Long-term storage of fresh sweetpotato roots to reduce puree supply chain risks

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Presentation outline

- Objective
- Background context
- Approach
- Highlights from findings
- Discussion

Objective

To maintain the puree-making quality of >5 tonnes of freshly harvested orange-fleshed sweetpotato roots during a 3-4 month storage period in a hot tropical area of sub-Saharan Africa

Background context

- A large Kenyan supermarket chain has begun using orange-fleshed sweetpotato puree in its bakeries to produce a vitamin A rich bread which urban consumers enjoy
- To maintain such market opportunities, the processors need to provide a year-round supply of high quality OFSP puree
- To do this, they require fresh OFSP roots, however sweetpotato production is rain-fed, and there are gluts and shortages in the root supply during the year and associated price fluctuations

Approach – Set-up (1/4)

	Kabode				Vita			
Variety:	Kabode				Vita			
Soil removal:	Washed (A)		Dry manual (B)		Washed (C)		Dry manual (D)	
Store room: Solar (1) or mains (2) powered	Store 1	Store 2	Store 1	Store 2	Store 1	Store 2	Store 1	Store 2
	15 boxes	15 boxes	15 boxes	15 boxes	12 boxes	12 boxes	13 boxes	13 boxes

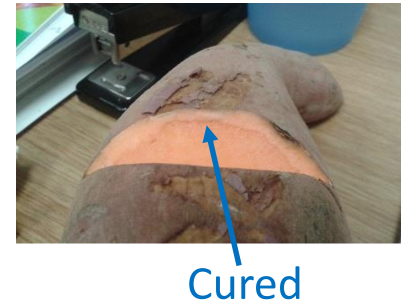
LTS4 trial set up on 13&14 Dec 2016; ~35-40 kgs roots per crate
NB: Limited Vita roots hence fewer crates



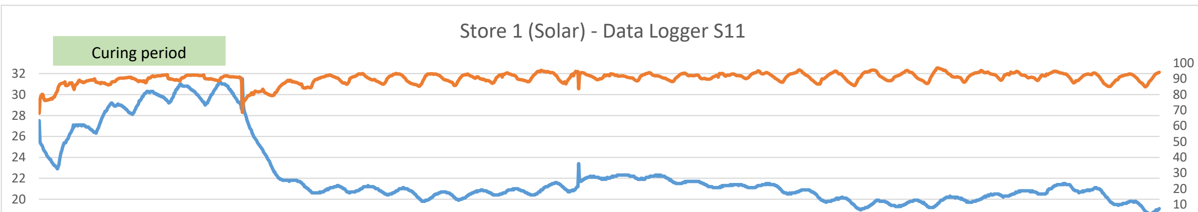



Rejected OFSP roots


Approach – Root curing (2/4)



- Sweetpotato roots retain the ability to heal wounds after harvest.
- To “cure” roots at start of storage they are exposed to high humidity so that wounds do not dry out, and warm temperatures so that roots can actively metabolise.
- The wound-healing process involves the synthesis of a layer of lignin to provide a barrier to water loss and entry of rotting pathogens, followed by the synthesis of a new periderm (skin) underneath this.



1. Uncertainty over curing period required
2. Wanted to compare external and internal signs
3. ~12 roots per trt had small areas of peel removed and were placed in stores
4. Each day we cut into the roots to see if the periderm had thickened or not
5. It took 5 days of curing at 30C & 95% rh for this to happen, although externally roots appeared to cure within 1-2 days.
6. Curing conditions were kept on for 5 days in stores and then active cooling started on 6th day (8am on 19/12/2016)

Approach – Experimental design (3/4)

Sampling plan and calendar - LTS 4 (Dec 2016)

Sampling:	Month 1	Month 2	Month 3 & Week 2	Month 4 & Week 6

Store 1 - Solar powered

Back wall

B2	B22	A14	A3	A7	top
D21	A32	A9	A21	B17	middle
C21	B8	A6	D9	B32	bottom

D27	C8	C1	C2		top
B9	D7	A29	D3		middle
B31	A26	D13	C23	B15	bottom

D26	D2	A30	D25	B24	top
C17	B25	A16	A17	D5	middle
D6	B12	D28	D11	A19	bottom

	B11	B7	C9	A13	top
	B23	C4	C12	C7	middle
	B14	C19	C11	A23	bottom

Door

Store 2 - Mains powered

Back wall

A15	D15	B19	B1	D4	top
D12	A18	B6	A10	A24	middle
D22	C18	A12	A25	C16	bottom

B13	D19	C10	A8	A27	top
A2	A33	D1	B3	C20	middle
D14	A20	B16	D17	B18	bottom

B26	A1	C6	C24	A28	top
D8	A5	C3	C15	C14	middle
A22	B29	A11	C13	D10	bottom

B28					
A4	B33	C5	D18	B4	top
B27	B21	B5	B30	D16	middle
A31	B20	D20	C22	B10	bottom

