Sand Storage – An innovation to extend the shelf-life of fresh sweetpotato for home consumption and market sales

Findings from Ghana & Malawi

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INTRODUCTION

African farmers have developed a range of practices in an effort to store sweetpotato roots and extend shelf-life. These include storage in soil, grass or ash, storage in pits, simply left in the ground and harvested piecemeal as required, or processed into sun-dried chips. β-carotene, an important source of dietary vitamin A, is better retained in fresh storage than in dried chips or flour. Important lessons have been learned regarding pre-storage handling and sorting with respect to curing and pest control.

Considering new innovations and local knowledge on root and tuber crops offers the potential for consistent improvements in the shelf-life of sweetpotato under on-farm conditions in SSA. Our objective was to compare storage innovations at the community level in Ghana and Malawi.

SUMMARY

A uni-modal rainfall pattern causes a fairly short harvest season, where the sweetpotato is abundant and cheap in the markets, followed by a long dry season during which sweetpotato becomes scarce and expensive. Generally, the crop is consumed, processed, or sold shortly after harvest because of lack reliable storage techniques.

In Malawi, ambient temperatures during the dry season are relatively cool while in northern Ghana, the temperatures are far warmer, but the start of the dry season is characterized by cooler night temperatures low relative humidity which occurs during the harmattan season. Since sweetpotato is an important crop in parts of northern Ghana and in Malawi, simple methods to extend the shelf-life of this crop for both home consumption and sale would be valuable. In both Malawi and Ghana, trials were designed and implemented at the community level using farmer participatory methods.

In Malawi, experiments were conducted at 3 sites with three replications each of 3 types of storage and two types of varieties, introduced orange-fleshed sweetpotato and local varieties. Storage treatments were ventilated pit storage system introduced from Afghanistan where it was used for potato, storage in dry sand in a pit dug with steps to allow access to deeper levels, and storage in dry sand in granaries.

In Ghana, research was done at five communities comparing 3 varieties and two storage methods: a local method using heap covered with straw and kept moist, and storage in dry sand in a "box" structure constructed of mud/adobe. Weight loss of sweetpotato in stores was monitored periodically to compare storage treatments over six and a half months in Malawi and four months in Ghana. In Malawi, at 1.5 months there were not striking differences among treatments, but by 3.5 months the pit method was starting to emerge as consistently superior, a trend that continued through 6.5 months. Losses in granaries were largely due to shriveling, while in the sand pit were due to termites, and rats (if sand cover was not thick). Losses in ventilated pits were due to termites, rats and Java black rot. Sprouting was consistently high in the sand pit, but sprouts were simply removed at assessments, and roots returned to storage. Women favored the sand pit as it was easy for them to manage both for home-consumption and sales. In Ghana, sand box storage similarly proved superior to moistened heap storage over a 16-week storage period. In Malawi, the sand pit method was preferred by farmers for both home consumption and commercial storage, while in Ghana, farmers said they would adopt the sand box method for home consumption.

MATERIAL & METHODS

In Ghana, we worked in five communities around Bawku in the Upper East Region, and in Malawi we chose three communities in Kasungu and Mzimba Districts. In Ghana, Bawku is at 11º N and ~220 masl. In Malawi communities were at mid-elevations of ~1200 masl, and the 13º S. Work was conducted at the community level with Catholic Relief Services (CRS) and their local partners. In Ghana, traditional moistened heap and sand box (Fig 1) were evaluated in ~100 households with 3 standard varieties (2 OFSP, 1 white variety). In Malawi, local and introduced (OFSP) sweetpotato were grown for storage trials using designs agreed to at the community level. Ventilated pits (Afghanistan method), and two types of storage in dry sand were evaluated: a pit dug with steps for convenience of access, and clay-cemented granary (Fig 1). Ninety household-level participants were involved, with more than 50% women. Zondeni OFSP and local varieties were included in the test. Each site (3) had a complete set of stores to be investigated, and each treatment was replicated thrice (Fig 2). During the production season, participants were trained on sweetpotato production management, OFSP utilization and processing, and postharvest handling to ensure the storage root quality at storage. Prior to storage in Malawi, farmers used their traditional practice of "curing" harvested roots by leaving them exposed to the sun on the field for a few days. The local variety was not treated in the same way, so went into stores without the "curing" treatment. Baseline and endline survey were conducted in Ghana and Malawi. In Malawi, data of weight loss, taste test, temperature and RH were collected at 0, 1.5, 3.5 and 6.5 months after stored (MAS). Market assessment and β-carotene analysis were done at 1.5 and 6.5 months. Weight loss comprises of shriveling, other disease incidence and pest damage were assessed. The costs per each type store was calculated at installation (Fig 2). Genstat (Anon, 2005) and STATA program were used to analyze the data.

Figure 1. Storage methods evaluated in Ghana and Malawi

Figure 2. Three types of postharvest stores were investigated in Malawi.

The costs per store were calculated in Malawi, it was recorded with an average of US$ 42.

