



Mango Production Guide



Researching Soils, Crops and
Water in Zambia



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Foreword



Zambia has the potential to produce sufficient food for its citizens and for export.

In order to ensure that good agricultural practices are employed by farmers, crop specific production information should be made available to them.

Due to technological advances and the changing environmental and socio-economic conditions it became necessary to revise the first edition of the Mango Production Guide, which was published in 2002. This revised edition of the Mango Production Guide is meant to provide farmers and other stakeholders crop specific information in order to promote good agricultural practices and enhance productivity and production..

The information contained in this booklet has been generated over a number of years of research and is appropriate for all categories of farmers. The information is meant for extension officers, agricultural training institutions and other development partners.

It is my sincere hope that this information will go a long way in stimulating Mango production in Zambia.

The Zambia Agriculture Research Institute (ZARI) is committed to alleviating poverty and enhancing food security by contributing to increased and sustainable food production.

A handwritten signature in blue ink, consisting of stylized initials and a surname, likely 'M. Mwale'.

M. Mwale
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Acknowledgements

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1.0 Introduction

Mango (*Mangifera indica* L.) is a popular and important fruit tree in Zambia. The mango fruit is popular for its pleasant taste and , has high nutritive value such as vitamins A and C. Although native to south eastern Asia , Mango is widely grown in Zambia. Mangoes are grown throughout the country although the concentration is found in in Northern, Western and Eastern provinces. They normally grow under minimal management at small scale level around homesteads. However, it is important to note that Mangoes are widely adapted and can grow well throughout the country.



Mango tree in season

2. Climatic and Soil Requirements

2.1 Climate

Mangoes require a warm to hot climate with a definite dry period in the year. The optimum temperatures vary from 25°C to 30°C. It is also important to note that mangoes are very sensitive to frost and in cases where there is frost occurrence, the fruits can be severely damaged. High humidity increases incidences of fungal infections.

2.2 Soil Types

Although Mangoes are adapted to grow in wide range of soil types, a deep well drained light sandy soil is most ideal for mango production. However, for commercial production the poorer, shallow soils are better. On these soils the trees stay smaller and

more manageable. On rich deep loam soils, the trees will grow vegetatively but will be deficient in flowering and fruiting. Mango perform well in sandy soils.

3. Recommended Varieties

There are several varieties of mangoes grown in Zambia. These include both unimproved local varieties and introduced improved types. In general, these are grouped into fibreless and fibre fruits. Commonly available varieties grown in the country are given in the table below;

Variety name	Fruit Category (Fibreless or Fibre)	Other Characteristics
Kent	Fibreless	Introduced, improved and commercially recommended. Usually propagated by grafting
Zill	Fibreless	Introduced, improved and commercially recommended. Usually propagated by grafting
Tommy Atkins	Fibreless	Introduced, improved and commercially recommended. Usually propagated by grafting. Purplish colour, tastier, fungus resistant fruit.
Alphonse	Fibreless	Introduced, improved and commercially recommended. Usually propagated by grafting
Singapore	Fibreless	Introduced, improved and commercially recommended. Usually propagated by grafting
Nblea	Fibre	Unimproved local types. Polyembryonic. Small and kidney shaped fruit
Peach	Fibre	Unimproved local types. Polyembryonic. Large fruited, smooth and tough skin, yellow/orange coloured, peach flavour
Saber	Fibre	Unimproved local types. Polyembryonic. Large and light green fruit.

4. Recommended Management Practices

4.1 Land Preparation

The orchard performance and profitability to a greater extent depend on the selection of planting sites. In selecting the site, factors like soil type, soil depth, soil fertility, drainage and water table must be carefully considered.

The process of land preparation should start with felling and clearing trees followed by a rough levelling of the field. Care

should be taken not to disturb the top soil. The degree to which the land must be cleared and levelled depends on the type of irrigation system that is going to be adopted in the orchard.

Management system for a commercial orchard begins with the selection of orchard site and the choice of variety or varieties to be planted in the orchard and extends upto day to day activities performed on trees in the established orchard.

