DELTA STATE GOVERNMENT

OFFICE OF THE CHIEF JOB CREATION OFFICER

GOVERNOR'S OFFICE.

YOUTH AGRICULTURAL ENTREPRENEURS PROGRAMME

(YAGEP)

TRAINING MANUAL

TOPIC:

PLANTAIN AND BANANA GROWING, PROCESSING AND MARKETING IN NIGERIA

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1.0 Introduction

Plantain/banana originates from South East Asia. They can grow anywhere in the region. Botanically, plantain/banana are monocotyledon plant. Taxonomically, the edible variety is called musa species. The stem of the plant is the rhizome in the soil. The upper part is the pseudostem made up of leaf sheets. It has shallow root system. The female flower develops into the fruits. They develop without pollination by the male flower. The female flowers are at the top hands of the bunch while the male flower is at the end of the bunch. They are the only food/fruit crop that has the highest production of 30 to 40 tons per acre. Potato gives 10 tons per acre while rice gives 4 tons per acre.

Plantain/banana are tropical plant that grows very well in worm humid climate. They are sun loving plants and they are successful in a temperature 10^{o}c to 40^{0}c. They cannot grow below 10^{0}c. They can grow in all type of soil. A well-drained red loamy soil is most suitable. They can perform well in medium black soil without water logging. Short duration crop like plantain/banana are occupying more areas. Fertilizers responding high yield varieties are the first choice of our farmers. Plantain/banana are the only major fruit that can be grown and marketed round the year. Apart from local consumption they can be exported to western countries plantain/banana fruits stand second next to mango in the world rating of fruit. It is important in our menu as well.

1.1 Description of plantain and banana

Cooking plantain is usually longer and bigger than banana. Plantain plant on the average is about 7-10 feet long. Though both are of the same family, plantain contains more starch when unripe/green than banana. Plantain and Banana are often described as vegetable and or fruit. They are green when unripe, yellow when ripe and dark when decay. Yellow plantain is edible and when unripe it must be boiled or cooked or fried or baked to be edible. Ripe plantain and banana are edible because ripeness reduces starch content. Ripeness also enhances flavor and sweetness by conversion

of starch to sugar. Plantain and banana are crops that can survive for many years before they age and stop production.

1.2 Their similarities

The Similarities of plantain and banana are as follows:

- ✓ They contain starch especially in unripe stage.
- ✓ They are green in colour in unripe state
- ✓ They contain important minerals which the body needs for good health
- ✓ Plantain is more generous with producing suckers than banana. They are needed and used as industrial raw materials.

1.3 Their differences

Below are their differences:

- ✓ Their sizes are not often the same. Plantain are usually bigger in terms of fingers and bananas may be larger in terms of bunches.
- ✓ Bananas contain more sugar than green plantain.
- ✓ Banana is eaten only in ripe state whereas plantain is eaten both in ripe and unripe state.

2.0 Growing plantain and banana

2.1 Land Preparation

If new lands are to be used, all vegetation must be removed. A systemic herbicide could be used to get rid of all growth or manual clearing by physical weeding or the use of tractor. For both new lands and previously cropped lands, plough with light machinery to a depth of 15-20cm (6-8”) is necessary not mandatory. Banana has a very high water requirement. In high rainfall areas (>60 inches annually) plantain/banana is not irrigated. In drier areas drip irrigation, or sprinkler systems using micro-sprinklers positioned 12 inches above the soil surface, are installed at the time of planting. Plantain/Banana is a tropical plant and cannot tolerate any freezing temperatures. Plantain/Bananas are grown on a variety of soil types but do best in well drained soils with a pH range of 6.0 – 6.5.The plantain and banana do well in red soil than the black soil because the red soil tolerate more soil borne diseases than the black soil

2.2 Selection of Planting Materials

Three types of suckers (Sword, Maiden and Bullhead) are available. It is advisable to use the Sword sucker with the full corm at the base. Plants from the Sword sucker develop into stronger plants. For rainy season planting, you may plant a sucker 60-90 cm (2-3') long. For the dry season, it may be 30-45cm (1-1 1/2') in length. Make a slanted cut on the upper part. Place longer sucker in the hole and fill back with soil or place the short sucker into the hole and cover over to just cover the cut surface of the sucker.

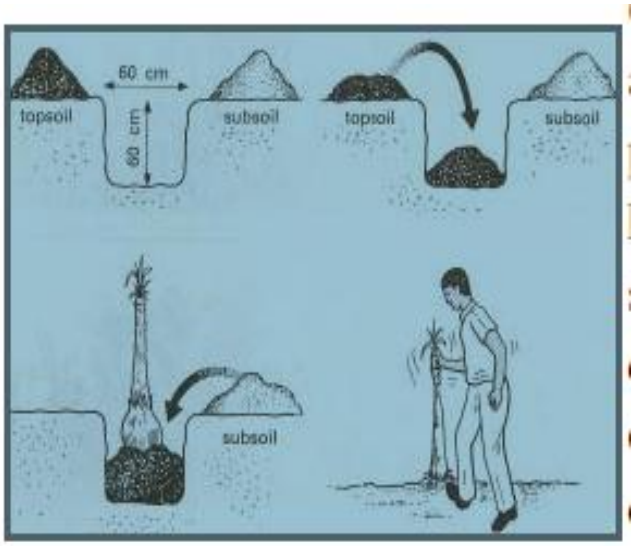
2.3 Pre-planting Preparation of the Suckers

Nematode and stem borer destroy the plants and that is the main reason why they topple over. Proper treatment of the planting material will avoid this. Trim away all brown areas from the base of the sucker to be planted. Trim the outer layers of the sucker away until only white flesh is visible. Remove all dry and drying leaves at the same time. Suckers meant for planting should be cleaned and treated in the field where they were taken. Dispose of all trimmed material by burning or burying immediately.

2.4 Planting of Suckers

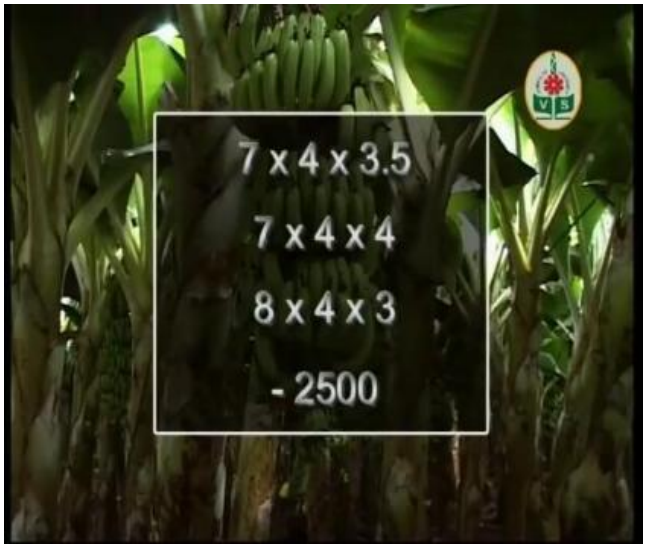
Planting holes should be marked out using the following spacing:
(a) 2.4m x 2.4m (8ft x 8ft) if plantain is the only crop to be planted (680 plants per acre).
(b) 3.6m x 3.6m (12ft x12ft) for intercropping field (302 plants per acre).

