

Introduction

Strawberries are one of the most delicate and highly perishable fruits. Their nonclimacteric physiological characteristics dictate that they must be harvested in an essentially ripe condition. The quality of fresh strawberries depends on their maturity and appearance (red color intensity and distribution, fruit size and shape, freedom from defects and decay), firmness, and flavor (determined by amounts of sugars, organic acids, phenolics, and characteristic aroma volatiles). The principal decays likely to affect strawberries are gray-mold and Rhizopus rots. Even a small amount of infestation can quickly spread throughout an entire package.

The most important factors in attaining and maintaining good quality are harvesting at the fully-ripe stage, avoiding physical injuries during all handling steps, enforcing strict quality control procedures, prompt precooling, and providing proper temperature and relative humidity during transport and handling at destination.

Loss of strawberry quality is not acceptable to consumers. The parameters which largely determine quality cause the quality to decrease rapidly at ambient temperatures; therefore, proper temperature management is important. Proper temperature management of strawberries begins with precooling (rapid removal of field heat) from field temperatures which can be as high as 30°C (86°F). Rapid removal of field heat is critical to retard deterioration of strawberries. The recommendation for maximum quality retention of strawberries is precooling to near 0°C (32°F) within 1 hour of harvest and maintaining at 0°C (32°F) throughout the marketing channels [3]¹. For commercial strawberry operations in Florida, cooling to this ideal criterion is approached (in practice strawberries are cooled and shipped at 2° to 5°C (35° to 41°F)) but depends on various factors, including volume of strawberries handled, cooling and handling equipment availability and capability, economics, energy, and market conditions.

Strawberries are an important crop in the United States. Nationally, Florida follows California in fresh strawberry production with an average annual value of \$68.4 million for the last 5 years [2]. Fresh strawberry yields in Florida averaged 1,867 flats per acre with 9.5 million flats packed off 5.1 thousand acres, with a season average f.o.b. of

\$7.20 per flat over the last 5 years, with record crops the last two years.

Strawberry growers and packers in Florida are aware of the value of their crop and of the quality demands of consumers. They are using good temperature management but are interested in additional improvements. Most strawberries in Florida are forced-air cooled in fiberboard flats stacked on pallets. Room cooling of strawberries is not an acceptable precooling method nor is reliance on refrigerated trucks during transit.

This publication presents quality parameters, cooling requirements, cooling methods, and management guidelines for maintaining the quality of Florida strawberries. Studies conducted to establish the relationship between cooling rate and air flow rate and the effects of new vent hole designs on cooling rates of strawberries 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 precooled strawberries.

Quality parameters

United States grade standards for strawberries allow for three grades: U.S. 1, Combination, and U.S. 2. The principal grade is U.S. 1. Although Florida shippers may not use U.S. grades for shipping, these, or similar grades, are used for inspection purposes at destination. Therefore, all growers should be aware of the grade specifications. If the strawberries do not meet the grade standards when they are picked, then it is simply impossible for them to make grade at destination.

Strawberries of one variety or with similar varietal characteristics with the cap (calyx) attached, which are firm, not overripe or undeveloped, and which are free from mold or decay and free from damage caused by dirt, moisture, foreign matter, disease, insects, mechanical or other means are U.S. 1. Each strawberry must have at least 3/4 of its surface showing a pink or red color and the minimum diameter of each strawberry must not be less than 3/4 inch.

Cooling requirements

Understanding of the cooling requirements of horticultural commodities requires an adequate knowledge of their biological responses. Fresh

¹Numbers in brackets refer to cited references.