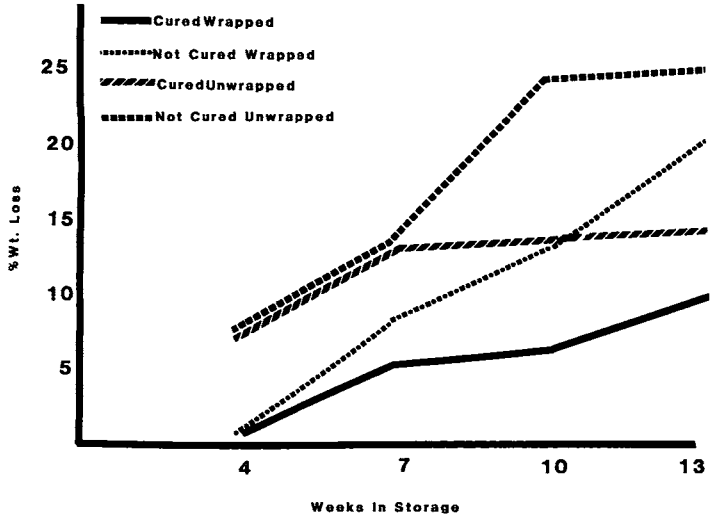

Fig. 1. Fresh weight loss of first harvest 'Picadita' boniatos with curing and wrapping treatments during storage at 25°C.

This first year study found a beneficial impact of curing on boniato quality. Unless a quality product is readily available, the continued decline in per capita consumption of sweet potatoes can be expected (4). The same may be said for boniatos. Efficient and effective postharvest treatments, storage, transportation, and marketing systems should be thoroughly investigated in order to insure quality preservation for both domestic and foreign markets (2).

Possibilities for a low cost, double-walled, black plastic Quonset-like structure for curing and improved storage of boniatos at packinghouses as described by Wagner (8) may warrent further investigation. Additional studies on several curing methods will be undertaken to determine techniques for improving storage quality of boniatos that are both adapted to local conditions and adoptable by growers and packers.

Literature Cited

1. Edmond, J. B. and G. R. Ammerman. 1971. Sweet potatoes: production, processing, marketing. The AVI Publishing Company, Inc., Westport, Conn.
2. Kader, A. 1983. Postharvest physiology and crop preservation. p. 455-470. In: M. Lieberman (ed.). Postharvest quality maintenance of fruits and vegetables in developing countries. Plenum Publishing Corporation, New York.
3. Manlan, M. 1983. Utilization studies on the tropical sweet potato, *Ipomoea batatas*. MS Thesis, Univ. Fla., Gainesville.
4. Mathia, G. A. 1975. An economic evaluation of consumer characteristics affecting sweet potato consumption. J. Amer. Soc. Hort. Sci. 100(5):529-531.
5. McGuire, J. F. and R. J. Champagne. 1977. The subtropical vegetable industry of Dade County. Proc. Fla. State Hort. Soc. 90:363-365.
6. O'Hair, S. K., P. McSorley, J. L. Parrado, and R. F. Matthews. 1983. The production and qualities of Cuban sweet potato cultivars in Florida. Proc. Amer. Soc. Hort. Sci. Trop. Reg. 27, Part B:7-14.
7. Ryall, A. L. and W. J. Lipton. 1979. Handling, transportation and storage of fruits and vegetables. Vol. 1, 2nd ed. The AVI Publishing Company, Inc., Westport, Conn.
8. Wagner, A. B., E. E. Burns, and D. R. Paterson. 1983. The effects of storage systems on sweet potato quality. HortScience 18(3):336-338.
9. USDA-SEA-AR. 1980. Sweet potato quality. Southern Coop. Ser. Bul. 249.

Proc. Fla. State Hort. Soc. 98: 189-191. 1985.

EFFECT OF FILM WRAPPING, WAXING AND IMAZALIL ON WEIGHT LOSS AND DECAY OF FLORIDA CUCUMBERS[1]

L. A. Risse, W. R. Miller and D. Chun
U.S. Department of Agriculture
Agricultural Research Service
2120 Camden Road
Orlando, FL 32803

Additional index words. Cucumis sativus, bacterial soft rot, alternaria rot, anthracnose rot.