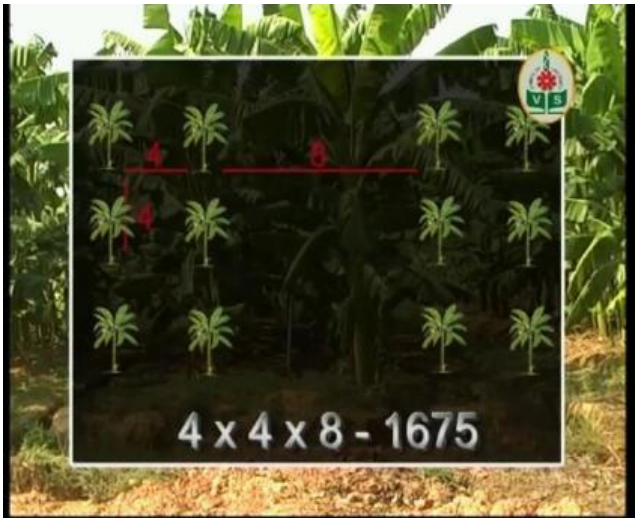
In preparing the planting holes, separate the top soil from the subsoil. The top soil is then placed at the bottom of the hole and the subsoil above to form a mound.



Other planting space models:

6 feet by 6 feet, 7 feet by 5 feet = 1200 plant per acre
7ft by 4ft by 3.5ft; 7ft x 4ft x 4ft; 8ft x 4ft x 3ft = 2500/acre (High density planting)
4 feet by 4 feet, 5 feet by 5 feet = High density planting
4 feet by 4 feet by 8 feet = 1675 per acre





Conventionally, growing plantain/banana is by suckers but in recent years tissue culture plant are now becoming popular. Sword suckers are more preferable for planting. They grow fast and fruits earlier than other suckers. Water suckers are not suitable; they grow slow and flower late. Double roll planting are common now. The wider spacing helps for proper aeration and better sun light. Planting spacing of 6ft x 6ft, 7ft x 5ft will give 1200 plants per acre. Planting spacing of 4ft x4ft x8ft will give 1675 plants per acre i.e. 4ft x 4ft per row and 8ft between per rows. In high density planting space, good nutrition is vital.

2.5 Fertilizer application

Nutrition requirements are high because of the fast growing nature of the plant. Banana roots are extensive but shallow, so frequent application of fertilizer with nitrogen (N) and potassium (K) are needed because these nutrients are leachable and move out of the root zone with heavy irrigation or high rainfall. Damage to the roots during weed control are likely to occur because of the shallow root systems. Weed control is maintained in plantain/banana fields by a combination of herbicides and ground cover (crop residue or cover crop or both).

Inorganic fertilizer

Organic fertilizer

w

In the absence of a soil test, the following are the recommended rates of fertilizers to be applied to each plant. Urea: 450g (1lb) 7SP—225 g(1/2 lb) MOP 225g (1/2 lb) All of the TSP and one half of the Urea and MOP should be applied in the hole at planting. At flowering, apply the remainder of the Urea and MOP.

2.6 Weeding

Weeding is done either manually using cutlass or hoes or by using herbicides. We have contact herbicides which are generally known as quick action and we have slow action which takes 4-5 days before its action weeds are noticeable. Quick action takes few hours for you to notice its action on weed. Herbicides are of different classifications. Apply them with caution. Below are pictures of a lady spraying herbicides and a well maintained farm without grass.

2.7 Desuckering

This maintenance practice helps the crops to give better yield. Mother plant with so many suckers around it will be sharing the nutrients available.

2.8 Detrashing – This is the removal of drying leaf from the plant. The fallen leaf serves as mulching and adds manure to the soil.

2.9 Spraying of fungicides and insecticides

This farm management practice helps to control fungi diseases and insects which are not friendly to the plant. Plantain/banana Weevils can destroy the entire farms in just few months if not controlled.

2.10 Bagging

One month after fruiting, you spray the newly developed fruits with insecticides, remove the flowers at the tips of the fruits then cover the fruits with transparent bags that will allow air and sunlight to pass through. The bagging protects the fruits from harsh weather, rodents, birds and other diseases.

2.11 Supporting/Propping

2.12 Harvesting and Storage

Plantains and banana require about three months from the beginning of flowering harvesting. Plantain should be harvested when the peel is green in colour. After harvest, the bunches should not be piled up on one another. The fruit should not be exposed to sun, rain or wind. The optimal storage and transportation temperature for maximizing plantain storage life is between 12°c and 14°c. This temperature ranges allows for storage between 4 to 5 weeks. The shelf life of green mature plantain can be extended at ambient temperature by storing the fruit in polyethylene bags with an ethylene absorbent (potassium permanganate) wrapped in porous paper. Banana bunches are harvested when the sharp edges of the fruit skin begin to “round” out. Fruit are green at the time of harvest. Banana plants can be 10

to 20ft. tall and fruit harvest may require that the entire plant be cut down to access the banana bunch. Each banana plant produces only one bunch of fruit. Bunch weight varies from 30 to 150 lb. depending on variety.

2.13 Sucker propagation and multiplication Methods

MACRO-PROPAGATION: AN OVERVIEW

This training manual aims to provide a step-by-step explanation of macro-propagation.
STARTING MATERIAL - start 'clean'!
It is very important that the starting material for macro-propagation is clean. Clean starting material can be obtained in a variety of ways:

- ✓ through paring of suckers;
- ✓ through hot or boiling water treatment of suckers;
- ✓ through using tissue culture plants;
- ✓ through chemical treatment of the suckers.

FIELD TECHNIQUES

Two decapitation techniques exist. The two decapitation techniques involve stimulating lateral bud production by destroying the active growing point (meristem) in the pseudostem. Both techniques increase sprouting and sucker multiplication in the field. Using false decapitation, a small hole is made in the pseudostem through which the meristem is destroyed. The foliage remains physiologically active for about three months thereafter. Using complete decapitation, the pseudostem is cut down, destroying the meristem. Both false decapitation and complete decapitation consist of the following steps:

- ✓ removal of apical dominance;
- ✓ sucker detachment.

FALSE DECAPITATION

Step 1: Removal of apical dominance
A small hole (~ 5 cm in diameter) is cut in the pseudo stem of six-month-old plants to destroy the actively growing point (meristem). The hole is made at about 20 cm above the ground by removing the central part of the plant. The

A hole made in the pseudostem of banana/plantain plant.

hole should slightly slope downwards inward the plant, so water and plant sap collect in the hole, further killing the meristem. The plant is left to stand for at least one month to allow sprouting.

Step 2: Sucker detachment
About four to seven suckers, depending on banana or plantain cultivar, will sprout three weeks after removal of the apical dominance. Sprouted suckers are detached immediately once they attain three to four leaves (usually when they measure 20-30 cm in height). Detached suckers are transferred directly to the field.

COMPLETE DECAPITATION
Step 1: Removal of apical dominance
The pseudostem of a 6 month old plant is completely cut down at ground level. Emerging suckers should not be cut. The meristem is destroyed by using a clean knife or machete and removing the 5 cm diameter growing part in the middle of the pseudostem. Usually, the meristem is soft and when hitting harder tissue (the corm), one can be sure the meristem is destroyed. The corm is left to sprout for a month.

After cutting down the entire pseudostem, the meristem is removed and the corm is left to sprout.

