

FREEZE DAMAGE TO TROPICAL FRUITS IN SOUTHERN FLORIDA IN 1977¹

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Abstract. On January 19 and 20, 1977, southern Florida experienced a severe freeze, with temperatures below 32 F for 13 hours or more and minima in the mid to low 20's. Major damage was done to tropical fruit plants in most locations on the mainland. Systematic observations of cold injury were made in the plant collections of the University of Florida AREC, Homestead, the USDA SHRU, Miami, the Fairchild Tropical Garden, Miami, and in private collections of many members of the Rare Fruit Council International. Data on more than 200 species and cultivars are presented in tabular form for the use of persons interested in growing tropical fruits in Florida.

Cold periods with light frost cause injury to tropical fruit plants on the average of about one year out of two in southern Florida. Most of these are of very short duration, with temperatures only 1-3° F below the freezing point. Typically many plantings escape damage because of proximity to bodies of water or warming effects of buildings and trees.

Severe freezes occur much less frequently. They are characterized by temperatures as much as 6-8° F below freezing and long durations of low temperatures. Generally such freezes affect nearly all locations on the Florida mainland. Previous to this year the most severe freezes of the century in southern Florida were in 1917, 1934, 1940 and 1958.

In January 1977 a severe freeze occurred in all areas of southern Florida except for the lower Keys and a few small

areas on the mainland. Air temperatures below the freezing point occurred in most locations from around 7 PM on January 19 through 8 to 9 AM on January 20. There were minima in the mid-20's in most locations and many reports of temperatures in the low 20's were received. There was less of a temperature inversion and more air movement than are typical of freezes in southern Florida. Therefore temperatures were relatively uniform over the entire area, even in coastal locations which usually are much warmer than the interior.

Accounts of past freezes, such as those published in the Proceedings of the Florida State Horticultural Society (1, 2, 3, 4, 5, 6), are of great value to growers and research workers who wish to learn the cold tolerance of different plant species, likelihood of injury in specific areas, and ways of preventing cold injury. This account is presented as a record of the effects of the 1977 freeze on 207 species and cultivars of tropical fruit in southeastern peninsular Florida.

Procedure

The plant collections of the Fairchild Tropical Garden, Miami (FTG), the U. S. Department of Agriculture, Subtropical Horticulture Research Unit, Miami (SHRU), and the University of Florida Agricultural Research and Education Center, Homestead (AREC) were included. In addition, much information from private plant collections was submitted by members of the Rare Fruit Council International on forms prepared by Dr. R. J. Knight, Jr. All information came from locations in the southeastern coastal area of Florida including Dade, Broward, Palm Beach, Martin and St. Lucie counties. Unless otherwise indicated the data are for plants growing in the open without cold protection such as covers, heaters or sprinkler irrigation. Cold injury was recorded at monthly intervals after the freeze until the full extent of injury could be determined. The numerical rating scale ranged from 0 (no damage) to 5 (plant killed), as indicated in Table 1.

Results and Discussion

Table 1 lists the tropical fruit species alphabetically by scientific name, along with their common name and cold injury ratings for large or mature plants and for small or juvenile plants.

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Table 1. Cold injury to tropical fruit species, January 19-20, 1977.

Scientific name	Common name	Injury rating*	
		Large or mature	Small or juvenile
Aegle marmelos	Bael	1-2.5	—
Aleurites moluccana	Candlenut	1	—
Anacardium occidentale	Cashew	3.5-4.5	4-5
Ananas comosus	Pineapple	2	2
Annona cherimola	Cherimoya	4-5	5
Annona diversifolia	Ilama	4-4.5	—
Annona fairchildiana	—	2	—
Annona glabra	Pond apple	2-3	3-4
Annona montana	Mountain soursop	4	—
Annona muricata	Soursop	3.5-4	4-5
Annona purpurea	Soncoya	4	—
Annona reticulata	Custard apple	3-4.5	4.5-5
Annona squamosa	Sugar apple	3-4	4-5
Annona cherimola X squamosa	Atemoya	1-3	2-5
Antidesma bunius	Bignay	3.5-4	4-5
Antidesma dallachyanum	Herbert River Cherry	3-4	—

Table 1. (Continued).