Abstract. **Imazalil (IM) (1-[2-(2,4-dichlorophenyl)-2-(2-propenyloxy)ethyl]-IH-imidazole) treated and untreated cucumbers (*Cucumis sativus* L.) were waxed or not waxed before being wrapped in heat-shrinkable plastic film before storage. Wrapped and nonwrapped cucumbers were stored for 2 and 3 weeks at 7°C plus holding for 3 days at 21°C. Wrapped cucumbers had significantly less weight loss than those nonwrapped, or nonwrapped but waxed. In all treatments, waxed cucumbers had the highest incidence of decay. Wrapped cucumbers had as much or more decay than nonwrapped. Treatment with IM, either as a dip or coated on film, resulted in the lowest incidence of decay.**

During the 1983-84 season, Florida produced ca. 4.6 million bu of cucumbers (*Cucumis sativus*) valued at ca. $34 million (1). Cucumbers are not adapted to long-term storage; they cannot be expected to keep satisfactorily even at optimum temperatures of 7° to 10°C for more than 10 to 14 days and still retain acceptable condition during retailing (5). Cucumbers are very susceptible to shriveling; hence, the humidity during storage/transit and marketing should be kept at 90 to 95%. For the fresh market, cucumbers are usually waxed to reduce moisture loss (4). However, waxing has been shown to increase the incidence of decay on cucumbers and tomatoes (9, 10).

Film wrapping or seal packaging of individual fruits and vegetables has shown that weight loss can be reduced and shelf life extended during marketing (2). In reducing weight loss and extending shelf life, the mode of action of individual film wrapping is related to the alleviation of water stress on harvested fruits and vegetables. Individual

[1]This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation by the U.S. Department of Agriculture nor does it imply registration under FIFRA. Use of a company or product name by the U.S. Department of Agriculture
does not imply approval or recommendation of the product to the exclusion of others which may also be suitable.

film wrapping of European-type cucumbers stored at 20°C and relative humidity of 65 to 75% for 5 weeks has shown that weight loss was 5% compared to 85% for nonwrapped cucumbers (3). It has been reported that the incidence of decay might increase with film wrapping of peppers or eggplants (6, 8). Also, more recent work has shown that certain fungal decays can be reduced by dipping peppers in Imazalil (IM) or wrapping them with IM-coated film (7).

The purpose of this study is to determine the effects that wrapping, waxing, and IM treatments have on the control of postharvest decay and weight loss at desired storage temperatures and relative humidity.

Materials and Methods

Three tests were conducted at ca. 3-week intervals from mid-November to late December during 1984. The cucumbers were commercially grown and harvested in the Sun City, Florida, area. The cucumbers were picked from field bins and were not precooled or treated before they were brought back to the laboratory.

At the laboratory, ca. 6 to 12 hr after harvest, the cucumbers were randomly sorted (with only obviously torn stems, bruised or decayed fruit removed) into lots of 20 cucumbers per treatment. The following 8 treatments were prepared: nonwrapped, nonwrapped/waxed, nonwrapped/IM dipped/waxed, wrapped, wrapped/waxed, wrapped/IM dipped, wrapped in IM film, and wrapped in IM film/IM dipped.

The IM dip (1,000 ppm) was prepared by adding Fungaflor 75% active ingredient to fresh water. The cucumbers were submerged in the prepared solution for 30 sec and air-dried on kraft paper. The cucumbers were waxed with a spray application of a commercial cucumber water wax at ca. 37° to 39°C. The cucumbers were then polished by soft fiber brushes. A low-density polyethylene, heat-shrinkable film (Clysar EHC-50), nominal thickness of 0.013 mm, without or coated with 12,000 ppm of IM during extrusion, was used for the wrapped treatments. The film was applied to each cucumber using a hot wire Weldomatic sealer (model 6001) and a Weldomatic heat tunnel (model 7001).

In the 3 tests, 2 duplicate samples of 20 cucumbers for each treatment were placed in 1/2-bu corrugated fiberboard boxes (wax-coated) and stored in cold rooms maintained at 7°C and 80 to 90% relative humidity for either a 2- or 3-week storage period. Following initial storage at 7°C, 10 cucumbers were removed from each box, weighed, and evaluated for incidence and type of decay. The remaining 10 cucumbers were left in the box and stored at 21°C and 88 to 95% relative humidity for 3 days and then weighed and evaluated for decay. Data were subjected to analysis of variance and mean separation by Duncan's multiple range test where applicable.

