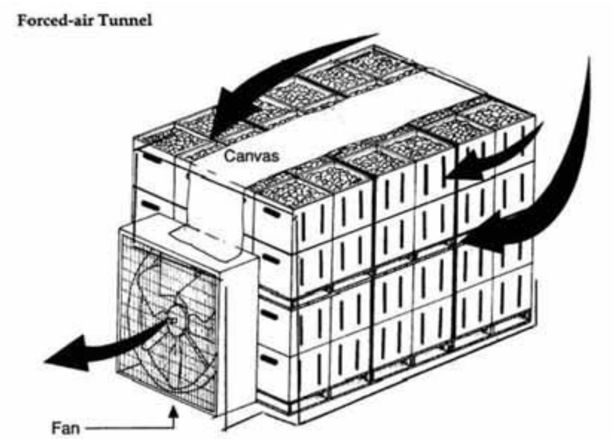
# PORTABLE FORCED AIR COOLERS

**Introduction**: Lowering temperatures by even a small amount during the marketing period, from ambient temperature (30°C to 35°C) to 15°C, will extend post-harvest life at least four times longer than leaving produce at 35°C. Forced air (FA) cooling can speed up the time it takes to lower the temperature of harvested crops and prepare them for storage or transport to market. If commodities need to be cooled to temperatures of 15 °C or below, using a portable forced air cooling unit inside a cold room can serve to reduce typical cooling times by 75% (from 20 to 24 hours via traditional room cooling to 6 hours or less via FA cooling). When produce such as tropical or sub-tropical crops such as mangoes, pineapples, tomatoes or peppers require cooling to 15 to 18 °C, an evaporative type forced air cooler can be used outdoors under deep shade. The theoretical lowest temperature that can be achieved using evaporative cooling is the wet bulb temperature, so the practice works best in dry conditions (during the dry season or in arid regions).

**Design Options & Materials Needed**:
Traditional electric powered, for use inside a cold room: If a cold room with adequate refrigeration capacity is available, adding a portable forced air cooling tunnel that can cool 4 pallets at a time will increase the fan's power use by only 800 to 1,500 watts per hour. A cold room with 5 tons of refrigeration can cool 3 MT of horticultural produce from an initial temperature of 27°C to a target temperature of 2°C in 6 to 8 hours.



Source: Gast, Karen L.B. and Rolando Flores, 1991

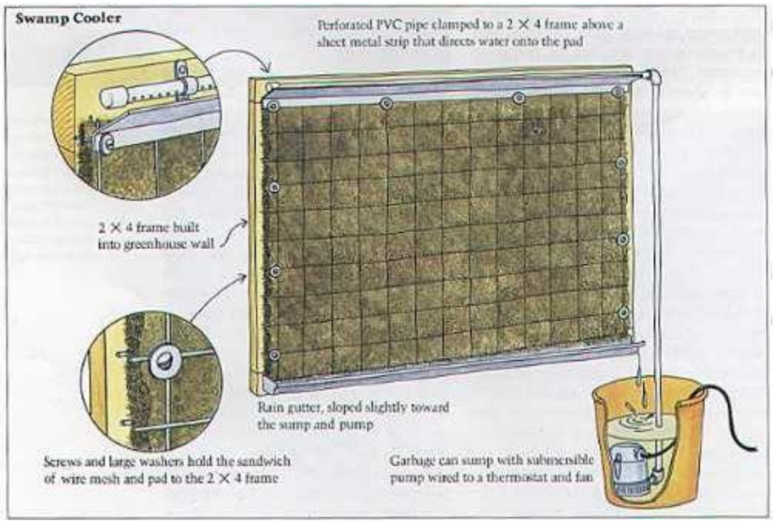

Photo Source: Kitinoja/Bali, Indonesia

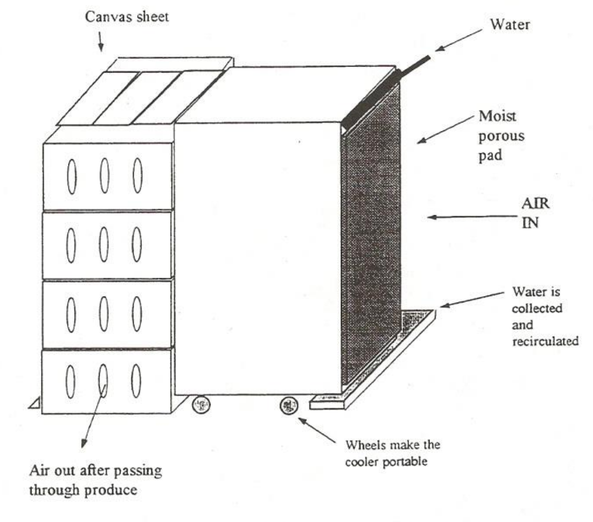
Evaporative cooling unit, electric powered, use outdoors under deep shade: Using an electric fan and a wet pad to move cool air through containers of fresh produce will speed the cooling process. The fan must be able to provide airflow of 1 L/ sec/kg against a wide range of static pressures. Doubling the airflow will speed cooling somewhat but the cost will rise considerably because the fan would need to have approximately four times greater horsepower to accomplish the same work.

| Cooling Technology | Purchase Price | Estimated Life of Operation | Typical Use, Size, or Capacity | Energy Use (kWh, liters or BTU) per MT |
|---|---|---|---|---|
| Evaporative forced air Cooling to 13°C (0.1 hp fan) | $200 to $400 | 6 years | 0.5 MT | 0.7 kWh |
| Evaporative forced air Cooling to 13°C (0.5 hp fan) | $1,000 to $1,300 | 6 years | 1 to 2 MT | 0.7 kWh |

Source: Winrock Int'l 2009, updated by Kitinoja (2012)

Solar powered forced air evaporative cooling unit, for use where there is no access to the electric grid
A solar powered fan and a solar powered water pump can be used to make a simple evaporative cooling pad for use in the forced air cooling unit. Ortho and http://h2othouse.com/html/cooling.html and Kitinoja & Gorny (1999) provide some sample diagrams and descriptions that are available online:




**Costs & Benefits**

A small portable FA cooler costs less than $400 to make and provides cooling at a more rapid rate for many years as compared to traditional slow room cooling for temperate crops. A simple FA evaporative cooler needs a water pump and small fan, and can cost about $200 while providing many years of cooling for tropical and sub-tropical crops. Cooling perishable crops will add many days to their shelf life and help to maintain quality and market value.

**References cited**

Gast, K. L.B., and R. Flores. 1991. Postharvest Management of Commercial Horticultural Crops: Storage Construction Fruits & Vegetables. Manhattan: Cooperative Extension Service University of Kansas.

Kitinoja, L. and J. Gorny 1999. Postharvest Technology for Small-Scale Produce Marketers: Economic Opportunities, Quality and Food Safety. University of California, Davis Hort Series No. 21.

Winrock International 2009. Empowering Agriculture: Energy Options for Horticulture. USAID 79 pp. http://pdf.usaid.gov/pdf_docs/PNADO634.pdf

**For further information**

Small-scale postharvest handling practices: A manual for horticultural crops (Chapter 6)
http://ucce.ucdavis.edu/files/datastore/234-1450.pdf
Postharvest Technology Center (UC Davis) http://postharvest.ucdavis.edu
The Postharvest Education Foundation http://www.postharvest.org
Postharvest Innovations LLC http://www.postharvestinnovations.com

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