

FRUIT AND VEGETABLES

PERISHABLES HANDLING

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF CALIFORNIA

Davis, California 95616

September 1966
Issue 15

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Modified Atmospheres for Produce

Recent developments in equipment and systems have helped to make commercial use of modified atmospheres for preserving quality of perishables a reality. Considerable publicity has been given to modified atmosphere services. The imagination of potential users has been fired by the possible benefits that might be obtained from such services.

One statement commonly made is that modified atmospheres will eliminate the need for precooling and transit refrigeration of fresh fruits and vegetables. Such reckless speculation has already proven costly to both users and suppliers of modified atmosphere services. These systems are not a panacea for all of the myriad of quality loss and

deterioration problems with fresh fruits and vegetables. A cautious approach is needed in considering uses of modified atmospheres in this industry.

There are presently three primary transit atmosphere services available for perishables shipments. Differences among the services and systems are described in an article in the May, 1966, issue of Produce Marketing. In two of the systems, nitrogen, an inert gas, is used to purge the atmosphere of oxygen, carbon dioxide, and other gases. The effect of modifying the atmosphere with nitrogen or maintaining produce freshness was discussed in an article by Dr. J. N. Harvey of the USDA in the July, 1965, issue of Produce Marketing. The third system involves direct control on regulation of oxygen and carbon dioxide concentrations in the storage atmosphere.

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Information on how modified atmospheres affect biological processes would help one understand the benefits (advantages) and disadvantages of such systems.

Rates of biological processes in fresh fruits, vegetables, and other living plant products are directly affected by product temperature. Rates are slowest at just above the freezing point and increase with increased temperatures up to a certain point.

Respiration, one of the overall biological processes that we try to regulate by temperature control and modified atmospheres, is a complex process involving numerous individual chemical steps, which occur in a specific sequence. Respiration rates are approximately doubled with every 18°F. increase in temperature (above the freezing point) up to a certain point that varies with commodities. Modifications of the storage environment atmosphere--fruits and vegetables are in mobile storage while in transit to markets--also affect respiration rates, but by a different means. Here the changes in oxygen or carbon dioxide levels affect specific chemical reactions involved. Reducing the oxygen level in the storage atmosphere limits the amount of oxygen available for the chemical reactions. Increasing the carbon dioxide level in the storage atmosphere regulates respiration by preventing completion of some of the chemical reactions in the process.

Rates of respiration and other biological processes are also influenced by other factors. Some are characteristic of the product, such as variety, maturity at harvest, types of organs involved--i.e. whether they are fruits, flower parts, growing points, leaves, or storage organs (stems, roots, tubers). Succulence or toughness of tissue has an effect. Other factors are related to the environment in which commodities are stored--relative humidity, light, presence or absence of plant disease causing organisms, and physical handling.

Still other factors result from interactions of environmental and product characteristics. Inherent characteristics in the product may cause it to respond differently under the same

environment. For example, respiration rates of different varieties of the same fruit or vegetable may vary with changes in product temperature. Actively growing parts such as asparagus tips or broccoli heads (floral parts) might respond differently from leaves or fruits to modifications in the oxygen and carbon dioxide levels of the storage atmosphere.

The foregoing examples point out a few of the complexities of trying to regulate respiration and other biological processes in living plant products. The interrelationships of the many factors involved are very complex. It is dangerous to generalize about the possibilities of using current man-controlled processes to achieve such regulation.

Considerable knowledge is available about some of the relationships (between products and their storage environments) but a very limited amount exists about others. Information on developments and results of research in the use of modified atmosphere for fruits and vegetables is included in the proceedings of the Perishables Handling Conferences held at the University of California (1964) and Purdue University (1965 and 1966). Limited numbers of copies of these proceedings are still available.

The fresh fruit and vegetables industry has learned to use temperature control as a valuable tool in reducing quality loss and deterioration, but expensive losses were incurred in the learning process. Excessive refrigeration of chilling sensitive fruits and vegetables is the best example. The industry is learning to use atmospheric modification in a similar manner. Over-simplification of the effects of this process has resulted in some expensive lessons (damage claims) to both suppliers and users. When we learn how, correct use of modified atmosphere could be a useful tool in maintaining produce quality after harvest. Assuming that this method is a cure-all in preserving quality can be dangerous and costly.

R. F. Kasmire

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