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Estate Mango Farming for Local Markets and Direct Sale

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The mango (*Mangifera indica*) has been cultivated in Florida for over a century. It has been grown on a commercial scale since the 1930s and the mango industry of Florida reached a pinnacle in terms of acreage in the 1990s. Hurricane Andrew, pressure from urban development and low prices due to off-shore competition have considerably reduced the profitability and acreage of mango farming in Florida. Increasingly there are opportunities for the production of mango using innovative production systems and new cultivars that can distinguish from those commercially available which will allow for the pushing of price to make activities profitable. This work details the principles and mechanics of estate mango farming for direct sales and for farmers' markets using a quarter-acre project in Miami-Dade County. Due to the small scale and nature of the market, significant opportunities are available in terms of cultivar and production systems that will allow a grower to be profitable. Proper management of scale is the key to success. Small acreage (less than five acres), high density, organic and/or sustainable practices, innovative pruning and superior cultivars are paramount.

The mango was brought to Florida in the mid to late 1800s. Following decades of introduction of new genetic material from around the world, the modern mango took its shape in Florida. Along both coasts south from Tampa Bay to the west and Merritt Island to the east, the mango has been grown, crossed with superior introductions and selected by pioneering Florida mango growers. These dedicated individuals shaped a new crop and created a new product and industry for the state (Goldweber, 1967). The Florida mango industry grew to its height of nearly 6000 acres by the 1980s, supplying domestic markets with highly colored, disease-tolerant mangos with excellent shelf life (Young and Sauls, 1979).

The Florida mango industry and its suite of modern cultivars caught the attention of the Western Hemisphere and other countries with potential to produce mangos. There was a rapid development of mango industries in Latin America that were based on Florida technology and cultivars. When hurricane Andrew struck south Florida in 1992, the Florida mango industry was crippled and this, along with pressure from urban development, allowed for other mango producing countries to ship to United States markets. This drastically lowered prices and the economic viability of the Florida export mango industry (Campbell, et al., 1993). The mango industry in Florida contracted significantly in the decades following hurricane Andrew and has never recovered its status as a major mango producing area.

For the past three decades there has been considerable shift in the mango world, with the development of new technologies, market potentials and available cultivars which have opened up a new direction for the mango in Florida. With a population of over four million, racially diverse and mango-familiar local consumers, the potential is now available to produce and market mangos through local markets at attractive prices. The current work details the principals, advantages and challenges in the building of a small-scale, 1/4-acre estate mango orchard intended for sale in local farmers' markets or other direct market outlets.

Assumptions for Small-scale Estate Mango Growing

Tree health and many aspects of fruit quality for mangoes are highly influenced by orchard practices. This becomes keenly evident when contrasting the mango to other crops such as avocado, citrus, jackfruit, or guava. Soils, climate, chemical inputs of pesticides and fertilizers have a profound influence on the tree growth and health and resultant fruit quantity and quality. The commercial Florida mango cultivars that are widely grown in the western hemisphere for export were selected because they were more adaptable across a wide range of conditions and agricultural inputs (Campbell and Campbell, 1993). However, the majority of mango cultivars, both traditional and newer hybrids, respond unpredictably to climatic and edaphic conditions and chemical inputs. In this manner the mango is similar to wine grapes, and it often helps to think of the mango in this light when producing for specialty local markets in estate farming systems.

A successful small-scale estate mango orchard is predicated on the adoption of sustainable or organic growing concepts, innovative orchard management techniques and superior cultivars with genetic size control, disease tolerance, and good fruit quality. Recommendations for orchard practices developed since the 1960s in Florida for commercial mango production are not directly applicable to the estate orchard system. Expenses are too high using conventional growing systems and the benefits and ultimate success of the estate orchard suffers. The small-scale estate orchard can be more adaptable and innovative than other commercial mango orchards and therefor more economically successful.

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Sustainable/Organic Orchard Production Systems

For the small-scale estate orchard it is advisable to use sustainable or organic production systems, as the scale allows these practices to be applied with success and mango trees respond favorably to them.

Herbicide. For weed control it is preferable to use mechanical means, either by hand or by machine. Herbicides have a profound influence on the performance of a mango tree, particularly with some of the more horticulturally-demanding cultivars. Field experience in south Florida by the authors has shown that mango trees that are not managed with chemical herbicides will exhibit a more vigorous and healthy growth and be more tolerant to disease and pests. Given the small scale of the estate mango orchard, weed control can be achieved with the use of hand mowers, string trimmers and hand removal. By removing herbicides from the orchard there will also be superior forage available for pollinators and for pest predators, which can be integral to fruit set in mango. Weeds must however not be allowed to grow too tall and increase the humidity in the orchard, as fungal diseases will become a problem.

