RADA

RURAL AGRICULTURAL
DEVELOPMENT AUTHORITY

IICA

INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE
OAS

TRAINING DAY ON

MINI-SETT YAM PRODUCTION

AT

BODLES AGRICULTURAL RESEARCH STATION

ON

THURSDAY, JANUARY 31, 1991

ORGANIZED BY: RURAL AGRICULTURAL DEVELOPMENT AUTHORITY (RADA)

SPONSORED BY: INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA)

OCTOBER 31, 1991

IICA OFFICE IN JAMAICA

WHAT IS IICA?

The Inter-American Institute for Cooperation on Agriculture (IICA) is the specialized agency for agriculture of the inter-American system. The Institute was founded on October 7, 1942 when the Council of Directors of the Pan American Union approved the creation of the Inter-American Institute of Agricultural Sciences.

IICA was founded as an institution for agricultural research and graduate training in tropical agriculture. In response to changing needs in the hemisphere, the Institute gradually evolved into an agency for technical cooperation and institutional strengthening in the field of agriculture. These changes were officially recognized through the ratification of a new Convention on December 8, 1980. The Institute's purposes under the new Convention are to encourage, facilitate and support cooperation among the 32 Member States, so as to better promote agricultural development and rural well-being.

With its broader and more flexible mandate and a new structure to facilitate direct participation by the Member States in activities of the Inter-American Board of Agriculture and the Executive Committee, the Institute now has a geographic reach that allows it to respond to needs for technical cooperation in all of its Member States.

The contributions provided by the Member States and the ties IICA maintains with its twelve Permanent Observer Countries and numerous international organizations provide the Institute with channels to direct its human and financial resources in support of agricultural development throughout the Americas.

The 1987-1991 Medium Term Plan, the policy document that sets IICA's priorities, stresses the reactivation of the agricultural sector as the key to economic growth. In support of this policy, the Institute is placing special emphasis on the support and promotion of actions to modernize agricultural technology and strengthen the processes of regional and subregional integration.

In order to attain these goals, the Institute is concentrating its actions on the following five programs: Agricultural Policy Analysis and Planning; Technology Generation and Transfer; Organization and Management for Rural Development; Marketing and Agroindustry; and Animal Health and Plant Protection.

These fields of action reflect the needs and priorities established by the Member States and delimit the areas in which IICA concentrates its efforts and technical capacity. They are the focus of IICA's human and financial resource allocations and shape its relationship with other international organizations.

The Member States of IICA are: Antigua and Barbuda, Argentina, Barbados, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, the United States of America, Uruguay and Venezuela.

The Permanent Observer Countries of IICA are: Arab Republic of Egypt, Austria, Belgium, Federal Republic of Germany, France, Israel, Italy, Japan, Netherlands, Portugal, Republic of Korea and Spain.

RADA
RURAL AGRICULTURAL
DEVELOPMENT AUTHORITY

IICA

INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE
OAS

TRAINING DAY ON

MINI-SETT YAM PRODUCTION

AT

BODLES AGRICULTURAL RESEARCH STATION

ON

THURSDAY, JANUARY 31, 1991

ORGANIZED BY: RURAL AGRICULTURAL DEVELOPMENT AUTHORITY (RADA)

SPONSORED BY: INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE (IICA)

OCTOBER 31, 1991

CONTENTS

PAGE

OVERVIEW: THE MINI-SETT TECHNOLOGY FOR PRODUCING ROUNDLEAF YELLOW YAM (*Dioscorea cayenensis*) FOR EXPORT - Vivian Chin ... 1

SOILS AND FERTILIZERS SUITABLE FOR YAMS
Renford L. Baker ... 5

NURSERY PREPARATION
George Stewart ... 11

SELECTION AND TREATMENT OF PLANTING MATERIALS
Con Hutchinson ... 13

YAM VARIETIES AND THEIR SPROUTING PERFORMANCE
Raymond Blake ... 16

TRANSPLANTING/PLOT MANAGEMENT AND HARVESTING
Alvin Henry ... 17

DISEASES AND PESTS OF YAMS
Fabian Edman ... 19

IMPORTANCE OF NEMATODES IN YAM PRODUCTION AND THEIR CONTROL - Dave G. Hutton ... 26

THE MINISETT TECHNOLOGY FOR PRODUCING ROUNDLEAF YELLOW YAM (*Dioscorea cayenensis*) FOR EXPORT

Vivian Chin [1/]

INTRODUCTION

The yam minisett technology gets its name from the process of dividing up whole yams or large pieces of yams into small setts, weighing approximately 56 grammes or about 2 ounces, which are used as planting material. This technology which was developed in Nigeria by farmers and refined by the International Institute for Tropical Agriculture (IITA), was introduced to Jamaica by the IITA in 1985 under a joint GOJ/UWI/IITA Root Crop Project. In Nigeria and some other West African countries this technology is used to produce "seed yams". Whole "seed yams" are then used as planting material in the traditional yam cultivations in those countries. In this country, it has been observed that the Jamaica Banana Producers Association has promoted for use as "seed yams" in traditional yam production, many of the small yams produced when the mini-sett technology is used to produce yams for export.

In Jamaica, the the larger "seed yams" which are at least one and a half pounds in weight are ideally suited for the export market which can now be presented with uncut yams which have a longer shelf life and lower post-harvest weight loss.

This technology was introduced to the Cropping Systems Project of the Ministry of Agriculture and IICA in July of 1986.
The experiences gained from the testing of this technology, on small plots (0.05 to 0.55 acres) on a large number of small farms under a wide range of soil and rainfall conditions, have led to the realization that the application of this technology under entirely rainfed conditions is accompanied by a high amount of risk since the successful application of the technology depended on the farmer guessing correctly when the heavy rains would fall. On the basis of that guess, the nursery would be prepared and planted with minisetts some six weeks earlier. Land would be prepared to receive the predicted rainfall and sometime later to be transplanted with the minisett plantlets some of which would be ready for transplanting at six weeks after sowing in the nursery. If the heavy rains came on or about the predicted date then all would be well. However, if the rains were insufficient to thoroughly wet the prepared field, or were late by just 2-3 weeks or more, then the farmer would be faced with a serious production problem of having plantlets ready for transplanting but no field ready to receive them. The longer that plantlets remain in the nursery after sprouting, the greater will be the intertwining of the roots and vines, and the damage to these structures when plantlets are to be separated for transplanting. The alternative to separating plantlets so that as much of the roots and vines

---

[1/] Agricultural Research Specialist, Inter-American Institute for Cooperation on Agriculture. "The views expressed are those of the author and do not necessarily reflect those of the Inter-American Institute for Cooperation on Agriculture."

remain intact is to prune both the vines and the roots before transplanting, but this latter recourse would have to be done when the prepared field has sufficient moisture for transplanting.

Thus, once the nursery is planted all other operations would have to be carried out according to the schedule dictated by the readiness of the plantlets for transplanting. Therein lies the risk of predicting when the rains are to be expected.

As a result of these considerations, a strategy to reduce this type of risk to a minimum has been formulated and is an integral part of the yam minisett technology for entirely rainfed conditions. The strategy is not based on predicting when the rains will come, and it is appropriate for early rains, timely rains and late rains scenarios.

STRATEGY

Predicting when the rains will start and timing the nursery and field operations on the basis of the prediction is a high risk approach to yam minisett production. To remove this risk from the production process the following strategy has been formulated:

Step 1.
Plough or fork the field as soon as possible after the preceding crop is reaped or as soon as the land can be worked. Allow the soil to weather. Intermittent rain, even during dry months, will help to hasten the weathering process and to crack the larger clods so that they can be more easily pulverized during the later tillage operations. As soon as the soil can be broken down to a fine state this should be done. Broadcast 6-18-27 fertilizer at the rate of 1 cwt. per square chain and using a hoe or a ridger pull up continuous mounds on the contours three feet apart. Leave the field in this state ready to receive the rains whenever they may come.

