Studies on the Effects of Pith Depths and Washing Treatments on the Storability of Irish Potato Tubers (*Solanum tuberosum*) at Nsukka

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Abstract

Different prestorage washing treatments were carried out on Diamant and Bateta potato varieties stored in soil pits of different depths. Tubers rots, fresh weight loss and sprouting were evaluated among the stored tubers. In comparing storage depths and potato varieties in relation to tuber rot, these values were indicated, LSD (0.05) comparing storage depth (D) = 0.013, potato varieties (PV) 0.106. At the lowest depth (30 cm) the rate of fresh weight loss (10.7 %) was highest compared to other tubers in other depths, 60 cm (9.71 %), 90 cm (7.71 %). Comparing storage depths in relation to tubers sprout, LSD (0.05) = 0.080. When tubers were not washed before storage, the value of rot was 25 % compared to when they were washed and dried before storage (28%) or when they were washed and immediately stored (44.6 %).

Keywords: Pith depths, Washing treatments, Storability, Irish potato tubers, *Solanum tuberosum*

Introduction

The progress in potato production and global utilization is under the threat of major constraining factors such as wide range of pests and diseases, difficulty in the production and distribution of disease-free seeds, inadequacies of cold storage facilities resulting in rotting, sprouting, tuber weight loss and violent fluctuations in potato prices. The situation is amplified by poverty, ignorance and lack of adequate improvisation necessary in rural agriculture (Dean, 1994).

Potato would have paralleled other tuber crops such as yam and cassava in rural African countries in their importance as food for the poor masses but for lack of adequate knowledge on post harvest-handling techniques that could prolong the shelf life of potato tubers. The belief is that Potato don't generally store well (Okonkwo *et al*, 1986).

Modern storage methods involve systems with controlled temperature, humidity, air circulation, irradiation and light regulation suitable for tubers that are kept for a relatively long time. In western European countries both seed and table potatoes can be stored with variable manipulations of the storage environment. Table potatoes can be stored at a temperature of 5^0C after wound healing. For chip manufacture, a temperature of $5^0 - 7^0$C is optimal. For potato crisps production, potatoes have been stored at $7^0 - 10^0$C (Haris, 1992). Sprouting is controlled after curing period by lowering the storage temperature to $2^0 - 4^0$C followed by storage at a constant temperature (Cheng *et al.* 1990).

Lower temperatures has been shown to reduce microbial deterioration. (Thomas and O, Beirne, 2000).

In most tropical African counties temperatures are relatively high. In addition such counties may lack adequate post harvest handling technologies for crops. As a result of this sprouting and microbial deterioration have been the major set back for potato production progress in Africa.

In Nigeria, table potatoes are rarely kept for a long time because of rotting, weight loss and sprouting (Nwokocha, 1989). Seed tubers are allowed to sprout freely hence farmers adopt storage measures that encourage sprouting (Salunkhe et *al*, 1991). In potato storage trials, the options should involve the adoption of what has been known for other tuber crops as research bases for that of potato.

Yams are popularly stored in open barns without much concern for the issue of weight loss (Tindall, 1993). Nnodu (1992) obtained favourable results from sweet potato tubers stored using moist saw dust in baskets. In all these cases, tubers were stored as harvested. Little or no attention was paid to the issue of hygienic conditions of tubers stored. This issue becomes important when we bear in mind that latent pathogens follow tubers from the fields to the storage sites where they resume pathogenicity with favourable weather conditions.

Cocoyams have been kept in good conditions in pits, slated shelves, or in the farm unharvested for an appreciable length of time (Eze and Maduewesi, 1989, 1990). The purpose of this work is therefore to adapt, with some modifications, known traditional methods for other tuber crop storages to the storage of Irish potato tubers in Nsukka. This is with a view to reducing weight loss, sprouting and microbial deterioration of the tubers.

Materials and Methods

Construction of storage pits: The pits were made inside the a storage shack in the Botanical garden if University of Nigeria, Nsukka. The depths were 30 cm, 60 cm and 90 cm respectively while they were 1.5m long and 1m wide.

Washing treatments: The washing treatments evaluated were;

1. Washing of tubers with water and spreading on laboratory benches to dry for 6 hours before they were put inside baskets for storage.
2. Washing tubers and storing them immediately in baskets without drying.
3. Storing in baskets without washing.

In all these storage trials, fifty tubers in three replications for each test were used for Bateta and Diamant Potato varieties and were kept in storage from July to December, 2004.

Determination of Weight Loss of Tubers: This was adopted from the work of Gollifer and Booth (1973). Twenty tubers were picked randomly from each replicate of potato tubers and marked with indelible ink. Weight readings were taken for the tubers at monthly intervals during the period of storage. The percentage fresh weight loss was calculated thus: riginal weight – Final weight / Original weight X 100/ 1.

Determination of sprouting: At monthly intervals for the period of 6 months; the tubers from each replicate were examined and the percentage sprouting of potatoes i.e. incidence of new shoots or roots was recorded. This was after the work of Gollifer and Booth (1973) as: Number of sprouted tubers / Total number of tubers sampled X 100 /1.

Determination of rot incidence: The tubers were examined for rot incidence using the methods described for the percentage sprouting above.

Results

Effect of pith depth on the storability of bateta and diamant potato tubers: Storage of tubers at any depth for up to three months encouraged tuber rot (Table 1).