Step 2: Sucker detachment

About four to seven suckers, depending on banana or plantain cultivar, will sprout three weeks after removal of the apical dominance. Sprouted suckers are detached immediately once they attain three to four leaves (usually when they measure 20-30 cm in height). Detached suckers are transferred directly to the field.

Suckers sprouting after a complete decapitation.

DETACHED CORM TECHNIQUES

Detached corm techniques are currently promoted by its advantages because of higher numbers of resulting seedlings and growth uniformity of the seedlings. Seedlings obtained using detached corm techniques are also less prone to stress once established in the field. Detached corm techniques include:

- ✓ whole corm;
- ✓ split corm;
- ✓ excised buds;
- ✓ meristem-drilling;
- ✓ PIF (plantes issues de fragments de tiges) / plants resulting from stem fragments.

These techniques are simple and therefore easy-to-grasp, and cheap to establish with minimum investment in construction of propagators and weaning facilities. Using detached corm techniques, activities are carried out in propagators and weaning facilities. Detached corms or buds are prepared for primary bud sprouting. Plantlets resulting from these primary buds are subsequently prepared for secondary bud sprouting. Plantlets resulting from

these secondary buds are rooted. Finally, after an acclimatization period, they are ready for field planting. After 12-18 weeks, using this technology, planting material can be multiplied ten-fold.

The following steps can be identified in using detached corm techniques,:

- ✓ construction of propagators;
- ✓ filling of propagators;
- ✓ selection of suckers;
- ✓ preparation of suckers and planting;
- ✓ propagator management;
- ✓ potting mixture preparation;
- ✓ rooting;
- ✓ acclimatization.

STEP 1: CONSTRUCTION OF PROPAGATORS

Propagators are used for sprouting of new seedlings and hardening of the subsequent sprouts. Simple propagators can be constructed using fairly cheap materials, such as bamboo and polythene sheets. Enterprising banana seedling producers could use iron rods and cast a concrete floor. It is important that at least 50% shade is provided and that the fragile seedlings are well-protected, by constructing a shade above the propagators. A convenient size for a propagator is 1.5 (width) x 5.0 (length) x 1 (height) meter. Propagators should be kept clean and completely covered with transparent polyethylene sheets. Humidity and temperature should be high. The propagator compartments can be made using wood or bricks and should measure not more than 0.5 m in height.

Examples of propagators, with and without shades.

STEP 2: FILLING OF CHAMBERS

Propagators are filled three quarter-full with steam-sterilized fine sawdust. Steam sterilization of sawdust can be performed as follows using an oil drum. Iron bars are welded 20 cm above the bottom of the drum on which an iron net is placed. The modified oil drum is then placed on stands welded on the outside, usually about 20 cm above ground. An old potato bag can be placed on top of the iron net to prevent sawdust from falling through the iron net. Water is poured into the drum up to the height of the iron bars. After applying the sawdust into the drum, the sawdust can be covered with old potato bags again. Heat is applied under the drum using firewood and steam from the water sterilizes the sawdust. Steam is passed through the construction for one hour.

STEP 3: SELECTION OF SUCKERS

Healthy sword or maiden suckers detached from plants that are in between flowering and harvest can be used as source material, as well as corms of plants that are about to flower or that are already harvested. Of critical importance is that the source material is pest- and disease free. A maiden sucker is the most mature sucker on a stool and will give rise to the next crop cycle. A sword sucker is a young sucker whose leaves are pointed like a sword. The decision whether to use a sword sucker, a maiden sucker or corms depends on the type of detached corm technique explained below. Prior to use, the pseudostem is cut off from the suckers.

Roots are removed from a harvested sucker or corm, followed by a thorough wash to remove plant and soil debris. The outer leaf sheaths are removed, one by one, 2 mm above the corm and from the leaf base with a sharp knife. This will expose all the buds and/or the meristem. The prepared material can be surface-sterilized for 20 min in a fungicide mixture. The buds are scarified and the planting material is air dried for 24 hours.

A whole corm

Suckers ready for cleaning

Cleaning, paring and antifungal treatment of corms

STEP 4: PREPARATION OF SUCKERS AND PLANTING

Detached corm techniques include:

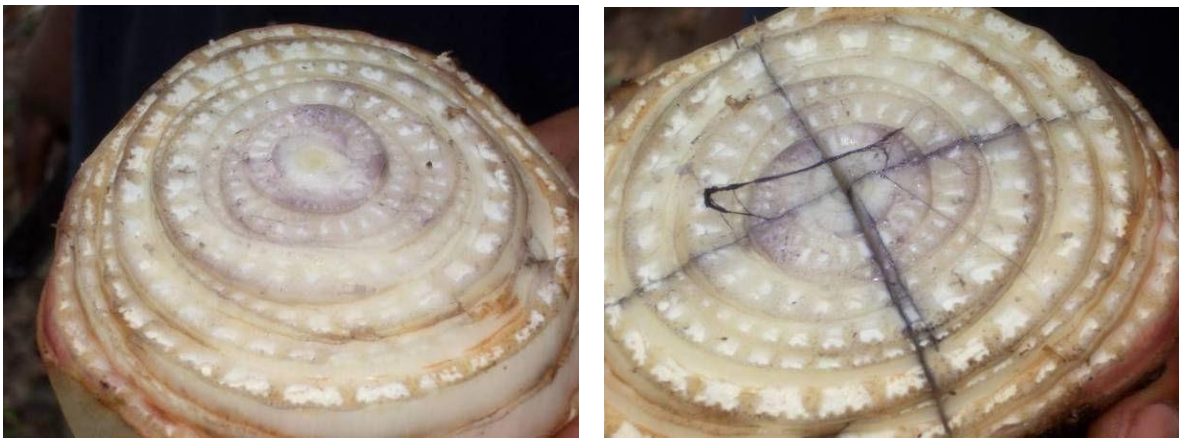
- ✓ whole corm;
- ✓ split corm;
- ✓ excised buds;
- ✓ meristem-drilling;
- ✓ PIF (plantes issues de fragments de tiges) / plants resulting from stem fragments.

Whole corm

Whole corm technique is applied to corms that are about to flower or that are already harvested. The meristem is absent while buds are present. Propagation is by means of bud manipulation. Roots are removed and the leaf sheets are cut away one by one, exposing the buds. A fungicide can be applied. The corm is scarified at the top (by cutting an X) after which every

other observable bud is scarified. The entire corm is planted in the propagator. Corms are planted at 30 cm intervals and covered fully with sawdust, and have to be well watered immediately after planting.

Harvest of entire corm from the field and preparation for whole corm technique.



A corm with removed leaf sheets (left) and after scarification (right)

Split corm

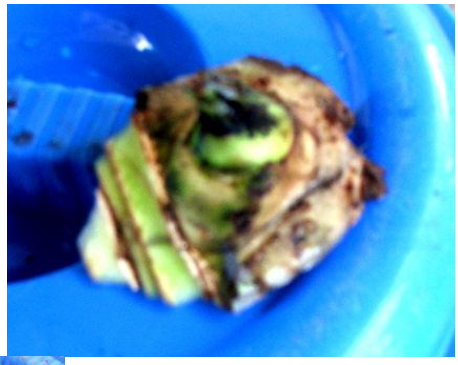
Split corm technique is applied to corms that are about to flower or that are already harvested. The meristem is absent while buds are present. Propagation is by means of bud manipulation. The whole corm is harvested and pared. Exposed buds on top are scarified. Leaf sheets do not need to be removed. The corm is fragmented into two or more bits, depending on its size, and planted in the chamber for buds to sprout. Prepared corm pieces are planted at 10 cm intervals and covered with 2 cm of sawdust. The chamber is well watered immediately after planting.

