

Crop Protocol

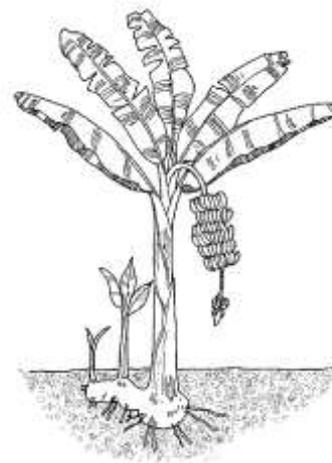
Perennial Crops

Bananas and Moringa

Why grow bananas and Moringa?

Bananas:

Bananas are commonly grown in East Africa as they are very easy to grow. They are a perennial crop which can continue to harvest for many years, providing it is carefully managed.



To maintain good yield, it is important to allow only three stems per mat to develop. The other suckers should be carefully removed and chopped for composting

Fig 1: bananas growth cycle

The two types of banana grown in the Nutrition garden are matoke (cooking) bananas and dessert (sweet) bananas which are eaten raw. Care needs to be taken not to over-eat bananas due to the amount of sugar in the fruit which may contribute to Type 2 diabetes. The Nutrition Garden Cook Book explains how much should be eaten per week and the recipes needed.



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Moringa:

Moringa is a Nutrition Super-Food (see Table 2) and only 10 grams of leaf powder per day contribute to high levels of protein, vitamin A, vitamin C, iron, calcium and selenium

Nutrition from Bananas

	sugar	Vit A	Vit C	Vit B6	folate
Matoke	70	18	18	12	5
Sweet banana	60	1	15	18	6

Table 1: % RDI from 100 grams of bananas

Nutrition from Moringa

:

	Protein	Vit A	Vit C	Iron	calcium	selenium
Moringa (dehydrated leaf powder)	39	489	27	252	180	90

Table 2: % RDI from 10 grams (ten grams) of Moringa leaf powder

Planting Programmes

Bananas and Moringa are trees, so are considered a perennial crop, for which rotation is less important as it may only occur every ten years when the crop could be replanted.

The number of trees to be planted will depend on the number of people to be fed from the Nutrition Garden.

A general guide for a small Nutrition Garden for fifty people who will eat 100 grams of sweet banana and 100 grams of matoke banana, twice a week – will be to plant at least 20 trees each of matoke and sweet banana.

There is less experience in East Africa on the area of land needed for the Moringa coppice to produce Moringa leaf powder. However the following guidelines are based on experience in West Africa where use of Moringa is very widespread.

Assuming 600 grams of moringa leaf powder can be produced over 12 months per meter square of coppiced Moringa (at 50 plants per meter square) – and a use rate of 5 grams per day per person – one person would need 3 meter square of coppice Moringa to last one year.

How to grow Moringa

Moringa oleifera is present naturally in Kenya and East Africa but little commercialization of its nutritional value has been exploited.

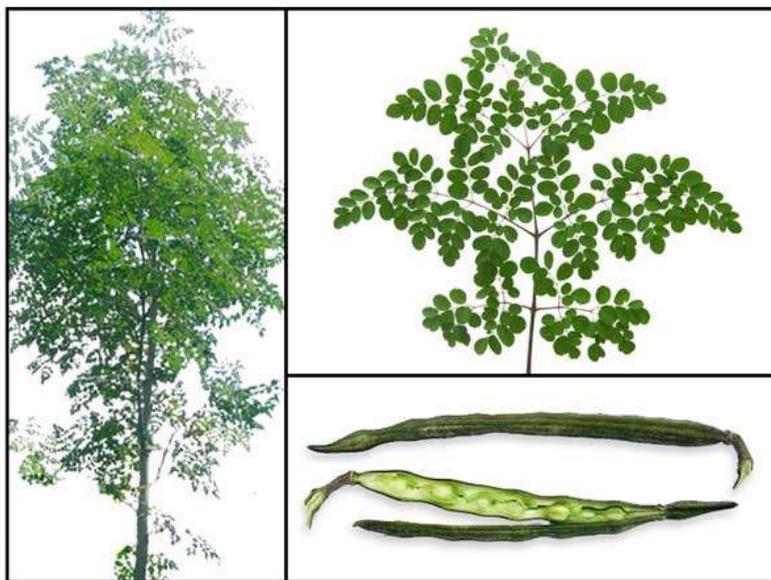


Fig 2: Moringa tree, leaf and bean

It is a drought tolerant crop, capable of being grown as a tree in semi-arid lands (as a wind break or shade tree with added value).