Step 2.
Once Step 1 is completed commence making arrangements to access freshly reaped planting material when the rains begin. The nursery can be prepared and made ready to receive the minisetts, but no cutting up of yams for minisetts should take place unless the heavy rains commence. The nursery should be prepared on a slightly sloping site so that it will drain readily. Either excavate a 4-inch deep bed of at least 52 square feet for each square chain of field to be planted out, or construct a perimeter of stones or bamboo enclosing an area of approximately 52 square feet to contain the sawdust which is the seedbed medium. The sawdust used in the nursery should have been properly weathered and steam sterilized. Once the heavy rains commence and the field begins to be thoroughly wetted, cut up freshly reaped almost mature round leaf yellow yams into 2-ounce minisetts. The smaller diameter yams are better suited for cutting up into minisetts since they produce a minisett which has a higher ratio of skin surface area per unit weight than minisetts which are cut from large diameter yams, with no wastage.

Step 3.
Compound a slurry comprised of the following compounds or suitable substitutes in the proportions given hereunder:

10 grams Basudin 40WP
20 grams Daconil
30 grams Gypsum or Wood ashes
1 gallon water

Step 4.
Dip the minisetts in the slurry, drain off excess liquid, then dry out in the shade.

Step 5.
Sow treated minisetts in the sawdust nursery bed which has been thoroughly moistened but not saturated. Both too much and too little moisture are unfavourable for the development of the minisetts into plantlets. Consequently, the nursery should be shaded with waterproof material if this is available, and there should be a channel around the more elevated and lateral portions of the nursery to prevent surface run-off from getting into the nursery.

Step 6.
When the continuous mounds in the field are thoroughly wetted, (this can be checked by digging into the mounds to see how far down the moisture front has penetrated) the field can be covered with the plastic mulch and properly sealed. Do not cut any holes in the plastic mulch until transplanting is to be done.

Step 7.
Transplant the minisett plantlets when the sprout is approximately three inches long. Spacing between plantlets along the tops of the continuous mounds is 1 foot. Cut an X instead of an O in the plastic mulch to place the plantlet in the mound. Ensure that the plastic is not touching the young sprout after planting. If two of the flaps of the X are touching the sprout after planting simply push those flaps into the soil with your finger. Place shrub cuttings on top of the plastic mulch to prevent the yam vine, as it develops, from touching the plastic. Otherwise, the distal portions of the vines will be burnt by the plastic mulch which becomes extremely hot under bright sunshine conditions. This problem gradually decreases as leaf area index increases.

Step 8.
After the field is transplanted or during the period when transplanting is intermittently carried out, if heavy rains still are experienced it will be seen that water collects in the furrows. Use a machete to puncture the plastic mulch at several points along each of the furrows so that the water can seep into the soil.

Step 9.
Once the field is transplanted there is very little more to be done apart from Step 8 until it is time to reap. Invariably, some weeds will emerge from the planting holes, and these can be removed during the course of crop inspection when the farmer is expected to pass along the furrows to inspect the crop.

APPENDIX 1

YELLOW YAM CULTIVATION USING MINISETT TECHNOLOGY: COST OF PRODUCTION PER SQUARE CHAIN AND EXPECTED RETURNS
(Costs and returns presented on 31/01/91 were revised on 28/10/91)

	J$/sq. ch.	
COST OF PRODUCTION		
Labour		1,231.00
Brush clearing @ $90.00/sq. ch.	90.00	
Forking @ $100.00/sq. ch.	100.00	
Hoeing, fertilizing & ridging @ $135.00/sq. ch.	135.00	
Laying out plastic mulch and securing @ 1.5 man-days @ $60/man-day	90.00	
Building 52 sq. feet nursery, cutting yams into minisetts and treating with pesticide slurry, spreading moist sawdust base,drying setts in shade, planting setts in nursery and covering with moist sawdust: 1 man-day @ $60	60.00	
Nursery care: 6 minutes/day for 11 weeks approximately 1 man-day @ $60	60.00	
Transplanting over a 5-week period @ 0.3 man-day per week: 1.5 man-days @ $60	90.00	
Weeding: 0.2 man-day/month for 3 months: 0.6 man-day @ $60	36.00	
Cutting off & removing vines 1 man-day @ $60	60.00	
Folding up plastic mulch 1 man-day @ $60	60.00	
Harvesting: 2 man-days @ $60	120.00	
Transporting yams from field to farmgate 5.5 man-days/sq. ch. @ $60	330.00	
Transportation of sawdust, fertilizer, plastic mulch, and mini-sett plantlets		230.00
Materials		2,370.32
0.56 roll plastic mulch @ $1500/roll	840.00	
200 lbs. yam planting material @ $7.00/lb.	1,400.00	
96 lbs. 8-21-32 fertilizer @ $114.60/112 lbs.	98.23	
16.5 cu. ft. sawdust @ $1.50/cu. ft.	24.75	
8.5 g. Basudin 40WP @ $137.45/lb. or $0.31/g.	2.64	
17 g. Daconil @ $276.65/kg.	4.70	
Opportunity cost of capital @ 25% p.a. for 1 year		957.83
Total on-farm and opportunity costs/sq. ch.		J$4,789.15
Saleable Production /sq. ch.		1,816 lbs
Cost of Production/lb.		J$2.64

RETURNS

Income from 1 sq. ch. yams: 1,816 lbs. @ $7.00/lb.	J$12,712.00
Salvage of plastic mulch at one-half of cost	420.00
Gross income/ sq. ch.	J$13,132.00
Net Income/ sq. ch.	J$ 8,342.85
Return on investment	174%

SOILS AND FERTILIZERS

SUITABLE FOR YAMS

RENFORD L. BAKER [1/]

Farmers grow yams throughout Jamaica using the traditional methods, while the "Mini-Sett Technology" can be considered an isolated approach.

The major yam producing areas are located in the parishes of Manchester, Clarendon, St. Ann, Trelawny, and Hanover. Traditionally, the crop is grown on soils found in the hilly upland regions at elevations 1000-3000 feet above sea level. Like all other crops, yam will thrive best under ideal situations where moisture and plant nutrients are adequate. A deep well drained loamy soil is also a requirement.

The main soils associated with the growing of yams are: Wirefence Clay Loam (32), Belfield Clay (41), Llandewey Clay Loam (47), Chudleigh Clay Loam (73), St. Ann Clay Loam (78), Lucky Hill Clay (74), Wait-a-Bit Clay (95), Sunbury Clay (3), Carron Hall Clay (94), and Flint River Sandy Loam (50). (Table 1.)

The soils vary in texture, depth, moisture, retention, internal drainage and nutrient rating. Therefore their capability to produce a good crop of yams will depend on how much one can remedy the constraints associated with each of these soil types. It may be very easy to grow yams using the traditional method on these soils but the constraints must be removed/minimized as the mini-sett method is introduced. Farmers will be forced to pay more attention to these constraints in order to obtain good marketable yields.

CORRECTION OF LIMITING FACTORS

On ideal soils or soils near to being ideal, a farmer has a rather wide range in which errors of management can be made without any ill effects to the crop. However, as the "limiting factors" of production come into play, the margin of error becomes smaller and specific practices must be adopted in order to make the growth of the crop a success.

