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HANDLING OF POSTHARVEST TROPICAL FRUIT CROPS

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People familiar with the tropics are aware of the wide variety of fruits grown in these regions. Some tropical fruits such as bananas, pineapples and papayas are available in temperate zone markets. However, such exotic tropical fruits as mangosteen, carambola, and star apple are rarely, if ever, seen in markets outside the tropics. Other fruits such as citrus, avocados and mangos, which are adaptable to the tropics as well as the sub-tropics, are commonly consumed in the temperate zone. Then there are those temperate fruits such as strawberries, pome fruits and cantelopes that may be adapted to production in certain areas of the tropics. Since bananas are the major tropical fruit exported to temperate zone markets, the handling practices involved with this crop will be described. Considerations for handling other major and minor tropical fruits will be discussed also.

Bananas are unique because they are produced on the same acreage day after day, year after year, as long as the root system can be maintained in a healthy condition.

Local markets in banana growing areas have varying requirements. The fruit may be allowed to begin the ripening process on the plant or it may be harvested in a mature but green state, depending on distance from market, available transportation and sophistication of the growers' and handlers' operations.

Bananas are either shipped to near-by markets as bunches or are packaged to varying degrees. Bunches are stacked on top of each other, occasionally, using banana leaves or pieces of used plastic sheeting between them to reduce scarring and bruising. Ripening practices vary from area to area and from one handler to another within an area. Usually, bananas are just allowed to ripen on their own, generally with some heat applied. This results in very little chlorophyll degradation and the final product is a greenish-grey, soft fruit. Some banana merchandisers ripen the fruit by placing clusters or hands of bananas in a chamber with a few avocados, which produce the ethylene that triggers the ripening process; ripening is fairly uniform. Some operations use calcium carbide, which, when exposed to moist air produces acetylene and provides the same ripening reaction as that which results from the use of ethylene or other unsaturated hydrocarbons. Some fairly sophisticated, otherwise modern operations are still using heat and high humidity to initiate the banana ripening process. Other operations use ethylene metered into closed rooms for banana ripening. The rooms are sealed, but have very little temperature control. These methods provide minimum control and the merchandisers must use the fruit when it is ripe, which reduces the flexibility of their banana marketing schedules.

Packaging for local markets varies with the handler and the market. Many bananas are packaged in baskets, bags, boxes or other types of semi-protective cartons just to hold the fingers, clusters, or hands together. Generally, bananas for local markets are packaged at a very ripe stage and this abusive handling promotes further deterioration. The shelf life of bananas ripened by some of these primitive methods is measured in hours rather than days.

Preserving fruit quality

Bananas that are exported must be delivered green, and ripened at their destination. Growing conditions and cultural practices are important determinants of fruit quality. Handling, packaging, transporting, ripening, quality maintenance and marketing practices are sophisticated and well-organized. Fruit harvests are on schedule, taking into account the age and the maturity of the bananas. Transportation of the harvested bunches from the plantation to the packing area is either by a cable system, which prevents the bunches from coming in contact with one another, or on padded carts with additional padding to reduce bunch to bunch contact. At the packing station, bananas are cut from the bunches as hands and separated into four to ten finger clusters. These are floated in water or conveyed through a spray system, and most of the latex from the cut surfaces is allowed to exude prior to the final packaging operation. Bananas are treated with an anti-oxidant and a post-harvest fungicide to prevent oxidation of post-packaging latex exudate and decay of the crown tissue. Because bananas are a most delicate fruit, every effort is made to minimize cluster-to-cluster contact and bruising. Following the latex removal, the clusters are packed in fiberboard boxes for export. The boxes are lined with polyethylene film to prevent abrasion due to contact with the box material. Every effort is made to minimize the number of handlings of the fruit. At some modern packing stations the packers are able to select the necessary fruit for each box from a moving line of clusters of bananas.

