



Banana 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 Banana Production Guide, which was published in 2002. This revised edition 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 Banana 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, appearing to be 'M. Mwale', written over a white background.

M. Mwale
Director
Zambia Agriculture Research Institute,
Ministry of Agriculture,
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Acknowledgements

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1.0 Introduction

Banana (*Musa spp.*) is one of the most important fruit crops in Zambia. Its production contributes significantly to food security and employment creation in both rural and urban areas. Banana cultivation thus contributes to the fight against poverty. The average yield of bananas for most small scale farmers in Zambia has been reported at 3,182Kg/ha. Although yield figures at commercial farms have not been reported these are likely to be in excess of 30,000 Kg/ha, with potential yields of improved varieties under good management going up to 60,000 Kg/ha annually. The low yields in bananas is due to a number of factors such as poor agronomic practices and diseases.

2.0 Climatic and Soil Requirements

2.1 Climate

To achieve better yields altitude of between 900 to 1600 metres above sea level with rainfall of 1000 mm to 1800 mm per annum are ideal.. The optimum temperature for banana growth is between 25.5° C and 30.5° C. Being a tropical/ subtropical crop, temperatures below 16.5° C result in stunted growth. Hence, banana cannot be grown in areas where temperatures are very low for longer periods of time as they are susceptible to frost damage.

2.2 Soil Types

Fertile, deep and well drained soils are suitable for banana production. Fertility of soil is very important for the successful cultivation of bananas since bananas are a heavy feeder. Soil depth should be 0.5-1m, rich in organic matter with pH range of 6.5-7.5.

Avoid soils that are salty, sandy, poorly drained and deficient in nutrients. Bananas do not tolerate water logging because roots are prone to rotting.

3.0 Recommended Varieties

The most commonly grown banana cultivars by farmers are local varieties and hybrids, which are the Cavendish types. It is important to note that the hybrids perform far much better than the local varieties. The local traditional varieties, produce low yields with small bunch and finger size. They are also much taller than their Cavendish hybrid counterparts. These are commonly grown in home gardens in many parts of the country. The commonly available commercial Cavendish hybrid varieties and their main attributes are given in the Table below:

Cultivar Name	Time to first fruiting (Months)	Potential Yield (bunch weight-kg)	Average Height (m)
William	11-13	31	3
GrandNain	11-13	31	2.5
Jaffa	11-13	33	3

4.0 Recommended Management Practices

4.1. Land Preparation

To grow a good banana plantation, it is important to choose a frost free site which is sheltered from strong winds or a workable slope. Banana plants are usually susceptible to blow out with strong winds.

Bananas grow best in fertile soils that are free of pests, diseases and competition from weeds. If the plantation is being established from

scratch the design of the roadways should aim to maximise the efficiency of the patch and reduce on soil erosion. Well-formed smooth roads will minimise fruit damage when being transported from the plantation to the shed.

When clearing the field all the patches that could harbour weeds, logs, stumps, and any other debris should be removed.

It is also important to take soil samples for a laboratory test and follow the recommendations. The soil should be of reasonable depth to allow development of a strong root system. When plantations are on shallow, stony soils it can result in blow overs during windy periods.

4.2. Planting

Choice of Planting Material

When establishing a new plantation it is important to commence with the best quality planting material available. Poor quality planting material has the risk of reducing the long term viability of a plantation. Diseases could be introduced in your plantation through contaminated planting material.



Potted banana planting material

The most preferred option of planting material is the tissue cultured plants. This is because they are normally disease free thus reducing risks of disease infestations of the plantation. The other choice of planting material is the conventional corm bits and suckers. It is usually advisable for farmers who opt for this type of planting material to establish a nursery block with tissue cultured plants and then harvest the corm or suckers 10 months later.

Sometimes corm bits and suckers can be obtained from a farmer's own plantation. This method is not recommended, especially for the establishment of commercial plantations as it puts a farmer at risk of spreading existing diseases and pests like Banana Bunchy Top Disease, Nematodes, Rust, Thrips and Weevil Borers. The corm bits and suckers may also be obtained from a neighbour's field. This is the least recommended source of planting material as there is an increased risk of introducing diseases from another field.

Tissue Cultured Suckers

Planting methods

The plant spacing in bananas will differ depending on the variety planted and the management practices. However, the range is from 2 m to 4m apart. For example for Gros Michel it is 3 x 3 m and 3 x 2.5 m for Cavendish types..

