sociated with mango, including *Helicotylenchus dihystera* (Cobb) Sher, *Hemicriconemoides mangiferae* Siddiqi, *Quinisulcius acutus* (Allen) Siddiqi, *Rotylenchulus reniformis, Macroposthonia* sp., *Pratylenchus brachyurus, Xiphinema* sp., *Meloidogyne* sp., and *Paratylenchus* sp. Some of these nematodes may actually be associated with the weeds beneath the mango trees, but the first five nematodes listed were also found in samples collected from lychee, beneath which few weeds occurred. Mean numbers of these nematodes per 100 cm^3 of soil are shown (Table 1). Although larvae of *Meloidogyne* species were found in the soil around the roots of mango, galling or mature females were not found on the roots in this study. The very high mean for *Macroposthonia* sp. on April 25 is due to the extremely high count of 4350/100 cm^3 of soil in one of the four samples collected on that date. Very high mean levels of *H. mangiferae* were found on lychee, and of *R. reniformis* on mango on all three sampling dates. The latter nematode has been previously reported on mango (11) and on several other fruit crops in south Florida (4, 5, 6).

Of the nematodes found in this study, only *H. mangiferae* has been demonstrated to be pathogenic to mango (9). Populations of this nematode from various parts of the world are somewhat variable (10), and several species have been synonymized with it (1, 10). Measurements (ranges and means) of 12 females found on mango in this study are as follows: L = 0.43-0.52 (0.47) mm; a = 14.7-17.2 (15.8); b = 4.1-5.5 (4.9); c = 18.7-24.8 (20.7); V = 91.4-94.2 (92.8); spear = 58-66 (62.6)μ; R = 122-150 (135.9); RV = 11-13 (11.7); R_{an} = 7-9 (7.5). *Hemicriconemoides mangiferae* has been observed feeding on roots of mango (8) and lychee (7). This nematode and *Xiphinema brevicolle* Lordello & DaCosta are associated with root damage and decline of mango and lychee in South Africa (7, 8). Infested trees responded to treatment with nematicides in these cases. *Hemicriconemoides mangiferae* has been found on several different tropical fruits (10), and has been shown to be pathogenic to sapodilla (*Manilkara achras* (Mill.) Fosberg), and tamarind (*Tamarindus indica* L.) as well as mango (9).

The occurrence of low, but consistent counts of *H. mangiferae* in samples collected from mango suggest that further investigation of the role of this nematode in mango decline in south Florida is needed. In addition, these preliminary investigations cannot rule out other nematodes, such as *R. reniformis*, or possible involvement of Verticillium in mango decline since symptoms were found in some affected trees. The finding of large populations of *H. mangiferae* on *L. chinensis* in Florida may indicate a potential problem on this crop as well.

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CANISTEL AS A ROOTSTOCK FOR MAMEY SAPOTE[1]

MARY ANN H. OGDEN
University of Florida, IFAS, Fruit Crops Department, Gainesville, FL 32611

CARL W. CAMPBELL
University of Florida, IFAS, Agricultural Research and Education Center, 18905 S.W. 280 St., Homestead, FL 33031

Abstract. **Mamey sapote** [Calocarpum sapota **(Jacq.) Merr**], **is becoming a commercial fruit crop in southern Florida. Nursery stock is expensive because it is difficult to vegetatively propagate and seeds for rootstocks are scarce. Mamey sapote has been veneer and approach grafted successfully to canistel** [Pouteria campechiana **(HBK) Baekni**], **and this combination shows potential as a rootstock. Canistel has a strong root system and is well adapted to the calcareous soils of southern Florida.**

Production of tropical and subtropical fruits is increasing in southern Florida. The market for these fruits has increased with demand from the people who have immigrated from the American tropics into the cities of Florida (1). Land for row crop production is decreasing because of urban sprawl and some of the land formerly used for winter vegetable crops is now being planted with tree fruits. Avocados are the primary tree crops being planted followed by limes and mangos.

Other tropical fruits such as carambola (*Averrhoa carambola* L.), atemoya (*Annona* Hybrid), and mamey sapote [*Calocarpum sapota* (HBK) Merr.], are now being planted on a small scale in Dade County. Recently 100 acres of mamey sapote have been planted but the groves have not yet reached commercial production. Most of the mamey sapote fruit are consumed locally, in the Miami

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area. A further increase in fruit production would make more fruit available for the tropical fruit markets in New York, New Jersey and Canada.

Mamey sapote has good economic potential and the market for the fruit is far from saturated (3). The fresh fruits that are sold locally range in price from $2.50-5.00 per pound, depending on location, availability and cultivar. The fruits have a red to pink flesh with a slight almond flavor and are eaten fresh, made into ices, cooked into preserves or used in pastries (3).