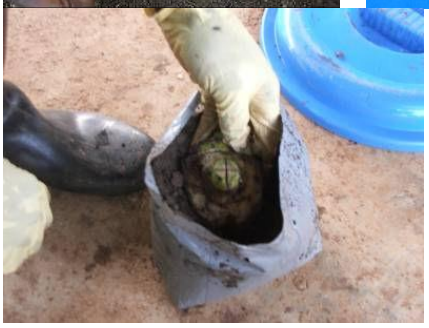
The corm is fragmented into two or more bits depending on its size.

Sprouting suckers.

Excised buds

Excised bud technique is applied to corms that are about to flower or that are already harvested. The meristem is absent while buds are present. Propagation is by means of bud manipulation. Buds are cut out from the corm in pieces of 50-100 g and planted in the propagator to sprout. Buds are planted at 10 cm intervals and covered with 2 cm of sawdust. The chamber is well watered immediately after planting.





Buds are cut out from the corm in pieces of 50-100 g. Buds can be planted

directly in plastic bags.

Meristem drilling

Meristem drilling is applied to a maiden sucker. The meristem and buds are present, but the meristem is drilled. Propagation is by means of bud manipulation. The meristem is destroyed by using a clean knife or machete and removing the 5 cm diameter growing part in the middle of the pseudostem. Usually, the meristem is soft and when hitting harder tissue (the corm), one can be sure the meristem is destroyed. The chamber is well watered immediately after planting.

THE PIF TECHNIQUE

PIF is applied to a sword sucker. Propagation is by means of meristem manipulation. The corm is pared and sterilized. The apical meristem is scarified or fragmented longitudinally into 2 or 4 bits before planting. Fragments are planted with the cut portion, which includes the meristem, facing up. The chamber is well watered immediately after planting. Twenty years ago Dr. Kwo an agronomist of Africa research center for plantain and banana in Njombe in Cameron achieved a technological breakthrough in the production of banana and plantain plantlets known as the PIF techniques that is to produce seedling from stem fragments. This horticultural technique has a great success story for those who has interest in farming banana and plantain or those who want to invest in the sector.

Lack of planting materials has hinder people from venture into banana/plantain farming. Research has now produced a permanent solution to this gap. This technique is effective in producing sufficient materials for the yearning farmers in few weeks. This technique is easy to establish and it is affordable for both educated and uneducated farmers. Combs are harvested and their skin is removed by peeling off the outer layers with a knife. The combs are peel like yam to remove nematodes and diseases.

After the trimming stage comes the second phase that is husking which consists of the removal of the outer stratum of the comb by peeling off 2 to 5 leaf after we would have left some space where new bud will sprout out. The comb will be kept for 48 hours on the average or 72 hours after which the farmer collects the material for a keep in a protected area with adequate air flow. The farmer will then proceed to cross cut the comb and the take them

the propagator where he will bury the comb in the sawdust. A shady area should be made to protect young sprouted plants from direct sunlight.

This techniques has arose the interest of people to go into plantain/banana farming. Seedling through this technique can be easily produced in few weeks and transfer to the field for planting. The hard way of uprooting suckers and transporting them to the farm has become a thing of the past. Thousands of seedlings can be produced in just few weeks. This technique is profitable. It creates more jobs for the unemployed that wish to venture into input production. Even the employed can still earn additional income from seedling production using the PIF technology.

Many stakeholders of plantain/banana production appreciate the PIF techniques few combs can produce thousands of seedlings. The propagator is built under the shade. The techniques offer huge financial benefits. Youths don't like farming because they think the sector is demeaning and should be left for the old men and women in the village. The new ways of farming now is encouraging and I will urge them to venture into it at the end of the season they will not regret their decision. The development of PIF technique has increase potentials. Many people are now interested in plantain and banana farming.

It is the right time we start consuming we start consuming what we produce here and stop eating imported foods. We must stop learning useless things and start learning simple ways of doing things and are life transforming. I will call on our young people to always look outside the box and join us in the production of more food to move this great country forward. You don't need degree to learn this simple PIF technique which you can pass on to your children. We must learn things that will make us useful to ourselves. We should stop importing food stuff and begin to produce ours by doing that you are engaging one or more person in Nigeria and disengaging someone from the importing countries.

STEP 5: PROPAGATOR MANAGEMENT

In propagator management, it is important that a clean environment is maintained. Plants should only be watered when necessary. If the plastic sheets are moist, no watering needs to be done. Depending on the cultivar, three to seven shoots arise from one piece of planting material. Large shoots (usually obtained after three weeks) should be manipulated (scarified) to obtain secondary plantlets as follows. Apical dominance is destroyed by cutting of the shoots and making an X mark in the middle of the remaining corm. After another three weeks, each of these shoots will give rise to three to seven shoots again.

Primary shoots growing in a propagator.

Young plants (primary shoots) emerging from axillary buds on the corms

STEP 6: POTTING MIXTURE PREPARATION

Potting substrate can come from a wide variety of sources: top soil, sawdust, coffee husk, cocoa husk, rice husk or oil palm fiber. These substrates can be mixed in different proportions and should be prepared in advance. Topsoil mixed with sawdust and composted organic matter at a 6: 3: 1 ratio is preferred. The potting substrate is steam-sterilized for 12 hours in a drum. An old oil drum, modified by welding iron cross bars at about 20 cm from the bottom can be used for steaming. Steam is prevented from escaping from the mixture when heating. After sterilization, the potting substrate should be allowed to cool for 24 hours.

Steam-sterilized potting substrate.

STEP 7: ROOTING AND ACCLIMATIZATION

After about 10 weeks, 10 to 50 secondary shoots will have emerged, each with two to three small leaves. These plantlets are detached. Those that have roots go straight into the potting mixture, using one plant per bag or cup. Those without roots are replanted in sawdust for 10 days prior to their movement to the potting mixture. It is important that a little portion of corm remains attached to provide the plants with a nutrient reserve.

Secondary shoots emerging from axillary buds on the corms (left). After they attain two to three leaves (right), they are ready for rooting

Secondary shoots without root (left) and with roots (right)

Sorting of secondary shoots without and with roots

Secondary shoots without roots are placed back in sawdust for 10 days

Plantlets with roots are transferred in their plastic bags or cups to weaning facilities for acclimatization. If plantlets are moved to distant nurseries for acclimatization, they should be transported in humid transparent polythene bags. Acclimatization is ideal at 25-27^{o}C and is accomplished in shades 2m in height for proper lighting and management. Plantlets being acclimatized should be watered four times a week.

Young plants in rooting substrate

Plantlets being acclimatized

After three to six weeks in the weaning facility, plants are ready for the field.

acropropergated plants in the field

5. TIMELINE FOR DETACHED CORM MACRO-PROPAGATION

Plants can be achieved ready for planting after 12-18 weeks.

