

## ***Suggested Cultural Practices for Moringa***

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### ***Introduction***

Moringa (*Moringa* spp.) is one of the world's most useful plants. This fast-growing tree is grown throughout the tropics for human food, livestock forage, medicine, dye, and water purification (Figs. 1, 2). It is known by several names in different countries, but is popularly called the "drumstick tree" for its pods that are used by drummers and the "horseradish tree" for the flavor of its roots.

Moringa is one of the world's most nutritious crops. Ounce for ounce, the leaves of moringa have more beta-carotene than carrots, more protein than peas, more vitamin C than oranges, more calcium than milk, more potassium than bananas, and more iron than spinach. Native to South Asia, this tree is

becoming a vital source of nutrition in this region, where most of the world's poor people live. The multiple uses of moringa have attracted the attention of researchers, development workers, and farmers.

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***

Moringa tolerates a wide range of environmental conditions. It grows best between 25 to 35°C, but will tolerate up to 48°C in the shade and can survive



*Fig. 1. Moringa is one of world's most useful plants*



*Fig. 2. Moringa flowers, pods, and foliage*

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a light frost. The drought-tolerant tree grows well in areas receiving annual rainfall amounts that range from 250 to 1500 mm. Altitudes below 600 m are best for moringa, but this adaptable tree can grow in altitudes up to 1200 m in the tropics.

Moringa prefers a well-drained sandy loam or loam soil, but tolerates clay. It will not survive under prolonged flooding and poor drainage. Moringa tolerates a soil pH of 5.0–9.0.

### **Preparing the field**

Moringa requires thorough land preparation and a well-prepared seedbed. At AVRDC, moringa is planted on 30-cm-high raised beds to facilitate drainage. Bed widths being tested at the Center vary from 60–200 cm.

### **Choosing a variety**

Among moringa species, *M. oleifera* and *M. stenopetala* are most commonly grown. *M. oleifera* is most widely cultivated and the focus of this guide. Varieties within *M. oleifera* differ in growing habit, leaf, flower, and pod characteristics (Fig. 3). Numerous accessions are being evaluated at AVRDC for superior production and nutrition qualities. Currently we recommend growers to use locally adapted lines. Characteristics of superior types include wide and dark green leaves, long and tender pods, bushy habit, and rapid regeneration after trimming.

### **Planting methods**

Moringa is planted either by direct seeding, transplanting, or using hard stem cuttings. Direct seeding is preferred when plenty of seed is available



Fig. 3. Leaf characteristics of different accessions

and labor is limited. Transplanting allows flexibility in field planting but requires extra labor and cost in raising seedlings. Stem cuttings are used when the availability of seed is limited but labor is plentiful.

### **Option 1. Direct seeding**

Sow two or three seeds per hill at a depth of 2 cm. Two weeks after germination, thin to the strongest seedling per hill.

For leaf, pod and seed production, space plants 3–5 m apart between rows and plants. If using raised beds, form beds with 2-m-wide tops, and space plants 3–5 m apart in a single row (Fig. 4).



Fig. 4. Wide rows are used for leaf, pod, and seed production

For production of leaves only, space plants 50 cm within rows spaced 1 m apart. If using raised beds, form beds with 60-cm-wide tops and space plants 1 m apart in a single row (Fig. 5). For intensive production of leaves, space plants 10–20 cm within rows 30–50 cm apart. Closer spacing allows harvest of young edible shoots every two to three weeks.



Fig. 5. Narrow rows are used for leaf production only

### **Option 2. Transplanting**

Transplanting moringa consists of two steps: seedling production and field planting.

**Seedling production.** Seedlings can be grown in divided trays, individual pots, plastic bags, or seedbeds (Figs. 6, 7). Use of divided trays and individual containers is preferred because there is less damage to seedlings when they are transplanted.

