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	PROCEDURE FOR THE HANDLING OF SWEET POTATOES FOR EXPORT				Page 1 of 5	Rev: 02
					ISO CLAUSE:	
					Date: 02/03/05	
Responsibility:	NPM: Cold Chain Services	Name:	Initial:			
Approved By:	Executive: I & CCS	Name:	Initial:			

1. INTRODUCTION

Botanically a sweet potato is a swollen root to act as a storage organ. Sweet potatoes are becoming a more important export commodity fetching good prices during certain times on the European market. Best prices are however only paid for best quality sweet potatoes. Other countries also compete with South Africa in the European market. Reliable supplies of good quality sweet potatoes will secure the European market for South Africa. Optimum pulp temperatures must be maintained during storage and transport to minimize waste, weight loss and sprouting.

It is also of paramount importance that sweet potatoes are kept dry at all times. Any condensation of moisture may result in decay. Careful handling to avoid skin injuries and correct curing to harden the skin are essential requirements to reduce quality loss.

The quality of sweet potatoes, as with most other crops, is largely determined by climate, soil condition and moisture and cultural practices. Storage disorders such as sprouting and chilling injury may occur if temperatures are not maintained correctly and fungal and bacterial decay are all aggravated by high temperatures and moisture conditions.

The handling procedures outlined in this document are based on the assumption that optimum cultural and growing conditions were practised and that the sweet potatoes complied to the specified quality criteria. Alternative procedures may be considered depending on port of export, transport equipment available etc. The PPECB may be consulted for information.

2. PACKHOUSE PROCEDURES

2.1 Preparation

Sweet potatoes must be washed with clean water soon after lifting to remove all soil particles and foreign matter. If the washing water is re-circulated it must be treated with 50 ppm to 100 ppm chlorine (active ingredient) to avoid any fungal built up in the water and to sterilise the surface of the sweet potatoes. Other more effective chemicals may be used provided it is registered and residues are within the international specifications.

An approved post harvest chemical may be applied after washing to reduce the incidence of waste. The correct concentration and application procedure, as stated on the label, must be followed to ensure that the prescribed international residue tolerance is not exceeded.


All free water must be allowed to drain from the container and sweet potatoes must be dried as soon as possible after treatment. Ventilated plastic lug boxes are recommended because it allows for easy drainage and can be cleaned easily before it is reused.

2.2 Curing

Curing is the process whereby the sweet potato roots are allowed to:

- heal the wounds on and in the skin (caused by handling) by the formation of new skin tissue (periderm) and by toughening of the skin (corky tissue formation and desiccation of the outer skin tissues).
- “ripening” of the root by allowing the conversion of the starch reserves to sugars. This is necessary for taste and flavour development.

Controlled curing requires temperature control between 24°C to 30°C at a relative humidity (RH) of 90% to 95%. The curing process is completed after 4 to 7 days depending on the maturity (development of the roots) at time of lifting. This method of curing requires a temperature and RH controlled ripening room. The sweet potatoes must also be inspected at least twice a day to ensure optimum conditions. Curing is completed once a thickening of the buds (eyes) is observed and packaging and cooling must then be applied to avoid sprouting.

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Natural curing is slower, but is less capital and labour intensive. Natural curing lends itself more to existing commercial practices and may result in less waste, if applied correctly, than controlled curing.

Curing must also be applied after packing to allow new wounds to heal. This can be achieved by transporting the packed sweet potatoes at ambient conditions to the port to allow for additional curing. Precooling is then done in the port and the cold chain is introduced to reduce quality loss.

It is however, of paramount importance that sweet potatoes are not exposed to the direct sun, rainy and moist conditions and to ambient temperatures less than 10°C during storage and transport. Waste will quickly develop if sweet potatoes are exposed to free water. Chilling injury is induced when exposed to 9°C for 24 hours.

2.3 Packhouse handling

Packaging requirements and minimum quality standards are stipulated by the Department of Agriculture and must be strictly applied. PPECB Quality and Logistics will ensure that the required packaging and quality standards are being maintained.

A very important aspect is hygiene management. All surfaces that may come into contact with sweet potatoes must be cleaned and disinfected on a regular basis. This also applies for the containers (plastic lug boxes) used in and between the field and the packhouse.

Washing, cleaning and disinfecting of handling and packhouse equipment should be done at least four (4) times per day to prevent the build-up of fungal spores. This is best done by washing with clean water containing 50 ppm to 100 ppm (active ingredient) chlorine or any other approved disinfectant. Lug boxes must also be dipped in the chlorine solution before it is returned to the field.

