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Training and Pruning a Mango Orchard to Improve Blooming and Yield in South Florida

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There are increasing opportunities for mango production using innovative production systems and new cultivars that can distinguish themselves from those already commercially available that will allow for elevated prices and profit (Campbell, and Ledesma, 2006). One-year-old 'Mallika' trees were managed by shoot bending after planting to increase flower and fruit production. Shoot bending is known to reduce shoot growth and to enhance flowering of fruit trees. 'Mallika' trees undergoing shoot bending were compared with control trees that were left to grow in their natural way and branch position. Training and pruning included shoot tipping to encourage branching, pruning to stimulate flushing in young-bearing trees, and arch bending to increase flower and fruit production. The results are preliminary and include data for the year 2015, including three factors: number of panicles, set fruit (pea size) and fruit ready to harvest.

Proper training and pruning of mango trees is an important component of a profitable mango orchard operation. Successful pruning is based upon scientific principles of tree growth and physiology and an experienced understanding of tree response to various pruning cuts and practices. Each tree is an individual and should be treated accordingly across an orchard (Day et al., 2005).

Trees are pruned to help maintain a balance between vegetative and reproductive growth throughout the tree and to maintain desired tree shape and size with an open tree canopy that allows penetration of sunlight. The practices of training and pruning are not easily separated because the training of a young tree will determine how the tree will be pruned as it matures. Shoot bending is known to reduce shoot growth and to enhance flowering on fruit trees (Lauri, et al., 1998).

Varieties can differ in growth characteristics, as well as their response to pruning cuts, rootstocks, soil, and growing conditions. Orchard design, objectives, and goals should be clearly defined and pruning principles developed accordingly. Medium to high-density plantings require greater commitment to detailed training and pruning than low-density orchards and should not be attempted unless such a commitment to pruning is made at the establishment of and throughout the life of an orchard.

Understanding the action and management of plant hormones allows horticulturists to manipulate plants for specific purposes. Auxins produced in the terminal buds suppress the growth of side buds and stimulate root growth. They also affect cell elongation (tropism), apical dominance, and fruit drop or retention. Auxins produced in the rapidly growing terminal buds suppress growth of side buds, giving a young tree a more upright form. As growth rates slow with age, reduction in apical dominance gives the maturing tree a more rounded crown.

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The auxin moves from the new leaves at the end of the branches by gravity down along the stems and prevents lateral growth. Reorientation of the branches from vertical to horizontal retards the movement of auxins to the end of the branches, allowing the lateral buds to grow. Branch bending has been used in the management of many temperate fruit. In other tropical fruit, like carambola, this treatment will induce a greater number of flowers and fruit on the horizontal branches.

The objectives of this experiment are to train and prune trees to develop and maintain small, mushroom-shaped trees that are capable of early production of large crops and high quality fruit. Training and pruning included shoot tipping to encourage branching, tip pruning to stimulate flushing in young-bearing trees, and arch bending to increase flower and fruit production in young trees.

Materials and Methods

Location. The study was conducted in a private mango farm in the Redland farming district of South Florida. The orchard consists of 1.5 acres with a spacing of 4 m within rows and 6 m between rows.

Land preparation and edaphic conditions. The experimental site consists of a crushed oolitic limestone substrate that was rock plowed for several decades, but left fallow for the past 20 years. Vegetation was removed with heavy equipment and the ground leveled in 2014. There was no scarification, and all organic matter was incorporated into the soil profile. Planting holes were dug with a backhoe and inter- and intra-row spaces were left leveled and unamended.

Planting. Three-gallon container mango trees were planted in March 2015. Tree spacing was 6 m between the rows and 4 m within the row. Trees had irrigation during the first month of planting for establishment. No additional inputs of fertilizer or

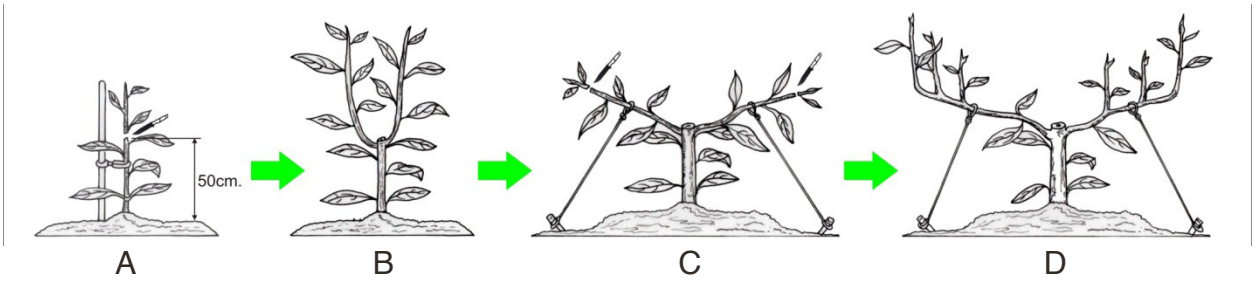

Fig 1. Tree training.

pesticides were applied. The mango orchard is free of herbicide and instead uses ground covers to suppress weeds. Additional mowing and hand weeding was performed as needed.

