



## Ground Covers for Organic Mango Production in South Florida

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Mango (*Mangifera indica*) is grown in South Florida primarily in Miami-Dade, Lee and Palm Beach Counties. There is an increasing demand for organic mango production to expand the South Florida industry in response to consumer demand for organic fruit. Organic production also creates a new category for mangos in marketing of the fruit. Organic herbicides can be effective in controlling weeds, but there are limitations, as well as efficacy and economic considerations for commercial use. In this study, four species of ground covers were evaluated to measure their efficiency related to mango growing under South Florida conditions. The trial was conducted using beach verbena (*Gladularia maritime*), perennial peanut (*Arachi pintoï*), dwarf mimosa (*Minosa pudica*), and blue daze (*Evolvulus glomeratus*). Time of establishment, growth efficiency, and competition from weeds were evaluated. Perennial peanut (*Arachi pintoï*) variety 'Amarillo', and dwarf mimosa (*Minosa pudica*) covers used in row middles had the best performance compared with other species in study. They established quickly and controlled weeds with the best efficiency.

The mango continues to grow in importance in the local market due to the local food movement and the poor quality of imported mangos. There is an interest in new mango plantings in South Florida, particularly in terms of specialty varieties and new categories of mature-green and organic mangos. For small-scale specialty mango production in South Florida to succeed, growers should actively seek alternatives to increase profitability (Ledesma and Campbell, 2016).

Organic mango production continues to expand in South Florida in response to consumer demand for organic fruit. New horticultural practices are necessary to be able to have proper management for this specific growing method. Weed control can be a challenge to combine with organic certifications. There are some alternatives for organic growers in terms of weed control including hand weeding, but that can be expensive and time consuming on all but the smallest of scales. Herbicides meeting organic standards are another option but there are limitations. Organic herbicides are considered to be efficacious if there is sufficient volume and concentration delivered directly to the weeds. These herbicides are expensive and may not be affordable for commercial crop production at this time (W. Thomas Lanini, 2012).

Ground covers can be used wherever grass does not grow, where tree roots offer competition, in lieu of mulch, or where a single large mass of plants is preferred over a variety of plants. Colorful foliage can contrast or complement the aesthetics of the orchard and the flowers can add a friendly habitat for pollinators. There are plants for wet areas, dry areas, or cool shady areas. One must match the needs of the ground

cover with the situation and the needs of the crop (Granatstein, et al., 2013).

Four species of ground cover were studied to evaluate their efficiency related to a mango grove under South Florida conditions. Beach verbena (*Gladularia maritime*), perennial peanut (*Arachi pintoï*), dwarf mimosa (*Minosa pudica*), and blue daze (*Evolvulus glomeratus*).

### Materials and Methods

The study was conducted at 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 consisted of a crushed oolitic limestone substrate that had been 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 unadulterated.

### Planting of ground covers

One-gallon container sized beach verbena (*Gladularia maritime*), perennial peanut (*Arachi pintoï*), dwarf mimosa (*Minosa pudica*), and blue daze (*Evolvulus glomeratus*) were planted within the rows of the orchard. The planting design includes plots of 4 x 12 ft per species of ground cover. Each plot contained 8 ground cover plants (Fig. 1). The area between the rows was consistently mowed and allowed to populate with natural

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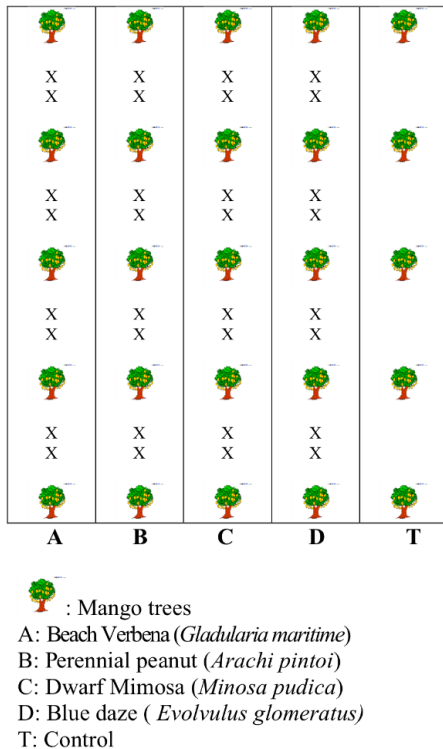


Fig 1. Planting design.

vegetation. At the end of the experiment, the row middles had mostly filled in with grass, which was mowed once a month.

