

# Greenhouse Bitter Melon Production in Southern Virginia

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**Bitter melon (*Momordica charantia*) is a member of the Cucurbitaceae (gourd) family, a relative of squash, watermelon, and cucumber. It is considered an important vegetable for the Asian and Indian populations living in the United States. Bitter melon is usually grown in the field during the summer months; however, the price of bitter melon is considerably higher from December to May when it is imported from other countries. No information is available about bitter melon production in a greenhouse setting and whether higher market prices justify the higher production costs. In Dec. 2007, a study was conducted with two different trellis systems at the Virginia State University greenhouse facility to study this possibility. The production per plant for a 6-month harvest was 62 and 42 lbs for vertical and horizontal trellis systems, respectively.**

Bitter melon (*Momordica charantia*) is a member of the Cucurbitaceae (gourd) family, a relative of squash, watermelon, and cucumber. It is believed that bitter melon was domesticated in East India and southern China (Yang and Walters, 1992) and it is grown extensively in Southeast Asia, India, South America, East Africa, and the Caribbean. Smaller production scale is grown in the United States, mostly aimed for ethnic consumers.

Bitter melon fruit is rich in Vitamins A, B, and C, as well as minerals such as calcium, phosphorus, potassium, and iron (Rasco and Castillo, 1990). The fruits, seeds, and roots are reported to contain compounds with pharmaceutical effects, including a substance with clinical properties similar to insulin (Huyskens et al., 1992; Jeffrey, 1980). The bitter melon plant is a fast growing, climbing vine with thin stems and tendrils. Male and female flowers are borne separately on the same plant, and require hand or insect pollination to produce fruits. Immature fruits are light green, oblong with white flesh, and are harvested 3 weeks after pollination. As fruit matures, the surface gradually turns yellow or orange and becomes unmarketable. Bitter melon requires a trellis to support the climbing vine so that the fruit will not contact the soil surface. Under field conditions, young plants are transplanted 24 inches apart in a row on raised bed with plastic mulch with a distance of 8 ft between rows. In commercial production, the distance between every other row is usually 13 ft to allow the passage of a tractor for fumigation. In each row, the trellis is made of wooden 4-inch x 4-inch landscape posts, 6 ft high, placed 13 to 15 ft apart. Galvanized #12 wire is used to hold up the nylon net and as support for climbing plants. The trellis system can be set up vertically or horizontally. With the horizontal trellis system, the plant is allowed to trail above ground between the rows.

Immature fruit is harvested and packed in 30- to 35-lb wax-cardboard produce boxes

and stored at 53 to 55 °F. There is not an established market standard for bitter melon. Fruits of different sizes are sold to different ethnic consumers. Chinese markets, however, prefer larger fruit. A fruit 9 inches long and weighing more than 0.6 lb with fresh appearance is considered acceptable by the market (Larry Leighton, Caribbean Fruit Connection, Miami, FL, personal communication). Market demand for bitter melon is considerable and currently the demand is met by imports from other countries with some production in Florida and California. With the increase in demand of ethnic produce, many supermarkets and specialty stores are adding bitter melon to their produce sections. Figure 1 shows the wholesale market prices for bitter melon for a 30-lb box in the New York Terminal Market from Jan. to Sept. 2006 as was reported by the USDA Market News Report. The wholesale prices of bitter melon per 30-lb box in the New York Market remained at \$40 or more year round.

The field production season in Virginia for bitter melon is limited from May to October with harvest only from July to October. In order to increase this production window, there was a need to study the possibility of growing bitter melon in a greenhouse setting. This study was conducted to study the greenhouse production of bitter melon under horizontal and vertical trellis systems.



Fig. 1. Weekly wholesale prices for a 30-lb box of fresh bitter melon in the New York Terminal Market, 2006.

