Module 41
Pre-Cooling

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Introduction

All citrus fruit is cooled in transit to overseas markets, mainly to maintain the quality of the product and extend its shelf-life, and to stop the development of postharvest diseases. Fruit is cooled to bring it down to the required temperature, after which the temperature must be kept stable.

Fruit can be cooled down already at the packhouse and then transported in reefer trucks to a cold store where it is kept in holding rooms. The second option is to transport fruit from the packhouse to a cold store, where it is cooled in pre-cooling chambers and then transferred to holding rooms.

Thirdly, fruit can be loaded into a container at ambient temperature and then cooled inside the container. The fourth option is to load fruit onto specialised reefer ships at ambient temperature, where it is cooled down and kept cool in the decks.

Always remember that the cold chain must be maintained once it is started – once fruit has been cooled, it must be kept cool.

We have two types of cooling; fruit can be cooled for sensitive or non-sensitive markets. Fruit cooled for sensitive markets must be cooled down to -0.5°C for period of at least 72 hours before it can be loaded into vessels for export. The cooling of fruit for non-sensitive markets is done according to the protocols as set out by the PPECB.

Pre-Cooling

Pre-cooling can be described as the process where the field heat of the product is removed and the product is cooled to the optimum storage temperature.

This process must be completed as fast as possible to slow down respiration and the associated ripening process.
**Dead Products**

We now have to look at the temperature requirements for two different types of products. Dead products are products that do not ‘breathe’, and therefore do not generate heat on a continuous basis. Examples of this are cheese, meat and chocolates.

**Live Products**

Then I am going to be talking about live products. These products generate heat, caused by the maturing process and respiration, and include products such as fruit and vegetables. The implications during storage for these products are that packaging must be well ventilated, and high air circulation is also needed to keep the temperature throughout the room constant.

**Ripening vs. Maturing**

**Ripening** means the process whereby the internal and external quality of a fruit improves in terms of becoming more suitable for consumption. **Maturing** means the diminishing of internal and external quality. After being picked, a citrus fruit does not ripen any further – the internal quality of the fruit will not improve. The fruit continues to mature, using the available resources (water and carbohydrates) in the rind to develop colour, but generally diminishing in quality.

**Heat Load Transfer**

The purpose of cooling is heat load transfer. Heat enters the cool area and the refrigeration plant must remove the quantity of heat that has penetrated the room. Some of the things that effect heat transmission are the difference in temperature inside and outside the cold store, the type of insulation of the cold room and the thickness of the insulation.

There are lots of sources of heat that must be controlled by the refrigeration process. There is heat given of by the lights in the cold room and the fans, heat given of by forklifts, and air entering the cold room from the outside. There is also product heat and the heat of given of by the fruit respiration. We also have packaging heat and heat entering through the insulation.
Cold Store Mechanics

For more information on how a cold store functions and an explanation of the principles of heat load transfer, please look at Module 44 – Cold Store Mechanics.

Product Cooling Requirements

There are specific regulations about which products can be loaded at ambient temperatures and which products must be pre-cooled before being loaded onto vessels. As an example, soft citrus may not be loaded onto vessels at ambient temperature, and must be pre-cooled before shipping. The PPECB issues a document on the cooling requirements for all perishable products. This document is available on the website of the PPECB, at www.ppecb.com.

We have pre-cooling protocols for in-transit cold sterilisation. The cold sterilisation process is required by some countries. It means that product is pre-cooled to a minus temperature to get rid of insect larvae and eggs. These requirements are very specific and must be strictly adhered to. Non-conformance will result in the product either being destroyed or returned to South Africa to go to another market.

PPECB Temperature Checks

The PPECB shall take product temperatures prior and during the transportation and shipping process with a calibrated thermometer. We also monitor and audit temperatures prior to the final departure of the vessel or the container. Non-conformance or deviation from the specified carrying conditions and any corrective action taken must be communicated to us at the PPECB.

Packing Requirements

When they prepare the cargo for refrigeration and storage, there are a few package and palletisation issues. The packaging should allow for adequate and unobstructed airflow in both the vertical and horizontal planes. Carton ventilation must also align with the pallet base openings. Load stabilisation interleaves must allow unobstructed airflow throughout the total load. Cardboard must be strong enough not to collapse during the cooling conditions.
active learning

Watch the DVD clips, read through the learning material and do workplace research to gather the knowledge and information to complete the assignments below.

Activity 41.1 – Group Discussion
In your group, list and discuss the differences between the cooling requirements for dead products and live products. See if you can think of other dead and live products that are exported from South Africa.

Activity 41.2 – Research Report
List the conditions that export citrus has to comply with to be loaded at ambient temperature.
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