It can be eaten by animals as well as humans. As a coppiced crop, it is best grown where water is not a limiting factor, with drip irrigation.

Real Impact has set up a tree seedling nursery and seed supply to promote the planting of Moringa in Kenya.



Fig 3: Moringa trees being grown as a shade tree with beans

Planting and growing Moringa

Moringa oleifera is a fast-growing tree grown throughout the tropics and sub-tropics. Moringa grows best at temperatures between 25-35°C.

It is fairly drought tolerant but grows best with annual rainfall of 250-1500mm, but does not tolerate prolonged flooding or poor drainage.

Moringa prefers:

- altitudes below 600m but can survive at 1200m in the tropics;
- well-drained sandy-loam or loam with a pH of 5.0-9.0;

It can be propagated by seeds or cuttings.

Moringa is a versatile plant that can be grown as a tree or as a “perennial-vegetable” under intensive cultivation. Moringa trees can grow up to 4m a year reaching a height of 15m and can live for approximately 20 years.

Regular pruning or trimming is recommended to encourage branching and leaf production. Under intensive cultivation, Moringa is direct-seeded or transplanted at close spacings into a fertile garden bed and then regularly trimmed. This intensive method produces the maximum quantity of leaves possible in a small plot.

Studies in Nicaragua determined that optimum spacing for maximum production in intensive plots was 10cm x 10cm (100 plants per meter square). The proposed Nutrition Garden pilot will grow the plants at half this density (50 plants per meter square) and experiment with higher planting densities, once the technology is better understood.

Disadvantages of this method are that it does not allow for seed production and it requires increased maintenance for irrigation, fertilization, and pest control. Extra trees should be planted nearby solely for seed production to expand the area under coppice at a later date.

Making Moringa powder

Leaf harvest

Moringa leaves can be harvested at any time once trees are established. For leaf harvest in intensive production plots, plants are trimmed to 15-50 cm above the ground.



Fig 4: Moringa coppice being harvested in West Africa

Intensive plots can be trimmed up to 9 times per year. For leaf harvest in trees, cut the entire tree back to a height of 1-2m; this is best done during the rainy season so that the tree is able to recover before the dry season.

Other methods of leaf harvest for trees include: trimming selected branches (leaving some branches for the next harvest or seed production); trimming each branch back by half; and picking a few leaves off of each branch.



Fig 5: harvested Moringa coppice stems

Once leaves are harvested, they should be stripped off the stems. During this procedure any damaged or discoloured leaves can be set aside for animal feed or compost. Stems and branches can also be used as animal feed or in compost.

Leaves are then rinsed in clean water or a very weak bleach solution (1:100) to remove dirt and germs.

Drying leaves

Leaves should be dried in an area protected from light to prevent the loss of vitamins and protected from dust and pests to prevent contamination. If necessary, leaves can be covered by a thin cloth or mosquito netting to help keep them clean while drying.



Fig 6: Moringa leaf drying room

The drying process should be completed as quickly as possible to prevent the growth of moulds; if leaves mould or mildew they should be thrown out or used for compost.



Fig 7: Moringa leaf drying shelves

If the humidity of the air is high, leaves should be spread out in a thin layer and mixed frequently; dehydrators, ovens, driers or fans may be required in cases of extreme humidity. When leaves become brittle and crush easily, they are dry.



