, 2016). It shows that, the respondents were mostly familiar with evaporative cooling method using basket alone after harvesting of tomato (91.7%). This is because most of the farmers prefer the packing of their tomato inside basket of various sizes. They are aware of Sorting and Grading practices (80.8%), Refrigeration Storage (59.2%) and Cleaning and Disinfecting (56.7%) respectively. This is because grading is a simple practice in most rural communities as it does not require



specialized training. Cleaning and disinfecting are a proper hygiene practices because food illnesses, post harvest diseases like Salmonella, Cryptosporidium, Cyclospora and Hepatitis A virus emanating from fruits to human. This may not be done a time due to lack of water and ignorance of the farmers. The refrigeration storage helps to reduce nonappearance of quality attributes like texture, nutrition, aroma and flavor at 10-15°C and relative humidity of 85-95% (Issac *et al.*, 2016). They were also aware of Pre-cooling practices (55.8%) which may be as a result of packing the tomato inside basket and putting them under shed at good temperature. Other practices such as post harvest treatment (32.5%), packaging (26.7%), transportation in refrigerated trucks (24.2%), use of MAP (14.2%), CaCl₂ (12.5%), Warehousing (10.0%), Controlled Atmosphere and Hermetic Technology (7.5%) were not within the knowledge of the tomato farmers in the study area. This is in line with the submission of Hussieni (2020) that most of the tomato farmers were not aware of current post harvest technologies on tomato.

Table 3: Respondents based on Available Post Harvest Technologies on Tomato Storage

Variables	Frequency	Percentage	Ranking
Evaporative cool system woven jute sack or basket	110	91.7	1 st
Sorting & grading	97	80.8	2 nd
Refrigeration storage	71	59.2	3 rd
Cleaning and disinfection	68	56.7	4 th
Pre-cooling practices	67	55.8	5 th
Post-harvest treatment	39	32.5	6 th
Packaging practices	32	26.7	7 th
Transportation in refrigerated trucks	29	24.2	8 th
Use of 1-methycyclopropene (1-mcp)	17	14.2	9 th
Use of calcium chloride (cacl ₂)	15	12.5	10 th
Underground storage	12	10.0	11 th
Warehouses Method	12	10.0	11 th
Modified atmospheric packaging (map)	09	7.5	12 th
Controlled atmosphere	09	7.5	12 th
Hermetic technology	09	7.5	12 th

Source: Field Survey, 2021

The Respondents' Constraints to Tomato Post Harvest Storage

Table 4 shows the constraints of the tomato farmers on the post harvest storage of tomato in the study area. It shows among the array of constraints facing the respondents on post harvest storage of tomato that: lack of capital, lack of infrastructural and government policies on tomato post harvesting were the most severe constraints of the tomato farmers (99.2%, $\bar{x}$ = 3.78). Following closely to these is lack of storage, resources and processing equipment (98.3%, $\bar{x}$ = 3.70) as well as dearth of current technologies on post harvest storage of tomato (95.8%, $\bar{x}$ = 3.67). Since majority of the respondents were none literate (95.8%, $\bar{x}$ = 3.63), their ability to take new ideas and innovations may be hampered.



Table 4: Respondents based on Constraints to Post Harvest Storage of Tomato

Variables	Frequency	Percentage	Mean ($\bar{x}$)	Ranking
Infrastructural facility like electricity, roads etc.	119	99.2	3.78	1 st
Lack of Capital for post-harvest activities	119	99.2	3.78	1 st
Government policies	119	99.2	3.78	1 st
Lack of storage resources/equipment	118	98.3	3.70	2 nd
Lack of current technologies on post-harvest storage	115	95.8	3.67	3 rd
Low Literacy level	115	95.8	3.63	4 th
Dearth of extension service delivery among respondents	106	88.3	3.11	5 th
Effective and efficient market system	100	83.3	3.02	6 th
Transportation facilities	98	81.7	2.99	7 th
Lack of improved and resistant varieties of tomato	43	35.8	0.77	8 th

Source: Field Survey, 2021.

