Banana farming
in Uganda

NARL-KAWANDA

NARO

Banana Farming

A Guide

Prepared by

National Banana Research Program of
National Agricultural Research Laboratories /NARO
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FOREWORD

The banana is one of the most important food security and cash crops in Uganda. Areas of the country where banana is the main staple crop experience less famine.

This is because the banana fruits all year round which ensures a continuous supply of food. For long, it was believed the banana was able to continue growing well in Uganda as a long as the nutrient levels in the plantations were adequate.

However, the crop has been experiencing declining productivity because of a complex of problems such as reduced soil fertility, pest/disease build-up and socio-economic problems. In the past, banana was a highly sustainable crop in Uganda, with long plantation life and stable yields. Indeed in some areas, gardens of 50-100 years still exist. However, the frequency of replanting in central Uganda is currently as short as five years.

In recent years, drastic yield decline in the traditional banana growing areas of central Uganda has led to the replacement of bananas with annual crops. Annual crops require more elaborate phasing or storage in order to have food all the year round.

Many farmers in the areas where bananas have lost sustainability appear unable to cope with the storage requirements of annual crops hence they are facing frequent food shortage crises. Displacement of bananas in farming systems poses a serious threat to food security, the environment and general welfare of the people in the affected areas.

Reversing the banana productivity decline and increasing plantation life in traditional banana growing areas are big challenges for which the NARO's Uganda National Banana Research Programme was created in 1989.

Over the years, through partnerships with diverse stakeholders and a number of development partners for which I am grateful, NARO's Banana research team has since generated technologies as well as farmer

oriented information packages that could go a long way in alleviating banana production problems. The gap however has been weak technology dissemination channels in order to effectively deliver information to the farmers.

This manual provides a summary package of some of NARO's latest know-how targeting banana farmers, and other stakeholders seeking information about banana production and utilisation. It is simple enough for all stakeholders involved in dissemination of agricultural information to understand.

The assistance of USAID through the Agricultural Biotechnology Support Program (ABSPII) towards the production of this manual is highly appreciated.

Wilberforce Tushemererirwe
Director of Research, NARL

1. INTRODUCTION

Banana is the most important food and cash crop in Uganda and, as a perennial crop (it fruits all year round), plays a key role as a household food security crop.

The aim of the project is to introduce banana cultivation in a post conflict region where farmers have not traditionally grown banana, even though the climate and soil are favourable.

Initiated in 2012, the project strategy for distribution of planting materials involved an initial provision of 60 tissue-cultured derived bananas.

For example in Lapool sub-county of Pader District, one family of Mrs. Rose Komakech and Mr Thomas Ogera, used their suckers and expanded their small farm from 60 plants to 260 banana plants on a quarter hectare in a period of 2 years.

Their goal being to expand their farm to reach commercial scale within the next one year. There is

increased enthusiasm that has been generated for planting more bananas in Northern Uganda with farmers in the areas such as Amuru district selling suckers for Ug sh5,000 each.

There is high potential for future market demand for banana and banana products in Northern Uganda and its neighbouring countries - particularly South Sudan, which is the closest market to the region.

ABOUT THE GUIDE

This Guide has been designed to deliver straightforward facts, practical information and helpful advice on all aspects of banana production in Uganda. It contains 12 chapters, each of which is dedicated to a particular step in the farming process, and some illustrative images.

ABOUT NORTHERN UGANDA

Northern Uganda is an area with great potential for banana farming. The agro-ecological conditions are suitable and, since bananas have not been consistently

grown in the region, the occurrence of pests and diseases is expected to be low. In addition, farmers in Northern Uganda are not accustomed to eating specific traditional varieties of Matooke, therefore, acceptance of hybrid bananas is not expected to be hampered by taste differences.

Northern Uganda has very good marketing possibilities, with neighbouring countries such as South Sudan who might be eager to import fruit from Uganda.

WHAT IS A HYBRID?

Ever wondered why bananas don't have seeds? Most edible bananas contain three copies of chromosome sets instead of two (they are triploids), and therefore they are largely sterile, although they retain very low levels of female fertility.