RESULTS, DISCUSSION & CONCLUSION

Storage methods using dry sand appeared promising in both places. The ventilated pit technique was not evaluated at the community level in Ghana, but proved a haven for pests in Malawi. Weight loss from sweetpotatoes in the storage in Malawi are presented in Figure 3. Additionally, farmers in Malawi did not cure the local variety due to late planting, and this stored better than field "cured" roots indicating that the traditional practice there contributes to reducing sweetpotato shelf life. In this trial, weight loss was considered that was caused by the damage of termites,

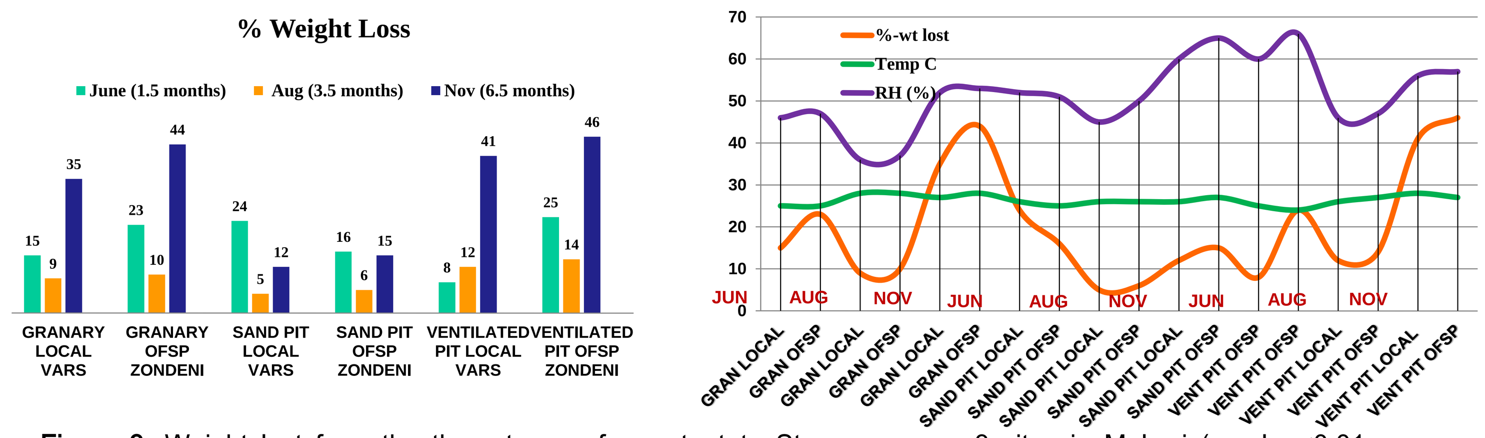
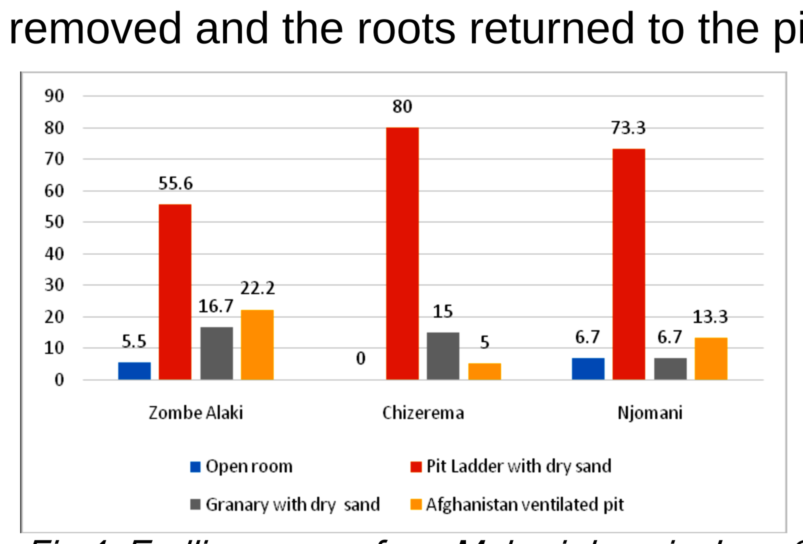


Figure 3. Weight lost from the three types of sweetpotato Storage across 3 sites in Malawi (p-value<0.01, LSD5%=16.7). (Ref.: Type of storage: p-value<0.01, LSD5%=9.6; Varieties: ns; Sites: p-value<0.1, LSD10%=8.2; MAS: p-value<0.001, LSD5%=9.6)

rats, weevils and rots mainly caused by fungal diseases. Termites and rats were a problem in the ground storage for Ghana and Malawi. This was not a problem in granary storage. Sweetpotato weevils were not a problem in any of the sand storage methods due to sand restricting movement. Losses in ventilated pits were due to termites, rats and Java black rot. Sprouting was a problem in the sand pit but these could be removed and the roots returned to the pit. From the endline



Surveys, in Malawi, farmers mostly women preferred the sand pit (i.e. pit ladder at Fig 4) compared to their usual practice of keeping the sweetpotato in an open room. In Ghana, sand-box was the preferred method.

Fig 4. Endline survey from Malawi done in June 2015 (ref. Dadhu-Agro enterprise, CRS)

Results from the ß-carotene analysis in Malawi in June and November 2014 are shown in the following table. OFSP Zondeni was still within the range of moderate ß-carotene (40-129 µg/g) – orange (Simonne *et al.* 1993).

Varieties	B-carotene ((µg/g)	
	June (1.5 MAS)	Nov (6.5 MAS)
Local (Kenya & Zimbabwe)	10.7	7.4
OFSP, Zondeni	83.9	91.8

Sand storage presents high potential for extending fresh roots for home consumption and sale.

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