A 50-cell tray with cells 3–4 cm wide and deep is suitable. Fill the tray with a potting mix that has good water-holding capacity and good drainage. Use peat moss, commercial potting soil, or a potting mix prepared from soil, compost or rice hulls, and vermiculite or sand. AVRDC uses a mixture of 67% peat moss and 33% coarse vermiculite. If you use non-sterile components, sterilize the mix by autoclaving or baking at 150°C for 2 hours.

Grow seedlings under shade or in a screenhouse with 50% shade. Sow two or three seeds per cell. One week after germination, thin to the strongest seedling. Irrigate seedlings thoroughly every morning or as needed (moist, but not wet), using a fine mist sprinkler to avoid soil splash and plant damage. Transplant seedlings one month after sowing.

Pots or bags may be used to grow larger transplants. Fill the containers (0.5–1.0 kg by volume) with potting mix similar to that used in seedling trays. If potting mix is not available, use 3 parts soil to 1 part sand. Sow two or three seeds per pot or bag. One week after germination, thin to the strongest seedling. These plants are transplanted in the field after they reach 50 cm high (Fig. 7).

If seedlings are started in a raised seedbed, the soil should be partially sterilized by burning a 3–5 cm layer of rice straw or other organic matter on the bed. The burned ash adds minor amounts of P and K to the soil. Sow two or three seeds in holes spaced 10 cm apart in furrows spaced 25 cm apart. Cover seedbed with a fine-mesh nylon net to protect seedlings from pests, heavy rain, and harsh

sunlight. Transplant seedlings one month after sowing or when they reach 20–30 cm high. Dig seedlings using a trowel taking care that roots are not damaged. Place the bare-root seedlings in a bucket containing water and transplant them as soon as possible.

**Field planting.** Spacings are similar to those recommended in the direct seeding method.

Moringa may also be planted 1 m apart or closer in a row to establish living fence posts. Trees can be planted in gardens to provide shade to vegetables less tolerant to direct sunlight. Moringa trees are also used to support climbing crops such as yam and pole beans. Trees are also planted in hedgerows forming wide alleys where vegetables are planted within (Fig. 8). Choose vegetables that are adapted to alley cropping, such as shade-tolerant leafy vegetables and herbs, since moringa hedgerows are highly competitive and can reduce yields of companion plants significantly.



Fig. 8. Moringa hedgerows in alley cropping system with lemongrass and herbs



Figs. 6, 7. Seedlings grown in trays and clay pot

### Option 3. Using stem cuttings

Compared to trees planted from seed, trees from stem cuttings grow faster but develop a shallow root system that makes them more susceptible to moisture stress and wind damage.

Make stem cuttings using branches of a tree that is at least one year old. Use hard wood and avoid using young green stem tissue. Cuttings can be 45–150 cm long with diameters of 4–16 cm. Cuttings can be dried in the shade for three days before planting in the nursery or in the field. Cuttings are then planted directly or planted in plastic pots or bags in the nursery or screenhouse (Fig. 9). When planting directly, plant cuttings in light,

sandy soil. Plant one-third of the length in the soil (i.e., if the cutting is 90 cm long, plant it 30 cm deep). Add a balanced fertilizer or compost to infertile soils to encourage root development. Irrigate regularly to keep the soil moist but not wet. Cuttings planted in a nursery are ready for field planting after 2–3 months. Follow the field planting recommendations mentioned for direct seeding and transplanting.



Fig. 9. Stem cuttings grown in clay pots and ready for field planting

### **Fertilizing**

Moringa grows well in most soils without additions of fertilizer. Once established, the extensive and deep root system of moringa is efficient in mining nutrients from the soil.

For optimum growth and yields, fertilizers are applied at planting time. Dig trenches around the base of the plant (10–20 cm from the base) and apply approximately 300 g of a commercial nitrogen fertilizer per tree. If commercial nitrogen fertilizer is not available, use compost or well-rotted farmyard manure at the rate of 1–2 kg/tree.

### **Irrigating**

Irrigate newly transplanted trees immediately after transplanting to promote early root development. In dry and arid climates, irrigate regularly for the first two months. Once established, moringa rarely need watering. The well-rooted tree tolerates drought and needs irrigation only when persistent wilting is evident.

