

Comparison of postharvest handling methods on the quality and shelf-life characteristics of OFSP roots intended for processing into puree



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A reminder of current sweetpotato harvest and postharvest handling in the Kenyan value chains



So we set up a **postharvest handling trial**

Objective

To identify practical postharvest handling methods which minimised shelf-life reduction and quality loss of freshly harvested OFSP roots during short-term keeping (<14 days) in Kenya

Experimental hypothesis

Careful dry soil removal and packaging techniques prolong shelf-life and maintain quality of freshly harvested OFSP roots intended for processing after up to 2 weeks keeping

Use of the findings

To develop a set of postharvest handling recommendations for OFSP puree processors to use with farmers in sourcing, harvesting, packing, transporting and short-term storage

Overview of our postharvest handling (PHH) trial

Variables investigated

- **Variety:** Kabode and Vita (both are OFSP)
- **Soil removal methods:** Wet manual, Wet brush, Dry manual, No soil removal
- **Packaging:** Plastic crate; Wooden crate; Sack
- **Shelf-life period:** 0, 3, 7, 10 and 14 days

Process

Sweetpotato roots harvested in Kabondo (ox-plough, manual)

Selected medium to large sized undamaged roots

Divided into treatments

Rough road transport to Organi

Placed in keeping rooms until shelf-life assessment

Trial was set-up in August 2015.



PHH trial treatments

Treatment ID code letter	Variety	Harvesting method	Soil removal method	Packaging	Shelf-life periods (days)	Replicates
A	Kabode	Ox-plough	Wet manual	Plastic crate	<u>3,7,10,14</u>	3
B				Wooden crate	<u>3,7,10,14</u>	3
C				Sack	<u>3,7,10,14</u>	3
D			Wet brush	Plastic crate	<u>3,7,10,14</u>	3
E				Wooden crate	<u>3,7,10,14</u>	3
F				Sack	<u>3,7,10,14</u>	3
G			Dry manual	Plastic crate	<u>3,7,10,14</u>	3
H				Wooden crate	<u>3,7,10,14</u>	3
I				Sack	<u>3,7,10,14</u>	3
J			No soil removal	Plastic crate	<u>3,7,10,14</u>	3
K				Wooden crate	<u>3,7,10,14</u>	3
L				Sack	<u>3,7,10,14</u>	3
T	Vita	Ox-plough	Dry manual	Wooden crate	<u>3, 10,14</u>	3
U				Sack	<u>3, 10,14</u>	3
W			No soil removal	Wooden crate	<u>3, 10,14</u>	3
X				Sack	<u>3, 10,14</u>	3
Y	Kabode	Manual harvest	Dry manual	Wooden crate	<u>3,7,10,14</u>	3
Z	Vita	Manual harvest	Dry manual	Wooden crate	<u>3, 10,14</u>	3
Example of labelling:						
		B-10 days-rep2	= Trt B (Kabode, Ox-plough, Wet manual, Wooden); (10 days sample); replicate 2			
		R-7 days-rep1	=Trt R (Vita, Ox-plough, Wet brush, Sack); sample after 7 days storage; replicate 1			
		R-7days-rep2	=Trt R (Vita, Ox-plough, Wet brush, Sack); sample after 7 days storage; replicate 2			

What criteria were assessed during the PHH trial?

KABODE - Effect of postharvest handling on OFSP fresh root shelf-life trial, Kabondo, Kenya set-up 3 Aug 2015













Date of sample analysis (dd/mm/yy):

