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Research Article

EFFECT OF FUNGAL INFECTION ON THE QUALITY AND PALATABILITY TEST OF ONION BULBS

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ABSTRACT
Experiment was carried out using five different onion varieties on sale at Tarauni and Sabon gari market, to determine the effect of fungal infection on the quality and palatability test of the onion bulb. The study spans the period between September to January, 2016. During the study a total of 141 colonies were isolated from both Sabon gari and Tarauni market which comprises of *A. niger, A. flavus, Rhizopus stolonifer* and *C. albican.* The colonies have the following composition *A. niger* 26 (38.2%), *A. flavus 8 (*11.7%), *Rhizopus stolonifer* 19 (27.9%) and *C. albican* 15 (22.2%). More colonies were recorded at Tarauni 72 (51.1%) than Sabo gari market 69 (48.9%). Also at the end of the study the onions which were kept at room condition of 4.5 $\pm$ 2.5^{o}C and 69.5 $\pm$ 18.5 % RH 38% appeared physically acceptable though organoleptic assessment revealed loss of aroma, flavour and fibrous nature of the onions. Ex-Gayanawa stored better with 54% loss, while Composite – 4 stored least with 70% loss.

***Keywords*:** *Onion, Fungi, Tarauni, Sabon Gari*

INTRODUCTION
The onion is a subspecies and member of the genus *Allium* (Wonneke, 1989). Because many *Allium* species share the common name onion, the "garden onion"- is referred to as the "bulb onion" and "shallot"- is referred to as *Allium Cepa.* The plant's name comes from Latin *Union,* or *Annianus,* and is associated with the Welsh *einion*, meaning "anvil" (Jones *et al.,* 1963). The onion plant *(Allium cepa),* is a biennial crop but usually grown as an annual. The plant grows to a height of 15 to 45cm (6 to 18inches). It is freshly, hallow and cylindrical with one flatten side, as the onion mature food reserve begin to accumulate in the leaf bases and the bulb of the onion swells (Opadokun, 2000).
Onion where originally native to central Asia, but today has a worldwide geographic range. They made their way to Egypt via trade where they became a crucial food plant in the ancient world. Because onion were a cheap source of food, Egyptian, slave laborers, those who constructed the pyramids, consumed them on a daily basis (Dogondaji *et al.,* 2005).
The onion (*Allium Cepa*) is an important vegetable crop in Nigeria. It is used as source of food and cash. (Grierson and Kader, 1986). The crop is grown for its bulb which is used for seasoning and flavoring of foods. They are nowadays available in fresh, frozen, canned, picked, powdered, chopped and dehydrated forms. Onion is a valuable food ingredient because it is rich in sugars, vitamins and minerals (Ole *et al.,* 2004).
In Nigeria, the bulk of onions are harvested in Northern part of country, around March/April and the remaining around August. There are acute shortages in supply between May to June and abundant supply between Octobers to February. In between these periods, Onion supply is relatively fair. This scenario is explained by climatic and weather characteristics. With appropriate agronomic measures, the interrupted supply trend can be overcome (Magashi and Adnan 2004). The shortages in supply is exemplified by the massive north to south movement of onions at the above periods of the year, partly because of the comparative advantage which the northern parts of the country have over the south in production of these vegetables (Opadokun, 1987). The southern towns and cities provide attractive markets for these commodities (Erinle, 1982).
Van Amstel (1986) estimated that approximately half of the farmers practice storage for period of one month or more. Tucker *et al.,* (1997) carried out a comparative study of the storability of onions at different temperature and reported that sprouting rotting and weight loss were lowest at 0^{o}C and was

highest at 35ºC. This could be attributed to increased respiration at higher temperature as reported by Williams (1987).

Lordvachescu *et al.,* (1981) reported that some pre-harvest chemical treatments contributed to sprout suppression and shelf life extension during onion storage. While Anon *et al.,* (1978) reported that losses of onion crops in developing and developed countries may reach up to 20-95% and 16-35% respectively. In another study Alao (2000) observed that accurate assessment of post-harvest losses of crops appears much more difficult in Nigeria due to the long chain of marketing system between producers and consumers. Nevertheless, he gave an estimate of post harvest losses of some crops in Nigeria as Onion, 15-20%; tomato, 20-60%; Cabbage, 37%; Okro. 20%, Citrus, 20-95% and carrot, 25%. Therefore, Alao (2000) concluded that the food security rating in Nigeria is very low and not guaranteed. Therefore, the present study was aimed at assessing the effect of storage at room temperature on the quality and palatability test of onion varieties. This will provide baseline information which will assist in increasing shelf life of onion which otherwise increases availability and reduce cost of onion at off season.

