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REGIONAL ADVISORY WORKSHOP FOR
YAM DEVELOPMENT PROJECTS
IN THE EASTERN CARIBBEAN

Castries, Saint Lucia
July 17 - 19, 1989

IICA

PROCEEDINGS

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IICA OFFICE IN SAINT LUCIA

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 31 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.

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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.



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10 NOV. 2007

**Castries, Saint Lucia
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PROCEEDINGS

Edited by:

**Antonio M. Pinchinat
Lucien Degras
Jn. Baptiste Giffard**

IICA OFFICE IN SAINT LUCIA

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REPORTS, RESULTS AND RECOMMENDATIONS
FROM TECHNICAL EVENTS SERIES

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CASTRIES, SAINT LUCIA

" The views expressed in signed articles are those of the authors and do not necessarily reflect those of the Inter-American Institute for Co-operation on Agriculture. "

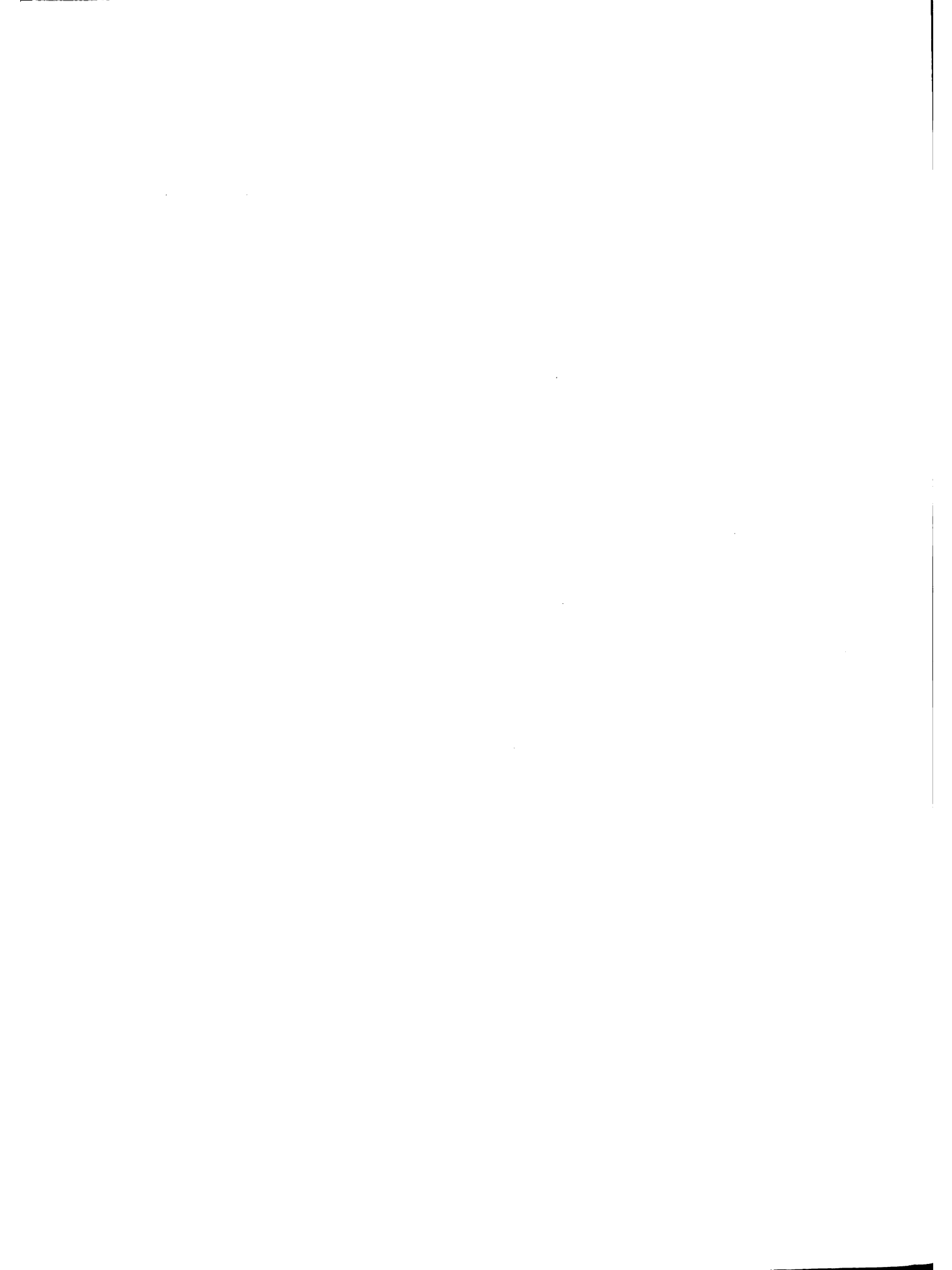
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List of Acronyms

CARDI	Caribbean Agricultural Research and Development Institute
CFCS	Caribbean Food Crops Society
CRAAG	Centre de Recherche Agronomique Antilles-Guyane
ECS	Eastern Caribbean States
EEC	European Economic Community
FAO	Food and Agricultural Organization of the United Nations
FCM	French Co-operation Mission
FSR/D	Farming Systems Research and Development
FWI	French West Indies
IICA	Inter-American Institute for Co-operation on Agriculture
IITA	International Institute of Tropical Agriculture
INRA	Institut National de la Recherche Agronomique (France)
INRAAG	INRA Antilles-Guyane (=CRAAG)
ISTRC	International Society for Tropical Root Crops
MOA	Ministry of Agriculture
NRCRI	National Root Crops Research Institute (Nigeria)
SRC	Scientific Research Council (Jamaica)
UK	United Kingdom
UNDP	United Nations Development Programme
UWI	University of the West Indies

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Technical Programme¹

MONDAY, JULY 17 :

- 0830 - 0845** WELCOME REMARKS — D. DEMACQUE,
*Director of Agricultural Services,
MOA, Saint Lucia.*
- 0845 - 0900** EXPECTATIONS FROM — N. EDWARDS,
*MOA, Saint Lucia,
YAM Project Leader.*
- 0900 - 1000** OVERVIEW OF YAM TECHNOLOGY
DEVELOPMENT IN THE CARIBBEAN — L. DEGRAS, *INRA,*
Yam Specialist.
- 1000 - 1015** COFFEE BREAK
- 1015 - 1200** COUNTRY PROJECT PROGRESS REPORT
— Antigua
— Dominica
— Grenada
— Saint Vincent
— Saint Lucia
- 1200 - 1230** DISCUSSION
- 1230 - 1330** LUNCH
- 1330 - 1530** WORK SESSION
- 1530 - 1545** COFFEE BREAK
- 1545 - 1700** WORK SESSION

TUESDAY, JULY 18 :

- 0730** PICK UP AT HOTEL
- FIELD VISIT :
— Union Agricultural Station
— CARDI Field Station
— YAM Farmers Dearuisseaux Co-operative
— Bellevue Co-operative
- 1300** LUNCH
FIELD VISIT — *(continued)*
Daban/Saltibus Ridge Yam Farmers
IICA Office
- 1500 - 1515** RETURN TO HOTEL

WEDNESDAY, JULY 19 :

- 0830 - 1000** **WORK SESSION**
YAM TECHNOLOGY GENERATION/TRANSFER NEEDS IN THE EASTERN
CARIBBEAN
- 1000 - 1015** **COFFEE BREAK**
- 1015 - 1230** **WORK SESSION :**
Formulation of local activities to address needs
- 1230 - 1330** **LUNCH**
- 1330 - 1530** **WORK SESSION**
— **Sub-regional Network on Yam TGT**
— **Assignment of responsibilities by Countries and Designation of**
Network Co-ordinator
- 1530 - 1545** **COFFEE BREAK**
- 1545 - 1700** **WORK SESSION**
Identification of Regional Institutional Support to the Sub-regional Network
(Roles of CARDI, UWI, INRA, IICA).
- 1700 - 1730** **CLOSING REMARKS :**
— **French Technical Mission (P. Dierickx, *FTM Regional Co-ordinator*)**
— **IICA (A. M. Pinchinat, *Regional TGT Project Co-ordinator*)**
— **Vote of thanks (*Country Delegate*)**
- 1730 - 1900** **COCKTAIL**

^{1/} A Yam research paper was also presented by Dr. M. M. Rao, CARDI.

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Foreword

The Ministry of Agriculture of Saint Lucia, in co-operation with the Regional Office of the French Co-operation Mission and IICA, held a Regional Advisory Workshop for Yam Development Projects, in support of agricultural diversification in the Eastern Caribbean States. The National Institute for Agronomic Research/Antilles-Guyane Centre, based in Guadeloupe (FWI) and the Caribbean Agricultural Research and Development Institute contributed valuable technical assistance.