To develop new banana hybrids, for example – disease resistant hybrids, plant breeders use a resistant diploid parent (which is fertile and has two chromosome sets) as the source of pollen to fertilise the susceptible female

flowers of a cultivated triploid banana cultivar.
The aim is to generate new bananas – i.e. hybrids - that retain the qualities of the original cultivar of interest in terms of taste and cooking qualities, but that also have resistance to pests and diseases.

However, the resulting bananas from the first cross will be fertile and seeded and, hence, inedible. A second cross is required to generate triploid, sterile bananas.

The new bananas can be very different from the original cultivar, so large numbers need to be screened to identify the best bananas.

Hybridization in bananas is essentially the same as for other crops except that, with fertile crops, scientists can use the first hybrids as parents in crosses to the original cultivar, and repeat this for several generations.

This is called back crossing and it helps to create a new cultivar that is almost identical to the original cultivar, but with the added benefit of desirable traits - such as resistance to pests and diseases.

WHY DEVELOP HYBRIDS?

Hybrids are being developed for the following reasons:

- Improved crop quality / nutritional value
- Higher yields
- Cycling, plant architecture, bunch orientation
- Shorter cropping cycle
- Improved taste
- Drought resistance
- Pest and disease resistance

HYBRID VARIETIES CURRENTLY DISTRIBUTED TO FARMERS

M2

Attributes

- Tolerant to nematodes
- Tolerant to banana weevils
- Resistant to Black Sigatoka
- Matures early - flowers after 9 months and the fruit fills in 3 months
- Produces heavy bunches - up to 35 kg in fertile soils (30 tons/ha/year)

M9

Attributes

- Tolerant to nematodes
- Tolerant to banana weevils
- Resistant to Black Sigatoka
- Higher yields (between 25 kg - 71 kg) in fertile soils (51.7tons/ha/yr)
- Good taste and texture

2. SITE SELECTION

Selecting a suitable site is vital when growing bananas. It is important to find the right environment so that the banana plants will flourish.
Banana plants grow best in areas with the following conditions:

■ Favourable soil with good drainage
- bananas like soil that is neither too wet, nor too dry.

■ Good light
- an area that gets enough sunshine to encourage strong growth, but not so much that the soil dries out, is ideal.

■ Adequate shade
- this can help with moisture retention.

■ Adequate wind protection
- this can also help with moisture retention, as well as preventing damage and toppling.

Areas to avoid when selecting a site are:

■ Swamps, or areas prone to flooding.

■ Rocky places
- these can complicate farming practices such as ploughing.

■ Other things to consider when selecting a site are accessibility and communication.
- Good access for both vehicles and workers will ensure that equipment and produce can be transported in and out of the field with ease.
- Communication is as important as accessibility and the chosen area should be equipped with good communications services.

BUSH CLEARING

If the site you have selected is a thicket or thick forest, you will need to clear the bushes and trees before you can start land preparation.

The choice of equipment used to do this will depend on the type of site. When clearing a site of unwanted bush, it is important to remove everything, including root systems and tree stumps. If left, they could interfere with the growth of the banana plants. They can also complicate farming practices such as ploughing.

Burning is not recommended because it destroys useful organic material. All removed material should be cleared from the field.

It is useful to leave a few trees around the border of the site to provide shade and wind protection, both of which can aid moisture retention. They could also help to fix nitrogen.

However, the trees must not be of a species that will compete with the bananas for water and nutrients. Nitrogen-fixing trees are ideal.

SPACING AND MARKING

Banana roots extend laterally, approximately 1.5 m from the main plant, and just below the surface of the soil.

They must be given room to spread so that the root system can develop and function properly. For this reason, bananas should be planted 3 meters (about 9 feet) apart from one another.