The sweet potatoes must be absolutely dry before it is packed into well ventilated cartons. These cartons must be strong enough to carry the weight without bottom sag. The corrugated board must also contain sufficient wet strengthener to avoid carton collapse when exposed to humid conditions in the cold chain.

3. PRECOOLING


The sweet potato changes from a vegetative to a “reproductive” stage during curing and sprouting will be initiated as soon as the environmental conditions (temperature and humidity) are favourable. The most effective and practical method to avoid sprouting is to cool the sweet potato to 13°C. The faster the product is cooled to 13°C, the more effectively sprouting, weight loss and quality deterioration is arrested.

Special precaution must be exercised to avoid chilling injury. Sweet potato pulp temperatures, must never drop below 10°C for more than 24 hours.

Effective and fast precooling can only be obtained in well designed and operated cold stores. The following important aspects must be implemented during precooling and cold storage:

- The cold store, if used for export produce, must be registered by the PPECB to ensure that it meets international requirements.
- Temperature control must be on delivery air and must be accurate to $\pm 0,5^{\circ}\text{C}$ within the set point.
- Relative humidity (RH) must be $90 \pm 5\%$. Desiccation (weight loss) will occur at lower RH levels and condensation (resulting in decay) will occur at high RH levels.

4. TRANSPORT

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4.1 Refrigerated Transport

The cold chain must be maintained as soon as sweet potatoes were pre-cooled and cold stored. Condensation of moisture due to fluctuating temperatures must be avoided at all costs because it will aggravate fungal decay. Warm temperatures after a period of cooling and cold storage will also stimulate sprouting that may continue during subsequent refrigeration.

The refrigerated transport systems must comply with the following requirements:

- The refrigerated road truck (RMT) must be certified by the PPECB for the carriage of export produce.
- The RMT must control the temperature on delivery air to an accuracy of "0,5°C from set point.
- The RMT must be pre-cooled to the carrying temperature (13°C) for at least 3 hours prior to loading of sweet potatoes.
- The exporter must record the pulp temperatures at the time of loading into the RMT.
- The exporter must ensure that the RMT cooling unit is operating satisfactory and correctly set at plus 13°C.
- The exporter or the RMT owner must inform the transfer depot in the port of expected arrival of the RMT.

4.2 Non-refrigerated road transport

Due to the fact that sweet potato varieties, suitable for export, can be stored at ambient temperatures for some period, it can be transported on open trucks. The following aspects are important considerations:


- The sweet potatoes must be relatively fresh when offered for export in order to keep waste, sprouting and weight loss levels to a minimum.
- Considerable savings can be achieved by storing and handling the sweet potatoes at ambient temperature. It must however, be realised that quality deterioration occurs faster at warmer pulp temperatures.
- Handling at ambient temperatures does not result in condensation.
- Under no circumstances should sweet potatoes be exposed to:
 - Ambient temperatures below 9°C
 - Direct sun and/or temperatures above 28°C
 - Rain or high humidity conditions resulting in the formation of free water on the sweet potatoes.
 - High velocity/low RH ambient air.
- The sweet potatoes must be loaded securely and sufficiently protected (tarpaulins, insulated structures) on trucks for road transport to the port.

5. HANDLING IN THE PORT

5.1 Quality and temperature inspections

The following procedures will be followed prior to, during and after loading of the sweet potatoes into containers:

- A final quality inspection will be done to ensure that the sweet potatoes comply to export requirements.

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- Pulp temperatures will be taken at the time of loading of the containers.

5.2 Loading of containers

Precooled sweet potatoes delivered by RMT can be loaded into containers up to the specified stack closing time (i.e. 12 hours before estimated time of arrival (ETA) of the vessel).

Unprecooled sweet potatoes delivered in a non-refrigerated truck must be loaded into containers **not later than 72 hours before the specified stack closing time.**

- Integral refrigerated containers do not necessarily have sufficient cooling capacity to cool warm loaded produce. Some container operators may therefore require precooling. Please consult with the PPECB on this matter.

Pulp temperature at time of loading must not exceed 26°C.

This procedure is required to ensure that the sweet potatoes are cooled to a maximum pulp temperature of 15°C at the time of loading onto the ship.

5.3 Cold chain management

The cold chain must be maintained once precooling has started. This is to eliminate condensation which in turn may trigger waste development and sprouting.

A total Time -Temperature -Tolerance (TTT) of 3 hours without cooling will be allowed for transport and loading of the containers. The average product temperature must not increase by more than 0,5°C during this period.


