

## ***Suggested Cultural Practices for Vegetable Amaranth***

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### ***Introduction***

Vegetable amaranth (*Amaranthus* spp.) is widely grown in the tropics and is one of the most important leafy vegetables in the lowlands of Africa and Asia. Amaranth is an annual, fast growing plant, and is easily cultivated in gardens and fields. Amaranth is a rich source of calcium, iron, and vitamins A and C.

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***

Amaranth grows well in both hot humid and hot dry climates. The plant prefers temperatures between 25 and 30°C. Amaranth is photoperiod-sensitive

and most species will flower when daylengths are shorter than 12 hours.

Amaranth grows best in a loam or silty-loam soil with good water-holding capacity, but it can grow on a wide range of soil types and soil moisture levels. Some species are tolerant to drought. Amaranth can tolerate a soil pH from 4.5 to 8.0.

### ***Choosing a variety***

Of all the indigenous tropical leafy vegetables, amaranth has the largest number of species and varieties. The choice of variety varies widely among regions and is dictated largely by the species available. For example, *A. tricolor* is often grown in South and Southeast Asia, *A. cruentus* in Africa, and *A. dubius* in the Caribbean area. Other common species are *A. viridis*, *A. hypochondriacus*, and *A. gangeticus*.



*Fig. 1. Tricolor, purple, and white vegetable amaranth (Amaranthus tricolor) varieties*

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Regardless of species, the choice of variety is influenced by individual preference for leaf color and taste. Some of the most common commercial amaranths are selections of *A. tricolor* which come in various leaf colors such as white (light green), dark green, red, purple and variegated (Fig. 1). Some of the commercial varieties available in the market are Tigerleaf, Greenleaf, Merah, Penang, and Puteh.

To identify what varieties are best adapted to your location, compare during different growing seasons the yield potential of currently grown varieties with that of other available varieties or accessions.

### **Preparing the field**

Amaranth requires thorough land preparation and a well-prepared bed for good growth. 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. The distance between centers of adjacent furrows is about 150 cm with a 90-cm bed top.

### **Planting**

Amaranth is planted either by direct seeding or transplanting. The choice of planting method depends on availability of seed and labor and may also vary with the growing season. Direct seeding is appropriate when plenty of seed is available, labor is limited, and during the dry season when frequency of flooding is less. Transplanting is preferred when there is limited amount of seed, plenty of labor, and during the wet season when heavy rains and flooding are most likely to wash out seeds.

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

When direct seeding is used, seeds are either broadcast or sown in rows on well-prepared seedbeds. Broadcast seeds uniformly at the rate of 0.5 to 1.0 g/m<sup>2</sup> of bed; there are about 1000 amaranth seeds per gram. Since amaranth seeds are very small, mix seeds with sand at a ratio of 1 g seed to 100 g sand to make it easier to sow the seed and obtain a uniform stand. Cover seed lightly with a layer of compost or rice hulls immediately after broadcasting.

When plants are to be grown in rows, make furrows 0.5–1.0 cm deep and space rows 10 cm apart on the bed. Sow seeds 5 cm apart within the row and cover with a layer of compost or rice hulls.

#### **Option 2. Transplanting**

To shorten the crop duration in the field and to secure a better and more uniform stand especially during the wet season, raising seedlings in a nursery followed by transplanting to the field is preferred to direct seeding. There are two steps to transplanting: seedling production and setting plants into the field.

**Seedling production.** Seedlings can be grown in a seedbed, pulled and bare-root transplanted, or they can be container-grown in divided trays, lifted with the root ball intact and transplanted.

Use plastic seedling trays for growing containerized transplants. Seedling trays vary in sizes. For amaranth, trays with cells 3–4 cm wide and deep (size 100–128) are suitable. Fill the seedling tray with 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 hulls, vermiculite, and/or sand. We recommend a mixture of 66% peat moss and 34% coarse vermiculite. If you use non-sterile components, we suggest you sterilize your potting mixture by autoclaving or baking at 150°C for 2 hours. If seedlings are started in a raised soil bed, the soil should be partially sterilized by burning a 3–5 cm thick layer of rice straw or other dry organic matter on the bed. This also adds minor amounts of P and K to the soil, which helps establish the seedlings.

If using trays, sow two or three seeds per cell at 0.5–1.0 cm depth and thin to one seedling at the two to three true leaf stage similar to methods described in the section on direct seeding. If using seedbeds, broadcast the seeds lightly in a seedbed and cover 1 cm deep. Cover the seedbeds with an insect-proof net, or sow the seeds inside a greenhouse or screenhouse. This provides shade and protects seedlings from heavy rain and pests. Water the seedlings thoroughly every morning or



Fig. 2. Amaranth seedlings ready for transplanting

as needed (moist, but not wet), using a fine-mist sprinkler to avoid soil splash and plant damage.

If the seedlings have been grown in shade, harden them off by gradually exposing them to direct sunlight during the 4–5 days just prior to transplanting. On the first day, expose them to 3–4 hours of direct sunlight. Increase the duration until they receive full sun on the fourth day. Seedlings are ready for transplanting about 3 weeks after sowing or when transplants have five or six leaves (Fig. 2).

**Setting plants into the field.** Recommended spacing varies depending on variety and harvest method. Wider spacings are used for tall varieties with broad leaves and multiple harvests while narrower spacings are used for short varieties with narrow leaves and single harvest.