Door

Approach – Sampling (4/4)

Raw root quality analysis




Each box weighed: roots counted, scored for general appearance, sponginess, shrivelling

Roots sorted, count and weigh of good quality and defective. The defective then counted and weighed 1st by surface damage, then by sprouted, then by weevil damaged, then by rotten. Portion of rotten and weevil roots needing discarding then cut out and weighed.

3 randomly selected roots of each treatment then vacuum packed and sent to FANEL for lab analysis (mc, Beta-carotene)

Simple quality analysis of puree

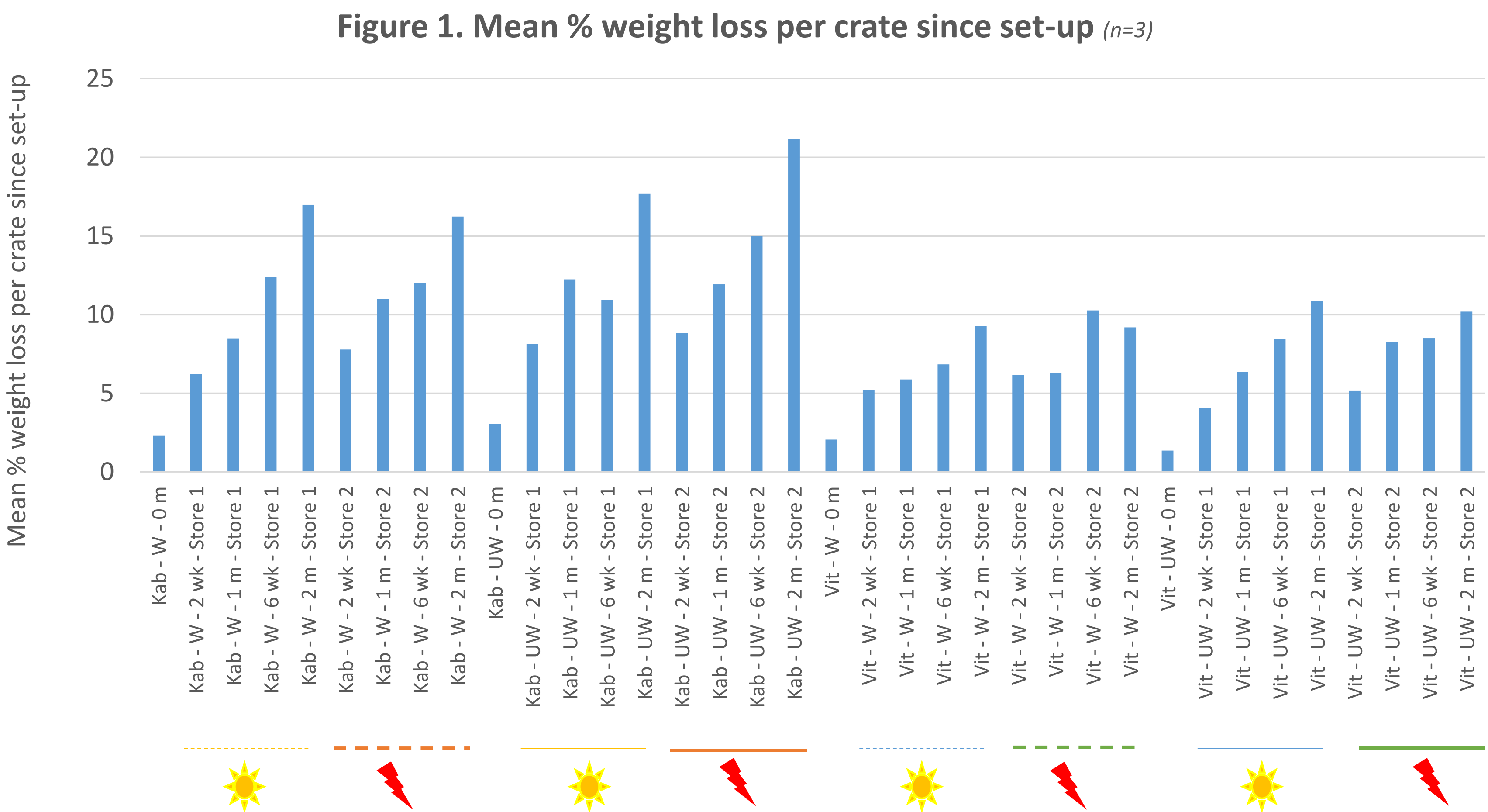




25 kgs roots/ treatment, washed, steamed, cooled, cut, pureed.

Sugar content (brix refractometer), puree stickiness, thickness, colour recorded. Puree sample sent to FANEL for betacarotene and bread making quality analysis

Highlights from findings (1/6)



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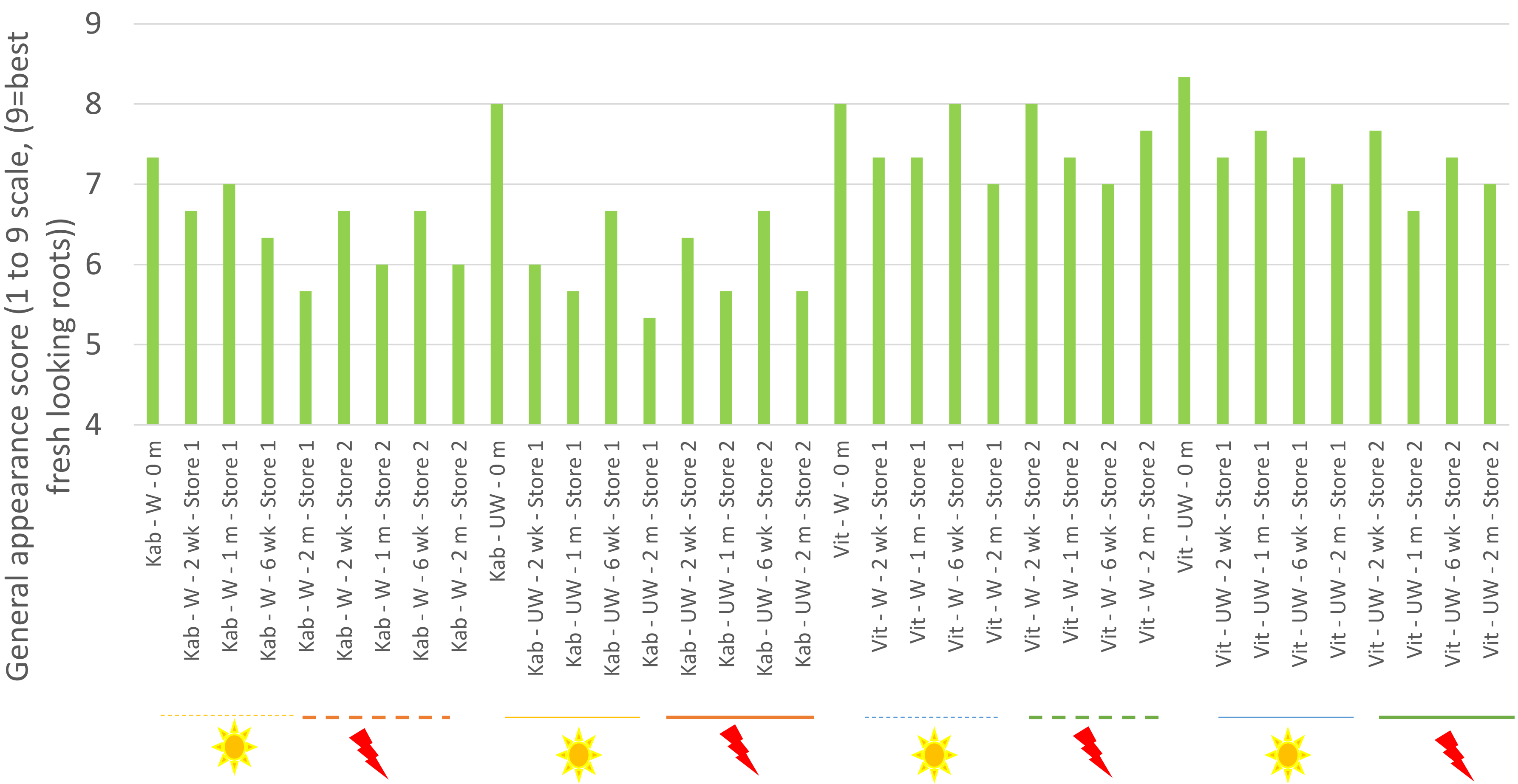
Highlights from findings (2/6)