The Workshop took place in Castries, Saint Lucia, 17 - 19th July, 1989 as per the attached Technical Programme (Annex 1). It was attended by officially-designated National Yam Development Project Leaders and their associates from five Eastern Caribbean States, backed by key resource persons (Annex 2).

The purpose of the Workshop was to provide technical and managerial advisory support to yam development projects, within the crop diversification work programme of the Ministry of Agriculture in each of the participating countries. It addressed developmental issues ranging from production to marketing.

The proceedings of the technical sessions are arranged in four sections as follows :

- (1) Regional Presentations
- (2) Country Project Reports
- (3) Conclusions and Action Programme
- (4) External Agency Co-operation

The major output of the Workshop was the establishment of a Regional Network on Yam Development Projects in the ECS, to further horizontal co-operation in agricultural diversification in the region.

DAVID DEMACQUE,
Director of Agricultural Services.

Ministry of Agriculture,
Saint Lucia.



REGIONAL PRESENTATIONS

Expectations from the Workshop

N. EDWARDS

Knowledge is Power, the old adage holds so true, yet we in the Caribbean too often, hardly know each other well enough to know what each other is doing.

This is particularly true today in agricultural research, development and transfer of technology which is both complex and expensive.

Information circulation is necessary for co-operation and development, so as to avoid duplication and to conserve our limited resources.

The objectives of this Workshop are :

1. To facilitate the dissemination and exchange of information and experience on yam development projects.
2. To provide easier access to such an information and experience exchange.
3. To undertake joint inter-country planning, implementation and monitoring of yam development projects.

Careful co-ordination is a necessary factor to achieving our expectation of information exchange, opportunities for sharing common problems, methodologies and technology and more importantly mechanisms for communications. Thus the update of what is going on in member countries, institutions and the identification of specific contact persons in each country or organization is a necessary factor and ideally placed in the agenda of this Workshop.

It is our hope that this Workshop will strengthen relationships between regional offices and officers.

Thank you

Overview of Yam Technology Development in the Caribbean

L. DEGRAS

1. INTRODUCTION

The yams originate from the humid tropics. Main areas of domestication of important species are tropical East Asia, West Africa and North-East of South America.

From Asia come the most widely cultivated species *Dioscorea alata*, the widely dispersed *Dioscorea bulbifera* and the so-called chinese yam (*Dioscorea esculenta*). From Africa comes essentially the specific complex *Dioscorea cayenensis-rotundata* and from America the Cush-cush yam (*Dioscorea trifida*).

The specification of these entities has been done under the millenaries of the pressure of abiotic and biotic environments, among which are the empirical pressures of human societies.

The dispersal of these species was partly done before historical time. Such is the extension of the Asian yam to Africa. Then the slave trade brought to America *D. alata* and *D. bulbifera*, along with *D. cayenensis-rotundata*. But *D. esculenta* reached both Africa and America in the late XIX century.

2. THE CARIBBEAN SITUATION FROM THE FIELD TO THE KITCHEN

2.1 The Main Cultivated Varieties and their Limitations

Among the Caribbean countries it seems, although no reliable statistical data are available, that the African yam complex (*D. cayenensis-rotundata*) is the most cultivated, under its so-called "white yam" (*rotundata*) and "yellow yam" (*cayenensis*) types. It must be underlined that more accurate recent studies establish that these are no longer valid as true species. Not only many varieties are intermediate, but other flesh colours like reddish or purplish parenchyma are known within the complex. And relationship with a number of wild African species implies a far more complex origin of both types, which can be considered as extreme if not entirely artificial biological forms. The "*rotundata*" type includes the Grosse Caille of Guadeloupe, Portugaise and Portuguese of Martinique and Dominica, the Lady's yam from Dominica, the yam Antoine of Saint Lucia, Negro of Jamaica, Habanero of Puerto Rico and so on. To the "*cayenensis*" type could be related the many "yellow yams" (in Haiti at least six different varieties), the Igname Poule of Martinique (which has a white counterpart), Igname Gui, A-tou-tan, among others.

Second in importance, further reduced in the last decade due to anthracnose epidemics, *D. alata* remains highly prized in Barbados (White Lisbon) and French West Indies (Pacala, Belep, Kinabayo, Plimbite). Its so-called "wild yam" type (Babaoule in Dominica, Taiti in Guadeloupe, Banja elsewhere and Igname Rural in Haiti), is also widely being appreciated for its availability from the neighbourhood woods, its tolerance to foliage diseases, its high yield (even with its large unpalatable head) and its bulbil propagation system. Other *D. alata* are for instance many "red yams" (from their underskin colour or/and the tendency of their flesh when cooked to turn red) like St. Vincent yam, Ste Catherine, and others.

Varieties of the aerial yam (*D. bulbifera*) are far less numerous. And among the many varieties known in the Asian-Pacific area from *D. esculenta*, one or two are seen in the Caribbean, apart from germplasm collections.

However the aerial yam remains of wider dispersal than the American-born Cush-cush yam (*D. trifida*).

The regression of this last one is exemplary of the impact of lack of germplasm regarding the adaptation to several new environmental evolutions : more aggressive diseases (i.e. virus) and pests (i.e. nematodes), less balanced soils (low organic matter content), or reduced mixed

farming (traditional farmers retiring). Among most species the same set of processes from natural, anthropic and social factors requires a renewal of the set of cultivars and appeals for intensive research.

2.2 Yam in the Farming Systems : Progress

Yam position in the Caribbean farming systems goes from varied individual plants in small domestic creole gardens to large-scale plots of one variety offering several hectares to export marketing.

Though large creole garden units still exist in Saint Lucia (Desruisseaux), FWI, Jamaica, Haiti and the Guyanas their status in farming systems is rapidly lowering in the Caribbean, negatively affecting local staple food availability (i.e. in French Guyana) as well as diversity of plant genetic resources. In spite of many recent scientific approaches (INRA, CARDI, FSR/D in general) stressing their pertinence to many problems, they are still criticized as objects of academic research instead of more needed investigations which could improve their biological productivity and economic return.

Intermediate cropping systems comprise root crops (either in mounds or alternate ridges), including yams, aroids, arrowroot, cassava and sweet potato, the ratio of which varies among and within the islands. Some temporary binary associations are practiced, like yam-sugarcane in Barbados or yam-aroids, more widely.

Interspecific or/and intraspecific associations of yams are common. The most seen are the African yam complex mixed with yellow yam and Portuguese yam or equivalent "rotundata" cultivars. They are generally staked.

No staked plots of *D. alata* are common. Large plots and eventually whole estates of this species are seen in several islands, being the only ones or so in Barbados, where White Lisbon is predominant and in Grande Terre of Guadeloupe where Pacala used to stand alone in monovarietal cropping systems. Today, due to the anthracnose disease, plots of several hectares in size are using Belep or Kinabayo in Martinique and Guadeloupe, with Plimbite increasing rapidly.

Such plots, located on flat lands or smooth slopes can be mechanically prepared and harvested, the necessary equipment having been built for this purpose in Barbados (CARIB Industries) and Guadeloupe (INRA). Rare individual farmers however have entered into mechanized harvesting, at least in the FWI, where mechanical soil preparation is now predominant. Farmer associations or co-operatives elsewhere are following this trend.

2.3 Propagation Needs and New Techniques

The renewal of varieties, the steady demand for yam at domestic levels, the increasing trend for yam as an export crop to ethnic markets overseas, as well as the regressive evolution of biocoenosis balance in the area lead to a general need of increasing the availability of yam planting material.

Traditional techniques cannot sustain that need. First, all give a low ratio of multiplication, though a tendency towards the use of smaller tubers is observed, as a result of advice extended to farmers some time back. Secondly, a wide range of heterogeneity is coming from planting material physiological diversity (e.g. apical dominance and irregular maturity). Third, by the prevailing use of discarded products from the marketable harvest (e.g. damaged tubers), the level of infestation by parasites (scales, virus, nematodes) is increased year after year. Fourth, lack of good storage conditions cut down by 20% to 40% the availability of planting material at planting time.

Not all is bad however in the traditional techniques. Among its practices, the use of ash must be encouraged and the second harvest of the African yam probably gives more security against nematodes than a unique late harvest.

