to take a handful of soil from the bottom of a 15-cm hole. Squeeze the soil. If it holds together when you release your grip, there is sufficient soil moisture; if the soil crumbles, it is 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 (AVRDC 2003).

6. Common Pests & Diseases and their control

The most important task is to prevent an occurrence of pests and diseases in the first place rather than having to react to them. In fact, once a pest or disease establishes itself on your crops there is often very little you can do to control it effectively. Protecting your plants from pests and diseases begins long before the crops are sown or planted in your garden. Key to healthy vegetables is;

Organic Control

The following are key in organic control of pests and diseases;
Soil fertility, Biodiversity, Hygiene, Good seeds, Healthy transplants, right plant at the right place, resistant varieties, proper timing of sowing, breaking the cycle, adjusting the spacing.

Organic management

- *Mechanical control* – netting, collars, traps, handpicking
- *Biological control* – this includes using creatures that feed on the pests e.g. Frogs – feed on slugs
- *Chemical* – ash and pepper sprays are effective organic disease management techniques.

7. Harvesting and Post-Harvest Management

First harvest is at a plant height of 30 cm, about 6 weeks after transplanting. Plants may be harvested at once or leaves and tender shoots maybe harvested several times. One single 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 to 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 a large surface and loose water rapidly. To reduce water loss, harvest during the cooler time of day, such as early morning or late afternoon.

8. Nutrition and Cooking

Leaf and tender stems are rich in vitamins A, C, E, B2, folic acid, calcium, iron and protein. They can be eaten boiled, steamed, stir-fried, as soup, stewed or pureed.

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EOA ECOLOGICAL ORGANIC AGRICULTURE

A Collaborative Work of BvAT and The Ecological Organic Agriculture Initiative

BvAT Practical Guide

Amaranth Growing Guide

Botanical name: *Amaranthus Spp.*

Common names: Amaranthus, pigweed
Mchicha (Swahili), *Terere* (Kikuyu), *Lidodo* (Luhya), *Ododo* (Luo), *Kelichot* (Kipsigis), *W'oa* (Kamba), *Emboga* (Kisii), *Kichanya* (Taita)

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1. Description

Amaranth is an herbaceous annual belonging to the family Amaranthaceae with green or red leaves and branched flower stalks (heads) bearing small seeds, variable in colour from cream to gold and pink to shiny black. There are about 60 species of Amaranthus, however, only a limited number are of the cultivated types, while most are considered weedy species and hence rarely preserved. Many amaranth species are collected from the wild for subsistence, while only few are cultivated or occur as protected weeds in backyards and home gardens (Stallknecht and Schulz-Schaeffer, 1993; Ouma; Biovision TTU, ICIPE: Keller, 2004). The flowers are used to produce the grain, while the leaves are used as a green leafy vegetable..

2. Benefits of Amaranth

A. Uses

- Amaranth can be used as a high-protein grain when the seeds are eaten as a cereal or as a leafy vegetable.
- The seeds can also be ground into flour, popped like popcorn or cooked into porridge.
- The leaves are cooked alone or combined with other local vegetables such as spider plant, cowpea, nightshade and pumpkin leaves.
- The leaves are rich in calcium, iron and vitamins A, B and C, but are fairly low in carbohydrates.

B. Health benefits of amaranth include:

- It improves digestion due to its high dietary fibre content.
- Juice from the leaves is used to treat diarrhoea and haemorrhage conditions.
- It is gluten-free and therefore suitable for people who are gluten intolerant.
- Vitamin A in the leaves improves vision.
- Both leaves and grain have high quality protein.
- It reduces bad cholesterol and lowers heart diseases.
- Has antioxidants which fight harmful radicals hence prevent cancer.
- It lowers blood sugar levels and is thus good for diabetics.
- It prevents anaemia due to high levels of iron.
- It prevents hair loss and premature greying.

3. Climatic, Soil and Water Requirements

Amaranth grows rapidly under hot-wet and full sunlight conditions, with few pest and disease problems. The optimum temperature is 20- 30°C for germination and 25-35°C for growth. It adapts to different kinds of soil conditions and tolerates heat and drought, but not cool temperatures.

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4. Propagation and planting

Amaranth requires thorough land preparation and a well-prepared bed for good growth. Prepare 20 cm high beds during the dry season and 30 cm during the wet season using a plough. The distance between centres of adjacent furrows should be about 150 cm with a 90-cm bed top. Amaranth is planted either by direct seeding or transplanting. The choice of planting method depends on availability of seed and labour and may also vary with the growing season. Direct seeding is appropriate when plenty of seed is available, labour 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 labour, and during the wet season when heavy rains and flooding are most likely to wash out seeds. Raising seedlings in a nursery and transplanting them to the field shorten the crop duration in the field, and secure a better and more uniform stand especially during the wet season.

Planting via direct seeding

When direct seeding is used, seeds are either broadcasted or sown in rows. Broadcast seeds uniformly at the rate of 0.5 to 1.0 g/m2 of bed. Since amaranth seeds are very small, mixing seeds with sand at a ratio of 1 g seed to 100 g sand makes it easier to sow the seed and to 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 to1.0 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. (AVRDC 2003)

Planting via transplanting

There are two steps to transplanting:

i. Seedling production

Seedlings are grown in a seedbed, pulled and bare-root transplanted. They can also be grown in divided trays, lifted with the root ball intact and transplanted. 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 phosphorus (P) and potassium (K) to the soil, which helps in the establishment of the seedlings. Broadcast the seeds lightly in a seedbed and cover them with soil. The seeds should be one 1cm deep. Cover the seedbeds with an insect-proof net to protect seedlings from pests.

ii. Setting plants into the field

Transplant in the late afternoon or on a cloudy day to minimize transplant shock. Dig holes 10 cm deep on the bed using recommended spacing for the chosen variety. Place each transplant in its hole and cover the roots with soil and lightly firm. Irrigate immediately after transplanting to establish good root-to-soil contact.

5. Husbandry

Amaranth is a low management crop and can grow in poor soils, but it will benefit from application of organic fertilizer resulting in higher yield. 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. As a rule, the plants should be irrigated if wilting occurs at noon. Another way to estimate soil moisture content is