Air Transit of Perishables

provides wider distribution, out-of-season markets, improved eating quality for some fruits and vegetables

L. L. Claypool and L. L. Morris

Air transportation—because time is an important factor in the effective marketing of certain fruit and vegetable crops—may provide an important service in the distribution of perishable products.

Some fruits and vegetables—berries, sweet corn, and certain consumer packaged commodities such as shelled lima beans, shelled peas, salad greens and cauliflower curd—are so perishable they can not be widely distributed by surface transportation.

The eating quality of others—apricots, figs, melons, nectarines, peaches, plums and tomatoes—is greatly improved by allowing the product to approach a degree of tree or vine ripeness which is not now possible for distant surface shipment.

With highly seasonal perishables—asparagus, cherries, cucumbers, grapes, okra, tomatoes—there is often a limited period of economical advantage in early arrival in distant markets.

Temporary market deficits may justify air shipment even with commodities not normally considered for air shipment.

Conditions in Transit

The high perishability of fruits and vegetables most likely to be shipped by air places added responsibility on grower, shipper, carrier and receiver to provide those conditions that will keep deterioration at a minimum.

The airplane seems to present no special problems attributable to the fact that the perishables are being flown through the air. However, the emphasis to be placed on the various factors influencing delivered quality will be shifted as compared with slower forms of transport.

Where advanced maturity adds to the eating quality of a product, growers and shippers should market only fruits of such premium quality. This may require special procedures directed specifically toward the production of products for air shipment. Even the varieties best suited for air shipment may be different from those usually produced for surface shipment. The standards now used to evaluate shipping maturity for some fruits will have little direct application to air-borne perishables.

The advanced maturity and the lighter packaging dictated by air transit increase the need for careful handling.

Good handling practices—including proper packaging—must start in the field and carry through all subsequent operations to the consumer.

The delivery of high quality produce is one of the important benefits of air transit but the increased delivered cost makes it necessary to avoid physical damage. Perishables can not be mixed with general freight without risk.

Temperature Control

Temperature control offers the most practical method of maintaining quality of harvested fruits and vegetables. The advanced maturity and increased perishability of air cargo makes commodity temperature control important even though the transit period is short. In fact, temperature plays such an important role that more deterioration could occur during a warm plane trip of a few hours than would occur during several days in a well-refrigerated surface conveyance. The maintenance of temperature near 32° F is desirable for many, but not all, horticultural commodities. Certain perishables are injured if exposed to temperatures below 50° F for extended periods. However, the relatively short time interval involved in air transit is not apt to cause trouble in this regard.

The temperature of a perishable commodity during air transit will be affected by the air temperature in the cargo compartment, the initial commodity temperature, the nature of the package and other insulating material used, the method of loading, the physical nature of the product, and the heat produced by the product.

The need for control of the product temperature begins before delivery to, and extends beyond delivery from, the carrier. Insulated delivery trucks and refrigerated holding space at, or near, the airports at each end of the trip should be provided.

Outside Air Temperature

An airplane is necessarily exposed to wide extremes in outside air temperatures which vary with the altitude, latitude, time of day, and season of the year. Although a threat of freezing exists, especially during the colder periods of the year, the maintenance of desirably low product temperatures is a greater problem. Usually, high altitudes do not assure desirably low product temperatures during transit. The commodity temperature lags behind that of the air.

In summer shipments, the cooling of unprotected commodities aloft may be more than offset by warming that occurs during ground stops. The air temperature in a plane parked in the sun may be several degrees above that of the outside air. In shipping tests, dry pack lettuce warmed several degrees during a transcontinental trip from the West Coast despite periods of cooling while in flight between stops.

The lower temperatures likely to occur near the wall and floor of noninsulated compartments make it desirable to stow the cargo away from these surfaces during cold weather. The desirable cooling that one would get during summer flights by stowing near the skin of the plane would be offset by the more rapid warming during ground stops.

It has not appeared feasible to put mechanical refrigeration on cargo-carrying planes. At present, it seems more practical to obtain the desired temperature changes during and after transit by means of insulated compartments, load blankets and special shipping cases. Supplemental refrigeration such as package icing is probably essential for some highly perishable commodities.

Air Pressure and Water Loss

Recent tests by the United States Department of Agriculture and other research personnel indicate that injury from reduced atmospheric pressures prevailing at high altitudes is extremely unlikely.

However, because water evaporates more rapidly at high elevations than at sea level, even under the same conditions of atmospheric relative humidity, and because relative humidity is usually lower at flying altitudes than at ground level, moisture loss from the product may be a serious problem unless relative humidity and temperature are controlled.

The problem of water loss is most serious with commodities having a high sur-

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ROLLER

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practicable after an average of 25% of the eggs in the egg-masses have hatched and not later than 50% egg hatch. This interval usually occurs about seven days—25% hatch—to 14 days—50% hatch—after egg hatching commences. All timing experiments have shown that treatment applied early—at the beginning of the egg hatching period—is more successful and desirable than a late treatment—at the completion of the egg hatching period.