A number of new multiplication techniques are at work in the Caribbean. Though since the 1974 CFCS meeting to the International Yam Seminar of 1980 (Guadeloupe), INRA researchers had investigated the high return permitted by using tuber pieces as small as 5 g for Cush-cush and 25 g for *D. alata*, it is only when a technological package, the "mini-sett technique", reached the Caribbean around 1984 - 85, that this possibility began to enter the extension activities in the Caribbean. A joint possibility mini-sett work programme has

been developed by IITA-UNDP-SRC in Jamaica, mainly on the African yam and the yellow yam specifically. CARDI has applied the technique to several *D. alata* in Saint Lucia at La Ressource field station. Experiments on Portuguese yam and other cultivars have been conducted in Martinique (principally by the Chambre d'Agriculture).

Two other horticultural techniques of propagation are available and have been effectively applied in the Caribbean. One is the use of binodal cutting of the yam vine easily done with all *D. alata*, permitting to multiply by 4 - 10 or more each plant. The other is "Moving tuber" technique, based on the ability of regrowth of buds after the mother-tuber is removed from under the first daughter plant in the field and planted again. Two or three "moves" can be effective in giving three to four normal harvested tubers instead of one. The moving tuber technique operates easier with *D. alata* and for early planting. INRA is preparing fact-sheets on both techniques.

In vitro culture is now practiced in at least ten institutional units over the Caribbean (including Barbados, Guadeloupe, Trinidad, Jamaica, Dominica, Dominican Republic, Cuba). White Lisbon, Oriental, Belep, Kinabayo, Plimbite, Cush-cush cultivar and African yams have benefitted from it. Its role in virus cleaning is a key component in the regional co-operation effort. Ratio of multiplication as high as 180000/year has been claimed.

3. ENVIRONMENTAL PROBLEMS

3.1 Biotic Environment

3.1.1 DISEASES

Diseases have reached a preoccupying stage in *D. alata* yam production since the year 1977 (about), when at the same time first results on the anthracnose attacks and control (INRA) and on the extent and damage of internal brown spot (CARDI) were presented at the CFCS meeting in Jamaica. These two problems have received some practical solutions at the production level, but these solutions need to be widened geographically and over the cultivated range of species and varieties.

Fungicide control of anthracnose seems tedious for many extension agents and farmers and perhaps due to soil, climate or fungus races interaction, fails sometimes to really succeed. Work from UWI (Trinidad), informs of fungus races surviving high rate of benlate application. Apart from the well known Oriental, a set of introduced selected tolerant cultivars are now at hand throughout the Caribbean from the network developed by INRA under an EEC contract from 1983 to 1987. Belep and Kinabayo are now known and appreciated in export markets. Plimbite is on increased propagation and demand.

However at least two other fungi, namely *Rhizoctonia solani* on African yam and *Sclerotium rolfsii* attacking every species at varied levels, are under observation at INRA for their possible negative impact on yield.

As for the virus problems, the reactivation of the CARDI Laboratory in Barbados, which cleaned some years ago White Lisbon and Oriental, the prospect for application of thesis results in INRA Guadeloupe and a new expertise effort supported by INRA in this field, will bring about some needed advances in an appraisal of the situation and need of clean material.

3.1.2 NEMATODES AND OTHER PESTS

The importance of nematodes as a determinant hindrance in Caribbean yam production is not yet recognised in spite of the research done in Jamaica, Puerto Rico and Guadeloupe. Its impact could even move to the level of loss of planting material in storage, beyond yield limitation in the field. But if nematicides like vydate (oxamyl), mocap and furadan, are perhaps efficient at varied degrees, their costs and (particularly for vydate) their danger for the environment and overall human health if dispersed over farms, remain apparently high. The hot water dipping practice, very efficient and convenient with small quantities of yam, seems less valid for commercial applications, up to now.

Crop rotations or plant associations remain to be explored. The role of some weeds like *Rottboellia exaltata* in accumulating nematodes is an example of interaction to be investigated.

Other pests, especially insect borers, act locally as real limitation. Thus in scattered areas, the larvae of Scarabeidae (*Phyllophaga*, *Lygirus* and other genera) and *Diaprepes famelicus* on a large scale in Haiti. The Curculionidae *Diaprepes famelicus* (maroca) which affects mainly *D. alata*, can cause serious damage to yams. The defoliating ants (*Acromyrmex*, *Atta*) are noteworthy in Trinidad and in Guadeloupe where some new control could result from INRA research.

3.1.3 WEEDS

Control of weeds by pre-emergent and post-emergent (shielded) herbicides, has progressed through more knowledge on time of application for more efficient action (Puerto Rico) and the use of new products such as Metribuzine (Martinique), Tazastomp (Guadeloupe) and Fusilade (Barbados), for instance.

3.2 Abiotic Environment

The regression of both the shifting agriculture and of the dominance of sugarcane in the cropping systems (principally in Barbados and Guadeloupe), without any compensatory fertilizer and soil management consideration, has led to soil problems linked with precedent biotic problems. Recent studies in Guadeloupe have stressed the need for a policy to restore soil fertility and overall organic matter level.

Climatic accidents or permanent soil limitations such as lack of organic matter for instance are in this context major constraints to yam production, negatively affecting drought tolerance. While research is still badly lacking on the most efficient use of irrigation water in yam fields, some farmers have experimented lower yields by excessive watering over heavy calcareous soils (vertisols) in Guadeloupe.

The sequential evolution of our climate is known to control the tuberization of yam, especially of *D. alata*, where staggered plantings cannot offer good prospects for economical yield all year round, as opposed to yellow yams. On the contrary, this control explains the improvement of the structure of the tubers of so-called "wild yam" (An-bas-bon, in Guadeloupe), the unpalatable head of which is reduced by planting delayed to August.

Interactions between climate (mostly temperature) and varieties control also the length of the dormancy period in storage, ranging from some weeks in Cush-cush to 4 - 5 months in *D. alata*. Air conditioned rooms at temperature under 20°C (better around 18°C) permits to double length of storage while controlling also scales infestation and slowing (at least experimentally) increase of nematodes. However it is inefficient against some fungus or bacterial attacks on Cush-cush or Yellow yams.

Economical storage sheds are under experimentation in Guadeloupe. Main attributes seem to be : windward free aeration, advanced roof against rain, roof covered with trash, wire mesh walls, shelves loaded no more than 0.80 m deep -- (permitting free air circulation under and over heap), screening tubers against defects (being the basic first step) completed by phytosanitary treatments eventually and then obligatory curing over 3 - 4 days.

4. SOCIO-ECONOMICS

Some socio-economic approaches can be found in CARDI FSR/D reports and also in some studies conducted in Jamaica. Costs of production have been approximated in Guadeloupe and Martinique. The actual cost appears always high but prospects to reduce it are good through mechanization, use of herbicide, no staking, better planting management, use of tolerant cultivars and farmers co-operation.

While current demand for yams is considered high, no one doubts that lower prices should open or widen more markets, domestic as well as export.

In this respect efforts to maintain culinary quality and to improve recipes are ranked as high priorities. INRA research development strategy and CARDI observations in Saint Lucia place Belep as the most required in export markets in spite of its shape. Plimbite is getting even more favour on this point among some connoisseurs.

Efforts to prepare a comeback of the yam on the processing scene is at work in the FWI. The well known techniques from the ten-year experience of pilot plant of Barbados is not however the most important consideration. Appropriate cultivars and overall low production cost are still determinant. This supposes action from a joint team of extension agents and farmers, with a steady support from researchers for improving the cultivars, even if some do permit initial processing steps. Competition will be hard in the coming years against cereals and white potato products inside the enlarged EEC markets, not forgetting other Third World yam producers like Brazil and the African Yam Belt.

5. THE INTER CARIBBEAN ORGANIZATIONAL LEVELS

Two international levels of organization are now trying to support the yam development research and/or extension in the Caribbean.

First, in February 1989, the Caribbean Branch of the International Society for Tropical Root Crops has been launched, during an UWI-FAO meeting in Trinidad, with Dr. Lynda Wickham, Caribbean Representative in the ISTRC Council put in charge of the Secretariat. The society will promote research on root crops in the area. A meeting is to be announced within a few months for probably 1990.

Second, projects are operating with international funds in several Caribbean countries where yam is a major crop.

The Yam and Cassava Development Project of FAO is supposed to end soon this year. It had developed facilities for in vitro culture in several islands, intended to offer support to all English-speaking States for releasing plantlets from tube to field. INRA has fed the project with its selected cultivars, which are supposed to be dispatched in virus free plantlets from CARDI/Barbados to interested Caribbean countries.

A project for yam protoplast regeneration and fusion against anthracnose is just beginning now (based partly on Caribbean yams). It aims at protoplast separation, regeneration, and fusion in England/London (Wye College/Dr. Mantell) and France/Angers (Dr. Boccoon-Gibod). Associated laboratories are located in Great Britain and in Oceania.