MATERIALS AND METHODS

Experimental Material

Five onion varieties Ex-Gayanawa, Ex-Bama, D77, DS79 and Composite – 4 on sale at Sabon Gari and Tarauni markets were used in this experiment. The physical condition during storage period was mean temperature 23.5ºC – 24.8ºC and mean monthly relative humidity of 66.8 – 78.8%. The mean storage temperature and relative humidity of the storage room for the fruits were 24.4ºC and 77% respectively.

Sample Handling

Two hundred and fifty onion samples were used for the experiment. The onions were cured, packed in jute bags and transported to Kano University of Science and Technology, Wudil for trial. Both the onions were stored in shallow plastic fruit crates at room temperature and relative humidity. The storage period lasted for five months which started one week after curing. This was followed with weekly observations for spoilage and for physical changes.

Isolation and Identification of Fungi Causing Deterioration of Stored Onion

This involved the isolation and identification of fungi associated with losses of quality and quantity of onion respectively. The methodology used follows the one used by Essien *et al.,* (1998), Amadioha (1999), and Yahaya (2005).

Colony Count and Subculture

In each week, growth of fungal colonies was monitored and the number of colonies that appear was recorded. Each distinct colony was sub cultured into fresh PDA.

Determination of Acidity and Sugar Content

The onions were analysed for titratable acidity and total sugars at the onset and termination of the experiment using Association of Official Analytical Chemists (1975) method of analysis.

Pathogenicity Test

Pathogenicity test will be conducted to prove Koch postulate. All fresh samples were washed in 10% (v/v) sodium hypochlorite solution and rinse in 3 changes of running tap water and allowed to dry. A ruler was used to mark a (2mm) diameter circle on each sample, a sterilize needle was used to streak fungal hyphae on mark portions. Controls was inoculated with sterile distill water. Material was place on the laboratory bench. Sterilize forceps was used to remove portions from the diseased areas on the 4th day and place on freshly prepared PDA plates and incubate at 25.7± 2oc for 3 days. Fungal growth that appeared was recorded.

Microscopic Examination

For each examination, a streak of fungal mycelium was place on a clean glass slide. One drop of cotton blue lactophenol was added and the cover slip place. The slides were mount on the microscope and observed at magnification of ×10 × 40 and x 100. Morphological characters of fungal isolated were determine and identify using method describe by Dorothea *el al.,* (1976). A length of the hyphae was determined with eyepiece graticule by using colonial and morphological characteristics.

Photography
A photograph of fungal mycelia was taken from mounted slide using camera Lucida at Biology laboratory Kano University of science and technology Wudil.

Statistical Analysis
The data was analyzed statistically using One-way analysis of variance (ANOVA) and differences among the means will be determined for significance at $P \leq 0.05$. This was achieved using computer program (SPSS, 16.0).

RESULTS AND DISCUSSION

Isolation of Pathogenic Fungi from Stored Rotten Onion Bulb
High number of colonies were recorded at Tarauni market 35 (7%) while 30 (2%) were counted at Sabo gari market. Although more colonies were counted at Tarauni market the differences was not statistically significant ($P > 0.05$) was obtained between the two seasons. The most commonly occurring colony in the two location was *A. niger* 26 (38.2%) followed by *Rhizopus stolonifer* with 19 (27.9%), *A. candida* 15 (22.1%) and the lest occurring colony of 8 (11.8%) was recorded in *A. flavus* (Table 1).

Table 1: Number of Colonies Counted in the Two Sampling Sites

Isolated Mold	Sampling Sites S/ Gari Market	Tarauni Market	Total	Mean	%
A. niger	13	13	26	13	38.2
A. flavus	3	5	8	4	11.8
R. stolonifer	9	10	19	9.5	27.9
C. albican	8	7	15	7.5	22.1
Total	**33**	**35**	**68**	**34**	**100**

Variation of Colonies Counted on Mondays and Thursdays in the Two Locations
More colonies were recorded on Mondays collection with a colony count of 72 (51.1%) and least colonies were recorded on Thursday with a colony count of 69 (48.9%) throughout the study period (Table 2).