Variety	Harvesting method	Soil removal method	Packaging	Treatment ID code	Replicate	Storage period (e.g. 3, 7, 10, 14 days since harvest)	Weight of sample (g)	Photo	Analysis criteria for each sample												
									General appearance of sample (1 to 9 scale; [9 = best fresh looking roots])	Sponginess score (1 to 9; [9 is best firm non-spongy roots])	Shrivelling score (1 to 9 scale; [9 = best non shrivelled roots; 1= totally shrivelled])	Total number of roots	No. of roots exhibiting rotting	No. of roots with skin damage	% of surface area with skin damage (7=0 to 5%; 6=6-10%; 5=11-20%; 4=21-30%; 3=31-60%; 2=61-80%; 1=81-100%)	No. of roots with deeper insect or millipede damage	Peeling quality (1 to 9 scale; 9 = easiest)	Time take to peel each sample (mins)	Wt. of roots after peeling (g)	Peeling remarks	
Kabode	Ox-plough	Wet manual	Ventilated plastic crate	A	1																
				A	2																
				A	3																
Kabode	Ox-plough	Wet manual	Wooden crate	B	1																
				B	2																
				B	3																
Kabode	Ox-plough	Wet manual	Sack	C	1																
				C	2																
				C	3																
				D	1																

- General appearance
- Weight change
- Sponginess
- Shrivelling
- Rotting
- Damage (any, surface area, deeper)
- Peeling quality and time