Breeding is the only way to make yam production an adult and major business for the Third World. We are convinced that within three or four years genetically improved materials will be available either from Africa (IITA, NRCRI, Ivory Coast) or from India. The Caribbean cannot remain aside of the challenge of useful application of modern technology to meet its yam farmers and consumers needs.

REFERENCES

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Increasing the Production of Yam in the Eastern Caribbean

A REVIEW OF RESEARCH UNDER FSR/D PROJECT

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ABSTRACT

This paper reviews the research conducted in yam at various steps of Farming Systems Research (FSR) Methodology of the Caribbean Agricultural Research and Development Institute (CARDI), over the past five years in the Eastern Caribbean. The activities carried out during this period include Island Studies, Characterization of Germplasm, Introduction and Evaluation of cultivars of White Yam (*Dioscorea alata*) for yield and tolerance to anthracnose, Seed Multiplication, Intercropping, Response to various sources of plant nutrients, Control of Anthracnose and Nematodes and ways to extend dormancy. Since White Yam received much attention until recently, it was suggested to focus research in improving the production of other species of yam i.e. *D. rotundata*, *D. cayenensis* and *D. trifida*. Future research needs of yam in the Caribbean are also highlighted.

^{1/} The full paper also presented at a Workshop on Yam and Cassava Development held at UWI Campus, Trinidad and Tobago, February 20 - 24, 1989.

**COUNTRY PROJECT
REPORTS**

Antigua and Barbuda

C. GRANT

1. INTRODUCTION

Yam as a traditional root crop in Antigua and Barbuda was grown in two agronomic systems : " commercial scale " and " subsistence level ".

Yams were produced commercially within the sugar plantation system where crops of yams were rotated with sugar cane. Later, yams were sold as a staple food to sugar workers and the remaining yams were exported. The main species of yams cultivated were *Dioscorea alata* and *D. rotundata*. The incorporation of filter press mud and bagasse maintained the high percentage of organic matter that provided the ideal micro-climate for the successful production of yams. Cut and bruised yam surfaces were treated with lime (CaO) which acted as a preserving agent of the yam planting material for the next growing season, which was and still is May of each year.

On the other hand, yams were also grown on a subsistence level by small farmers with plot sizes of less than two hectares. Cultivation sites were mainly hill-slopes and valleys that were either privately owned or deemed unsuitable for the cultivation of sugar cane. Farmers usually sold their produce at the village market or in the city.

Yam is an ideal crop which can be grown as an import substitution commodity. For example, it is viewed that yams can be readily substituted for white potatoes within our economy. At present (1988/89), Antigua imports annually 653,189 kg of white potatoes at a CIF value of 671,622 E.C. dollars. Imports of yams and white potatoes in the previous three years (1985 - 1987) are recorded in Table 1.

TABLE 1. IMPORTS OF YAMS AND WHITE POTATOES FOR 3 YEARS

YEAR	COMMODITY	QUANTITY (kg)	VALUE (\$)
1985	Yam	1,594	3,149
	White Potato	422,276	454,559
1986	Yam	13,060	15,086
	White Potato	920,060	903,299
1987	Yam	2,657	2,896
	White Potato	617,229	657,018

Source : PROMIS (Antigua).

A portion of the foreign exchange losses could be saved by an increased and sustained production of yams on the local market.

A comprehension of the peaks and troughs of the imports of these commodities can guide planners and producers about their production strategies.

There are some 25 farmers who are directly engaged in yam production whose farming system is either intercropped or on a pure stand basis throughout the five agro-ecological zones. Some production sites may not be conducive toward the successful production of yams due to high alkalinity (pH) and stoniness, coupled with low rainfall (rainfall from about 480 to 1300 mm/year during the five year period 1984 - 1988).

2. DOMESTIC PRODUCTION OF YAMS

The two yam species grown in Antigua are the *D. alata* and *D. rotundata*. The *D. alata* cultivars are White Lisbon, Belep, Kinabayo and Oriental. The *D. rotundata* cultivar is the Antiguan yam (Negro yam as known in Jamaica). The *D. alata* cultivar White Lisbon is the main cultivar that is grown on a commercial scale in spite of its increasing susceptibility to anthracnose (*Colletotrichum gloeosporoides*). The *D. rotundata* is less prominent because of its low productivity per unit plant.

In 1987, a total quantity of 500 lb. of yam planting material were imported from Saint Lucia through the CARDI Office. The cultivars were Belep, Kinabayo and Oriental. These yam planting material were evaluated at CARDI's Field Station at Betty's Hope and the MOA Dunbars Experiment Station.

The following year, an additional 500 lb. yam planting material was imported by the Ministry of Agriculture. It was also distributed to CARDI and then evaluated. The cultivars appeared to be tolerant to anthracnose. The cultivars performed satisfactorily in view of the levels of rainfall soil pH and technology used in the production system. Table 2 gives production details at CARDI Field Station at Betty's Hope.

TABLE 2.2. YAM PRODUCTION AT CARDI FIELD STATION 1988/1989

CULTIVARS	AREA (ha)	PRODUCTION (kg)
White Lisbon	0.20	2,345
Oriental	0.12	1,256
Belep	0.04	987
Kinabayo	0.02	60

Source : CARDI Field Station (Antigua).

It shows that the variety Belep yielded in excess of 24,000 kg/ha. As a replacement for White Lisbon, Belep appears to be the cultivar selected by most farmers.

Table 3 reflects a similar trend where the cultivar Belep appears to perform satisfactorily in terms of yields at the MOA Dunbars Experiment Station. However, on the basis of the data shown, there are some reductions in yield which can be probably attributed to agro-ecological conditions as well as available soil moisture.

TABLE 3. YAM PRODUCTION AT DUNBARS EXPERIMENT STATION 1988/1989

CULTIVARS	AREA (ha)	PRODUCTION (kg)
Oriental	0.10	909
Belep	0.05	1,136
Kinabayo	0.05	136

Source : Department of Agriculture — Dunbars

The incidence of yam anthracnose on the newly introduced cultivars Belep, Oriental and Kinabayo appeared negligible or in most cases non-existent. However, Benlate (benomyl) and Peltar are the fungicides used in rotation to prevent the incidence of the *Colletotrichum* fungus. Field reports from Antigua Sugar Industry Corporation (ASIC) have indicated satisfactory results using both fungicides alternately.

3. PROPAGATION TECHNIQUES OF YAMS

Prior to the advent of the mini-sett technique, it was customary for farmers to prepare yam pieces in excess of 100 g.

However, reports from CARDI's Field Station have demonstrated the superiority of the mini-sett technique which has been used in training and visit (TNV) method to train farmers as well as Extension Personnel. Field technicians have also reported success using the mini-sett technique for the establishment of the 1988/89 yam crop. Seed pieces used weighed 56 - 84 g, however, the ideal weight is 50 grams. The mini-sett technology can have a great impact on the country's yam industry in view of the recurrent problem of shortage of planting material.

4. YAM SEED MULTIPLICATION PROJECT

The Yam Seed Multiplication Project is a collaborative venture between the Agricultural Extension Division (AED), CARDI and the Ministry of Agriculture. The object of such a venture is to address the need for disease free yam planting material, as well as the quantity of material itself. Prior to this venture, it was norm that yam farmers disposed of all their yam seed material, consequently resulting in an annual deficit of yams.

Approximately three meetings were held with farmers, MOA Extension personnel and CARDI personnel. At the final meeting, the following decisions were taken :

- (1) The ten participating farmers will pay \$1.00/pound for 375 lb. of yam planting material and will sell 50 - 60% of the crop at \$1.25 per pound.
- (2) CARDI will supply the fungicides.
- (3) MOA will supply the fertilizer and pay CARDI for the planting material given on a barter basis.
- (4) The AED/CARDI will organize a Train and Visit field day for farmers, as well as Extension Officers.
- (5) The MOA will purchase all the available yam seeds (estimated at 2,000 lb.) from CARDI at a negotiable price.

Table 4 shows the total quantity (2,250 lb.) of yam seed material which was distributed to ten farmers within the following six Extension districts :

- (1) South-East
- (2) South-Central
- (3) South-West
- (4) North-East
- (5) North-Central
- (6) North-West

TABLE 4. YAM SEED MATERIAL ISSUED TO FARMERS (1989)

VARIETIES	WEIGHT (kg)
White Lisbon	454.55
Oriental	431.82
Belep	136.36
TOTAL	1,022.73

Source : CARDI Field Station (Antigua).

