

Cooling Practices

Training Assistance in Temperature Management

Dr. Lisa Kitinoja is available via e-mail to serve as a mentor or advisor to young professionals, extension workers, farm advisors, and private consultants around the world who are involved in activities related to postharvest handling, packaging, cooling, shipping and storage of fresh fruits and vegetables.

Temperature and Relative Humidity Control

Throughout the period between harvest and consumption, temperature control has been found to be the most important factor in maintaining product quality. Fruits, vegetables and cut flowers are living, respiring tissues separated from their parent plant. Keeping products at their lowest safe temperature (0 °C or 32 °F for temperate crops or 10-12 °C or 50-54 °F for chilling sensitive crops) will increase storage life by lowering respiration rate, decreasing sensitivity to ethylene gas and reducing water loss. Reducing the rate of water loss slows the rate of shriveling and wilting, causes of serious postharvest losses.

Keeping products too cool can also be a serious problem. It is important to avoid chilling injury, since symptoms include failure to ripen (bananas and tomatoes), development of pits or sunken areas (oranges, melons and cucumbers), brown discoloration (avocados, cherimoyas, eggplant), increased susceptibility to decay (cucumbers and beans), and development of off-flavors (tomatoes) (Shewfelt, 1990).

Cooling involves heat transfer from produce to a cooling medium such as source of refrigeration. Heat transfer processes include conduction, convection, radiation and evaporation.

If a ready supply of electricity is available, mechanical refrigeration systems provide the most reliable source of cold. Methods include room cooling, forced-air cooling and evaporative cooling. A variety of portable forced-air coolers have been designed for use by small-scale growers and handlers (Talbot and Fletcher, 1993; Rij et al, 1979; Parsons and Kasmire, 1974). However a variety of simple methods exist for cooling produce where electricity is unavailable or too expensive. Some examples of alternative systems (from Thompson in Kader, 1992) include night air ventilation, radiant cooling, evaporative cooling, the use of ice and underground (root cellars, field clamps, caves) or high altitude storage. Ice can be manufactured using simple solar cooling systems, where flat plate solar collectors are used to generate power to make ice, which is then used to cool produce (Umar, 1998). Ice can be used either directly as package ice, to cool water for use in a hydro-cooler, or as an ice bank for a small forced air or room cooling system.

Several simple practices are useful for cooling and enhancing storage system efficiency wherever they are used, and especially in developing countries, where energy availability may be limited and any savings may be critical. Shade should be provided over harvested produce, packing areas, for buildings used for transport vehicles. Using shade wherever possible will help to reduce the temperatures of incoming produce and will reduce subsequent cooling costs.

Trees are fine source of shade and can reduce ambient temperatures around packinghouses and storage areas. Light colors on buildings will reflect light (and heat) and reduce heat load. Sometimes spending money will save money, as when purchasing lighting equipment. High – pressure sodium lights produce less heat and use less energy than incandescent bulbs.

Another aspect to consider when handling fruits and vegetables is the relative humidity of the storage environment. Loss of water from produce is often associated with a loss of quality, as visual changes such as wilting or shriveling and textural changes can take place. If using mechanical refrigeration for cooling, the larger the area of the refrigerator coils, the higher the relative humidity in the cold room will remain. It pays however, to remember that water loss may not always be undesirable, for example if produce is destined for dehydration or canning.

For fresh market produce, any method of increasing the relative humidity of the storage environment (or decreasing the vapor pressure deficit (VPD) between the commodity and its environment) will slow the rate of water loss. The best method of increasing relative humidity is to reduce temperature. Another method is to add moisture to the air around the commodity as mists, sprays, or, at last resort, by wetting the storeroom floor. Another way is to use vapor barriers such as waxes, polyethylene liners in boxes, coated boxes or a variety of inexpensive and recyclable packaging materials. Any

added packaging materials will increase the difficulty of efficient cooling, so vented liners (about 5 percent of the total area of the liner) are recommended. The liner vents must line up with the package vents to facilitate cooling of the produce inside. Vented liners will decrease VPD without seriously interfering with oxygen, carbon dioxide and ethylene movement.

What is the cost?

There is no charge for mentoring services. Just send an e-mail or mail a letter to Dr. Lisa, and she will do her best to answer your question or point you in the right direction. Many training materials are available via e-mail at no charge. A CD Rom packed full of practical training materials is available at a small fee (to cover the cost of copying, postage and packaging materials).

Reference Book:

Cooling India
Vol. 2 No 1
February-April 2006