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## Materials and Methods

This study was conducted in a Nexus Teton greenhouse structure with pea gravel floor and concrete walkway. Seeds were planted on 15 Jan. 2008 and transplanted to 30-gal pots on 20 Feb. 2008. The medium for the pots were Fafard nursery mix. The plants were irrigated, using a typical greenhouse drip irrigation system with a pressure compensating emitter (Netafim, Fresno, CA). The emitters supplied each plant with 0.5 gal/h. Treatments for this study were two different trellises: horizontal and vertical. There were five plants for each treatment and they were arranged in two rows; in one row there were three plants and in a parallel row, there were two plants. Plants were spaced 5 ft apart within each row and rows were 10 ft apart. Plants initiated flowering in March, mostly male flowers. Long days caused the male flowers to bloom up to 2 weeks earlier than the female flowers, while short days have the reverse effect (Huyskens et al., 1992). In this study, on average the first female flowers were observed after the appearance of 18 male flowers. On a daily basis, all the female flowers were hand-pollinated, using the male flowers from the same plants. Three female flowers were pollinated and tagged at the time of pollination and it took 21 d before their fruits were harvested. When the harvest initiated, on a bi-weekly basis 1/2 lb of 8N-16P-8K fertilizer was added to each pot. The trellis system utilized greenhouse trusses and 1-inch galvanized tubing as vertical members; Hortonova, 6-inch × 6-inch, plastic netting (Fred C. Gloeckner Company, Harrison, NY); 7/16-inch aircraft cable; and tomato twine. Plastic netting was stretched between the vertical members to form a vertical trellis wall that was 8 ft tall. In the vertical treatment, when the bitter melon vines reached the top of the trellis wall, they were reoriented to the sides and downward. For the horizontal treatment, the vines were allowed to trail up and over the top of the vertical wall and then onto a horizontal canopy. The horizontal canopy was formed with aircraft cable and tomato twine with 6-inch × 6-inch spacing.

Harvest began on 21 Apr. 2008 and continued until 15 Oct. 2008. No fruit was harvested during the month of August as a result of irrigation and ventilation breakdown during one weekend which caused defoliation of the plants. New foliage developed and harvest initiated again one month later. In mid-October all plants developed large amounts of foliage with very few flowers. It was decided to terminate the study.

## Results and Discussion

From 21 Apr. to Oct. 2008, the plants were harvested 26 times. The overall result for number of fruits per plant combined over all harvests was 61 fruits for the horizontal trellis system in comparison to 89 fruits for the vertical trellis system. The overall result for fruit weight per plant combined over all harvests was 42 lb for the horizontal trellis system in comparison to 62 lb for the vertical trellis system.

In general, fruits were harvested twice a week. However, the data were combined and the results are reported on a monthly basis. Figure 2 shows that the number of fruit produced in the vertical trellis system, in all months, was higher in comparison to the horizontal trellis system. The difference in the number of fruits harvested between the two treatments was one fruit per plant for the month of July, and 13 fruits per plant for the month of September in favor of the vertical trellis. Figure 3 shows that in each of the six monthly harvest periods, plants with the vertical trellis system produced fruits with more weight than plants with the horizontal trellis system. The difference between the fruit weight per plant harvested from the horizontal and vertical trellis systems in July was 0.8 lb and it was 9.9 lb in September.

Although the results point to the advantage of using a vertical trellis system in the greenhouse for the production of bitter melon, it is worth mentioning that the seeds for this experiment were obtained from an open-pollinated variety source planted in a farm in Florida. Also, after the plants were set up in the greenhouse, it was recognized that the plants with a horizontal trellis system were closer to the evaporative cooling pad system in the greenhouse and this may have caused lower fruit production for plants within the horizontal trellis system.

Both Figures 2 and 3 indicate two distinct peaks of higher production for number and weight of fruits. There was a gradual increase from April to May and then a decrease from May to June. The same trend was suggested by the same figures from July to October. This information suggests that there are three distinct production cycles with bitter melon; first, an increase that eventually reaches a peak, then a decrease. The data suggested that this pattern is repeated every 3 months.