Scientific name	Common name	Injury rating*	
		Large or mature	Small or juvenile
Artocarpus communis	Breadfruit	4.5	5
Artocarpus heterophyllus	Jakfruit	3.5-4	4-5
Artocarpus hypargyraeus	Kwaimuk	2-3	—
Averrhoa bilimbi	Bilimbi	3-4	5
Averrhoa carambola	Carambola	1-2	2-4
Bactris gasipaes	Peach palm	1	—
Blighia sapida	Akee	1-3	4
Bromelia pinguin	Pinguin	2	—
Brosimum alicastrum	Maya breadnut	0-0.5	—
Bunchosia armeniaca	—	1	—
Butia capitata	Jelly palm	0	0
Byrsonima crassifolia	Nance	1	—
Byrsonima spicata	Maricao	3	—
Calocarpum mammosum	Mamey sapote	2-4	4-5
Calocarpum viride	Green sapote	2-3	3-4
Carica papaya	Papaya	4	4-5
Carissa carandas	Karanda	2.5	2.5-4.5
Carissa macrocarpa	Natal plum	3	—
Carissa opaca	—	3	—
Carissa spinarum	—	3	—
Casimiroa edulis	White sapote	0-2	0-2.5
Casimiroa tetrameria	Wooly white sapote	1	—
Cecropia peltata	Cecropia	1-3	—
Ceratonia siliqua	Carob	0	3
Cereus jamacaru	Pitaya	1	—
Cereus spp.	Pitaya	1-2	—
Chrysobalanus icaco	Cocoplum	4-4.5	5
Chrysophyllum cainito	Star apple	2-4	4-4.5
Chrysophyllum oliviforme	Satinleaf	4	—
Citrus aurantifolia	Lime	2-4	4-5
Citrus aurantium	Sour orange	0	0
Citrus depressa	Shekwasha	0.5	—
Citrus excelsa	Kalpi	3	—
Citrus grandis	Pummelo	2	—
Citrus jambhiri	Rough lemon	2.5-3	—
Citrus limetta	Sweet lemon	2.5	—
Citrus limettioides	Sweet lime	2.5	—
Citrus limon	Lemon	2-4	—
Citrus macrophylla	Alemow	3	—
Citrus madurensis	Calamondin	0-1	—
Citrus medica	Citron	3.5-4	—
Citrus paradisi	Grapefruit	0-3	—
Citrus reticulata	Tangerine	0-2	—
Citrus sinensis	Sweet orange	0-0.5	—
Citrus taiwanica	Nansho daidai	0	—
Citrus X	'Troyer' citrange	0	—
Citrus X	'Sinton' citrangequat	0	—
Citrus X	CRC 1456 citrumelo	0	—
Citrus X	'Ichang' lemon	0-1.5	—
Citrus X	'Lakeland' limequat	3	—
Citrus X	'Meyer' lemon	3	—
Citrus X	'Murcott'	0	—
Citrus X	'Minneola' tangelo	0	—
Citrus X	'Orlando' tangelo	0	—
Citrus X	'Sampson' tangelo	0	—
Citrus X	'Ortanique' tangor	1	—
Citrus X	'Tahiti' lime	2-4	4-5
Citrus X	'Temple' tangor	0	—
Clausena excavata	—	1-2	—
Clausena lansium	Wampee	1-2	2-3
Coccoloba uvifera	Sea grape	2-4.5	4-5
Cocos nucifera	Coconut	2.5	2-5
Coffea arabica	Coffee	2-3	3-5
Cola acuminata	Cola	—	4.5-5 ^v
Couepia polyandra	Olosapo	—	4
Cyphomandra betacea	Tree tomato	3	—
Diospyros blancoi	Velvet apple	1-3	4-5
Diospyros digyna	Black sapote	2-4	4-5
Diospyros kaki	Japanese persimmon	0	0
Diospyros senegalensis	—	2	—
Diospyros virginiana	Persimmon	0	0
Dovyalis abyssinica	—	—	2
Dovyalis caffra	Kei apple	0	0
Dovyalis hebecarpa	Ceylon gooseberry	1-2.5	—
Dovyalis abyssinica X hebecarpa	Dovyalis hybrid	1-2	3-4.5
Elaeagnus philippensis	Lingaro	0-2.5	3-4
Eriobotrya japonica	Loquat	0-0.5	0-0.5
Eugenia aggregata	Cherry of the Rio Grande	0	0-2.5
Eugenia brasiliensis	Grumichama	1-4	3-4.5

Table 1. (Continued).

