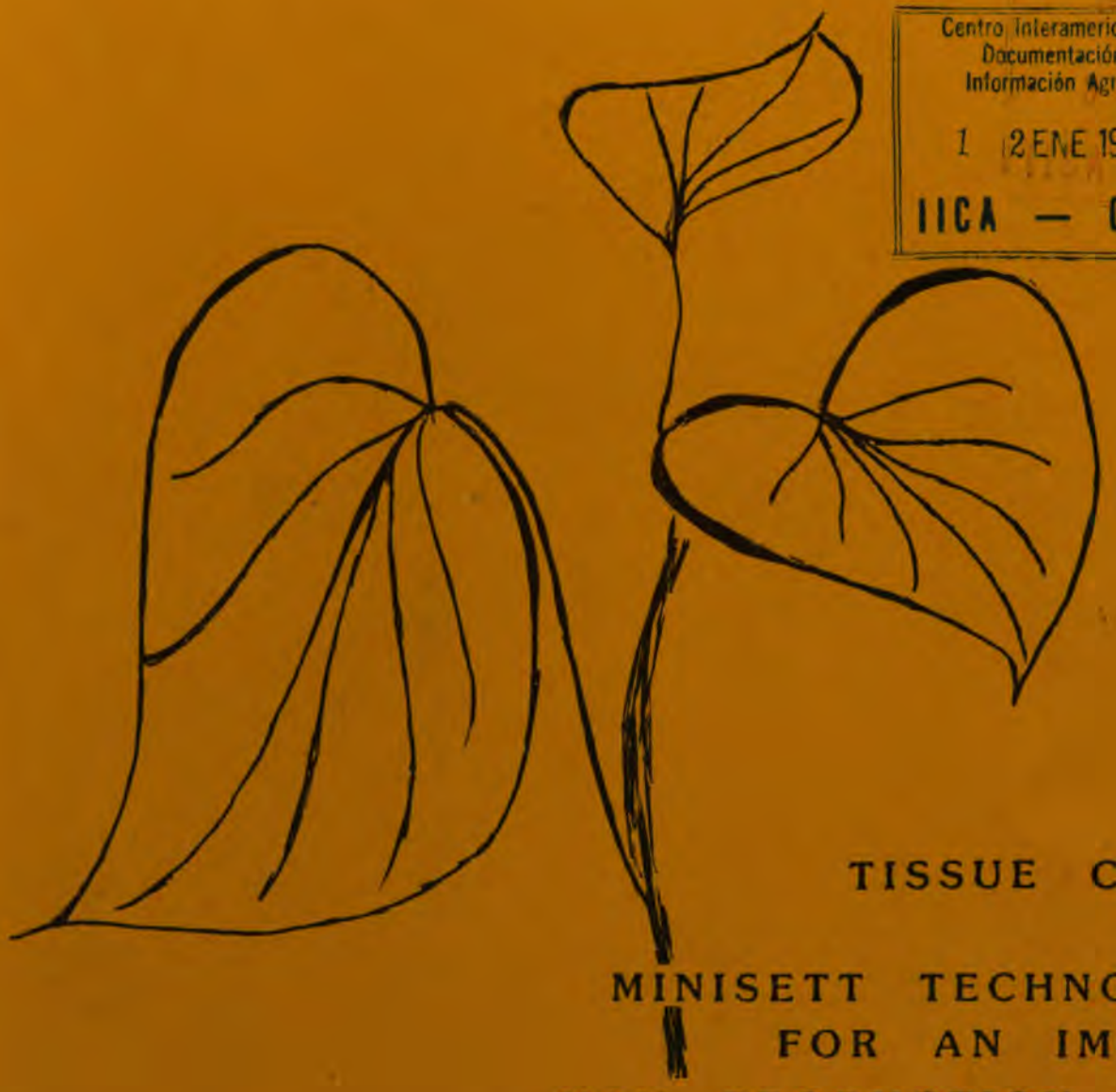


TISSUE CULTURE AND MINISETT TECHNOLOGIES FOR AN IMPROVED YAM PRODUCTION SYSTEM

A TEST MANUAL

MINISTRY OF AGRICULTURE

SCIENTIFIC RESEARCH COUNCIL

UNIVERSITY OF THE WEST INDIES

INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

INTERAMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE

TISSUE CULTURE
AND
MINISETT TECHNOLOGIES
FOR
AN IMPROVED YAM PRODUCTION SYSTEM

A TEST MANUAL

Ministry of Agriculture
Scientific Research Council
University of the West Indies
International Institute of Tropical Agriculture
Inter-American Institute for Cooperation on Agriculture

PREFACE

The yam "minisett" technology was brought to Jamaica by the International Institute of Tropical Agriculture (IITA) under a joint GOJ/UWI/IITA Root Crop Project in 1985. A little more than a year later, some of the results are showing the enormous potential of this technology for Jamaican local and export production.