Table 4 reveals that extension services delivery is also not available to the clientele in the study area (88.3%, $\bar{x} = 3.11$), as well as lack of effective and sustainable market outlets for tomato (83.3%, $\bar{x} = 3.02$) so that they can sell tomato at reasonable prices. Transportation issues abound in most of the production places (81.9%, $\bar{x} = 2.99$) probably due to bad road networks (most farmers use bull-cat) and finally lack of improved resistant varieties over the existing local varieties of tomato (35.8%, $\bar{x} = 0.77$), although this is not seen as a major challenge by the farmers since the local varieties being planted is acceptable in the market at all year round. This in support of the findings of Asgedon *et al.* (2010), that the major constraints to post harvest storage of tomato are lack of infrastructure, capital, equipment and low literacy level of the tomato farmers.

Test of Relationship Between Selected Socio-economic Characteristics of the Respondents and their Information Needs on Tomato Post Harvest Storage

Table 5, shows the result of the Pearson Correlation analysis between some selected socioeconomic characteristics of the tomato farmers and their information needs on post harvest storage of tomato. Only educational level ($r = 0.977$, $p = 0.041$), household size ($r = 0.803$, $p = 0.032$), average monthly income ($r = 1.051$, $p = 0.017$) and farming experience ($r = 0.988$, $p = 0.047$) were positively related to the respondents' information needs on tomato post harvest storage at $p \leq 5\%$. The null hypothesis is therefore rejected. This implies that the higher the educational level, average monthly income, farming experience and household size the higher the information needs on post harvest storage of tomato. This is because educational level paves way for more understanding of the techniques introduced, average monthly income pave way for more financial power for implementation of post harvest storage techniques, farming experience pave way for better understanding of the need for post harvest storage while household size paves way for more cheap and easy labor for needed for post harvest storage. This is in line with the findings of Sharada (1999), who opined that there is great scope for increasing productivity and understanding through higher levels of formal schooling, despite the traditional nature of rural farming. He further stated that formal education is thought to be particularly important in terms of enhancing the spread of innovations and helping to extend



the limit of the frontier including outputs. Agbo *et al.* (2015) and Umanna (2010), in the same opinion also agreed that education, farm income and farming experience had significant relationship on farmers' information needs on productivity, storage knowledge and handling in Nigeria. Debashis and Kanungo (2016) posited that a good number of socioeconomic variables such as educational level, average income etc. had positive significant impact on the information needs of farmers regarding various production related technologies in agriculture. Age and gender were not significant at $p \leq 0.05$.

Table 5: Relationship between Some Selected Socioeconomic Characteristics of the Respondents and their Information Needs on Tomato Post Harvest Storage

Variables	Coefficient (r)	P- value
Gender	-0.363	0.351
Age	0.947	0.406
Educational Level	0.947*	0.041
Household Size	0.803*	0.032
Average Monthly Income	1.051*	0.017
Farm Size	-0.327	0.638
Farming Experience	0.988*	0.047

Correlation Significant, 5%*

Source: Field Survey, 2021.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the research the following conclusions can be inferred; major information gap on tomato post harvest storage is; lack of current information, techniques for record keeping and sustainable market ($\bar{x} = 3.50$) as well as awareness of improved techniques on post-harvest storage ($\bar{x} = 3.34$). Major constraints were; lack of research ($\bar{x} = 3.31$) and inadequate training ($\bar{x} = 3.30$) while major constraint was lack of capital, government policy and infrastructural problem ($\bar{x} = 3.78$) as well as post harvest storage equipment ($\bar{x} = 3.70$). The following recommendations were proffered in line with the study:

1. Areas of information needs of the farmers on post harvest technology on tomato should be addressed and provided
2. Most of the improved tomato post harvest storage technologies were not available and not practiced by the respondents in the study area. So, capacity building is needed through the State ADP Office, NGOs and Agricultural Development Partners to help train the tomato farmers on improved post harvest storage technologies to avoid economic wastage of this perishable crop.
3. Improved and adoptable post harvest technologies that are simple, cheap and compactable with the culture of the farmers must be in place plus constant and continuous advisory services program through the ADP extension team to help train the farmers with improved post harvest storage methods as well as engaging more extension personnel to better the farmers to extension agent ratio and relationship in the study area.
4. Government should incorporate policies that will focus tomato post harvest storage to reduce wastage of the product in the national policy document as well as infrastructures development.



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