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CHANGES IN NUTRITIONAL COMPOSITION OF IRISH POTATOES (*SOLANUM TUBEROSUM L.*) UNDER DIFFERENT STORAGE CONDITIONS TO PREVENT SOFT ROT CAUSED BY *ERWINA CAROTOVORA* (JONES) HOLLAND

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ABSTRACT

Investigations were carried out to determine the best storage condition that will prevent soft rot caused by Erwinia carotovora. Changes in nutritional composition of irish potatoes in various storage conditions were also monitored. The result revealed E. carotovora as an important bacterial rot of irish potatoes. Storage at low temperature (5+2°C) showed insignificant changes in potatoes' constituent but percentage fat decreased. Potatoes stored at 27+2°C with good ventilation showed insignificant changes in nutritional content except fat that significantly decreased, however, with insignificant sprouting. Sun-drying of potatoes showed significant decreases in all nutritional contents. The report concluded that storage at 27+2°C with good ventilation was the best and thus recommended the condition as the ideal storage condition.

INTRODUCTION

Solanum tuberosum L. is in the family Solanaceae and was reported to have originated from South America (Adisa 1986). They are used as table potatoes (Descrosier, 1977) and they have wide utilization as food and feeds (Uritani *et al*, 1984). However, difficulties abound in respect of storage. Several fungi and bacteria have been implicated to be responsible for part harvest losses (Booth, 1974; Bigrami and Dube, 1976; Melhus *et al* 1916; Frech, 1988; Erasla and Gulay, 1989; Booth and Burton, 1983). Various methods locally used for prevention of spoilage of potato tubers include storage at ambient temperature, mild exposure to sun, and storage in a refrigerator. However, the effects of these storage conditions on the food contents of the tubers have not been given attention. Therefore the aim of this study was to investigate the role of *Erwinia carotovora* in the spoilage of *S. tuberosum* and also to study the changes in nutritional composition of potato tubers under different storage condition with the view to determining the most appropriate method of storage.

MATERIALS AND METHODS

Several tubers with soft rot symptoms were collected from some states in southern part of Nigeria in November and were carefully put in polyethylene bags and taken to the laboratory for further studies. Isolation was severally carried out under aseptic conditions on malt extract agar (MEA), potato dextrose agar (PDA) and nutrient agar (NA) at 27+2°C. Pathogenicity test was carried out.

Investigation were carried out to determine the best storage condition that discourages development of soft rot caused by *E. carotovora* and at the same time will preserve the nutritional content of potato. In this case, healthy potato tubers were selected to different storage conditions often used in the south western Nigeria in Africa. These conditions include: storing a set of the selected tuber at 5°C+2°C with relative humidity of 80+5%, the second set was exposed to mild sun for at least six hours daily at 70+5% relative humidity; and the third was stored at room temperature of 27°C with good ventilation and relative humidity of 75+5%. After eight weeks storage, some nutritional composition were analysed to estimate changes in the amount of starch, sugar, fat, protein and moisture contents. In each of these storage conditions, tubers were inoculated with *E. carotovora* in pathogenicity test in order to observe symptoms of spoilage. Sugar and starch were determined according to the method of PEARSON (Pearson, 1976). Protein was estimated using adapted Kjedahl method as used by Lees (Lees, 1975).

RESULTS AND DISCUSSION

Present investigation revealed an important bacterial rot caused by *E. carotovora*. The tubers inoculated with *E. carotovora* showed softness to touch with slimy exudates which had repulsive odour. Lund (1971) reported several strains of *E. caratovora* as major causes of bacterial rot of tubers. Several previous report (Booth and Burton, 1983; Ramsey *et al,* 1949; and Bonde, 1950) have implicated *E. carotovora* as major bacterial rot organism in storage.

During the present investigation the tubers inoculated with *E. carotovora* stored at 5°C+2°C did not change in appearance except for an insignificant evidence of sprouting. The inoculated tubers stored at 27°C+2°C appeared soft to touch with heavy production of slimy exudates, but healthy tubers stored under this condition appeared healthy and when they were cut open, there was no discoloration. Sprouting was observed in the two sets of treatments at 27+2°C. The inoculated tubers that were exposed to mild sun showed restricted small recrotic areas closed to the inoculation point. However, healthy tubers given similar treatment appeared healthy for eight weeks but were brownish internally when they were cut opened.