5. DEVELOPMENT STRATEGIES FOR YAM DEVELOPMENT

In summary, there is need for improved strategies in technology for increased yam production. Outlined below are a number of strategical approaches, which should be followed :

- (1) Import substitution — where yam can be substituted for white potatoes.**
- (2) Expansion of germplasm (cultivars) that are ideally suited under local agro-ecological zones.**
- (3) Storage of yams to plant specific cultivars to extend production period.**
- (4) Evaluation of cultivars that are tolerant to anthracnose.**
- (5) Use of Mini-sett technique as a means to generate planting material within specified time.**
- (6) Development of Tech-Pack approaches for technology generation and transfer.**
- (7) Technology transfer for mechanization of harvesting and use of herbicides, to counter unavailability of agriculture labour.**
- (8) Procurement and distribution of yam planting material as an integral function of MOA/CARDI, to selected specific agro-ecological zones for growing yams.**
- (9) Assessment of acceptability of yams by the consumers.**
- (10) General improvement in agronomic (cultural) practices and evaluation of the best farming systems.**
- (11) Use of the Train and Visit approach in the transfer of technology from Research—Extension — Farmers and the reverse.**
- (12) Use of the Key Farmer approach.**
- (13) Identification of factors limiting the production of yam in Antigua and Barbuda.**

Dominica

R. ALLPORT

Undoubtly yams play a very important role in the small farming systems in Dominica. It is cultivated by a relatively high proportion of small farmers.

The main species cultivated are *Dioscorea alata*, *D. rotundata/cayenensis* complex and *D. trifida*.

A report on the yam collection realized by the MOA (1985) in La Plaine describes close to 20 cultivars, 16 of which were grown by farmers. More recent observations showed that at least 22 cultivars are grown and marketed in Dominica : 3 were *D. trifida* ; 2 *D. rotundata*; 1 *D. cayenensis* ; 1 *D. esculenta* ; 1 *D. bulbifera* ; the remainder were all *D. alata*. However Ladies Yam (*D. rotundata*) and White Yam including Babaoule (*D. alata*) were the most available. Indeed Ladies Yam is the only yam available throughout the year at the local markets.

The general practices in yam agronomy are more or less standard regardless of species or cultivar.

Farmers prepare the land manually using hand tools (fork, cutlass and hoe). Generally they clear a hole up to a foot deep and a foot across where the mound is to be built and into it they introduce the softer vegetative materials left over from land clearing (such as leaves and ashes). They then bring the surrounding soil over the hole into a mound. The height of the mound varies from 1 - 2 feet according to cultivar and farmer practices and the spacing from 2 - 4 feet apart, again according to farmer practices and quality of land.

All yam cultivars are staked, which is an important feature of yam growing in Dominica and though extremely laborious may be important for anthracnose control and attainment of higher yields.

Some common problems experienced by farmers relate to :

- (1) shortages of planting material
- (2) borers
- (3) nematodes

The shortage of planting material is the most common problem identified by almost all farmers and may have serious implication on the production and marketing of the different cultivars. In a series of joint programs of the Ministry, FCM, and CARDI, planting material has been multiplied, observed, distributed and monitored. But shortages continue to be a serious setback to economic development of the commodity.

For commercial production, 72% of farmers would like as their 1st choice Ladies Yam, 22% White Lisbon, and 6% Cush-cush (*D. trifida*).

Ladies Yam was preferred to White Lisbon because of :

- (1) higher yield
- (2) earlier maturity
- (3) easier storage ability and greater market potential

The constant lack of planting material especially of Ladies Yam and Yellow Yam (*D. cayenensis*) may be due to lack of adequate technology with regard to maintaining ; multiplication and preparation of existing material, coupled with the natural inclination to market the best tubers with their heads intact.

Other problems experienced to varying extent are borers (especially in the north) and nematodes, causing severe crop losses.

Borers, if damage is high, render the yam unmarketable and nematodes lead to drops in actual production. Jointly, CARDI and MOA are currently preparing a "tech pack" based on work carried out in Dominica, to address the problems caused by these two pests.

Marketwise, though, it is estimated that Dominica's production of yams has remained rather constant over the years (Table 1). Exports have dropped from 91 tonnes in 1984 to 53 tonnes in 1988 (Table 2).

TABLE 1. PRODUCTION OF YAM (1984 TO 1987)

YEAR	PRODUCTION (Tonnes)
1984	5139
1985	5500
1986	6600
1987	5700

TABLE 2. RECORDED YAM EXPORTS (kg)

DESTINATION (Country) 1/	YEAR				
	1984	1985	1986	1987	1988
Antigua	2641	2517	3916	3910	3569
G/DLPE	62936	34544	19824	13727	6672
N.A.	4699	10510	15285	17827	19351
USVI	10741	10729	24119	13939	14879
TOTAL	90718	62971	72675	63072	52776

Source : Dominica Trade Statistics

1/ Code : G/DLPE — Guadeloupe
 N.A. — Netherlands Antilles
 USVI — U.S. Virgin Islands

What is even more significant is the drop in exports to Guadeloupe from a high of 63 tonnes in 1984 to less than 7 tonnes in 1988. No doubt this decline has resulted from a quarantine ban imposed by the French authorities on the imported product due to the incidence of yam nematode (*Scutellanea bradys*) in Dominica.

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Grenada

R. O'NEALE

Yam is one of the most widely cultivated tuber crops in Grenada. The crop is usually grown by small farmers on plots not more than 0.75 acre. Owing to the uneven relief of the island, most of the plots are situated on hillside and slopes.

Yam cultivation is done mainly by hand labour, although in few cases tractors are used for ploughing.

Several varieties of yam are cultivated. Some of the more popular are White Lisbon, Moonshine and Wild Yam (in the *Dioscorea alata* group) ; Yellow Yam (*D. cayenensis*) ; and Cush-cush (*D. trifida*).

In Grenada yams are presently produced mainly for local consumption.

In the past two years trial shipments have been made to the UK and indications are that there is great potential for the export of substantial quantities of yams to extra-regional markets. In addition to this, cargo space is also available for moving produce to overseas markets.

In spite of the opportunities which are opening up for the export of yams there are serious constraints which limit the production of yams and the rate of expansion of yam cultivation in Grenada.

The two most serious problems are pests (*Nematodes*) and diseases (*Anthracnose*).

Inadequate crop rotation practices and the use of nematode infested planting tubers have led to progressive reductions in the yields and the availability of healthy planting materials mainly of White Lisbon and Yellow Yam.

In the past year (1988), the Ministry of Agriculture has embarked on work aimed at nematode control in yam which is based on :

- (1) the use of clean planting material
- (2) crop rotation
- (3) chemical treatment of planting material and soil, where applicable.

Anthracnose has also been a serious factor in the lowering of yields and crop failure in many cases (White Lisbon).

Farmers have not adequately adopted chemical control measures to combat this disease, which continues to be a problem.

Consequently, CARDI is presently undertaking the multiplication of Oriental yam (*D. alata*) for distribution to farmers. In the present year, 4,000 mini-setts have been prepared for that purpose in different yam growing areas of the island.

Other constraints are the lack of small mechanical ploughing equipment adopted to hillsides and small plots to lower the high cost of land preparation and insufficient dissemination of reliable crop economic data.

Poor harvesting techniques also lead to considerable losses. This problem may also be related to the excessively large planting setts and wide spacing used by some farmers, resulting in large tubers that are frequently forked damaged during harvest.

There are also non-technological constraints which limit yam production in Grenada. Some of these are :

- (1) the shortage of labour
- (2) high cost of planting material (\$1.25/lb.)
- (3) high cost and low productivity of manual labour.

A yam development project in Grenada will necessarily have to be centered around the following areas :

- (1) the introduction and multiplication of high yielding disease resistant varieties with good consumer acceptance ;**
- (2) the use of proper sized setts and management practices which will give marketable sized tubers, better suited for packaging ;**
- (3) the preparation and promotion of a technology package which will address the problem of pests and diseases ;**
- (4) the provision of proper support services, including credit, market intelligence, provision of fertilizers and others ;**
- (5) adequate training of farmers and extension agents.**

Within this framework, the co-ordination or networking among different institutions involved in yam research and development in the Caribbean will be of great importance.

Saint Lucia

N. EDWARDS

Yam is grown extensively in Saint Lucia for home consumption and export to regional and extra regional markets. It is one of the most commonly cultivated crops in the inter-cropping systems on small farms.

The main species cultivated are *Dioscorea alata*, *D. rotundata/cayenensis* complex and *D. trifida*. There is no specialised system of production of any of these species. Most of the production comes from small farms averaging 0.5 acres.

