

WORLD AND LOCAL IMPORTANCE OF SOME TROPICAL FRUIT CROPS GROWN IN FLORIDA

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Abstract. World production of major fruit crops rose from 54.6 million metric tons (MMT) for 1969-71 to 64.1 MMT for 1978-80. Grapes, bananas and plantains, citrus and apples comprised over 80% of all production. Percentages made up by other crops in 1969-71 were mangos (5.9%), pears (3.6%), peaches and nectarines (3%), plums (2.7%), pineapples (2.4%), apricots (0.73%), strawberries (0.58%), papayas (0.57%), and avocados (0.46%). By 1978-80 the pineapple's share was 2.9%, papaya's 0.73%, strawberry's 0.77% and avocado's 0.53% whereas plum dropped to 2.1% and apricot to 0.57%. Despite greater estimated mango production, this fruit's share dropped to 5.4% for 1978-80. Like other Florida commodities fruit crops respond to economic stimuli. Dade County avocado plantings rose from 2185 ha in 1969 to 4330 in 1981, and now are 4332 vs. a total of 5173 ha for Florida. Limes rose from 1781 ha in 1969 to 2836 in 1984 and mangos occupy 769 ha (vs. 567 in 1969). Two world fruits less important in Dade County are banana and papaya (142 ha each). Some fruits locally important present a dy-

namic, rapidly changing picture. These include mamey sapote (120 ha), annonas (28 ha), lychee (24 ha), carambola (16 ha), acerola and longan (each 12 ha), and sapodilla (8 ha). Because of varying factors that influence different crops, the present picture is likely to change.

Tropical fruit claims a distinctly minor share of Florida's horticulture when compared with the giant citrus and vegetable production industries, yet it is a healthy, growing contributor to the State's economy. Tropical fruit crops of one or another kind have been economically important in parts of Florida for nearly a century. The picture has been dynamic, changing in response to economic and environmental pressures, and this situation continues. On the world scene, tropical fruits currently represent over half of estimated fruit production, and their share of the market has grown in recent years (Table 1). This discussion relates Florida's tropical fruit production to the world picture, and assesses the potential of specific crops for further growth and development within the State.

World Fruit Production

A strong caveat applies to all world fruit production data now available. In 1979 FAO (Food and Agricultural Organization, United Nations) estimates were the only figures to be had for 22.6% of the countries for which pear production was reported. These same estimates made up the only reports from 68.4%—39 of 57—countries for which mango production information was supplied (Table 1). Many thousands of metric tons (MT) of mangos, papayas and bananas are produced on smallholdings, in dooryards and along roadsides in developing tropical countries. The degree of success FAO statisticians attain in reporting this production is conjectural. Thus, reported figures probably do show trends, but it would be unwise to put overmuch confidence in them. Fruits for which FAO keeps records generally increased from 1969 through 1980. C. N. Smith (11) reported a marked rise in world fruit exports for 1970 through 1974, and these probably absorbed much of the

Table 1. World production (1,000 MT) of some important fruit crops from 1969 to 1980.^a
^aSource: references 2 and 3.

Crop	1969-71 ^b	1975	1976	1977	1978	1979 ^c	1980
Grapes	54,583	60,440	60,161	57,005	57,871	69,266 (29.3)	65,255
Bananas and plantains	47,059	52,881	54,869	56,489	57,643	58,226 (60.3)	60,519
Citrus ^w	37,678	49,546	48,692	49,967	50,323	52,495 (48.4)	56,511
Apples	28,301	24,314	23,018	21,348	32,771	36,272 (26.7)	35,660
Mangos	12,276	12,664	12,803	13,346	13,751	14,067 (68.4)	14,342
Pears	7,541	7,410	7,714	6,813	7,203	7,776 (22.6)	7,909
Pineapples	4,952	5,842	5,959	6,109	7,125	7,532 (64.5)	7,636
Peaches and nectarines	6,289	5,920	6,974	6,201	6,914	6,939 (34.0)	7,201
Plums	5,707	4,040	4,485	4,473	5,450	5,230 (31.5)	5,506
Papayas	1,186	1,168	1,190	1,238	1,839	1,905 (66.7)	1,917
Strawberries	1,212	1,234	1,274	1,317	1,686	1,701 (31.7)	1,724
Apricots	1,524	1,337	1,501	1,250	1,505	1,448 (29.7)	1,449
Avocados	954	1,103	1,190	1,221	1,314	1,385 (57.1)	1,416
Total	209,262	227,899	229,830	226,777	245,395	264,242	267,045

