Prepackaged Products

maintenance of high quality important factor in marketng fresh fruits and vegetables

L. L. Claypool

Successful prepackaging of fresh fruits and vegetables involves many factors which contribute to the success attained.

One factor of greatest importance—the reliability of the packaged product—means that high-quality standards must be maintained, as the purchaser is denied the privilege of selection by examination that he has with bulk items.

During the period of growth and development in the field, food materials manufactured by the leaves are stored within the fruit or vegetable which remain alive after removal from the plant and during all subsequent handling as fresh produce.

The process by which the stored food energy materials are drawn upon to maintain the living tissue is known as respiration. Except for the mechanics involved, it is similar to respiration in animals.

During respiration simple carbohydrate materials such as sugars are broken down, using up oxygen. Water, carbon dioxide, and energy are released.

Leafy vegetables such as spinach and broccoli, and other vegetables such as asparagus, sweet corn and peas, may respire up to ten times as fast as cranberries, European grapes or citrus fruits. Topped beets, dry onions, potatoes, sweet potatoes and tomatoes respire at relatively low rates compared to other vegetables, whereas apricots, blackberries, strawberries, ripe pears, plums, and peaches respire at relatively high rates compared to other fruits.

Storage life of various fruits and vegetables is related to the relative respiration rates and to the quantity of reserve food materials available. Those products having both a low respiration rate and a large reserve supply of stored materials have the longest storage lives, whereas those with high respiration rates and low reserves are most perishable.

The eating quality of fruits and vegetables is based upon a number of factors, of which flavor and texture are important.

Flavor is due in large part to dissolved sugars, to the characteristic flavor substances and, especially in fruits, to the balance between sugars and acids. The substances resulting in high flavor are among the first to be affected after harvest by natural respiration processes.

Flavor is never improved by storage. It is always best at harvest time.

Melons, peaches, apricots, plums and cherries are harvested before they are vine- or tree-ripe because of commercial methods of handling, which make a compromise necessary between quality and condition in order to get the product to market in a salable state. For this reason, they appear to improve in flavor after harvest. However, they never reach the quality or flavor of comparable vine- or tree-ripened fruits. Even pears and apples which ripen after harvest diminish in flavor as the length of time in storage is prolonged.

The rates of flavor and texture changes are related to a considerable extent to the rates of respiration.

Texture may change rapidly after harvest because of normal life processes continuing in the tissue. Asparagus becomes fibrous, corn and peas become tough and starchy, many fruits may become soft and certain apple varieties mealy.

At the present time there is nothing that the packer or handler can do toward increasing the amount of stored energy materials in the product. These may vary with growing conditions including soil and climate, but are beyond the control of the shipper and distributor.

The above considerations are of great importance to the prepackager and have a direct bearing on handling practices and shelf life of the commodity.

Refrigeration has become a common practice in the handling of perishable products because the life processes are slowed up by reducing the temperature, so that the rate of loss of eating quality and condition may be retarded.

The following table, showing the relative respiration rates of Wickson plums over a four-day period after the temperature of the fruit had come to equilibrium with room temperature, illustrates the temperature effect.

These exact relationships do not exist with all commodities, but with the possible exception of the 77° temperature, these figures are quite representative of all fruits and vegetables.

More often than not the commercial life of many commodities such as berries, peaches, melons, beans and leafy vegetables, ends not by natural processes, but by the attack of decay organisms.

Temperature degrees F	Relative respiration rate compared to the rate at 32° F
32	1
37	1.3
42	2.1
50	4.4
59	5.3
68	7.7
77	18.6

Decay-producing bacteria and fungi react to temperature in a way similar to that of their hosts—as the temperature is lowered the growth of these organisms is slowed so that actual damage may be reduced greatly.

For the best condition and quality of a product, together with least amount of spoilage, the temperature of the product should be reduced as soon after harvest as possible to approximately 32° F and maintained at this level until the product is consumed. Exceptions would be those commodities—such as sweet potatoes, mature green tomatoes, cucumbers, squash and peppers—which are subject to chilling injury. It is not commercially feasible to maintain a 32° F temperature during shipping and handling but the closer this is approached the better.

Whenever living tissue is enclosed in a relatively air-tight—impervious—package, the content of the atmosphere within the container changes.

Air normally contains about 79% nitrogen, 20.7% oxygen and a trace of carbon dioxide as the three principle ingredients. If, however, a small amount of air is confined with living tissue, the oxygen is gradually used up in respiration and replaced by carbon dioxide. If the oxygen and carbon dioxide concentrations can be controlled and under certain conditions, such a practice may be used to prolong the life of a product.

Under prepackaging conditions the atmosphere within the package cannot be controlled, and the concentrations of oxygen may become dangerously low, while at the same time carbon dioxide may build up to a very high level.

In an experiment with a relatively impervious film container, ripe peaches reduced the oxygen concentration to about 0.5% and increased carbon dioxide to

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GRASS SEED PRODUCTION, by D. C. Sumner and Milton D. Miller. Ext. Cir. 155, Sept., 1949.

CALIFORNIA SPINACH ECONOMIC STATUS 1948–1949, by Sidney Hoos and P. C. Habib. Ext. Cir. 393, Sept., 1949.

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about 50% within one day at 75° F. At 32° F neither oxygen nor carbon dioxide approached the danger point for short duration holding.

At the high temperature the gases would not pass through the film at a rate comparable to their use or production in respiration. In fact, pressure built up in the package causes some of the nitrogen to be forced out.

At the lower temperature because of a reduced respiration rate equilibrium was soon reached and the atmosphere within the package remained fairly constant in its composition at levels not injurious to the tissue. As a film becomes more pervious to carbon dioxide and oxygen, it also becomes less retentive of water vapor, and dehydration of the packaged product may become a problem.

A high relative humidity builds up in film packages. It is highest in the most retentive films. The spores of many decay organisms are able to germinate and invade the tissue when the relative humidity approaches saturation. As a result, decay may be more serious in packages than would be the case with bulk products. This emphasizes the importance of holding prepackaged commodities at the lowest suitable temperature possible during the entire marketing period.

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