Loading of Reefer Containers – Fruit

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Container loading is the process whereby a forklift is used to place 20 pallet loads into a 12m container. The doors are closed and the truck with the container leaves for the port. 2 to 3 weeks later the container is offloaded in the overseas port and 20 perfect pallet loads, with fruit in prime condition, are ready for distribution to the market.

It is as simple as that.

NO, IT'S NOT!!!

The whole process starts far earlier and critical planning and decisions are necessary to ensure that sound fruit is offered to the consumer. Just as for a high-rise building, successful loading of a container requires a stable foundation – secure pallet loads.

1. **Pre-Season Planning**
    - ***a. Crop Projections***
        - i. Realistic crop estimates form the basis for sound operational planning.
    - ***b. Cooling***
        - i. Provision should be made for adequate pre-cooling and cold storage space when harvesting commences.
        - ii. Infrastructure must be able to cool fruit within the load out temperature regulations published by PPECB.
        - iii. It is wise to have contingency plans should loadshedding, insufficient shipping space, labour disputes, etc disrupt the loadout operation.
    - ***c. Shipping Space***
        - i. The timely provision for shipping space, based on expected crop volumes, should take place well in advance of the harvesting period.

2. **Training**
    - **a. Product Knowledge**
        - i. Personnel involved in the handling of fruit should understand the basic cold chain principles and buy into the process.
        - ii. Basic fruit knowledge is an asset for a worker to appreciate the difference in the sensitivities of different fruit kinds and cultivars.

b. Process Knowledge

i. The complete process from planning to load out must be clearly defined and responsibilities spelled out for the various role-players.
ii. Every person should know his/her role to ensure an effective container loading process.

3. Packaging

a. Cartons

i. Dimensions of cartons (300x400mm/400x600mm) must allow stable stacking on ISO pallets (1000x1200mm).
ii. Apples in bushel boxes (500x333mm – 18kg) are palletised on pallets of 1070x1000mm.
iii. Stacking strength of cartons under high humidity conditions must be sufficient to stack a pallet load 2.4m high without bottom layers sagging between pallet slats or excessive bulging of the bottom layers.
iv. Cartons must have sufficient horizontal and vertical ventilation for effective cooling in cold stores (horizontal) and containers (vertical). (There are exceptions where a market may insist on ventilation holes being covered and this impacts on the cooling rate of the fruit.)
v. Carton strength should provide for any weakening caused by ventilation holes.
vi. Cartons, other than telescopic, should have interlocking features to ensure stable pallet loads. Securing strips/sheets are vital to keep the 'pillars' in place.

b. Other Items

i. Internal packaging materials such as trays, punnets, bags, wrappers, etc. should not hamper ventilation to the extent that cooling is compromised below effective levels.

4. Pallets and Palletisation

a. Pallet Bases

i. The standard dimensions of an ISO pallet are 1000mm x 1200mm. However, the Citrus Research International (CRI) specifies a pallet size of 1010mm x 1210mm for citrus to allow corner pieces to sit on top of the pallet base. For the standard white block pallet, the corner pieces extend down to floor level.
ii. Note that the pallet slats are not evenly spaced to ensure that carton edges sit on top of a slat and not between slats. This is to prevent sagging of carton bottoms.
iii. Only good quality pallets should be used.
iv. All pallets must have the specified ISPM15 mark burned in on at least 2 corner blocks.

v. Pallets may not be treated with the anti-fungal chemical SOPP as this chemical may contaminate the consignment with residue levels above minimum levels allowed in the destined country.

b. Palletisation

i. Cartons should be stack tight and secure on pallet bases.
ii. The specified securing strips/sheets must be used for interlocking cartons to secure cartons in tight pillar positions.
iii. Specified corner pieces must be secured in the right position with plastic straps that can be re-tightened before container loading.
iv. Pallet ID stickers must be place in specified positions.