Average yields are relatively low (0.5 t/ha) mainly due to lack of high yielding/disease tolerant cultivars and prevalence of traditional crop management practices.

Systems of yam cultivation in Saint Lucia include both sole and mixed relay croppings. The latter practice is thought to be the peasant farmer's answer to the vagaries imposed by his environment.

With the expansion into bananas the cultivation of yams for sometime appeared as a real challenge. At one end of the spectrum was the old traditional mixed cropping complex with declining yields and decreasing consumption demand for the product on the other. Strategies of food security and diversification around bananas have since then to some extent offset this trend.

Other impediments have also existed some of which still pose a challenge that only a strong vibrant research and development programme can address.

Some very common but serious problems experienced by farmers relate to shortages of high yielding/disease tolerant planting material ; problems of diseases (namely anthracnose) and other pests to a lesser extent ; traditional cultural practices of soil preparation, harvesting, handling and storage. These problems have very serious implications for the rate of expansion of yam cultivation, total production, yields and quality.

As a concrete measure to elevating these constraints, a yam development project was created by the Ministry of Agriculture together with IICA as a framework for technology generation and transfer.

The project consists of several components at various phases of production. These have been conveniently distinguished as pre-production, production to harvest and post harvest. In each phase major problems faced by farmers will be addressed. Difficulties will be addressed by directing efforts into :

- Research
- Multiplication of planting material
- Training
- Extension
- Monitoring
- Procurement of Services
- Market Intelligence

The project aims to increase the supply of yam for both the export and local markets to increase the number of farmers involved in its cultivation. Activities have been undertaken by the Ministry of Agriculture and CARDI to multiply and monitor planting material distributed to farmers after much observation and screening on research stations. Shortages of adequate planting material of desired cultivars still remain a problem to be solved.

Monitoring of crop fields is of high priority with technical assistance being provided by Extension Officers and resource personnel. Core and satellite farmers already identified are trained in various aspects of yam production.

Efforts at marketing also continue with production geared towards the ethnic markets of the UK. Over the years yam exports have decreased slightly falling to 7.8 tons in 1988 (Table 1).

TABLE 1.

YAM EXPORTS (1986 - 1988)

YEAR	EXPORTS (Tons)
1986	8.1
1987	5.9
1988	7.8

Co-operation and co-ordination is a necessary and important factor within this framework and thus it is of great importance that linkages among different institutions involved in yam research and development in the Caribbean be strengthened.

Saint Vincent and the Grenadines

C. G. GUNSAM AND H. JOHN

1. INTRODUCTION

Yam is grown extensively in Saint Vincent for both home consumption and export to regional and extra regional markets. It is one of the most valuable root crops cultivated in the country, with most of the production coming from small farmers with holdings averaging 0.3 hectare. An estimate of all yam production per annum including White Yam (*Dioscorea alata*) for the period 1977 - 87 ranged from 500 to 2,000 tons (Statistics: Ministry of Agriculture, Industry and Labour).

A survey carried out during 1984 - 86 revealed that anthracnose was responsible for 50 - 60% losses in all the local cultivars of *D. alata*. In fact in 1983 and 1984 it was observed that an occurrence of anthracnose caused almost total destruction of local "water" and White Lisbon yams in the country. As a result the production of white yam has been at its lowest level in spite of the favourable market demand.

2. PRODUCTION OF YAM

Production of yam occurs on about 500 acres. Production has expanded substantially over the past 10 years from approximately 1,300,000 lb. or 650 tons in 1977 to 3,300,000 lb. or 2,200 tons in 1987. However between 1984 - 85 there was a decrease in production which may have resulted on the outbreak on anthracnose on the *D. alata* species.

3. PRODUCTION AREAS

All species of yams in Saint Vincent can be found growing in all the Agricultural districts. However the *Dioscorea rotundata* and *D. cayenensis* are mainly grown in the higher rainfall zones while the *D. alata* cultivars are grown in the drier zones. These zones are characterised by annual rainfall of 2,159 - 2,540 mm in the high rainfall areas and 1,000 mm - 2,000 mm in drier areas.

4. YAM SPECIES/CULTIVARS

Four species of yams are grown in Saint Vincent as follows (Table 1) :

TABLE 1. YAM SPECIES AND LOCAL NAMES

SPECIES	LOCAL NAME
1. <i>Dioscorea rotundata</i>	Portuguese
2. <i>D. cayenensis</i>	Dominic
3. <i>D. trifida</i>	Cush-cush
4. <i>D. alata</i>	Several

Of the *alata* species there are eight local types, mainly :

- (1) Local Water Yam
- (2) White Lisbon
- (3) Moonshine
- (4) Bascombe
- (5) Barrel
- (6) Chinese
- (7) Bush Yam or Bobas
- (8) Coconut Yam

An additional three introduced *D. alata* cultivars came from INRA, namely Belep, Kinabayo and Plimbite and Oriental from CARDI. These cultivars were recently introduced as a result of acclaimed tolerance to anthracnose. The planting materials of these introductions have not yet been extended to farmers on any commercial scale.

5. PLANTING MATERIAL AND SEASON

Tubers are the main planting material used. Usually the large tubers are cut into portions weighing about 70 – 100 grams. Small whole tubers are also planted. In the case of *D. rotundata* and *D. cayenensis* planting materials are in mainly two forms : (1) head portion that is left back into the soil after harvesting and (2) cut portions of harvested tuber mini-sett

The mini-sett technology has been encouraged at both CARDI and Ministry of Agriculture Field Station, for rapid multiplication of the *alata* species. However the technology has not been practised by farmers.

The *alata* species is normally planted in April to May while the *D. rotundata* and *D. cayenensis* are planted in January/February.

6. LAND PREPARATION

Yams are normally planted on mounds or round banks. In this process a trench locally called a "foot hole" or "cup hole", 20 – 30 cm deep is dug and organic matter (including weeds) is placed into the hole and a mound formed on it with soil removed from the second trench above or in front of this one.

7. YIELDS

Yields of traditional cultivars that lack tolerance to pest and disease have been generally low, averaging approximately 8,000 lb./acre. Although the production of yam tripled from 1977 to 1987, the increase in volume was due to the expansion in cultivated area rather than productivity per land unit. This low efficiency of production is due mainly to the low use of high yielding inputs such as appropriate fertilizers, inadequate pest and disease control measures and lack of specific high yielding crop varieties adapted to Saint Vincent.

Varieties presently available to farmers are traditional types of which the *alata* species is very susceptible to anthracnose and is characterised by low yield potential. However over the last 2 – 3 years the Ministry of Agriculture and CARDI have farm-tested three introduced cultivars from INRA which are tolerant to anthracnose and generally higher yielders than traditional cultivars. Two acres of these cultivars are presently being rapidly multiplied by CARDI and Ministry of Agriculture.

It is anticipated that next year (1990) the planting material produced on the two acres will be sold at a subsidized price to farmers.

8. MARKETING CHANNELS

The principal purchasers of yams are Traffickers, St. Vincent Marketing Corporation and three private marketing agents namely : Eastern Caribbean Agencies, Square Deal, and L. Gunsam.

A survey conducted earlier this year by the Research Unit of the Ministry of Agriculture among the principal yam purchasers showed that the small quantities that are available to principal purchasers were far less than what they could have marketed.

For example the St. Vincent Marketing Corporation can export 10,000 lb./month. However only 1,080 lb. were shipped in December of 1988. Eastern Caribbean Agencies (ECA) exported 4,320 lb. in 1988 but they have indicated that they can export much more. Similarly L. Gunsam indicated that with regular supplies, they can export 20,000 lb./month on a weekly basis of 5,000 lb. This Marketing Agent is willing to guarantee 40c./lb., providing volume of supplies can be regular.

9. MAJOR CONSTRAINTS

1. Most of the traditional cultivars in particular the *alata* species are characterized by low yield and are susceptible to anthracnose.
2. Unavailability of "clean" or disease free planting materials to farmers.
3. Poor marketability and lack of co-ordination between production and marketing.
4. Unavailability of agricultural inputs and credit to farmers.

Other constraints are post-harvest losses due to poor handling and packing techniques and production is seasonal and labour-intensive.

10. IMPROVEMENT PLAN

Improvements to the above problems and constraints require technical inputs, farmers education and capital investments.

Therefore farmers should be able to have :

1. Cultivars that are high yielders and at the same time do not require high technological inputs.
2. A ready source of disease-free planting material.
3. Guaranteed markets and stable prices for their produce, and
4. Access to agricultural credit.

