Cold Chain Development Success: Special considerations when handling fresh produce

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Cold chain factors when handling fresh produce

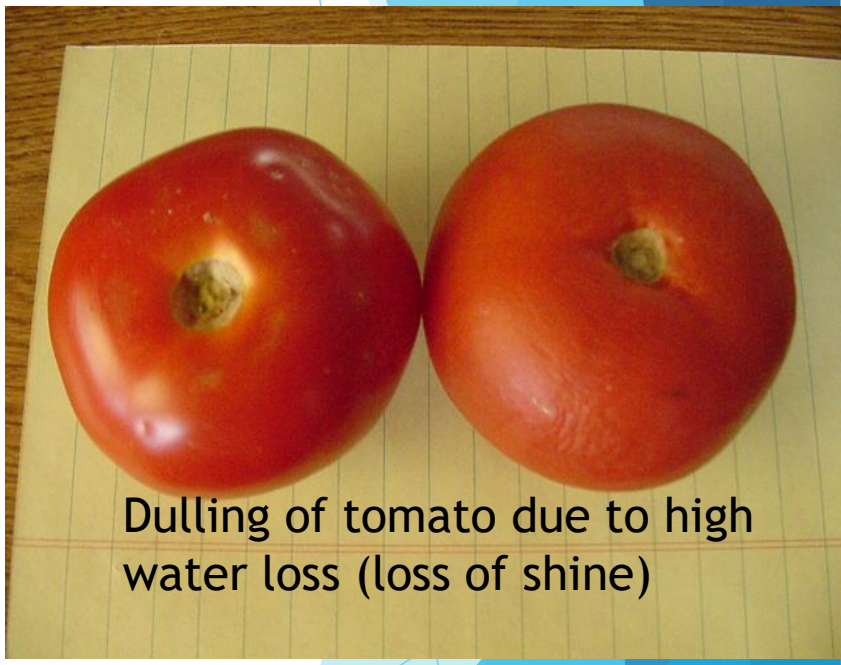
7 major factors that lead to less than desirable results (shorter shelf life, lower quality, customer dissatisfaction)

- Delays in cooling after harvest
- Damage due to rough handling or during transport before cold storage
- Use of poor quality containers for transport or storage
- Transport or storage conditions are too warm
- Storage conditions are too cold (chilling injuries)
- Cold storage conditions are too dry (low RH%)
- Handling mixed loads of fruits and vegetables

1. Delays in cooling after harvest

Temperature affects the postharvest life of fresh produce

- High temperature conditions reduce shelf life and quality, result in high rates of water loss
- Fresh produce is alive, contains field heat, continues to breathe after harvest
- Delays after harvest cause produce to gain more heat (due to natural respiration, exposure to sun)



Dulling of tomato due to high water loss (loss of shine)

Many farms and small packhouses in West Africa do not provide any type of pre-cooling (cooling before transport or cold storage)

2. Damage due to rough handling or transpor

Physical damage (bruising, abrasions, cuts, drops or compression) causes fresh produce to suffer a wound response leading to:

- Increased respiration rate
- Ethylene production
- Increased decay incidence

Handling damaged produce via the cold chain will be a waste of resources since it will only lead to higher levels of postharvest losses.