Fertilizer. Previous research in Florida has shown that mango trees are highly responsive to nitrogen fertilization in sandy soils (Young and Miner, 1960) and in general nitrogen is conducive to improved mango yields. However, quality suffers and in the humid tropics, high nitrogen rates inhibit flowering and can reduce yields and quality. Experience of the authors has shown that there is a considerable advantage to the use of organic source material and other slow release materials. Field experience over the past 3 decades in Miami-Dade County has shown that inorganic nitrogen sources and previously reported application rates can have a negative impact on the health of newer mango cultivars. Ammonia nitrogen sources should be avoided, as well as any fertilizers that have significant chlorine content. Organic nitrogen sources will make the trees more controlled in their growth rate and will increase the responsiveness to flowering by either cold or water stress. As a result the small-scale estate orchard will have a routine occurrence multiple bloom events and crops in a single season. Organic plant debris, composted manures and other low nitrogen sources are ideal and can be used to distinct advantage in a small-scale orchard. The lowering of the nitrogen content also slows vegetative growth and discourages sucking insects in the orchard.

Pesticides. Given the small-scale and outlet for the estate orchard, most pest problems can be tolerated or controlled by mechanical means. All caution should be exercised to reduce humidity in the orchard and this includes the water application of any organic or other agents to the trees and fruit. Scales and other sucking insects are removed by pruning and disposed of outside the orchard. Infestations higher in the tree should be prioritized as these spread by gravity faster to infest the remainder of the tree. In some years Caribbean fruit fly can become an issue; therefore, all fruit should be harvested and diseased, misshapen, thinned or dropped fruit should be removed from the orchard to avoid buildup of fruit fly.

Innovative Orchard Management Techniques

Orchard spacing. Because of the scale of the estate orchard there is no need to maintain wide between-row spacing to accommodate equipment. Also, in-row and between-row spacing can be tighter due to a higher tolerance for some pest and disease pressure. Between-row spacing of 12–14 ft and an in-row spacing of 9 ft can be used with small stature cultivars. Rows should be oriented to the prevailing winds to allow maximum air flow in the orchard; thus in South Florida the rows should be oriented from East to West unless there are other mitigating circumstances (Fig. 1).

Fig. 1. The one-year-old B.A. Campbell Estate located in Homestead, FL.

Pruning. Pruning for size control, proper air flow and health of the tree and fruit becomes critical in the small-scale estate orchard. The cultivars selected must be dwarf, semi-dwarf of at least manageable at a small, productive size. Most commercially-available mango cultivars cannot be managed as described above in our current orchard system and maintain a healthy and productive nature. Pruning begins at planting and involves tipping in the first three years to form a multiple-branched canopy that is precocious and bushy (Campbell, 2004). In the following years both thinning and tipping are conducted annually after harvest to keep the tree at less than a 12 ft height and an 8 ft spread. All pruning is done with hand tools and the pruned material mulched in the orchard underneath the trees.

Irrigation. No irrigation is used in the small-scale estate orchard, except during establishment of young trees. Young trees are watered every fourth day by hand if there is no rain. Watering of new trees ceases after 2–3 months. After this the orchard is left on its own. The idea is to maintain the orchard as dry as possible, that is, at a low humidity state. In south Florida

this is a challenge, so the lack of irrigation is combined with air movement and orchard spacing to optimize the situation. Non-irrigated mango trees, once established, will thrive and be productive throughout their life in south Florida.

Unique edaphic and site conditions. The current project is planted on a south Florida upland hammock site that was never cropped for fruit or vegetables. There was minimal disturbance to the soil structure and there is now a duff layer of 2–3 inches overlaying oolitic limestone, with solution holes of varying sizes and depth. Trees were planted by pick and shovel and some of the remnant hardwood coppice vegetation was left intact to provide a high canopy for cold protection and forage for honeybees and pest predators. The remnant coppice has been pruned up to a 15 ft height to allow for the young mango trees to establish. As the trees develop, decisions will be made as to how much of the original vegetation can be left.

The planting and maintenance of an estate orchard in this manner is somewhat counterintuitive to the principles of modern mango production. The techniques used are more in line with the production systems used in south Florida and the Caribbean decades ago. However, such methods took advantage of the adaptive nature of the mango tree and not the use of modern agri-chemicals. The mango tree grown in the "Caribbean" management method is healthy and adaptive to the environment, responding to cold and drought induction of flowering and providing considerable advantages of pest and disease tolerance.

Cultivar Selection

Success in the small-scale estate orchard depends upon the selection of appropriate cultivars that have genetic size control, disease tolerance and superior eating quality. After nearly two decades of testing, Fairchild Tropical Botanic Garden has identified cultivars that fit into an estate orchard system. These cultivars are now commercially available in South Florida. 'Rosigold', 'Nam Doc Mai 4','Fairchild', 'Mallika', 'Angie', 'Neelum', 'Cogshall', and several unnamed, numbered selections are included in the current orchard. The numbered selections are not yet commercially available, and were grafted in the field to 'Turpentine' rootstocks or in some cases on experimental rootstocks for size control. There has also been an effort to concentrate on early-season cultivars to avoid the monsoon season and thus to minimize fungal disease pressure and the need to protect the fruits with fungicides.

Innovations necessary for success in the estate orchard can only be achieved on a small-scale. The estate orchard offers extreme flexibility if the grower possesses the proper horticultural skills. All of the cultivars included in the estate orchard must be able to be differentiated from commercially available cultivars. They must have superior taste or appearance, preferably both, in order to be successful in local markets. Such an orchard is limited in potential profit due to its scale and is designed to supplement income for the grower rather than be a sole source. As the mango market continues to evolve there may be more opportunities for the estate mango orchard in the future.

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