Proceedings of the 13th ISTRC Symposium, 2007
pp. 478 - 481

On-farm trials on long-term storage of sweetpotato at Gezaulole village, Kigamboni, Tanzania

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Abstract. The influence of store design on farm pre-treatment, storage site, type of soil and the nature of storage place (shade) on sweetpotato storage was assessed at Gezaulole village near Dar es Salaam, Tanzania. The design of the store had an influence on the storability of the fresh sweetpotatoes. Recovery of marketable tubers stored in pits constructed under shade was significantly higher ($P < 0.05$) than that from clamps. Preharvest prunning had no influence on the recovery of marketable sweetpotato tubers.

Introduction

In the tropics, sweetpotatoes are consumed or marketed soon after harvesting because their shelf life can be as short as one week (Rees *et al.*, 1998; Thomson *et al.*, 1997). In-ground storage (delayed harvest) is often not possible due to infestation by sweetpotato weevils (*Cylas* spp.). The seasonality of sweetpotato production leads to large fluctuations (3 fold) in market price and quality (Thomson *et al*., 1997). Both producers and consumers could benefit if storage enabled sweetpotato to be marketed for a longer period of time (Hall *et al.*, 1998). In temperate areas, long-term storage of fresh roots is successfully practised. For example, in the United States sweetpotato can be stored for up to one year (Picha, 1986). In some cooler areas of the tropics, fresh storage is also practised. In the highlands in southwest of Tanzania sweetpotato are traditionally stored in cellars (T. Ngendello, personal communication). In warmer regions, fresh storage is also feasible and has been demonstrated in Uganda, where in one trial sweetpotato were stored for up to 4 months (Devereau, 1995). Some of the trails, however, failed for reasons that were not clear.

Stores constructed in tropical climates vary with respect to type of store (pit, clamp and cellar), lining with dry plant material such as grass, cultivar, and quality of the roots.

Most stores are lined with dry plant material such as dried grass, bamboo, ash (Woolfe, 1992) or sand. The function of the lining and use of different materials is however not clear. It is thought it reduces sprouting and/or reduces the invasion by rats. It is speculated that the lining material insulates and reduces temperature changes, or that it modifies the storage atmosphere. The choice of cultivar can affect the storage success, because sweetpotato cultivars differ significantly in storability. When stored under marketing conditions (sacks) the weight loss per week for Polista and Sinia B and SPN/0 were between 8.4% and 10.3% and 7.8% and 10.7% per week, respectively (Van Oirschot, 2000; Rees *et al.*, 1998).

Damage to roots increases weight loss and reduces the storability of roots. Damaged areas form pathways for pathogens and for water loss. When roots are kept under curing conditions (27-29°C, and 95% RH), damaged areas heal.

Two types of stores have been reported in the literature: the pit and clamp type. Devereau *et al*. (1995) reported that roots

stored for longer in the pit rather than the clamp. In both cases however, storage performance was not consistent. Factors that affect performance of these stores are not known. This research aims to determine the time of storage and understand the relationship between store design, pre-treatment, site of the store, type of soils under which the stores are constructed and storage time.

Materials and Methods

Identification of the participants (farmers). Fourteen farmers were identified to participate in the storage trial. This was done in collaboration with the Gezaulole village government.

Pruning of canopy of sweetpotato. Two groups of 7 farmers each were formed in order to facilitate the on-farm pre-treatment of sweetpotatoes. One group was asked to prune their sweetpotatoes in the fields 14 days before the storage exercise while the other group left theirs unpruned. Previous research (Bonte and Wright, 1993; Tomlins *et al.*, 1999) had indicated that pre-harvest curing of the tubers underground by removing the plant canopy 9 days before harvest might reduce the injury to the tubers during post-harvest handling and transport. This could lead to prolonged storage life of the tubers.

Store construction and design. A total of 56 stores were constructed for assessment of their ability to store sweetpotatoes for Dar es Salaam markets. Stores were constructed in the area under four different types of soils that are clay, loam, sand and calcareous soils. Each farmer constructed 4 stores (2 pits and 2 clamps). One pit and one clamp were constructed under shade while the rest were constructed in the open sun. In addition, a simple structure made up of wood and dry grasses was fabricated to protect each store from rainfall and heat from the sun. The pit comprised a circular hole of 70 cm diameter and 70 cm deep. The clamp comprised of a raised bed of 100 mm of soil on which the mound of roots was pilled. Table 1 shows the layout of the stores.