Figure 2. Mean root general appearance score per crate *(n=3)*



Highlights from findings (3/6)

Figure 3. Mean % of roots with any signs of surface mould on them (by number)

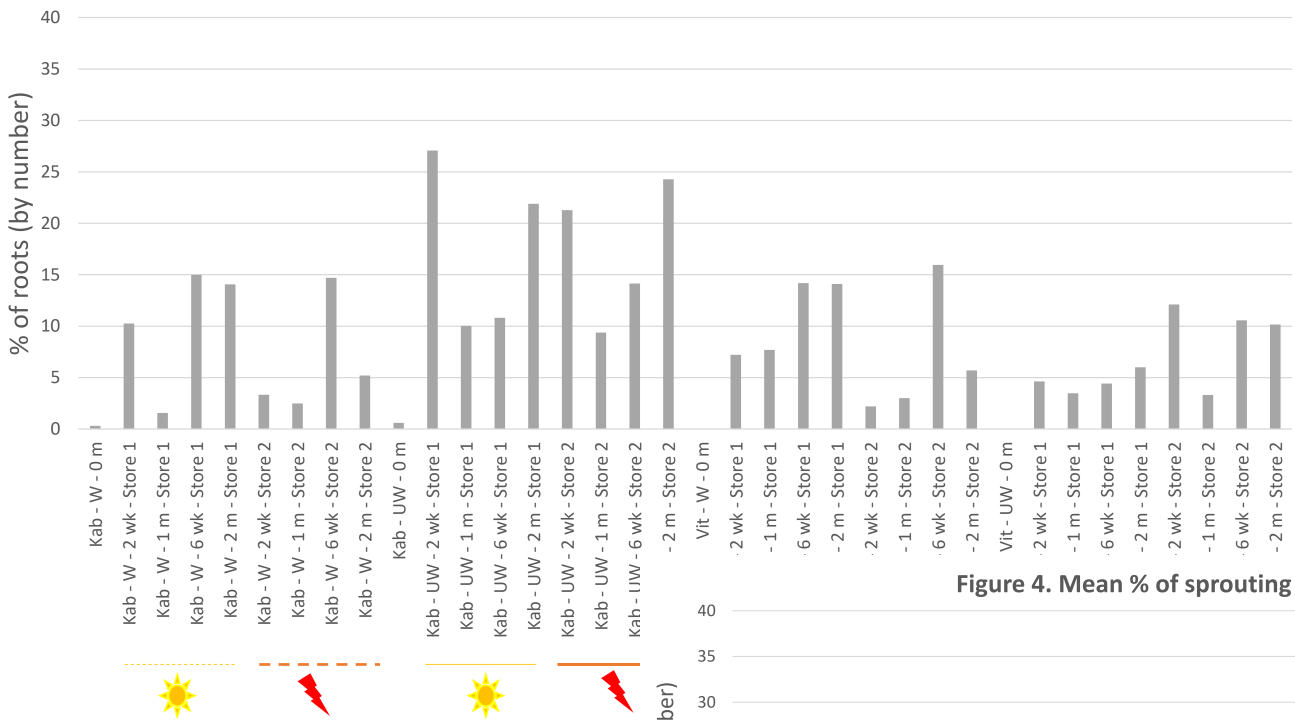
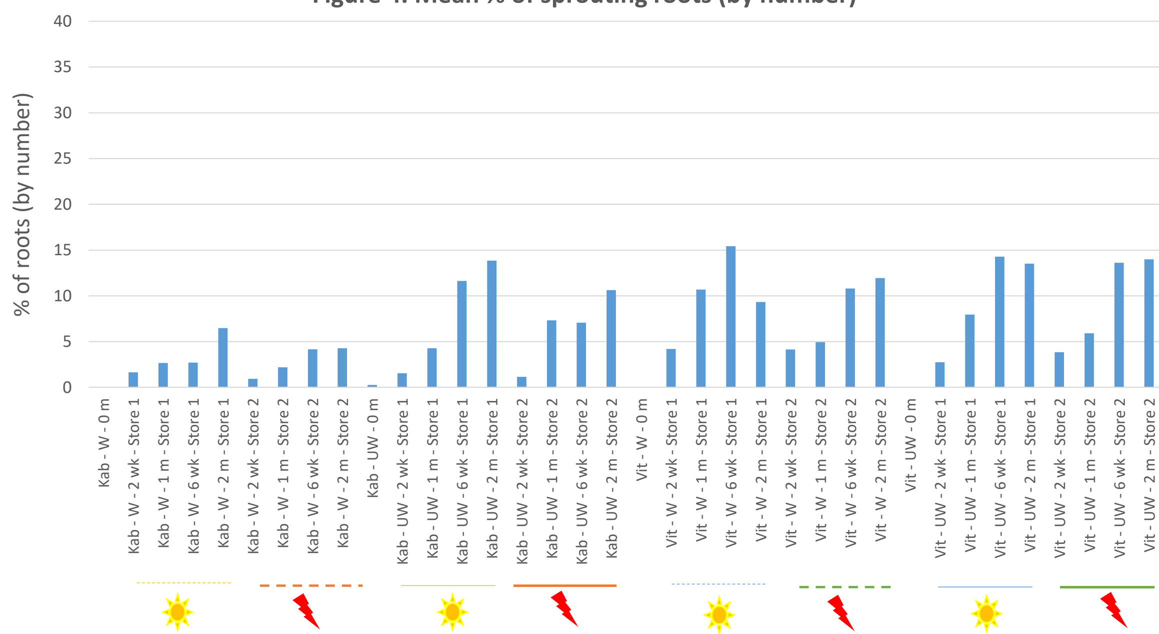