6. DURING THE VOYAGE

The Master of the vessel will be instructed in writing by the PPECB regarding the carrying temperature requirements. The vessel will be required to deliver air at 13,0 ± 0,5°C to the container. A technical report will be supplied to the exporter, the importer or the insurance company should a claim be filed.

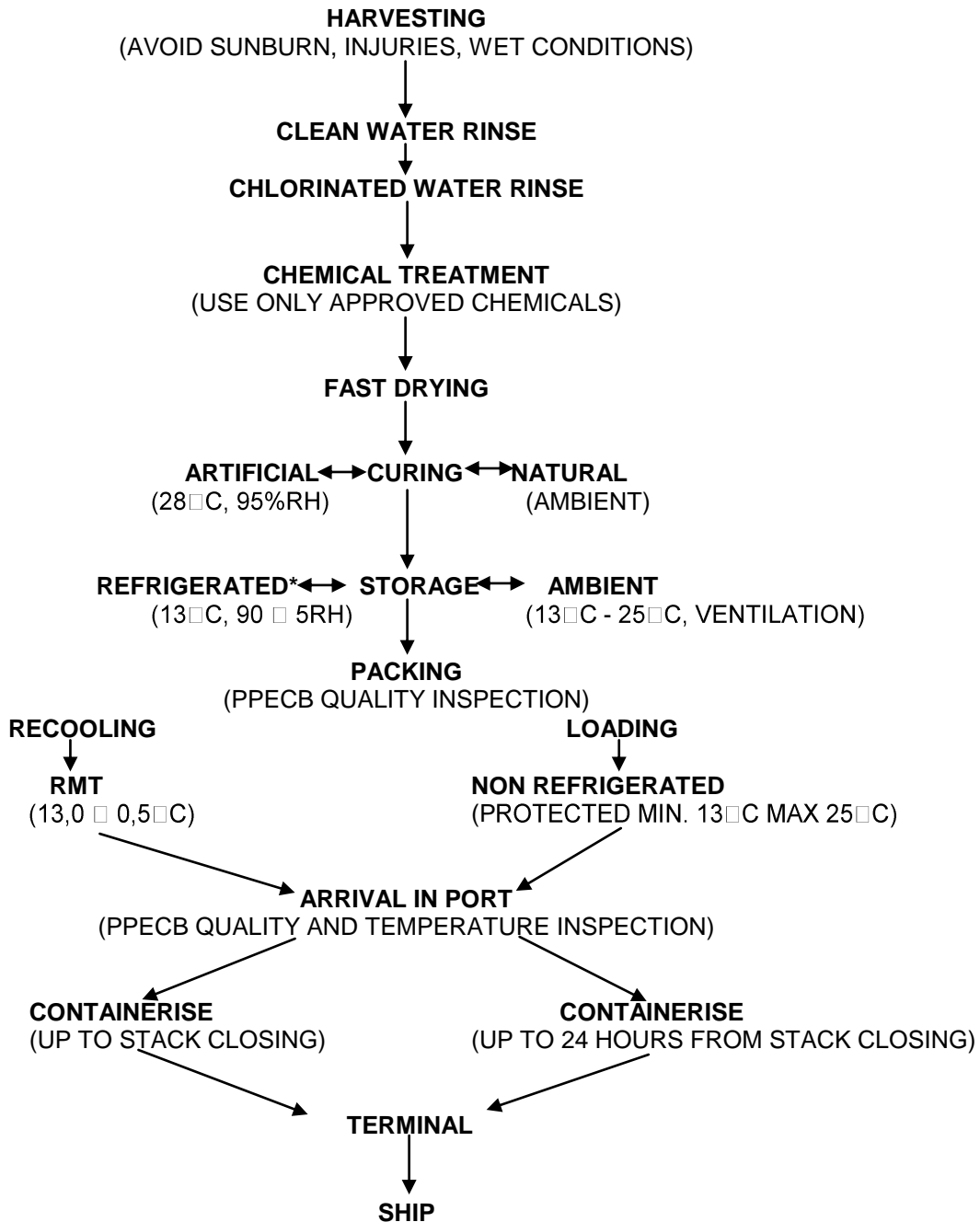
7. AFTER DISCHARGE

It is the responsibility of the exporter to inform the importer to:

- Maintain the cold chain at 13°C during subsequent transport and cold storage.
- Ventilate sweet potatoes in order to prevent condensation when refrigeration is terminated.

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FLOW DIAGRAM FOR POST HARVEST HANDLING OF SWEET POTATOES



* THE COLD CHAIN MUST BE MAINTAINED UNTIL DISCHARGE ONCE THE SWEET POTATOES HAVE BEEN PRECOOLED.