5. In-Season Planning

a. Cooling

i. Use forced air pre-cooling to cool fruit to the prescribed temperatures.
ii. Apply delivery air with consideration of unique cultivar temperature sensitivities. Too low delivery air temperatures and/or too fast cooling rate are risk elements.
iii. Check pallet load bases and load for damages and incorrect palletisation. These defects must be rectified BEFORE the pallet loads are stacked in the pre-cooling tunnel.

b. Ambient Loading

i. Reefer containers are designed to keep fruit cool and remove any heat generated by the fruit as well as ambient heat that leaks through the isolation.
ii. However, it can do a little bit more. The ability to **cool** fruit is demonstrated by the fact that in the case of 'Dual Temperature' plums, the plums are heated to +7.5°C just after leaving the loading port and re-cooled to -0.4°C a few days later.
iii. In the case of citrus, trials with commercial citrus loaded ambient proved so successful that a set of protocols was compiled to load hard citrus (except Navels) ambient for the European market.
iv. In 2006 more than 100 containers were loaded ambient out of Maputo harbour without a single quality defect ascribed to ambient loading. This paved the way for hard citrus being loaded as a standard procedure.
v. This success speeded up the switch to 'Super Vent' cartons with superior cooling capability.
vi. It is very important to note that citrus (non-climacteric) is normally shipped and +4°C and higher, thus a more lenient target shipping temperature. With deciduous fruit (climacteric pome and stone fruit) control of the ripening process is very critical and ambient shipments are not allowed.

c. Booking Shipping Space

i. Book required containers well in advance of shipping to ensure availability.

d. Stockkeeping

i. Make use of an effective stockkeeping system to record exact positions of individual pallets.
ii. Store pallets as far as possible in block positions for specific container consignments to speed up the loading process.
iii. Daily age analysis of pallets must be done to ensure that the first-in-first-out (FIFO) principle is applied as far as possible.

e. Order Picking

i. Identify pallets as per consignment order.
ii. As a contingency measure, identify replacement pallets should selected pallets not be suitable (temperature, damages, etc) at time of loading. This is to avoid long delays with exporters who must be contacted for instructions.

f. Pre-Tripping of Containers

i. Before empty containers can be made available for loading, these containers must be cleaned and prepared by the empty depot.
ii. PPECB is responsible for the pre-tripping function at the empty depot where cleanliness, damage and functionality are checked.

g. Booking Containers

i. When booking a container PPECB must be advised by means of a booking according to prescribed procedures.
ii. Essential specifications are required to ensure the container is properly prepared (e.g. ,temperature settings, vent opening, vessel, disport, etc.)

h. Stack Times

i. Confirm stack times before transportation is arranged.

i. Transportation

i. Book transportation for containers timely with reliable transport contractors.

j. 21 Pallets

i. It is possible to load 21 pallets instead of 20 provided special steps are taken.
ii. The standard white block pallet (1000x1200mm) is not suitable for this purpose. Not only is cargo damaged when attempting to load 21 pallets, but the vital airflow is blocked at the door-end.
iii. Adjustments to the carton as well as the pallet dimensions are required to ensure safe cargo shipment.

iv. The stacking pattern for 21 pallets is different to that of 20 pallets. After 5x1200mm and 6x1000mm, the stacking pattern switches and this will result in the normal open floor area at the door-end covered completely.
v. A gap of approximately 100mm must be left open between the last pallet and the doors (This is normally where the T-bar floor tapers down.).
vi. Please note that not all containers have the same internal length and some may not be suited for the loading of 21 pallets.

k. Slipsheets

i. Slipsheets, that replace wooden pallet bases in a container, can be used under very specific circumstances and with special equipment.
ii. Durable plastic sheets, the same size as a pallet base, are placed on top of a pallet base and cartons stacked on top as per standard palletisation procedure.
iii. The pallet load is handled in the same way as the standard cooling procedure.
iv. When the pallet load is placed in a container, a special forklift attachment is used to lift the pallet load plus slipsheet from the wooden pallet base. The pallet load on top of the slipsheet is then placed in the container.
v. The big advantage of slipsheets is that it creates an additional 153mm of space on top of a standard pallet load. It could therefore be possible to add an additional layer to the pallet load, thereby saving freight costs.
vi. **HOWEVER**,
    1. The right equipment must be used.
    2. The receiver of the consignment must either have similar equipment, or de-stuff the container by hand.

l. Dual Loads

i. Although dual loads (when a container is partially loaded at more than one loading point) are not a preferred procedure, there are circumstances that warrant consideration.
ii. Procedures for dual loads are prescribed by PPECB and are also included in Hortgro's Handling Protocols published on their website (www.hortgro.co.za).