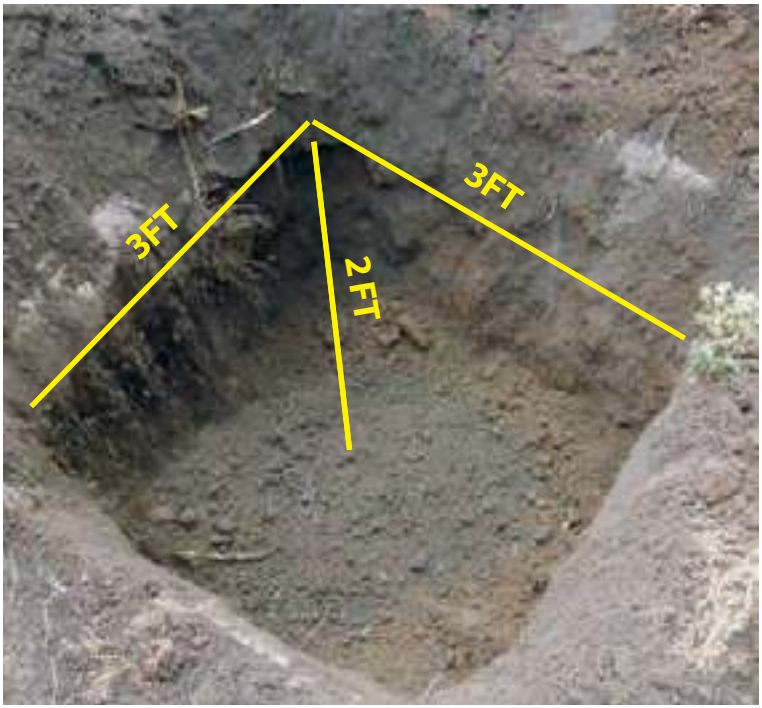
Eventually, the roots of each plant will meet in the middle of this 3 meter space, forming a mat. Using a tape measure (or measuring stick), mark the spots where the plants will be planted.

Avoid marking and planting as you go because any oversight may lead to an uneven spread of the bananas. Once the field is marked out, the planting holes can be dug.

PREPARING THE PLANTING HOLE

In many countries, capturing enough water for crops is the biggest problem faced by farmers. **More water means better plants, better fruiting, better yields and better profits.**

Every step a farmer takes must be geared towards increasing and sustaining the availability of water, including when preparing a hole for planting.



Bananas require large planting holes - they must be at least 3 feet long x 3 feet wide, and 2 feet deep. When digging a hole, the topsoil should be separated from the subsoil.

The topsoil is then mixed with manure and put back at the time of planting. Topsoil is more fertile than subsoil, so the subsoil is rejected.

3. SELECTING PLANTING MATERIAL

Plant (or cultivar) selection should be based on demand and yield. Select cultivars that are marketable and produce high yields without too many problems.
There are two types of planting material you can use -TC (Tissue Culture) plantlets, or suckers (which are the cheaper option).

TC PLANTLETS

TC plantlets are recommended for planting because they are healthy, pest and disease free, and uniform.
This means that they don't require cleaning or paring - you just remove them from their packaging and plant them. They also have a shorter harvesting period and can be planted throughout the year.

SUCKERS

Suckers arise from around the base of the main stem of a banana plant (or from the corm). There are two types of suckers - water suckers and sword suckers.

Water suckers are small in size and do not look vigorous. They have large leaves and look older than they actually

are. These are not approved for planting and should always be rejected. Sword suckers are sharp and look like swords. They are vigorous and strong. In most cases, they are healthy and do not have problems. These are approved for planting.

PREPARING SUCKERS FOR PLANTING

It is not advisable to transfer soil from one plantation to another because of the risk of cross-infection. Once a sucker is dug up, it should be cleaned. Suckers are cleaned in a process called corm paring.

This process prepares the sucker for planting by removing soil and parasites, removing the roots, and reducing its size so that transportation costs are lowered and damage is restricted.

CORM PARING STEPS

Using a sharp knife, remove the soil from the corm of the sucker and cut off the roots. If there are any dark spots on the corm (which could be harbouring banana weevils or their larvae), they must be cut away. Loose layers, where weevils and other insects could be hiding, should also be removed.

Cut off the bottom of the corm so that it is flat and will sit upright on the ground. To further reduce the size of the sucker, cut off the top too.

The correct place to make this cut is where the pink part of the stem ends and the black part starts. The cut must be slanted (or diagonal) so that the sap is able to drip off and doesn't cause rotting.

There is no need to worry about the absence of roots on a pared corm - once it is planted, new roots will emerge from the bulb.

Removing the roots makes germination quicker and easier - prepared plants take one week to establish themselves, unprepared plants take up to a month.

Carefully parring corms makes them more than 99% clean of the pests and diseases associated with root damage. However, pared corms can be cleaned further of pest and diseases by either hot water treatment (boiling water (1000C) for 1 minute) dipping them in a chemical solution like Dursban(1.5cc of dursban per litre for 1hour).