### **Controlling weeds**

Cultivate the soil thoroughly before planting to suppress early weed growth. Apply straw and/or plastic mulch around the base of each young tree (Fig. 10). Maintain a weed-free planting by regularly cultivating between beds and rows.



Fig. 10. Young planting with mulch around base of trees

### **Controlling pests and diseases**

Moringa is resistant to most pests and diseases, but outbreaks may occur under certain conditions. For example, diplodia root rot may appear in waterlogged soils, causing severe wilting and death of plants. Mite populations can increase during dry and cool weather. These pests create yellowing of leaves (Fig. 11), but plants usually recover during warm weather. Other insect pests include termites, aphids, leafminers, whiteflies, and caterpillars (Fig. 12).

Chemical control of insect pests should be used only when severe infestations occur. Choose a pesticide that targets the specific pest causing the damage, and avoid pesticides that kill or inhibit the development of beneficial organisms. Choose pesticides that last only a few days.

Cattle, sheep, pigs, and goats will eat moringa seedlings, pods and leaves. Protect moringa seedlings from livestock by installing fence or by planting a hedge around the plot.



Figs. 11, 12. Mites cause general yellowing of leaves; close-up of caterpillar consuming leaf tissue

## Pruning

Moringa should be trimmed to promote branching, increase yields, and facilitate harvesting. If left to grow without cutting the main trunk, the fast-growing tree will grow straight and tall producing leaves and pods only on the primary stem. To encourage the development of many branches and pods within easy reach from the ground, prune the apical growing shoot when the tree is 1.0–2.0 m high. Use a sharp cutting knife, machete, or pruning saw to make smooth cuts. New shoots will emerge from just below where the cut is made (Fig. 13). Thereafter, cut the growing tips of the branches so that the tree will become bushier. Another pruning strategy is to cut back each branch by 30 cm when it reaches 60 cm in length. This will produce a multi-branched shrub.

If the tree is being grown for pod production, remove flowers during the first year. This will channel all of the young tree's energy into vegetative and root development (rather than energy-draining pods), leading to more vigorous growth and productive yields in the future.

Older trees that are unproductive or too high for easy harvesting can be pruned at ground level. New shoots will emerge quickly from the base.



*Fig. 13. New shoots emerge from where pruning cuts are made, creating a bushier tree*

## Harvesting

Leaves can be harvested after plants grow 1.5–2.0 m, which usually takes at least one year. Harvest leaves by snapping leaf stems from branches. Harvesting young shoot tips will promote development of side branches where cuts along the main branches are made. Allow plants to develop new shoots and branches before subsequent harvests. If plants are grown at closer spacing and higher density, cut plants about 10–20 cm above ground.

Older leaves will need to be stripped from their tough and wiry stems. These leaves are more suited

to making dried leaf powder, since stems can be removed during the sifting process.

For fresh vegetables, tie harvested leaves in bundles and place them under shade to maintain freshness (Fig. 14). Moringa leaves can easily lose moisture after harvesting, therefore, harvest early in the morning and sell the same day, if possible.

The leaflets can also be dried in the sun for a few hours and then stored for consumption during the hot-wet season, a time when minerals and vitamins are most lacking in diets.

Flowers and pods are normally produced during the second year of growth. Harvest pods when they are young, tender, and green. They are eaten as green beans. Older pods are fibrous and develop a tough shell, but their pulp and immature seeds remain edible until shortly before the ripening process begins. Immature seeds can be used in recipes similar to green peas. Fresh or dried flowers are used for making teas.



*Fig. 14. Fresh moringa leaves and pods in bundles*

## Collecting and storing ripe seeds

Mature pods contain ripe seeds that are used for planting the next crop or for extracting oil. When producing seed for oil extraction, allow the pods to dry and turn brown on the tree. Harvest pods before they split open and fall to the ground. Store seeds in well-ventilated sacks in a cool, dry, and shaded area. Seeds remain viable for planting for two years. ⌘

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