[1/] Director, Research and Development, Ministry of Agriculture, Jamaica

TABLE 1. SELECTED CHARACTERISTICS OF SOME SOIL TYPES ON WHICH YAMS ARE GROWN IN JAMAICA

SOIL TYPES & SLOPE RANGE	ORDER	INTERNAL DRAINAGE	MOISTURE SUPPLYING CAPACITY	NATURAL FERTILITY				SPECIAL MANAGEMENT PROBLEMS
				N	P	K	pH	
Belfield Clay (10-35°)	Vertisol	Moderate	Moderate to high	Low	Low	High	6.1-6.5	Erosion, Slumps
Llandewey Clay Loam (10-30°)	Incepti-sol	Rapid	Low to moderate	Low	Low	High	6.1-7.3	Erosion, Moisture
Wait-a-Bit Clay (5-30°)	Ultisol	Slow	High	Low	Low	High	5.1 5.5	Erosion, Acidity
Wirefence Clay Loam (2-30°)	Ultisol	Moderate	Moderate	Low	Low	Low	5.1 5.5	Erosion, Acidity
Chudleigh Clay Loam (Brown Bauxite (2-30°)	Oxisol	Very Rapid	Moderate	Low	Med.	Low	6.1-6.5	Moisture
St. Ann Clay Loam (Red Bauxite) (- °)	Oxisol	Very Rapid	Low	Med	Low	Low	6.1-7.3	Moisture, Stones in Places
Carron Hall Clay (5-30°)	Vertisol	Moderate to slow	High	Low	Low	High	7.4-8.0	Erosion, Stones in places
Cuffy Gully Gravelly Sandy (10-35°)	Incepti-sol	Very rapid	Low	Low	Med.	Med.	6.1-6.5	Stony, Steep, Erosion
Lucky Hill Clay Loam (2-10°)	Alfisol	Very slow	Moderate to high	Low	Med.	Low	6.1-7.3	Drainage

Success in supplying any of the limiting factors is by systematic trials based on scientific principles. Therefore, by increasing the supply, a limiting factor will increase the growth of the plant. However, over supply of such a factor could be injurious to the plant e.g. water supply which could cause water-logging and the crop fails.

DRAINAGE

High clay content and the development of a hard pan generally results in high water table. A soil which is mottled indicates poor drainage. Poor drainage contributes to poor soil aeration. Crops grown on poorly drained, poorly aerated soil suffer from root rot, foot rot and attack by fungus. Improve drainage by using graded drains or breaking up hard pan. Plant on raised beds.

EROSION AND MOISTURE SUPPLY

Mulching, especially with plastic, in the mini-sett method can reduce erosion and improve the water holding capacity of sandy soils. Placing the plastic mulch on the prepared soil after a shower of rain can be very beneficial. Use irrigation where available.

Figure 1. gives the rainfall distribution and 91 years annual averages for selected stations. This can assist greatly in making plans to meet planting dates.

HIGH SOIL ACIDITY

The following pH range are guidelines for the tolerance of different crops and nutrients availabilities:

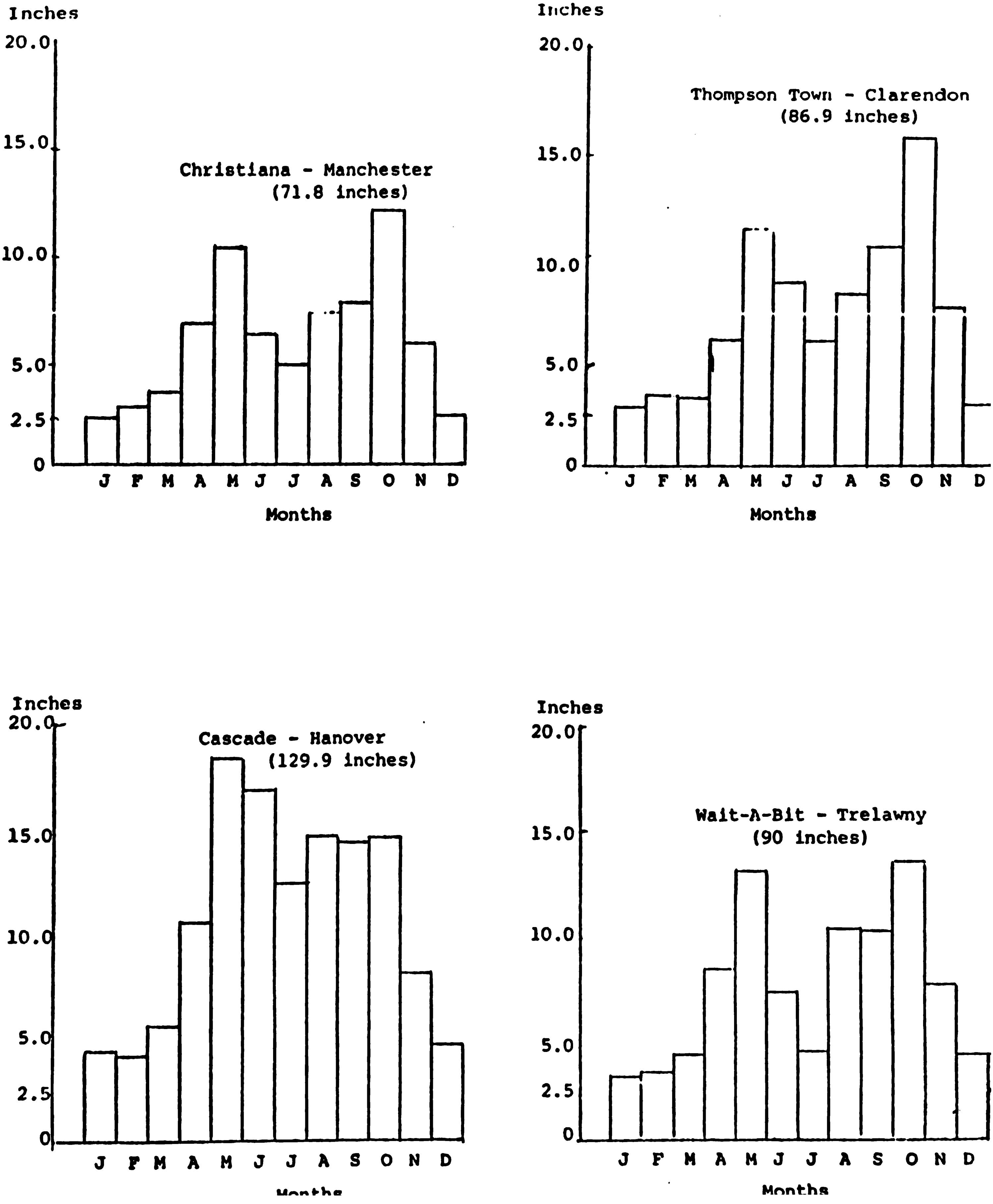
i) extremely acid soil - pH less than 4.5 unfavourable support of most plant nutrients. Iron and aluminum become toxic. Availability of phosphate is low;

ii) very strong acid pH less than 4.5 - 5.0 calcium and phosphate relatively low;

iii) strong acid pH 5.1 - 5.5 more favourable supply of nutrients.

Add ground limestone to correct the high acidity or add lime to supply calcium. Pay special attention to plant nutrients most likely to be deficient. Drain if necessary.