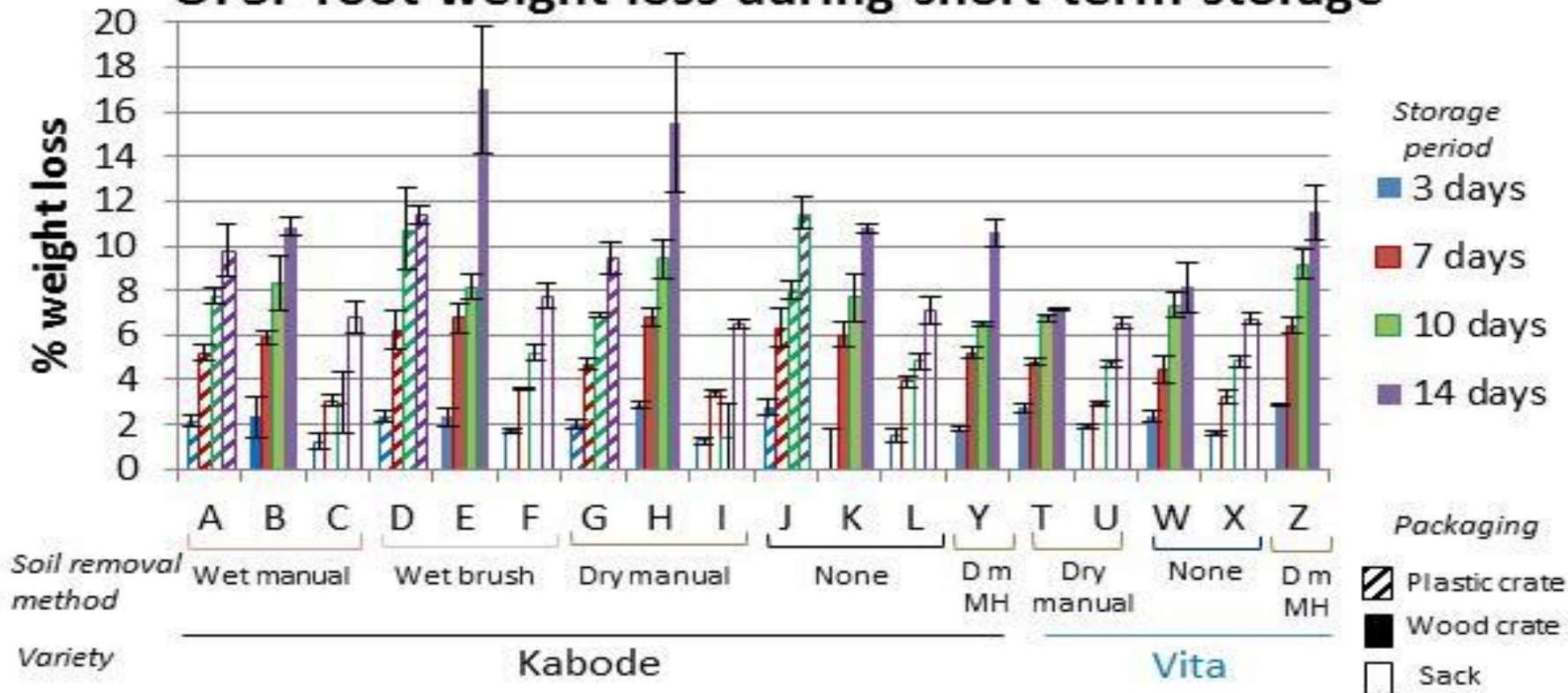


Images of Kabode roots, 14 days after harvest with different soil removal and packaging treatments

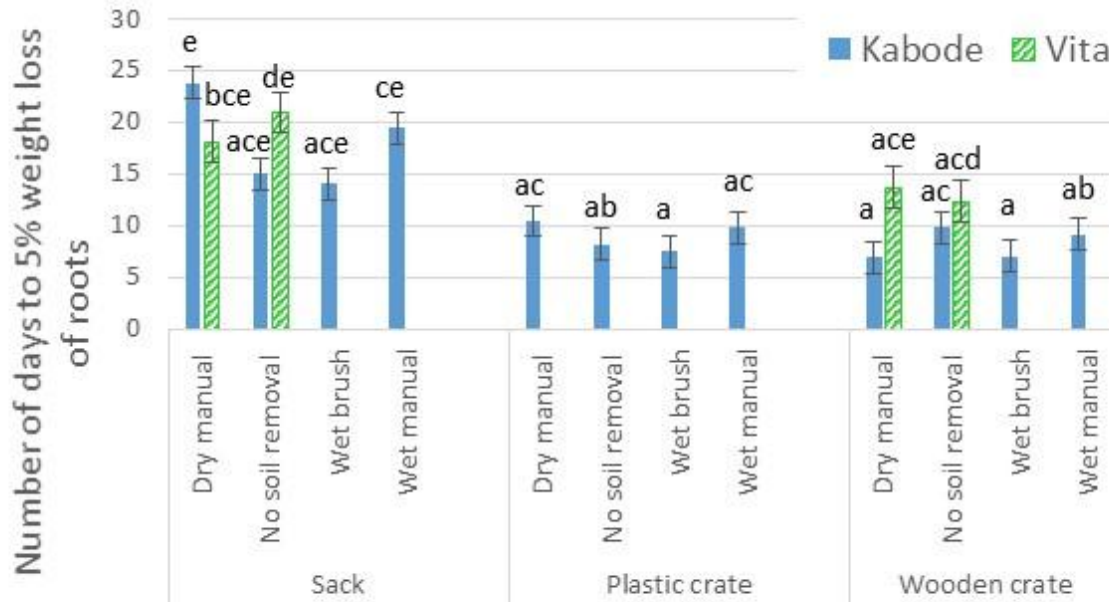
	days	Sack	Plastic crate	Wooden crate
Wet manual	14			
Wet brush	14			
Dry manual	14			
No soil removal	14			

Complex trial design.. complex results due to so many interactions

Influence of postharvest handling techniques on OFSP root weight loss during short-term storage



Statistical comparison: simplified % weight loss over time to 'Number of days to 5% weight loss'