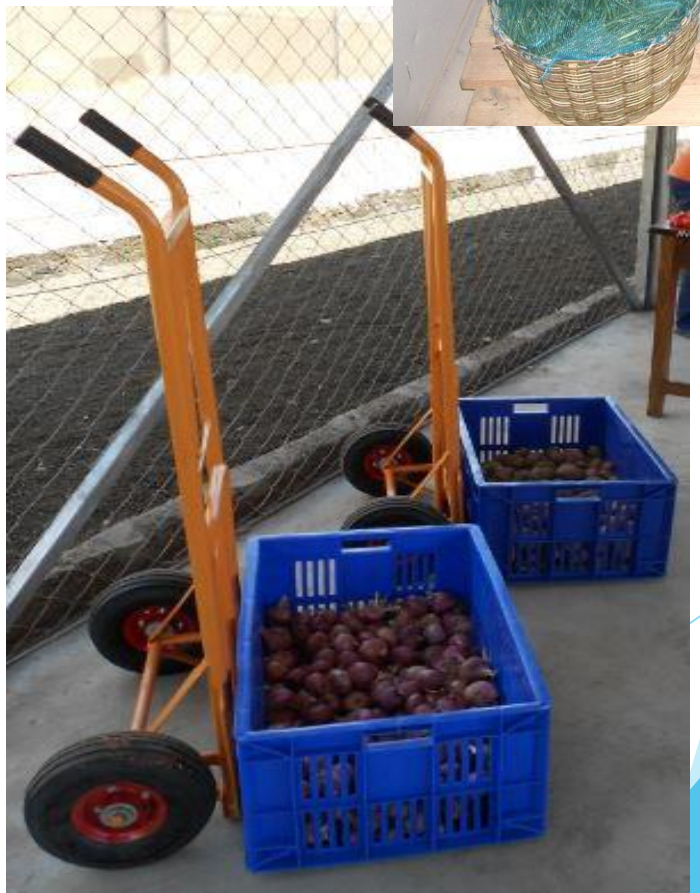
Sorting out any damaged produce before storage will help to increase the potential shelf life of the entire load.

Produce transport in Benin (above) and Ghana (below)

3. Use of poor quality containers

Containers protect fresh produce from damage, but can interfere with cooling

- Containers need to be sturdy and stackable
- Containers **require vents** to allow air to flow through the packed produce
- Containers should not be over-filled
- Stacks of containers in the vehicle or cold room should not be too tall (interferes with air



French beans in baskets, poorly stacked

4. Transport or storage conditions are too warm

It is very common for fresh produce to experience exposure to high temperatures in the field, during harvest, packing or loading delays, and during transport in open vehicles

- Higher than recommended temperatures during cooling delays and transport will reduce postharvest storage life
- Warm produce added to a cold room will stress the refrigeration system (increase energy use and costs) and warm any other produce that may already be in the room.

Transporting tomato in Nigeria

Protecting produce from the sun after harvest, using pre-cooling and reducing delays will protect fresh produce from the affects of warm temperatures.

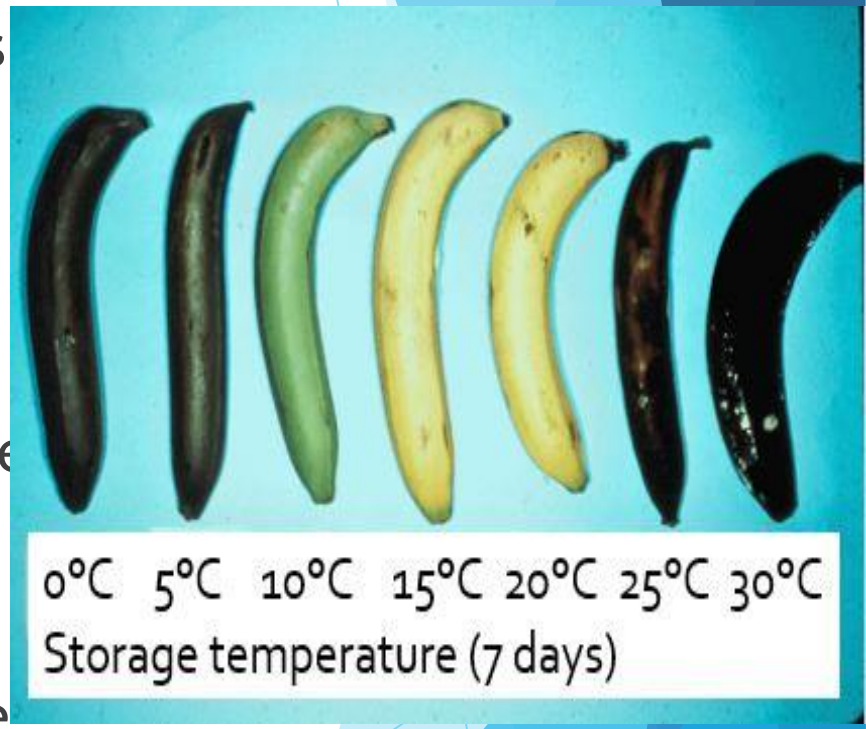
5. Storage conditions are too cold

Lower temperatures are not always safe for all fresh produce

- Each type of crop has its own temperature requirements

(examples: MG tomatoes 18-20ºC; ripe tomatoes 13-15ºC; mangoes 13ºC; green bananas 13-14ºC; capsicum 7-10ºC; lettuce 0ºC)

