Introduction

Commercial forced-air precooling has become an important postharvest procedure in Florida for rapid cooling and maintaining quality of several vegetable crops, strawberries, blueberries, and cut flowers. A detailed description of forced-air cooling and several different types (Figures 1 and 2) are described in several publications [1, 3, 4, 5, 6, 8, 9] (numbers in brackets refer to cited references). One study [2] discusses in detail the numerous variables which affect product cooling rate and/or overall cost of forced-air cooling systems for fruits and vegetables. These variables relate to the product, such as, size, shape, initial product temperature, desired final product temperature, and thermal properties; to the product configuration, such as, product packaging (bulk or in shipping containers), carton vent area, depth of product load during cooling; to the precooling system, such as, air-flow rate, temperature, and relative humidity, ambient temperature; and to economics, such as, time of operation per year, unit costs of cooling space, heat exchangers, compressors, and fans, electric power cost, maintenance cost, labor cost, and interest rates.

In forced-air cooling (Figure 1), produce is air-cooled rapidly by a difference in air pressure on opposite faces of stacks of vented containers (pallet boxes, corrugated cartons, flats, etc.). Fans create the pressure difference, which is called static-pressure difference. This pressure difference forces air through the containers and product, removing produce heat. The product is most efficiently cooled when the cooling air flows around the individual fruits or vegetables in the containers, rather than by flowing around the outside of the containers (as in room cooling). In other words, the cooling medium (cold air) comes into intimate contact with the product to be cooled.

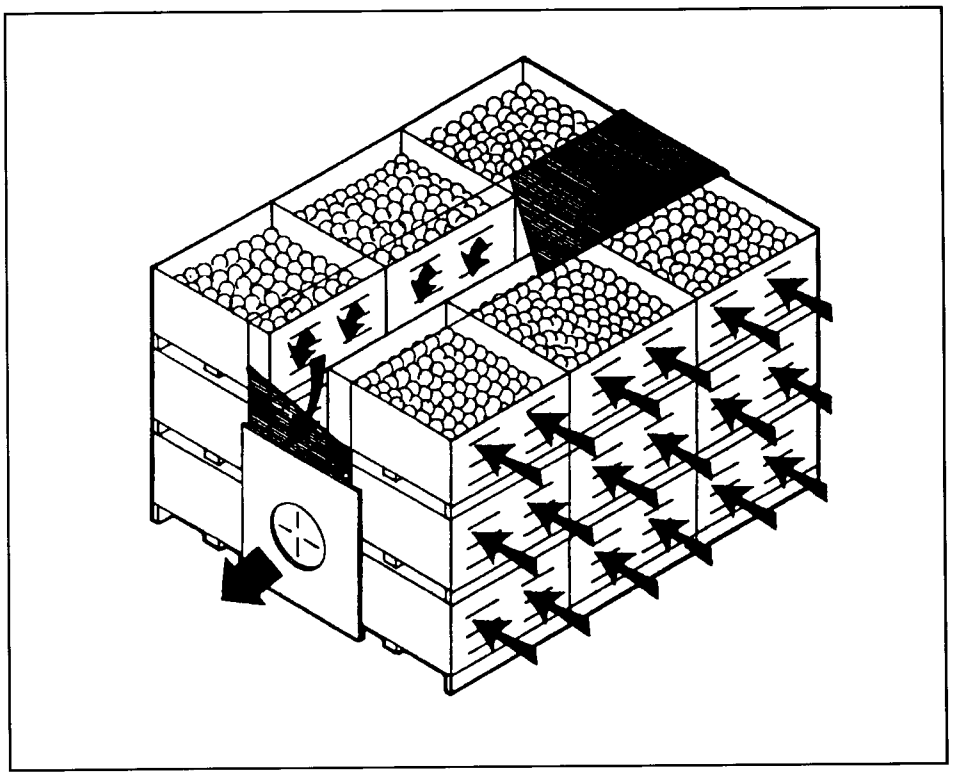

Figure 1. Forced-air tunnel with portable exhaust fan.

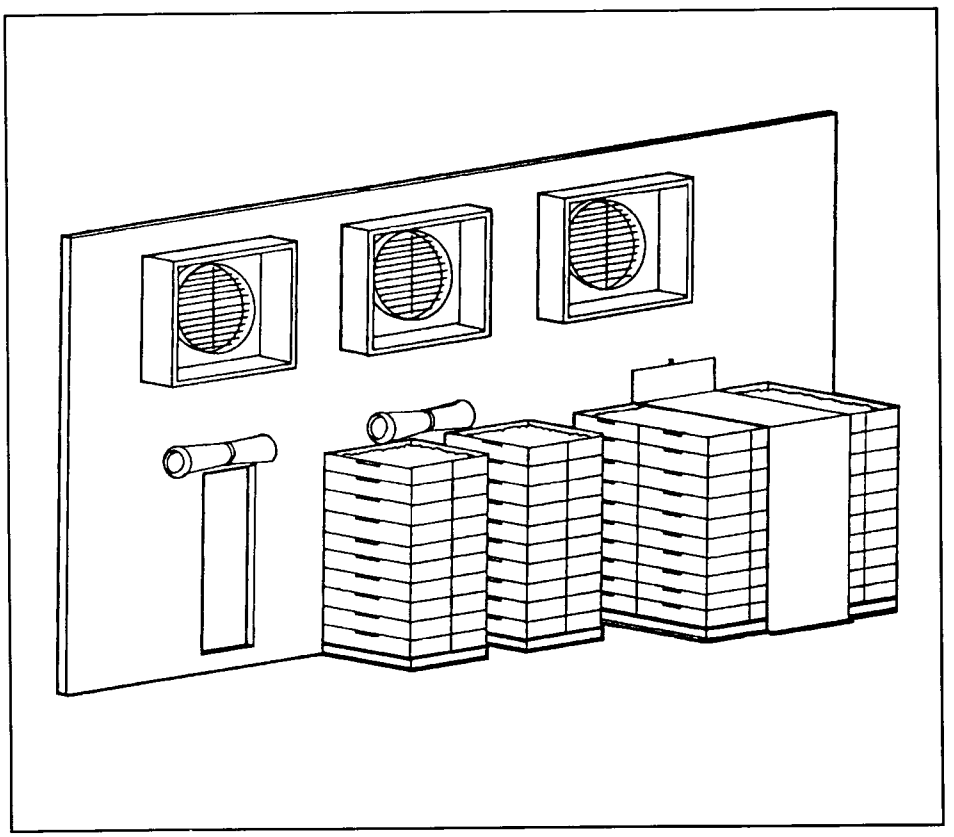

Figure 2. Forced-air cooler with permanent constructed air plenum.