PLANTING THE CORM

Planting banana corms is quite straightforward. Once the planting hole is dug, simply place a corm in the centre of the hole.

The corm should sit upright on its flat bottom.
The topsoil that was excavated when the planting hole was dug should now be mixed with manure or fertilizer and put back into the hole around the corm to fix it in place.

Put more topsoil on top of the corm, but do not bury it completely. The top of the corm should be 1 inch below the surface of the soil.

Do not compact the soil when putting it back - looser soil will improve both water percolation and aeration.

It is important to retain the unfilled space of the hole (basin) above the corm. This will serve to capture water when it rains, and will make the application of organic matter and/or pesticides to the plant easier.

SUCKER RESTRICTION

A well-fertilized, well-mulched plantation will contain plenty of nutrients and plenty of moisture. As a result, it will also produce a lot of suckers. Some of these suckers will need to be dug out.

The number of suckers around each plant (mat) must be restricted so that competition for resources is limited. Keeping 2 - 4 suckers per mother plant is advisable, depending on the bunch and yield size you want or require.

This can either be as 1 mother plant and 2 daughter plants, or as 1 mother plant, 2 daughter plants, and 2 smaller daughter plants.

1 mother + 2 daughters
1 mother + 2 daughters + 2 smaller daughters

If too many suckers are left around a plant, its bunches will be reduced in size, and its yield will be lower. Water suckers should be removed and destroyed. Keep the strongest of the sword suckers; these can be used to produce future crops.

The suckers that are retained must be spaced - spacing of plants aids the continuity of bunch productivity, and also helps the movement of air through the plantation. Surplus healthy sword suckers can be sold to other farmers.

4. SOIL FERTILITY MANAGEMENT

Fertilization is necessary to supplement the naturally occurring minerals of the soil and ensure a maximum supply of nutrients to the plants.

For most areas in Uganda the fertilizer application rate is approximately, 100Kg of Nitrogen, 25kg of Phosphorus, 100kg of potassium and 15kg of Magnesium per hectare per year. When applying fertilizers to a field, it is important to spread them widely, like a blanket.

This encourages the roots of the plants to travel, rather than restricting them to one area, and evens out the distribution of nutrients.

If fertilizers are only applied to the soil directly around each plant, plenty of suckers will emerge, but the roots of the mother plants won't be encouraged to grow and spread. Healthy root growth is essential for healthy plant growth. Well-fertilized plants are able to obtain plenty of moisture and nutrients, and will produce better yields.

5. SOIL MOISTURE MANAGEMENT

WATER TRENCHES

Water trenches are dug mainly as a means to harvest water and channel it into the field to the plants. However, they can also help to control soil erosion. The larger the trench, the more water it will harvest.

A trench can be any length but should, ideally, be about 2 ft wide and at least 1 ft deep. Trenches must be dug across the gradient (or slope) of the field.

Field size and gradient will determine how many trenches are needed, and how far apart they should be.

The bigger the field, the closer the trenches. Preferably, one trench should be dug after every two lines of plants (6m-8m apart).

Fields with a steep gradient will require more trenches to arrest water runoff. In some cases, grass may have to be planted on the upper side of the trenches to further reduce erosion. Any type of grass can be used, but vetiver grass is very good for this purpose. It is best to dig trenches either before the bananas are planted, or as

soon as possible afterwards.
If trenches are dug when the plants are established and growing, the roots will be damaged. Over time, as soil is washed into them, the trenches will ‘silt up’, so they will need to be reopened and maintained.

Forking the soil in the trenches, to break any hard crust that may have formed and loosen it, is also important and will ensure that the water can percolate into the field.

MULCHING

Mulching is another way to help retain moisture in a field. The deeper the mulch, the better the soil moisture retention will be. Blanket mulching with thick grass is recommended.

The mulch should be spread all around the field, like a blanket, up to a depth of about 30 cm. However, it is advisable to keep the mulch 15 - 30 cm away from the base of the banana because it can encourage insects to crowd the plant.

Fertilizer can be applied to the field before mulching, but this must also be spread like a blanket so that the roots are encouraged to travel and aren't restricted to one spot.