The question of sharing this important technology became of concern to us at IICA. A seminar was organized, whereby the tissue culture and minisett technology as a component of improved yam production system could be shared over a two-week period from November 24 - December 5, 1986. This manual was developed by Dr. Vishnoo Asnani, IITA, in conjunction with Stephen Harwood of IICA, and consolidates the work done by Dr. Asnani and other scientists in various institutions/ organisations. The manual has been written in simple language avoiding heavy technical terms as this is directed primarily to farmers and extension agents. It will be tested over a one-year period beginning at the seminar. We hope it will make a contribution to the work of farmers, field officers and technicians. Assistance given by various individuals and organisations in compiling this manual is sincerely appreciated.

Jan Hurwitch-MacDonald
Director ad interim
IICA Office in Jamaica

INTRODUCTION

Root crops are a significant part of the diet of the people of Jamaica and the West Indies. They are a major source of energy (calories) within these diets. The most common of these root crops is the yam.

Yam was introduced to Jamaica from West Africa in the 1600's. Over the years it has been grown mainly for domestic consumption, but recently demand has broadened in Europe and North America. Considering the foreign exchange position of many Caribbean countries it would be beneficial to expand production for the export market.

Traditionally the growing of yam in Jamaica is done by small farmers who usually plant on an acre or less. Due to diseases, nematodes, and various other production problems the yields on these farms have been low. The yields are adequate for the domestic market but not enough to export profitably.

Being a tuber crop, the yam propagates by way of the "head" of its tuber. In traditional farming these "heads" are cut from the whole tuber at harvest time and then utilised as planting material in the next planting cycle. Therefore, the amount of tubers harvested determines the number of heads to be available as planting material. Another consideration in this re-using of yam "heads" over many plantings is the accumulation of disease (pathogens) in the "heads". As a result plants produced using these "heads" can become less productive. Moreover, the yam grown from these "heads" in the traditional method is often toed and odd shaped. In order to market these yams they need to be cut. Cutting a tuber to the right shape can mean exposing it to further disease and shrinkage (due to moisture loss).

Recently in Nigeria work has been done on a method of farming to help minimize traditional farming problems. A new technique has been developed out of these efforts called "minisett" technology. It is a simple and efficient method developed at the International Institute of Tropical Agriculture (IITA) to help increase yam production. This new technology has been tested in several West African countries and is now being introduced in Jamaica.

"Minisett" technology gets its name from the cutting up of yam tubers into small pieces to use for planting material. These small pieces, or "minisetts", are coated by dipping in a protective solution They are then sprouted in sawdust beds to be planted back into the field.

The minisett technique provides for a whole tuber to be used instead of just the "head". Thus, the ratio of one "head" to be used as planting material from one tuber changes to many minisetts per tuber (from 10-20 pieces). A much larger amount of planting material becomes available from year to year.

Disease accumulation in the "head" is no longer a problem. New tubers are grown each year so they can be used as planting material, thereby eliminating the use and reuse of the "head" for planting purposes.

Minisetts are pieces of the tuber cut to a uniform size and weight (between 40-60 grams/1.4-2.1 ounces). This helps ensure a uniform shape in the next generation of tubers. Spacing between the plants can also help in getting a smaller, more uniform tuber. Harvesting can be made simpler with a uniform shape by allowing yams to be pulled out of the ground, instead of painstakingly digging up each tuber with a fork and possibly injuring the tuber. With less toes the new tuber need not be cut and is easier to store. Exportation becomes easier because the uniform shape is easier to transport.

THE PROCESS

In order to use the "minisett" technology a series of steps must be taken. The process is divided into land preparation, "minisett" preparation and planting. The preparation of the land should be timed to be finished when the "minisetts" are ready for planting.

To prepare your land for "minisetts" you want to fertilize it first. Both organic and inorganic fertilizers may be used. Your organic fertilizer should be preferably chicken manure. One ton (2000 lbs./909 kgs.) of chicken manure per acre is appropriate. Other manures could be used but chicken manure has more nutrients for your soil. Inorganic fertilizers are chemical compounds. Depending on the fertility status of the soil, it would be useful to apply 7:14:14 (or 12:24:12) inorganic fertilizer mix, used at a rate of 500 pounds (227 kgs.) per acre. All fertilizers must be throughly tilled (cultivated) into the soil. Surface application of fertilizer is unadvisable because yam is a root crop. After the fertilization process has been completed the contouring of the field is next.