Results and Discussion

Cucumbers wrapped in nonperforated film significantly reduced weight loss compared to nonwrapped, and nonwrapped/waxed cucumbers during 2- or 3-week storage at 7°C plus 3 days at 21°C (Table 1). There was no difference in weight loss of wrapped and wrapped/waxed cucumbers. Weight loss of nonwrapped cucumbers was 10 to 20 times more than for those wrapped or wrapped/waxed. Weight loss of waxed cucumbers was 3 to 6 times more than for those wrapped or wrapped/waxed. This reduction in weight loss difference is not as great as reported earlier (3) but storage time was shorter, temperature lower, and relative humidity higher during storage in this study as compared to the earlier study.

Table 1. Percentage of weight loss of cucumbers after 2 and 3 wk of storage ot 7°C plus 3 days at 21°C by treatment, 3 tests, 1984[z].

Treatment	2 wk at 7°C	2 wk at 7°C + 3 days at 21°C	3 wk at 7°C	3 wk at 7°C + 3 days at 21°C
Nonwrapped	2.2 a[y]	3.0 a	3.5 a	4.2 a
Nonwrapped/waxed	0.6 b	0.8 b	1.2 b	1.3 b
Wrapped	0.1 c	0.2 c	0.2 c	0.4 c
Wrapped/waxed	0.1 c	0.1 c	0.2 c	—[x]

[z]Relative humidity during storage was 80 to 90% at 7°C and 88 to 95% at 21°C.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.
[x]All cucumbers decayed.

Table 2. Percentage of decay of cucumbers after 2 and 3 wk of storage at 7°C plus 3 days at 21°C by treatment, 3 tests, 1984[z].

Treatment	2 wk at 7°C	2 wk at 7°C + 3 days at 21°C	3 wk at 7°C	3 wk at 7°C + 3 days at 21°C
Nonwrapped	0	32 b[y]	12 ab	80 a
Nonwrapped/waxed	0	57 a	18 a	98 a
Nonwrapped/waxed/IM dipped	0	28 bc	2 b	65 ab
Wrapped	2	58 a	22 a	98 a
Wrapped/waxed	2	70 a	18 a	100 a
Wrapped/IM dipped	0	22 bc	0 b	12 c
Wrapped in IM film	0	10 bc	0 b	28 bc
Wrapped in IM film/IM dipped	0	5 c	0 b	10 c

[z]Relative humidity during storage was 80 to 90% at 7°C and 88 to 95% at 21°C.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

Cucumbers wrapped in IM film or IM dipped had less decay compared to all other treatments during a 2-week storage period at 7°C plus 3 additional days at 21°, 3 weeks at 7°, and 3 weeks at 7° plus 3 additional days at 21° (Table 2). During 2-week storage at 7°, there was no difference in the incidence of decay between any treatment as decay ranged from 0 to 2%. During extended storage of 3 weeks at 7° plus 3 days at 21°, decay of nonwrapped/waxed, wrapped, and wrapped/waxed cucumbers ranged from 98 to 100% compared to 10 to 28% for cucumbers wrapped in IM film/IM dipped, wrapped/IM dipped, and wrapped in IM film. About 60% of the decay found in this study was bacterial soft rot (*Pseudomonas* sp.) and a cottony leaklike decay. The remaining 40% of the decay was anthracnoselike and alternaria rots. In many cases, bacterial soft rot and cottony leaklike decay followed bacterial spot symptoms. IM treatments significantly reduced the incidence of anthracnose and alternaria rots, but did not affect the incidence of bacterial soft rot (data not shown).

Imazalil in the form of dip or coated on the film was effective except when the cucumbers were waxed. Cucumbers dipped in IM and then waxed generally had a lower incidence of decay compared to cucumbers that were waxed but not dipped in IM. Waxing of either nonwrapped or wrapped cucumbers generally increased the incidence of decay as reported earlier (9). In this study, IM reduced fungal decay on cucumbers as similarly reported on peppers (7).

In summary, the incidence of decay during 2 weeks' storage at 7°C was negligible; during 3 weeks' storage at 7°, IM effectively controlled decay, but during additional storage at 21° decay generally increased rapidly. Even at the higher storage temperature, IM was effective. Wrapped cucumbers generally had a higher incidence of decay than nonwrapped cucumbers, but weight loss was significantly reduced when compared to nonwrapped or nonwrapped/waxed cucumbers. Wrapping cucumbers in combination with an IM treatment was very effective in reducing decay during prolonged storage (3 weeks) at 7°C.