### Beach Verbena (*Gladularia maritime*)

Endemic to Florida, and listed as a state endangered species, it occurs on the east coast of Florida on beach dunes, though it has been reported in Levy County on Florida's west coast. Beach verbena has purple or lavender flowers born in clusters at the top of this 12 in. tall ground cover, which stand out against the fine-textured foliage. Stems creep along the ground and root to bind the sand together. Plants grow to 1 ft tall and spread 3–5 ft. The plant is reported as salt and drought tolerant. It adds color to the ground year-round.

### Perennial Peanut (*Arachi pinto* variety 'Amarillo')

Ornamental peanut is an attractive, low-maintenance ground-cover, used in fruit groves, coffee and other crops throughout the world. This drought-tolerant, hardy perennial requires no supplemental water once established. Perennial peanut originates from central Brazil and makes its own nitrogen. It has since been distributed to Argentina, Australia, Colombia, the United States, and more recently to South East Asia, Central America, and the Pacific.

### Dwarf Mimosa (*Minosa pudica*)

This plant is native to South and Central America. It grows mostly in shady areas, under trees or shrubs, and is recommended as a mat-forming groundcover that withstands foot traffic and mowing. It is the larval food source for the little Sulphur butterfly. *Mimosa pudica* spreads by rhizomes that produce long tap roots

at the nodes. It grows in well-drained soils and is highly drought tolerant once established, making it also suitable for dry, sandy areas. This species has been known to be invasive under certain conditions and caution should be used when planting.

### Blue Daze (*Evolvulus glomeratus*)

Blue daze is a low-growing evergreen subshrub native to Brazil and Paraguay. The plant grows in a low, spreading mound, up to 2–3 ft (0.6–0.9 m) in diameter, but no more than 1 ft (0.3 m) tall. The stems become woody as they age. Leaves and stems are densely downy, covered with blue attractive flowers that bloom continuously. Each flower lasts only a day, opening in the morning and closing by afternoon. It is highly tolerant of salt, and grows well in full sun in poor sandy soils that are well drained.

### Establishment and aftercare

No fertilizers were applied. The soil was a result of previous levelling of the oolitic limestone being mixed with organic material. Planting of the four species took place in Mar. 2015. A microaspiration irrigation system was used for the mangos and the same system was used for the first two months after planting on the ground covers. Weeding was necessary until the plants became established. The presence of weeds was surveyed in each plot. The most common weeds were identified. Growth of the four cover species was measured every 2 weeks from Mar. 2015 to Nov. 2015.

## Results and Discussion

Ground cover in a mango grove must be managed. A grove can be divided into two distinct areas: the area between the tree rows, and the area directly underneath the trees.

The plants needed weeding every month especially following initial planting and during early establishment. Watering was required in first two months, if there was no rainfall. The study ran only during the warm months of the year. The results would have been influenced by lower temperatures found in the winter.

The perennial peanut and dwarf mimosa ground covers used in row middles had the best performance. They covered the area of 60 sq. feet by week 25 after planting (Fig. 2). They were

Table 1. Square footage of growth of each ground cover

| Week | Growth (ft <sup>2</sup> ) |                  |              |           |
|------|---------------------------|------------------|--------------|-----------|
|      | Beach Verbena             | Perennial Peanut | Dwarf Mimosa | Blue Daze |
| 1    | 1                         | 1                | 1            | 1         |
| 3    | 1                         | 2                | 1.5          | 1         |
| 5    | 3                         | 2.5              | 2.2          | 1.5       |
| 7    | 5                         | 3                | 3            | 2         |
| 9    | 3                         | 5                | 6            | 2.5       |
| 11   | 0                         | 6.5              | 10           | 2.5       |
| 13   | 0                         | 10               | 15           | 5         |
| 15   | 0                         | 22               | 19           | 6.5       |
| 17   | 0                         | 28               | 26           | 8         |
| 19   | 0                         | 39               | 30           | 10        |
| 21   | 0                         | 41               | 40           | 15        |
| 23   | 0                         | 50               | 45           | 17        |
| 25   | 0                         | 54               | 48           | 18        |
| 27   | 0                         | 55               | 48           | 20        |
| 29   | 0                         | 56               | 50           | 21        |
| 31   | 0                         | 58               | 52           | 21        |