^aSource: References 2 and 3.

^bAverage for this 3-yr period.

^cNumber in parenthesis = % of producing countries for which FAO estimated crop this year.

^wOranges, mandarins, lemons and limes, grapefruit, pummelos, and other citrus.

increased production. The 1978-80 average of 258,892 million metric tons (MMT) total world fruit production exceeds the 1969-71 average (209.3 MMT) by nearly 24% (Table 1). The importance of tropical and subtropical fruit is shown by the fact that 5 genera (Citrus, bananas and plantains, mangos, pineapples and papayas) now constitute over half the total estimated world production. The 1978-80 average for these fruits, 52.7% of the total, was an increase of 2.9% over the 1969-71 average of 49.8%. Citrus, bananas and plantains, and mangos account for the major part of non-temperate fruit production, having averaged 46.4% over 1969-71 and 48.7% from 1978-80. In the years 1975-77, production of these 4 fruits exceeded half of total world production (Table 1).

Temperate and tropical fruits can be divided into 3 groups based on their share of the production total. The 4 most important crops, over 80% of total production, are grapes, citrus, bananas and plantains, and apples. The next group, which accounts for 16 to 17.5% of total fruit production includes mangos, pears, pineapples, peaches and nectarines, and plums. The smallest share of world output, varying from 2.22% to 2.59% of the total between 1975 and 1980, is held by papayas, strawberries, apricots and avocados (Table 1).

Changes observable in recent years vary for different crops. Citrus fruits, for example, with 37.7 MMT equalled only 18% of total fruit production in 1969-71, but by 1975 had already risen 3.7 percentage points to 49.5 MMT, and after a slight decline in 1976 rose steadily through 1980, averaging 53.1 MMT (20.5% of total fruit production) for 1978-80. Pineapples showed a steady rise in absolute and relative production during the observation period, from 4.95 MMT (2.4%) in 1969-71 to 7.43 MMT (2.9%) by 1978-80. Papayas also rose, after 1977, and by 1978-80 averaged 1.89 MMT (0.73% of total production) vs 1.2 MMT (0.57%) during the 1969-71 period. Strawberry production rose after 1977 as well, and by 1978-80 averaged 1.7 MMT (0.66% of total fruit production) vs. 1.2 MMT (0.58%) for 1969-71. Estimated avocado production rose steadily from 1975 through 1980, and the 1978-80 average, just short of 1.4 MMT, exceeded the 1969-71 average by nearly 44% (Table 1).

Major Tropical Fruits in Florida

Southern Florida's 3 most important tropical fruit crops are avocados (*Persea americana* Miller), 'Tahiti' (syn. 'Persian') limes (*Citrus latifolia* Tan.), and mangos (*Mangifera indica* L.). Avocados occupied 4379 producing ha here in 1983 (6), and a total of 5209 ha in 1984 (7). Mangos

grew on the least land of the 3 major crops. This equalled only 25% of Florida's avocado hectareage in 1972, and has declined proportionally since then (Table 2).