Scientific name	Common name	Injury rating*	
		Large or mature	Small or juvenile
<i>Eugenia curranii</i>	—	3.5	—
<i>Eugenia luschnathiana</i>	Pitomba	0-1	3-4.5
<i>Eugenia uniflora</i>	Surinam cherry	0-1.5	1-2
<i>Eugenia uvalha</i>	Uvalha	0-1	1-2
<i>Euphoria longana</i>	Longan	1-4	4-5
<i>Feijoa sellowiana</i>	Feijoa	0	0
<i>Feronia limonia</i>	Wood apple	2	—
<i>Ficus carica</i>	Fig	0	0-1
<i>Flacourtia cataphracta</i>	—	4-5	—
<i>Flacourtia indica</i>	Governor's plum	2-4	4-5
<i>Flacourtia inermis</i>	Lovi-lovi	2.5 ^y	—
<i>Flacourtia jangomas</i>	Paniala	3	—
<i>Flacourtia montana</i>	—	4	—
<i>Flacourtia rukam</i>	Rukam	0 ^y	—
<i>Fortunella spp.</i>	Kumquat	0	0
<i>Garcinia livingstonei</i>	Imbe	1-2	3-4
<i>Garcinia mangostana</i>	Mangosteen	4-5	—
<i>Garcinia mooreana</i>	—	4	—
<i>Garcinia spicata</i>	—	2.5-4	—
<i>Garcinia xanthochymus</i>	Gamboge	1.5-3	—
<i>Genipa americana</i>	Genipap	2 ^y	—
<i>Harpephyllum caffrum</i>	Kaffir plum	2	—
<i>Hovenia dulcis</i>	Chinese raisin	1	—
<i>Inga paterno</i>	Monkey tamarind	2-4	—
<i>Inocarpus edulis</i>	—	2	—
<i>Licania tomentosa</i>	—	2.5	—
<i>Litchi chinensis</i>	Lychee	1-3	2-4
<i>Macadamia integrifolia</i>	Macadamia nut	0-3	2-4
<i>Malpighia glabra</i>	Barbados cherry	0-2.5	3-5
<i>Malus spp.</i>	Apple	0	0
<i>Mammea americana</i>	Mammee apple	3-4	4-5
<i>Mangifera indica</i>	Mango	2.5-4	3-5
<i>Manilkara kauki</i>	Kauki	0-2	—
<i>Manilkara zapota</i>	Sapodilla	2-4	4-5
<i>Melicoccus bijugatus</i>	Mamoncillo	2.5-4	4-5
<i>Mimusops caffra</i>	—	1	4
<i>Mimusops elengi</i>	—	0-2	—
<i>Monstera deliciosa</i>	Ceriman	2.5	—
<i>Morus sp.</i>	Mulberry	0	0
<i>Muntingia calabura</i>	Panama berry	3-5	4-5
<i>Musa spp.</i>	Banana	2	—
<i>Myrciaria cauliflora</i>	Jaboticaba	0-3	1-5
<i>Myrciaria floribunda</i>	Guava berry	1-1.5	—
<i>Myrciaria glomerata</i>	—	0-2	—
<i>Myrciaria vexator</i>	—	0-2	2-5
<i>Myrica rubra</i>	—	0	0
<i>Nauclea latifolius</i>	Nauclea	0-3.5	—
<i>Parmentiera cerifera</i>	Candle tree	4.5	—
<i>Parmentiera edulis</i>	Cuachilote	3.5	—
<i>Passiflora edulis</i>	Purple passion fruit	3-4.5	—
<i>Passiflora edulis flavicarpa</i>	Yellow passion fruit	3-4.5	—
<i>Passiflora quadrangularis</i>	Giant granadilla	4.5	—
<i>Pereskia corrugata</i>	—	—	4
<i>Persea americana</i>	West Indian avocado	3-4	4-5
<i>Persea americana</i>	Guatemalan avocado	1-3	—
<i>Persea americana</i>	West Indian—Guatemalan hybrids	1-3	2.5-4
<i>Persea americana</i>	Mexican avocado	1-2	2-2.5
<i>Persea americana</i>	Mexican—Guatemalan hybrids	1-2	—
<i>Phoenix dactylifera</i>	Date	0	—
<i>Phyllanthus acidus</i>	Otaheite gooseberry	1-2	—
<i>Pleiogynium timorense</i>	Burdekin plum	0	—
<i>Pometia pinnata</i>	Fijian longan	4	5
<i>Pourouma cecropiifolia</i>	Amazon tree grape	—	5
<i>Pouteria caimito</i>	Abiu	4-5	5
<i>Pouteria campechiana</i>	Canistel	2.5-4	4-5
<i>Pouteria hypoglauca</i>	—	0 ^y	—
<i>Pouteria obovata</i>	Lucmo	2-4	—
<i>Prunus persica</i>	Peach	0	0
<i>Pseudanamosis umbellulifera</i>	—	0-2	—
<i>Psidium cattleianum</i>	Cattley guava	0-2.5	0-2
<i>Psidium friedrichsthalianum</i>	Costa Rican guava	2-2.5	4-5
<i>Psidium guajava</i>	Guava	2.5-3.5	3-4
<i>Psidium guineensis</i>	—	—	4
<i>Psidium littorale</i>	—	—	0-1
<i>Psidium sartorium</i>	—	4.5	—
<i>Punica granatum</i>	Pomegranate	—	1.5
<i>Pyrus serotina</i>	Pear	0	—
<i>Quararibaea cordata</i>	South American sapote	4.5	5
<i>Rheedia aristata</i>	—	0.3	2-4