In traditional yam production in Jamaica the field is formed into mounds approximately 2-3 feet (1 metre) high. The yam plant is then encouraged to grow up either a bamboo or wooden pole which is at the edge of the mounds. These poles are usually 8-10 feet (3 metres) high. Yam requires a well drained soil that can allow moisture and air to the tuber. The mounds serve this purpose. Meanwhile the pole is for the plant to get maximum exposure of sunlight. Poling also allows the plant to grow upwards so that scarce land can be planted in more yam or other crops. However, bamboo and wooden poles are not only expensive but also becoming difficult to get. Making high mounds requires a lot of labour.

"Minisett" technology does not require these operations. Instead, the field contour to be used is in a continuous ridge. This continuous ridge is approximately 1.5 feet (0.5 metres) high and has a distance of 3 feet (1 metre) between the centre of one ridge to another. This can be mechanised or prepared manually. A continuous ridge provides good drainage. It is also an easier configuration to irrigate. Growing other crops between the ridges has been found to be successful. The yam plant is not poled up, as in the traditional method, instead the plants cover the ridge with their vines.

"Minisett" technology uses a "plastic mulch" which is laid over the continuous ridges prior to planting and is kept in place until harvest. This roll of plastic is 4-5 feet (1.2-1.6 meters) wide so it can be put length wise on the ridges and

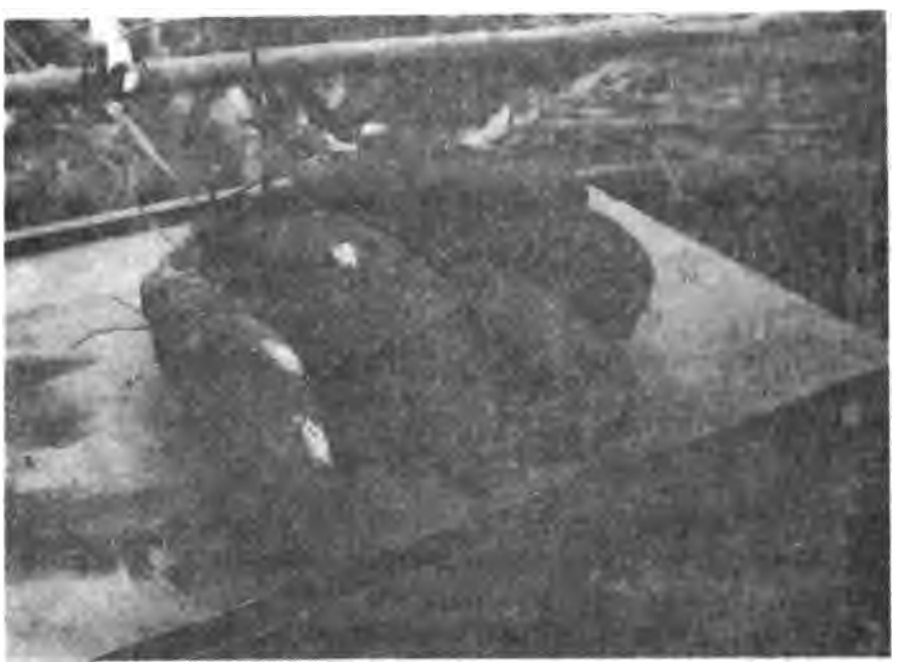
held in place with soil or stones. The plastic serves three purposes:

1) to retain moisture in the soil for the yam plant, and
2) to curtail weed growth. Minimum weedings are done in the "minisett" technique, whereas, many more weedings are necessary in the traditional yam production method. "Plastic mulch" is an initial investment that is paid for by less labour cost in weeding, no cost for poles, and increased yields per acre.
3) Soil conservation. Less erosion occurs when the "plastic mulch" is used.

Time involved in preparing the land will vary with size of field and the availability of equipment for mechanisation. Land should be prepared by the time the minisetts are ready for planting into the field.

"MINISETT PREPARATION"

Traditionally, at harvest time farmers cut off the "heads" of each harvested tuber. In this new technology the farmer harvests all tubers whole. He then selects whole, healthy tubers to be used as "Mother seed yams".



These are the selected Mother Seed Yams

Yam at harvest is in a dormant stage for reproduction. It does not have the sprouts on the tuber for plant reproduction. These sprouts appear on the tuber after the dormancy period passes. Depending on variety this is usually 6-8 weeks after harvest. It is at this time the tuber is physiologically ready to be cut into minisetts for sprouting.