Soil removal method and packaging container

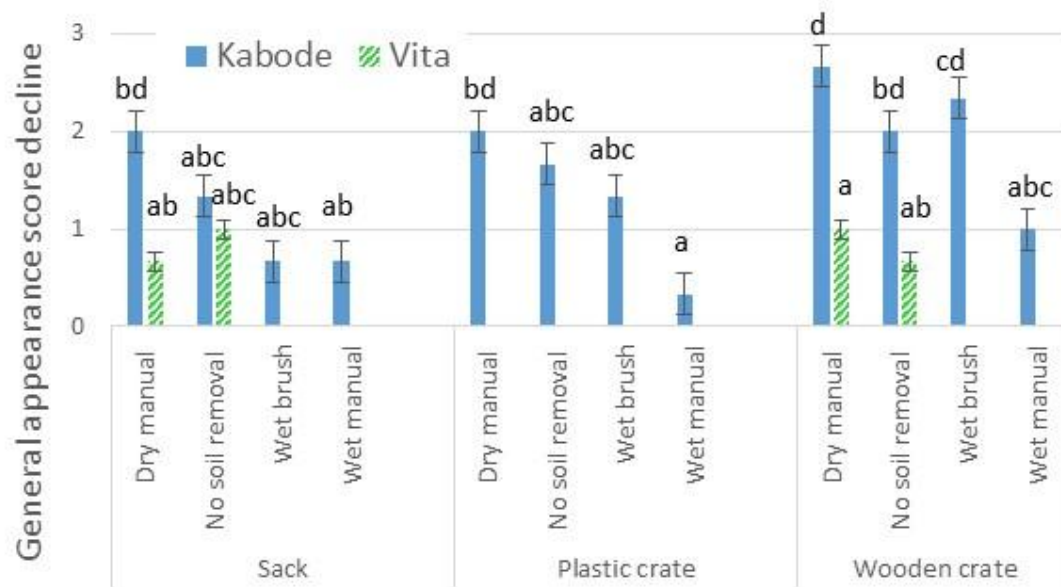
- Root weight loss was slower in all the soil removal treatments when packaged in polypropylene sacks as opposed to wooden or plastic crates

Analysis of Variance Table

	Df	Sum Sq	Mean Sq	F value	p-value						
var	1	182.42	182.42	16.1057	0.0003375 ***						
soil	3	75.74	25.25	2.2290	0.1038615						
store	2	823.81	411.90	36.3674	5.767e-09 ***						
var:soil	1	21.39	21.39	1.8890	0.1788699						
var:store	1	22.53	22.53	1.9896	0.1680329						
soil:store	6	41.74	6.96	0.6142	0.7172073						
var:soil:store	1	91.96	91.96	8.1191	0.0075985 **						
Residuals	32	362.44	11.33								

Signif. codes:	0	***	0.001	**	0.01	*	0.05	.	0.1	.	1

Statistical comparison: Decline in general appearance score between day 3 and day 14



- General appearance typically declined from 7 days onwards
- For first 3 days general appearance of roots with dry manual or no soil removal (nsr) was better than washed roots
- However their general appearance declined from day 3 to 14
- Roots in wooden crates had a greater decline in general appearance than those in sacks
- Vita roots appeared to decline less rapidly than Kabode

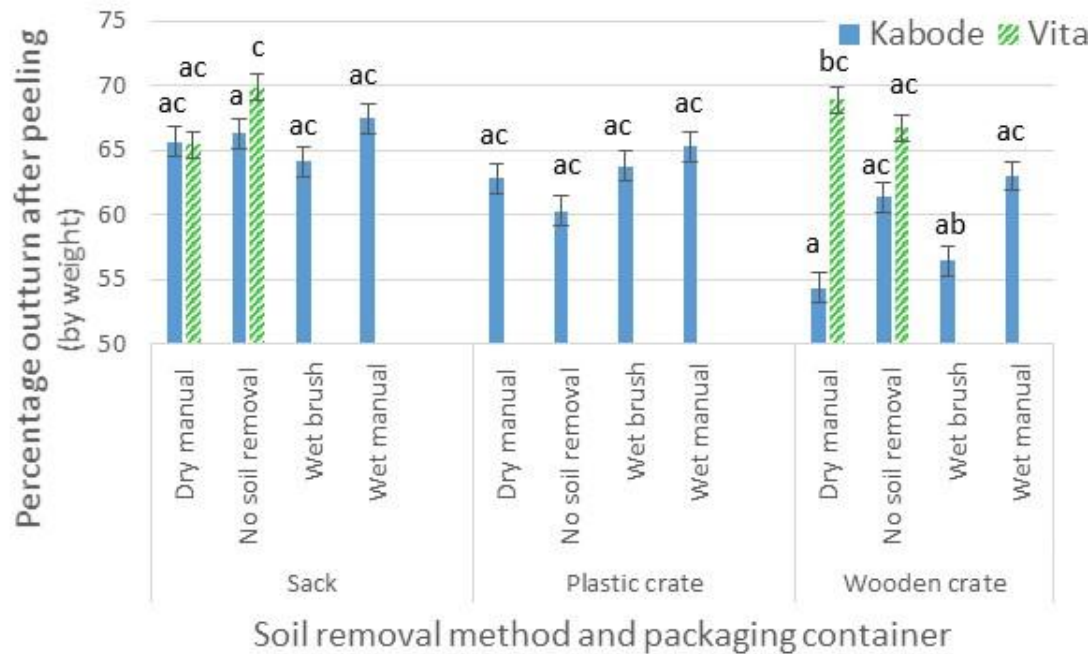
Soil removal method and packaging container