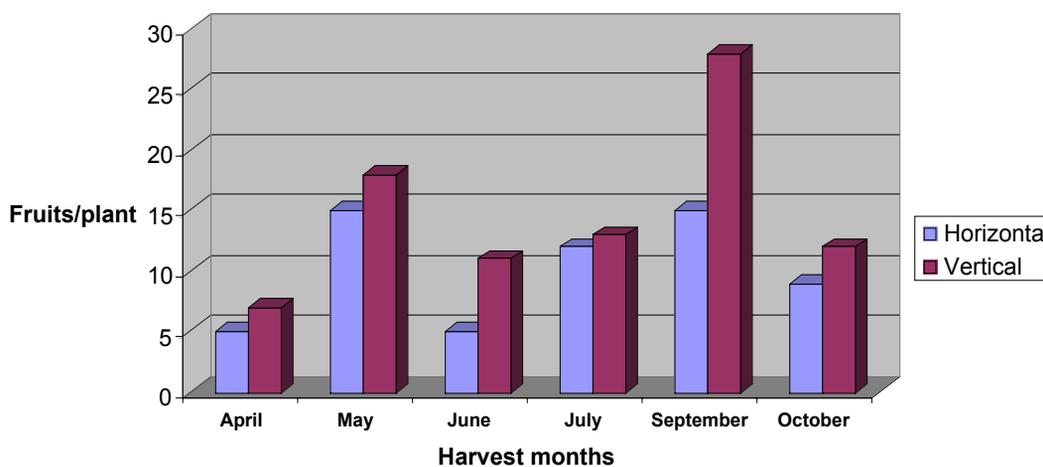


Fig. 2. Effects of two different trellis systems on the number of bitter melon fruits per plant.

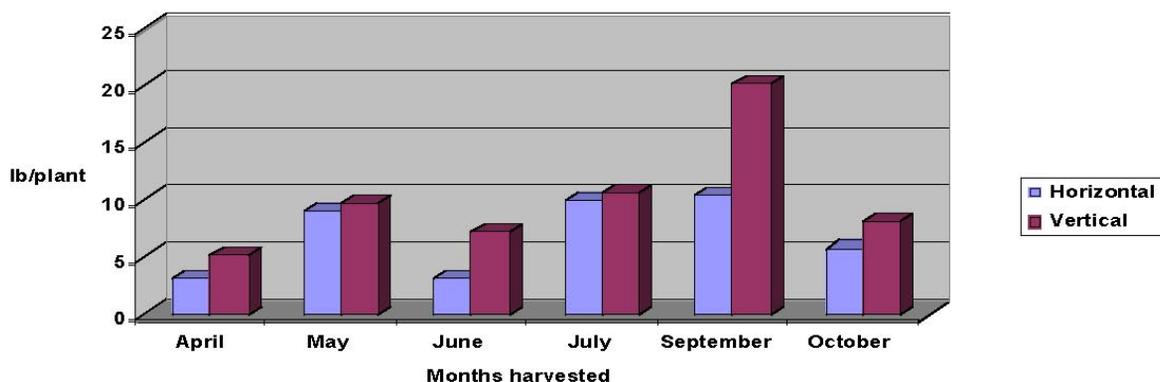


Fig. 3. Effects of two different trellis systems on the weight of bitter melon fruits per plant.

### Conclusion

The results from this experiment indicated the possibility of growing bitter melon in a greenhouse setting and that under greenhouse conditions, the period of harvest of bitter melon can be extended beyond field production period. Plants grown in the greenhouse using a vertical trellis system produce more fruits per plant in comparison to plants grown under a horizontal trellis system. The limitation for requiring hand pollination should be considered when deciding to plant bitter melon in a greenhouse setting. There is a need for pruning bitter melon plants to control the excessive foliage development, which is a limitation under greenhouse production. Experiments should be conducted to evaluate the economic feasibility of greenhouse bitter melon production on a year-round basis.

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