Table 1. (Continued).

Scientific name	Common name	Injury rating ^z	
		Large or mature	Small or juvenile
<i>Rheedia lateriflora</i>	—	2-3	—
<i>Rheedia macrophylla</i>	Charichuela	—	0 ^y
<i>Rheedia madruno</i>	Madruno	—	2-3
<i>Rollinia deliciosa</i>	Biriba	—	5
<i>Rollinia emarginata</i>	—	0	—
<i>Rollinia orthopetala</i>	—	3	—
<i>Rubus albescens</i>	'Mysore' raspberry	0-1.5	—
<i>Rubus</i> sp.	'Brazos' blackberry	0.5	—
<i>Salacca edulis</i>	Salak palm	4-5	—
<i>Sandoricum koetjape</i>	Santol	3-4.5	—
<i>Sclerocarya binea</i>	—	3	—
<i>Sclerocarya caffra</i>	Marula	3	—
<i>Solanum quitoense</i>	Naranjilla	2	—
<i>Solanum macranthum</i>	Potato tree	3	—
<i>Spondias dulcis</i>	Ambarella	4	5
<i>Spondias mangifera</i>	—	4	—
<i>Spondias mombin</i>	Yellow mombin	4-4.5	—
<i>Spondias purpurea</i>	Purple mombin	4-4.5	—
<i>Spondias tuberosa</i>	Imbu	—	5
<i>Stelechocarpus burahol</i>	Kepel	—	4 ^y
<i>Synsepalum dulcificum</i>	Miracle fruit	1-2.5 ^y	—
<i>Syzygium cumini</i>	Jambolan	3-4	—
<i>Syzygium grande</i>	—	1.5	—
<i>Syzygium jambos</i>	Rose apple	1-3	3-5
<i>Syzygium malaccensis</i>	Malay apple	3-4.5	4-5
<i>Syzygium samarangense</i>	Wax jambu	3-4	—
<i>Talisia oliviformis</i>	Cotopriz	0	—
<i>Tamarindus indica</i>	Tamarind	1-3.5	4-5
<i>Theobroma cacao</i>	Cacao	5 ^y	—
<i>Triphasia trifolia</i>	Limeberry	3	—
<i>Vitis</i> spp.	Grape	0	0
<i>Zizyphus joazeiro</i>	Jua	1	—
<i>Zizyphus mauritiana</i>	Indian jujube	0-1	—

*0 —No damage.

0.5—Fruit or flowers frozen, or occasional tender new shoots killed.

1.0—Most tender new shoots killed.

1.5—Some leaves killed.

2.0—Most or all leaves killed but no wood damage.

2.5—Leaves and occasional twigs killed.

3.0—Leaves, twigs and some branches killed.

3.5—Most small to medium branches killed.

4.0—Large branches killed.

4.5—Killed to ground but sprouted from crown or roots.

5.0—Killed, did not sprout from underground parts.

^yProtected by shelter of trees or buildings.

The reported uniformity of low temperatures throughout the southern Florida area was borne out by the relative uniformity of injury to tropical plants at many different locations. There was variation in injury to individual plants of many species, however, because of microclimatic variations as well as genetic variation between plants of a given species. In many cases 1 or 2 observations were sufficient to determine the extent of cold injury, but some species required 4 to 6 monthly observations before injury could be determined accurately.

Since the data given are mostly for plants growing outdoors without frost protection, it follows that any protection would have reduced the injury. Various types of protection are available, and should be used whenever frosts or freezes are predicted. Many commercial orchards and home garden plantings of tropical fruits were protected successfully from injury in the 1977 freeze. Growers who are willing to avail themselves of good weather information and available methods of cold protection need not hesitate to

plant tropical fruit trees in southern Florida because of the danger of freezes.

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