Literature Cited

1. Anonymous. 1984. Florida agricultural statistics-vegetable summary. 1984. Fla. Dept. Agr. and Consumer Serv.
2. Ben-Yehoshua, S. 1985. Individual seal-packaging of fruit and vegetables in plastic film—a new postharvest technique. HortScience 20(1):32-37.
3. Elkashif, M. E., D. J. Huber, and M. Sherman. 1983. Delaying deterioration of broccoli and cucumber using polymeric films. Proc. Fla. State Hort. Soc. 96:332-335.
4. Hartman, J. D., and F. M. Isenberg. 1956. Waxing vegetables. N.Y. State Col. Agr., Cornell Ext. Bul. 965. 14.
5. Lutz, J. M., and R. E. Hardenburg. 1968. The commercial storage of fruits, vegetables, florist, and nursery stock. U.S. Dept. Agr. Hdbk. 66.
6. Miller, W. R., D. H. Spalding, and L. A. Risse. 1983. Decay, firmness and color development of Florida bell peppers dipped in chlorine and imazalil and film wrapped. Proc. Fla. State Hort. Soc. 96:347-350.
7. Miller, W. R., D. H. Spalding, L. A. Risse, and V. Chew. 1984. The effects of an imazalil-impregnated film with chlorine and imazalil to control decay of bell peppers. Proc. Fla. State Hort. Soc. 97:108-111.
8. Risse, L. A., and W. R. Miller. 1983. Film wrapping and decay of eggplant. Proc. Fla. State Hort. Soc. 96:350-352.
9. Segall, R. H., A. Dow, and P. L. Davis. 1974. Effect of waxing on decay, weight loss and volatile pattern of cucumbers. Proc. Fla. State Hort. Soc. 87:249-251.
10. Segall, R. H., C. M. Geraldson, and P. H. Everett. 1973. The effect of cultural and postharvest practices in postharvest decay and ripening of two tomato cultivars. Proc. Fla. State Hort. Soc. 86:246-249.

Proc. Fla. State Hort. Soc. 98: 191-194. 1985.

EVALUATION OF SOLAR DEMONSTRATION PROJECTS FOR FLORIDA CITRUS PACKINGHOUSES

W. M. MILLER
University of Florida
Institute of Food and Agricultural Sciences
Citrus Research and Education Center
700 Experiment Station Road
Lake Alfred, FL 33850
M. T. TALBOT
University of Florida
Institute of Food and Agricultural Sciences
Agricultural Engineering Department
9 Frazier Rogers Hall
Gainesville, FL 32611

Additional index words. drying, energy.

Abstract. **Two solar demonstration projects at commercial Florida citrus packinghouses were installed and evaluated in providing dryer preheat for surface drying fruit. Efficiencies of these collector systems were monitored and their potential energy contribution for drying determined. For a conventional heated air collector installation, efficiencies were 50 to 65% with a temperature increase of 18 to 25°C. For energy collection from an isolated side loft roof section painted flat black with no transparent cover, efficiencies were < 5% and the temperature increase ca. 2°C. Also, long-term weathering effects to 3 transparent cover materials, a glass sample and 2 fiberglass samples, were studied by transmissivity measurements. Both fiberglass materials exhibited a marked decline in light transmission over the 3-yr test period.**

Solar energy has received wide attention as an alternative to fossil fuel dependence in the United States. In general, agricultural applications appear well suited. Ample area is available for placement of collectors and precise temperature control and drying time are not critical in many applications. The projects discussed in the research reported herein were part of a USDA program with Department of Energy funding to demonstrate solar drying of crops and grains in Florida. The funding was on a cost-share basis with up to 50% of cooperator's costs supported by the granting agency. The overall program goals were to 1) design, construct, and evaluate full-scale prototype solar drying system on operating farms; 2) demonstrate technical and economic feasibility of using solar energy technology to provide significant heating requirements for on-the-farm crop and grain drying, and supplemental uses; 3) test solar energy technology developed under operating farm conditions; 4) incorporate and utilize energy conservation techniques; 5) minimize interruption and interference in cooperators' normal operations; 6) identify incentives and opportunities for widespread applications of solar energy technology. A report on the 10 projects installed in Florida are detailed in a report by Talbot (9).

The cooperation of the Lake Garfield Citrus Co-op and Winter Haven CGA and financial support of the U.S. Dept. of Energy through the USDA "On-Farm Demonstration of Solar Drying of Crops and Grains" program is gratefully acknowledged.