Propagation stage	Time period
Primary bud sprouting	3 – 5 weeks (depending on the climate condition and variety
Secondary bud sprouting	2 – 3 weeks
Rooting and detached plantlets	2 weeks

Acclimatization	3 – 6 weeks

6. BUDGET FOR DETACHED CORM MACRO-PROPAGATION

This is a budget estimate for constructing a propagator comprised of four chambers with a total capacity of 800 corms. These 800 corms can yield at least 8,000 plants in four months. The Propagator can last for more than five years

Item	Unit cost (=N=)	Quantity	Unit	Total cost (=N=)
Propagator (1.2 x 2 x1 m)				
Transparent plastic sheets		8	sheet	
Wood/scandle		50	scandle	
Nails/zink nails		3	packet	
Pins		2	packet	
Roofing sheets		22	sheet	
Transparent roofing sheets		18	sheet	
Old roofing sheets		16	sheet	
Subtotal propoagator				
Materials				
Olddrums (200 L)		2	drum	
Tags for identification		100	tag	
Sawdust		100	bag	
Plantain or banana corms		800	corm	
Top soil		3	tipper	
Poultry manure		50	bag	
Polybags		8000	bag	
Subtotal materials				
Tools				
Wheel barrow		1	barrow	
Cutlass		1	cutlass	
Digger		1	digger	
Spade		1	spade	
Big knives		2	knive	

Item	Unit cost (=N=)	Quantity	Unit	Total cost (=N=)
Small knives		2	knive	
Large bowl		1	bowl	
Watering cans		7	can	
Fungicide		1	can	
Protective clothes		1	suit	
Subtotal tools				
Labour (1 month)				
Technician for construction		1	person	
Skilled labour for preparation		2	person	
Labour for Maintenance		4	person	
Subtotal labour				
Grand total				

3.0 Post-Harvest Management – Processing

3.1 Handling of harvested plantain & banana

Improving postharvest handling:

The majority of factors that reduce the storage life of plantain and banana occur after harvest. Postharvest handling includes field storage, grading, packing, transport, and marketing. Improved practices during postharvest handling can greatly increase storage life. This is illustrated by comparing traditional postharvest handling of plantain and banana with the highly organized postharvest handling of dessert bananas for export.

Traditional postharvest handling: In West Africa, production of plantain and banana is mainly small scale and farmers have no specialized

harvesting equipment. Fruits are often moved in bulk from farms to towns for sale, which can be several hundred kilometers away. Vehicles used for transport include trucks, the tops of buses, and bicycles. Plantains and bananas may be transported as whole bunches, as hands, as clusters, or as individual fingers. They may be stacked up to 2 meters deep to fill all available space. In some cases, plantains and bananas are cushioned with leaves or stored in jute sacks, but often there is no protection against damage.

Dehanding (separating bunches into hands) and transporting fruit in sacks reduces damage during transport. However, dehanding and packing are labor- and time-intensive processes. Therefore, there may be a trade-off between the advantages of dehanding and the time and skill available. Harvesting, dehanding, and loading plantain and banana into vehicles may take 2-3 days. Journey time to town may be a further 3 days. Therefore, plantain and banana may be exposed to ambient conditions, with no protection from physical damage, dehydration, and high temperatures, for up to 6 days. Despite this, most of the produce reaches the market green and without significant damage. It is estimated that losses in traditional West African systems are less than 10%.

Improved postharvest handling: For transport to more distant markets, often thousands of kilometers away, a highly organized postharvest system has been developed for plantain/bananas.

The bananas are harvested at a specific maturity, relating to the number of days from flowering, the angularity of the fingers in cross section, the size of fingers, and distance to market.

3.2 Preserving harvested plantain & banana

Improving storage life of plantain and banana

Objectives. This guide is intended to enable you to:

- ✓ analyze the problems of storing plantain and banana
- ✓ describe strategies for improving storage life
- ✓ explain the effect of temperature, humidity, and ventilation
- ✓ discuss the effects of atmospheric composition on storage life
- ✓ demonstrate and discuss chemical and physical treatments of fruit

- ✓ analyze and describe traditional and improved postharvest handling methods

Study materials

- ✓ Plantain and banana fruits of different qualities
- ✓ Materials for traditional storage
- ✓ Materials for controlling atmospheric composition
- ✓ Chemicals for coating of fruits

Practical

- ✓ Practice traditional methods of storage and handling
- ✓ Practice methods for controlling atmospheric composition
- ✓ Practice chemical coating of fruits
- ✓ Analyze and describe postharvest handling, storage, and marketing systems of plantain and banana in your region

Improving storage life

The storage life of a crop can be improved by various methods. Some are simple, such as field sanitation. Others require more advanced technologies, such as cool chains. To maintain product quality throughout the market chain, the whole system, from the farm to the consumer, should be considered. Improvements in one area may be ineffective if other areas of the retail system are not considered.

Several strategies can substantially improve storage life:

- ✓ breeding and selection
- ✓ improved cultural practices
- ✓ appropriate time of harvest
- ✓ improved field storage
- ✓ control of postharvest environment
- ✓ treatment of fruit
- ✓ improved postharvest handling

Breeding and selection: Some genotypes have a greater ability to retain market quality than others. For example, the storage life of two tetraploid plantain clones was 30-40% shorter than that of the triploid 'Agbagba'. However, improved storage life must be considered relative to other desired characteristics. For example, plantain clones bred for resistance to the fungal disease, black sigatoka, may have a reduced ripening period, and hence

shorter storage life, but resistance may be considered to be the more important characteristic.

Improved cultural practices: Cultural practices affect the postharvest quality of a crop. Timely cultivation, moderate use of nitrogen fertilizer, avoidance of drought, and control of fungal infection all increase storage potential. Crops are prone to pests and diseases in the field. Thus, farmers should be aware of crop protection measures.

Appropriate time of harvest: Fruits harvested at the appropriate time give the highest quality. In commercial production of dessert banana, the date of harvest is based on size rather than maturity, because the fruit can be ripened as required by exposure to ethylene. Market standards dictate the size at harvest.

However, plantains are mainly grown on small-scale farms, where sophisticated management practices are not used. The date of harvest depends on market demand, and the financial needs of the farmer. Farmers may harvest fully mature fruit for their own consumption and local markets, and harvest less mature fruit for sale at distant markets.

Improved field storage: After harvesting, fruit should not be exposed to sun, rain, or wind. Collection points for the harvested fruit should be accessible to vehicles for transportation. Collection points should also be shaded. Researchers have reported up to 10 °C difference in temperature between shaded and exposed fruit. Rudimentary grading at this point can also improve overall fruit quality. Farmers should discard diseased, damaged, or over-ripe fruit.

Control of postharvest environment: Ripening can be delayed by manipulating environmental conditions. These environmental conditions affect the physiology of the crop. The three main methods for extending storage life are control of temperature, ventilation, and humidity (see Section 3). Modifying atmospheric composition also affects crop physiology and delays ripening, but it is currently less used.

Improving storage life

Treatment of fruit: Chemical coating of fruit, treatment of fruit with gibberellic acid, and treatment of fruit with radiation all extend storage life.

Improved postharvest handling: Improving postharvest handling is the easiest way to extend storage life.

Temperature, humidity and ventilation

A plant product after harvest is still living. The most important physiological functions affecting product quality during storage are the rates of respiration and transpiration. To extend storage life, respiration and transpiration should be reduced as much as possible. This is often done by controlling, individually or in combination

- ✓ temperature
- ✓ humidity
- ✓ ventilation
- ✓ atmospheric composition

Temperature: Reducing the temperature reduces the rate of respiration, which delays ripening and thus extends storage life. Optimum storage temperature for plantain and banana is 13-14 °C. At this temperature, storage life of mature, ripe fruit is 1-2 weeks. Below 11 °C, stored fruit develops chilling injuries, and peel turns gray.