m. Cargo Mass

i. The total mass of the container cargo (including palletisation materials) must be declared.
ii. This can be done by weighing individual pallets and calculating the total mass or by weighing the container before and after loading.
iii. Care must be taken to ensure that the cargo does not cause the vehicle to exceed the road regulations in terms of axle mass distribution. This can happen when 'heavy' fruit such as pears and hard citrus are loaded.

n. Mixed loads

i. Note that when considering the mixing of fruit kinds in a container, compatibility must be taken into account.
ii. Compatibility rules can be found on PPECB's website.
iii. Issues that determine compatibility are:
    1. Contamination (Aromas)
    2. Temperature settings
    3. Packaging
    4. Fruit characteristics (e.g., need for ventilation (vent settings)).
    5. Ethylene sensitivity

o. Airlocks

i. Cooled airlocks at the loadout areas are highly recommended and are compulsory for cold sterilisation consignments.

p. Docking Station

i. Docking stations, where containers can be backed up to seal the opening of the airlock, are necessary to shield container openings from warm ambient temperatures.

q. Humidity

i. Fruit starts losing moisture the moment it is picked. To reduce and control moisture loss, the general rule is to keep the fruit environment above 85% relative humidity (RH).
ii. Cold stores, as well as containers, are designed to provide this level of humidity.
iii. Unfortunately, containers often fail to meet the set standards.
iv. Provision for moisture loss can be made by, for instance, using shrivel sheets for sensitive fruit kinds such as some plums cultivars.

r. Horizontal Airflow Cooling System

i. Although it is not a standard practice, exporters may opt for using the Horizontal Cooling System whereby the container floor is covered with a sheet and air forced below the floor to the door-end.
ii. The gap on top of the pallet loads is blocked in a few places.
iii. The air then moves horizontally through the pallet loads towards the refrigeration end of the container making use of the principle that the horizontal ventilation of the cartons is more effective than the vertical air flow.

6. Loading the container

a. The Cold Chain

i. It is of vital importance that the cold chain is not compromised during loading process of a container.

ii. A well planned and executed process should not take more than 30 minutes – preferably less than 20 minutes.

b. Container Types

i. 12 m Hi-Cube Container

1. 12m hi-cube (9'6) refrigerated containers (forty-foot containers – FEU) are used a standard shipping mode for export fruit.
2. FEU's internal width is pretty much standard at 2 285mm, but the length varies depending on the width of the refrigeration unit.
3. The refrigeration unit on one end blows cold air via a T-bar floor through the cargo load.
4. The return air passes over the pallets back to the refrigeration unit. A gap of approximately 150mm must be left between the top of the pallet loads and the roof of the container. The maximum height of the pallet loads is indicated by a red 'load' line on the container walls.
5. The container temperature settings are done by the empty container depot according to the booking instructions. These settings are checked by PPECB but the loading point supervisor must also check the correctness of the settings.

ii. 12m Standard Container

1. This container, with a height of 8ft 6inches, is not used extensively for fruit shipments.

iii. 6m Standard Container

1. Not used as a standard mode for fruit.

iv. 6m Port-Hole Container

1. In 1977 the first weekly container service to Europe was introduced.
2. For fruit a 6m 'Port Hole' container was used.
3. These containers did not have its own refrigeration but a large refrigeration plant supplied cold air that was circulated through the two large holes at the one end of the container.
4. This container service handled about 15% of the South African export fruit at the time.
5. This service was phased out in 2005.

v. Controlled Atmosphere Container (CA)

1. Similar to CA cold stores, these containers are fully sealed and contain an atmosphere where the oxygen has been removed and replaced by nitrogen.
2. This atmosphere inhibits the ripening process of the fruit.
3. It is used extensively for fruit kinds like avocadoes.

c. Check the Container

i. On arrival at the loading point the condition (in and outside) as well as the temperature settings must be checked.
ii. Power points must be available to check temperature settings.

d. Cooling of Container

i. Due to the risk of condensation the cooling of the empty container beforehand, must be avoided in high humidity conditions.
ii. Only in the case of cold sterilisation shipments must the container be pre-cooled.

