lene and fruit firmness of the 2 cultivars in response to the different chemicals. Treatments of ACC, Ethrel, Ethionine and Methionine accelerated ethylene evolution in peaches and caused considerable decreases in fruit firmness. This was in contrast to antiethylene agent of silver nitrate and AVG which prevented fruit from softening which would be due to the blockage of ethylene biosynthesis in peach tissues. When Ag+ were present along with ethylene, the softening reaction was not inhibited.

The exceptional high fruit firmness of 'Flordagold' peach at maturity, ripening and during storage stages (5) was confirmed. There were low production rates of ethylene by 'Flordagold' when compared to 'Fla 3-2' peaches. This was apparently also reflecting in a slower rate of loss of firmness.

The action of the various chemical on whole fruit did not allow us to determine the basis for the difference in ethylene biogenesis between the two cultivars. However 'Flordagold' did respond differently to added methionine than did 'Fla 3-2'.

In general, there were no remarkable differences in TSS and juice acidity between the 2 cultivars, however the different treatments did produce some differences when cultivars and periods of treatments were analyzed. It seemed reasonable to conclude that TSS and acidity were not contributing to the difference between the two cultivars.

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Proc. Fla. State Hort. Soc. 94:289-291. 1981.

UTILIZATION OF THE FLOW-THROUGH SYSTEM FOR RIPENING INITIATION OF TOMATOES[1]

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Abstract. **Catalytic generation of ethylene for ripening initiation of tomatoes in Florida is a common practice. Although this practice is very safe there are the disadvantages of high concentrate costs and accumulation of CO_2 which interferes with ripening.**

An alternative flow-through system was developed which blends the required amount of tank ethylene (150 ppm) with fresh air and passes this mixture through the ripening room at the rate of 1 room air change in 6 hours. This rate of change is sufficient to maintain CO_2 concentration below 2%.

The flow-through system was recommended for commercial use on a trial basis in the spring of 1980. It is estimated that 40 to 50% of the tomato ripening rooms in Florida have now converted to the new system. Additional 37% have modified their ripening practices to allow for air changes in the rooms.

Construction of special rooms for ripening tomatoes with exogenous ethylene began in Florida in 1968. Prior to that time some tomato ripening initiation with exogenous ethylene had taken place in existing rooms which had been appropriately modified. By 1971 one manufacturer in Florida had constructed 35 air-tight tomato ripening rooms with temperature and humidity control and ranging in capacity from 10,000 to 15,000 cu. ft. Harllee-Gargiulo, Inc. became the "World's leading user of ethylene gas technique for ripening tomatoes".[2]

At that time ethylene from high pressure cylinders was injected into ripening rooms generally by the method of cylinder differential weight (pounds ethylene per room). Atmospheric samples taken from some of these rooms one hour after injection showed ethylene concentrations up to 15,000 ppm; CO_2 up to 8% also accumulated in these ripening rooms. Ripening rooms were opened each 12 or 24 hours for a short period of time to allow the tomatoes to "breathe", after which time rooms were closed and more ethylene introduced. The Florida Fire Prevention Code states in part that ethylene shall be introduced by some means under positive control and measured so that the quantity introduced does not exceed one part ethylene to one thousand parts of air (1,000 ppm). The flammable range of ethylene is 3.1 to 32% (31,000 to 320,000 ppm). Generally tomatoes were ripened safely with this technique but the rare accidents that occurred were traced to poor practices such as "... a few minutes before the wall blew out a loud hissing noise was heard. The shop foreman said the normal operation was that the cylinder of gas was turned on by one employee and 10 minutes later another worker was to shut it off", or "... a rubber hose connected the cylinder of ethylene to a galvanized pipe which was stuck through the wall to the ripening room. The cylinder valve was opened and ethylene was allowed to enter the room until the galvanized pipe showed signs of frosting".

Development of catalytic generators eliminated the hazards associated with poor practices employed by a few

[1]Florida Agricultural Experiment Station Journal Series No. 3414.

[2]Aluma Shield News Vol. 2, Supplement to the Packer, September 4, 1971.

operators using the high pressure cylinders. Generators released a small amount of ethylene over a period of time and therefore eliminated any possibility of an explosion. The concentrate base is essentially ethanol which is converted to ethylene and water. With this source of ethylene, rooms still needed to be opened periodically to add more concentrate and change the room atmosphere.

Ripening is irreversibly initiated when the internal concentration of naturally-produced ethylene reaches 0.1 to 1.0 ppm (6), therefore extremely high concentrations of exogenous ethylene for commercial applications are superflous. Ripening tomatoes are injured in atmospheres when O_2 is less than 4% and CO_2 greater than 4% (4). Carbon dioxide is a competitive inhibitor of ethylene action that delays fruit ripening by displacing the ripening hormone, ethylene, from its receptor site (2). High concentrations of CO_2 not only retard ripening but can also prevent intensity of red color development (1, 3, 5).