Figure 4. Mean % of sprouting roots (by number)



- Small areas of surface mould on some roots in all treatments. More so on the unwashed Kabode, but not Vita.
- No. of roots with sprouts increasing over time but less than 15% at 2 months. Less sprouting in washed Kabode roots.

Highlights from findings (4/6)

Figure 5. Mean % of roots with any signs of weevil damaged roots (by number)

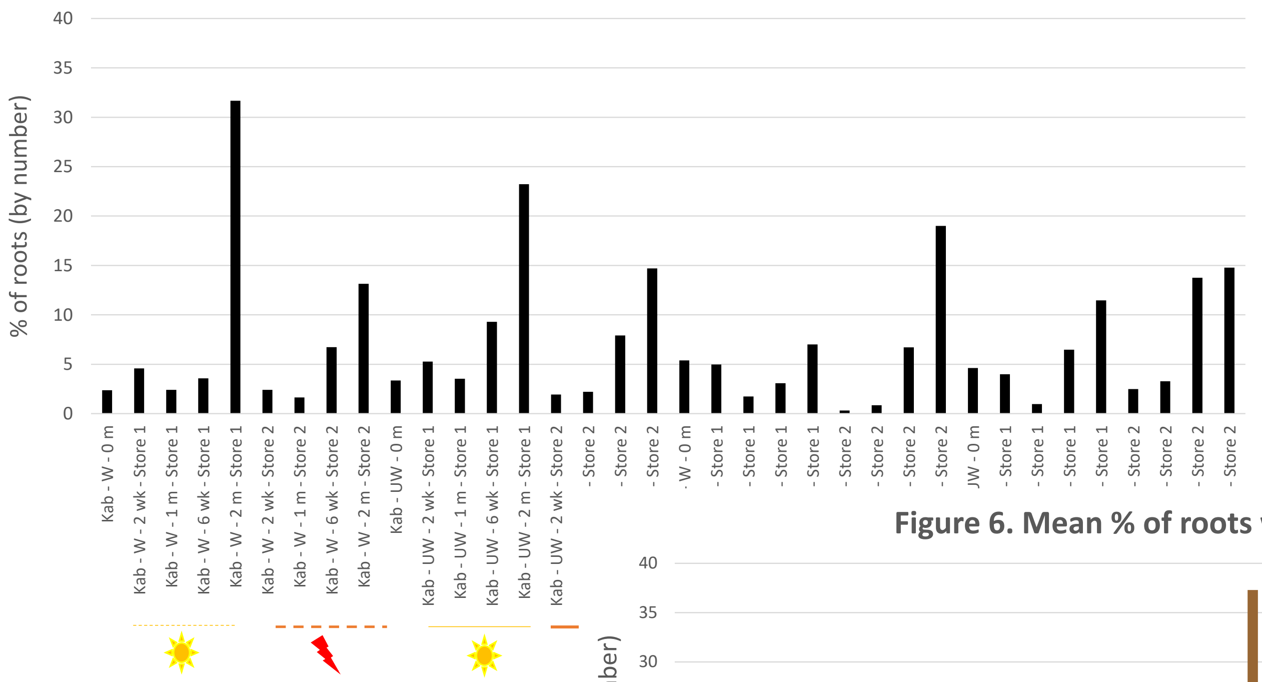
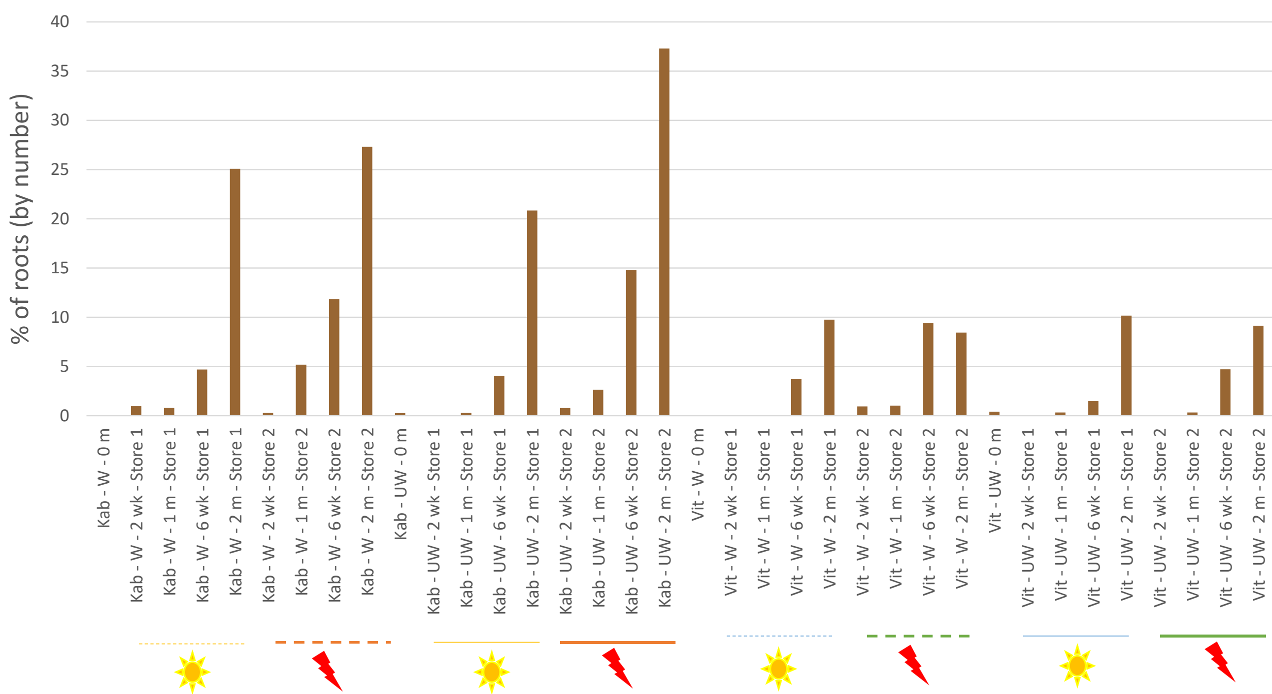