Table 2: Total Number of Colonies Counted from Tarauni and Sabon Gari Market on the Mondays and Thursdays

Location	Tarauni	Sabon Gari	Total	Mean	% Abundance
Monday	32	40	72	36	51.1
Thursday	34	35	69	34.5	48.9
Total	**66**	**75**	**141**	**70**	**100**

Rottening of Onion Varieties in Storage Containers
High incidences of rotten onion bulbs were recorded (mean 28.4%) after the five months storage periods. Curing of the onions resulted in low sprouting incidence, 14.4% throughout the storage period. The mean percentage weight loss of 58.2% was recorded for the onions. Ex- Gayanawa stored better than Ex-Bama,

D77 and Composite -4 in that order. After five months in storage the improperly cured onions started developing green outer leaves (Table 3).

Table 3: Effects of Varietal Difference on Storage losses of Onions

	Mean Percentage Storage Losses after 5 Months				
Onion variety	**% Rot**	**% Sprout**	**% Weight Loss**	**% Total Storage Loss**	**% Good Bulbs**
Composite – 4	29	16	20	66	23
D77	58	15	20	60	27
DS79	25	16	22	56	38
Ex-Gayanawa	20	14	21	52	52
Ex-Bama	28	11	22	57	45

Palatability Test of Stored Onion

Palatability test carried out (result not shown) at the end of the trial showed that the onions became more fibrous and lost much of their aroma and flavour. Chemical analysis of the onions showed that the total sugars increased with a variation light in the titratable acidity. The increased acidity of the onions might have been responsible for the loss of flavour and aroma at the end of the trial.

Discussion

The study recorded 141 fungal colonies from samples collected from both Tarauni and Sabon gari markets. Tarauni market recorded high colony count 72 (51.1%) than Sabon gari market 69 (48.9%). The composition of the four colonies isolated were *A. niger* 26 (38.2%), *A. flavus 8 (*11.7%), *Rhizopus* 19 (27.9%) and *yeast* 15 (22.2%). More colonies were recorded on Mondays samples 72 (51.1%) than Thursday samples 69 (48.9%). Also the study established that the suitable ambient physical condition for the storage of Onion where mean temperature of 23.5-24.8 ^{0}C and relative humidity of between 66.78-78.8%. EX –Gayanawa variety stored better than remaining varieties of Onions.

The finding of this research could be related to the results of Okoye *et al.*, (1986), who studied effect of storage on shelf life of onion varieties in Northern Nigeria and recorded, the mean percentage weight loss for onion varieties as 21.6%, while storage loss for different varieties of onions were DS 79 60%, D77 62%, EX Bama 60%, and Composites 74%. The results also agreed with the work of Yahaya and Mustapha (2005), who investigated losses of perishables crops in Kadawa, Kwakwachi, and Sharada irrigation areas of Kano State and recorded losses due to mechanical damage during storage in tomato as 4-6 %, and onion 2-4%. The result also agrees with the finding of Dogondaji *et al.*, (2005) that fungi are the major causal agents responsible for storage losses of onion bulbs. According to FAO (1989), the high incidence of black mould is attributed to the ability of infections to spread from bulb to bulb by direct contact through bruises or wounds and by air-borne spores.

The result of the present study shows that at the end of the storage period most of the onion samples show fungal infection, the variety Composite 4 incurred more loss, while the Ex Gayanawa variety incurred less loss and stored better at the end of the storage period. In comparism with the present study Hayatu (2000) and Yahaya, (2005) reported that fungal infection is the most important factor responsible for post-harvest losses of onion, however, these losses normally starts from the field and continue after harvest (Yahaya, 2005). Wound and injury occur as a result of poor handling during harvesting, Packaging, Transportation and in Storage. Opadokun (1987) reported that losses of fresh produce in the field may sometimes be exceeded by losses in storage which normally occurs where freshly harvested produce are not cooled after harvest or where it is not transported and stored under controlled conditions. Opadokun (1987)

observed that it is not unusual to see truckloads of perishable vegetables parked on farms, at roadside truck stops and at food terminals rapidly deteriorating in the fill summer sun.

Similarly, Dogondaji *et al.*, (2005) showed that attempts to dry onions in primitive storages with humid air frequently results in wetter not dryer onions in production areas. Such crops are often destroyed by diseases such as neck rot and sour skin (Jaworski *et al.*, 1989).

Palatability test carried out at the end of the study showed that most of aroma and flavor test of onion became lost after the storage period. This was similarly reported by Opadokun (1987). Chemical analysis of the onions varieties showed that the total sugars increased with a light variation in the titratable acidity. The increased acidity of the onions recorded in this study may have attributed the loss of aroma and flavour at the end of the trial.