FIGURE 1: Rainfall Distribution and 31 years Annual Averages for selected Stations



LAND PREPARATION

TABLE 2. TIME OF PLANTING AND HARVESTING OF MAIN VARIETIES OF YAMS IN JAMAICA

VARIETIES	SPECIES	MAIN TIME OF PLANTING	MAIN TIME OF HARVESTING
Negro	D. rotundata	December-March	July-December
Lucea	D. rotundata	December-March	Aug.-December
Yellow	D. cayenensis	April-June	December-May
Round Leaf Yellow	D. cayenensis	April-June	December-June
Tau	D. cayenensis	April-June	November-May
White	D. alata	April-May	December-April
St. Vincent	D. alata	April-June	October-April
Hard	D. alata	April-June	January-April
Yampie	D. trifidia	April-June	January-April
Sweet	D. alata	March-May	November-Feb.
Renta	D. alata	May-June	January-May

Source: Ferguson et al (1985) Root Crop Production in Jamaica with special emphasis on Yams.

FARM TECH '85 Seminar, Kingston, Jamaica

Table 2. gives the planting and reaping dates for different varieties of yam when the traditional method of planting is used. This acts at present as a good guideline for the Mini-Sett Yam Technology. Forward planning can therefore be done for selection and preparation of the site.

The site should be ploughed, harrowed and banks/ridges made with as few large clods as possible. There should be adequate root-room for the tubers, at least 10" - 12".

The ridges should be approximately thirty inches (30") apart. The ridges should be covered with the plastic mulch after rain or when enough moisture is trapped in the soil.

FERTILIZER FOR MINI-SETT YAMS

To date, little is known about response of mini-sett yam plants to fertilization. It appears that improper fertilizer regimes can retard maturity. Immature yams when harvested can deteriorate rapidly in storage.

The following mixtures used in fertilizing traditional yams are best recommended for the use in mini-sett cultivation: 8-21-32 (6-18-27); 14-28-14 (12-24-12); 11-22-22 (7-14-14). These fertilizers are usually added at 4-6 cwt/acre for traditional planted yams.

NURSERY MANAGEMENT

GEORGE STEWART [1/]

Properly organized management of the Mini-sett nursery is critical to the success of the production lot. It is to be appreciated that the nursery is the cradle of production.

Bits are set on beds of 3 - 4 inches of sawdust or other suitable material, e.g. coir. The beds should be adequately watered and a light sprinkling of nematocide, e.g. Furadan, should be added. The bits are then laid on the skin area at least one inch apart and covered with one inch of sawdust.

WATERING

Regular watering at least every three days is necessary to ensure maintaining the moisture level in the nursery. Any drying out of the nursery will allow for the premature drying off of the early feeder roots and a slower rate of germination.

SHELTER

To protect the nursery from the impact of the sun and heavy rains, a shed of thatch or coconut boughs should be made. This shed should be sloping to allow for the water to run off in heavy showers.

Where old zinc sheets are used, it is necessary to cover the zinc with banana or cane leaves or some bush to reduce the heat in the nursery.

TRANSFERRING PLANTS

Plants should be taken from the nursery as soon as sprouts are visible. Avoid exposure of tender plant roots by covering the moment they are lifted to the time they are being placed in the field.

[1/] Mini-sett Yam Subject Matter Specialist Consultant

MAINTENANCE

It will be observed that when sprouting plants are taken from the nursery, other bits which are yet to sprout will be displaced. Due care should be taken to reset and cover such bits.

Watering of the nursery should be continued as before sprouting started to facilitate the regular germination of remaining bits. Consistent good nursery care will allow for a much shorter planting period.

PREPARATION OF MINISETT YAM PLANTING MATERIAL FOR ROUNDLEAF YELLOW YAM (Dioscorea Cayenensis) AND NEGRO YAM (Dioscorea rotundata)

CON HUTCHINSON

Preparing Mini-sett yam planting material starts with the selection of clean healthy yam tubers which are cut up into 2 oz. pieces, treated for protection against insects and diseases and placed in sprouting beds (nurseries) where after 6-8 weeks germination (sprouting) will have taken place and the mini-setts would then be ready for transplanting out into the field which would have been previously prepared.

The steps to be followed to achieve the objectives are as follows:-

1. Preparation of the sprouting bed.
2. Selection of mother yams.
3. Preparation of slurry (treatment solution).
4. Cutting, treating and drying minisetts.
5. Placing minisetts in the sprouting beds.

STEP 1: PREPARATION OF SPROUTING BED

The sprouting bed should be located in a cool slightly sloping area of the field to facilitate drainage and should be covered to a height of 4'-6' and made leak proof so that the moisture in the sprouting medium can be controlled. An area of approximately 52 sq. ft. (5' wide for ease of operation) dug out to accommodate 4" of saw dust should be provided. This will hold enough mini-setts to plant 1 square chain. The area can be bordered with stones, bamboo, planks or other available material.

Sawdust used on the beds should have weathered for some time before use and steam sterilized whenever possible to get rid of harmful insects, fungi and bacteria. A suitable nematicide e.g. Furadan or Vydate L should be broadcast on the bed to promote nematode control in the nursery.

1/ Mini-sett Yam Subject Matter Specialist, Consultant

STEP 2: SELECTION OF MOTHER YAMS FOR MINI-SETTS

Mother yams should be freshly harvested and almost mature. The distal end of the yam tuber should show some white colouration. Yams of medium or small diameter are more suitable for cutting into mini-setts because the large diameter yams when cut up produce less planting material per unit weight since excess flesh has to be trimmed off.

Diseased and insect infested yams must not be selected and used for minis-etts. Nematodes, symptoms of which are seen as burn, dry rot, or cracking of the skin of the yam tuber, should not be overlooked and such yams with visible damages should not be used as planting material as research has shown that even after treatment sprouting rate is significantly reduced and infected planting material set out in the field reduces the quantity and quality of the tubers produced.

STEP 3: PREPARATION OF SLURRY

After cutting the tubers into minisetts they should be dipped in a solution comprising insecticide, fungicide, gypsum or white lime or wood ash. The last three named are quick drying agents which help to preserve the cut surfaces of the minisetts to prevent rotting in the nursery.

A plastic pail of 2-4 gallon capacity is preferred to mix the slurry as metal containers may react unfavourably with some chemicals used.

The slurry mixture comprises:

10 grams Basudin 40 W.P.
20 grams Daconil
30 grams Gypsum
1 Gallon Water

There are other often used insecticides and fungicides which are suitable for mixing the slurry e.g. Decis, Metasystox, Anthio 33, Dipterex 95, Kocide.

Bear in mind however, that whichever chemical is used, great care should be taken not to exceed the manufacturer's recommended rate of application as this error could destroy the cells of the freshly cut yam and cause rotting of the minisetts in the nursery.

STEP 4: CUTTING, TREATING AND DRYING MINI-SETTS

As soon as the dipping solution is ready, cutting up of the Mini-sett should begin. The yams having been freshly reaped should be cut up into 2 ozs. mini-setts making sure that as much of the skin area as possible is left on each set as it is from this area that sprout and roots will grow and develop. The sets should be placed in the solution and allowed to remain from 3-5 minutes prior to being removed to a drying area with the cut surfaces turned upwards to facilitate quick drying. A sharp knife with a thin blade should be used for cutting.

Zinc sheets, plastic or canvas can be used for laying out the sets for drying but since sheets is most convenient as it allows for easy drainage of the excess slurry. The slurry should be agitated at regular intervals.

STEP 5: PLACING MINI-SETTS IN SPROUTING BEDS

As soon as the sets are dry to the touch they are ready to be placed in the bed which has been covered with approximately 1" of moist sawdust. The sets should be laid out in rows of 1/4" - 1/2" apart with the skin area resting on moist sawdust.