Florida hectareage in bearing avocados has grown steadily over 14 yr. Land planted to producing limes held fairly steady between 1740 and 1821 ha from 1970 through 1976, but dropped to 1538 ha in 1977, the year of the most severe recent freeze (Table 2). Hectareage in producing limes increased after 1977, and by 1982 reached 2954, the most land in limes on record (Table 2). By 1984, total lime hectareage had declined to 2836 (7). Mango hectareage has expanded recently, but still occupies considerably less land than the other 2 crops. Bearing mangos occupied 567 ha in Florida in the early 1970's. This fell to 546 ha by 1974, then rose sharply and by 1976 reached 688, the highest producing hectareage ever. Land in mangos then declined until it reached 567 ha in 1981, exactly what it was from 1970 through 1973; it has since begun to rise again, and reached 681 ha bearing in 1984, of a total of 1048 ha (7).

Total lime yields in Florida consistently exceeded those of avocados from 1970 through 1982 despite the greater amount of land set in avocados (Table 2). This resulted from the much higher yield per ha of limes, which have a greater juice (i.e. more water) content than avocados and thus differ more than if both were compared on a dry weight basis. Furthermore, limes bloom and fruit over more of the year than avocados and mangos which normally are more restricted to specific seasons of production. Mangos, however, have outyielded avocados in Florida since 1970, by a wide margin since 1973. This is probably because growers have replaced unreliable mango cultivars with the more dependably productive 'Tommy Atkins', 'Keitt', and 'Van Dyke', and also have initiated significantly improved methods of disease control. McGuire reported a dramatic increase in mango production and the value of the crop in 1975 (9). The increased production and returns continued through 1976, but the 1977 freeze reduced mango yields to a 5-yr low (Table 2). During the 1970-82 observation period the trend was upward for per-hectare returns from both limes and mangos, although the sharp decline in the dollar's value during this period makes much apparent gain illusory. Returns from avocados tended to show a peak-and-valley distribution from 1970 through 1982. The per-hectare return from mangos started markedly lower than that from avocados in 1970, but passed avocado per-hectare returns in 1973 and has continued to exceed them since except for 1975, when avocados brought \$221.58 more per ha than mangos (Table 2). Since 1981, per-hectare return from avocados has been sharply lower than that for mangos and limes, no doubt reflecting competition from California's

Table 2. Comparison of land planted, yields and monetary returns from avocados, limes and mangos in Florida from 1970 through 1982.^z

Year	Land in production (ha)			Total yield (1000 MT)			Total value of sales (\$ million)		
	Avocados	Limes	Mangos	Avocados	Limes	Mangos	Avocados	Limes	Mangos
1970	2145	1740	567	17.1	31.9	3.69	5.452	4.140	0.459
1971	2185	1821	567	17.5	39.9	4.49	6.466	6.037	0.990
1972	2266	1821	567	17.1	39.9	4.37	6.003	6.753	1.440
1973	2347	1781	567	18.4	38.1	6.24	7.208	7.560	1.438
1974	2509	1781	546	19.9	39.9	5.61	7.171	9.378	1.912
1975	2590	1781	668	26.3	39.2	8.12	11.600	10.012	2.844
1976	2792	1821	688	19.1	36.3	9.98	8.659	11.606	3.000
1977	2954	1538	668	9.7	16.7	4.37	7.383	8.786	2.406
1978	3116	1660	668	20.9	26.1	5.61	9.240	11.642	2.138
1979	3237	1862	587	24.7	39.9	6.49	16.298	13.796	2.938
1980	3683	2145	587	27.9	43.5	6.24	16.297	13.337	3.000
1981	3764	2590	567	23.4	47.2	5.99	10.004	16.156	3.336
1982	4047	2954	607	31.5	61.7	5.61	16.656	22.255	3.600

^zSource: references 4 and 5.

^yAvocado and lime harvests began in the year listed and ended in the next year; mango harvest began and terminated in the year listed.

burgeoning avocado production, which rose from 51,120 MT picked from 7438 ha in 1970 to 195,954 MT from 28,104 ha in production by 1982 (5).