Grafted or air-layered mamey sapote are very expensive in nurseries because they are difficult to propagate except by seed (2, 3). The seeds are very scarce and expensive locally and must be imported from the Dominican Republic for about $1.00 each.

Canistel [*Pouteria campechiana* (HBK) Baehni], a close relative of mamey sapote in the *Sapotaceae* (some authors include mamey sapote in the genus *Pouteria*), is well adapted to the calcareous soils of southern Florida (4), and the seed supply is locally abundant. Graft compatability of mamey sapote on canistel rootstock via veneer grafts has been reported with trees over 2 years old and there is no apparent delayed incompatability (Crafton Clift, pers. comm.). The objective of our research was to test the degree and conditions under which canistel was compatable as a rootstock for mamey sapote.

Materials and Methods

Tests were conducted at the University of Florida Agricultural Research and Education Center, Homestead, Florida, to determine time required for graft healing, differences in mature and juvenile scions for veneer grafts and the optimum diameter of the stock and scion for approach grafts.

Veneer grafts were tested using juvenile and mature budwood of mamey sapote scions on canistel rootstock, and as a control, the same combinations were replicated on mamey sapote rootstocks. Veneer grafts of mature mamey sapote scions tend to heal faster and show quicker growth flushes under field conditions during the time of the year when the nights are cool, the days warm and the humidity is lower; usually late November to early December and from late March to early April. Thus, half the plants were placed in a controlled temperature greenhouse with night temperatures of 18-19°C and day temperatures of 23-24°C. An equal number of replicates were placed in a slathouse with night temperatures of 26-27°C and day temperatures of 32-35°C. These sites were selected to protect the plants from the extreme temperatures and full sun in the outdoor nursery during August, when the tests were conducted.

Mature mamey sapote scions of station selection #2 were veneer grafted to 3 year-old canistel rootstocks and seedling mamey sapote rootstocks. The mature mamey sapote scions were too large for grafting on seedling canistel rootstocks. Juvenile mamey sapote scions from young seedl-

Fig. 1. Mamey on canistel rootstock. 6 months old.

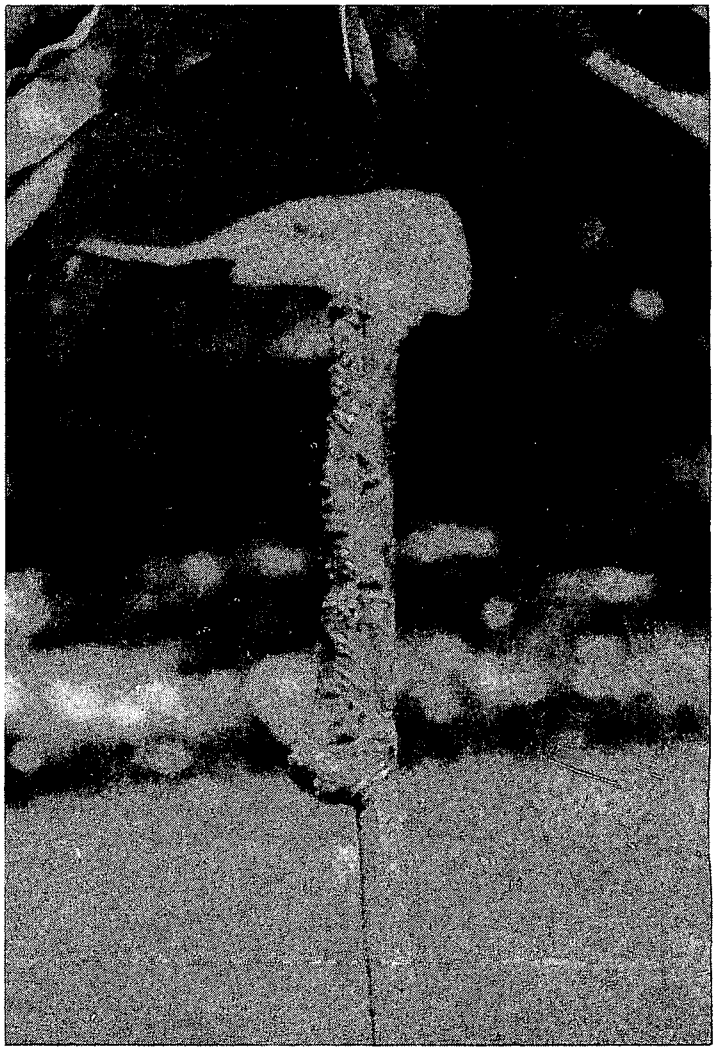

Fig. 2. Oversized mamey scion on canistel rootstock.

ing plants, were grafted onto seedling canistel rootstocks, and to the control, seedling mamey sapote rootstocks (Table 1).

Approach grafts of seedling mamey sapote on seedling canistel were made in December and gradually cut apart by the following March. Other approach grafts were made in August with mamey sapote on canistel, and mamey sapote on mamey sapote, and all were cut apart by late October.