To ensure more even sprouting the sets should be placed about 2" - 3" inside the edge of the bed as the edges dry out quite rapidly and the drying out is not conducive to sprouting. When the exercise of laying out the sets is completed, they are covered with another layer of sawdust making sure that no set is left exposed.

We should ensure that moisture is maintained evenly throughout the bed for a period of 6-8 weeks by inspecting the bed are regular intervals. Too much water will rot the mini-sett.

At six (6) weeks the sets will have started to sprout as can be seen by carefully lifting sets and replacing at different parts of the bed.

Should sprouting be retarded as sometimes happens due to low moisture level, the necessary adjustment should be made by sprinkling the bed with water making sure that excessive wetting does not take place as too much water will cause the sets to rot. When mini-sett sprouts have grown to 2"-3" they are ready to be planted out in the field.

YAM VARIETIES AND THEIR SPROUTING PERFORMANCE

PREPARED FOR TRAINING SESSION ON THE MINI-SETT YAM TECHNOLOGY CONDUCTED BY RADA AND IICA

RAYMOND BLAKE [1/]

Traditionally, the propagation of yam varieties, with the exception of Chinese yam, Yampi and varieties of the Dioscorea alata or the white yam family, have been carried out using the head as the only planting material. With the varieties stated, propagation is by the use of pieces of the tuber, or small whole tubers, known as seed yams, are or may be used.

The sprouting performance of yam varieties becomes relevant and important where rapid propagation or increase of planting material is required. Using the head as planting material for rapid increase is especially limited in the Negro and Yellow yam varieties where a single tuber is generally obtained from a plant when they are grown. In these two varieties of yam, the problem of limited propagation may be overcome by using small pieces of whole tubers, ranging in weight from 60 - 90 grams (2 to 3 ozs.) for sprouting by the mini-sett technique. By this technique 12-16 plants or more may be obtained from a single tuber.

The sprouting performance of the four varieties of yam - Dioscorea cayenensis, rotundata, alata and trifida differs. Mini-setts from the D. alata species of yam have the most efficient sprouting performance, reaching as high as 95 per cent. Mini-setts prepared from the tubers of White yam and Sweet yam after sprouting have had significant sprouting in two weeks after placing in nursery beds, with completion in six to seven weeks. Negro yam and Yampi are next to the varieties of the White yam family in efficiency of sprouting performance.

Sprouting performance of mini-setts is not simultaneous in any of the yam species and this non-uniformity of sprouting is very much aggravated in the Yellow yam species. Emphasis must be placed on the extreme importance of using nematode free tubers of yellow yam to prepare mini-setts in the nursery beds for sprouting, immediately after tuber maturity in this species, in order to minimize the deleterious effect of any nematode infestation of tubers.

[1/] Agronomist, Bodles Research Station, Ministry of Agriculture, Jamaica

TRANSPLANTING, PLOT MANAGEMENT AND HARVESTING OF MINI-SETT YAM FOR ROUNDLEAF YELLOW YAM (Dioscorea cayenensis) AND NEGRO YAM (Dioscorea rotundata)

ALVIN HENRY [1/]

PLANTING OUT OF MINI-SETTS

Once the land has been prepared, i.e. ploughed or forked to a depth of 1-1.5 feet, fertilized and ridged, thoroughly wetted and the plot covered with plastic mulch and sealed. When the mini-setts have sprouted to a length of approximately 2-3 inches, it is time to transplant.

LIFTING OF MINI-SETTS FROM NURSERY

The sprouted mini-setts are to be carefully dug up from the nursery bed, just before planting, taking care not to damage sprouts or roots. Do not remove the mini-setts from the nursery bed until you are ready to plant. Just as soon as they are dug up, the roots begin to dry out. If they lay exposed to the sun and wind in the field as little as fifteen minutes before planted in the soil, it can reduce their vigour - and your yield. Take enough mini-setts into the field at any one time, which you can adequately plant out in the shortest time without running the risk of the roots being dried out.

SPACING

The spacing will influence the size of the yam produced. The greater the space between the mini-setts, the larger will be the yam.

Recommended spacing between the plantlets along the continuous mound is one foot (12 inches) with ridges 3 feet apart (from crest to crest).

PLANTING OUT

Cut an X instead of an O along the centre (top) of the ridge in the plastic mulch to place the plantlet in the mound. Handle the mini-setts carefully, making sure you do not damage the sprouts or the roots. Ensure that the plastic is not touching the young sprouts after planting. If the flaps at the X are touching the sprouts after planting, simply push those flaps into the soil with your finger. Press the soil firmly around the mini-setts.

[1/] Mini-sett Yam Subject Matter Specialist, Consultant

PLOT MANAGEMENT AND MAINTENANCE

Place shrub cuttings, (brambles) on top of the plastic mulch to prevent the yam vine as it grows from touching the plastic, or else the distal portions of the vines will be burnt by the plastic mulch when the temperature rises.

When growth begins, the yam is not staked, instead the plants are allowed to cover the ridge on the bramble with their vines.

The plastic mulch should remain in place during the entire growing period of the mini-sett. It reduces weed growth and erosion and helps converse moisture in the soil.

Normally it should not be necessary to weed more than twice during the growing season.

After the field is transplanted, if heavy rains are still experienced, it will be seen that water collects in the furrows. Use a machette to puncture the plastic mulch at several points along each of the furrow, so that the water can seep into the soil.

HARVESTING

Harvesting is less difficult with the mini-sett yam because the yams that are produced in shallow ridges are smaller and usually without toes. Care should be taken not to bruise or injure the yams during or after the reaping operation. Physical damage reduces quality and may result in damaged yams being rejected for the export market. Physical damage also can reduce the price and shelf life of the yams. Tubers weighing 2-4 lbs. should be produced within 7-9 months after planting.

DISEASES AND PESTS OF YAMS

by

FABIAN EDMAN

Plant Pathologist
Plant Quarantine/Produce Inspector
Ministry of Agriculture

January, 1991

DISEASES AND PESTS OF YAM

Information on the pests and diseases which affect yam is limited. However, within the last three to four decades workers in Africa, India, the Far East and the Caribbean have documented the existence of different diseases and pests on the crop, their epidemiology and control.

Copper fungicides should not be used since it has been observed that these fungicides can produce phytotoxic effects in yam plants.

FUNGAL DISEASES

1. Anthracnose - Collectotrichum gloeosporides/Glomerela cingulata

Anthracnose is one of the major foliar diseases limiting the production of yam. It is estimated that this disease reduces yield of white yam, D. alata, by 67%. D. alata is the most susceptible species to this disease negro yam, D. rotundata, and yellow yam D. cayenensis, are less susceptible and the attack occurs late in the season causing relatively little loss.

Symptoms

(i) Small brown spots sometimes with a yellow border appear on the leaves. These spots may enlarge and spread giving a blackened appearance and causing the leaves to wither. Brown to black fruiting bodies may be observed in the lesion under wet conditions and appear as dark concentric rings.

(ii) Oval to elongated black lesions on petioles and stems.

(iii) Dieback of young shoots.

Development and Spread

The pathogen overseasons on crop debris. Infection is favoured by wet and humid conditions. Spores are dispersed by wind and rain splash, hence the disease is most severe when there is heavy rains.

CONTROL

Crop debris should be removed as this is the major source of inoculum. Benlate, Daconil/Bravo, Topsin and Dithane M45 gave good control in a trial undertaken at grove Place. Benlate alternated with Mancozeb at weekly intervals has been reported to give good control and increase yield.

2. Cercospora Leaf Spot - *Cercospora carbonacea*

Symptoms

Lesions on leaves appear as brownish spots which darken with age and may spread to cover the entire leaf surface. The spots are sometimes surrounded by a yellow border.

