

grade berries. It is important to acknowledge that while proper postharvest cooling and handling techniques can help maintain product quality, the quality packed can never be improved.

Cartons should not be overfilled because stacking will cause crushing. After packing, blueberries should be kept in the shade and transported to the cooler as soon as possible. The temperature of harvested blueberries in the field can be as high as 30°C (86°F), and even higher when exposed to sun; and when fruits are allowed to remain at this temperature for 4 hours, marketability drops by at least 40 percent. Again, very careful handling of the packed blueberries is essential to maintaining quality.

A large percent of the rabbiteye blueberry crop that is destined for the fresh market is machine-harvested into field lugs. These lugs are hauled into the packinghouse where they often sit for several hours until the packingline can handle them. Some growers pick blueberries mechanically between 10 PM and 10 AM, if possible, to take advantage of lower field temperatures. Others try to lower the temperature of these lugs to 70°F or lower prior to packing. The lugs must not be cooled below the dew point temperature in the packinghouse or condensation will form on the cold berries when they are exposed to the warmer packinghouses air.

A well designed forced-air cooler should be maintained at a constant temperature near 0°C (32°F). As noted above, the air flow rate has a definite effect on the cooling rate of blueberries in cartons, and new container designs can improve cooling efficiency. A cooling schedule should be developed for the forced-air cooler to maximize efficiency. Use of a schedule allows cooling times to be adjusted based on the initial temperature of the berries and prevents inadequate or excessive precooling resident time.

Temperatures should be measured with a reliable electronic thermometer. Fruit pulp temperatures should be taken prior to precooling and during precooling. Fruit temperatures should be measured on the warm side of the cooler (inside of the stack in systems that draw air through the berries; outside of the stack in systems which blow air through the berries). Care should be taken in sampling the blueberry temperatures to determine when cooling is completed. There is a large difference in the temperature between the fruit near the

air inlet and the fruit in the last container downstream. Precooler personnel should be trained to use proper blueberry temperature measurement techniques. Leaving blueberries in the forced-air cooler longer than necessary can lead to undesirable water loss because of rapid air movement. On the other hand, inadequate cooling can lead to rapid deterioration due to high temperatures.

Following cooling, blueberries should be stored in a cold room maintained at -0.5-0°C (31-32°F), for the shortest time possible. The cold room temperature should be colder than the temperature of the berries leaving the precooler. In addition to inefficient use of refrigeration, berries that have been cooled and then allowed to rewarm (causing moisture to condense on them) are susceptible to decay. Humidity as well as temperature must be controlled in storage facilities. If the air inside the storage room is too dry, water will evaporate from the blueberries and they will become soft and shriveled. At a storage room temperature of -0.5 to 0°C (31 to 32°F), the relative humidity should be from 90 to 95 percent. Much of the water that evaporates from the fruit is absorbed into or passes through the packing materials and condenses on the inside surfaces of the room. Under certain atmospheric conditions, it may be necessary to add moisture with a humidification system to maintain the relative humidity.

Trailers that are to carry blueberries should be precooled to -0.5 to 0°C (31 to 32°F) prior to loading. Also, extreme care must be exercised in loading palletized units to prevent shifting during transit by using strapping and corner boards. Proper bracing is a must for palletized blueberry shipments. The pallet units should be loaded away from the walls to prevent outside heat from transferring directly into the berries.

Summary

This publication presents cooling requirements, cooling methods, quality parameters, and management guidelines for maintaining the quality of Florida blueberries. Studies conducted to establish the relationship between condensation and container design and the effects of new container designs on cooling rates of blueberries are discussed. Management guidelines or recommendations to the packinghouse operators concerning possible system performance improvements are presented, such as increasing resident time within the forced-air precooler to achieve better cooling or lowering the cold room temperature to prevent warming of