

Suggested Cultural Practices for Bitter Gourd

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Introduction

Bitter gourd (*Momordica charantia*) is one of the most popular vegetables in Southeast Asia (Fig. 1). It is a member of the cucurbit family along with cucumber, squash, watermelon, and muskmelon. Native to China or India, the fast-growing vine is grown throughout Asia and is becoming popular worldwide. Depending on location, bitter gourd is also known as bitter melon, karella, or balsam pear.

The immature fruits and tender vine tips are used in a variety of culinary preparations. The fruits and shoots are soaked in salt water to remove some of their bitterness and then boiled, fried or pickled.

The fruit of bitter gourd fruit is similar in nutritional value compared to other cucurbits, with the notable exceptions that it is much higher in folate and vitamin C. The vine tips are an excellent source of vitamin A. The medicinal value of the gourd in the treatment of infectious diseases and diabetes is attracting the attention of scientists worldwide.

The following suggested cultural practices were developed at AVRDC in the Taiwan lowlands. Growers may need to modify the practices to suit local soil, weather, pest, and disease conditions.

Climate and soil requirements

Bitter gourd grows well under the same conditions preferred by other cucurbits. It is normally grown as an annual crop, but can perform as a perennial



Fig.1. Bitter gourd is well-liked in Southeast Asia for its uniquely-flavored fruits and tender vine tips

in areas with mild, frost-free winters. The plant thrives in the tropics from lowland areas to altitudes of up to 1,000 m. Bitter gourd requires a minimum temperature of 18°C during early growth, but optimal temperatures are in the range of 24–27°C. It is more tolerant to low temperatures compared to other gourds, but cool temperatures will retard growth and frost will kill the plant. The plant is adapted to a wide variety of rainfall conditions, but regular irrigation is needed to ensure high yield.

Bitter gourd tolerates a wide range of soils but prefers a well-drained sandy loam soil that is rich in organic matter. The optimum soil pH is 6.0–6.7, but plants tolerate alkaline soils up to pH 8.0.

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Choosing a variety

Numerous hybrid and open-pollinated varieties are available. Hybrids usually produce higher yields, but their seeds are relatively expensive and must be purchased for every planting. Open-pollinated varieties have the advantage that their seeds may be saved and used for future plantings.

The choice of variety depends on market preference in a certain region, and is based on fruit shape and color. Generally, there are three types: 1) small, 10–20 cm long, 100–300 g, usually dark green, very bitter; 2) long, 30–60 cm long, 200–600 g, light green in color with medium size protuberances, and only slightly bitter; and 3) triangular fruit type, cone-shaped, 9–12 cm long, 300–600 g, light to dark green with prominent tubercles, moderately to strongly bitter (Fig. 2). Select a variety that is well adapted to your growing conditions and preferred by consumers. Growers are encouraged to compare the performances of different varieties during different seasons to identify superior types.

Preparing the field

Thorough land preparation and a well-prepared bed is required. Plow, harrow and rototill the field. Form 20-cm-high beds during the dry season and 30 cm or higher during the wet season using a plow or mechanical bed shaper (Fig. 3). The distance between centers of adjacent furrows is about 150 cm with a 90-cm bed top (Fig. 3).



Fig. 3. Forming raised beds

Planting

Direct seeding is the most common method of planting. In cooler climates, it may be necessary to start the seedlings in a greenhouse to ensure good germination.

Option 1. Direct seeding

Optimum plant density differs with variety and usually ranges from 6,500 to 11,000 plants per ha. In some intensively managed plantings, a closer spacing of 50 x 50 cm is used resulting in 40,000 plants per ha. On raised beds, sow two or three seeds per hole at a depth of 2 cm. Space holes 40–60 cm apart in rows spaced 1.2–1.5 m apart. Plant density using this spacing will range from 13,600 to 17,300 plants per hectare. When planted in warm soil, seedlings will emerge in a week or less. Thin to one seedling when they have four true leaves.

Option 2. Transplanting

Sow seeds in small plastic pots or containers using a potting mix that has good water-holding capacity and good drainage such as peat moss, commercial potting soil, or a potting mix prepared from soil, compost, rice hull, and vermiculite or sand. Plant two or three seeds per container and thin to a single seedling when they have four to six true leaves. Water the seedlings thoroughly every morning to maintain a moist but not wet soil.

Seedlings are ready for transplanting 15–20 days after sowing or when they are 10–15 cm tall. Bare-root plants will not survive so pull seedlings with their root balls intact before transplanting. Transplant seedlings into the field at spacings similar to those used for the direct seeding method.