Any other grass or weeds that grow up through the mulch must be hand weeded. **Do NOT use a hoe for weeding. Banana roots feed near the surface of the soil and will be damaged if a hoe is used.**

Although mulching is a great way to control weeds and keep soil moisture levels up, it is also a fire hazard, especially during the dry season.

Therefore, it is important to clear a buffer zone around the edge of the field to create a break between the planting area and the surrounding bush, and prevent potential fires from reaching the crop (fires could also spread from the planting area to the bush). Smoking in and around the field must be prohibited.

6. INTER CROPPING

Intercropping is the growing of more than one crop in the same field, especially in alternating rows. The goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop.

When to intercrop

Banana plants take 6 months to grow a canopy. Within this period, it is possible to farm one or two seasons of another crop - beans, for example.

It will take 8 - 9 months for banana plants to flower - this is the equivalent of two growing season for legumes. So, when your bananas have just been planted is the time to consider whether or not you want to intercrop.

When intercropping, it is important to fertilize and mulch the field to maximize the moisture and nutrient content of the soil. Intercropping is possible in a field that has already been mulched, especially with beans.

A hole can be poked through the mulch and the seed dropped in, the plant will then germinate as normal. Trash from harvested intercrops can be recycled as more mulch.

Selecting a Suitable Intercrop

Some crops are more suitable for inter cropping with banana than others. Perennial crops, such as lemon should not be mixed with bananas.

Nor should root crops, such as potatoes, because digging the soil to plant and harvest them will cause damage to the banana. Crops that inter crop well with

banana include beans, cow pea, legumes and coffee. Coffee has a tap root, which grows straight down into the soil, and bananas have fibrous roots which spread laterally, so the two don't interfere with each other.

Coffee is also spaced the same as banana when planted (3 m x 3 m). Bananas provide a high canopy to shade the

coffee, and the coffee provides a lower canopy, which cools the soil around the bananas. However, when inter cropping banana with coffee, the demand for water and nutrients will rise.

Coffee husks are often used as organic matter or mulch, but are problematic when used on banana plantations.

Using husks that have come from other fields can be dangerous because they could be harbouring coffee disease. If you mix banana with coffee, you must decide which of the two crops is to be the main one, and farm the field accordingly.

7. FIELD MANAGEMENT

WEED CONTROL

Weed control is important when maintaining a banana plantation. Weeds and other unwanted plants compete with the banana for water and nutrients, and so should be removed. **Do NOT use a hoe to weed the field.**

Banana roots stay close to the surface of the soil and spread laterally, forming a 'mat' across the planting area. Weeding with a hoe will damage the roots and weaken the plants which, in turn, will affect the yield.

Weeding must only be done by hand or, at a later stage, with herbicide. Once the weeds have been uprooted, they should be removed from the field and destroyed.

USING HERBICIDES

Herbicides are used to destroy, suppress or prevent the spread of weeds and other unwanted plants. Using herbicides is one of the cheapest means of controlling weeds. Weed control is important when preparing a field

for planting. Herbicides are usually concentrated liquids, which are then mixed with water at recommended rates and applied to the field with a sprayer.

The most commonly used herbicides in Uganda are Roundup and Gramaxone. Roundup is a systemic herbicide. Systemic herbicides are absorbed by a plant, and are circulated around its system.

Gramaxone is a non-systemic (or contact) herbicide. Non-systemic herbicides are not absorbed by a plant's system and only control the foliage part of them.

If spraying a field after planting, precautions must be taken to avoid herbicide drift. For example, young suckers can be covered with polythene bags whilst spraying takes place.

As soon as spraying is done, they should be uncovered. It is not advisable to apply herbicides on days with high winds, or immediately after rain - when you should wait at least 3 hours before spraying.

DETRASHING

Detrashing refers to the removal of unwanted, dead or dying leaves at regular intervals. Healthy banana plants produce one new leaf every two weeks. As the plant grows, some leaves will be dead, some will be dying, and some will be forming.

Only the dead and dry leaves must be detrashed and arranged between banana plants as mulch. Detrashing the plants only the dead dry leaves regularly will help keep the plantation healthy without risking latent infections of banana bacterial wilts, which can be spread by transfer of sap from plant to plant by the tools if the leaves are not dead and dry. Never cut or detrash functional leaves, these are needed for photosynthesis.

REMOVING MALE BUDS

When they flower, at about 8 - 9 months, banana plants produce both male and female parts. However, the male part, or bud, is not needed and should be removed.

