HARVESTING AND POST-HARVEST HANDLING OF
GREENHOUSE TOMATOES

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Greenhouse tomatoes are harvested at various stages of maturity, from a "green-wrap" or green mature stage to a full colored vine-ripened maturity. This wide range of maturity at harvest poses one of the major problems facing growers today. Green to pink-green and over-ripe soft tomatoes are not conducive to consumer acceptance nor repeat orders from wholesalers or retailers of these tomatoes.

For many years, greenhouse tomatoes were grown and sold pretty largely in the same community. With the increased use of centralized packing houses in this industry, there has been a steady increase in the shipping distance for some lots of greenhouse tomatoes. Also with the development of large scale buying and chain store distribution, there has been a tendency to concentrate wholesale sales to a one- to two-day period per week with minimum sales during the balance of the week. Because of these distribution practices, wholesale and retail buyers tend to dictate the stage of fruit maturity that they will accept from growers.

Most wholesale and retail buyers of greenhouse tomatoes believe that the "greener" the tomato is that they purchase, the better chance they have to dispose of the tomato before it becomes unsalable. This philosophy of wholesale and retail distributors of tomatoes has developed because of the variable range of maturity of tomatoes supplied to them by the greenhouse industry, plus a minimum understanding of the proper post-harvest handling procedures that might assure a reasonable "shelf-life" for these greenhouse tomatoes.

During the past ten years, the Ohio Agricultural Experiment Station has been carrying on a rather intensive study in an effort to learn more about the basic physiology and the chemical and physical changes which occur in greenhouse tomato fruits harvested at different stages of maturity. Many of the results of these studies have been reported to the industry during the last eight years.

Essentially these studies have revealed that when greenhouse tomatoes are (1) properly grown and harvested at a pink-red to firm-red stage of maturity, (2) immediately cooled to a 50° to 55° F. temperature range, and (3) held and displayed at this temperature range through the marketing period, that maximum shelf-life and superior fruit quality are available to the consumer as compared with any other system of handling these tomatoes. When tomatoes are harvested at a green or pink-green stage of maturity and then subjected to optimum temperatures for subsequent off-the-vine ripening processes, the shelf-life and usually the quality are inferior to properly handled more mature tomato fruits.

These studies have indicated that successful marketing of high quality vine-ripened greenhouse tomatoes involves grower recognition of his responsibility in growing, harvesting, and handling these fruits, and wholesale and retail outlets assuming their responsibility in holding and displaying these tomatoes under conditions which will allow for maximum retention of quality and a practical marketing period. Without the cooperation of all parties concerned, period of marketability (shelf-life) will be reduced and high quality fruits will not be available to the consumer.
Grower Responsibility

The grower of greenhouse tomatoes must realize that there are no post-harvest handling procedures which will improve the quality of tomatoes that he has grown. Management of cultural practices which contribute to the production of quality tomatoes plus his knowledge of the effect of cultural practices and environmental situations on the quality and keeping quality of the tomatoes that he grows are definitely his responsibility. In most instances, this information is available to the grower.

Harvesting the Crop:

Greenhouse tomatoes should be harvested frequently enough to assure a uniform maturity of tomatoes harvested at any particular picking. If there is much variation in the fruit maturity at any given harvest, it is essential that the fruits be graded on a maturity basis (color) prior to lowering the "field heat" or internal temperature of the fruit. Ideally, fruits should be harvested frequently enough to assure a maximum percentage of fruits in the pink-red to firm-red stage of maturity. If fruits are harvested in the pink-green stage of maturity, these fruits should be separated from the other two color grades and held at the proper temperature (70°F.) for full color development before they are cooled to the 50° to 55° F. holding and display temperature. All fruits in the pink-red to firm-red stage of maturity should be immediately removed from the harvest area and cooled as rapidly as possible to 50° to 55° F. Green mature fruits that are harvested should be held at a 70° F. temperature until fully colored before being removed to 50° to 55° F. holding temperature.

As mentioned previously, the shelf-life of fruits harvested at a pink-red to firm-red maturity is much longer than less mature fruits which must be subjected to higher temperatures for full color development, prior to being cooled to the 50° to 55° temperature.

Cooling Greenhouse Tomatoes:

Harvested tomatoes should be removed from the greenhouse as soon as possible. This is particularly critical during the months of September, October for the fall crop and May, June and early July for the spring crop. The "field heat" should be removed as fast as possible for all maturity (color)grades down to the optimum temperature as indicated above for each color grade.

Except for cooling just prior to serving, tomatoes should never be subjected to temperatures below 50°F.

Forced air cooling involving the use of ice bunkers or refrigerator coils is the best method for removing field heat from tomatoes. Hydro-cooling and vacuum cooling methods are not satisfactory for tomatoes.

Grading Greenhouse Tomatoes Prior to Packaging:

It is impossible to achieve maximum shelf-life and uniform quality of tomatoes when three or four maturity grades are included in the same container. Therefore, it is essential that the grading operation in addition to sizing, elimination of culls, and selection of No. 1 and No. 2 grades, also includes separation of the various maturity grades for best post-harvest handling.

Bruising of tomatoes during mechanical or hand-grading contribute markedly to a minimum shelf-life and a poor quality fruit for the consumer. Studies on the rate of deterioration of tomatoes which were mechanically graded as compared with careful hand-grading revealed the potential damaging effect of improperly designed mechanical graders. Hand-grading can be just as detrimental, or more so, as compared with mechanical grading of tomatoes, if the grader does not understand the need for care in handling greenhouse tomatoes.
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Holding and Transporting Greenhouse Tomatoes:

Growers have the responsibility of holding and delivering tomatoes to the wholesaler or retailer so that these buyers have some assurance that a high quality tomato, with a reasonable shelf life, has been provided. Growers should also do everything possible through package labeling and possibly through the use of leaflets in the container to point out optimum holding and display temperature conditions for maximum retention of tomato quality and shelf-life during the marketing period.

Wholesale and Retail Handling

After quality tomatoes have been received, it is essential that wholesalers and retailers maintain the proper temperature (50° to 55°) during the entire holding and display period. Packaged tomatoes need to be handled carefully to avoid excessive bruising, in store to store delivery and in the preparation of the display. Apples, melons, and other fruits should not be stored in the same storage or holding area with tomatoes, since ethylene and other volatiles from these ripening fruits hasten the breakdown of tomatoes. Relative humidity should be maintained around 85% during the holding and display period to minimize fruit and calyx (green sepals) shriveling. Relative humidity should be reduced, if any evidence of disease is noted.

Display: Temperature of the display area should be held as close to 50° F. as possible. Avoid allowing temperature to drop below 45° F. for any length of time since the flavor of the tomato may be reduced. Avoid piling tomatoes in the display, since the weight of three or four tomatoes will often cause bruising of the bottom fruits. Remove any fruit which may have started to break down from bruising damage or from too long a stay in the display.

Conclusion

The tomato is one of the most important items sold in the produce area. Proper display of quality vine-ripened greenhouse tomatoes should prove beneficial to consumers, retailers, wholesalers, and growers.

A system for successful handling of vine-ripened greenhouse tomatoes from grower through to consumer, has been briefly described.

There are obviously many difficulties apparent in carrying out this proposed system. There are certain grower practices which must be changed as well as presently accepted marketing procedures. These can only be accomplished by close cooperation of all groups concerned.
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