Fig. 2. Varieties of bitter melon differ in fruit size, color, ridging, and degree of bitterness

Staking and trellising

Bitter gourd grows very fast and vines elongate rapidly within two weeks after planting. Thereafter, the plant sends out lateral stems. Staking and trellising will increase fruit yield and size, reduce fruit rot, and make spraying and harvesting easier.

There are several methods of trellising bitter gourd. At AVRDC, bamboo poles, wood stakes, PVC pipes or other sturdy material are used to provide support and keep the fruit and foliage off the ground. The trellis is arranged either in a lean-to or tunnel structure. The trellis should be 1.8–2.0 m high, constructed from stakes 1.2–1.8 m apart, which is almost similar to the plant row spacing.

For the lean-to type, the stakes are joined between two adjoining beds forming an A-shape structure (Figs. 4, 5). Horizontal stakes are installed at the top joining all other beds. The stakes support the climbing vines and lateral stems. Strings are used to secure adjoining stakes. Plantings are easier to manage and more productive when 2-m-high rather than 1-m-high string trellises are used.

For the tunnel type, plants are grown inside an arch-shape structure made of either PVC or galvanized iron pipe (Fig. 6). Plants are supported by bamboo stakes where vines freely climb and reach the top. The vines and lateral stems will then grow along the structure.

Another type of trellising consists of a system of vertical strings running between top and bottom of horizontal wires, or horizontal wires running across all directions on top as shown in Fig. 7.

Pruning

Bitter gourd develops many side branches that are not productive. To improve yield, remove lateral branches until the runner reaches the top of the trellis. Leave 4–6 laterals and cut the tip of the main runner to induce early cropping. Removal of lateral branches in the first 10 nodes has a positive effect on total yield. Without pruning, most of the female flowers occur between the 10th and 40th nodes, or at a height of 0.5–2.0 m.



Figs. 4,5. Lean-to trellis structures



Fig. 6. Tunnel trellis structure



Fig. 7. Horizontal trellis on top of structure

Fertilizing

Bitter melon requires a balance of nutrients from organic and chemical fertilizers. Fertilizer application rates depend on soil type, fertility level, and soil organic matter. In sandy soils at AVRDC, fertilizer application consists of a basal application followed by four sidedressings, providing a total of 184 kg N, 112 kg P₂O₅ and 124 kg K₂O per ha (Table 1). In clay or heavy texture soils, the entire amount of P, and one-third of N and K is applied before planting, either by broadcasting and tilling or by banding a few cm deep and to the side of the plant row in the bed. The balance of N and K is applied in two or more sidedressings. No matter the soil type, the first sidedressing is applied when plants have four to six true leaves. Subsequent sidedressings are applied at two-week intervals. Compost or manure can be used to satisfy the basal application of organic fertilizer.

Table 1. Recommended fertilizer rates (kg/ha) for bitter melon production at AVRDC

Timing	N	P ₂ O ₅	K ₂ O
Basal (organic)	28	28	28
Basal (inorganic)	36	54	36
Sidedressing 1	30	7.5	15
Sidedressing 2	30	7.5	15
Sidedressing 3	30	7.5	15
Sidedressing 4	30	7.5	15
Total	184	112	124

Irrigating

Bitter melon will not tolerate drought. Maintain good soil moisture in the upper 50 cm of soil where the majority of roots are located. At AVRDC, fields are furrow-irrigated every 10 days during the cool-dry season, and weekly during the hot-dry season. During the rainy season, drainage is essential for plant survival and growth. In water-limited environment, trickle or drip irrigation is an efficient method of supplying water and nutrients to bitter melon plantings.

Pollinating

Flowers of bitter melon are first developed 45 to 55 days after sowing and vines will bloom for about

six months. Flowers are cross-pollinated by insects, especially bees. Pollination can be a problem during the wet season since bees are less active during overcast conditions. Each flower opens at sunrise and remains viable for only one day. Pollen loses viability as the day advances and may be fully inviable by midday. To ensure good pollination and avoid the need for hand pollination, introduce beehives or blow pollen around with an unloaded mister.