Fruit should be harvested early in the day, when the temperature is low. Immediately after harvest, fruits are cooled to the storage temperature. This stage, called pre-cooling, should be rapid.

Fruit can be cooled using cold air (room cooling, forced air cooling), cold water (hydro-cooling), direct contact with ice, or evaporation of water from the fruit (evaporative cooling, vacuum cooling). Plantain and banana are usually cooled with cold air, to prevent temperatures becoming too low, which can cause chilling injury.

Humidity: High humidity reduces water loss, and increases storage life. However, high humidity also encourages fungal growth. A relative humidity of 90% provides the best compromise for storing plantain and banana.

Humidity can be raised in a container or room by spraying water in a fine mist. Humidity is reduced by venting. Humidity can be controlled with the help of a humidistat.

Traditional methods for increasing the storage humidity include spraying fruit intermittently with water, storing fruit on wet sacking, and storing fruit in

boxes filled with moist sawdust. Although effective, these methods can cause excessive wetting, which leads to fruit splitting and reduces market quality.

Ventilation: Air circulation is an effective method used to reduce temperature in storage rooms. However, ventilation also increases water loss from fruit, by removing the saturated layer of air that surrounds the fruit.

If ventilation is used to reduce temperature, water loss can be reduced by

- ✓ covering fruit with tarpaulins
- ✓ packing fruit into bags, boxes, or cartons
- ✓ wrapping fruit in polyethylene bags or heat shrink plastic films

Atmospheric composition: Respiration can be reduced, and hence storage life increased, by modifying atmospheric composition within the storage area. However, this method can be costly, and therefore is less used.

Normal atmospheric composition is approximately 21% oxygen, 78% nitrogen, and 0.03% carbon dioxide. By reducing the proportion of oxygen and raising the carbon dioxide, the rate of respiration is reduced, and plantain and banana ripening is delayed. For example, bananas stored in 5% carbon dioxide and 3% oxygen at 20 °C have been stored for more than 6 months.

Control of atmospheric composition requires a sealed environment. Sealed storage rooms, where levels of atmospheric gases can be monitored and adjusted, are expensive. A cheaper alternative is a plastic tent. Plastic tents are used in Malaysia and the Philippines to extend the storage life of banana/plantain.

A simple and cheaper method is to seal fruit in polythene (polyethylene) bags. Plantains sealed in polythene bags remain green for a longer period than fruits stored in perforated polythene bags, paper bags, or wet cocoanut fiber. As the fruits respire, the atmosphere within the bag decreases in oxygen and increases in carbon dioxide. Respiration is then inhibited because of the reduced oxygen.

Plantain and banana may be sealed individually, or several fruits may be bagged together. When several plantains or bananas are stored together in

a bag, the first fruit that ripens produces ethylene, and this causes other fruit to ripen. Therefore, only bag together fruit of the same maturity.

In one study, storing bananas in polythene bags at 20 °C delayed ripening by up to 6 days. Also, weight loss was reduced and there was less mechanical damage. High humidity develops in polythene bags. This reduces water loss from fruit, and also has a lubricating effect, which protects fruit from physical damage.

Although polythene bags can extend storage life, there are a number of problems associated with their use. High humidity within bags can result in development of crown rots. These rots are controlled with fungicides such as benomyl and TBZ.

'Green soft' or 'boiling' may also occur in fruit stored in polythene bags. The peel remains green, but the pulp becomes soft and develops an off-flavor and odour. This disorder results from storing fruit in high levels of ethylene and carbon dioxide, with low oxygen. 'Green soft' can be avoided by including an ethylene absorber in the bag or using semi permeable polythene.

Polythene bags are now widely used in Australia to extend storage life of fruit. Studies in Sudan and Ghana confirmed the advantage of using polythene bags to extend storage life, but the technology has not been adopted in this country. Reasons may be lack of information or unavailability of materials. However, it is more likely that polythene bags were not suited to the current system of handling, or that the extra investment in materials and time was not rewarded by higher profit at the market.

Ethylene removal: Reducing ethylene levels delays ripening. Using chemical ethylene absorbents or oxidizers, to reduce ethylene inside polythene bags, is a feasible method for extending storage life. Ethylene can be absorbed by activated carbon, or oxidized by potassium permanganate, ozone, ultraviolet light, or the use of catalysts.

Treatment of fruit: Researchers have investigated some chemical and physical treatments of fruit, as a cheaper way of extending storage life. The main methods investigated so far are

- ✓ chemical coating of fruits
- ✓ treatment with gibberellic acid

- ✓ radiation

Chemical coating of fruit: There is commercial interest in the use of chemical fruit coatings, such as Prolong and Semperfresh, to delay ripening. These formulations are based on sucrose esters and carboxymethyl cellulose, and they are water dispensable. They provide a microfilm coating on the fruit surface. This film has no effect on water movement, but it may restrict the rate of gas movement through the skin of the fruit, slowing down respiration.

Studies have shown that Prolong and Semperfresh delay the ripening of plantains by 8-10 days at 30 °C and low humidity. Hence, chemical coatings have potential use where temperature and humidity cannot be controlled.

However, fruit coating has not been accepted in the banana trade, mainly because of high costs. Also, the subsequent ripening of the coated fruit is unpredictable, and uneven.

Treatment with gibberellic acid: Dipping of fruit into gibberellic acid was shown to delay ripening of bananas at high humidity, but not at low humidity. This method has not been adopted commercially.

Radiation: Studies in the USA and India have reported that storage life can be extended by irradiating bananas after harvest. It increased storage life by 4-8 days at 24-28 °C. However, some types of plantain might be damaged by these doses. Also, the technology is not widely available, and is expensive; and despite acceptance by the USA Food Council, radiation is still unacceptable to consumers in many countries because of negative associations.

3.3 Processing plantain & banana into flour and other value chain

Plantain is a major source of food in Nigeria. They can be grown and processed profitably. The production of plantain as shown from research is over 70 million metric tons per year. Despite this figure, we are still in short supply meaning that demand is more than supply. Plantain can either be used for domestic consumption or as a source of raw material by other processing producers. For instance, plantain can be processed into chips or flour and sold locally or export abroad. Plantain flour because of its value has

now become a popular food today in both local and foreign market. In Nigeria, the potential national demand for plantain flour has been estimated to be in excess of 200,000 Tons/Annum. The current supply level is probably less than 20% of the estimated demand with only few companies producing on mechanized and commercial scale. The facilities required for a small/medium scale plantain flour mill include drying machine, slicing/chipping machine, milling machine and packaging machine.