The cultivar included for the current study is 'Mallika', a hybrid between 'Neelum' and 'Dusheri'. 'Mallika' is considered among the best of the new generation of Indian dessert mangos (Campbell and Ledesma, 2004). The tree is semi-dwarf, making it attractive to mango growers outside of India, who are always looking for new niche markets. The bright yellow fruit are flattened oblong shaped, with a rounded base and an irregular, non-waxy skin. The fruit weigh from 10 to 18 oz. When properly ripened, the pasty, but completely fiber-free flesh is a deep orange, with an intensely sweet, rich, and highly aromatic flavor (Ledesma, 2015).

Tree training and pruning in young trees. After planting until May 2015, 'Mallika' trees were trained and shaped to increase flower and fruit production. Trees had no irrigation after April 2015 once they were considered established.

Shoot tipping. Each central leader shoot of the grafted trees was tipped (Fig. 1A) to induce precocious branching (Fig. 1B). All lateral shoots were maintained and tipped after the second vegetative flush according to the method described by Campbell, et al. in 2002.

Branch bending. Branch bending was conducted by reorienting each upright shoot away from the vertical. (Fig. 1C,). Branch bending was achieved by the use of simple concrete weights of 5 to 7 pounds placed on the ground beneath the canopy of each tree. The concrete weights were designed with a hook protruding upward that would serve as the point of attachment for a string. The string was tied to the center of the branch (Fig. 1D) and each branch pulled down to the horizontal and attached to the concrete weights. The branches in the treatment trees were bent to the horizontal and were compared with the control trees that had no branch bending. The controls received initial pruning and tipping, but no bending of branches.

The trees started blooming by March 2016. No fungicides or insecticides were applied. The numbers of panicles were evaluated. Trunk diameter was evaluated one and two years after planting. Fruit set and the number of fruit ready to harvest were also evaluated and compared with the control trees.

Results and Discussion

The results are preliminary and include data for 2015 and 2016 (Table 1). Evaluation began in March 2015.

This experiment carries on the young tree training work for mango begun by Campbell et al. in 2002. In the previous work, young mango trees were tipped each year at planting and throughout the life of the tree. In the present study the trees were also tipped, but instead of removal of the more vertical branches in year two and beyond, branch bending was added into the training system. All treatment trees that had their branches bent to the horizontal showed an increase in lateral growth and spread over the treatment time. All treated trees flowered during the first year of planting and had a significant increase in trunk diameter.

The trees that were not treated showed little lateral growth and finished the experiment taller and with a significant reduction in lateral growth and spread. The branching that was present in the control trees also showed inferior crotch angles and tended to have more shoot loss and breakage in the wind and with heavy rains. The majority of the trees did not flower during this season.

The trunk diameter of the trees increased with branch bending. At the end of the second year, the trunk diameter was twice of the size of the control. The increased trunk diameter will allow

Table 1. Evaluated Factors.

Tree #	Number of panicles		Fruit set		Picking time		Trunk diameter	
(inch)	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
1	32	0	202	0	15	0	3.2	1.6
2	35	0	208	0	17	0	3	1
3	45	0	215	0	15	0	3.2	1.2
4	46	0	218	0	16	0	3.6	1.5
5	44	0	220	0	24	0	3.8	1.5
6	48	0	230	0	26	0	4.5	2
7	40	0	180	0	12	0	2.9	1.5
8	42	0	200	0	19	0	3	1.7
9	45	0	208	0	20	0	3.2	2
10	50	2	230	1	25	0	4.4	2

for greater fruiting potential of these young trees and hopefully superior size control of the tree. Size control and precocious fruiting are keys to success in the high density orchard of the future. Blooming occurred on all of the treated trees. There was minor blooming on only one of the control trees that had a larger trunk diameter than other control trees. Trees were purchased in a commercial nursery and this one control tree may have been grafted on a different rootstock.

With the El Niño conditions in 2015–16 causing weather anomalies in South Florida, this season was considered abnormal for blooming and setting. Even with the El Niño conditions, the 'Mallika' trees in this study showed improved flower and fruit production after pruning management procedures including shoot tipping to encourage branching, pruning to stimulate flushing in young-bearing trees, and branch bending. Flowering and fruit production will be evaluated for several more years.

Literature Cited

Campbell, R.J., C.W. Campbell, and N. Ledesma. 2002. Tropical Mangos: How to Grow the World's Most Delicious Fruit. Fairchild Tropical Garden. 71 p.

Campbell, R.J. and N. Ledesma 2004. A new generation of mangos for Florida. Proc. Fla. State Hort. Soc. 117:204–205.

Campbell, R.J. and N. Ledesma. 2006. Trends in mango production and cultivars worldwide. Proc. Interamerican. Soc. Trop. Hort. Soc. Vol 49: 129-131.

Day, K.R., T.M. DeJong, and R.S. Johnson. 2005. Orchard-system configurations increase efficiency, improve profits in peaches and nectarines. California Agr. 59(2)75–79.

Lauri, P.E., J. Claverie, and J.M. Lespinasse, 1998. The effects of bending on growth and fruit production of Inra Fencer® sweer cherry.Acta Hort. 468:411–418. doi: 10.17660/ActaHortic.1998.468.50

Ledesma, N. 2005. Economic feasibility of small-scale specialty mango production in south Florida. Proc. Fla. State Hort. Soc. 117:204–205.