Bitter melon is monoecious, in other words, male and female flowers are borne separately on the same plant (Fig. 8). The male flowers normally exceed the females by about 25:1. Long days cause male flowers to bloom up to two weeks before female flowers, while short days have the opposite effect. Spraying vines with flowering hormones after they have six to eight true leaves will increase the number of female flowers and can double the number of fruits. For example, one application of gibberellic acid at 25–100 ppm increases female flowers by 50% and can work for up to 80 days. Other hormones have similar effect, but may reduce vine length and leaf area resulting in decreased total yield. As mentioned earlier, pruning the lower lateral branches increases the number of flowers per plant by increasing the number of flowers on higher laterals.



Fig. 8. Female flower

In Taiwan, yield of bitter melon is increased by grafting with luffa (*Luffa* spp.). Luffa resists fusarium wilt and is more tolerant to flooding, which allows bitter melon to survive in waterlogged soils.

Controlling weeds

Mulching is commonly used for bitter melon crops grown on raised beds (Figs. 4–6). Use organic or plastic mulch depending on availability. Organic mulch such as dry rice straw or grass is usually available and cheaper than plastic mulch. If you use organic mulch, be sure that it is free of weed seeds. Mulch can be laid down before or after transplanting and after sowing. Several herbicides are available, but make sure that you select a herbicide recommended for bitter melon. Hand or hoe weeding can be performed as needed.

Controlling diseases and pests

Bitter gourd is susceptible to many of the same diseases that affect other cucurbits. It is a host of watermelon mosaic potyvirus (Fig. 9) and is infected by downy mildew (Fig. 10), *Cercospora* leaf spot, bacterial wilt, fusarium wilt, and root knot nematode. Fungal infections often occur during prolonged wet periods. Fungicide sprays may be used under such conditions to prevent infection. The use of resistant varieties is the best defense for most of these diseases.



Figs. 9, 10. Symptoms of watermelon mosaic potyvirus on cucumber (left) and downy mildew on luffa (right)

Fruit fly is the most destructive insect pest of bitter gourd. This fly is difficult to control because its maggots feed inside the fruits, protected from direct contact with insecticides. Bury any infested fruits to prevent the build up of fruit fly populations. To prevent flies from laying eggs inside the fruits, enclose the gourd in paper while it is on the vine. A cylinder of paper, longer than the fruit, is tied with string around the stalk. Where consumers want their bitter gourd straight rather than curved, tie a pebble at the end of a long piece of string to the flower end to weigh down the fruit and keep it from curling. Double layer paper bags may be used against fruit fly and are applied when gourds measure 2–3 cm in length.

Beetles, thrips, cutworms, bollworm, aphids and mites are other common pests of bitter gourd.

Chemical control of insect pests should be done only when significant damage occurs. Avoid pesticides that kill or inhibit the development of beneficial organisms especially the pollinators. Choose pesticides that last only a few days. Wear protective clothing and follow all instructions carefully on the label when applying pesticides.

Harvesting and handling

Bitter gourd requires close attention at harvest time. The fruits develop rapidly and must be harvested frequently to keep them from becoming too large or too bitter. Normally it takes 15–20 days after fruit set or 90 days from planting for fruit to reach marketable age, however, bitter gourd can be harvested at earlier stages depending on the purpose for which it will be used. Fruit should be light green, thick and juicy, and the seeds should be soft and white. Harvest every 2–3 days using a pair of scissors or a sharp knife to cut the fruit stalk. If a fruit remains too long on the vine, it will turn spongy, sour, yellow or orange, and split open (Fig. 11).

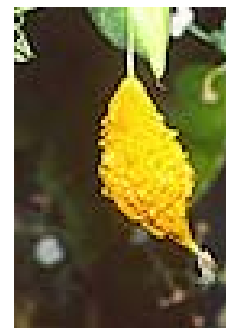


Fig. 11. Overripe

Bitter gourd yield can vary depending on variety and crop management. Average marketable yields are 8–10 t/ha. A yield of 20–30 t/ha is excellent and some F_1 hybrids yield up to 40 t/ha.

Fruits of bitter gourd do not keep long and should be sold in the market immediately. Remove damaged and deformed fruits. Carefully arrange fruits in bamboo baskets or boxes (Fig. 12) and store in a cool place at 12–13°C with 85–90% relative humidity. Under this condition, fruit storage life can be extended 2–3 weeks. Bitter gourd is chilling sensitive and damage may occur if kept below 10°C. Do not store fruits at temperatures above 13°C, as this will result in fruits turning yellow and splitting open. Keep harvested fruits away from other fruits (such as banana, pineapple and apple) that release large amounts of ethylene, a ripening hormone. ☞



Fig. 12. Bitter gourd boxed and wrapped for shipping