Mother Seed Yam after breaking dormancy

Cutting tubers into minisetts requires a flat cutting area, a pan or bucket with a solution for dipping the minisetts, drying area and a prepared bed for the minisetts to be sprouted in. A sharp knife or machete is used to cut up the tubers. The selected "Mother seed yam" tubers are cut into 40-60 gram (1.4-2.1 ounces) pieces. Each minisett must have an edge that is part of the outer skin of the tuber (epidermis). Immediately

after cutting the tubers the minisetts must be submerged in a solution to coat against disease and pests. This solution consists of insecticide, fungicide and gypsum. The solution should be as follows:

Water	Insecticide	Fungicide	Gypsum
1 gallon	10 grams*	20 grams	30 grams
2 gallon	20 grams	40 grams	60 grams
3 gallon	30 grams	60 grams	90 grams

* equals 0.35 ounces

Tuber being cut into Minisetts

The measurement for one gallon of water is 10 grams insecticide, 20 grams fungicide and 30 grams gypsum. All ingredients are available in powdered form and can be purchased at a farm supply store. The grams are the weight of the ingredient in powdered form. The freshly cut minisetts are dipped in this solution for a few minutes.

Minisetts should be dipped into solution of fungicide, insecticide and gypsum

After dipping the minisetts they are laid out on a flat dry area out of direct sunlight. The minisetts should be dry to the touch before removing to be placed in the sprouting bed. This should be about two to three hours drying. As the minisetts are drying the sprouting bed should be made ready. A sprouting bed is a flat area that is shaded by trees or thatch.

The flat area can be bordered off with planks blocks, bamboo stocks, or dead coconut tree trunks, or stones. The area should be about 3 feet (1 metre) wide and 10-20 feet (3-6 metres) long, depending on how many minisetts are being sprouted. Within the bordered area a layer (½"-1"/1.25-2.5 cm) of fresh, moist sawdust is layed out for the minisetts. Once the minisetts are completely dry after dipping they are placed on this sawdust 'bed'. Minisetts should be laid out in such a way that the skin (epidermis) is touching moist sawdust and the cut portion (flesh) is up. Spacing between the minisetts should be approximately ¼"-½"(1 cm).

Planting minisetts in sawdust bed

Covering minisetts with moist sawdust

Since they are placed so close together in a relatively large sprouting area, hundreds can be placed in a single bed. Once the minisetts are layed on the sawdust another layer of moist sawdust is placed over the minisetts to cover them. About 1" (2.5cm.) of sawdust is required, enough to cover the minisetts and hold moisture in during the sprouting period. Besides a flat area, small wooden or plastic boxes can also be used for sprouting. When using boxes another layer of minisetts can be put on top of the first. In tests already done this has been found to be successful and a good utilisation of space.

ABOVE: A nursery bed with minisetts covered.

BELOW: Watering the nursery bed to maintain appropriate moisture.

When completed the sprouting bed should look like a bordered off area of sawdust with no minisetts visible. This area must be moist at the time the minisetts are put in and the moisture maintained for 6-8 weeks. By this time the minisetts should have noticeable sprouts. It is suggested that the minisetts be checked every week by digging up a few minisetts in various areas of the bed.

Sprouted minisetts are ready to take to the field

Prior to sprouts forming the minisetts will develop small roots. Be sure to replace all dug up minisetts carefully. Checking the minisetts regularly helps to see their progress and to be sure that the moisture level is kept right. Over-watering of the bed can cause the minisetts to rot and underwatering can dry them out too much so that they do not sprout. The sprouting minisetts are to be carefully dug up and transplanted in to the prepared field. If you use plastic mulch, you just poke holes along the centre (top) of the ridge every 12"-18"(30.5-45 cm.), depending on how big a tuber you wish to grow. The minisetts are transplanted into the soil through the hole in the plastic mulch. Be sure that the sprout is exposed to the air and sunlight. Do not plant minisetts into a dry field. It is necessary to maintain the plastic mulch in place during the entire growing period of the minisetts.

Laying plastic mulch on
ridges in the field

Punching holes and planting minisetts through the plastic mulch

THE AFRICAN EXPERIENCE

West Africa is the largest yam producing area in the world. The need for better, more efficient methods of yam production would most likely evolve from there. Nigeria, being a major producer of yam in West Africa is where "minisett" technology was developed. With a collaboration between Nigeria's National Root Crops Research Institute (NRCRI) at Umudike and the International Institute of Tropical Agriculture (IITA) at Ibadan the "minisett" was born.

In West Africa yam is grown to large 10-15 pound (4.5-6.0 kgs.) tubers for local consumption, the reason being that the large tuber is pounded into a meal which is then eaten. In order to grow such large tubers, large "head" pieces were required. Therefore, a large body of planting material was needed. In certain cases whole small tubers are used as planting material. This meant that about 1/5 of the yams produced were being reused as planting material for next year's production.

Since tubers used as planting material are stored 2 - 4 months, they suffer substantial damage from spoilage and shrinkage. These tubers also transmit viruses, nematodes and other fungal organisms to new crops contributing to even lower yam production.

The "seed yam" technology starts with clean healthy yam tubers (500-1000 gm/1-2 lbs.), or "mother seed yams", at the right physiological age, which is after they have come out of dormancy one to two months after harvest.