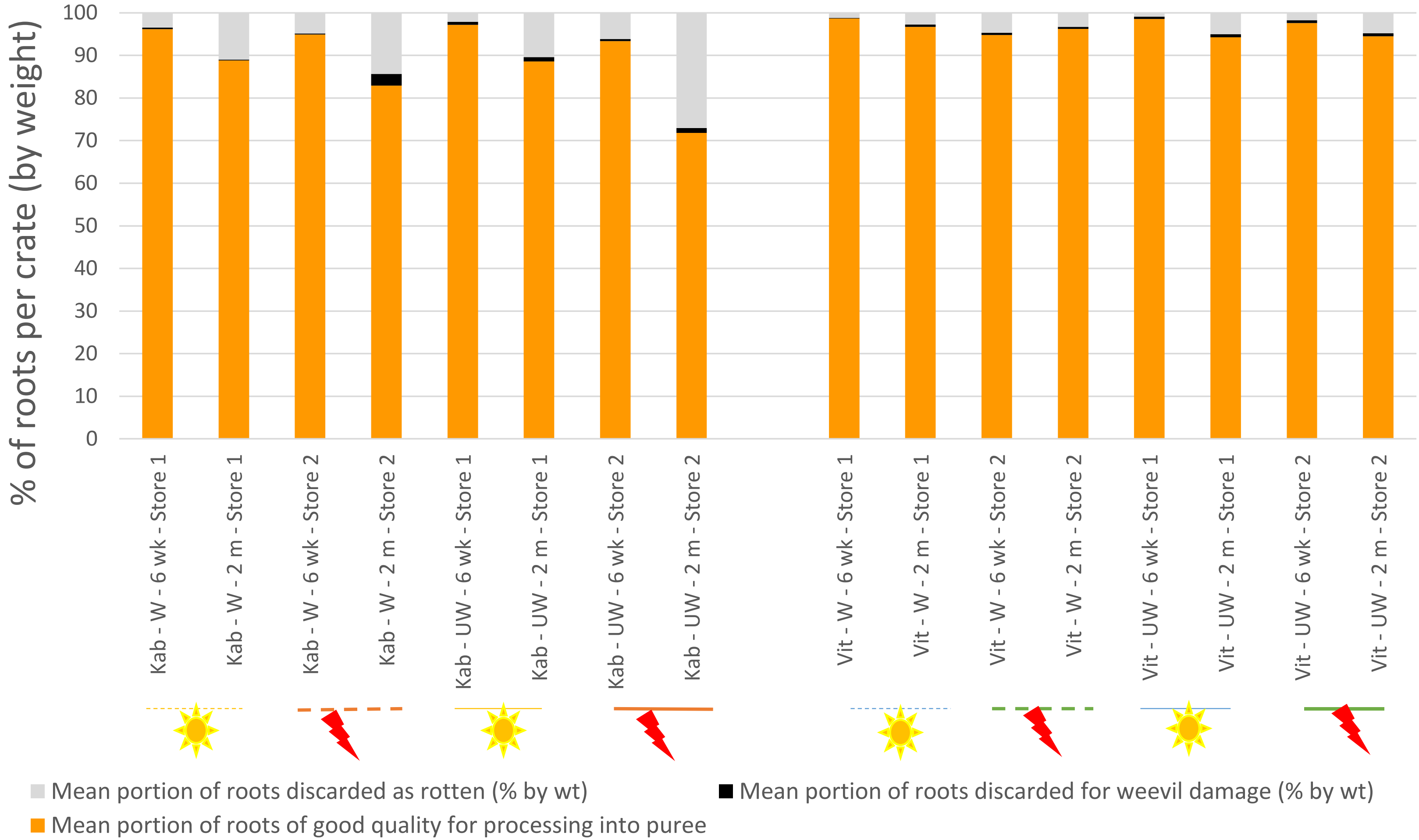
Figure 6. Mean % of roots with rots (by number)



- Incidence of signs of weevil damage increasing. Live weevils that have emerged also being found.
- No. of roots with rots increasing over time. Higher in Kabode than Vita, but not a big difference between washed and unwashed roots.

Highlights from findings (5/6)

Figure 7. Mean portion of fresh sweetpotato roots per crate of good quality for puree processing versus needing discarding after 6 weeks and 2 months storage



- At 2 months storage 89% of root weight was good quality, (Store 1: 92%; Store 2: 86%)
- Kabode roots in Store 2 whether washed (W) or unwashed (UW) had most quality deterioration, although >70% was usable for puree after 2 months storage

Highlights from findings (6/6)

Treatment codes: A= Kabode washed; B = Kabode unwashed; C = Vita washed; D = Vita unwashed

Example of very small portion of roots that actually needs discarding

Discussion

- **Promising that 89% of roots can be used in puree supply chain after 2 months storage.**

- Thorough sorting of roots prior to storage has helped delay and reduce build up of weevil pests and damage, but weevils are emerging and feeding/ breeding on the stored roots.

- Rots and sprouting also increasing over time.
- No obvious superiority in quality of washed vs unwashed roots yet.
- Trial will continue to 4 months storage.
- Puree quality data will also be analysed.
- Ongoing work to **cost-effectively** bring storage temperatures down to 15-17C, to help reduce weevil survival and reproduction, root sprouting and rotting.

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