Development of the Flow-Through System

To optimize the use of existing tomato ripening facilities a new system was needed. The system must be simple to install, operate and maintain. Additional requirements of the system were absolute safety and cost efficiency.

The system developed consisted of a small blower fan (about 40 watts) to introduce outside air into each ripening room. An exit port, equal in size to the entrance port, was provided through the wall opposite the blower fan. To prevent a CO_2 concentration higher than 2% the minimum air flow through the room should be 1 room change per 6 hours.

Source of ethylene is from a cylinder (technical grade) at a fixed location. The amount of ethylene (150 ppm) for each room is accurately metered with a rotameter and piped to the junction with the blower fan where it is instantaneously blended with incoming air. The resulting air-ethylene blend (150 ppm) is over 200 times less than the minimum flammable range. The minute quantity of ethylene required can be provided at a fraction of the cost of generator concentrate which was currently being used. Ethylene for the flow-through system can also be supplied from a generator but there would be no precise regulation of the concentration in the ripening room. The generator produces sufficient ethylene to be used with this system.

It is essential that the existing internal fans in each ripening room be used to prevent possible stratification of the air-ethylene blend or accumulated CO_2. Internal atmosphere of the room can be easily monitored by sampling the air at the exit port and determining concentration of CO_2 and ethylene. With the established rate and blend of air-ethylene it is not necessary to open the rooms for aeration. Rooms can be safely entered at any time for inspection of the fruit.

Room Distribution, Commercial Testing and System Utilization

Distribution of rooms. Exact data on the number and size of commercial tomato ripening rooms in Florida are not available. The predominant size is a "2- or 3-car" room which normally hold 2500 or 3750 30-lb. boxes, respectively. Based on the best available information currently there are 1400 to 1500 car-equivalents. About half of these rooms are located in the Ruskin/Palmetto area. Most of the other rooms are located in Immokalee/Naples, Ft. Pierce/Pompano, and Dade County areas.

Commercial tests. Based on experimental tests the flow-through system was introduced to a few tomato grower/packers in September 1979 and suggested for commercial trial. During the 1979-80 production season commercial tests were conducted in packinghouses located in the Ruskin/Palmetto, Ft. Pierce/Pompano, and Dade County areas. All 3 packers converted 100% to the new system prior to the next season. One packer was able to convert his operation in South Carolina to the flow-through system for the 1980 spring season.

Results of the commercial tests were verbally communicated to grower/packers attending the Florida Tomato Committee meetings in September 1980. An Extension publication (7) on the system was prepared and distributed to packers this year.

Utilization. A recent survey shows the following tomato ripening room systems in use or in process of modification:

	Car equivalents	Percent
Generator only	314	21
Flow-through		
Cylinder ethylene	604	42
Generator ethylene	529	37
Total	1,447	

Of the total 1,447 car equivalents accounted for in this survey 85% were verified by personal visit or telephone while the remaining 15% were rooms or trailers that were thought to exist.

Discussion and Conclusion

During the past 12 years the number of tomato ripening rooms in Florida has increased from 9 to 1,447 car equivalents. Florida has the largest number of tomato ripening facilities in the world. The flow-through system of ripening initiation, introduced to the Florida industry 2 years ago, has impacted upon 79% of these tomato ripening rooms. In addition to Florida, the system has been introduced in California, Mexico, and the eastern part of the U.S.

The flow-through system can be installed by packinghouse maintenance personnel and the system is essentially trouble-free. The blower fan requires only periodic lubrication and only line breakage would interfere with the delivery of ethylene. Rooms that previously were not sufficiently air-tight can be used with this system. The need for periodic aeration of rooms has been eliminated and CO_2 concentration is below a level where it interferes with ripening. The system utilizing ethylene from cylinders also eliminates the need of generator maintenance and concentrate handling.

Cost of operating the new system is substantially less than when only the standard generator was used. Although no actual operating costs have been obtained for either system, estimates are that the flow-through method can be operated 75 to 85% cheaper. Faster ripening is also achieved because of the improved atmosphere. This saving in time impacts on both construction and operational costs.

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Proc. Fla. State Hort. Soc. 94:291-294. 1981.

ETHYLENE PRODUCTION AND FIRMNESS OF PEACH AND NECTARINE FRUITS AS RELATED TO STORAGE[1]

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Additional index words. Prunus persica, cold storage.

Abstract. **Firm ripe fruit of 'Flordagold' peach and a numbered selection of nectarines (Fla 3-4) were stored at 2°, 6°, 10°, 15° and 18°C for 4 weeks. Ethylene production, firmness, total soluble solids and acidity were studied as related to storage treatments. Minimal ethylene production was observed at 2°C with slightly higher levels produce at 6°C. Storage at 2°C and 6° kept fruits at a good quality for marketing for at least 4 weeks.**

[1]Florida Agricultural Experiment Station Journal Series No. 3544.
[2]Assistant Professor, Tanta University, Egypt, Assistant Professor, Assiut University, Egypt, and Professor, University of Florida, respectively. The authors appreciate the technical help of Drs. D. D. Gull and P. G. Webb.