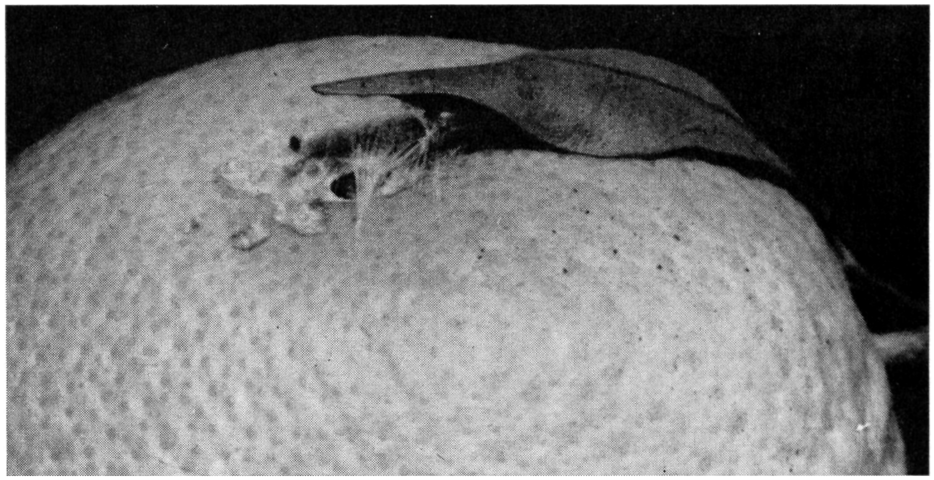
Egg hatching continues for an interval of approximately five weeks, although most of the eggs commence to hatch at the same time in any one area so that about half the total number of larvae have emerged within two weeks of the initial hatch. Therefore it is necessary to: *1*, set up the check trees before mid-March so that egg hatching will not have begun; *2*, choose six average-sized trees in each five acres of grove—these trees should be at least four trees within the border of the grove; *3*, place numbered tags or other means of identification on or near 10 egg-masses in the top of each of the chosen trees; *4*, determine the total number of eggs in each egg-mass when the masses are first chosen so that the percentage of hatch can be obtained; and *5*, record the accumulated total number of hatched eggs—exit holes—every two days.

Insecticide Formulations

Larvae of the fruit tree leaf roller can be controlled by sprays and dusts.

For application with a speed-type sprayer using 500 gallons of water per acre, or with a spray-duster or boom

Fruit tree leaf roller, adult moth.



Larval injury to Valencia fruit, showing larva, injury, and nest on fruit.

sprayer using 300 to 500 gallons of water per acre, one of the following insecticides may be used:

DDT, 50% wettable powder, 6 pounds.
DDD, 50% wettable powder, 6 pounds.
Parathion, 25% wettable powder, 3 pounds.
EPN, 25% wettable powder, 3 pounds.

Fruits should not be picked for 30 days after a parathion or EPN application.

For application with a fish-tail duster —high capacity fan type—at the rate of 75 pounds per acre, 5% DDT or 5% DDD may be used.

These formulations may be made stronger, or other insecticides added, if other citrus pests are also a problem.

Orange Tortrix

To control the orange tortrix together with the leaf roller, the dosages for spray application should be raised to nine pounds of DDD, 50% wettable powder, or six pounds parathion or EPN, 25% wettable powder. For dust application, 5% DDD at the rate of 90 pounds per acre should be used.

To reduce tree smutting by black scale, wettable sulfur may be added to the leaf roller spray formulas, or dusting sulfur used in place of part or all the diluent in dusts.

Aphis Control

Aphis may be controlled by combining one quart of 20% TEPP per acre to the leaf roller spray formulas. Two quarts of 40% nicotine sulfate are also effective but more expensive.

Parathion, used at higher dosages in addition to controlling the leaf roller larvae, will also check California red scale, katydids, and will reduce citrus aphis.

Citrus tree deficiencies may be corrected by adding the appropriate minor element to the leaf roller formula. Neutral preparations of zinc, copper, and manganese are compatible with all four suggested insecticides.

E. Laurence Atkins, Jr., is Assistant Specialist in Entomology, University of California College of Agriculture, Riverside.

The above progress report is based on Research Project No. 1084.

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face exposure such as leafy vegetables or small fruits, and can best be controlled by lowering the commodity temperature and holding the product in an insulated or closed compartment.

L. L. Claypool is Associate Professor of Pomology, University of California College of Agriculture, Davis.

L. L. Morris is Assistant Professor of Truck Crops, University of California College of Agriculture, Davis.

The above article is a condensation of the more detailed report: Air Transportation of Fruits, Vegetables and Cut Flowers: Temperature and Humidity Requirements and Perishable Nature. L. L. Claypool, L. L. Morris, W. T. Pentzer, and W. R. Barger, U.S.D.A., H. T. & S. Office Report No. 258.

WALNUTS

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To reduce the danger of mites becoming a serious problem, a grower should keep his orchard in a vigorous growing condition and never let it suffer for want of water. In his insect control program, he should avoid frequent treatments, by using effective insecticides at adequate dosages and applied with efficient equipment under weather conditions that will insure satisfactory control.

A. E. Michelbacher is Associate Professor of Entomology, University of California College of Agriculture, Berkeley.

O. G. Bacon is Assistant Professor of Entomology, University of California College of Agriculture, Berkeley.