The mother yam seed is cut into "minisett" pieces and coated with a solution (fungicide, insecticide and gypsum or wood ash). It is placed in a nursery bed of moist fresh sawdust for sprouting. These sprouted "minisetts" are then put into a prepared field to be grown. Six - eight months later the harvested yam tuber (800 - 1000 gm/2.0 lbs.) is then stored to be used as planting material for the large yams which are consumed. The whole process requires about two years.

JAMAICA

The Caribbean is another yam producing area of the world with Jamaica being one of the largest islands in the area for yam production. With years of experience in Nigeria the "minisett" technology was brought to Jamaica by IITA under a joint GOJ/UWI/IITA Root Crop Project in 1985.

Yam Production field using minisett technology in Jamaica

Unlike the experience in West Africa, Jamaica does not require large 10 - 15 pound (4.5-7.0 kg) tubers. Instead the smaller 3 - 4 pound (1.5 kg) yams are preferred for local consumption. Jamaicans prepare yam for consumption by boiling, roasting or cooking into soups. Because of this difference in uses of the yam, the growing requirements of two years in West Africa, is only one year in Jamaica.

Uniform size tuber produced by minisett technology is easier to harvest

This is where minisett technology stands to be even more beneficial to Jamaican yam farmers. The minisett technique can improve availability of planting material and contribute to higher production of yam. Minisett allows for the smaller yam to grow more uniformly thus, easier for export.

A Jamaican small farmer is happy with the results of his efforts using minisett technology for yam production

Time Table For Minisett

* Harvest Yam
  - Select yam to be used as "Mother seed yam" for next planting. These yams will be cut into minisetts. Remaining yam is sold or consumed. Yams dormant.

* Allow 6 - 8 weeks for dormancy to pass.

* Cut yam into minisetts weighing 40 - 60 grams (1-2 ozs.) each. The cut pieces are dipped and dried, then placed in sawdust beds for sprouting.

* Allow 6 - 8 weeks for sprouting, or more if necessary.

* Transfer sprouted minisetts to prepared field. Plant minisetts 30 - 40 cm (12-18 ins.) apart in 5 - 7 cm (2 ins.) deep holes. The field is a continuous ridge contour with plastic sheeting placed over the ridges. Holes are punctured in the plastic for planting.

* Weeding when necessary. Plastic mulch will limit these weedings to one or two times in the 6 - 8 months growing period. The plastic mulch helps retain moisture, watering will be minimal, if any. (Assuming adequate rainfall).

* Depending on the variety used, yams of 3 - 4 lbs. (1.3 - 1.8 kg) should be ready in 6 - 8 months.

Harvest Yam

- Select yam to be used as "mother seed yam" for next planting. These yams will be cut into minisetts. Remaining yam is sold or consumed. Yams Dormant.

- PROCESS REPEATED -

PRODUCTION HINTS

As farmers in Jamaica start to use the Minisett technology. it is important for them to know just how much time and space it will take to use this new method. The following figures will aid in using the Minisett technology. These figures reflect the full experience from West Africa and the limited experience so far in Jamaica.

- 5 lbs of yam tuber can be cut up into 45 Minisetts weighing 50 grams each. A 50 gram Minisett grows into a 3-4 lb. tuber by harvest time.

- 1 litre of solution (fungicide, pesticide & gypsum) can coat 400 Minisetts.

- 700 Minisetts can be layed in a sawdust sprouting 'bed' measuring 5'x5'(25 square feet). Approximately 8 cubic feet of sawdust is required for this size 'bed'.

- A 1'x 2' crate can hold 35 Minisetts per layer.

An Example of a One Acre Production Effort Using Minisett:

1. Using a continuous ridge contour with ridges 3 feet apart (1 metre), and planting sprouted minisetts 12 inches (30 cm) apart. A farmer will have about 12,400 plants in an acre of land. His end harvest should be approximately 12,000 tubers weighing about 3 - 4 lbs (1.3 kg) each, which would yield a total production of about 36,000 lbs (16,300 kg) per acre.

2. This farmer would need 1600 lbs (700 kg) of yam "mother seed yam" tubers. From this amount he can get approximately 14,000 Minisetts weighing 50 grams (2 ozs) each.

3. In order to treat these Minisetts, he would require 35 litres solution of insecticide, fungicide and gypsum.

4. To make this solution 100 grams (3.5 oz) of fungicide, 200 grams (7.0 oz) of insecticide and 300 grams (10.1 oz) of gypsum or wood ash will be required.

5. Any fungicides like dithane, trimiltox or kocide can be used and any insecticides like diazinon or basudin can be used. All fungicides and insecticides are available through farm supply stores. Gypsum is available through suppliers of building materials.