Saint Lucia Field Trip

L. DEGRAS

Silent moments of the field trip conducted by Mr. Lubin and Ms. Edwards included the visits to CARDI Field Station at La Ressource and a farmer's field at Latille, the meeting with co-operative farmers at Bellevue and the visit to farmer fields on the Daban/Saltibus ridge.

On CARDI Field Station fair multiplication plots of Oriental, Yam Langie, Belep, Kinabayo, Florido and Plimbite were shown by Cathalina Fontenelle.

In the farmer field at Latille, interesting yam-based mixed cropping systems were under weeding. Pigeon pea was used mainly as border rows of the plots. Oriental and Kinabayo were on ridges with alternate corn rows in the furrow. Belep was planted mostly in pure stand. The yam plants were not staked. Sweet potato and plantain completed the field.

At Bellevue (Choiseul), after lunch the FTM office hosted a meeting of the Workshop participants and members of the Bellevue Co-operative. Among the many valuable points brought up by the farmers, the following were highly relevant to the Workshop purpose :

- (1) Lack of planting material is the first hindrance to yam development.
- (2) Yam development however is a reality since several years and market demand is high.
- (3) Production aims primarily (95%) at domestic market.
- (4) Yellow yam is by and large the first in production, followed by Portuguese yam.
- (5) Oriental, recently provided by the Ministry, is well accepted, but due to lack of planting material is not common. It is sold cheaper than the precedent varieties.
- (6) Cush-cush represents, no more than 1% of total production. A strong decline of Cush-cush is seen, from previous years.
- (7) Some lower yield is likely to prevail in Yellow yam also. However, planting of this cultivar remains on a year round basis.
- (8) From the discussion it appears that nematodes could be implicated in decline of both Cush-cush and Yellow yams. Sampling was proposed for expertise at INRA (Guadeloupe).
- (9) The share of Portuguese and Lady's yams in export market was predominant.
- (10) It appears also that no freight or other shipping space problem is affecting export from Saint Lucia.

The visit to the fields on the Daban/Saltibus ridge permitted the Workshop participants to look at an important zone of a traditional yam farming system. It is based on shifting cropping on very steep land, with mounds receiving up to six big pieces of second-harvest tubers, of Yellow yam mainly. Portuguese yam plantings however are not rare, either mixed or in quite pure stand. Some of the fields portions are of creole garden type, including scattered Cush-cush, yam, dasheen or eddoes, plantain, bananas and vegetables. Pine trees are installed, the zone being under the Forest Reserve control. Some ditches catch a part of the heavy rain, which should affect these hills that reach a height of about 500 - 600 meters above sea level. The soil, apparently should permit fast drainage and easy harvest.

**CONCLUSIONS AND ACTION
PROGRAMME**

Summary of Discussion Results

The results of the discussions which took place in the Work Sessions are summarized as follows :

1. PROBLEM IDENTIFICATION

In the first working session, the yam development purpose (domestic or export) was outlined and the main varieties to satisfy that purpose were selected by each country (Table 1).

TABLE 1. YAM DEVELOPMENT PURPOSE AND SELECTED CULTIVARS BY COUNTRY

COUNTRY	MARKET PURPOSE PRIORITY 1/		CULTIVARS
	DOMESTIC	EXPORT	
Antigua	1	—	Belep, Oriental, White Lisbon
Dominica	2	1	Ladys Yam, Cush-cush, Yellow Yam
Grenada	2	1	Belep, Kinabayo, Plimbite, Ladys Yam
Saint Lucia	2	1	Belep, Kinabayo, Ladys Yam, Oriental
St. Vincent	2	1	Portuguese, Yellow Yam, Belep, Kinabayo, Plimbite

1/ Priority (Code) : 1 = first
2 = second

The major yam development problems were then analysed by country and rated on a scale of 1 - 8, from highest priority (1) to lowest (8). It should be noted that all countries identified insufficient planting material as the major problem (Table 2).

TABLE 2 : MAJOR YAM DEVELOPMENT PROBLEMS BY COUNTRY 1/

Major Problems	Country 1/				
	Antigua	Dominica	Grenada	Saint Lucia	Saint Vincent
1. Disease and Other Pest Damage					
1.1 Anthracnose	2	—	2	3	2
1.2 Nematodes and Borers	—	3	3	—	—
2. Insufficient planting material	1	1	1	1	1
3. Poor harvesting techniques	4	—	6	2	7
4. Lack, of improved tools for harvesting	6	—	7	4	8
5. Unfavourable marketing conditions (pricing, channels)	—	3	5	5	3
6. Lack of germplasm	3	—	4	—	6
7. Inadequate transfer of technology	5	2	4	2	4
8. Insufficient freight space	—	4	—	6	5

1/ CODE : + = serious
— = not serious
1-8 = priority levels, from highest (1) to lowest (8)

The identified problem areas at country level were further ranked as constraints on a regional basis (Table 3). For simplicity, "Lack of improved tools for harvesting" (7) and "Poor Harvest techniques" (3) from Table 2 were combined as 1 Harvesting techniques and tools" (6) in Table 3. Thus, priority levels ranged from 1 (highest) to 7 (lowest).

TABLE 3. REGIONAL RANKING OF YAM DEVELOPMENT CONSTRAINTS

RANK 1/	PROBLEM AREA
1	Planting Material
2	Diseases and other Pests
3	Technology Transfer
4	Marketing
5	Germplasm Availability
6	Harvesting Techniques and Tools
7	Freight

1/ CODE : 1 - 7 = highest (1) to lowest (7), priority level.

2. PROPOSED ACTIVITIES

The Workshop undertook to formulate activities aimed at addressing the major problems limiting yam development in the region.

2.1 PLANTING MATERIAL

To address this constraint the following steps were considered. :

2.1.1 The various Ministries of Agriculture should be responsible for the production of yam planting material with support from CARDI where necessary.

2.1.2 MOA/CARDI should spearhead the production of certified seed of new varieties for at least three years before contemplating the use of contract yam-seed producers (farmers).

2.1.3 To facilitate the transfer of the mini-sett technique for the production of yams, CARDI/IICA will undertake production of slides featuring the mini-sett technology.

2.1.4 Apart from the mini-sett technology there are three other methods that can be utilized to propagate scarce planting material :

- (1) **The use of bulbils**
It applies specifically in the case of Belep yam.
- (2) **The use of stem cuttings**
It is particularly suitable to alata varieties. Cutting with nodes should be taken in the months of May to June, from yams planted in March.
- (3) **The moving tuber technique**
Mother tubers are planted in the field and after sprouting the tuber is out, removed and planted again. The same operation is repeated as long as sprouting continues. This gives rise to several plants from the same tuber.

2.1.5 INRA will produce a manual on the last three techniques of yam multiplication, (translated into English).

2.2 DISEASE AND OTHER PESTS

2.2.1 Anthracnose

Anthracnose was identified as the main disease problem in most of the islands. For its control the following measures were proposed :

- (1) The use of available tolerant/resistant varieties.
- (2) Intercropping with different crops, mixed planting of different yam varieties with varying levels of resistance to anthracnose and the use of buffer zones to reduce the spread of spores of the casual bacterium.
- (3) The treatment of planting material with fungicides or woodash.
- (4) Early planting of yams (March — April).
- (5) Early staking to reduce levels of humidity which predispose the yam plant to the disease.
- (6) Chemical spraying.

- (7) Increasing organic matter in the soil.
- (8) Adjusting soil pH to counter aluminium toxicity that can predispose certain yam varieties to anthracnose.
- (9) Newly developed disease resistant/tolerant varieties should be proposed (by INRA) to the various Ministries of Agriculture for local trials as they become available.

2.2.2 Nematodes

The following measures were proposed for the control of nematodes, the major parasites of yams:

- (1) the treatment of the planting material with a nematicide and a fungicide.
- (2) Crop rotation.
It was suggested that yams should not follow vegetables in the crop rotation pattern and should not be planted on land highly infested with *Rotboellia exaltata* a host of nematodes that infest yams.
- (3) Intercropping with tannia.
Tannia is said to be a "bad host" for yam nematodes.
- (4) Selection of planting material without cracks.
- (5) Proper storage of planting material.
Temperatures above 20°C are favourable for nematode multiplication within the stored tuber. At 27°C the increase in nematode population is exponential, therefore yam planting should be stored in well ventilated cool areas, with an ideal temperature of 15 – 20°C.
- (6) In *alata* varieties, node cuttings should be made if the tubers are highly infested with nematodes.
- (7) Application of hot water treatment at 50 – 52°C for 30 – 35 minutes using sets weighing not more than 150 g each.