Although monetary returns per ha for mangos were increasing, total yield for Florida remained below 6500 MT after the 1976 peak of 9980 MT. The disastrous freeze of January 19-20, 1977 sharply cut that year's production of all 3 major tropical fruits, and mangos recovered more slowly than the others. While Florida's mango production remained fairly static after the gradual rise from 1970 through 1976 that was interrupted by the 1977 freeze, the tonnage of mangos marketed in the United States expanded by a factor of 5.5 between 1970 and 1982 (Fig. 1). Thus, Florida's share of the national market shrank from 58.2% in 1970, when a total of 6343.4 MT of fruit was sold, to 16% of a total 35,012 MT sold in 1982. During this same time Mexico's share of the United States market increased (with minor setbacks in 1973, 1976 and 1979) from 25.5% in 1970 to 69.6% in 1982. From 1970 through 1978 Haiti's share of the U. S. mango market varied from 6.4 to 11.1% of the total, then rose to 12% in 1979 and has grown since, reaching 17.1% in 1981.

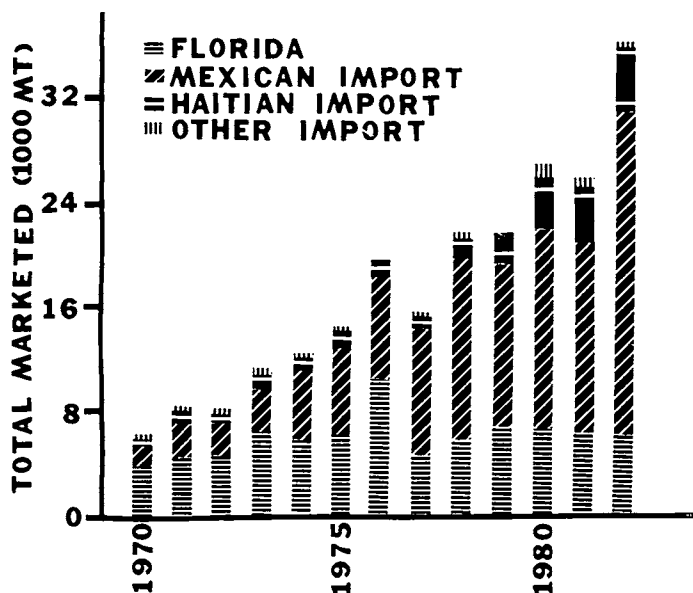


Fig. 1. Total mangos (1,000 MT) marketed in the United States by geographic origin, 1970-82.

In the short run the trend toward a steadily shrinking share for Florida of the national mango market may slow or be halted by the change in tolerances allowed for ethylene dibromide (EDB) fumigant used for fruit fly control (8). Fumigation of mangos imported into the U. S. from Mexico, Haiti and other Caribbean countries was required in accordance with the Mediterranean Fruit Fly Control Program or the Quarantine Program of the U. S. Department of Agriculture. Earlier this year previous tolerances were revoked. EDB may continue in use to fumigate mango fruit for U. S. importation until September 1, 1985, but the tolerance for residues of EDB remaining in or on the mango fruit prior to its admission has been reduced to 0.03 ppm (= 30 parts per billion in U. S., but not international usage). A serious question is whether residual EDB can be expected to drop to this level before fruit rot fungi make fruit unsalable (J. R. King, pers. comm.). Thus, Florida mangos may have a competitive advantage over most imported fruit until practical EDB alternatives are developed.

Minor Tropical Fruits in Florida

Classifying a specific crop as "minor," or otherwise, may

reflect a temporary situation when today's dynamic market is considered and pomology's past history in Florida is examined. Still, only 500 ha are currently devoted to the fruit crops listed in Table 3 vs. the 7608 ha recorded for avocados, limes and mangos in 1982 (Table 2). This fact justifies considering the 2 groups separately. Some fruits of major world importance are minor crops in Florida. The pineapple, for example, is not important in Florida now, but it was 75 yr ago. The first successful recorded planting, on Plantation Key in 1860, stimulated pineapple trials elsewhere in Florida. By 1890 an important industry was centered in the east coast "pineapple belt," a strip 220 km long and 1.5 to 4.5 km wide extending south from Fort Pierce to Miami. By 1910 pineapples grew on 2025 ha in this area, and the annual crop exceeded a million crates, approximately 32,660 MT (12). Between 1910 and 1917 Florida's pineapple industry declined, and the freeze of 1917 (abetted perhaps by wartime fertilizer shortages and postwar competition from overseas) gave it a blow from which it has not recovered.