6. A sprouting bed of 500 square feet (45 square metres) would accomodate the 14,000 minisetts. Allowing for about 15% of the minisetts which may not sprout, the farmer will have at least 12,000 sprouted minisetts to plant into a one acre field.

7. To cover one acre of continuous ridge 3-3.5 rolls of plastic mulch is needed. Plastic mulch is available at Caribbean Industrial Equipment, 7 South Avenue, Kingston 10.

TISSUE CULTURE PROPAGATION

With the arrival of minisett technology as a method to provide more planting material, yam production can expand. However, the full advantage of this technique cannot be realized if the amount of disease and viral infection continues. The minisett technolgy can decrease the level of infection because, for the first time the farmer can choose healthier yams to use as planting stock for the next year. However, this method cannot eliminate all the diseases. It is therefore necessary to have a method which can produce disease and virus free 'clean' planting material. Tissue culture propagation is the method for achieving this goal. In this method small microscopic pieces of yam plant tissue (growing tip or meristem) are propagated to increase the amount of clean, disease free planting material. Work in tissue culture propagation of yam has been going on in Barbados for several years.

PREPARATION IN GREENHOUSE

A yam plant in the field is taken into a greenhouse where the plant is grown under close observation. It is put into sterile soil and sprayed for any surface infections that it may be carrying. Under greenhouse conditions the plant is grown with no overhead watering to avoid the trapping of airborne micro-organisms around the growing tip of the plant. It has been found that by giving special thermal treatment plant growth could be accelerated over that of viral growth. Therefore, the growing tip which is now disease/virus free can be chosen for propagation by way of tissue culture. Plant material can be verified to be free from viruses by using an electron microscope.

PREPARATION IN LABORATORY

Meanwhile in the laboratory, preparation for processing the selected part of the yam plant is going on. All cutting tools and test tubes are cleaned and sterilized. Sterilization is done by putting these items through an autoclave. An autoclave is a pressurized steam chamber (like a pressure cooker). Within an autoclave all bacteria and fungi are killed. Through the entire laboratory preparation process, hands must be kept clean and a laboratory coat worn.

Prior to sterilization the medium is prepared. Medium is the sterilized substance in which the plantlet will be grown. The medium contains all the nutrients, vitamins and hormones which are necessary for the planting segment to develop into a yam plantlet. Since the medium contains so many ingredients it is advisable to prepare medium stock solutions. Most ingredients are in a powdered form that needs to be made into a solution first and then diluted and added to the other ingredients of the medium. These solutions are then mixed together to create the medium itself. All ingredients are mixed with agar which gives the medium a consistency similar to gelatin when cold. The medium is mixed hot and poured into the test tubes. The test tube, medium and a top cover on the tube is then put into an autoclave to sterilize both the test tube and the medium.

The plant tip must also be prepared to go into the medium. These plant tips are obtained by cutting them from the plants in the greenhouse and they are then placed in distilled water. They are then taken into the laboratory. These tips are transferred into a 70% alcohol and 30% distilled water mixture for 3 minutes. They are then soaked in a mixture of 95% distilled water with 5% bleach for 30 minutes.

INOCULATION

Since both the medium and the growing tips are ready it is time to "plant" these segments into the medium. This is called inoculation. It is important to do this in a sterile atmosphere. A laminar flow allows for this particular sterile atmosphere. The laminar flow is a chamber where filtered (clean) air is run through at a fast enough speed so as not to allow the outside (dirty) air to mix in the chamber. All working areas are cleaned beforehand with alcohol. Test tubes and forceps have been autoclaved prior to using the laminar flow. At this point work can be done in the laminar flow. In the laminar flow the growing tips are washed 3 times in separate lots of sterile distilled water leaving the tips in the last change of water. The meristem is then removed from the plant tip (using the stereo microscope) and placed on top of the medium in the test tube. The test tube is then covered.