Table 1: Effect of storage depth (D); Potato variety (PV) and D X PV interactions on the percentage rot of Bateta and Diamant tubers stored for three months at different depths in pits

Depth (cm)	Variety		Means for Depth
	Diamant	Bateta	
30	43.9	53.5	48.6
60	43.8	53.8	48.8
90	42.1	48.5	45.2
Means	43.3	51.9	47.5

LSD (0.05) comparing: Storage depths (D) = 0.130; Potato variety (PV) = 0.106: D X PV = 0.184

Tubers stored at 30 cm depth rotted the most for both Diamant (43.9%) and Bateta (53.5%) relative to those stored at 60 cm and 90 cm. Rotting increased progressively with duration (months) of storage at all depths (Table 2). After the first month Bateta tuber had weight loss of 0.16% in contrast to 23.3% at the end of six months storage (Table 3). In the case of weight loss, potato tubers lost weight progressively when they were stored for longer periods of up to six months. Lowest values for weight loss are observed for both Diamant and Bateta tubers within the first month as against high values in the sixth month (Table 3).

Effect of after washing treatment on diamant and bateta tuber rots: Both Diamant and Bateta tubers showed a very high degree of rotting (42.4 %) and 46.8 %) respectively when tubers were washed, and immediately stored. When tubers were washed, and dried prior to storage, rot incidence was reduced but more so when they were not washed at all before storage. Within the first month of storage, there was no tuber rot among unwashed Diamant Potato tubers, while almost 50% of the tubers rotted when they were washed and immediately stored (Table 4).

Table 2: Effects of storage duration (SD) storage depth (D) potato variety (PV) and SD x D x PV on the percentage sprouting of Bateta and Diamant tubers stored at different depths in pits

Variety	Month	Pit depth			Mean
		30 cm	60 cm	90 cm	
Diamant	1	0.05	0.00	0.00	0.02
	2	7.30	6.00	7.90	7.07
	3	15.30	17.90	13.30	15.50
	4	25.30	21.30	19.30	21.97
	5	50.10	47.40	47.10	48.27
	6	64.60	52.10	55.30	57.33
Bateta	1	0.00	0.00	0.00	0.00
	2	8.00	6.60	6.60	7.07
	3	13.20	13.30	17.30	14.60
	4	43.90	39.90	22.60	21.17
	5	43.90	39.90	38.60	40.80
	6	60.00	58.60	46.00	54.87

LSD (0.05) Comparing storage duration (SD) = 0.114; Storage depth (D) = 0.80; Potato variety (PV) = 0.067; and SD x D x PV interactions = 0.279

Table 3: Effect of storage duration (SD), potato variety (PV), and SD x PV interactions on the percentage fresh weight loss of Bateta and Daimant tubers stored at different depths in pits

Months	Variety		Mean of Months
	Bateta	Diamant	
1	0.16	0.06	0.11
2	1.2	21.1	1.6
3	4.4	9.6	6.7
4	12.1	18.6	15.3
5	21.1	22.6	22.1
6	23.3	28.0	26.6
Means	8.1	10.7	9.4

LSD (0.5) Comparing storage duration SD = 0.120; Potato Variety (PV) = 0.069; SD x PV = 0.170.

Table 4: Effect of washing treatment (WT), Potato Variety (PV) and WT x PV interactions on the percentage rot of Diamant and Bateta tubers after six months storage

Storage treatment	Variety		Means
	Daimant	Bateta	
Washing and drying	25.5	30.5	28.00
Washing and instants storage	42.4	46.8	44.60
No washing at all	21.8	29.4	25.60
Means	29.90	35.57	32.73

LSD (0.05) Comparing washing treatment (WT) = 0.077; Potato variety (PV) = -.063 and WT x PV interactions = 0.109.

Discussion

Considerations for effective storage have always been of prime concern to farmers in the production of tuber crops especially in the tropics with fairly elevated temperatures and without controlled storage environments. For both Bateta and Diamant Potatoes used in this work, it has been observed that the lowest rate of rots observed at 30 cm depth

should not be regarded as acceptable. However, at this depth rots may be relatively reduced if anti microbial agents were applied in the storage tests. On the contrary, Eze and Maduewesi (1989) obtained favourable rot reduction of cocoyam corns at 66.7 cm depth without the application of antimicrobials.

Early in the history of Irish potatoes, soft rot as observed in this study have been described as disease of potato tubers with little or no varieties showing any specific resistance to attacks. (Arinze *et al*, 1975; Ciampipanno *et al.*, 1989). Bateta and Diamant tubers have been observed to be susceptible to soft rots pathogen. The reduction in fresh weight loss observed when Irish potato tubers were buried in deeper depths is similar to previous reports on sweet potato (Nnodu, 1992).

Gichohi and Pritchard (1995) reported relationship between higher air temperature and tuber fresh weight loss. Burying of these tubers at deeper depths had much accumulation of respiratory heat. Respiratory heat around tubers has been reported to promote potato tuber sprouts (Forbush and Brook, 1993). It is here recommended that tubers in pits should not be kept beyond the third month.

Washing of tubers seems to offer the moisture which some pathogens require to penetrate the skin or lenticels of potato tubers. The implication of moisture around tubers has been highlighted by O' Beirne and Francis (2002). For this reason, it is recommended that if tubers be washed at all they should be dried at room temperature before storage, otherwise they should be stored without washing. The suggestion for irish potatoes in rural environment is that only read - for - use table potatoes should be washed.

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