Table 3. Land planted to minor tropical fruits in Dade County, Florida, 1982.

Fruit crop	Hectares*
Banana and plantain (<i>Musa</i> hybrids)	142
Papaya (<i>Carica papaya</i> L.)	142
Mamey sapote (<i>Calocarpum sapota</i> [Jacq.] Merrill)	80y
Acerola, Barbados cherry (<i>Malpighia punicifolia</i> L.)	12
Annonas (<i>A. squamosa</i> L., <i>A. squamosa</i> x <i>A. cherimola</i> Miller)	28
Carambola (<i>Averrhoa carambola</i> L.)	16
Longan (<i>Euphoria longan</i> [Lour.] Steud.)	12
Lychee (<i>Litchi chinensis</i> Sonn.)	60x
Sapodilla (<i>Manilkara zapota</i> [L.] Van Royen)	8

*Source: reference 5.

y1981 plantings were estimated to occupy 60 ha (1).

xThis figure is the Florida total.

Table 3 lists land in tropical fruits currently of minor importance in Dade County. Some of these may increase in hectareage and concomitant economic value in the near future as local and national ethnic markets, and widening interest in traditional markets increase the demand for them. Others have been grown in more or less unchanging quantities for some years, and little or no evidence suggests a potential for their expansion. One example of these is the acerola or Barbados cherry (*Malpighia punicifolia* L.). This fruit has a short shelf life, large bony seeds making it difficult to process, and insufficient appeal (despite its high vitamin C content) to support a large market. The lychee (*Litchi chinensis* Sonn.), in contrast, has wide appeal. Florida's orchard plantings peaked at approximately 15,000 trees on approximately 120 to 140 ha in 1957 but because of cold damage, urban expansion and erratic production had declined by 1966 to somewhat less than half the earlier figures, around 50 to 55 ha (14). The 60 ha reported for the State in 1982 (Table 3) thus represent a modest increase during the intervening 15-yr-period. No superior, dependably productive cultivars adapted to the region have been developed during this time to sustain a significant expansion of Florida's commercial lychee plantings, but demand for the fruit assures a market for whatever can be produced. The same is true of longans (*Euphoria longana* [Lour.] Steud.), of which no well tested, fully dependable cultivars have been established.

The guava (*Psidium guajava* L.) has a long history in Florida, having been introduced from Cuba in 1847 (10), although some claim it was here before that time. It is naturalized over much of the southern half of the State. Despite a growing market for processed guava products

and outstandingly good cultivars developed for specific uses here, the Caribbean fruit fly (*Anastrepha suspensa* [Loew]), present in Florida since 1965, acts as a constant damper to significant expansion of an industry. The currently estimated 36 ha of guavas (5) in Florida—probably many more than an actual count would confirm—are not likely to increase until effective methods for fruit fly control are developed.

Banana (*Musa* hybrid) plantings have been made for some years in Dade County of specialty ('Apple' or 'Manzana') and cooking (primarily 'Orinoco' or "horse plantain") cultivars to supply demand generated by local Hispanic populations. Plantings have remained fairly constant at or near 140 ha (5). Because the cultivars grown are not readily available as imports the market appears stable as existing production meets a steady demand.

Mamey sapote (*Calocarpum sapote* [Jacq.] Merrill) plantings have expanded greatly in recent years over the few dooryard plantings known 30 years ago. Hectarage was estimated to be 60 in 1981 (1), reported at 80 in 1982 (5), and now approaches 120. How far this expansion may continue is a valid question, but the crop can be cultivated without unusual difficulty in South Florida (1), and until saturated demand lowers prices, further plantings can probably be expected. The sapodilla (*Manilkara zapota* [L.] Van Royen), a related fruit also important in ethnic markets, has undergone a recent expansion as well, reaching an estimated 8 ha in Dade County by 1982 (5).