Fig 8: Stacks of leaf drying shelves in processing factory West Africa

Methods of drying

- spread cleaned leaves on a cloth inside the house or other protected structure
- spread cleaned leaves in hanging trays made with mosquito netting
- hang leaf bunches from roof or porch with string (similar to tobacco drying; for this method, the leaves are left on the stems).

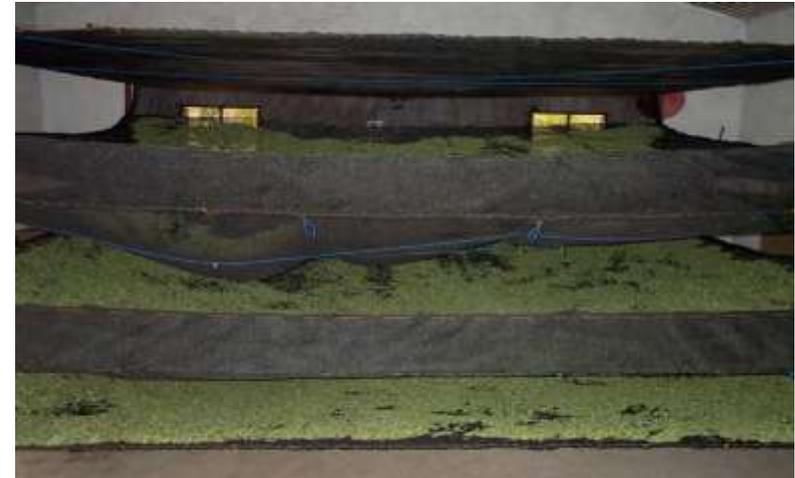


Fig 9: leaves drying on shelves made of shade net

Grinding Leaves

Dried leaves can be made into powder using a mortar & pestle, local grain grinders, burr mills (hand crank or motor driven), or simply by rubbing the dried leaves against a fine screen.



Fig 10: Moringa leaf powder

Once the dried leaves have been transformed into a powder, the powder is sifted to remove any remaining stems.



Fig 11: Moringa leaves in milling machine

Storing Moringa leaf powder

Moringa Leaf Powder should be stored in air-tight containers protected from heat, humidity and light. If the powder is not adequately dried or stored it could encourage the growth of moulds or mildews which could cause problems ranging from unpleasant to harmful.

If stored powder is exposed to heat or light it will degrade and the nutrient content will be reduced.

Moringa Leaf Powder can be stored for up to a year under the following conditions: clean, dried powder stored in air-tight containers, protected from light and humidity, and kept below 24°C.



Fig 12: Moringa being packed

Using Moringa leaf powder

Moringa Leaf Powder can be added to any food or beverage and it will increase the vitamin, mineral and protein content. For healthy individuals, a few spoonfuls of Moringa Leaf Powder can be added to any meal to make it more nutritious. Since the nutrient content of Moringa Leaf Powder decreases if exposed to heat, add the powder after the food or drink has been prepared, just before serving.

Moringa Leaf Powder has the greatest impact on those who are more vulnerable: malnourished children, pregnant or lactating women, children at weaning age, HIV/AIDS patients, and the elderly. Malnourished children ages 1-3 years should consume three rounded tablespoons (25g) of Moringa Leaf Powder each day. Pregnant or lactating women should consume six rounded tablespoons (50g) of Moringa Leaf Powder each day.

Moringa bean

Moringa is also grown for its edible nutritious pods. These long beans can only be harvested from mature trees, not from coppices.



Fig 13: Harvested Moringa pods in Indian store house

Water purification with Moringa seeds

Dirty water can be purified by crushing Moringa seeds and adding these to the water. The seeds release a substance which acts as a natural coagulant, pulling substances out of the water.

One crushed moringa seed kernel can treat 1 litre of water. The seed powder, added to the water and stirred for 5 to 10 minutes, functions both as a coagulant (binding to impurities) and as an antimicrobial agent.

Once the seed powder and impurities have settled to the bottom of a container, the clean water can be poured off. Moringa treatment—using

either *M. oleifera* or *M. stenopetala*—removes up to or more than 90% of impurities, including bacteria, but moringa-treated water should be treated further to make it completely safe from all pathogens.

