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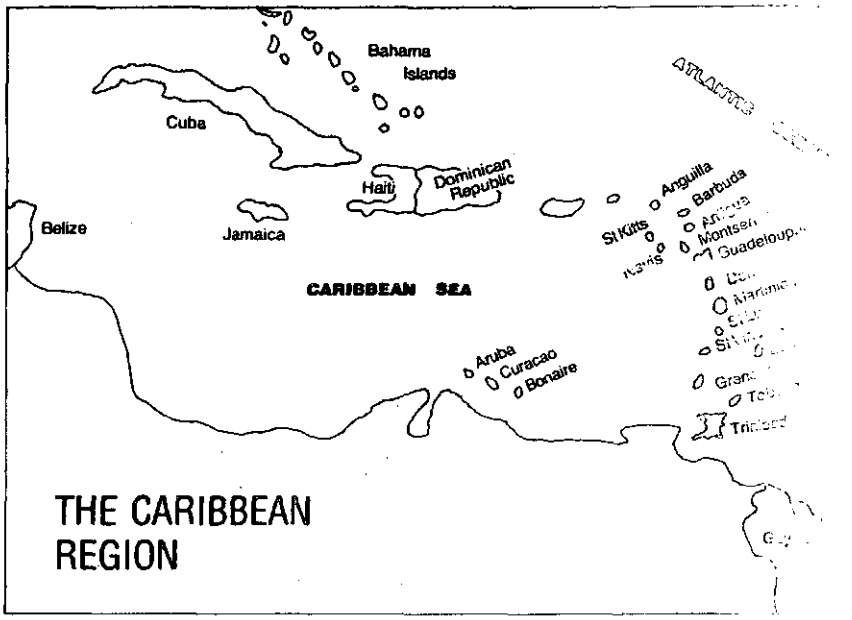

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INTERIM REPORT ON CONSERVATION AND EXCHANGE OF GERMPLASM OF CROP PLANTS

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ECONOMIC COMMISSION FOR LATIN AMERICA Office for the Caribbean

INTERIM REPORT ON CONSERVATION AND EXCHANGE OF GERMPLASM OF CROP PLANTS

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for

The United Nations
Economic Commission for Latin America
Subregional Headquarters for the Caribbean/
Caribbean Council for Science and Technology

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INTERIM REPORT ON CONSERVATION AND EXCHANGE OF GERMPLASM OF CROP PLANTS

INTRODUCTION

Conservation of soils, water and/or forests has in the past received more attention than conservation of plant genetic resources. During the past two decades, however, interest has been focused increasingly on the conservation of germplasm, occasioned by the fear that the gene bases of important crop plants are being narrowed, with consequent loss of important germplasm. Criticism has been levelled at the "Green Revolution" for its replacement of indigenous crop plants by high-yielding varieties. It has been suggested that such replacement in areas where traditional agriculture is dependent on the use of indigenous landraces, leads to the disappearance of the indigenous varieties, with the consequent loss of potentially useful germplasm.

Interest in genetic diversity is heightened by events such as the reduction of corn production in the United States in the early 1970's resulting from the ravages of southern corn leaf blight caused by a previously undetected race of Helminthosporium maydis. The problem was brought about by the cytoplasmic uniformity of much of the corn grown at the time.

Another disease - Dutch Elm disease - has decimated the population of the American Elm (Ulmus americana) despite the fact that the population is highly variable. It is thus now clear that genetic variability is no buffer against genetic vulnerability unless included in such diversity is resistance to organisms that pose a threat.[1/] Of utmost importance is the diversity of alleles that code for susceptibility and resistance to pathogen or insect pest. Germplasm of indigenous varieties must then be conserved as these may hold important genes against disease. It is perhaps relevant here to cite the example of the teosinte weed in Mexico. A primitive ancestor of commercial corn, the teosinte (Zea diploperennis) nearing extinction, has recently been found in an isolated plot of 10 hectares. Unlike the commercial

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1/ Brown, William L. (1983) Genetic Diversity and Genetic vulnerability - An Appraisal. Economic Botany 37 (1) 4-12.

corn the weed is immune to three (3) major corn diseases and tolerant to another two (2). In addition to its strong immunity the teosinte possesses roots that store food, allowing it to live for many years, whereas the commercial corns last for a year only and must be continuously replaced. Experiments crossing teosinte with commercial varieties are currently underway.[2/]

The potential usefulness of such germplasm would be realised only if the accessions were carefully evaluated so that the breeder can know which few of the several are likely to provide the desired trait.

A conference of Experts in Genetic Resources held at Beltsville, Md., United States of America, in 1972, recommended that a gene bank for Central America and the Caribbean be established.[3/] The resulting project has to date covered Central America only.[4/] The CCST has proposed a project on 'Conservation of Germplasm of Crop Plants' in the Caribbean. It is envisaged that the project would take place on a phased basis. For Phase 1, Dr. E. Julian Duncan of the Department of Biological Sciences of the University of the West Indies, was appointed as consultant, with terms of reference as detailed below:

Terms of Reference

The immediate objectives of Phase 1 were seen as:

(i) Assessing the potential and existing facilities for regional research on methods of conservation;

2/ Scott, Anne (1983)Boosting corn with a tough cousin from the hills. South (International) July p.49.