The recommended plant density is 1,600 plants/hectare. The number of suckers developing should be kept to a maximum of 1-3 per station, depending on planting distance and other practices.

4.3 Weed Control

Grass weeds can be suppressed by slashing every six weeks. Pre-emergence herbicides such as Atrazine, Diuron, Simazine at 1.5-3kg/ha and post emergence herbicides such as Paraquat (Gramoxone) at 4kg/ha can be used to control annual grasses, while perennial grasses can be controlled by Glyphosate or Dalapon. For broad leaved it is recommended to use 2, 4-D and non-volatile amine salts on older broad leaved plants.

4.4 Fertilizer Use

Banana plants need a large requirement of Nitrogen and Potassium. This is one reason why soil testing is very important before planting so as to know how fertile or lacking in these two nutrients the soil is. The amount of Nitrogen, Phosphorus and Potassium (N:P:K) and other trace elements required for achieving high yields will differ from location to location. In general, bananas in Zambia will need the following:

At planting apply 50g muriate of potash per hole and 50g single super phosphate.

For yearly applications it is recommended to apply 120gms ammonium nitrate per stool every month except June and July to avoid frost damage, 150gms D compound in January, March and September and 50gm single super phosphate every January.

In the case of manure, it is recommended to apply 7-10kg per stool per year.

For commercial production it is recommended to apply the following types and quantities given below:

- a) 25kg /ha of Mono-Ammonium Phosphate for the first 30 days.
- b) 1,050 kg of Poly Feed per hectare per year
- c) 2500kg of Potassium Nitrate (Multi K) per hectare per year
- d) 80 tonnes of chicken manure per hectare per year can also be applied.

4. 5. Irrigation

Water requirement of banana varies according to topography, soil, climate, cultivar and type of culture. Bananas are grown both as a rain-fed and as an irrigated crop. Wherever, the adequate rainfall is not available, banana growers should supplement it with irrigation. Proper water management is essential for obtaining good yields in commercial banana production.

It is always recommended to irrigate the plants immediately after planting. After that irrigate at weekly intervals. Irrigation through drip system will induce early bunch formation and about 40 - 45% of water can be saved. Drip system has to be operated daily for 2- 3 hours. Delay in irrigating results in delayed formation and maturity of the bunch thereby resulting in poor quality of fruit. .

5. Crop Protection

Banana 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

Major diseases of banana that are known to cause significant economic loss include Banana Bunchy Top Disease and Sigatoka. The adverse impact of these two diseases should be minimised through recommended control measures and use of resistant cultivars.

5.1.1 Banana Bunchy Top Disease (BBTD)

This is one of the most important diseases of banana, which has caused a lot of devastation to plantations. It is a viral disease spread

5.1.2 Sigatoka (*Pseudocercospora musae*)

Another important disease of banana that has been reported in Zambia is the Yellow Sigatoka. The symptoms of the disease are yellow brown streaks or spots parallel to the veins on upper surface and black on the undersides of leaves. The streaks start appearing on the 4 – 5 leaf stage.

Control Measures

The planting of tolerant or resistant varieties and removal and destruction of severely spotted leaves (trash) from the banana plantation is recommended. Severely diseased leaves can also be buried within the plantation or piled up together. Application of an appropriate fungicide is also recommended.

5.1.3 Cigar End Tip Rot (*Verticillium theobromae*)

One or all fingers on a bunch may be affected by this tip rot. The first symptoms are localized darkening and wrinkling of the peel at the tip. The darkened area is bordered by a black band and a narrow chlorotic region between infected and healthy tissues.

Control Measures

Frequent removal of dead flowers followed by bagging bunches with perforated polyethylene sleeves. Bracts and dead flower parts accumulate in the fruit bags and should be removed a few weeks after bagging

by the aphid *Pentalonia nigronervosa*. The symptoms of Banana Bunchy Top Disease may become visible at any stage of plant growth. The leaves of the apex of the plant become marginally chlorotic, narrower, dwarfed and upright, giving the top of the plant a bunched appearance. An infected plant may not produce a bunch or the bunch does not emerge from the pseudostem depending on the stage of infection. The initial symptoms of infection are less distinct but are very characteristic, showing development of dark green streaks on the petioles, midribs and leaf veins of the newly emerging leaves.



Banana Bunchy Top Disease

Control Measures

The following measures should be taken to control the disease:

- a) Select original planting material very carefully.
- b) Inspect nurseries and mature plantations regularly.
- c) Dig out infected plants and ensuring that no buds are left in the field as sources of inoculum.
- d) If the plantation is more than 50 % infected, destroy the plantation rather than re-planting in the same plantation.
- e) Keep the plantation weed-free as much as possible.
- f) Control the aphid vector with an appropriate aphicide or insecticide.

control measures include the use of less susceptible varieties and use of chemicals such as injecting the stem with Monocrotophos. In the case of severe attack Dimethoate, Methyl demeton, or Phosphamidon may be sprayed around the collar region. Additional measures that can be taken are soil incorporation at the time of planting with Carbofuran 3 G 10g, Phorate 10 G 5 g/plant, Lindane 1.3 D 20 g/plant, dipping the suckers in 0.1 per cent quinalphos emulsion before planting and application of castor cake at 250g or Carbaryl 50g dust or Phorate 10g per pit before planting to prevent infestation.

5.2.2 Banana aphid, (*Pentalonia nigronervosa* f. *typical*)

Apart from causing damage aphids are also vectors of bunchy top disease.

Typical symptoms of banana aphid damage include wavy and upward rolling of leaf margins and stunted plant growth.

Control Measures

Control of this pest may be achieved by use of following management practices:

- a) Maintaining a clean field
- b) Use healthy and pest free suckers
- c) Uprooting and destroying the diseased plants
- d) Spray Methyl demeton 25 EC 0.05% or monocrotophos 36 SL 0.072%. The spray should be directed towards the crown and pseudostem base up to ground level. Inject monocrotophos 36 SL 1ml/plant (1ml diluted in 4 ml of water). Avoid injection with monocrotophos after flowering.

Field sanitation is helpful in reducing the source of inoculum and subsequent cigar-end rot disease.

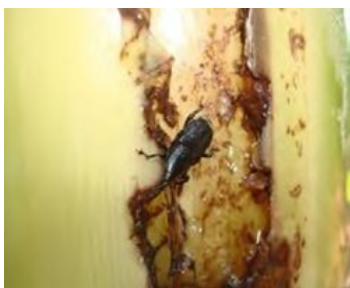
Application of an appropriate fungicide is recommended.

5.2 Major Insect Pests and Control Measures

There are also a number of pests that attack bananas in Zambia and these include borers such as the Rhizome weevil (*Cosmopolites sordidus*) and banana aphid (*Pentalonia nigronervosa*).

5.2.1 Rhizome weevil (*Cosmopolites sordidus*).

Typical symptoms of Rhizome weevil damage include boring of the grubs into the rhizome thereby causing death to the plant, presence of dark coloured tunnels in the rhizomes and withering of outer leaves.



Rhizome weevil on banana pseudostem

Control Measures

Control of this pest may also be achieved by using recommended cultural practices which include use of clean planting material, practising crop rotation and maintaining the plantation clean, including removing pseudo stems and trimming the rhizomes. Other

6.0 Harvesting

The banana bunch can be harvested when the fingers turn light green and the corners become rounded rather than angular. The pseudo stem should be cut back after the bunch is removed.

7.0 Post-Harvest Handling and Processing

The optimum conditions for ripening bananas are at temperatures of 20°C – 21°C and 90% relative humidity. As the fruit ripens, sugar content increases while starch content decreases. Green bananas can be stored for up to seven days at room temperature or up to 20 days under refrigeration. Neither green nor ripe bananas should be stored at temperatures lower than 14°C. Banana fruits will discolor and the flesh will become mealy at cooler temperatures.

Careful handling is important during and after harvesting, because bananas bruise easily. Bruising can be minimized by the use of plastic sleeves, padding, and limited handling. Three-quarters-mature bananas do not bruise as easily as fully mature fruit. The bunches are usually cut into individual hands and washed before boxing. Ethylene gas can be applied to bananas to start the ripening process and to assure evenness of ripening. Bananas also produce ethylene gas naturally. During the ripening process, temperatures should range from 14°C – 18°C, relative humidity should be controlled, and there should be adequate air circulation to ensure high quality fruit.

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