AVRDC recommends using raised beds that are 20–30 cm high with bed tops about 90 cm wide. Rows are spaced 10–15 cm apart with 5–10 cm between plants within row.

Transplant in the late afternoon or on a cloudy day to minimize transplant shock. Dig holes 10 cm deep on the bed using recommended spacings. Place each transplant in its hole and cover the roots with soil and lightly firm (Fig. 3). Irrigate immediately after transplanting to establish good root-to-soil contact. Transplanting can be done manually or by machine.



Fig. 3. Transplanted bed

### Fertilizing

Although amaranth is a low management crop and can grow in poor soils, yield is increased with fertilizer application. A combination of both inorganic and organic fertilizers improves yield and maintains soil fertility. The amount of fertilizer to apply

depends on soil fertility, soil type, fertilizer recovery rate, and soil organic matter. A soil test is highly recommended to determine the available N, P, and K. The amount of applied fertilizer can then be calculated based on your target yield and adjusted for residual nutrients.

Suggested fertilizer recommendations are shown in Table 1. Fertilizer recommendations depend heavily on local conditions, so consult your fertility management specialist or conduct your own fertilizer trials to determine optimal rates.

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

Nutrient	Preplant	Days after sowing/transplanting		
		10	20	30
Compost	10,000			
N	48	30	8	8
P <sub>2</sub> O <sub>5</sub>	64	8	8	0
K <sub>2</sub> O	48	15	8	0

### Irrigating

Although amaranth is relatively drought tolerant, insufficient water will reduce yield. Water should be applied especially just after sowing or transplanting to ensure a good stand. At AVRDC, fields are furrow-irrigated every 10 days during the cool-dry season, and weekly during the hot-dry season. As a rule, the plants should be irrigated if wilting occurs at noontime. During the rainy season, drainage is essential for plant survival and growth. Raised beds, clean furrows and large drainage canals facilitate quick drainage of excess water after heavy rain.

Another way to gauge soil moisture content is to take a handful of soil from the bottom of a 15-cm-deep hole. Squeeze the soil. If it holds together when you release your grip, there is sufficient soil moisture; if the soil crumbles, it's time to irrigate. Irrigate thoroughly to maintain vigorous plant growth.

Avoid over-irrigation, which may enhance disease development and nutrient leaching. Drip irrigation or micro-sprinkler irrigation is recommended in areas with limited water supply. If sprinkler irrigation must be used, avoid late evening irrigation to prevent diseases.

## Controlling weeds

Weeds compete for light, water, and nutrients, thereby resulting in reduced yield. Weeds may be controlled using a combination of methods. Choose the most appropriate method(s) for your location.

Thorough land preparation is the first key to effective weed control. Amaranth is small-seeded and slow to germinate, therefore, weed control is essential early in the season. A seedbed free of weed seeds allows amaranth seedlings to get a head start on the weeds and establish a canopy that can shade out emerging weed seedlings.

Mulching is recommended to reduce weed competition, soil compaction and erosion; mulching also conserves soil moisture. Be sure the organic mulching materials are free of weed seeds. Mulching is easier to apply if the amaranth crop is transplanted, but can also be used for row-seeded crops after the seedlings reach a height of 10–15 cm.

If mulch is not available or does not provide adequate weed control, several herbicides are available, such as Lasso (alachlor 4EC), Amex (butralin 4EC), Devrinol (napropamide 2E or 10G), and Dual (metolachlor 8E or 25G). Before using a herbicide, check that it is recommended for amaranth and follow the instructions carefully on the label. Hand or hoe weeding can be performed as needed.

## Controlling insect pests and diseases

Insect pests and diseases must be controlled to ensure good yield and marketable quality. Amaranth is susceptible to damage by foliar insects such as leafminers (Fig. 4), leafrollers, cutworms, aphids, flea beetles, and mites. An effective method of controlling insect pests is to cover the bed with a fine screen or nylon mesh netting (32-mesh or finer).



Fig. 4. Leafminer damage

Chemical pesticides should be used mainly as a corrective measure. Choose a pesticide that targets the specific insect that is causing the damage, and try to avoid pesticides that kill or inhibit the development of beneficial organisms. Choose pesticides that have short persistence, i.e., the effects last only a few days. Pesticides should be applied in the evening, and workers should not be allowed into the field until the recommended waiting period (usually 12 to 24 hours) has passed. Wear protective clothing and follow instructions in the label when applying pesticides.

## Harvesting

Amaranths are ready for harvest in 20–45 days after planting or sowing depending on variety and plant type (Fig. 5). Plants may be harvested once or several times.

Once-over harvesting is adapted for short maturing and quick growing varieties such as *A. tricolor*. Whole plants are pulled from soil with roots, washed and tied in bundles.

With multiple harvests, young leaves and tender shoots are picked at 2–3 week intervals. Eventually, the plants begin to flower and develop fewer leaves. Frequent harvesting of leaves and shoots delays the onset of flowering and thus prolongs the harvest period.

Amaranth and other leafy vegetables have large surface-to-volume ratio and lose water rapidly. To reduce water loss, harvest during the cooler time of day, such as early morning or late afternoon. ☞



Fig. 5. Amaranth ready for harvesting

For the latest information on vegetable production and research, go to the AVRDC website at <[www.avrdc.org](http://www.avrdc.org)>.