- Temperatures in the cold room that are too low for the crop will cause chilling injuries (pitting, spotting, surface damage)
- Chilling injuries increase susceptibility to decay
- Different temperature needs make it difficult to use one cold room for storage of all the different fruits and vegetables.



6. Cold storage conditions are too dry

- Most fruits and vegetables require high relative humidity (RH%) in cold storage for optimum shelf life and quality maintenance
- Lower RH% leads to higher rates of water loss
- Symptoms include shriveling, wrinkling and dulling of the surface (loss of shine)

- Onions and garlic bulbs are the exception to this rule-- these crops require lower RH% for best cold storage results (65-70% RH) after curing

7. Handling mixed loads of fruits and vegetables

Fruits and vegetables often have very different cold storage requirements in addition to temperature and RH.

- Some vegetables have strong odors (onions, garlic, potatoes) that can be absorbed by other crops
- Most fruits give off ethylene during ripening (ethylene is a natural plant hormone)
- Ethylene causes de-greening of vegetables, leading to yellowing and browning

5 key recommendations for achieving optimum results via the cold chain

- Protect fresh produce from heat after the harvest
- Use high quality containers with adequate ventilation
- Invest in pre-cooling
- Respect the different requirements for various types of fresh produce
- Invest in two or more cold rooms

Pallet with stacked cartons of vegetables

Recommendation 1:
Protect fresh produce from heat after the harvest

- Provide shade
- Cover filled field containers with plant materials to prevent sunburn and heat exposure
- Avoid delays in packing
- Avoid delays before transport

Harvesting and field packing cabbages in Ghana

Recommendation 2:
Use high quality containers

- Sturdy
- Capacity of 10 to 20 kg
- Stackable
- Vented (5%) to provide adequate air flow
- Don’t overfill the containers

Photo (above) courtesy of GEMS4 Project

Plastic crates make excellent, reusable containers for fresh produce, and are easy to stack and clean between uses

Recommendation 3: Invest in pre-cooling

Pre-cooling methods that can be used to remove field heat and reduce produce temperature before cold storage

- Hydro-cooling (spray, shower or immerse produce such as fruits, vegetables or melons in cool water)
- Use of ice (typically a slurry or ice and water, added to packed containers of leafy crops)
- Forced air cooling (requires a cold room, fans are used to pull or push cold air through packages of fresh produce)
- Evaporative cooling (fans and a wet pad of straw or plant fiber are used to pull or push cooled air through packed containers of produce)

Ice bath for cooling produce

Recommendation 4: Respect the different requirements for successful cold storage of various types of fresh produce

Each type of fresh produce has specific needs regarding:

- Optimum Storage Temperature
- Relative humidity in cold storage
- Ethylene sensitivity
- Natural length of its potential shelf life (for example, onions and potatoes can be stored for much longer than tomatoes or hot peppers)

Recommendation 5: Invest in two (or more) cold rooms

Having two cold rooms allows you to:

- Use one cold room to pre-cool produce and therefore avoid having to add warm produce to a partially full cold room of fresh produce
- Avoid storage of mixed loads of fruits and vegetables
- Avoid storing crops with different temperature requirements in the same cold room
- Avoid storage of crops with incompatible odors in the same cold room
- Avoid storage of crops that are sensitive to ethylene with those crops that produce ethylene

Conclusions: Successful cold chain development in West Africa

Getting the most from investments in cold chain development, infrastructure, management and logistics requires:

- Treating fresh produce with gentle care from farm to market
- Using high quality containers for transport and cold storage
- Respecting the different temperatures needs of different fruits and vegetable crops
- Pre-cooling fresh produce before cold storage
- Avoiding mixed loads in cold storage

For further information

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