This is done to encourage all of the plant's nutrients to go to the female part, which is developing into the fruit. Male buds also have natural openings through which Banana Bacterial Wilt could enter the plant, so removing them minimizes the risk of disease.

Male buds are easy to recognize - they look like long tails with heads (see image below).

The best time to remove them is when the last cluster of fingers on the bunch is open and all of the clusters are facing upwards. If you remove them before this, the bunch will be poor. If you delay, and remove them too late, you will have wasted nutrients that should have gone to the fruit.

Rather than cutting the buds with a knife, use a forked (Y-shaped) stick to detach them. This will prevent the transfer of sap from plant to plant and lessen the chance of cross-infection. Removing the male buds won't affect the growth of the plant.

8. PEST AND DISEASE MANAGEMENT

WEEVILS

Weevils are hard-shelled beetles with rather long snouts. They feed on banana plants and damage the corms. Weevils, particularly the black variety, can affect the seedling stage, vegetative growing stage, flowering stage and fruiting stage of bananas.

Infestation

Adult weevils feed at ground level, so infestation begins

at the base of the stem. Eggs are laid in small cavities that are chewed out by the female. The resulting larvae bore through the stem, creating tunnels, and disrupting the plant's ability to transport water and nutrients.

Symptoms

Infested plants will exhibit the following symptoms:
Wilting
Yellowing leaves
Retarded growth
Very low productivity

Treatment

Trapping

In small plantations, trapping can be used to control infestation. Traps are made using 10 - 15 cm long pieces of banana stem. The stems are split in the centre and then laid upside down next to the infected plant. After 3 days the traps should be collected and opened - they will have captured adult weevils.

The trapped weevils must be removed from the field and crushed. This is very important because weevils 'play dead' and, if not killed, will continue to cause damage. If desired, a pesticide (such as Furadan) can be applied to the traps. This will ensure that the captured weevils die 'in situ'.

Chemical Control

In large plantations, it is best to use chemicals (or pesticides) to control infestation. The two forms of pesticide most commonly used are systemic pesticides, and non-systemic (or contact) pesticides.

Systemic pesticides are absorbed by a plant and are circulated around its system, making all parts of it toxic to pests or parasites. They can also make plants toxic to

humans and other animals, so have to be used carefully. Systemic pesticides can remain active inside a plant for up to 3 months after application.

They must NOT be used on plants that are to be harvested within the active period. This form of pesticide can either be sprayed on a plant, or applied at the base of it.

Non-systemic pesticides are not absorbed into a plant's system and stay only on the external parts of it. This form of pesticide is safer to use and, therefore, preferred. It is applied to the outer parts of a plant.

NEMATODES

Nematodes live in the soil, so infestation happens via the roots of the plant. Nematodes burrow their way into the roots, feeding on them as they go. Infestation of young plants may be lethal, while infestation of mature plants causes decreased yield.

Symptoms

Infested plants will exhibit the following symptoms:

- Stunted root system
- Root lesions
- Corm lesions
- Toppling
- Low productivity

Treatment
Using nematicides (such as Furadan) is currently the only way to control nematodes in an established plantation.

BACTERIAL INFECTIONS

Bacterial infections are caused by bacteria. Bacteria enter plants through both natural openings, and fissures or wounds made by tools or insects.

Contaminated tools can spread infection (which is why careful use of them is important), and so can some insects - such as bees. The commonest bacterial disease to affect banana in Uganda is Banana Bacterial Wilt (BBW).

BANANA BACTERIAL WILT (BBW)

Banana Bacterial Wilt is a devastating disease that enters

the plant via natural openings, fissures and wounds. It makes the fruit unpalatable and eventually kills the plant.

Symptoms

- Infected plants will exhibit the following symptoms:
- Wilting
- Yellowing and snapping leaves
- Yellow ooze on pressing stem
- Blackening of male bud
- Uneven ripening

Treatment

The disease can be controlled by adopting good crop management practices - such as the 'ABCD' approach:
A - Avoid the transfer of infection. Do NOT transfer infected material (plant parts, bunches, etc) from one area to another.

B - Break off the male bud. Male buds have natural openings through which bacteria can enter the plant, especially via insects. Timely removal of the buds with a forked (Y-shaped) stick will restrict bacteria transfer.