One of the most important things of tree management is the selection of the right variety which is compatible with the growing environment. If a grower is interested in new varieties , especially exotic varieties which have good market demands, it is advisable to analyse the growing environment of those varieties with that of the local environment where the orchard is going to be established. Since mango is very sensitive to environment, particularly to air temperature, temperature profiles may be helpful to decide the appropriateness of such varieties.

4.2 Planting

Planting should be done when the growth flushes in the plants have hardened. Leaves should be cut to half its size to minimize the rate of transpiration (water loss) and to reduce transplanting shock. It is better to establish plants in the orchard after heavy rains are over. In the event that mangoes are to be grown under irrigation planting may be done any time of the year. It is advisable to paint the stems of plants with a white water-based paint to protect plant stems from direct sunlight and heat.

Plant spacing may be adjusted depending on soil type, variety and management systems to be adopted. For most varieties in Zambia a spacing of either 7 x 10 meters or 10 x 10 meters is recommended. If the soils are sandy or tree dwarfing methods such as regular pruning or use of chemical growth retardants are to be used, high density planting may be done with narrower spacing. However, it is advisable to use inter-row spacing of 10 meters as this make it easier for orchard management practices when trees grow bigger.

Planting designs such as rectangular or triangular may be used. However, rectangular planting designs are commonly used in commercial orchards. Planting holes are made about 2 - 3 months prior to planting and filled with topsoil, compost and basal fertilizer mixture and heap up to allow the soils to establish. Planting holes should be square shaped. In deep soils, the recommended hole dimensions are 60 x 60 x 60 cm while in shallow soils 90 x 90 x 90 cm holes are recommended. By the time of transplanting, soils must have well settled in heaped planting holes. For grafted mangoes, planting should be carried out in such a way that the stock-scion union never touches the ground at all.

Selection of true to type, healthy and vigorous planting materials is important to ensure successful establishment of the orchard. Planting materials should be sourced from a recognised and registered nursery to guarantee the authenticity of the variety and hygiene of plants. Where a grower is raising own planting materials, a recommended procedure should be adhered to. In case of grafted mangoes care must be taken to obtain bud-wood from a reliable source.

4.3 Irrigation

Water requirements of mango depend on many factors such as soil type, soil depth, rain fall patterns of the region where orchard is established, plant density, variety , tree size and tree age etc. All these factors must be taken into account in designing the irrigation systems.

Mangoes require consistent soil moisture if they are to produce high quality fruit and so should be watered regularly. After planting, it is important to water the plants every day or every two for five weeks, so that the root ball does not dry out. Later, 6 weeks after planting, the frequency of watering can be reduced to once every week to two weeks in the winter. After the plants are well established, the tree becomes less sensitive to moisture stress.

For mango orchards, flood, basin, furrow or under tree sprinkler irrigation systems are commonly used. The principal objective in irrigation is to apply the required amount of water per tree at right time. This quantity of water should be evenly applied around the root zone which is considered to extend 1 - 1.5 m beyond the canopy drip line to a depth of about one to one and a half meters in well grown trees. Irrigation systems should be designed at a capacity to provide the maximum water requirement during peak water demand periods with in the life span of the irrigation system.

4.4 Fertilizer Use

Manures and fertilizers may be applied before flowering and after harvesting but not during flowering. Fertilizers are applied 45 to 90 cm away from the trunk up to the peripheral leaf drop and incorporated. Fertiliser should be applied when the soil is moist to avoid plant injury and death which may occur when the soil is dry. Young plants are also damaged by excessive fertilisation.

Apply fertiliser once per month for young trees, three to four times a year for large trees. Amounts to be applied will vary depending on tree size. To determine the right amounts of fertiliser to be applied, soil testing should be done.

5. Crop Protection

Mango is susceptible to a number of insect pests and diseases that reduce the yield and quality of the produce. There are measures that can be taken to minimize the damage.

5.1 Major Diseases and Control Measures

Some of the common diseases that affect mangoes are Powdery mildew, Scab and Anthracnose.

Powdery mildew (*Oidium mangiferae*)

The disease mainly affects the inflorescence and causes the young fruits to drop. The commonest sign is an appearance of whitish powder on plant parts. Diffuse mats of white mycelium commonly develop on the lower leaf surfaces especially in areas adjacent to the leaf veins and occasionally on the upper surfaces of leaves. Initially, infected areas become light green and chlorotic and lesions may be surrounded by dark green margins. Conidia on the mycelial mat may give it a distinctive powdery appearance.