Ethylene production in fruits during maturation is important to shelf-life (1, 2). Fruits develop the capacity for enhanced ethylene production during cold storage. Cold stress induces metabolic changes that lead to accelerated ethylene production that influences ripening of pears (4). Ethylene evolution by both peaches and nectarines increased as storage period was prolonged (6). Higher rate of ethylene production was found in peaches and nectarines with higher storage temperatures (6).

Fruit firmness is known to be associated with ethylene production (3). The rate of softening of 'Flordagold' peach fruit was found to be slower than other peaches (3). Little changes in total soluble solids (TSS) and a considerable decreases in acidity of peach and nectarine fruit were found with increased cold storage (6).

The purpose of this investigation was to study the effect of low temperature storage on the post-harvest physiology of two new selections 'Flordagold' peach and nectarine 'Fla 3-4'.

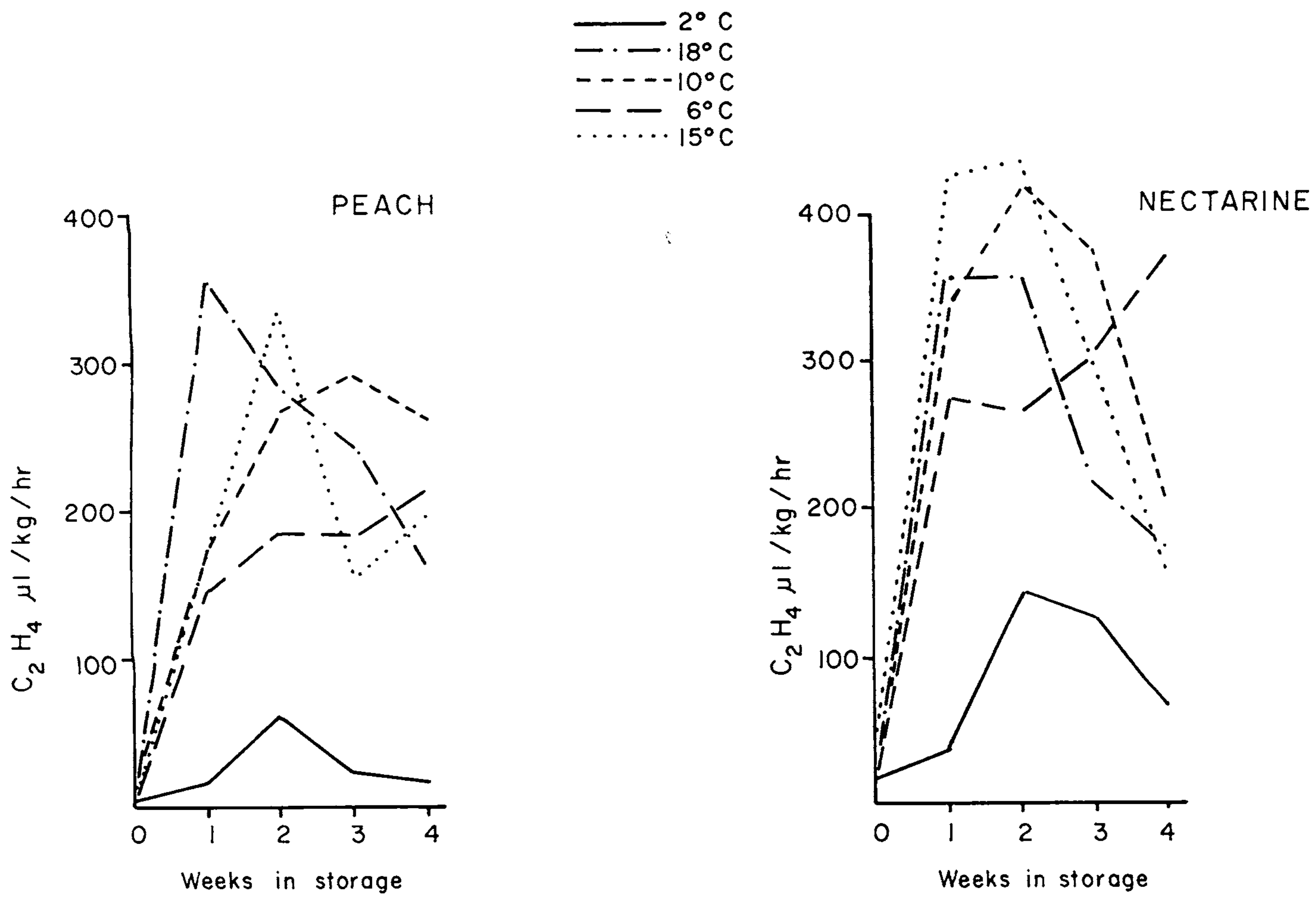

Fig. 1. Effect of 2°, 6°, 10°, 15° and 18°C storage temperatures on ethylene production in peach and nectarine.