Results and Discussion

With the veneer grafting technique, juvenile tissue showed good healing, and at the end of 2 months, scions on both canistel and mamey sapote rootstocks were sprouting. The mature mamey sapote scions died on all rootstocks in both the cooled greenhouse and in the slathouse, with the mature scions in the cooled greenhouse dying first. During August when mamey sapote is difficult to graft, experiments under controlled conditions in the greenhouse and the slathouse showed better results than grafts under field conditions, where temperature and shade were not controlled.

Approach grafts healed within 2-3 months. There were immediate growth flushes during the spring after the plants were cut apart. At 6 months, the plants showed vigorous growth and some branching (Fig. 1). There were problems later with the approach grafts when using seedling stocks and scions in which the stem diameters were not closely matched in size. The mamey sapote seed is much larger

Table 1. Veneer grafts. Ten rootstocks were grafted in each treatment and evaluated in 2 months.

Combination		Climate controlled greenhouse	Slathouse
Scion	Rootstock		
Mamey #2 (mature)	3 yr. canistel	all died	all died
Mamey #2 (mature)	mamey seedling[z]	all died	all died
Mamey seedling (juvenile)	mamey seedling[z]	10 healed (2 dormant, 8 sprouted)	10 healed (3 dormant, 7 sprouted)
Mamey seedling (juvenile)	canistel seedling	9 healed (7 dormant, 2 sprouted)	10 healed (5 dormant, 5 sprouted)

[z]Control.

Fig. 3. Lateral view of roots formation on mamey scion with canistel rootstock.

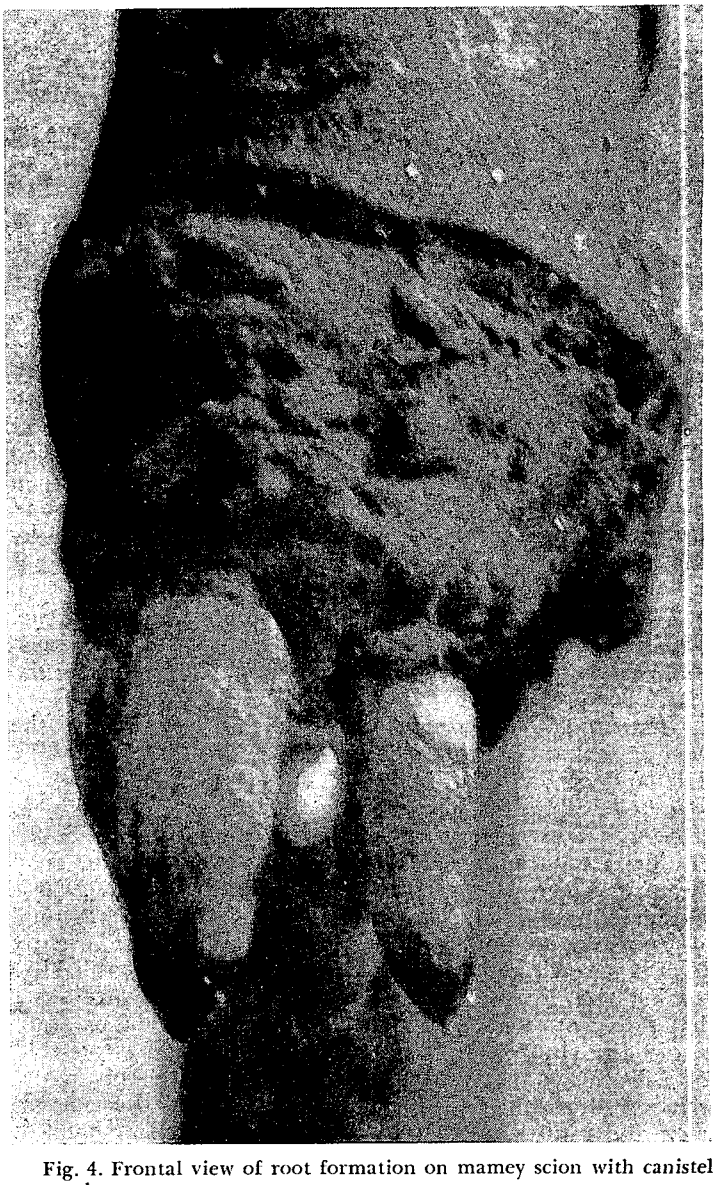

Fig. 4. Frontal view of root formation on mamey scion with canistel rootstock.

than the canistel seed and the same age young mamey sapote seedlings are much larger and more vigorous than young seedling plants of canistel. Approaches done when the mamey sapote scion is larger than the rootstock result in the scion outgrowing the rootstock (Fig. 2).