3/ Anon. (1979) Crop Genetic Resources in Central America. Document of GTZ Project, CATIE, Turrialba, Costa Rica. pp.32.

4/ Anon. (1981) Project 6: Conservation and Exchange of Germplasm of Crop Plants. CCST/CRP/81/6, UNECLA, Port of Spain, Trinidad.

(ii) Designating possible centres of conservation within the Caribbean/ Latin America;

(iii) Advising on protocol for exchange of germplasm; and

(iv) Enhancing collaboration amongst regional institutions.

Method of Approach

It was proposed that representative territories of the English-speaking Caribbean between Belize and Guyana be visited. Due to insufficient funding, it was possible to visit three (3) territories only. Barbados, Saint Vincent and the Grenadines and Trinidad and Tobago were chosen on account of their relative proximity to each other.

While recognizing that as a principle, conservation of germplams of crop plants is desirable, it is realised that a list of priority crops must be drawn up, considering the manpower limitations in the region. Such a list should include species currently endangered or thought to be threatened. It was therefore decided to interview personnel in the Departments of Agriculture and in Agriculture-based institutions in the islands visited, on the topics listed below. A list of persons interviewed is contained in the Appendix to this report.

(a) Status of crops grown for local consumption;

(b) Status of crops grown for export;

(c) Breeding programmes in progress;

(d) Gene base for such programmes;

(e) Germplasm collections held and methods of storage;

(f) Facilities for germplasm conservation;

(g) Desirability of a gene bank.

Findings

In general, very little effort is currently made to conserve germplasm. Facility for such work is minimal.

Barbados

The crops considered of importance for the export trade are:

Sugar-cane

Yams

It is hoped that production of yam will rise to 9,072 kg per week for export to United Kingdom markets. To a lesser extent, markets are established

for sweet potatoes, onions and sweet peppers. It is planned to include ochroes and carrots among export crops.

For the local market, in addition to the above, guinea corn, eddoes, cassava, pigeon peas and cow peas are produced.

Crop improvement on yam is undertaken by CARDI; there is limited breeding of sweet potato, pigeon pea and cow pea by the Ministry of Agriculture.

Planting material used for the yams (White Lisbon) is mainly of local origin. In the case of sweet potato, the Minsitry in 1980 collected 21 cultivars locally. Seven hundred (700) lines were obtained from crosses, of which 17 currently exist.

Collections have been made of the local varieties of certain tree crops, which are held in living collections. These include:

Avocado
Cashew
mango; and
Barbados cherry - all in the Scotland District.

The Barbados cherry collection has recently been enriched with varieties brought in from Florida.

The cow pea and some cucumber lines are held as seed. The former includes one (1) local line; all others being imported.

Sugar-cane is held in living collection at the West Indies Central Sugar-cane Breeding Station, except for those cultivars known to be susceptible to disease. The latter are now held in tissue culture.

Guinea corn is in no way formally conserved. Planting material is obtained from local farmers' holdings. A collection of pigeon pea varieties was held, but has been sent to Antigua.

Facilities for storage are minimal. A tissue culture facility, concentrating on yams, is run by CARDI and in limited measure one is run by W.I.C.S.C.B.S.

Saint Vincent and the Grenadines

Crops considered to be of importance for the export trade are principally:

Bananas;

Arrowroot;

to a lesser extent, rootcrops, sorrel, peanuts and a few tree crop products.

The above in addition to breadfruit, pigeon peas, plantains, cocoa nutmegs and a variety of fruit, are considered of importance for local consumption.

Apart from arrowroot, no other crop has received much attention from a breeding point of view. The arrowroot cultivars are held both by the Ministry and by the Arrowroot Growers Association in museum plots Banana collections are held by Windward Islands Banana Growers Association (WINBAN).

A sorrel programme is planned. It is hoped to build up a seed collection, but facilities are non-existent. The fear exists that valuable material might be lost, as one agency is currently shipping the entire fruit, with consequent loss of seed to the local scene.

Collections (living) are held of citrus, mango and in less comprehensive manner of various annonaceous fruit, avocadoes and coconuts. Save for such living collections there are no facilities for germplasm conservation.

Trinidad and Tobago

The situation in Trinidad and Tobago is paradoxically somewhat better than that in the other two territories. Although not as agriculturally biased as the others, Trinidad and Tobago nonetheless has better facilities and carries out or has carried out breeding trials on a larger range of crops. This has been occasioned by the presence in the territory of, earlier the Imperial College of Tropical Agriculture, latterly of the Faculty of Agriculture of the University of the West Indies, and of the headquarters of CARDI.

Breeding programmes have at one time or another been conducted on

cocoa, bananas, sweet potato, pigeon peas;

to mention a few. As a result germplasm collections currently exist for cocoa, pigeon peas and sweet potato. The banana lines have largely been lost.

