Some Quality Changes During Storage of Cassava Root

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Abstract

Two storage experiments were done at Awassa College of Agriculture during the year 1995 to investigate the quality changes on cassava root. In each experiment, two cultivars namely, *Amarokello red* (local) and *Umbure*, and three storage methods, namely, earthen floor (ground), trench storage and sacks were factorially combined and were examined for vascular streak (primary deterioration), tuber weight loss, starch and total protein content.

The blue coloured vascular streak which occurred closer to the rind was found non-significantly different between cultivars, and storage methods. Also, the starch content was almost similar between the storage methods, but was significantly ($P<0.05$) higher in cultivar *Amarokello red* than *Umbure*. The protein content showed little variation between the different storage methods and the cultivars.

Introduction

Cassava *(Manihot esculenta Crantz)* is the fourth most important root crop in tropical countries. Apart from its use as human food, cassava serves as an animal feed as well as a source for the manufacturing of industrial starch products (Coursey and Haliday, 1974). Moreover, the crop is highly resistant to drought and easy for propagation (Grace, 1977 and Cock, 1985a).

The production of cassava crop in the world has considerably increased from 70 million in 1960 to an estimated 150 million tons in 1990 with the highest production share from Africa (43%), Asia (35%) and Latin America (22%). It is also a staple food for around 500 million people in the world (Cock, 1985a). In Ethiopia, this crop has been cultivated in the southern and southwestern regions for several decades as a food crop (Taye, 1994). Recent survey showed that farmers are using different cultivars including the *Amarokello red* which has been cultivated for several years and *Umbure*, a recently introduced one (Taye, 1994).

The tuber root is the major source of carbohydrates consisting about 85% starch on dry weight basis (Cock, 1985b). It is highly perishable than any other major root crop and deteriorates within 3-4 days after being detached from the plant (Rickard and Coursey, 1981).

During storage of cassava tuber, various changes including vascular streak, degradation of starch sugars and secondary deterioration takes place (Booth *et al.*, 1976; Rickard and Coursey, 1981). The major cause of losses in stored cassava tuber roots results from primary deterioration, which is often followed by secondary deterioration (George and Browne, 1994).

To increase the shelf life and maintain the quality of the tuber root various storage methods such as storing in clamps, boxes, plastics, flour, and piling on ground, leaving in soil intact with stem, arranging in trenches, and storing in sacks have been used in many places. Different studies were also conducted on clamps (Booth, 1976), on sawdust and clumps (Boothe *et al.* 1976), and on ground and polythene bags (George and Browne, 1994).

However, in view of the storage importance, the available information on the quality of cassava root particularly on starch and protein content is not adequate. Therefore, this study was intended to examine the effect of different storage methods on the quality of two cassava cultivars.

Materials and Methods

Matured tuber roots of the *Amarokello red* and *Umbure* cultivars that were grown on the farms of Awassa College of Agriculture for about 14 months (1994-95) were used for the study.

The two cultivar roots were investigated in three storage methods which include: pilling on the surface of the earth (ground), covering with soil in trench (30 x 50cm) (underground), and storing in sacks. The treatments were factorially combined in randomized complete block design with three replications and other different characters which include vascular streak, weight loss (%) were recorded.

The vascular streak was visually checked every day by the transverse cutting of the tuber with a stainless knife. The starch (%) was analyzed using the method indicated in AOAC (1984) while the crude protein (%) was determined by multiplying 6.25 and the nitrogen content which was determined using the kjealdahl apparatus.

Undamaged and cleaned ten kilograms of tuber root were used for each experimental unit and each experiment was carried out of four weeks.

The average minimum and maximum storage temperature during the experimental periods were 11-27°C and 13-26°C, respectively, while the minimum and maximum relative humidity were 66-72.3% and 57.9-67.4% respectively.

Results and Discussion

Days for the appearance of vascular streak did not show significant difference in both experiments. The blue-black colour was observed to be originating close to the rind after the second and third days after harvesting in all storage methods for both cultivars. This result, however, is different from the work of George and Browne (1994) who indicated the absence of vascular streak on roots that were stored in the trench.

Both experiments indicated that roots stored in the trench and sack resulted in significant ($P<0.05$) lower weight loss compared to those in the earthen floor (**Table 1**). The higher root weight loss from the earthen floor might be due to high evaporation and transpiration as compared to the trench and sacks. A significant difference ($P<0.05$) in the weight loss during storage between the cultivars in the second experiment may be attributed to the unique difference of the cultivars.