INCUBATION

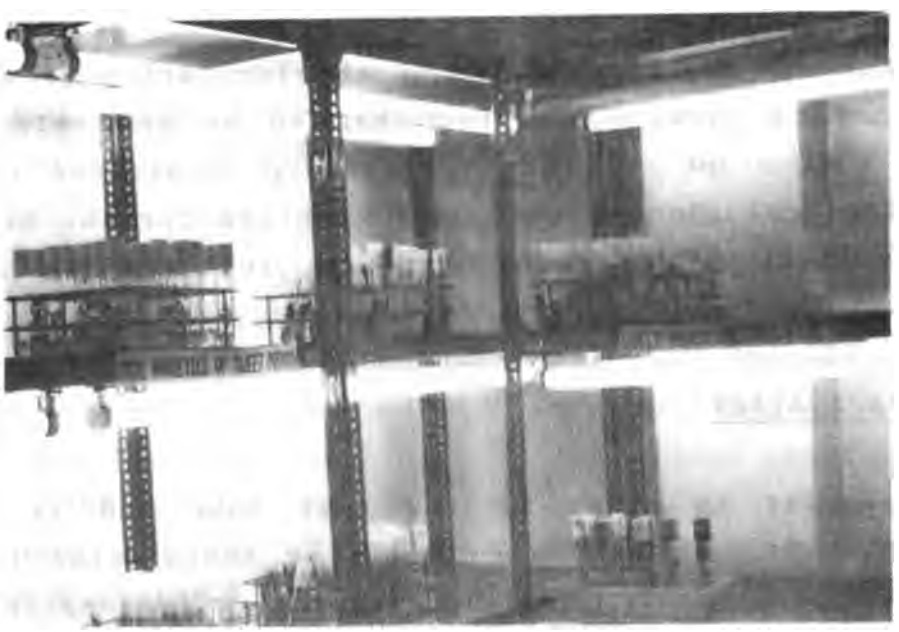
These test tubes are transferred to the incubation room to allow the meristem to grow. This room has to be kept clean at all times and a constant cool air temperature maintained (by way of air conditioners) along with proper lighting for the meristem to grow. The light is timed to be on for 16 hours and off for 8 hours to simulate a day in the room.

MICRO - PROPAGATION

Once a plantlet is grown in the test tube and it has been verified that it is virus-free it can be subcultured to produce several such plantlets. This subculturing is accomplished by utilizing the nodal segments of the plant (those pieces of stem which include a bud). The process of subculturing is done in the

same manner as described above except that the nodal segment is used instead of the meristem. Using this method thousands of plantlets can be produced in a relatively shorter time than by any other method. This is called micro-propagation.

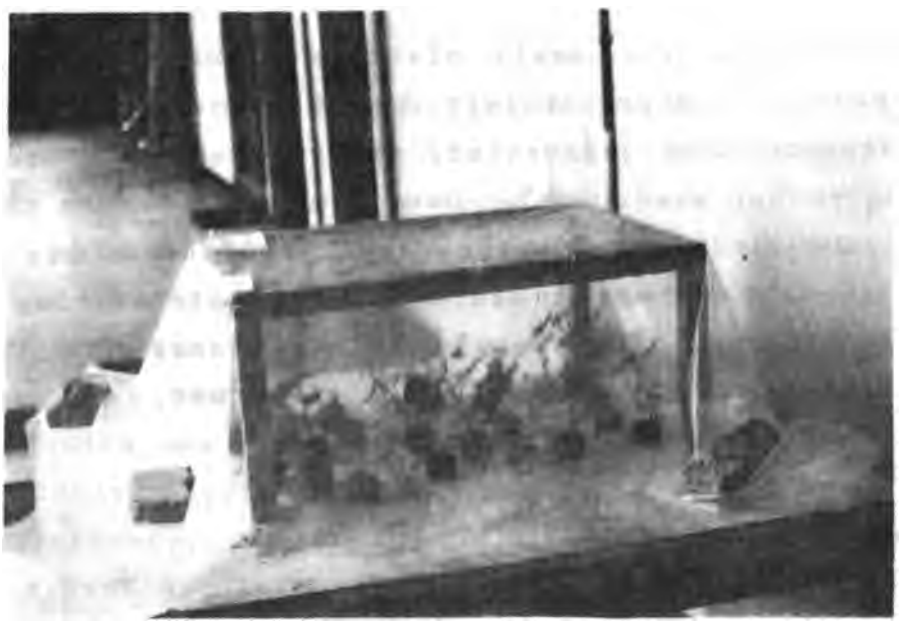
Meristem growing in the test tube to develop into plantlet



Micro-propagation in the incubation room

HARDENING

Plantlets grown in the test tube must be 'hardened' before they can be taken into the field. "Hardening" is the process by which a delicate test tube grown plantlet is slowly acclimatized in order that it can survive in outside environmental conditions. The 'hardening' process takes about four weeks. First, the plantlet is taken out of the test tube, all the medium is washed off with distilled water and the plantlet is put in small jiffy pots or in a tray of sterile soil (similar to the greenhouse), then set in a shaded, enclosed area. Humidity in this 'hardening' area is kept at 100% in the first week with misting done twice daily and soil surface watering once a day. During the second week the plant is misted once a day and surface watered once a day. During the third week the plant is no longer covered but still shaded and potted and watered only once daily. By week four the hardened plantlet is put into a screenhouse to protect it from diseases.



Hardening in Progress

Plantlet ready for field after hardening

PROTUBERS

In the screenhouse the small plantlet produces a small tuber called a protuber (approximately 3 - 5 grams in weight). Once these protubers are harvested, they are used to produce foundation 'mother seed yams'. Over a growing season these larger disease/virus free 'mother seed' yam tubers are then made available to farmers who in turn continue minisetting the yams after each harvest. The result is a cleaner yam that helps improve production and yields for the farmer, and provides a better yam for local consumption and export.