The Ministry of Agriculture holds living collections of local accessions of the following:

Cassava - supplemented with 24 lines from Mexico, Colombia and Venezuela

Tannia

Sapodilla

Guava

Dongs

Mango

West Indian cherry

A collection of Citrus varieties is maintained at the Ministry's holdings at St. Augustine, and a small collection of pomerac is held.

The Seed Production Laboratory at the Chaguaramas Agricultural Development Project holds as seed collections:

Pigeon pea	(Chag Pearl)
Bodi bean	(local line)
Maize	(imported).

The Division of Forestry of the Ministry of Agriculture, Lands and Food Production is currently collecting seed of teak and Caribbean pine, for which requests from abroad are received in ever-increasing quantities.

A nucleus of a seed storage facility exists at CADP. This however, is not currently capable of holding seed in long-term storage. That apart, the design of the building is such that environmental conditions are not sufficiently well controlled. A tissue culture facility exists at the Unitersity of the West Indies, St. Augustine campus, and discussion on the establishment of a facility at the national level are in progress.

There are in the country persons with experience in breeding at the University of the West Indies, CARDI and the Ministry of Agriculture, Lands and Food Production.

Discussion

The function of a gene bank should include: collection of threatened germplasm for conservation, evaluation, selection and breeding.

Germplasm can be conserved in one of three ways:

(a) Living collections;

(b) Seed in medium or long-term storage;

(c) Through tissue culture.

Plants with seeds that are difficult to store, such as most tropical fruit trees, or which normally produce little or no seed, are best kept in living collections. The major problem with such collections is underutilization, since most demand for seed or clonal material is from those who desire growing good quality crops. Such collections are of greatest importance when allied to a selection and breeding programme.

Seed storage requires excellent facilities: equipment for research in seed storage characteristics; germinators and rejuvenation and multiplication facilities.

By means of tissue culture material can be maintained at low cost; introduced to countries with fewer quarantine problems and rapidly multiplied. While there is knowledge on the protocol of such methodology for many crop plants, the majority of the crop plants in the region have not yet been researched in this field.

The latter two of the above mentioned methods in the context of the Caribbean region, require a research input. It is unlikely that the various Government agencies will have either the manpower or the facilities to handle such research. Research will of necessity be conducted through the University campuses and Agriculture-based Institutions in the region.

In view of the manpower limitations, priorities must be established. With hindsight, it would seem that objectives of the project need some modification. The modified plan should include firstly a survey to determine what crop varieties are threatened; this to be followed by a collection of such varieties, on which research on methods of conservation can be carried out by the research organizations in the region. The survey should perhaps

not be confined to food crops, but should include forest crops. It is reported in Barbados that the Mastic tree (Mastichodendron sloaneanum) became extinct (in that island) some 200 years ago. Recently a plant was discovered growing in Florida, from which a re-introduction to Barbados has been made. In Saint Vincent, the Wild almond (Magnoliaceae) - a handsome furniture wood - has been so heavily harvested, that there is fear of extinction. A halt has recently been called on felling of the species and efforts are currently being made to collect seed.

Recommendations

It is recommended that a breeder be appointed for a period of about three (3) months, to travel through the islands to:

(i) Collect threatened germplasm for conservation;
(ii) Collect local land races for evaluation.

That research institutions in the region be invited to participate in research on methods of conservation of the species selected. In this respect the campuses at Mona and St. Augustine of the University of the West Indies; CARDI - both in Barbados and Trinidad; and institutions such as the West Indies Central Sugar-cane Breeding Station, should be invited to participate. Thought should be given to collaboration with CATIE, Turrialba, Costa Rica.

Concurrent with the research, and as a result of the output of the various centres, areas (localities) for gene banks could be considered, and protocol for storage, recall and exchange be worked out.

APPENDIX

Personnel Interviewed

Barbados

Mrs. Francis Chandler	-	CARDI, yam project
Mr. Barton Clarke	-	Ministry of Agriculture
Mr. Percy Jeffers	-	Deputy Chief Agricultural Officer
Mr. John Cropper	-	CARDI
Mr. Ian Walker	-	Breeder, West Indies Central Sugar-cane Breeding Station

Saint Vincent and the Grenadines

Mr. Kenneth Bonadie	-	Deputy Chief Agricultural Officer Ministry of Agriculture
Mr. Grafton Vanloo	-	Chief Agricultural Officer Ministry of Agriculture
Ms. Erica McIntosh	-	Agro-Lab Ministry of Trade and Agriculture

Trinidad and Tobago

Mr. Lennox Andrews	-	CENTENO fruit crops
Mr. Anthony Seesahai	-	CENTENO root crops
Mr. Terrence Indalsingh	-	CADP
Dr. Bal Ramdial	-	Chief Conservator of Forests Ministry of Agriculture, Lands and Food Production
Dr. Theodore Ferguson	-	Head Department of Crop Science U.W.I. St. Augustine