Storage of sweetpotato tubers. Each store was filled with 100 kg of freshly harvested sweetpotato. So each farmer stored 400 kg of sweetpotato. The tubers were covered with 10 cm of soil and jointly inspected every four weeks by farmers and researchers.

Market valuation. Sweetpotato market prices were assessed in two major sweetpotato markets (Tandika and Tandale) of Dar Es Salaam, Tanzania. Each individual farmer took the marketable roots to either of the markets for sale. The prices were then compared with the market price of fresh sweetpotato during the time of storage.

Inspection of stores. Stores were inspected every four weeks after storage to assess the tubers for rots, sprouting, shriveling and attack by weevils and vermins. Stores were also inspected for the general conditions of the storage structures in terms of protecting the tubers adequately.

Results and Discussion

Inspection of stores. By the fourth week, sprouting was observed in some stores with non- pre-treated sweetpotato. By the eighth week, tubers were sprouting in most treatments except in the clamp/un-prunned/ open and clamp/prunned/open storage. Otherwise, they were still in good condition. By the third inspection (12 weeks), 13% of the tubers were rotten except those sampled from the clamp/prunned/ open stores. Shrivelling was usually noticeable in clamp stores probably because of high temperature and humidity.

Recovery of sweetpotatoes. Much of the marketable roots were recovered from pits constructed under shade (51.7 and 55.0%). This was also reported by Tomlins *et al.* (1999) from studies done in the Lake zone. Table 2

Table 1: Layout of the stores.

No. of stores	Parameters combination
7	Clamp- not pruned (open)
7	Clamp –pruned (open)
7	Pit - not pruned (open)
7	Pit - pruned - (open)
7	Clamp- not pruned (under shade)
7	Clamp –pruned (under shade)
7	Pit - not pruned (under shade)
7	Pit - pruned (under shade)
56 stores	

Table 2: Percent recovery of marketable sweetpotato tubers from various stores after 16 weeks.

Type of treatment	Mean
Recovery of sweetpotatoes	
Clamp/pruned/open	33.8[a]
Clamp/pruned/shade	40.8[a]
Clamp/not pruned/open	29.4[a]
Clamp/not pruned/shade	44.0[a]
Pit/pruned/open	37.3[a]
Pit/pruned/shade	51.7[b]
Pit/not pruned/open	36.4[a]
Pit/not pruned/shade	55.3[b]

shows the percent recovery of marketable sweetpotato tubers. Pruning had no effect on the recovery of marketable sweetpotatoes.

Suitability of sweetpotato tubers for different uses. Stores were opened after 16 weeks of storage. During this time, sweetpotatoes were sorted out into marketable roots, those fit for household use and rotten ones. Results are presented in Table 3. Percentage of tubers fit for household use was similar in all the stores. Percent rotten sweetpotatoes was highest in clamp/ pruned /open stores.

Effect of soil type on sprouting of sweetpotato. The lowest sprouting (8%) was recorded in the stores constructed in calcareous soils, while the highest (45%) was found in the stores constructed in the clay soils. This may not be serious because previous studies showed that sprouting was not a problem in marketing sweetpotato tubers (Tomlins *et al.*, 1999).

Marketability of the stored sweetpotatoes. Market prices of the sweetpotato increased from Tsh 11,500 to 14,500 in both markets. Storage method never affected prices.

Table 3: Suitability of sweetpotato tubers for use after 16 weeks of storage.

No. of stores	Store types	Fit for household use	Rotten
7	Clamp/pruned /open	16.2	50.0
7	Clamp/pruned/shaded	25.0	34.2
7	Clamp/not pruned/open	31.0	39.0
7	Clamp/not pruned/open	31.0	39.6
7	Clamp/not pruned/ shaded	28.0	28.0
7	Pit/pruned/open	27.0	35.7
7	Pit/pruned/shaded	26.0	22.3
7	Pit/not pruned/ open	28.0	35.6
7	Pit/not pruned/ shade	21.0	23.7

Conclusion and Recommendation

Pit storage which is constructed in shade has the ability to store fresh sweetpotatoes for about 16 weeks. Clamp storage, although seemingly easier, results into more rots. Pruning the canopy of sweetpotatoes 14 days before harvesting the tubers for storage had no effect on the recovery of marketable tubers.

Therefore, farmers are encouraged to store their sweetpotatoes in pits constructed in shade. The cost of prunning sweetpotato before harvest and storage is not justified.

Acknowledgements

The authors wish to thank Dr. Wilbald Lori, TFNC for his guidance, and for facilitating fieldwork. The advice and guidance of Mr Mbukuzi is also appreciated.

This work was funded by the United Kingdom Department for International Development (DFID).

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