Control Measures

Control measures generally involve application of an appropriate wettable fungicide to control the disease.

Bacterial Black Spot (*Xanthomonas campestris*)

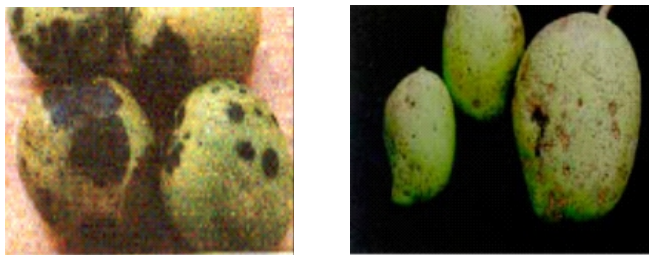
The symptoms appear as angular water-soaked spots which are delimited by veins. These may merge becoming black, slightly raised and exuding gum under humid conditions. Older lesions turn light grey, dry out and crack.

Control Measures

- Orchard sanitation by way of removal of infected materials
- Application with an appropriate fungicide is recommended.

Anthracnose (*Colletotrichum mangiferae*)

The initial symptoms on leaves are small, dark brown spots that may coalesce to form irregular lesions. The centers of old lesions may dry and fall out giving the leaf a perforated or tattered appearance. Anthracnose lesions are not raised or as black and angular as those caused by bacterial black spot. In extreme cases, anthracnose can cause twig die-back.



Mango fruit attacked by Anthracnose disease

Control Measures

Spraying with appropriate systemic and non-systemic fungicides is recommended.

5.2 Major Pests and Control Measure

Some of the common pests that affect mangoes in Zambia and their control measures are given below.

Mango weevil

Mango weevil usually attack fruits. When this pest attacks a Mango fruit, small puncture spots appear on the ripe fruits. When cut open, whitish creases will be noticed and the adult beetle may be found in the seed. The affected fruits will usually rot and the weevil will emerge once the fruit is ripe. The mango weevil is similar to the one that attacks maize.



Mango weevil

Control Measures

Appropriate insecticides should be used to control this insect pest.

Mealy bugs (*Drosicha mangiferae*)

The insect pest is widespread in Zambia although levels of infestation are low and not of economic importance. The nymphs suck the sap from tender shoots and inflorescence which causes them to wither and dry up causing the young fruits to fall easily.



Mealy bug

Control Measures

If infestations become severe, recommended insecticides may be applied.

Fruit fly

The female adult fly will lay eggs under the surface of the fruit skin. The eggs hatch into maggots which is the destructive stage by causing the affected area to become marshy and to rot thereby reducing the quality of the fruit.

Control Measures

The control measures include field sanitation by removal of affected fallen fruits, use of pheromone traps containing appropriate insecticide and also by spraying with recommended insecticides.

Termites

Termites on mango trees usually eat the cellulose, which is a fiber found in all plants and plant products such as paper, cardboard, fruits and wood. Termites attack the trunks, eating off the bark which results in reduced translocation of nutrients to the plant.

thereby resulting in retarded growth and possible death especially in young plants. Termite attack is more severe under extended dry conditions.

Control Measures

When the infestation is severe, recommended termiticides can be used. Other control measures include regular irrigation and keeping the orchard clean.

6. Harvesting

The mango fruits should be harvested at green mature stage. In case of Alphonso variety, the fruit is considered to be mature when the shoulder outgrow the stem and the external colour becomes light green with a yellowish red blush. In some mango cultivars, the harvest maturity reaches 12 weeks after fruit set, while in others it takes about 15 weeks.

The best way to observe maturity in mango is the colour of the pulp, which turns cream to light yellow on maturity and hardening of stone.

To harvest mango, fruits should be hand picked and the fruits should be harvested with a 1-2cm stem attached to it. Harvested mangoes should be placed in field containers of not more than 25 kg capacity for movement to the packing shed. The fruit should be kept in the shade and handled carefully.

7.0 Post Harvest Handling and Processing

Post-harvest handling of mangoes should ensure that the quality of fruits is maintained to meet consumer and market requirements.

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