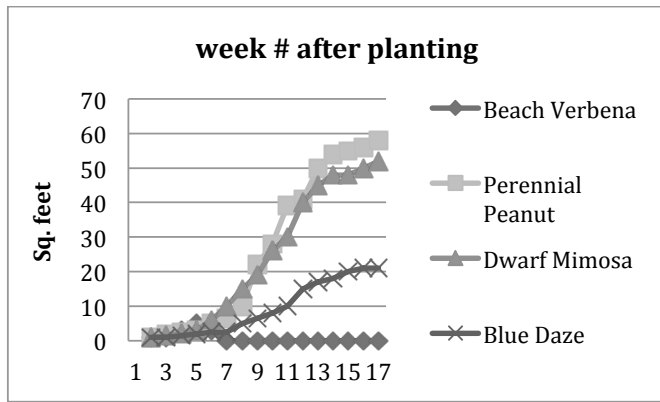


Fig 2. Growth Comparison.

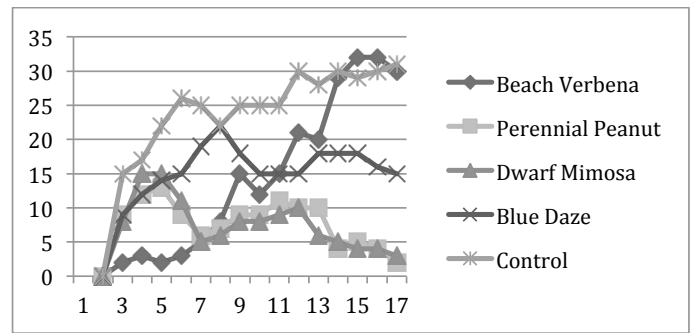


Fig.3. Weed frequency.

established by the fifth week. After that, they started growing and spreading in the area (Table 1). The perennial peanut kept growing even with a nutritional deficiency during the period of the study.

The perennial peanut and dwarf mimosa both controlled the weeds more efficiently than blue daze (Table 2). After 31 weeks, the average amount of weeds removed in each ground cover plot were two in the perennial peanut plot, three in the dwarf mimosa plot, as compared to 30 weeds removed in the beach verbena plot and 31 in the control plot (Fig. 3). The use of perennial peanut evokes questions about mango nutrition due to its habit of nitrogen fixing. Future studies must be conducted to evaluate production of mangos using perennial peanut and the interaction with the nutrition of the grove and the subsequent fruit quality.

The blue daze had a spreading mound habit and kept individual plants separate. The plants grew up to 2 ft in diameter, and stopped growing. Bees and other local pollinators frequently visited them.

The beach verbena declined by the second month of the experiment. Aggressive weeds competed with it and it died, save one individual plant. The beach verbena revived after 8 months of collecting data.

Dwarf mimosa was the most tolerant of the poor growing conditions, but was difficult to locate in nurseries and was also the most expensive. It also spread into the row middles and was tolerant of heavy traffic and mowing. It was dense enough to crowd out weeds. This species also attracted more pollinators as the perennial peanut was not attractive to pollinators. These species also have the ability to improve soil structure and can be a host for beneficial predatory insects.

The most common aggressive weeds identified were red morning-glory (*Ipomoea coccinea* L.), air potato (*Dioscorea bulbifera* L.), balsam pear (*Momordica charantia*), bull thistle (*Cirsium vulgare*), dandelion (*Taraxacum officinale*) and black nightshade (*Solanum americanum*).

### Literature Cited

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Table 2. Number of weeds removed in each ground cover plot.

| Weed occurrence | Beach Verbena | Perennial Peanut | Dwarf Mimosa | Blue Daze | Control |
|-----------------|---------------|------------------|--------------|-----------|---------|
| Week 1          | 0             | 0                | 0            | 0         | 0       |
| 3               | 2             | 9                | 8            | 9         | 15      |
| 5               | 3             | 12               | 15           | 12        | 17      |
| 7               | 2             | 13               | 15           | 14        | 22      |
| 9               | 3             | 9                | 11           | 15        | 26      |
| 11              | 5             | 6                | 5            | 19        | 25      |
| 13              | 8             | 7                | 6            | 22        | 22      |
| 15              | 15            | 9                | 8            | 18        | 25      |
| 17              | 12            | 9                | 8            | 15        | 25      |
| 19              | 15            | 11               | 9            | 15        | 25      |
| 21              | 21            | 10               | 10           | 15        | 30      |
| 23              | 20            | 10               | 6            | 18        | 28      |
| 25              | 29            | 4                | 5            | 18        | 30      |
| 27              | 32            | 5                | 4            | 18        | 29      |
| 29              | 32            | 4                | 4            | 16        | 30      |
| 31              | 30            | 2                | 3            | 15        | 31      |