A simple follow-up treatment, involves filling transparent plastic bottles with clear water and exposing them to sunlight for two to six hours. The ultraviolet rays from the sun destroy harmful microorganisms.



Fig 14: Clean water produced using Moringa treatment

MORINGA PEST and DISEASES

There are few serious pests and diseases of Moringa. More will be known about the potential pests and diseases once it is more widely cultivated.

How to grow bananas

Site selection

- Well drained site with plenty of sunlight
- Not previously cropped with bananas

Preparation of planting hole

- Dig a hole of 50cm width and a depth of 50 cm.
- Add at least 20 litres of ready- made 'pile compost' to the planting hole and a debe of dry cow/sheep or goat manure. Add 200 grams of DAP to the planting hole.

Planting material

- Use tissue cultured banana plants when starting off a new plantation to avoid bringing in banana diseases to the plantation.



Fig 15: Tissue cultured bananas in lab (left) and weaned in nursery (right)

De-sucker plants

It is important to de-sucker mother plants as they grow, so that only three stems are present in each 'mat'. This will help to maintain the yield of the plant and ensure large bunch sizes, by reducing competition.

Plant supports

Make sure that the stem is supported with a wooden pole when the bunch begins to mature. Otherwise the weight of the bunch can break the stem before the bunch has matured and the harvest will be lost

Harvest

The first flower may appear within 9 months of planting and will be mature 12 weeks later.

Remove the main flower/bud 3-4 days after the first appearance of the last hand. This is a sterile, male flower called the "banana heart". This helps to reduce the spread of Xanthomonas bacterial wilt.

MAIN BANANAS PESTS

Banana weevil lays eggs near the stems which hatch into larvae that tunnel into the stem and may lead to death of the plant. Cut out and destroy infected stems



Fig 16 : Banana weevil damage (left) larvae in stem (middle) adult (right)

MAIN BANANAS DISEASES

Bananas suffer from Sigatoka disease and Panama wilt (Fusarium). Planting tissue cultured plants and using Good Agricultural Practice can reduce the impact of these diseases.

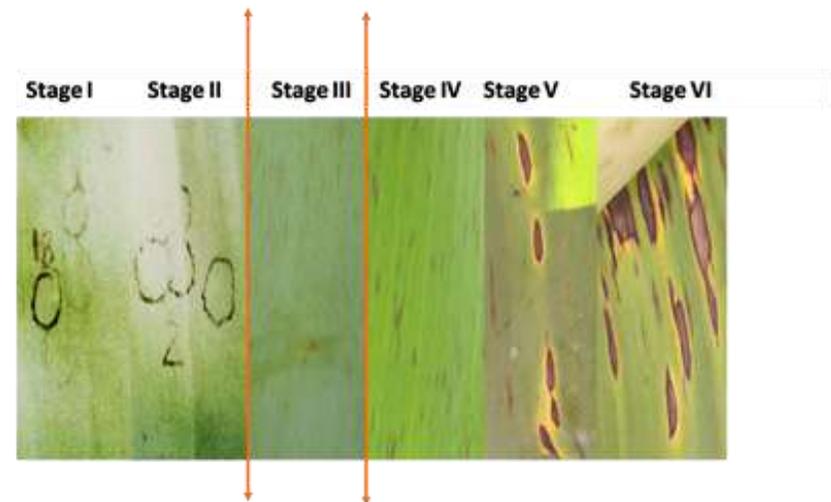


Fig 17 : Sigatoka Disease



Fig 18: Panama Wilt

Uwezo

Syngenta make a series of good quality, reliable pesticides in pack sizes suitable for small-scale farmers – the series is called UWEZO. Uwezo is stocked by most agrovets in Kenya. The pack sizes are sufficient to use in one 15 litre spray tank.

Check the Labels and use the product specific to the pest present. Do not spray if the pest levels are not high. Observe all health and safety instruction and leave the recommended number of days after spraying before picking any produce