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RESEARCH ARTICLE

Effect of Storage on Proximate Composition of Some Horticultural Produce in the Evaporative Coolant

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ABSTRACT

A total of eighteen evaporative coolants were used for the storage. The experiment consisted of two factors –water quality and air movement were studied. The water quality was in two levels which include open stream, tap water and disinfected water, and air movement was in two levels namely; natural air movement and enhance air movement .Five horticultural produces which include three leaf vegetables(*Telfairia spp*, *Celosia spp* and *Amaranthus spp*) and two fruit vegetables (Tomato and Okra) were stored in the experiment. Each produce was stored at a time. Data collected include visual qualities-freshness, colour and length of storage. Also collected were temperature and humidity of evaporative coolants and the ambient, incidence, frequency and severity of disease. The result showed that shelf-life of leaf vegetables (freshness, colour) was extended appreciably compared to those kept on laboratory benches. *Telfairia*, *Amaranthus* and *Celosia* shelf-life was extended from 2 days to 5, 8 and 6 days, respectively. Furthermore, Okra and Tomato kept on the benches were durable for 2 weeks and 8 days, respectively, while those in the evaporative coolants lasted for 8 and 4 days, respectively.

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INTRODUCTION

Postharvest loss has been defined as any change in the availability, edibility and wholesomeness or quality of food that prevent it from being eaten by man (Babarinsa and Nwangwu, 1988).Fruits and vegetables are classified as very highly perishable produce in their natural state after harvest (Wills *et al*., 1998; Kay and Pallas, 1991). Once harvested, they tend to shrivel, wilt or rot at a very fast rate. This is due to their relatively high moisture content, soft texture and respiration rate (Morris, 1987).Postharvest is the bane of agricultural production in Nigeria. Available data indicate that postharvest losses may be as high as 50% and above in Nigeria (Sotimenhin, 1987; Nwufo *et al*., 1990). This emphasizes the fact that it is not sufficient for the nation to plan a food sufficiency programme, if appropriate measures are not identified and specified for minimizing postharvest losses from the field to marketing (Idachaba, 1985). In fact, large quantities of fruits and vegetables are being produced during the growing season, but due to lack of effective postharvest handling much of the produce are wasted and millions of naira are spent in importing their concentrates. This then makes postharvest management of fruits and vegetables very important in any food sufficiency programme in Nigeria. Moreover, it will help to stabilize prices by carrying over produce period of high production to period of low production (Osifo, 1995).Therefore, adequate storage should help to solve the problem of excess supply during the fruiting season when supply exceeds demand with consequent low prices (Thompson, 1971).

Also environmental factors which hasten deterioration of produce after harvest must be modified appreciably to provide suitable atmosphere for the storage of these produces .This is achieved through appropriate technology. The technology should be available to farmers adequate, affordable and easily adoptable (Okoli, 1985). An example of an appropriate technology is the evaporative coolant system (ECS) or the vegetable basket (Nwufo *et al*. 1990).

The evaporative coolant is adaptable to the environment where the farmers live. Most poor farmers cannot afford storage by refrigeration, irradiation and use of chemical control, which may be adequate but not affordable by most farmers. Evaporative coolant system (ECS) is a process of producing a cooling effect as a result of evaporation of liquid. Electricity is not needed. It is based on the principle of adiabatic cooling of unsaturated air when it comes in contact with water (liquid) for a sufficiently long time. Evaporative coolant is capable of reducing the temperature and producing appropriate humidity suitable for the storage of many tropical fruits and vegetables (Babarinsa and Nwangwu, 1988).

The vegetable basket

The vegetable basket is a model of an evaporative coolant as earlier said. The frame of the basket is constructed with raffia fronds or cane and flexible materials (NASPRI, 1990). They are constructed at different capacities depending on need and financial disposition of the farmer. Both inside and outside of the box frame are lined with thick absorbent materials such as jute bag (NASPRI, 1990). The lining must be well fitted on the surface of the frame so as to have smooth surface without foods.

MATERIALS AND METHODS

Production of Test Produce

The five vegetables were grown in the research farm of the Department of Crop Science University of Nigeria Nsukka. They were harvested and handled early in the morning to minimize mechanical injuries and effect of the sun. The harvesting was done as was appropriate for each produce.

Laboratory Analysis of Produce

Sample of the produce used for storage were obtained for proximate analysis at the start and at the end of the storage period, at the Department of Crop Science Laboratory, University of Nigeria, Nsukka. Samples were oven- dried at a temperature of $80^{O}C$ for 72 hours. After drying, the samples were weighed again and their weights recorded. The dried samples were grounded with the help of mortar and pestle into powder which were used for the proximate analyses.

The following determinations were made: Moisture, Total protein, Fibre, Ash, Vitamin C, Iron (Fe), Phosphorus (P), Potassium (K) and calcium (Ca). The percentage moisture loss at visible wilting (45 minutes) for the three leaf vegetables (*Telfairia spp Amaranthus spp and Celosia spp*) were determined. Also the % moisture loss after oven drying for 48 hours was also determined. Fruit vegetables (Okra and Tomato) were exposed to the atmosphere till appreciable weight loss was noticed, the percentage moisture loss from the two fruit vegetables after oven- drying for 48 hours was determined.