Analysis of Variance Table

	Sum Sq	Mean Sq	F value	Pr(>F)						
var	1	5.6641	5.6641	16.1427 0.0002679 ***						
soil	3	13.7673	4.5891	13.0789 5.136e-06 ***						
store	2	3.7356	1.8678	5.3232 0.0091603 **						
var:soil	1	0.7932	0.7932	2.2607 0.1409633						
var:store	1	1.3749	1.3749	3.9185 0.0550363 .						
soil:store	6	1.9744	0.3291	0.9379 0.4795340						
var:soil:store	1	0.1905	0.1905	0.5429 0.4657758						
Residuals	38	13.3333	0.3509							

Signif. codes:	0	****	0.001	***	0.01	**	0.05	.	0.1	1

Statistical comparison: Percentage out-turn after peeling of roots kept for 14 days



- For Kabode - % outturn (by weight) generally lower for roots in wooden crates than in sacks
- This difference was not apparent for Vita
- Note: no clear trends in peeling time, peeling score tended to drop between day 10 and 14



Resulting postharvest handling recommendations

FARMERS

1. Ox-plough or manual harvesting with care
2. Transport to collection centre
3. Manual washing away of soil, and air-drying of roots
4. Sort roots and remove any weevil damaged, rotting or small roots
5. Careful packing of dry roots in clean 50kg sacks (avoid over-filling sacks)

TRANSPORTERS

1. Careful loading, stacking and off-loading of sacks

PROCESSORS

1. Careful emptying of sacks of roots
2. Sort roots into:
 - a. **Immediate use:** those to be used in next 2 days – heap in peeling shed, to include any broken or heavily skin damaged roots
 - b. **Short-term keeping:** those to be used in next 2 weeks, as determined by root demand, root stocks and root quality. Ensure roots are not *Cylas* infested, not broken, not wet, and then place them in a clean sack in a cool place (e.g. store room or shade)
 - c. **Long-term storage:** those to be kept for up to 4 months. Ensure roots are as undamaged as possible, dry, no *Cylas* weevil damage, then place in selected packaging container (may be sack, wood or plastic crate – trials not yet done). Curing prior to storage. Ensure regular monitoring, stock control and rodent management.

Discussion

- Complex experimental design and analysis
- Washed roots kept in sacks **did not** rot within 4-5 days
- Root weight loss and general appearance changed less in sacks than crates
- However, **further study needed for long-term fresh root storage** and also on optimum practical curing and storage conditions and environments
- High % damaged roots - processors will be keeping damaged roots – a *challenge*
- Root supply - in trial obtaining sufficient roots was difficult (*OFSP vine value issue*), and subsequently there have been gluts – *knowledge and control of root supply is vital*
- Our trial was fairly small-scale, a higher density of roots in the sacks and crates might give different results
- Rodent management in fresh root stores: *serious issue needing study*
- β -carotene retention during fresh root keeping and storage needs further study/ understanding (*temp, transport to analysis lab, varieties*)

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