2.3 TECHNOLOGY TRANSFER

The participants at the Workshop voiced the concern that the available improved technological options related to yam development were not reaching the farmers and in many cases not even the Ministry of Agriculture in a particular country.

They therefore proposed that —

- (1) New advances in relevant yam technology will be published in the CFCS newsletter.
- (2) In each country, a committee be set up on yam development priorities, to ensure that yam project action be conducted in areas of relevance to the farmer and national development policy and plan. The Committee (or Team) should comprise Research, Extension, Marketing and Farmer representatives as core group to facilitate linkages among these basic development functions. The National Yam Project Leader should be its *ex-officio* secretary.
- (3) New technology normally should be validated before its transfer to target farmers.
- (4) Technology transfer means such as demonstrations, reciprocal visits, horizontal co-operation and distribution of tech packs should be intensified.
- (5) Transfer of technology through farmer organization should be promoted.

2.4 MARKETING AND FREIGHT

It was agreed that the Marketing (4) and Freight problems (7) in Table 3 should be combined because of their strong linkage. They are non-technological constraints that may be beyond the reach of MOA Yam Project Leaders.

Particularly, the problem of freight, where it exists, should be addressed at the level of the OECS Secretariat through the Minister for Agriculture of the interested country.

2.5 GERMPLASM

To facilitate the introduction of new yam germplasm —

- (1) New varieties available from INRA should be requested by interested countries, through the National Yam Project Leader.
- (2) Exchange of information on and planting material of promising genotypes should be strengthened within the OECS and between the OECS and other sources of germplasm.

2.6 HARVESTING TECHNIQUES AND TOOLS

- (1) INRA will send information to the various Ministries of Agriculture on a harvester which is presently being used in Barbados.
- (2) The MOA in each country should assist farmers in improving the effectiveness and efficiency of yam harvesting techniques and tools, through the national Extension Service.

3. ASSIGNMENT OF RESPONSIBILITIES

Specific responsibilities for implementing the proposed activities were distributed among the institutions represented at the Workshop (Table 3). The Project Leader (PL) in each country will be responsible for requesting assistance from identified sources and co-ordinating activities among co-operating institutional sources.

TABLE 3. DISTRIBUTION OF INSTITUTIONAL RESPONSIBILITIES 1/

ACTIVITY	INSTITUTION				
	MOA	INRA	CARDI	IICA	FTM
1. Planting material	R,C	S,T	S,T	T	T
2. Disease and other pests	R,C	T	T	T	T
3. Technology Transfer	R,C	T	T	T	T
4. Marketing and Freight	R,C	—	I	T	I
5. Germplasm	R,C	S,T	S,T	T	T
6. Harvesting Techniques and Tools	R,C	T,S	I	—	—

- 1/ CODE : C — Co-ordination of activities
 I — Information
 R — Request for assistance
 S — Supply of materials/inputs
 T — Technical assistance

Network

To ensure the highest level of efficiency in carrying out activities addressing the identified constraints, the Workshop participants agreed to establish a Regional Yam Development Projects Network (YPN) in the Organization of Eastern Caribbean States. The core member countries in the Network are the same represented at the Workshop. Co-operative activities may be carried out between the Network and other interested countries within the OECS or elsewhere.

The MOA Yam Project Leader (PL) from Dominica (R. Allport) was chosen as MOA Network Leader for the period 1989 - 90. The PL from Antigua (L. Grant) was designated as alternate NL. IICA will ensure Network Co-ordination (NC), through its Multinational Project on Support for the Organization and Management of Technology Generation and Transfer in the Eastern Caribbean, based in Saint Lucia (c/o A. M. Pinchinat). The basic roles of the PL, NL, NC and co-operating institutions are reflected in the matrix of the YPN action programme (Table 4).

TABLE 4. NETWORK ACTION PROGRAMME

ACTION	RESPONSIBLE	
	PERFORMER	CO-OPERANT
1. Preparation of YPN Regional Meeting Reports/Proceedings	Network Co-ordinator (NC)	MOA Network Leader (NL)
2. Quarterly Country Feedback to NL	MOA Yam Project Leader (PL)	NC, IICA, CARDI
3. Collection, collation and dispatch of Network information to PLs	NL	NC, IICA, CARDI
4. Network Action Technical Advisory and Monitoring	NC	CARDI, IICA, INRA
5. Publication of news, progress reports and technical articles based on Network action	NL, PL	NC, CARDI, IICA, INRA
6. Holding of one Annual Meeting at rotative venues (July—September period)	NC	NL, PLs, IICA, CARDI, INRA
7. Accessing External technical/ financial assistance for Network activities	NC	NL, PLs, INRA, CARDI, IICA, FTM

The Project Leaders will give feedback on activities in their respective countries to the Network Leader who will collect, collate and dispatch information through the establishment means of communication such as CFCS newsletter, FOCUS and other relevant regional communication media (e.g. EC News).

The monitoring of local activities of the Network will be conducted, through the MOA Agricultural Planning Unit, by the Team on Agricultural Technology (TAT). Regional YPN action technical advisory and monitoring will be performed by the NC in co-operation with CARDI, IICA and INRA. Technical and financial assistance at regional level will be accessed and co-ordinated by the NC in co-operation with NL, PLs, INRA, CARDI and IICA. Through INRA, in particular, technical support linkages will be developed with relevant disciplinary networks, such as the Caribbean Branch of the International Society for Tropical Root Crops, based at UWI in Trinidad and Tobago.

A report of the first Workshop should be prepared by the Ministry of Agriculture (Saint Lucia), FCM and IICA. One annual meeting will be held, preferably in the NL country. The next meeting was proposed to be held in Dominica or alternatively Antigua, between July — September 1990.

**EXTERNAL AGENCY CO-OPERATIONS
STATEMENTS**

Mission Francaise de Cooperation et d'Action Culturelle a Castries

As the quality of the present proceedings shows, the first " Regional Advisory Workshop for Yam Development Projects " was a success. I would like to emphasize the key of this success : the co-operation in its full meaning " to operate with . . . "

From the design up to the implementation, it has been a model of co-operation : exchange and confrontation of ideas as well as experiences, collaboration and complementing of available means.

This co-operation operated at several levels :

- Co-operation within the OECS countries at the level of their Ministries of Agriculture.
- Co-operation between the French Institute for Agronomic Research in Guadeloupe (INRA — CRAAG) and the French Mission.
- Co-operation between the French Mission in Castries and the Ministry of Agriculture of Saint Lucia.
- Co-operation between IICA and the French Mission.

Besides the bilateral projects implemented within the structures of the Ministries of Agriculture of Dominica, Saint Lucia, Saint Vincent and Grenada, this is the type of intra-regional co-operation the French Mission wants to promote.

Thus, the French Mission will continue to support the Yam Network that was born at the end of this advisory Workshop.

I would not end before giving special thanks to Dr. Degras, who is always ready to share his great knowledge on Yam with other Caribbean partners and who did not wait for institutional agreement to start this co-operation in the region a long time ago.

PHILIPPE DIERICKX,
*Regional Co-ordinator for the French Rural
Development Projects.*

Inter-American Institute for Co-operation on Agriculture

The member countries of the OECS have shown strong resolve to diversify in order to strengthen their national agricultural sectors. The underlying policy is for import substitution while enhancing exports of agricultural products which can be profitably grown. The strategy to achieve this purpose has been outlined in the Regional Agricultural Plan prepared by the CARICOM Secretariat, the OECS Crop Diversification Programme for Joint Marketing and the Plan for the Reactivation of the Agricultural Sector in Latin America and the Caribbean (PLANLAC), designed by IICA and supported by OECS along with the other IICA member States.

The first Regional Advisory Workshop for Yam Development Projects was organized and carried out as a co-operative effort among OECS members in the pursuit of the region's agricultural diversification objectives. This three-day meeting held in Saint Lucia has led to the effective launching of a regional Yam Project Network. IICA will gladly support the functioning of the YPN, within the framework of its current on-going Multinational Projects in the OECS within the Institute's five programmes. These aim at strengthening national capabilities in —

- (1) policy setting and planning (Program I);
- (2) organization and management of technology generation and transfer (Program II);
- (3) farmers organization (Program III); and
- (4) animal and plant protection services (Program V).

IICA's support to agro industry and marketing (Program IV), will be channelled so as to address specific agricultural processing and commercialization needs of the IICA members of the OECS.

Opportunity is taken to thank the Ministry of Agriculture of Saint Lucia for having called on IICA to participate, along with the French Co-operation Mission and CARDI, in carrying out the Workshop.

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Grenada/Saint Lucia/Saint Vincent and the Grenadines.*

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