Development and spread

The fungus overseasons on plant debris. The disease occurs during warm wet weather and is more severe at higher altitudes. It is spread by rain and wind.

Control

Spraying and Maneb every ten (10) days if infection is severe has been found to be effective.

3. Fusarium Wilt - *Fusarium oxysporium: Fusarium solani*

Reports from Nigeria indicate that 45 - 78% of plants of susceptible species can be lost to this disease.

Symptoms

The disease is first observed as a sudden wilting of plants 4-5 months old. The wilt starts with the apical foliage and progresses downward. Leaves of severely affected plants turn yellow and fall off and the plants die within a few days. Examination of the tuber of affected plants show death of the feeder roots.

Yellow Yam *D. cayenensis* is more susceptible than other species.

Development and Spread

The fungus overseasons in the soil and in plant debris such as vines, roots and tuber skin. The disease is more severe during wet weather following a period of relative dryness. Nematode damage aids in the entry of the pathogen.

Control

Dip setts for five minutes in 3,000 ppm benomyl followed by dusting with 0.3% benomyl in talcum powder, or for thirty minutes in 1,000 ppm benomyl or thiobendozole.

4. Phyllosticta Leaf Spot - *Phyllosticta* sp.

This disease is found in association with the anthracnose disease and is of little importance.

Symptoms

Numerous small spots, brownish-red to light buff (brown) in colour and bordered with dark brownish-red margin.

Development

It is reported that the development of the disease depends on the stage of development of the crop, the cultural practices and climatic conditions. However, these variables were not defined, but it was noted that under wet conditions the disease was more prevalent.

Control

Benlate alternated with mancozed at weekly intervals for anthracnose control.

5. Post Harvest

Botryodiplodia sp. *Penicillium* sp., and *Aspergillus* sp.

have been reported as causing post-harvest rots.

Control

As for Fusarium i.e. treatment of the harvested tuber if the yam is to be stored for a long time.

VIRUSES AND VIRUS-LIKE DISEASES

Yam Mosaic - Polyvirus. (Flexuous Filamentous particles measuring 787 um).

Symptoms

The leaves appear mottled with dark green and chlorotic patches, and some amount of vein clearing. In some instances the leaves appear lanceolate, curled instead of the normal cordate structure giving a shoestring effect. When the infection is severe the plant becomes stunted. These conditions have been observed on the Yampie, D. trifida.

Spread

Primarily by means of infected planting material. Aphis goddypii is suspected to be a vector.

Control

Tubers from infected plants should not be used as planting material. Seriously affected plants should be rogued.

Internal brown spot - (Flexuous virus-like particles and Bacilliform particle).

Symptoms

Hard brown nodules surrounded by necrotic areas are observed in the flesh of infected tubers. Mosaic symptoms also appear on the foliage.

This condition occurs in the D. alata variety White lisbon in Barbados, but to date has not been observed in Jamaica.

Spread

Primarily by means of infected planting material.

Control

Use disease free planting material and rogue affected plants in the field.

INSECT PESTS

Yam weevil - Palaepus costicollis

The adult weevil along with its legless larvae tunnel through any dry portion of the tuber, especially the head and feed on the surrounding flesh, resulting in rotting of the damaged portion of the tuber.

Control

Crop rotation should be practised along with the use of clean planting material. Dusting the head/setts with Basudin will give some control.

Yam Scales - Aspidiella hartii

These insects along with the mealy bug form a thick whitish colony on the surface of the tuber. They are sometimes found on unthrifty plants in the field which were propagated from infested setts.

Control

Use of clean planting material, and avoid rotating yam after ginger.

Spraying infested hills with malathion and white oil will reduce the infestation.

Slugs

Slugs feed on the leaves and tender growing points causing vine dieback and defoliation. Exposed tubers are also eaten.

Control

Apply metaldahyde bait around mounds.

REFERENCES

1. IITA (International Institute of Tropical Agriculture) 1985. Common Africa Pests and diseases of Cassava, Yam, Sweet Potato and Coco-yam.

2. Naylor, A.G.; 1978 Diseases of Plants in Jamaica

3. Onwueme, I.C.; 1982. The Tropical Tuber Crops. Yam, Cassava, Sweet Potato, Coco-yams.

4. Pans Manual No. 4 . Pest control in Tropical Root Crops.

Lecture presented by

DAVE G. HUTTON
FACULTY OF AGRICULTURE REPRESENTATIVE
FACULTY OF AGRICULTURE UNIT
THE UNIVERSITY OF THE WEST INDIES
MONA, KINGSTON 7, JAMAICA

to

A TRAINING SESSION ON THE MINISETT TECHNOLOGY
FOR EXTENSION OFFICERS

Sponsored by

RURAL AGRICULTURAL DEVELOPMENT AUTHORITY (RADA)
IN COLLABORATION WITH
THE INTER-AMERICAN INSTITUTE
FOR COOPERATION ON AGRICULTURE (IICA)

held at

BODLES RESEARCH STATION, OLD HARBOUR, JAMAICA

JANUARY 31, 1991

INTRODUCTION

The importance of yams (Dioscorea spp.) to the domestic and export agriculture and economy of Caribbean countries has been adequately defined elsewhere in this training programme. Nematodes have the potential to cause severe reductions in qualitative and quantitative production of the several varieties of yams grown in this region. In fact, nematodes do cause significant losses in yam production. Twenty years ago, for example, the yampie (D. trifida) was a favoured yam and grown extensively in Jamaica. Today, the yampie is almost extinct in this country. Why? Because a nematode, Pratylenchus coffeae, has decimated planting materials and crops in the field. Nematodes are thought as well to be the major factor in the declining production of white yams D. alata in Jamaica, to the extent that since 1977/1978, the Data Collection ad Statistics Branch of the Data Bank and Evaluation Division, Ministry of Agriculture has not provided any production figures for this crop.

Different nematodes assume different levels of importance at the various stages of pre- and post-harvest yam production. Thus, with control in mind, one needs to look at, (a) the nematodes in the soils where yams are grown, (b) the nematodes infesting yam roots and developing tubers in the field, (c) the nematodes infesting table yams and (d) the nematodes infesting yam planting materials (setts or heads). However, it bears repeating that nematodes affect the quality and quantity of yam production.

THE NEMATODES OF MAJOR IMPORTANCE TO YAM PRODUCTION

Over 30 species of parasitic nematodes were found associated with yam cultivations in Nigeria, some in soil, some roots and some infesting yam tubers [8,11]. Scutellonema bradys is the important yam nematode in that country but the root-knot nematodes, Meloidogyne spp, cause severe damage to yam roots and unsightly bumps on tubers, thereby affecting the appearance of table yams. In Jamaica, 14 genera of potentially destructive nematodes have been found associated with yam cultivations [7]. In Jamaica, as also in Puerto Rico [1], P. coffeae is the important yam nematode. However, S. bradys and Hopolaimus sp. (in one instance in Jamaica) also infest and damage tubers. Helicotylenchus spp. also damage feeder roots causing reddish, brownish or brown-to-black discolourations and girdling of the roots. Meloidogyne spp. and Helicotylenchus spp. have not proven to have any significant effect on yam production in Jamaica, but they are important in some other countries.

All yam varieties grown in Jamaica are susceptible to nematodes, some more so than others. For example, the author has never seen a yellow yam (*D. cayenensis*) tuber which did not show nematode damage and which did not harbour populations of *P. coffeae*, the only nematode so far found associated with this yam variety and also with the yampie; both varieties are highly susceptible to this nematode. *P. coffeae*, *S. bradys* and *Hopolaimus* sp. (in one mentioned instance) have been found in negro yam (*D. rotundata*) tubers and *P. coffeae* and *S. bradys* in white yams. The point might be made that over the past 15 or so years, the author has seen more and more of *P. coffeae* and less and less of *S. bradys* in yam tubers in Jamaica.