As indicated in Table 1, similar to the work of George and Browne (1994) the starch content was found not to be significantly different among the different storage methods in both experiments. However, significant ($P<0.05$) higher starch content was obtained in the cultivar *Amarokello red* than in *Umbure*.

The total protein content showed little difference among the different storage methods and between the cultivars in both experiments (**table 1**). The low amount of protein (1.9-2.0 %) determined in this experiment was similar to the findings of Cock, (1985b). This suggests the consumption of cassava tuber root as the only food could cause protein deficiency unless it is supplemented with other protein rich foods.

Conclusion

The appearance of the vascular streak in two-three days time from the time of harvesting in all treatments indicate that cassava root deteriorates very rapidly. New ways of post-harvest management of cassava roots needs to be investigated in order to overcome the rapid post-harvest degradation.

The low protein content in both *Amarokello red* and *Umbure* suggests the need for supplementing cassava tuber root with other protein-rich crops such as legumes for better nutritional balance. Moreover, the significant difference in starch content between the cultivars Amarokello red and Umbure suggests the need to consider starch as a major criteria in order to select best cultivars for consumption.

Table 1. Effect of storage methods and cultivars on some qualities of cassava root

	Storage methods				Cultivars		
	[1]A	[2]A	[3]A	[4]LSD 5%	[5]AM	[6]UM	[4]LSD
Experiment 1							
Days for the appearance of vascular streak	2.0	2.0	2.0	N.S.	2.0	2.0	N.S
Weight loss (%)	36.6	21.5	16.7	9.0	25.2	24.1	N.S
Starch (%)	59.6	59.8	54.8	N.S	61.6	54.1	7.1
Crude protein (%)	2.0	1.9	2.0.	N.S	2.1	2.0	N.S
Experiment 2							
Days for the appearance of vascular streak	3.0	2.0	2.0	N.S	2.0	3.0	N.S
Weight loss (%)	31.3	23.2	15.7	10.7	29.8	20.0	8.7
Starch (%)	56.7	56.2	54.1	N.S	58.9	48.9	9.4
Crude protein (%)	2.0	1.9	1.9	N.S	2.1	1.9	N.S

Initial root starch (%) for cultivars AM-1 and AM-10 in experiment 1 and 2 were 67.3 and 64.2, respectively, while for total protein (%) were 2.2 and 1.8, respectively.

[1]A = Earthen floor, [2]A = Trenches, [3]A = Sacks, [4]LSD 5% = Least significant differences at 5% level, [5]AM. = Amarokello red, [6]UM = Umbure, N.S. = Not significantly different.

Acknowledgement

The Ethiopian Ministry of Planning and Economic Development is acknowledged for financing this study.

Reference

AOAC (1984). Official methods of analysis of the Association of Analytical Chemists, Williams, S., (ed.) AOAC inc. Virginia, USA.

Booth, R. H. (1976). Storage of fresh Cassava (Manihot esculenta) 1. Post Harvest deterioration and its control. *Experimental Agriculture*. 12:103-111.

Booth, R. H.; Debucke, T.S.; Cardenas, O.S.; Gomez, G. and Hervas, E. (1976). Changes in quality of cassava roots during storage. *Journal of Food Technology*. 11:245-264.

Cock, J. (1985a). Cassava: a new potential for a neglected crop. Westview press, Boulder and London. pp. 191.

Cock, J. (1985b). Cassava: a basic energy source in the tropics. In: *Cassava research, production and utilization*. Eds. J. H. Cock and J. A. Reyes. UNDP, CIAT.

Courtesy, D. G. and Haliday, D. (1974). Cassava as animal food. *Outlook Agriculture*. 8(1) 10-14.

George, J. B. and Browne, C.B. (1994). Changes in quality of fresh cassava tubers during storage. *Tropical science*. 34:161-165.

Grace, M. R. (1977). Cassava processing. Food Agriculture Organization. Rome, Italy. pp. 5-11.

Marriott, J. S.; Been, B. O. and Perkins, C.E. (1978). The etiology of vascular discolouration in cassava roots after harvesting association with water loss from wounds. *Physiology of plant*. 44:38-42.

Rickard, J. E. and Coursey, D. G. (1981). Cassava storage. *Tropical Science* 23:1-32.

Taye, M. (1994). Cassava in South and Western Ethiopia. *Cassava Newsletter*, CIAT, Colombia. 18(1): 6-7.