It can be concluded that four fungal species namely *A. niger, A. fumigatus*, and *A. flavus, R. stolonifer, C. albican* were found to be *t*he common pathogenic fungi associated with losses of stored onion. Effort should be made to improve condition of the onion at pre-harvest and post –harvest because poor quality produce cannot be improved after harvest.

Care should be taken to avoid mechanical damage during harvesting and handling, improper post-harvest sanitation, and poor cooling environmental control. Efforts to control these factors will be very successful in reducing the incidence of disease. In addition for better quality and palatability onion should be store at mean temperature of 23.5-24.8 ^{0}C and relative humidity of between 66.78-78.8%. Also EX –Gayanawa stored better than remaining varieties of Onions.

REFERENCES

Association of Official Analytical Chemists (1975). *Official Methods of Analysis* 12 edition. The Association of Official Analytical Chemists.

Alao SEL (2000). The importance of post harvest loss prevention. Paper presented at graduation ceremony of school of food storage technology. (Nigerian Stored Products Research Institute, Kano) 1-10.

Anon R, Brice JL and Currah A (1978). Report of the Steering Committee on Postharvest Food Losses in Developing Countries, National Research Council and National Science Foundation, Washington DC.

Dorothea F, Ronald J and Ronald CB (1976). *A Colour Atlas of Pathogenic Fungi*. (Wolfe Medical Publication Ltd.) 12 – 53.

Dogondaji SD, Baba KM, Muhammad I and Magaji MD (2005). Evaluation of onion storage losses and implication for food security in Sokoto metropolis. *Bulletin of Science Association of Nigeria* **26** 10-14.

Erinle ID (1982). The effect of some factors on the keeping quality of tomatoes. *Proceedings of 5th Annual Conference of Horticulture Society of Nigeria* 72-81.

Essien JP, Odoema CS and Essien EP (1999). Effect of Traditional Preservation on Seedborne Pathogens and Seed Viability of *Capsicum*, Okra and Tomato. *Journal of Tropical Science* **39** 238 – 243.

Food and Agricultural Organization (1989): *Training Manual* F.A.O. Rome 20-56.

Grierson D and Kader AA (1986). The Tomato Crop Fruit Ripining and Quality. (Chapman and Hall Ltd, New York) 243 – 280.

Hayatu M (2000). Post Harvest Physiological Studies of Some Selected Members of Family *Solanaceae.* M. Sc thesis (unpublished), Department of Biological Sciences, Bayero University, Kano 2 – 25.

Lordvachbescu C and Minvallescu N (1981). Efficiency of some pre-harvest treatments on onion quality preservation. *Acta Horticulture* **116** 115 – 150.

Magashi AI and Adnan A (2004). Theoretical model for uninterrupted supply of *Lycopersicon esculentum* (tomato) for economic reliance in Northern Nigeria. *Paper presented at the 3rd Annual Conference of Education for Rehabilitation and Reliance.*

Ole H and Shakuntalah A (2004). Content of iron and zinc in commonly consumed vegetables in Bangladesh. *Journal of food composition and analysis*. **17** 587-595.
Opadokun JS (1987). *Reduction of Post Harvest Losses in Fruits and Vegetables.* Lecture delivered *at* AERLS/NSPRI, *(*Joint National Crop Protection Workshop IAR, Zaria). 3-26.
Okoye WI, Onwuzulu UC and Ubani UN (1986). Stability of different Tomato and Onion varieties. Nigerian stored Products and Research Institute Technical Report No. **4** *Annual Report* 57-61.
Tucker WG, Stow JR and Ward CM (1997). The high temperature storage of onions in the United Kingdom. *Acta Horticulture* **62** 181 – 189.
Van Amstell H (1986). Onion production and onion trade in northern Nigeria: A survey of farmers and traders. Nigerian Stored Products Research Institute, Kano Technical Report No. **4**.
Williams JO (1987). Storage of fruit and vegetable in the northern Nigeria, Nigerian stored products research institute, Kano Technical Report No. **5** 19-22
Yahaya SM and Mustapha Y (2005). Contribution of Harvest and Post –Harvest Handling Practices to Pathogenic and Non Pathogenic Loss of vegetables Grown in Kano State. Unpublished M.Sc. Thesis, Department of Biology Sciences, Bayero University Kano 20 -21.