IMPROVED YAM PRODUCTION SYSTEM

Minisett technology and tissue culture propagation are being utilized independently of each other: minisett in West Africa and tissue culture propagation in Barbados. It is only with the recent developments in Jamaica that the two methods are seen as complementary to each other (see diagram on both methods). The

tissue culture technique produces disease/virus free plantlets in the laboratory. After producing foundation mother seed yam tubers from these plants they can then be minisetted to increase the total amount of disease/virus tested planting material available to farmers. So the benefits are obvious when both techniques are linked up.

As with every seemingly perfect scenario, problems arise. After disease/virus tested plants are exposed to the natural environment they become infected in time. Therefore fresh virus free planting material has to be supplied whenever the yield loss due to infection becomes too great. This is where a systematic relationship between the two propagation techniques becomes necessary. Setting up an independent laboratory which produces disease/virus free plants for foundation seed yam producers, together with farmers trained in the use of minisett technology, can help in developing an improved yam production system in the future. This system requires the production of disease/virus free plants in the laboratory, production of foundation seed stock and the utilization of the minisett method. A yam farmer therefore will acquire his planting material for his production using minisett technology from the foundation seed yam producers. He uses the selected tubers produced from his own crop as mother seed yam tubers for 3-4 years. During this time some accumulation of diseases occurs and if he continues to use his own mother seed tubers the yield will decrease. To prevent his yield decreasing too much he will sell off his harvest at this time and acquire new foundation seed yams, the producers of which will get their supply of planting material from the tissue culture laboratory. Under this system a yam farmer will renew his stock approximately every 3-4 years to maintain high yields.

BARBADOS - TISSUE CULTURE PROPAGATION

PREPARATION IN GREENHOUSE	TISSUE CULTURE VIRUS TESTING	TEST TUBE MICRO-PROPAGATION CYCLE	'HARDENING'	PROTUBERS FOUNDATION STOCK	FARMERS USING TRADITIONAL METHOD OF PRODUCTION	TO CONSUMER

WEST AFRICA - MINISETT TECHNOLOGY

FARMER USING MINISETT TECHNOLOGY CYCLE	PRODUCTION OF SEED YAM	PRODUCTION OF WARE YAM	TO CONSUMER

JAMAICA - IMPROVED YAM PRODUCTION SYSTEM

PREPAKATION IN GREENHOUSE	TISSUE CULTURE VIRUS TESTING	TEST TUBE MICRO-PROPAGATION CYCLE	'HARDENING'	PROTUBER	FOUNDATION SEED STOCK CYCLE	FARMERS USING MINISETT TECHNOLOGY CYCLE	TO CONSUMER

TISSUE CULTURE AND MINISETT TECHNOLOGIES FOR AN IMPROVED YAM PRODUCTION SYSTEM

A SEMINAR

NOVEMBER 24 - DECEMBER 5, 1986

MINISTRY OF AGRICULTURE

SCIENTIFIC RESEARCH COUNCIL

UNIVERSITY OF THE WEST INDIES

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OF TROPICAL AGRICULTURE

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TWICKENHAM PARK,
ST. CATHERINE
JAMAICA

THE DAILY GLEANER, SATURDAY, NOVEMBER 22, 1986

IMPROVED YAM PRODUCTION SYSTEM TECHNOLOGIES

THE Inter-American Institute for Co-operation on Agriculture (IICA) office in Jamaica is sponsoring a seminar/training course on "Improved Yam Production System Technologies," (mini-sett) next week, in collaboration with the Ministry of Agriculture, the Scientific Research Council, the University of the West Indies and the joint International Institute for Tropical Agriculture.

The seminar training course will be held November 24 to December 5 at the Ministry of Agriculture Training Centre, Twickenham Park, St Catherine, and will be attended by Research and Extension Officers of the Ministry of Agricultrure as well as participants from other Caribbean counties.

●**Mini-sett technlogy** has been developed in Nigeria, tested in several West African countries and is now being introduced in Jamaica. It is a simple yet efficient method of providing larger quantities of planting material in the rapid propagation of yam. Yam tubers are cut into many small pieces for making planting material; these small pieces, or mini-setts, are coated in a protective solution and then sprouted in sawdust beds before being eventually planted back into the field. Because the yam tubers can be cut into as many as 10 to 20 pieces, a much larger amount of planting material becomes available from year to year.

Together with mini-sett technology, micro-propagation utilising tissue culture technology can help to further increase yam production. An additional benefit is that a smaller and more uniform yam will be produced, which is found to be prefered by local consumers, as well as by the export market.