The average production cost per Kg of plantain flour is N236, while the average retail price per Kg of good quality plantain flour is N550 per Kg. Plantain is the major raw material for plantain flour production, and it is available all year round in commercial quantities in many parts of Nigeria such as Delta, Ondo, Enugu, Imo, Osun, Oyo, Ogun, Anambra, Bayelsa e.t.c Nigeria is said to be the largest producer of plantain in West Africa. The processing line for plantain flour production is as follows:

1. Sorting: This involves inspection of plantain fingers to identify and remove unsuitable ones i.e. spoilt, immature pulps e.t.c.
2. Weighing: The sorted plantains are properly weighed to quantify input of the raw plantain.
3. Blanching: The green plantain fruits are soaked in hot water for some minutes to soften the skin for easy peeling.
4. Peeling: The plantain peels are removed manually using sharp knives to obtain the pulp.
5. Slicing/Chipping: The pulp is sliced or chipped with the aid of a mechanical slicer.
6. Drying: The sliced plantain is dried in a short time with the aid of an industrial drying machine.
7. Milling: The dried plantain slices/chips are milled in a hammer mill.
8. Sieving: The flour is sieved to obtain the desire particle size.
9. Packaging: The flour is packaged in moisture proof packaging material ready for sale.

3.4 Other value chain of plantain and banana
Product from plantain and banana

1. Chips or Crisps

Ingredients

Unripe Plantain or Banana	as required
Vegetable oil	Deep fry
Salt	to taste

Method

Peel Plantain or Banana
Immerse in a bowl containing water
Heat vegetable oil or palm oil in a frying pan or electric fryer to about 170^{o}C
Rub salt on peeled fruit
Slice salted fruits directly into the hot oil and fry with constant temperature until crispy, golden yellow
Removed chips into plastic sieve and allow the oil to drain
Spread chips on polyethylene bag or any clean material and allow to cool.
Package with an impulse (Electric) sealer or candle flame with the aid of hacksaw or kitchen knife

2. Fritters

Ingredients

Mashed banana	4 tablespoonful
Wheat flour	3 tablespoonful
Corn starch	1 tablespoonful
Powdered wheat	1 cup
Milk	½ cup
Juice of 1 lemon	
1 beaten egg	
Salt	to taste

Method

Mix all dry ingredients except sugar, with mashed banana
Add the lime juice, milk and egg
Fry tablespoonful in very hot oil
Sprinkle with the sugar before serving

3. CHOM-CHOM

Ingredients

Plantain or banana paste	3 cups
Wheat flour	3 cups
Vegetable oil	deep fry
Egg	2

Seasoning (Pepper, Onion, curry, crayfish, salt) to taste

Method

Mix Wheat flour into the paste
Beat the egg and add to mix
Add the seasoning and mix further
Add water to form a fairly thick and consistent paste
Roll paste into balls and fry in hot oil until brown

4. Moin-Moin

Ingredients

Blended Plantain Pulp	1 cup
Corn flour	2 cups

Crayfish, pepper, onion, palm oil, salt to taste

Egg	2 (cooked, peeled)

Method

Mix blended pulp into corn flour
Add crayfish, pepper, palm oil and salt
Cut to disperse the egg and to obtain uniform mixture
Pour the mixture into greased cans to about 2/3 full
Cover the cans with a lid or aluminum foil and place
On sticks in a cooking pot
Steam steadily on fire until cooked removed from fire and serve with custard or pap.

Note: The paste can also be cooked in the oven (do not cover the can in this case). I part each of corn flour with plantain paste and cowpea (Beans) may also be used. Ingredients and procedures remain the same.
The mixture can also be wrapped in plantain or other leaves in the place of cans

5. Amala

Mix plantain or banana flour with boiling water contain stirring while adding the flour
Let stay on fire for a short while with continue stirring
Allow the paste to thicken
Serve hot with Ewedu or okra soup mix with vegetable soup and meat or fish.

6. Cake (100%)

Ingredients

Plantain flour	600g	6 cups
Granulated sugar	300g	3 cups
Margarine	180g	2 to 3 heaped tablespoon
Egg	12	
Baking power	12g	2 level tablespoon
Powder Milk	12g	2 level tablespoon
Mixed fruit (Optional)	180g	or as required
Food colour (optional)	2-3 drops	
Brandy flavor (optional)	1-2 drops	
Water	230ml or 1½ cups	

Method

Mix the flour with baking powder and add milk 5-10 minutes later
Cream margarine and sugar unto smooth
Add egg to the resultant cream and mix before the adding of dry ingredients.
Mix further with the adding of water to obtain a dropping paste
Add mixed fruit and few drops of colour and flavor
Pour the batter into greased baking pans to 2/3 full
Bake for about 30-45 minutes at 150-200^{o}C

7. Meat Pie (25%)

Ingredients

Plantain flour	1 cup
Wheat flour	1 cup

Baking powder	1 table spoon level
Irish Potato	2 to 3 medium size
Carrot	2 to 3 medium size
Minced meat or corn- beef	1 cup
Salt, onions, nutmeg, magi	
Cubes and curry	to taste
Butter and vegetable oil	1 tablespoonful

Method

Peel potato and carrot and cut into small pieces and boil with corn beef, salt, onions, magi cubes, curry and boil for about 20 minutes.
Mix the flour with baking powder and set aside for 5-10 minutes
Then add water and vegetable oil or butter and mix thoroughly
Leave to rise for 15-20 minutes
Roll the dough on a floured board and cut into small bits
Scoop small quantity of the already cooked ingredients and fold into dough
Seal and dress the end of fold with fork
Perforate the top of the dough with fork
Brush with beaten egg and bake at 200^{o}C for 30-45 minutes

8. Bicuit (50%)

Ingredients

Plantain or banana flour	100g
Wheat flour	100g
Sugar	100g
Grated coconut	100g
Egg	2
Baking powder	10g

Water enough to make stiff dough

Method

Sift and mix the two flours thoroughly in a dry mixing bowl
Cream sugar and margarine until light and fluffy
Add the flour mixture, baking powder and coconut
Mix to obtain fairly stiff dough
Roll out on a floured board
Cut into desired shaped and arrange on baking trays

Prick (Perforate) with a fork
Brush with beaten egg and bake at 175^{o}C until evenly
Brown on both sides.

10. **Chin-Chin (50%)**

Ingredients

Plantain or banana flour	2 cups
Wheat flour	2 cups
Margarine	2 tablespoonful
Egg	3 medium
Milk	2 tablespoonfuls
Granulated sugar	½ Cup
Baking powder	1 teaspoon level
Curry	1 teaspoon level
Vegetable oil	deep fry
Water	

Method

Mix plantain or banana flour into wheat flour
Add baking powder, mix and set aside
Cream the mix to soften the pastry
Beat egg with granulated sugar, milk and curry
Fold in the flour and add water to bind
Knead into fairly stiff and smooth dough
Turn the dough into a floured board and roll into thinly
Cut into desired shapes
Fry the strips in small batches until golden brown on both sides
Drain and cool before packaging into polythene bag.

11. **Banana Jam**

Jam is prepared by boiling equal quantity of fruit or mixture of fruits with sugar, together with water and lemon juice or lime juice, until the setting point is reached. Lime or lemon juice could be used to replace citric acid, which acts as acidity regulator in commercial jams. The use of pectin as a gelling agent can be excluded in plantain/banana jam, since pectin is present in Musa fruit. During boiling, a proportion of the sucrose is acid hydrolyzed to

invert sugar and a gel is produced on cooling. Ascorbic acid is used in jam preservation, which could extend the shelf life for 3 years. No colouring material is required in plantain or banana jam, as desired colour developed on its own accord during processing.