Roots formed at the graft unions of the mamey sapote scions when the scions were considerably larger than the rootstocks (Fig. 3, 4). Roots do form on rare occasions with veneer grafts of mamey sapote scions on mamey sapote rootstocks under field conditions (Pablo Lara, pers. comm.). When the grafts were over 6 months old, some of the rootstocks with oversized scions abruptly shriveled and died, leaving a living scion. After 1-2 weeks the mamey sapote scions showed slow wilt and died. The problem appeared to be water stress, when the mamey sapote scion was too large and vigorous. In other studies when mamey sapote scions were approach grafted to mamey sapote rootstocks, the leaves transpired more water than the roots could supply, even when the leaves were trimmed to 1/4 the original size (2). The approach graft combinations were successful when closely matched in stem diameter.

Maturity of the budwood, ratio of stock/scion diameter and time of the year for grafting, all affect the grafting success of mamey sapote. Mature budwood is much more difficult to graft than with juvenile budwood on either older or younger rootstocks. Juvenile budwood appears to live much longer and shows faster healing than mature tissue. Although more research needs to be done, canistel shows potential as a rootstock for mamey sapote. Veneer grafting is preferable to approach grafting for commercial propagation under Florida conditions, because approach grafting is cumbersome and takes much longer to form a graft union.

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GROWING AND FRUITING THE LANGSAT IN FLORIDA

WILLIAM F. WHITMAN
Rare Fruit Council International,
189 Bal Bay Drive,
Bal Harbour, FL 33154

Abstract. **The langsat** (Lansium domesticum, **Jack), a member of the mohogany family, is widely planted in the Asiatic tropics for its fruit. Many horticulturists considered the tree too tropical to grow in Florida. The writer planted two langsats in the mid-fifties that ultimately fruited. Adverse winter weather can cause over 90% defoliation in bearing size trees followed by a rapid spring recovery. Fruiting in Florida normally occurs from August through October, though in one variety it continues on into spring. A corky bark disease on the trunk and larger limbs of mature trees is thought to be caused by a fungus canker** (Cephalosporium sp.) **with larvae** (Tineidae sp.) **feeding on the diseased tissue. The langsat requires a neutral to acid soil and a near frost-free climate, a combination seldom found in South Florida.**

The langsat (*Lansium domesticum,* Jack), a fruit of the Asiatic tropics is widely grown in Malaysia, Indonesia, Thailand and the Philippines. Yet few people are aware that under the most favorable conditions it is possible to grow and fruit this member of the Meliaceae in South Florida. Popenoe wrote "While it cannot be said to rival the mangosteen (*Garcinia mangostana,* L.), the langsat is considered one of the best fruits of the Malayan region." (6). Seeds of the langsat were introduced into Florida many decades ago without apparent success as far as establishing bearing size trees. Popenoe stated "Experiments indicate that it is not suitable for cultivation in Florida or California, the climate of both states probably being too cold for it." (6). Many horticulturists agreed with this noted writer and considered this fruit, along with the mangosteen and rambutan (*Nephelium lappaceum,* L.), both of which have now also fruited here, unsuited to even Florida's warmest areas.

In the mid-1950's the writer set out two vegetatively propagated five foot langsats at his experimental fruit grove in Bal Harbour. This planting site, located between Biscayne Bay and the Atlantic Ocean, is just south of Haulover Inlet. It is an area in North Dade County that tends to be windy with some winter vegetative salt damage, but warm enough to seldom experience frost. The growing medium was a black acid sandy loam trucked in to replace an unsuitably high pH. existing bay bottom marl fill. The plants were protected in the grove from excessive sun and wind by cubical shade cloth covered structures. These reduced sunlight by over 50%. An assumption of the grower was that the langsat in Florida would require shade screen protection throughout its life, partly because of the low relative humidity during the winter. As the trees grew larger and taller new structures replaced existing ones. Further size increases became impracticable when the enclosures reached a 16 ft. height with the trees inside requiring additional space. At this point the overhead shade cloth was removed from the top of the structures. Several months later the remaining four sides of shade screen with the supporting beams were taken down without ill effects to the previously enclosed trees. Later it was found that after the langsat reaches six to eight feet in height shade is no longer required under this site's growing conditions. However the removal of shade should be done gradually if shock to the plant is to be avoided. Shrub type sprinkler heads irrigated the langsats three times a week unless rain prevailed. A 6-6-6 fertilizer with minor elements was applied three times a year.

In Florida the langsat makes a small, upright, sparsely leafed tree with an open type growth. During the winter adverse weather can cause over 90% leaf drop in mature trees. This is quickly replaced by new growth (Fig. 1) with the return of spring. Such defoliation is injurious to immature trees as they can suffer severe die-back under these conditions. The pinnate leaves vary from less than a foot in length to 20 inches. These have 5 to 8 alternately spaced