RESULTS

The Proximate composition

The result of the proximate composition of the five horticultural produce before and after storage indicated that there was no significant difference (P>0.05) in the chemical composition of the produce (Table 1 and 2).The result showed that leaf vegetable contain high amount of protein. *Telfaria* had 36.6% and 35.75% protein before and after storage. *Celosia* had 25.95% and 34.40% protein before and after storage. But okra fruits had the least percent protein of 3.93% and 3.75% before and after storage, respectively. The result also showed that the vegetables contain very high amount of minerals. *Telfairia* contains 3.40g/100g and 1.89g/100g of calcium before and after storage respectively. Okra had 3.11g/100g and 3.35g/ 100g calcium before and after storage, respectively.

Table 1: Effect of storage on proximate composition of three leaf vegetable stored in evaporative coolant (mg/100g dry weight)

Nutrients	Telfairia	Amarathus	Celosia
	Before and After storage		
Ash	9.12 NS 10.72	23.13 NS 19.58	8.50 NS 9.12
Moisture	12.65 NS 11.67	13.07 NS 10.08	11.08 NS 12.90
Ether Extract	18.53 NS 19.43	18.90 NS 18.08	20.12 NS 18.48
Fibre	7.62 NS 9.62	11.60 NS 9.88	8.50 NS 9.62
Protein %	16.6 NS 15.75	15.30 NS 10.53	15.95 NS 15.4
Vitamin C	16.85 NS 15.08	16.50 NS 14.47	13.23 NS 15.85
Fe(Iron)	0.10 NS 0.24	0.07 NS 0.08	0.03 NS 0.17
P(Phosphorus)	0.46 NS 0.54	0.53 NS 0.34	0.32 NS 0.44
K(Potassium)	0.20 NS 0.17	0.22 NS 0.11	0.03 NS 0.08
Ca(Calcium)	3.40 NS 1.89	4.82 NS 1.72	1.72 NS 0.83

Table 2: Effect of storage on proximate composition two fruit vegetable stored in evaporative coolant (mg/100g dry weight)

Nutrients	Tomato	Okra
	Before and After storage	
Ash	11.41 NS 10.72	8.55 NS 8.92
Moisture	12.62 NS 11.22	8.40 NS 7.90
Ether Extract	17.90 NS 17.84	0.03 NS 0.02
Fibre	7.35 NS 7.68	15.80 NS 14.95
Protein %	9.84 NS 8.92	3.98 NS 3.24
Vitamin C	13.14 NS 0.08	0.02 NS 0.02
Fe(Iron)	0.06 NS 0.43	0.16 NS 0.15
P(Phosphorus)	0.56 NS 0.80	0.26 NS 0.24
K(Potassium)	0.67 NS 0.77	1.45 NS 1.62
Ca(Calcium)	0.07 NS 0.07	3.11 NS 3.35

The result of the percentage moisture loss at visible wilting for (45minutes) before storage showed that for the three leaf vegetable (*Telfairia, Amaranthus and* Celosi*a*) had 8.23%, 10.32% and 12.62%, respectively while percentage moisture loss after oven drying for 48 hours were 73.92%, 78.34% and 84.72% for *Telfairia spp, Amaranthus* and *Cleosia spp*, respectively. Also the percentage moisture loss for the two fruit vegetables after oven drying for 48 hours were 91.78% and 97.14% for okra and tomato, respectively.

DISCUSSION AND CONCLUSION

Proximate Composition of the produce before and after Storage in Evaporative Coolant

There was no significant difference in the proximate composition of the produce on the nutrient analysed before and after storage. This result is similar to the report of Nwufo *et al*. (1990) who reported that fruits stored in the evaporative coolant retain their fresh appearance of colour, freshness and the chemical composition. Babarinsa and Nwangwu (1988) also reported that plantain and banana stored in brick walled evaporative coolant had a longer shelf- life than the control which was stored in ambient environment. The plantain and banana wrapped with polyethylene and stored in the evaporative coolant had a lesser weight loss and the shelf- life of the produce was extended by 6.2 days compared with those stored in the ambient. Babarinsa and Nwangwu (1988) reported that tomato and onion when stored in the evaporative coolant maintained constant Vitamin C content before and after storage compared with those stored in the ambient temperature. This could be as result of break down in vitamin C content of the produce due to high temperature of the ambient.

Babatola (2001) reported that storing leaf vegetables such *as Amaranthu spp*, *Celosia spp,* and *Corchorus spp* in evaporative coolant was much better than storing in refrigerator, dry baskets, and wet baskets and on laboratory desk. Superiority of vegetable basket could be explained on the basis of reduced temperature just suitable for storage of leaf vegetable than refrigerators that can produce reduced temperature that could lead to chilling and other physiological injuries. Prolonging shelf lives of the produce and the chemical composition is not reduced with the use of evaporative coolant.

There was no significant difference in the proximate composition of the produce on the nutrients analysed before and after storage. This result is comparable to the work of Nwufo *et al.* (1990) who reported that fruits stored in the evaporative coolant retain their fresh appearance of colour, freshness and the chemical composition.

Leafy vegetables should be stored in evaporative coolants especially when in transit or to be used some days after harvest, because they help in prolonging shelf lives of the produce and the chemical composition is not reduced. This will enable the farmers to convey their produce from one location to the other without encountering much losses thereby maximizing profit.

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