HOW NEMATODES DAMAGE YAMS AND AFFECT PRODUCTION

As mentioned previously, nematodes affect the quality and quantity of yam production. In the field nematodes damage yam roots. In fact, all the nematodes that attack yams will do some damage to roots although some, for example, the root-knot nematodes, will be more important than others on the roots. Damage, results in the roots being unable to function effectively, plants being stunted and unthrifty and incapable of maximum production. *P. coffeae* and *S. bradys* are of greater importance with respect to the damage they cause to yam tubers, although both attack roots; their damage is very obvious and high populations may be recovered from the roots.

A dry rot of tubers has been observed wherever yams are grown. In Jamaica, this condition is called "burn" or "burning". Parasitic nematodes have been shown to be associated with this dry rot from as far back as 1931. *P. coffeae* and *S. bradys* are the nematodes identified from dry-rotted yams; *P. coffeae*, as mentioned previously, is the most important nematode pathogen of yams in Jamaica.

Symptoms of burn or dry rot are cracking of the skin and dark necrotic lesions which are corky in texture due to disintegration of the cortex. The skin of some yams actually looks burnt in spots of varying sizes; if kept long enough, the whole tuber might be affected. High populations of one nematode or the other are associated with the dry rotted areas on the yam tubers. In stored yams, whether kept for consumption or planting, the dry rot spreads and penetrates deeper into the starch tissues with time and the nematode populations tend to increase.

Burning definitely affects the appearance of yams and when table yams are being prepared for cooking, they must be peeled as deeply as the extent of the dry rot, causing some quantitative loss. However, the eating quality of yams is not affected by the dry rot.

There was a period during the seventies when shipments of yams with the dry rot (and containing the noxious nematodes) were refused entry into the U.S.A., a distinct setback to this important trade then. The author does not know what the situation is today.

It has been established that in the skin of yam tubers are groups or bands of cells which function as stem and root primordia [12]. It appears that as the dry spreads over and penetrates into the yam planting material, that these primordia are damaged or destroyed; damaged primordia will not produce vigorous sprouts and destroyed primordia will produce none. Thus, when extensively dry-rotted planting pieces are planted in the field, incomplete stands of unthrifty plants result. Such stands will not produce maximum quantitative yields.

How the root-knot nematodes damage yam roots and tubers ad the effect of Helicotylenchus spp. on yam roots were mentioned previously.

CONTROL OF YAM NEMATODES

To date, research on nematode control in yams has focused largely on disinfestation of planting materials and less, much less, on suppression of nematode populations in the field. In one field trial, Hutton [4] found that pre-planting fumigation of fields was of no benefit if the white yams planted were infested with P. coffeae, even at low levels. In another field trial, less burning was observed on yellow yam tubers harvested from plants which were treated with a nematicide twice during the growing season, thereby enhancing the suitability of these tubers as planting material [9].

There is extensive data from Jamaica, and elsewhere, detailing the several advantages to be derived from disinfesting yam planting material of P. coffeae in particular.

There was good control of the nematode and excellent sprouting of negro yam tubers dipped in oxamyl, a systemic nematicide, at 1200 and 2400 ppm for 30 min. (3). Dipping in water at 51°C for 30 min. or in phenamiphos or diazinon were less effective treatments either because the nematode population were not suppressed or the treatments injured the tubers.

In another trial, dipping negro yam tubers in various solutions of oxamyl or in water at 51°C for 35 min. were effective treatments for suppressing populations of P. coffeae in the tubers and for preventing spreads and penetration of the nematode-related dry rot for 8-10 weeks. Also, these treatments allowed the tubers to sprout earlier and the sprouts were more vigorous compared with untreated tubers (10).

When white yam planting material was dipped in oxamyl at 2400 ppm for 20 min. P. coffeae populations were reduced significantly and there was substantial improvement in vine growth. However, quantitative yields did not increase (4).

In several experiments with yellow yams, where nematode infested planting pieces were disinfested with hot water and/or nematicide dips, there were earlier and higher incidences of sprouting compared with untreated planting pieces. The sprouts were more vigorous and plants from the disinfested pieces bore heavier yields of tubers (6,8,9). The increases in quantitative yields ranged from more than 10% to over 40%. There was evidence from one trial that there is a critical level of dry rotting of yellow yam heads beyond which their usage as planting material is disadvantageous (in terms of sprouting, good growth, development and production of plants) (8).

It is to yam growers' benefit that they use yam planting pieces having a minimum of dry rotting. This suggests careful selection of the pieces. For a variety such as the yellow yam, this selection process will be somewhat more difficult since, as mentioned earlier, yellow yam tubers are always affected by the dry rot and harbour P. coffeae. Following the forementioned trials, the recommendation was made in Jamaica that the Ministry of Agriculture or a designated agency should establish pilot schemes in the major yam growing areas for the purpose of disinfesting yam planting material of noxious nematodes. It was further recommended that large-scale field trials designed to assess the economic benefits of using disinfested planting materials be established.

SELECTED REFERENCES

1. Acosta, Nelia and A. Ayala. 1976. Hot water and chemical dips for nematode control in tubers of Dioscorea rotundata Poir. Jour. of Agri. of the Univ. of Puerto Rico. 60: 395-402.

2. Bridge, J. 1972. Nematode problems with yams (Dioscorea spp.) in Nigeria. PANS 8 (1): 89-91.

3. Coates-Beckford, Phyllis L. and C.W.D. Brathwaite. 1977. Comparison of various treatments for the control of Pratylenchus coffeae in yam. Nematropica 7 (2): 20-26.

4. Hutton, D.G. 1979. Comparison of the performance of white yam plants growing from Pratylenchus coffeae-infested and disinfested planting pieces. In: Investigations 1977/1978. Bull. No. 67 (News Series), Min. of Agric., Jamaica. pp 47-48.

5. Hutton, D.G. and C.W.D. Brathwaite. 1989. Growth and yield response to disinfesting negro yam (Dioscorea rotundata) planting pieces of Pratylenchus coffeae and planting in soil free of the nematode. In: C.W.D. Brathwaite and G.V. Pollard Ed., Urgent Plant Pest and Disease Problems in the Caribbean. Proceedings of the First Meeting of the Society for Plant Protection in the Caribbean held in Kingston, Jamaica, November 22-27, 1981. pp 137-143.

6. Hutton, D.G., A.H. Wahab and H. Murary. 1982. Yield response of yellow yam (Dioscorea cayenensis) after disinvesting planting material of Pratylenchus coffeae. Turrialba 32 (4): 493-495.

7. Hutton, D.G., Phyllis L. Coates-Beckford and Sharon E.A. Eason-Heath. 1982. Parasitic nematodes associated with varius plant species in Jamaica, 1949-1981. In: Proceedings of the Third Research and Planning Conference on Root-knot Nematodes, Meloidogyne spp. International Meloidogyne Project (IMP), Region 1 hosted by the Instituto de Investigaciones Agropecuarias de Panama. North Carolina State University Graphics. pp 92-108.

8. Hutton, D.G., A.H. Wahab, J. Dehaney and A. Ayala. 1985. Critical levels of dry rotting of yellow yam (Dioscorea cayenensis) planting material and control of Pratylenchus coffeae. Jour. of Agric. of the Univ. of Puerto Rico. 69: 231-237.