C - Cut the affected stem off at ground level at the first sign of infection. This will prevent bacteria from entering

the corm. If, however, a plant is completely infected, it must be dug up. It should be safe to replant bananas after 3 - 6 months. Any and all infected material should be removed from the field and left in a mound to rot.

D - Disinfect any tools that have come into contact with infected material. The tools can be disinfected by flaming (holding them over fire), or by soaking them in a solution

of 1 part Jik (household bleach) and 5 parts water.
Other ways to help control the spread of infection are to suspend detrashing in the affected areas, suspend the use of sharp tools, and restrict the movement of animals through and around the field.

FUNGAL INFECTIONS

Fungal infections are caused by fungi. Fungi are non-flowering plants of the mushroom family. Fungal diseases are soil-borne pathogens and cause about 87% of plant diseases.

Once established in the soil, they can survive there, without a host, for 15 - 100 years. Fungal diseases can only be controlled by growing resistant planting material. The most common fungal diseases to affect banana are Fusarium Wilt and Black Sigatoka.

FUSARIUM WILT

Fusarium Wilt (also known as Panama Disease) is a destructive fungal disease that enters the plant through the roots, disrupting the plant's ability to transport water and nutrients.
It is the first disease of bananas to have spread globally and cannot be managed with chemical pesticides.

However, some bananas are resistant to the disease - such as the East African Highland variety.

Infection

The fungus enters the plant through the roots and colonizes the water-carrying (xylem) vessels, causing them to become blocked. Unable to obtain moisture properly, the plant wilts and dies.

Symptoms

Infected plants will exhibit the following symptoms:

- Yellowing and drying of leaves
- Wilting
- Splitting of the stem base
- Vascular discolouration

Treatment

Once a plantation is infected with Fusarium Wilt, the only option for continued long-term banana production is to replace susceptible cultivars with resistant ones.

The fungus cannot be controlled using fungicides and cannot be eradicated from the soil using fumigants. All infected plant material should be destroyed.

BLACK SIGATOKA

Black Sigatoka (or Black Leaf Streak Disease) is a foliar fungal disease that affects the leaves of plants, leaving them unable to function properly.

It does not immediately kill banana plants but, by interfering with photosynthesis, it can negatively impact bunch weight and yield.

Infection

Black Sigatoka doesn't enter the plant via the roots. Instead, fungal spores, which are scattered when the fruit of the fungi burst, land on the leaves of the plant and begin to germinate.
Most infections start on the underside of the leaves. As the spores mature, they form blackish-brown streaks. The streaks get bigger and blacker, until they form large spots (or lesions) which restrict the plant's ability to photosynthesize.

Symptoms

Infected plants will exhibit the following symptoms:

- Speckling on underside of leaves
- Blackish-brown streaking of leaves
- Black spotting of leaves

Treatment

Black Sigatoka usually develops on the 3rd or fourth leaf to have opened, so one way of controlling the disease is to encourage the plant to produce plenty of new functional leaves by enhancing the plant's nutrition.

Also by reducing the humidity in the field by maintaining the correct spacing, good field sanitation (removing infected leaves and weeds) and proper drainage.

VIRAL INFECTIONS

Viral infections are caused by viruses. A virus is a microscopic organism that requires a host (the plant) to reproduce. Once a virus infects a plant, it starts to take over its functions.

Plant viruses are usually transferred from plant to plant by insects. Viral diseases that commonly affect banana include Banana Streak Virus (BSV) and Banana Bract Mosaic Virus (BBrMV).

BSV

Banana Streak Virus causes reduced leaf size, leaf streaking and leaf mottling. In severe cases, it can cause the pseudostem to split and collapse. It also reduces the productivity of plants.

Infection

Banana Streak Virus is spread by infected planting materials and mealbugs.

Symptoms

- Infected plants will exhibit the following symptoms:
- Reduced leaf size
- Yellow streaking of leaves (which then becomes black)

- Mottling of leaves
- Splitting and collapse of pseudostem
- Low productivity

Treatment

There is no way to treat or control Banana Streak Virus because it enters the genes of the plant. Therefore, infected plants must be removed and destroyed.

9. ECONOMICS OF BANANA PRODUCTION IN UGANDA

Bananas make a major contribution to the economy of Uganda. Production is mainly by small-scale farmers with two main objectives - food, and cash income.