e. Selecting Pallets

i. Select pallets as per consignment order.
ii. Place pallets in pre-stacking area closest to the container bay.
iii. Pre-stack only in cooled airlock and only when arrival of the container has been confirmed.
iv. Pallets destined for cold sterilisation shipment must not be pre-stacked but taken directly from the cold store to the container.

f. Checking Pallets

i. Check pallet loads for any damage and repair or replace.
ii. Tighten any pallet straps that are loose.
iii. Make sure that pallet loads are vertical and stable.
iv. Make sure that pallets are correctly included in the consignment.

g. Placing Pallets

i. Place floor covers in position if specified.
ii. Load warmest pallets first.
iii. A 9/11 stacking pattern must be used (for 20 pallets per FEU).
iv. Load pallets as quickly as possible to limit any warming up.
v. Use side-shift capability of forklifts to stack pallets tightly.

h. Temperature Recorders

i. Place temperature recorders, when required, in the designated pallet load and position. (The position may vary according to special market requirements or as per exporter's instruction.)
ii. Minimum time should be used for this action.

iii. In the case of cold sterilisation shipments, the temperature probes must be positioned as stipulated by the specific country. (This action is executed by PPECB officials.)

i. Void Plugs

i. To avoid short circuiting of air at the door-end of the container after the last pallet has been loaded, the pallet gaps as well as the open floor area must be covered.
ii. The floor covers must not cover the tapered down area of the T-bar floor at the door, leaving an opening of approximately 100mmm.

j. Airflow

i. The T-Bar floor was originally designed for cooling of cartons before consignments were palletised. With palletised cargo the risk of air short circuiting is far greater and special efforts are required to manage this risk.
ii. Cold air is delivered at the floor next to the refrigeration end of the container and travels along the T-bar floor underneath the cargo.
iii. Because there is an air pressure drop towards the door end, less cold air is delivered the closer it gets to the door.
iv. Research has shown that the cooling in the container can be divided into thirds. The first third, closest to the refrigeration end, will cool faster than the middle third. The worst cooling is near the door.
v. Warmest fruit, high respiration cultivars and poor ventilated packaging should be loaded first because the cooling at the refrigeration end is better.
vi. Different methods are applied to enhance or equalise the airflow. (See **5.r** Horizontal Cooling). Another method is to cover some part of the container floor with a sheet. This can be used for cold sterilisation shipments and is recommended by Citrus Research International. Note: Very specific guidelines are provided by CRI.
vii. Commercial floor covers are available but at relatively high cost – Otflow.

k. Air Bags

i. In the case of open top display cartons that tend to bulge (e.g. citrus 400mm x 600mm) place and inflate air bags between the last two pallets and the doors. This is to prevent the last two pallets to sag and collapse against the doors.

l. Seal

i. Close the doors as soon as loading has been completed.
ii. Attached the required container door seals.

m. Documentation

i. Complete the necessary documentation.

n. Gensets

i. PPECB prescribes a maximum time period of 6 hours for deciduous fruit (citrus 16 hours) in which the container must be loaded, transported and powered up in the terminal (1 hour for loading the container, 2 hours transit time to the port terminal and 3 hours to connect the container to power.) This tolerance is called Time Temperature Tolerance (TTT).
ii. This time span is considered as the maximum time in which cargo temperature should not exceed a specific temperature rise tolerance.
iii. If the loading of a container takes place and the TTT is expected to exceed the TTT, a genset must be used.
iv. When gensets are to be used, availability must be checked with the transport contractor when the booking is made.
v. On arrival of the container at the loading point the supervisor must check that the genset has been fitted.
vi. Gensets must be started before the vehicle is allowed to depart.

7. Arrival Condition Reporting

a. Obtain the temperature data as far as possible where temperature recorders have been used.
b. Use the data to identify problems when the container was loaded, well as cooling equipment failure.
c. Pay note to instances where pallet loads have been damaged during loading, en route and/or destuffing.

8. Conclusion

a. The loading process of containers is a major part of the export operation and the condition of the fruit on arrival overseas is largely depended on the integrity of this process.
b. All the links in the handling chain must be treated as vital and role-players must be aware of consequences of deviations.
c. A post seasonal evaluation of the effectivity during the season is advisable to identify shortcomings and to lay a foundation for the next season.