BARBADOS:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Prepared by:

Ministry of Agricultural and Rural Development

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Note by FAO

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CHAPTER 1
Introduction to Barbados and its Agricultural Sector

Barbados is a small tropical island, the most easterly of the Caribbean islands, situated near latitude 13°N and longitude 59°W. It covers an area of 430 km^2 and is roughly triangular in shape. It has an undulating landscape which is generally low with most of the land mass lying below 150 meters above sea level. It reaches a maximum height at mount Hillaby which is approximately 280 meters above sea level.

The climate of Barbados is maritime and tropical with a sub-humid to humid rainfall regime which approaches a semi-arid character in the drier parts of the island. There is wide variation in rainfall from year to year and considerable variation within a year. In general there is a dry season from January to May, with less than 20% of the annual rainfall amount and a wet season from June to December. The inception of the rainy seasons may vary from year to year.

Annual rainfall ranges between 100 and 2,000 mm per year. The island can be divided into three rainfall zones, low, intermediate and high.

Barbados has uniformly high temperatures throughout the year. Temperatures are constant from day to day, month to month, and year to year. Daily mean air temperatures average between 24 and 27°C. