



# BANANA

## PRODUCTION MANUAL FOR SECONDARY SCHOOL LEAVERS & PUPILS



Developed by Ministry of Education, Sport, Arts and Culture  
with support from SNV Netherlands Development Organization



## **ACKNOWLEDGEMENTS**

The Ministry of Education, Sport, Arts and Culture wishes to acknowledge and thank the Provincial Education Director for Manicaland, the District Education Office in Mutasa District, SNV Netherlands Development Organization and the staff at St. Columbas Primary School, St. Peters Primary and Secondary Schools for their support, guidance and advice in producing the teaching and learning materials for bananas. Further, the expertise and work done by Marymount Teachers' College and Mutare Teachers' College need to be recognized, as well as the illustrations provided by the late Blessing Mukuze. Special mention should go to Local Capacity Builder, Gift Dzitiro for providing technical support in the compilation of this manual.

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# INTRODUCTION

This MODULE has been developed on the assumption that people in certain areas of Zimbabwe make a living on the farming of fruits such as bananas. The Nziramasanga Commission (1999) revealed that over 70% of the O-level candidates fail to obtain a full certificate and do not have relevant skills to provide for a reasonable livelihood. This suggests that their education was not always relevant.

The present O-level Agriculture syllabus on Crop Management provides learners with the option as quoted from (Zimsec 2003:62) "One crops from each of the groups A, B, and C should be selected for study. Group A: Legumes...; Group B: Roots and Tubers... and Group C: Other Cash crops: cotton, sunflower and sugarcane. Bananas as a cash crop are absent. O-level candidates in banana growing areas like Honde or Rusitu Valleys may be encouraged to opt to study such cash crops as sunflowers which are irrelevant to local conditions.

Moved with this plight, this MODULE hopes to fill a gap, by providing relevant education to learners in banana growing localities. This module could also be used as a stand-alone course for training people in banana growing areas.

# CHAPTER 1 – BOTANY AND GROWING CONDITIONS

## Botany

Bananas belong to the family Musaceae which also include plantains and is believed to have originated from the India and Malaysia region.

The banana plant bears the following botanical features:

### Roots

The root system is not well developed making protection from the wind is absolutely essential. No tap root exists and roots are found within the 30-50cm below the ground surface.

An underground corm is the true stem while the outside "stem" is a pseudo-stem, which is a bundle of leaf sheaths.

### Inflorescence

The inflorescence (flowering part of the plant) is only formed when there is a high rate of photosynthesis, therefore Nitrogen is required in abundance during plant growth to encourage maximum leaf development.

The inflorescence emerges as a large bud at the end of bundle of leaves that form the tip of the pseudo stem.

Bud has purple leaves called bracts. Underneath the bracts are a cluster of flowers.

### Fruit

The female flowers develop into tiny green banana (without fertilization and without seed)

Male flowers dry up and fall off, however the male bud remains at the end of the bunch stalk.

Banana fruit develops without production of viable seed from ovaries of female flowers.

Fruit grow in hanging clusters, with up to 10 banana fingers to a tier (called a hand). The assemblage of hanging clusters is known as a bunch, comprising 3 – 20 tiers.

Each bunch can weigh up to 30 – 50kg.

## Food value of a banana fruit

Ripe bananas contain many nourishing ingredients. High carbohydrates makes good energy source for athletes. Has an energy value of 371kJ (89 Pascal)

Bananas are usually consumed as a fresh fruit or dessert. The banana fruit and plant also have other uses:

- Fruit can also be used in yoghurt and fruit salad
- Pseudo-stem can be used in paper making
- Pseudo-stem can also be used in textile production

## **Growing conditions**

For bananas to grow well they need the following:

- High rainfall or a good supply of water all year round.
- Bananas and plantains are today grown in every humid tropical region and constitute the 4th largest fruit crop of the world. The plant needs 10 - 15 months of frost-free conditions to produce a flower stalk. All but the hardiest varieties stop growing when the temperature drops below 25°C. Growth of the plant begins to slow down at temperatures above 38°C and stop entirely when the temperature reaches 47° C. Optimum temperatures are between 25-30°C
- Too high temperatures and bright sunlight will scorch leaves and fruit, although bananas grow best in full sun. Freezing temperatures will kill the foliage.
- Fertile, deep and well-drained soils are required for banana growth. Poorly drained soils will cause the plant roots to die, which will therefore affect growth.
- optimum soil pH: 5, 5 to 6, 5.

In Zimbabwe, bananas are usually grown and do well in low-lying areas such as Zambezi, Burma, Shamva, Rusitu and Honde valleys.

## CHAPTER 2 – SITING A BANANA PLANTATION AND LAND PREPARATION

### Choosing a Site

When choosing a piece of land to grow bananas make sure all the conditions listed in the previous chapter are present. In addition:

- The land must be flat or a gentle slope. The risk of erosion is increased if the slope becomes too steep. With erosion comes poor anchorage of the plant making it more likely to fall over.
- The land must be close to an all-year-round water source such as stream, river, water canal, borehole etc. This is so because bananas require adequate water supply throughout the year.
- The chosen land must than be protected from strong wind, animals and thieves which may cause damage or loss of yield.
- The area must be frost-free as frost damages both the leaves and fruit causing a reduction in the quantity or quality of yield.
- Heavy clays need to be avoided because of poor drainage in as much as sands should as they harbour nematodes.

### Clearing a Site

The land is cleared to make it suitable for banana planting, but in clearing we need to ensure that grass and undergrowth remains to reduce the risk of erosion.

Clearing is done for a number of reasons of which the most important are:

- Marking of planting stations becomes easy
- Habitats for pests are destroyed

The trees are cut down and stumps are dug out of the ground. The holes are covered with soil. It is not necessary to plough the land especially on sloping ground because any form of ploughing increases the risk of soil erosion.

The site should have been free of banana growth for at least three months as this reduces pests and diseases carry over.

If an old banana plot is to be used, in addition to a three months rest period, all banana corms and roots should be removed as these may also act as a source of pest and disease carry over.

## CHAPTER 3 - PROPAGATION

To propagate is to increase or multiply using sexual (seed – grown) propagation or vegetative (asexual) means. The banana fruit is seedless and therefore cannot be grown from seeds. Propagation of bananas is done vegetatively. This is the increase of plants using parts of the parent plant rather than seeds.

### Vegetative Propagation

Advantages of vegetative propagation are numerous. Vegetatively propagated plants grow faster than seed grown ones. Unlike seed – grown plants, vegetatively grown plants are an exact copy of the parent plant. Thus one can easily predict all the characteristics of the newly grown banana. Vegetative propagation is important for keeping the good characteristics of a particular species.

Bananas produced vegetative propagation have the same genetic constitution as the parent; hence under similar conditions one can easily predict the cropping hectare. In addition, they produce fruits in the same year of planting. This is because the new plants have been extracted from adult plants that are already bearing fruits.

Vegetative propagation also has disadvantages. For example, they have poor anchorage because the root system has less time to develop and multiplication is much slower than with seed propagation.

### How to Propagate Banana Plans

Lacking seeds, propagation typically involves removing and transplanting part of the underground stem (called a corm). Usually this is done by carefully removing a sucker (a vertical shoot that develops from the base of the banana pseudo stem) with some roots intact. However, suckers should not be taken until the mother plant is at least 1.5 m high and well anchored.

Two types of suckers can be distinguished and these are:

- Sword suckers
- Water suckers

The figure below shows the differences in the two types of suckers.

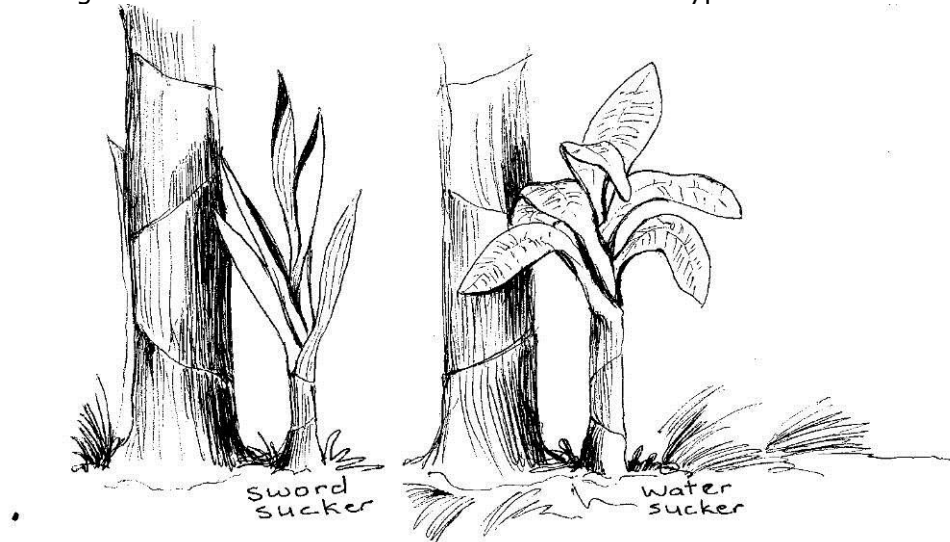


Figure 1: Sword and Water Sucker

The sword sucker has a spear shape or outline. This indicates a strong attachment to the mother plant. The water sucker on the other hand has broad leaves and appears to be watery. This indicates weak attachment to the mother plant. It is thus advisable to only use sword suckers for propagation.

## **Tissue Cultured Propagation**

In some countries, commercial propagation occurs by means of tissue culture. This is a specialized process. Pieces cut from the banana stem are placed in a culture solution containing nutrients and growth chemicals. The growth chemicals cause roots and shoots to appear and grow. The seedlings are cared for in trays. They are then transferred from the trays to pots. Usually they remain in the pots for 2-3 months before planting.

This method is carried out in South Africa and some other countries. Zimbabwe imports such seedlings from South Africa. The seedlings do not carry pests and diseases. When planted, the seedlings will grow and produce suckers. These suckers will be as good as the imported seedlings. There is no need to continue importing seedlings.

This method is preferred since it ensures disease-free planting material. When using vegetative parts such as suckers for propagation, there is a risk of transmitting diseases (especially the devastating Panama disease).

# CHAPTER 4 - PLANTING

## Varieties

There are several local and imported varieties of bananas. Choose the variety that suit the local conditions and are high yielding. Imported varieties e.g. Williams, are high yielding but require more inputs such as fertilizers. Traditional varieties e.g. Nzarayapera, have lower yields but require less inputs.

## Planting Time

The best times for planting bananas are January/February period and August/September period, because conditions are more ideal during these times. The timing also ensures that flowering of the plant does not initiate during the peak of winter. Such a coincidence will result in malformed bananas, a condition called November dump because it occurs when bananas are planted around November.

Plants planted in the January/February period take a longer time to grow but are likely to produce bigger bunches (fruit) than the August/September plants. August/September plants grow faster because of the hot season and later the rainy season but are unlikely to produce bigger bunches.

## Layout

Communal farmers usually grow bananas in areas not suitable for maize such as stream banks and wetlands. Contour ridges of maize fields are also used for banana growing. As part of the contour ridge the banana plants will benefit from the fertilizers added to the maize crop. However, the profit on bananas can be higher than for maize if modern farming methods are used.

Normally, any flat land is used for growing maize or some other crop. If communal farmers use a plantation lay-out they can produce good quality bananas that can give better returns than maize. This would need some of the flat land or gently sloping land to be used for growing bananas.

In a plantation the plants are uniformly spaced. Each plant has sufficient space to grow and will receive enough sunlight. Therefore, higher yields of bananas are expected.



**Figure 2: Layout of banana plantation using modern farming methods**

To achieve this layout of a plantation you need to follow certain procedures described below. The aim is to accurately position the planting holes.

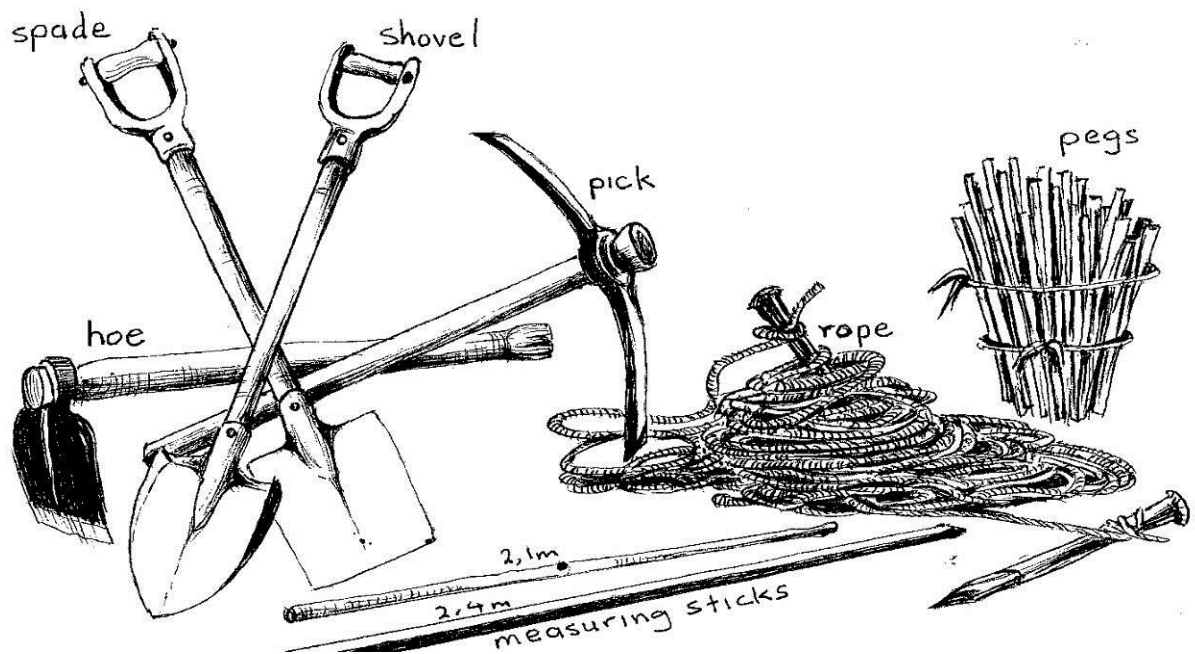


Figure 3: Tools that are needed for planting

## Marking Out Plantation

Planting stations should be marked out so that the distance between holes in a row is 2,1 metres. The distance between the rows should be 2,4 metres. The distances between plants and rows are need for purposes of:

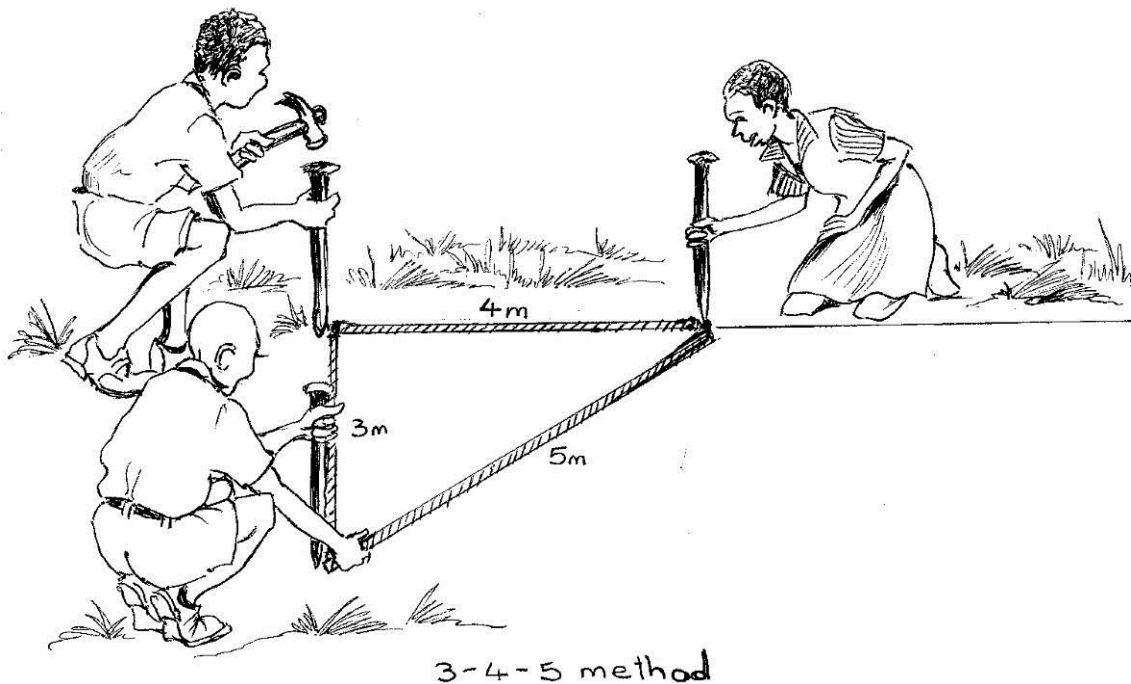
- Movement of air for carbon dioxide for photosynthesis.
- Avoiding plants crowding each other, because each plant needs exposure to sun light.
- Space among plants gives low enough levels of humidity that will avoid diseases.

The first thing is to decide on is the position of the first line, because it will determine layout of the entire plantation. Start from the edge of the field to mark the first line.

Place the rope or wire along the first line. Using the 2,1m stick, mark out the positions of the pegs on the first row. The pegs are driven or hammered into ground on the marked positions.



The second line to be marked is a line at right angles to the first line. The 3-4-5 meters method can be used to ensure you mark out a right ( $90^\circ$ ) angle. Using the 3-4-5 meters method the right angle is marked on the beginning or end of the first row.



**Figure 4: Ensuring a right angle for the lay-out of the plantation**

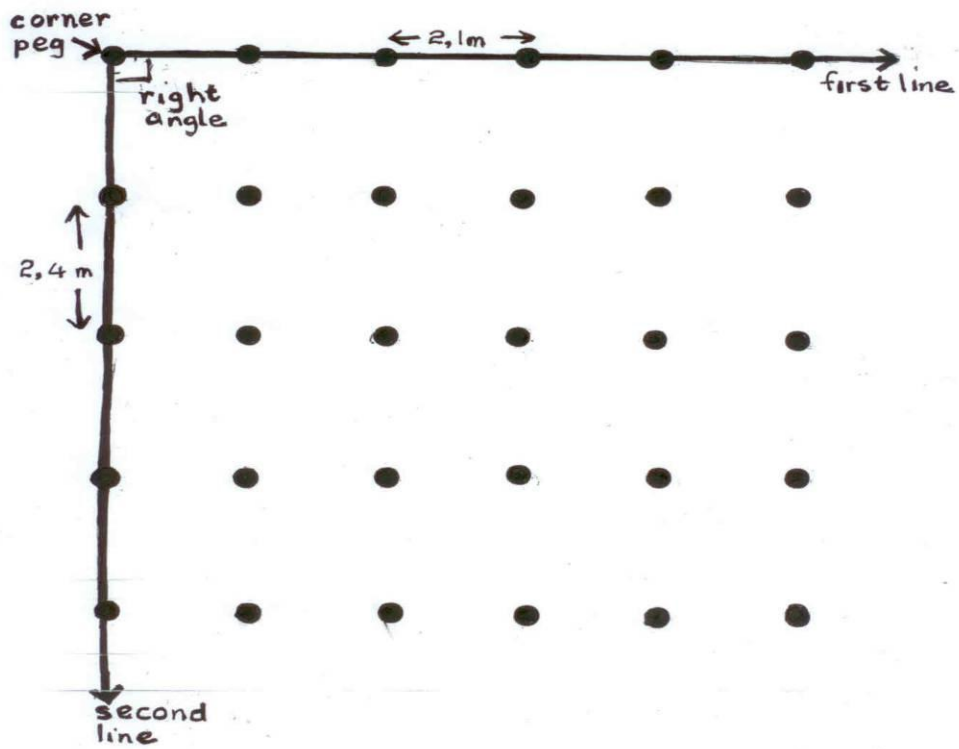
It is called the 3-4-5 method because the ratio of the lengths of 3 sides of the right-angled triangle is 3:4:5. Thus, use 3 sticks whose lengths are in the ratio 3:4:5 to obtain a ( $90^\circ$ ) right angle.

For example: 3m, 4m and 5m **or** 30cm, 40cm and 50cm **or** 60cm, 80cm and 100cm  
**or** 1.5m, 2m and 2.5m.

The 3 sticks are placed and form a right angle at the corner peg. Your plantation is now marked along the edge with 2 lines: the first indicating the first row (length of the plantation) and the other showing the width of the plantation on which the other rows can be marked.

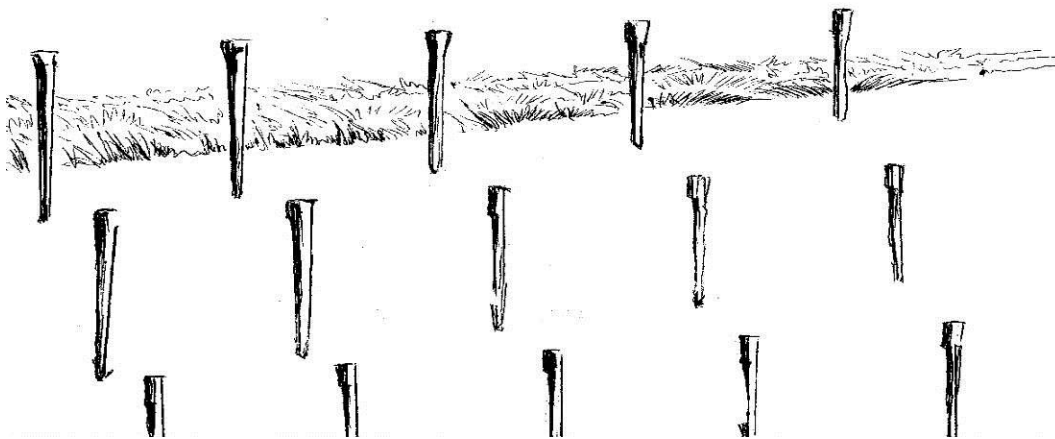
On this second line, mark out the positions of the first pegs of the other rows, using the 2,4m stick. So, along the second line you will mark the rows 2,4 metres apart with a peg. Then, for each row, place your rope or wire at the first peg for the row and place pegs 2,1m apart to mark the planting stations.

Make sure that all the rows are at a right angle and that the distance between rows remains 2,4 metres at all planting stations.



**Figure 5: view from above on marked lay-out of plantation**

The dots in the picture are positions of pegs and not positions of plants. The pegs mark the planting stations. The pegs will guide you later when finding the exact position to place the plant in the planting hole.



**Figure 6: Marked lay-out of banana plantation**

## Digging out the holes

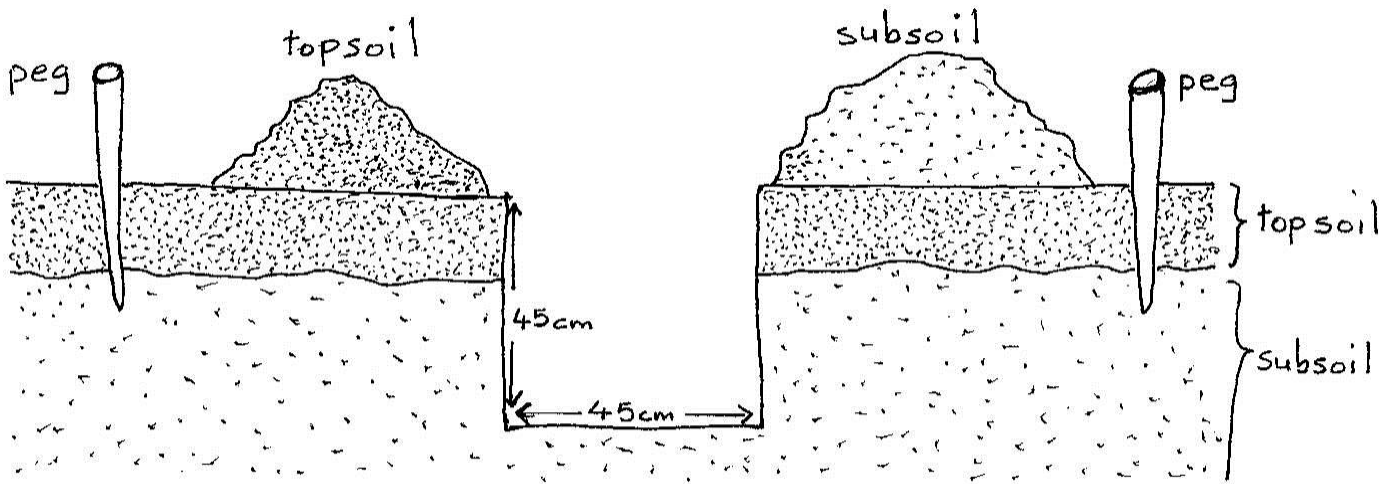
To mark the planting stations use the 'planting stick'. Place the planting stick between two pegs in a row. The centre of the stick shows where to place the sucker in the planting hole.

Dig out a hole of the following dimensions: 45cm wide x 45cm long x 45cm deep.



**Figure 7: Use pegs to determine where to dig holes for banana plants**

Place top soil on one side of the hole and subsoil on the other. The topsoil is darker and contains humus. The subsoil is lighter in colour.



Repeat the digging of holes until the intended area is done. Digging is easier if the soil was watered a day before.

## Planting

1. Fill the hole with water a day before planting.
2. On the day of planting, mix the top soil with 30g of Compound C.
3. Fill the hole with top soil and if necessary, some of the subsoil to obtain the correct planting depth. 15 centimeters of the pseudo stem should be below ground level.
4. Place the sucker in the hole. Use the planting stick to make sure the plant is placed midway between the two pegs. The top of the underground stem should be 15cm below ground level.

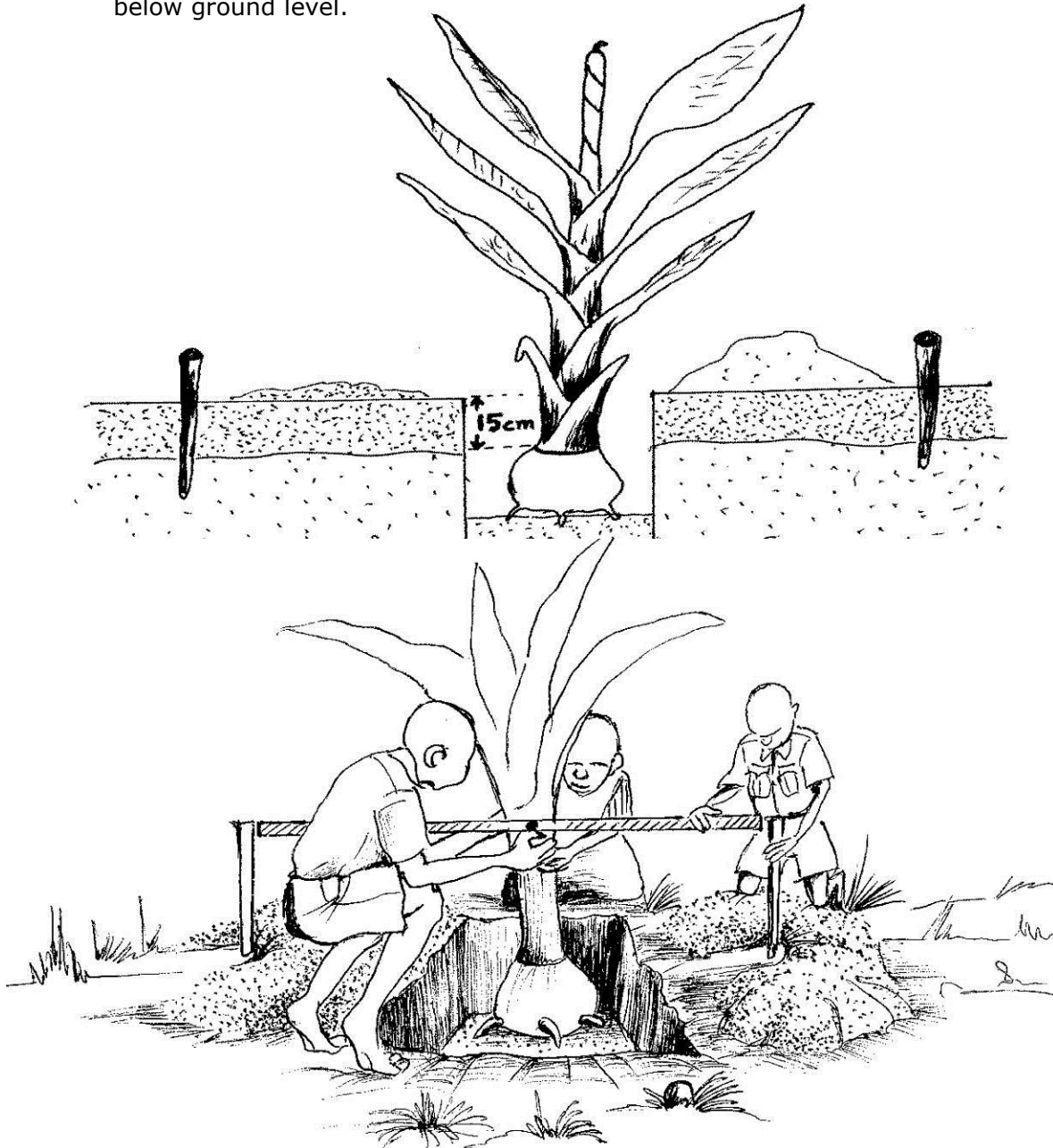


Figure 8: Positioning the sucker in the hole

5. Place 30g of compound C around the plant but not on the roots.
6. Cover with 10cm of soil.
7. Place 30g of Compound C around the plant.
8. Cover with 10cm of soil
9. Place 30g of Compound C around the plant. [**N.B.** Up to this stage we applied Compound C 4 times] Instead of Compound C, kraal manure may be used during land preparation and planting. For best results the manure must be well decomposed.
10. Make a basin (about 90cm diameter) around the plant.
11. Fill the basin with water.



12. After planting follow watering guideline as per chapter 5. 2-3 weeks after planting apply 16g of Temik per plant. Dig a shallow trench around the plant and spread the Temik. Cover up the Temik with soil. [**N.B.** Temik is a very dangerous poison]
13. After 1-2 months of planting check and replace poorly growing plants. You can either replace the plant, or if the plant was only damaged during planting but still looks healthy, the plant can be cut just below the damaged part.
14. Keep the basin area clean and well watered. Remove weeds by hand from the basin to avoid damaging the roots. Weeds outside of the basin need to be slashed to avoid soil erosion.
15. Keep baboons out of the field because they destroy young plants.

# CHAPTER 5 - CARE AND MAINTANACE OF THE BANANA PLANTATION

## Watering

Bananas require constant water supply throughout their growth. For the first 6 months use hose and basin irrigation. Put enough water in each basin (25 litres of water every 2-3 days).

The amount of water can be decreased or increased depending on the weather conditions and the soil type. You do not have to water if it is raining. Increase watering if it is hot.

After 6 months some other method of irrigation like sprinkler irrigation so that the whole ground is watered, can be adopted. Sprinklers would be more appropriate beyond 6 months. Irrigating for 6 to 8 hours every three to four days would be sufficient depending on weather conditions. If the use of the hose is to be continued, then watering should no longer be restricted to the basin because the roots would have spread beyond the basin.

Flooding can be used on flat land. However, flooding on slopes is discouraged because it can cause soil erosion.

## Top dressing fertilizers

Compound J can be applied around the plant at a recommended rate of 80g per planting station per month.

Apply every month except in June and July when plant growth virtually stops since up to 80% of the plant roots would have died back because of the winter.

Other fertilizers like Ammonium Nitrate, Urea and Murate of Potash can be used but the farmer should consult the Agritex extension officer to get the correct application rates.

## Compost and animal manure

The use of animal manure offers a cheaper and affordable option for farmers especially where mixed farming is practiced. Animal manure is high in Nitrogen and Potash.

It is vital to ensure that the manure is fully decomposed as raw manure will take longer to become available to the plant and may burn plant roots while decomposing.

The manure should incorporated into the soil at a rate of 10 to 25 tonnes / ha.

If possible, old banana stalks and other organic material should be composted and put back on the bananas, preferably in the planting holes of new fields, well mixed with the soil. Bunch stalks need to be fully composted because just like animal manure they will cause burn to the plants if they have not properly rotted.

Well-composted animal manure is known to assist in reducing nematode levels, as well as for its nutritional and soil conditioning benefits.

## Propping

Propping is the use of poles to support the banana plant from falling over, particularly under the increased weight of banana bunches.

Ensure props are well dried to avoid bending. Best props are made from materials that are resistant to termites. Woods like wattle resist termites, but these must be dried for a few months before use. Gum can also be used, but is very prone to termite damage, so usually lasts only one season. Bamboo can also be used, but ensure it is dry before propping – green bamboo will bend and then dry in that bent shape.

All plants should be propped as soon as they throw a bunch. The correct length should be used depending on the height of the plant – for Williams and Grand Nain, 3m - 4m props should be used.

A minimum prop diameter of 30mm is strong enough to support the weight of the bunch.

Position the props correctly, 2 per plant. Avoid piercing the stalk at the same point for both props as this increases the stress on the plant.



**Figure 9: Correct positioning of props**

Store unused props off the ground to avoid termite damage.

## **Follower sucker selection and De-suckering**

Correct sucker selection as a future plant is critical to follow-up the current plant after harvesting, because it maintains a healthy and proper plantation. It is important to always ensure that the selected follower sucker is a sword sucker and never a water sucker.

Timing of sucker selection – as soon as a suitable sucker appears in the right position: this will only occur when the mother is properly established, and it will only be allowed to grow by the mother when it [the mother] has sufficient nutrients to spare over and above that required to fill the bunch. The right position is determined by the marching direction.

For newly planted lands use the procedures for desuckering below. Until the plant reaches 1.5 to 1.8 meters in height (where leaves start separating) completely remove all suckers as they emerge. This is, because suckers can seriously affect the yield because of competition for nutrients. Stay on top of desuckering. At least once every 2 weeks during

warm months and every month to 6 weeks during the winter. Once the plant has reached a height of 1.5 to 1.8 meters in height (where leaves start separating), you can start selecting the follower sucker.

March Direction of Plantation – the marching direction of the plantation is usually uphill so that the new sucker is properly embedded in the soil.

## **Leaf cutting**

Leaf cutting is important in controlling diseases and maintaining a neat plantation. All dead, yellow, diseased leaves should be neatly cut off and removed. This becomes more urgent with the onset of rains. Leaf spot spreads under humid conditions.

- All leaves with greater than 35% green matter should be kept.
- Lay cut leaves down in the mulch row
- At least 15 leaves should be left to nourish the bunch once thrown

Leaf cutting can also be done to prevent the leaves from bruising the banana fruits but this must be done as a final option. The leaves are the food factory hence should be preserved at all cost

## **Stalk cutting**

During harvesting, the pseudo stem should be cut at least 1.5m above the ground level.

Leave old pseudo stems standing after the bunch has been removed until the follower sucker has gained full benefit from it – nutrients are said to transpose themselves to its benefit. This is particularly important for potash supply, which is not easily available in the soil. This will also ensure that the second generation crop matures faster and has better quality than the first generation crop.

## **General Field Maintenance**

- Keep the fields neat, tidy and free of rubbish.
- Minimize soil erosion by maintaining drains and contours, and any other practical means such as planting vertiver grass.
- Minimize damage to bananas and vehicles by keeping roads, drains and bridges in good condition.

## **Mulching**

Mulching helps to reduce erosion in as much as it preserves soil moisture. It is important to alternate rows along the contour, covering the full width of the row. This is to ensure a comprehensive mulching of at least one row, rather than thin mulching in every row.

If available, use of mulch material such as grass, Napier fodder etc. can be very beneficial to a plantation, by reducing erosion, encouraging microbial activity leading to reduced nematode levels, suppressing weeds, etc.

## **Bell removal**

Removal of the bell ensures that nutrients are not wasted by feeding a non-beneficial growing part.

The bell should be removed as soon as is practical. Usually once the fingers from the bell start to have mixed sizes it will be ideal to remove the bell, because from now onwards the fingers that are added to the bunch are no longer productive.

The bell should be taken completely out of the fields and compost to prevent the build up of thrips which tend to hide inside the bells. Timely removal of the bell increases the size of the fingers (fruits) since the bell can consume a lot of nutrients without any benefits since it will be the tip of the plant and most nutrients are channeled towards it.

## **Petal removal**

Removal of petals helps to reduce bruises on bananas, which reduce the quality of bananas. Petals are removed when the fingers are still facing down. This allows the wax from the bananas to drip down so as not to stain the bananas.

## **Shading**

Tie leaves over bunches in exposed positions particularly on the edges of fields along roads to shade the fruits from the direct sunlight. Also, ensure the neck of the bunch stalk is adequately shaded as this is very susceptible to scorching resulting in a second grade bunch which will probably fall off the plant.

## **Sleeving**

After removing petals, banana bunches may be covered in plastic sleeves to protect the fruit against insects, leaf bruising as well as frost conditions, thus preserving the quality of the fingers.

## **Weed control**

Weeds must be removed because they compete with the banana plants for nutrients and water. The basin must always be free of weeds. The weeds should be pulled out by hand to avoid damaging the roots.

The weeds in the rest of the plantation can be slashed. The roots of the weeds will hold soil together and thus reduce soil erosion.

- Be particular to ensure there are no grasses in banana fields.
- Ensure broad leaved weeds are eliminated.
- Ensure weeds are never allowed to seed, as this will increase the amount of weeds in the long term.
- Keep a 2m weed-free area around the field.
- Hand weeding: can be effective, but take care not to damage banana roots.

## **Herbicides**

Herbicides are preferred commercially, but might not always be affordable. If herbicides are applied, ensure that grasses higher than knee-high are slashed at least a week before applying the herbicides. Take care not to spray banana plants, especially young ones.

When using Paraquat/Gramoxone:

- Mix at 100 ml per 15-litre knapsack.
- Try to catch weeds when they're small.
- Controls most weeds, but not couch grass or star grass. Yellow nut sedge, is normally resistant, but good control is achieved with Paraquat if it is sprayed when flowering or about to flower.

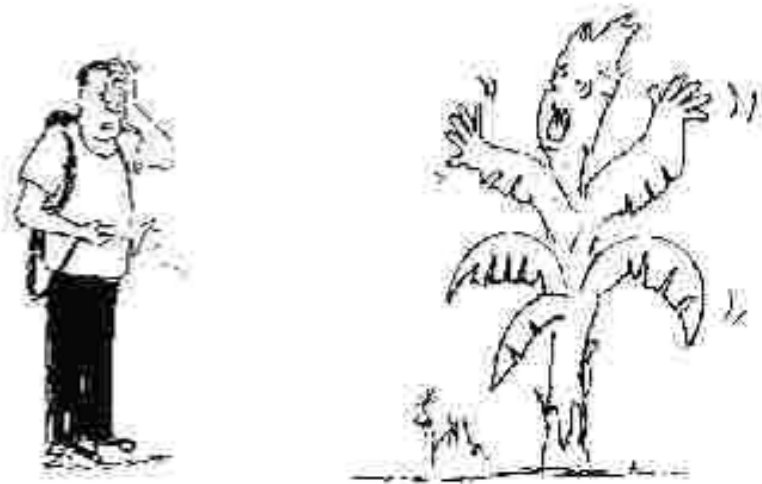
Take adequate health and safety precautions and clean equipment after use.

## Pest and disease control

Check regularly for pests such as Semi-loopers, Red Spider Mites, Thrips and slugs. Do not spray chemicals unless necessary.

- Slugs are usually associated with poor weed control. If present they can be removed by hand but if you are not vigilant they can cause a good deal of damage before detection – always with the onset of proper rains.
- If possible, control Semi-loopers by hand-picking: they can have a devastating effect as they eat the fruits. When covering the bunches do make sure it is done before the semi-loopers lay their eggs. Otherwise, you will find the fruits spoiled at harvesting. If necessary, control Semi-looper with DDVP @ 15 ml per 15 litre knapsack
- If necessary, control Red Spider Mite with Dicofol 18.5% EC @ 30 ml per 15 litres

Avoid losses of chemicals through spillage, theft or incorrect usage. Take adequate health and safety precautions, and clean equipment after use.



**Figure 10: Safety precautions are important when handling chemicals.**

- Always wear protective clothing when handling chemicals
- Avoid spraying chemicals on a windy day to reduce chemical drift
- Minimize baboon damage by keeping them out of the fields.

# CHAPTER 6 – HARVESTING AND MARKETING

The time from planting to fruiting depends on the variety of banana planted and conditions such as temperatures; water applied; and amount of nutrients available.

Month of planting also affects flowering and fruit development. January/February planting will throw bunches in 10-12 months. August/September planting will throw bunches in 9-10 months. The follow-on sucker will throw a bunch in 3- 4 months after harvesting of the mother plant.

## Harvesting

### Indicators

There are a number of signs that show that a bunch is ready for harvesting. These are:

- Change of colour from green to yellowish.
- Fingers are about three quarters full i.e.  $\frac{3}{4}$  of fruit is rounded.
- Ridges should still be prominent on the remaining quarter of the finger.

### Process of Banana Harvesting

- Proper handling at harvesting is vital as banana quality is severely affected by bruises and cuts and will not sell well.
- At least three people should be involved in cutting the bunch of the plant.
- The bananas should then be removed from the bunch as 'hands' which should be cleaned before packaging.
- Care should be taken to ensure that the juice from the cut 'hands' do not spill on to the banana as this compromises quality.

### Handling of Bunches and 'Hands'

Avoid bruising of the fruits by avoiding any pressure on them. The hands are cut off from the bunch and dipped in a water bath with fungicide. Avoid contact between the banana fingers and the juice from the cut surfaces. The juice will stain the skin of bananas and the stained parts turn black.

The hands are then graded according to fruit size, colour and quality of skin.

If bananas are to be transported over some distance to the market, then this must be done in padded crates to avoid bruising. Transport is preferably done in the evening to reduce sunburn. Alternatively refrigerated trucks can be used.

## Marketing

For small scale producers supplying bananas to companies can be challenge. To overcome these it is appropriate to enter into a formal agreement before harvesting. Keep the following in mind:

1. Confirm purchase through an order (written) or marketing agreement which gives description of bananas in terms of quantity, quality, agreed price, dates and place of delivery.
2. The payment modalities must also be outlined in the agreement e.g. bank deposit, cash or cheque and also when the payment would be done.
3. All farmers should understand the terms of the marketing agreement and should be committed to meeting their part.
4. In bulking the bananas the collection centres should be sited in such a way that the minimum possible distance to centre is achieved by each farmer. However,

this should not mean establishing more than the necessary number of collection centres as this will also increase bulking costs.

5. Proper handling of bananas is vital. Bananas should be carefully loaded into crates or bins and transported to the market as soon as possible. At most the bananas should reach the market 3 days from the time of harvesting, unless the transport is refrigerated.
6. If farmers are facing challenges in meeting their supply obligations to the buyer, these should be communicated to the buyer in an open manner.

### **Ripening**

Bananas are normally ripened before they are sold to consumers. Agree with the buyer who ripens the bananas. Most traders prefer buying untreated bananas from the farmer. The trader will carry out the ripening of the bananas.

There are traditional and commercial methods of ripening bananas.

Commercial ripening - involves the use of a ripening gas ethylene. Bananas will spend about 5-7 days in the ripening room. The temperature of the room is controlled at about 15°C.

Another commercial method involves dipping the banana hands in an ethrel solution and left in a room for 3-4 days.

Bananas should not be exposed to the sun or extreme heat after harvesting.

Traditional ripening - The banana hands are piled up and covered with sacks. They are left at room temperature. The bananas will take a long time to ripen.

## CHAPTER 7 - BANANAS AGRI-BUSINESS

To get the best results in banana production, the bananas should be managed as a business. This entails the following: forecasting, business planning, budgeting, proper record keeping, and sound financial management.

### **Forecasting**

This is the process of predicting the expected costs and returns from a business. This is an important process as it helps in planning. We can therefore have predict the cost, yields and revenues to forecast profits. Forecasts are needed for labour requirements, input needs, yields, sales and for expected demand from buyers. It will be important to consult relevant technical people like Agritex extension officers when coming up with forecasts.

### **Business planning**

Business planning is directly related to forecasting. A business plan is the result of forecasting and tries to put a price tag to costs and revenues. Proper planning is important in order to know input costs including labour, timing of operations and expected returns. Usually a plan is based on a fixed factor of production usually land. Therefore, plans are usually expressed on a hectare (10000m<sup>2</sup>) basis. But on small holder an acre (about 4000m<sup>2</sup>) may be more appropriate.

### **Record keeping**

The keeping of proper records is important as it assists in proper forecasting, planning and budgeting. Records assure you to know how much something cost, to keep track of all costs and to be familiar with the amount of revenue. These records will help you to determine if you are making a profit and if thus your efforts are not in vain. In addition, records of operations like planting dates and costs must be kept, because they will help in forecasting as well as decision making in the future for improving production.

### **Price determination**

By knowing how much it costs to produce a kilogram of banana, a farmer is able to determine the minimum price per kilogram that he or she should be willing to accept on the market. However, commercial buyers also offer different prices based on the quality of the bananas. It is therefore very important to ensure that the quality produced by the farmer is the best possible.

### **Budgeting**

A budget translates a business plan into a financial statement of expected income and expenditure. A gross margin budget is the most commonly used type of budget in crop production because it gives the expected income from a crop less all the variable costs related to producing the crop. Variable costs can be distinguished from fixed costs in that variable costs are costs related to the particular cropping enterprise like fertilization and labour; while fixed costs may be shared between different cropping enterprises like supervision, electricity and fuel.

A typical gross margin per hectare for bananas can be arrived at as follows:

### 1. Expected Yield

The expected yield depends on the amount of inputs used; the potential for the banana variety used as well as how the plantation is managed. All these influence the bunch size.

So to determine the expected yield at your particular field, you need to use the numbers from your records. The numbers used in this example are based on averages from small holder farmers that used modern farming techniques on a 1 hectare plot.

Formula: Number of planting stations x average bunch size (kg)

Example:  $(10000\text{m}^2 / (2.4 \times 2.1) \text{ plants}) \times 25\text{kg bunch per plant}$   
 $= 1982 \text{ plants} \times 25 \text{ kg/plant}$   
 $= 49550 \text{ kg}$

### 2. Gross Income

The gross income is the total income expected per harvest before costs are deducted. In your calculations you should use the numbers from your records, e.g. what are your costs and what prices did you get for your products. The numbers used in this example are again based on averages for small holder farmers that used modern farming techniques on a 1 hectare plot.

Formula: Expected yield (kg) x market price per kg

Example revenue:  $49550 \text{ kg} \times 20\text{c per kg}$   
 $= \$9910$

Example Total Variable Costs:

Item	Costs US\$
Fertilization (Lime, Compound C and Compound J)	1350
Pests, diseases and weed control	900
Irrigation (excl. labour)	1800
Labour (290 labour days@ 3USD per labour day)	870
<i>Total</i>	<i>US\$4920</i>

### 3. Gross Margin

Gross margin is the profit based on the revenue and the variable costs. Thus, it excludes other fixed costs such as price of land, electricity and fuel.

Formula: Gross income – Total Variable Costs = Gross Margin

Example:  $\$9910 - \$4920 = \$ 4990,-$