Bananas are an essential part of household food security in many Districts because they are harvested all year round, with peak production during the dry season. They provide a steady supply of food throughout the year, both to the urban and rural population, and are a major source of income in most of the rural areas of the country.

It is estimated that bananas provide 30% of the calories, 10% of protein and 5 % of fats for the entire population of Uganda.

10. HARVESTING METHODS

There are two methods of harvesting but one is preferable to the other for assisting future productivity.

Method 1
The best way to harvest a banana plant is to cut the bunches from the top and leave the stem standing. Rather than killing the plant immediately, this method allows it to shut down gradually, sharing nutrients with its daughter plants for up to a month in the process.

The daughter plants will grow normally around the stem and will not have to fight for resources. Bunches should be removed from the stalk with a sharp knife, allowing the latex (or sap) to fall on to the soil and not on to other fruit.

The bunches must not be dropped, but should be placed on the ground on top of a freshly cut banana leaf. Fruit that is bruised during harvesting has a shorter post-harvest life, ripens quickly, and may not have good eating quality.

Method 2

Some farmers cut their plants at the bottom of the stem. This causes the plants to fall and shut down immediately. Plants that are harvested in this way are unable to share any nutrients with their daughter plants.

As a result, the daughter plants are left fighting other suckers for resources. This method also encourages weevils (who feed at ground level) and is not recommended.

It is also not good practice to remove the best fingers from the bunches, this will reduce the quality and is ultimately cheating the customer.

Whichever method is used, it is vital that **ALL** cut plant material is removed from the field. If it isn't, weevils and other pests will multiply.

Another advantage of using Method 1 is that there will be much less cut material to clear from the field, making the task quicker and easier, especially for farmers with large plantations. Once the removed material has rotted and dried, it can be recycled as mulch and manure.

WHEN TO HARVEST

In order to develop their full characteristic flavour, taste and colour bananas need to be picked at optimum maturity.

Fruits harvested young are more susceptible to shrivelling, mechanical damage and have poor eating quality when cooked or upon ripening (in the case of dessert bananas).

On the other hand, harvesting at an advanced stage of maturity is not good for fruits intended for export since they may need to spend more than a week within the marketing system before reaching the consumer.

It is important to identify key indicators of maturity for the bananas in order to be able to harvest them at the right stage and time.

The most significant visual changes occur in the size, shape, length and volume as bunches advance in age. During early stages of development, individual fingers are angular, however as growth progresses, fingers become more rounded in shape.

11. STORAGE

Bananas often have to be stored for a few hours or days, and at different stages throughout the marketing chain, before they are finally sold.

In major exporting countries, refrigeration is often used during storage and transportation to ensure a longer shelf life and good quality. However, as this option is not available in Uganda, bunches must be stored in a well-ventilated place, out of the sun.

The common practice of leaving the fruits in heaps, exposed to direct sunlight, should be avoided. Bananas must not be stored near smoke or exhaust fumes, as both can speed up the ripening process.

Bananas bruise very easily, which also reduces the quality of the fruit, so it is important to handle them carefully. It is advisable to keep harvested bunches well-padded when transporting them, and to keep them clean

12. MARKETING BANANAS

Bananas are grown for food, and are sold for cash. They are usually sold in the field to traders who for re-sale them in local or city markets. However, some bananas are bought for export by road to neighbouring countries or by air to Europe and other overseas markets.

Suckers can also be sold to neighbouring farmers - in fact, selling suckers can be more profitable than selling bunches.

GRADING FRUIT MATURITY

The maturity of a banana can be measured by the types of ridges on the peel.

This is referred to as the grade of the fruit. In major exporting countries, the grades are described as - thin, light three quarters (3/4), three quarters (3/4), heavy three quarters (3/4), and round full.

As a rule, bananas should not be harvested when at the thin grade because the bunches sell for a lower price and the fruit shrivels quickly. Bananas should normally be harvested at about the three quarters (3/4) grade.

At this stage they should be able to withstand a transportation and storage period of 4 - 6 days before starting to ripen, although this depends on the type of banana.

Heavy three quarters (3/4) and round full bananas will ripen quickly, but have the best flavour for home consumption or short-term marketing.

Banana Farming

in Uganda

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