Papaya (*Carica papaya* L.) was observed growing naturalized along the St. Johns River during Bartram's 1773 Florida exploration (13), yet establishing a large-scale industry here has met with difficulties. Hectarage has held steady around 140 for some years (Table 3). Recent development of virus-tolerant lines by the University of Florida at Homestead may permit papaya culture to expand, although a growing off-shore competition may continue to hold down Florida's share of the market.

The sugar apple, sweetsop or anon (*Annona squamosa* L.) and the hybrid atemoya (*A. squamosa* x *A. cherimola* Miller) currently appear to be in a favorable position for expansion. The same factors that encouraged growth of the sapotaceous fruit market operate: an enthusiastic local and national audience generating profitable returns plus adapted, productive cultivars of acceptable quality. Furthermore, growing conditions since 1977 have been favorable enough to permit good yields. Control methods need to be developed for chalcid wasp, *Bephratelloides cubensis* (Ashmeade), a serious pest. The immediate future should see an expansion of *Annona* plantings that will continue upward from 1982's reported 28 ha (5) until existing and potential demand is met.

The carambola (*Averrhoa carambola* L.), introduced to Florida many years ago, currently enjoys an expanding market resulting from increased immigration from Southeast Asia of people who value it, along with a growing interest on the part of many native North Americans in less common fruits. Improved cultivars plus a recognition by growers and packers of the productivity and market potential of this species have combined to promote expanded plantings. Like limes, carambolas mature over a long season and the compact trees permit planting at high density. The novel star shape of the fruit and the attractive waxy, bright-colored appearance of the better cultivars also give them a wide appeal. One of Dade County's largest packers shipped 47.2 MT of fresh carambola fruit during 1983, had shipped 30.8 MT by mid-October 1984 and expected to ship a total of 68 MT during calendar 1984. This production came from an estimated 1,000 to 1,500 trees. Approximately 10,000 trees are expected to be planted soon in South Florida, with a fruit production to exceed 450 MT within 5 yr (W. C. Schaefer, pers. comm.). Present research efforts directed

toward developing improved cultivars and improved methods of carambola fruit handling are likely to promote continuing expansion until currently strong demands are met.

Dynamics of Minor Tropical Fruit Production

Any projection respecting the production of minor tropical fruits in South Florida must rely largely on inference, however, some trends now apparent give an idea of possible changes (or lack of significant change) in the immediate future. No expansion would seem likely for the acerola or guava unless unforeseen changes occur in demand, pest control techniques or varietal improvement. Reduced plantings may even result (particularly with acerolas) due to competition from more remunerative fruits. Lychee and longan hectarage is currently increasing. If adequate production can be maintained in these crops, their expansion is likely to continue for the immediate future. Both lychee and longan trees grow to larger sizes than do carambolas, so more of the latter can be set per unit of land area. Banana plantings (including "horse plantain") may remain static (near 140 ha) judging from recent experience, or expand slightly if improving economic conditions permit out-of-state markets to grow. Papaya production could increase significantly because of a new cultivar with improved virus resistance, but heavy production in the Bahamas may discourage increased planting in Florida.

An end to recent expansion of mamey sapote plantings is not in sight; for the immediate future more plantings are to be expected. What is possible for the mamey is equally likely for the *Annona* cultivars. Their potential for heavy production in small-scale plantings, coupled with the favorable prices they bring, will encourage increased planting in the immediate future. This is also true of carambolas, which are available for a long season, in strong demand on the market, and relatively easy to grow.

Several minor tropical fruits thus clearly afford viable alternatives to the 3 major fruit crops, assailed as these are by out-of-state competition. The current efforts directed toward enlightened market development can foster stability and orderly growth in a small but healthy industry.

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