Method 1

Ripe pulp	200g	2 or 3 small banana
Granulated sugar	200g	1 cup
Water	200 ml	$1^1/_2$ to 2 cups
Lime Juice	30-35ml	4 or 5 lime fruit
Ascorbic acid	1000mg/kg	(Preservative)

Method 2

Ripe banana	670g	6-7 small banana
Sugar	300 g	2 cups
Mango juice	82 ml	4 to 5 big mango
Orange juice	244ml	6 to 8 sweet orange
Lime or lemon juice or citric acid		(Optional)
Pectin		(Optional)

12. Juice

Method

Obtain some ripe banana fruits
Peel and blend the pulp
Soak slurry in hot water for 10-15 minutes for optimum juice extraction
Pulp and water should be in the ratio 1:3
Filter through white muslin (akamu) cloth
Pasteurize the juice by boiling and simmer for 3 minutes (optional)
Cool and fill into sterilized bottles
Colouring may be added prior to boiling.

13. Ice Cream

Ingredients

Ripe banana 20-24 depending on size
Egg 12 (albumin, whisked)
Granulated or icing sugar 1 cup or 5 heaped tablespoon
Water 500ml (1 cup = 170ml)
Vanilla powder or liquid vanilla flavor essence (pinch/few drops)
Pint cream a pinch (sparingly)
Milk (5 heaped tablespoon for powdered or preferably 1 tin of evaporated

Method

Peel and blend the pulp
Soak slurry in hot water for 10-15 minutes for optimum juice extraction
Pulp and water should be in the ratio 1:3
Filter through white muslin (akamu) cloth
Add all ingredients to the extracted juice and mix thoroughly
Pour into cream cups or seal in polythene bag
Place in a freezer until required

3.4 Nutritional value of plantain and banana

NUTRITION FACTS OF PLANTAIN

Principle	**Nutrition Value**	**% of RDA**
Energy	12.2kcal	6%
Carbohydrate	31.89g	24.5%
Protein	1.30g	2%
Total Fat	0.37g	2%
Cholesterol	0mg	0%
Dietary fibre	2.30g	6%
VITAMINS		
Folates	2.2mg	5.55
Niacin	0.989mg	4%
Pyridoxine	0.299mg	23%
Riboflavin	0.054mg	4%
Thiamin	0.052mg	4%
Vitamin A	1122Iu	37.5%
Vitamin C	18.4mg	31%
Vitamin K	0.7mg	1%
ELECTROYTES		
Sodium	4mg	< 1%

Potassium	499mg	10.6%
Calcium	3mg	< 0.5%
Iron	0.60mg	7.5%
Magnesium	37mg	9%
Zink	0.14mg	1%

NOTE: For every 100g plantain intake, the above nutrition values are absorbed in the body system. While 122 calories are obtainable from plantain, 89 calories are obtainable from banana.

4.0 Marketing of plantain and banana produce

4.1 Local market network

Local marketing of plantain and banana starts in the farm or residential places where the plants grow. While still un-harvested some market women come around to price them, harvest later and take them to local markets a day before the market day even that same market day. Others buy in clusters, load their vehicles and take them to cities, towns or places outside production where comparative prices are high. The patronage of industrial users of the produce such as dairy products, baby foods manufacturers is still at a teething stage in the country.

4.2 International market network

The Exporters Association (Adex) informed that the export of plantains and banana is growing annually. According to them, plantains exports evolved favourably in recent years due to the increased demand from Holland, USA and Germany. Last year, the Netherlands was the largest importer with US $49.8 million, 18.5% more than in the previous year. The US followed with $32.7 million dollars and a significant 105.2% growth in imports. Germany ranked third with imports worth $19.3 million and a growth of 70.1%.These three countries were the main destinations of this fruit, with a share of 85% of the total.

According to Adex, the increase in shipments to the United States was primarily due to the fact that the companies preferred to export to large

buyers in the US who offered to pay the same price as the Europeans.Belgium ranked fourth with 6.1 million dollars and, despite having an 18.1% fall, the European country remains a major destination for plantains.

Japan was another country that bought plantains/banana last year of about $2.8 million, despite having a contraction in orders of about 34.4%.Other countries that bought plantains were Finland, South Korea, UK, Canada, and France, among others. The exporter guild stated that some of the new markets for plantains and banana last year included Ukraine, Macao and Uganda. Plantain exports to the Ukraine amounted to $56,160 dollars and small samples were sent to Macao and Uganda. There was also a discovery in exports to other destinations, such as Finland.

Source: America Economia. Publication date: 24/2/2016

4.3 Packaging

Skilled teams harvest the bananas, using specialized equipment to cut stems and support cut bunches. Where flat land allows, wire and pole systems suspend and transport bunches from the field to the packing shed.

The bananas are then separated into hands. The hands are washed in a solution (2% alum, 20% chlorine) to sterilize them, and to prevent latex from cut fruit staining the peel, and then treated with fungicide.

The hands are then packed into fiberboard boxes. The boxes may be lined with polythene, or the hands may be sealed in polythene bags. The boxes are stowed at a specific stack height and configuration in refrigerated stores or transport containers. At the destination countries, the unripe bananas are distributed to ripening depots, where the ripening process is initiated with ethylene gas. Bananas are then distributed to retail outlets/markets. The storage life of bananas, using these techniques, is 4-8 weeks.

5.0 Brief on NABPAN

NATIONAL BANANA AND PLAINTAIN GROWERS, PROCESSORS AND MARKETERS ASSOCIATION OF NIGERIA (NABPAN)

1. NABPAN is an umbrella body comprising growers, processors and marketers of banana and plantain in Nigeria. Unlike in the past when commodity associations were formed arbitrarily without National focus, NABPAN was incorporated in Corporate Affairs Commission on 30th day of March, 2015 by the Federal Ministry of Industry, Trade and Investment, in collaboration with Raw Materials, Research and Development Council of Nigeria charged with the mandate of taking banana and plantain to the next level.
2. Organogram of NABPAN: The association is being run at Federal, States and Local Government Area Levels.

a. Federal Level: The Federal offices consists of the President, six(6) Vice Presidents, one(1) Vice President (VP) per geopolitical zone, General Secretary, Assistant General Secretary, Financial Secretary, Treasurer Organizing Secretary and Publicity Secretary.

b. State Level: Offices at State Level are same with Federal except that state heads are called state Chairmen, assisted by state Deputy Chairmen. For even spread of offices, not more than three and not less than two offices are allocated to each of the three senatorial zones

c. Local Government Area Level: The offices at the Local Government Area level are same with the States. All offices at the three levels are elective positions.

3. Registration of Members: Payment of registration fee of five thousand naira only (N5,000.00) is mandatory in order to be a member. More

importantly, a prospective member must have personal interest, passion and commitment to banana and plantain farming. These are the driving forces that will enable one scale through the initial stresses of investment gestation period.

4. Benefits Accruable to Members: Like all co-operatives, NABPAN is mandated to among other things to avail itself of the existing opportunities to develop and reposition commodities (banana and plantain) for better performance within and outside the country. NABPAN is an association formed and conceptualized on value chain and giving each member the opportunity to excel in any or some or all the areas of operation.

In order words, NABPAN allows for individual efforts as well as group or communal interactions to success. As a body, information are easily disseminated among members especially on new techniques and technologies, access to funds, better seedlings/suckers species, climate and economic forecasts, to mention a few. However, a lot need to be done in the area of man power capacity development, materials and financial encouragement from government to catch up with countries like Cameroon, Kenya and Ethiopia in Africa and the Caribbean.