Bananas are transported by rail or truck from the packing stations to a nearby port where they are loaded by conveyor into a ship within 36 hours of harvest. Powerful refrigeration systems with high velocity fans cool the fruit to below 60°F within one to two days. Holding most varieties of bananas at temperatures below 56°F results in chilling which makes them unsalable. Temperatures above 60°F increases the potential for premature and non-uniform ripening in transit, an important postharvest handling problem. Voyages from topical plantations to temperate zone markets take from less than a week to as long as four weeks. For short trips bananas are packaged in highly perforated polyethylene film. Sparsely perforated films are used for greater distances. For shipment to more distant markets (requiring over two weeks) modified atmosphere systems can be advantageously utilized. Higher-than-normal carbon dioxide levels, and lower-than-normal oxygen levels are maintained in sealed, 1.5 mil thick polyethylene bags (Banavac®) which line individual boxes. Such an atmosphere suppresses respiration, prevents premature ripening and inhibits rots and molds. At the port of destination the bananas are unloaded by conveyors in much the same pattern that they were loaded in the tropics, and transported by truck or rail to ripening rooms.

Bananas are ripened at distribution centers in modern ripening facilities, which provide temperature and humidity control. The ripening process is initiated by ethylene gas, which is metered into the room either from cylinders or from ethylene generators. The latter is the newest innovation in banana ripening and promotes uniformity plus eliminates the hazards of explosions associated with the use of cylinder gas.

Bananas are distributed to the retail stores in a semi-ripened condition (still partially green). Ripening at relatively low temperatures (60–65°F) with exogenous ethylene promotes longer shelf life and better over-all quality.

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Container shipment

Bananas are shipped in containers (40 ft, 18 tons) on a limited commercial scale. Loading boxes of bananas into refrigerated containers in the tropics and handling them only once more at their destination has obvious advantages. Cooling begins when the fruit is placed in the container at the packing station rather than on board the ship. The reduced number of total handlings of each box of bananas reduces scarring and bruising, thus enhancing quality. Controlled ripening of bananas in transit is feasible through containerization. The techniques required for such an operation have been perfected and can be utilized beneficially under the proper circumstances. stances.

While banana containerization is apparently a desirable advance for the industry, there are disadvantages, and its prospects for the future are largely dependent on the economics of such an operation. Refrigerated containers and special container ships are expensive. Ultimately, such an operation will require the installation of shore-mounted cranes at each port of loading and discharge. For each container actively involved in transporting bananas, at least two additional in transit containers must be available to keep the operation running smoothly. Utilizing such a system for other produce as well as bananas enhances the feasibility of containerization. However, the multi-national aspects of produce containerization limit the prospect of back-hauling other materials. Unless advanced clearance is assured, the discharging of some goods could tie up the containers for long periods.

Export quality important

Tropical fruit crops produced for local markets are frequently not grown under optimum cultural practices. The quality of such products is seldom adequate for export markets. Maturity indices, if existent, are primitive and vary depending upon local conditions and market demands. Present packaging and handling systems and conditions contribute little to the maintenance of the quality of the harvested fruit. Packages used in each area for different commodities are fairly standard, but their design generally reflects tradition rather than commodity requirements. Transportation to the marketplace is frequently in over-loaded vehicles on unimproved roads. Consequently, product shelf life is minimum and losses due to decay and over-ripeness are substantial.

Many tropical nations are in an excellent position to help supply the world's food needs, including fruit crops. However, there are many considerations in the exportation of tropical fruits. It is important to know those crops that are currently being produced and in what volumes they are available. The procurement of produce will no doubt involve experienced local producers and technicians. By taking advantage of the experience of such experts one can avoid many pitfalls. These are the people who are knowledgeable about the production of those crops that can be grown locally, where they can be grown, and when they can be grown. The experience and cooperation of local fruit handlers is invaluable because they are best acquainted with the most dependable producers of quality produce.

The production of high quality fruits in a potential source area is essential, but this is no guarantee that such quality will be available for export. The proximity of a production area to seaports or airports, depending upon the choice of transportation, is a critical consideration. If not already available, provisions must be made to provide adequate, unabusive, rail and/or truck transportation to the point of departure. It is essential that the transportation vehicles be capable of providing ample heating and/or cooling and ventilation in keeping with the requirements of the fruit crop in question.

Transportation of fruits from the country of production to the country of consumption is somewhat complex. Some tropical countries are able and willing to produce export quality fruit in volume but it is unlikely that they are capable of providing adequate sea or air transportation and marketing. Therefore, fruit exportation will necessarily require the involvement of dependable, multi-national shipping and marketing organizations. This is imperative and may well be the limiting factor for a successful operation.