9. Hutton, D.G., and C.W.D. Brathwaite. In press. Investigating the benefits of disinfesting yellow yam planting material of Pratylenchus coffeae and of nematicide treatments to plants in the field. In: Investigations 1979/1980. Bull. No. 69 (New Series). Min. of Agric., Jamaica.

10. Hutton, D.G. In press. Treatment of negro yam planting material to suppress dry rot. In: Proceedings of the Second Regional Workshop on Tropical Root Crops held in Kingston, St. Vincent and the Grenadines, Sept. 14-18, 1987.

11. Nwankiti, A.O. and O.B. Arene. 1978. Diseases of yam in Nigeria. PANS 24 (4): 486-494.

12. Wickham, L.D., L.A. Wilson and H.C. Passam. 1981. Tuber germination and early growth in four edible Dioscorea species. Ann. Bot. 47: 87-95.

SOME FACTS ABOUT NEMATODES

For the benefit of those of us who might not know too much about then, allow me to provide some facts about nematodes in general and plant parasitic nematodes in particular, as well as information on the methods and benefits of controlling them.

Nematodes, a group of worms, belong to their own section of the Animal Kingdom and are quite different from other animal forms such as earthworms, other worms, insects or the relatives of insects.

Nematodes are very successful and exist in virtually every possible micro- or macro-ecological situation. They live comfortably in hot springs or cold polar seas, they occur in Arctic or Antarctic ice on the one hand or arid deserts on the other; they live in strong acid solutions in the guts of man and other animals, in vinegar (acetic acid) and other harsh media. Nematodes are the most numerous of multicellular animals; any sample will usually contain more of them than other multicellular animals. Most nematodes are harmless and feed on dead matter in the soils or water where they live; these are free living nematodes. Some nematodes are animal parasites, infesting man and other animals. Then, some nematodes feed on and damage living plants; these are plant-parasitic nematodes. Nematodes range in length from under 0.3 mm for some plant parasites to over 8.0 m for some that parasitize whales.

SOME FACTS ABOUT PLANT-PARASITIC NEMATODES

Most plant-parasitic nematodes occur in the soil or other growing media, but some live in roots, stems, leaves, flowers or other parts of affected plants. They are very small and must be magnified to be seen. Plant-parasitic nematodes cause injury by puncturing plant cells and feeding on the contents. As they feed, they release harmful chemicals. Then, other injurious organisms (bacteria and fungi) may be attracted to the nematode-damaged tissues and cause further damage or disease.

Plant-parasitic nematodes differ in their morphological features and behaviour. Some feed on just one or a few closely-related plants; others will attack a wide range of plants. Some increase their populations slowly, others quickly. Those nematodes that have wide host ranges and can increase their populations quickly, usually do greatest harm.

Some nematodes live in the soil or growing media all the time, some live inside the plant virtually all their life, while some live in soil or inside the plant at different stages of their life. Of the numerous plant types cultivated by man or growing naturally virtually all of those studies have been found to be attacked by one or more plant-parasitic nematodes. Plant-parasitic nematodes are moved around, mainly by man, in soil or other growing media or in plant parts.

For plant-parasitic nematodes to survive, they must have living host plants on which to feed. They will die out, some quickly, some over longer periods, in absence of plant hosts. In warm countries with a year-long growing season, plant-parasitic nematodes will always be active, as long as their plant hosts are present and climatic conditions are favourable. The more nematodes that are present at planting time, the greater the damage that will be done to the crop or plants being put in. It is important to remember that low nematode levels at the start of one crop can build up to damaging levels by the start of the next crop.

Some diseases cased by bacteria, fungi or viruses can become intensified on nematode-damaged plant; the severity of the disease as well as the number of affected plants will increase. Also, fungi or bacteria which do not normally cause disease can become very destructive to plants which are damaged by nematodes. Then, plants which are resistant to fungi, bacteria or viruses can become quite susceptible to these organisms if damaged by nematodes and some nematodes can transmit certain destructive plant viruses.

Plant-parasitic nematodes have strong powers of survival. Once established, it becomes extremely difficult to eliminate them.

SOME GENERAL SYMPTOMS OF NEMATODE DAMAGE TO PLANTS

Symptoms on above-ground parts - Plant damaged by nematode generally grow slowly and will be stunted compared with healthy plants. Leaves of damaged plants may be smaller than normal and pale-green to yellow instead of being a normal green. Some nematodes damage the root tissues through which water and nutrients pass, causing plants to wilt (droop), even when they are watered adquately. Nematode-damaged plants usually appear to suffer from lack of nutrients, even when they are fertilized suficiently. In fact, they do suffer from lack of nutrients because they are unale to take up the available nutrients as the damaged and /or lost roots cannot function effectively.

Nematode-damaged plants will often just look "sickly" or unthrifty, without any noticeable cause of the "sickness". Because plant nematodes are very small and not seen in the field and because the symptoms of their damage on above-ground plant parts are not as striking as in the case of some diseases caused by viruses, fungi or bacteria, are reasons why their presence is generally overlooked or not recognized. However, not every plant in a field or garden will look sickly or unthrifty; usually, the unthrifty plants will be in groups or patches among healthier plants. If the same crop is grown repeatedly in the area, the patches of unthrifty plants will usually get bigger as the nematode populations increase and spread. Nematode damage can result in some seasonal plants drying up earlier than normal, e.g., tomato and tobacco. Nematode-damaged plants are poorly anchored and will topple or be blown over easily, e.g., banana and plantain, and nematode-damaged anthurium plants soon become prostrate.

As a general rule, nematode damage does not result in wholesale death of plants. Where this is observed, nematodes are not likely to be the cause.

Symptoms on below-ground parts - Roots damaged by nematodes are generally abnormal. Some nematodes cause roots to stop growing or their ends rot off. Other nematodes cause roots to be galled or swollen. Bacterial nodules on the roots of leguminous plants should not be confused with the goals or swelling caused by some nematodes. Nematode-damaged roots may become rotted and lost resulting in a scanty (spares) root system on the one hand. On the other, nematode-damaged roots may become more profuse (bushy) than normal giving a "beardy" appearance, e.g. carrot or sweet potato roots. Some nematodes caused reddish, browning or brown-to-black discolourations on roots. Generally, nematode-damaged roots become rotted. This rotting is caused by bacteria, fungi and even free living nematodes which enter the damaged roots.

Effect on production - Of greatest importance to growers is the fact that nematode damage often results in significant reductions in the quality as in the case of carrots, potatoes, yams and many ornamentals as well as the quantity of yields produced by plants. The following reductions in quantity of yields have been determined in Jamaica from trials or estimated by observing affected plants in the field:

CROP	Quantity of yield losses caused by nematodes	CROP	Quantity of yield losses caused by nematodes
Anthurium	20 - 60%	Muskmelon	25%
Banana	35 - 45%	Okra	50%
Carrot	20 - 40%	Pineapple	70%
Chocho	20 - 50%	Plantain	50 - 80%
Coffee	20%	Pumpkin	50%
Corn	25%	Strawberry	10 - 20%
Cowpea	15%	Sugar Cane	25 - 40%
Cucumber	35%	Tobacco	20 - 35%
Gungo Pea	15 - 30%	Tomato	20 - 65%
Lettuce	35%	Yam	10 - 40%

INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE

11 Fairway Avenue, Kingston 5. P.O. Box 349 Kingston 6. Tel.: (809) 927-6462, 927-4837
FAX: 809 927-6933. Telex: 2270 OAS JAM. Cable: IICAJA

Superb Printing & Stationery Supplies, 1G Arnold Rd., Kingston 4, Telephone: 922-7328