Various methods have been suggested for storage of potato (Pearson, 1976 and Anon, 1978). In Nigeria, as well as other developing countries, three major methods have been suggested (Anon, 1978) for storage of potato after harvest. These include cool storage, storage at room temperature and sun drying. The efficacy of these methods in relation to quantity and quality of *S. tubersom* has not been well documented. Changes observed in nutritional composition of healthy potato tubers stored under various conditions are reported in Table 1. There was reduction in all constituents (except fats) assayed in tubers exposed to mild sun at 26°C+2°C. This observation might be due to utilization of these substance during the intensified respiratory process associated with warmth. There was significant reduction of moisture content of tubers at 26°C+2°C. Both and Burton, 1983 reported that sprouting encouraged evaporation which may be responsible for the present observation (Table 1).

Table 1: Change in nutritional constituent of potato stored under different storage conditions

Nutritional Constituents dry Matter	Storage at 5+2°C a b	Storage at 27+2°C with good Ventilation	Storage at 26+2°C six-hours daily	Control (Value at the beginning of storage)
% Starch	20.03 + 0.32*	19.07 + 0.80*	13.97 + 1.41**	20.08 + 1.0
% Sugar	1.22 + 0.11*	1.16 + 0.10*	0.85 + 0.06**	101 + 1.01
% Fat	0.056 + 0.003**	0.065 + 0.004**	0.067 + 0.003**	0.20 + 00
% Protein	1.96 + 00*	1.98 + 0.20*	1.00 + 0.03**	1.99 + 00
% Moisture	80.40 +1.00*	79.60 + 2.00*	70.42 + 3.00**	80.42 + 3.00

a Data are means of four determination
b Standard error
* No Significant difference (P = 0.05)
** Significant difference (P = 0.05)

From the observations in this study storage under refrigerated condition should have been the most ideal method of storage because there was high conservation of nutritional substances but sustainability of sufficient and constant supply of energy to run cold storage may become a limiting factor. Exposure to mild sun at 26°C+2°c is equally not ideal because of significant reduction of nutritional constituents of the tubers (Table 1). Furthermore, the browning of the internal part and sprouting becomes limiting.

It appears storage at 27°C+2°C with good ventilation would be the most ideal because of its obvious advantages which include considerable amount of conservation of nutritional content and constant internal appearance. Therefore the most appropriate postharvest storage condition is room temperature (27+2°C) with good ventilation. However, absolute care must be taken to keep rodents and insects away from the storage. Proper handling of the tuber in transit and storage is important in order to minimize attack by wound parasite.

REFERENCES

Adisa, V.A. (1986) Microbial spoilage of *Solanum tubersom L.* in Nigeria. *Die Nahrung* 30: 709-712.

Anon (1978) *Postharvest Food Losses in Developing Countries.* National Academy of Science Washington D.C pg 110-139.

Bilgrami, K.S and H.C Dube (1976). A textbook of Modern Plant Pathology, Vikas Publishing House. New Delhi 341pp.

Booth, R.H and W.G Burton (1983). Future needs in Postharvest Technology in developing countries. *Agriculture, Ecosystem and Environment*. 9: 269-280.

Booth, R.H (1974) Postharvest deterioration of tropical root crops, losses and their control. *Tropical Science* 16: 49-63.

Bonde, R. (1950) Factors affecting Potato black leg and seed-piece decay. *Michigan Agri Experimental Station Bulletin 482.*

Bourne, M.C. (1981) The world problem of post harvest losses. *Industry and E*nvironment 4: 3-5.

Descrosier, N.W. (1977) *Elements of Food Technology* Avi Publishing Company Westport. Connecticut. 722pp.

Erasla, N and T. Gulay (1989). Studies on powdery scab and potatoes with special regards to the reaction of certain potato cultivars and clones. *P. Flanzbnk*a 96: 350-353.

French, E. (1988) Bacterial and Fungal diseases of Potato. Life 20(4):3-4.

Lees R. (1975) *Food Analysis*: Analytical and quality control methods for food manufacturers and buyers. Longman group Limited. Britain pg 240-345.

Lund, B.M. (1971) Bacterial Spoilage of Vegetables and Certain Fruits. *Journal of applied Bacteriol*ogy 34:9-20.

Pearson D. (1976). The Chemical Analysis of Food. Chemical Publishing Company Inc. New York pp 203.

Melhus I.E., J. Rosenbaum J. and Schulz, E.S (1916) *Sporangispora subterranean* and *Phorma tuberose* on Irish Potato. Journal of Agric Research 7: 213-254.

Ramsey, G.B., Waint, J.S and M.A Smith (1949). *Market Diseases of Fruits and Vegetable: Potato.* U.S Agric Miscellaneous Publication 98. Washington DC. U.S Department of Agriculture.

Uratani I., E.S. Data and Tanaka Y. (1984). Biochemistry of Postharvest deterioration of Cassava and Sweet Potato Roots. Tropical Root Crops: Postharvest Physiology and Processing. Pg 61-75.