Timing of intended export is critical in order to assure fair and optimum returns to both producers and exporters. Comprehensive studies of the intended markets are needed to determine which fruits will be in greatest demand in which markets and at what times of the year. It would be senseless to try to compete with local (destination) production of the same or similar fruits. There will be periods of demand for which there is little or no supply. Timing is important to capitalize on these preferred markets. For instance, there is a good market for cantelopes in the United States in January and February; this coincides with an excellent production season for cantelopes in southern Honduras.

Knowing and providing the proper packaging, storage and handling for each fruit crop is vitally important. Limited variations from optimum packaging, storage and handling conditions can be tolerated to varying extents, depending upon the intended market and its distance from the source. Awareness of which fruits can be handled concurrently will help to avoid possible cross commodity interactions and prevent possible losses.

Export of quantities of a particular fruit crop may jeopardize the supplies available to the local markets causing local scarcity or price increases to national consumers. This would be undesirable, as with the U.S. wheat shipments to Russia. Even though all other requirements are satisfied, the importing of a specific fruit into the intended marketing country might be impossible due to national, restrictive regulations. Also, the possibility of introducing a disease or insect should be investigated and accommodations provided to satisfy possible quarantine laws.

Obviously, temperate zone consumers would like to enjoy the same quality of a particular fruit purchased from their local supermarkets that they have, or could have, enjoyed in the tropical country where it was grown. Any amount of handling plus the time required to get fruit to the marketplace will take its toll on the ultimate quality available to the consumer.

Delivery of luscious, tropical fruits in perfect condition to the consumer several thousand miles away is desirable but, perhaps, unrealistic and uneconomical. However, the development of quality standards can be such that a dependable level of quality required to sustain the demand for the product can be assured. A certain amount of quality loss and deterioration is unavoidable and tolerable, but within practical limits, should be minimized. Realistic, flexible standards should be developed for the individual intended markets.

The human factor

The "people" aspect of harvesting and handling any fruit crop is a critical, but unavoidable consideration in delivering a quality product. Those individuals directly involved in harvesting the crop, getting it into the package, and handling that package generally have little or no appreciation for quality maintenance. Their interest is primarily in earning a living. Their sensitivity to the delicate characteristics of the fruits they handle is minimal at best. This is often evidenced by their abusive manner of handling the fruit. How to effectively motivate individuals to carefully handle the fruit to minimize damages and losses is a problem common to produce handling. Monetary incentives are not consistently successful. Interest may be enhanced by active involvement in the organization with which they are working, but this is not always feasible. Comprehensive training programs coupled with a continuing, sincere expression of interest by all levels of management are helpful in impressing on workers the importance of quality maintenance. If these laborers were qualified for any other jobs they probably would not be handling fruit. This complicates the situation and further emphasizes the need to motivate them.

Horticulturists, physiologists, and economists continue to attempt to overcome the "people" factor in the produce industry. Perhaps it is time we enlisted the involvement of sociologists and psychologists who could hopefully provide some of the necessary insight which would contribute to our understanding of the basic problems involved. The inputs of such professionals might provide us with realistic solutions to means of motivating people to handle fruit with respect.

Interest in the production of tropical fruit crops for marketing in temperate zones persists, frequenly with the stimulus of potential profit. Postharvest horticulturists contemplating involvement in tropical fruit crop studies need to know what has been done previously. If the potential for profitable exportation is apparent today, it very likely existed in the past and has been investigated by others. The horticulturist must then learn of the physiological, economic and logistical limitations that previous investigators apparently encountered. We in the developed nations don't have all the answers. A closer look at what has been done by local horticulturists and other experts will frequently save one a lot of unnecessary work and/or provide a strong basis on which to either proceed with or abandon his proposed research and development projects. Also, all aspects of production and export of a given fruit crop might appear favorable, but frequently the consent of the local agencies is required.

Should one consider it feasible and necessary to conduct studies in a tropical country on tropical fruit, he should avoid the use of sophisticated laboratory equipment. Seldom is it possible to obtain locally the technicians required to operate and maintain such equipment. However, with some imagination, meaningful investigations can be conducted with several simple pieces of apparatus.

In conclusion, the exploitation of potential tropical fruit markets is promising if based on a well-conceived program.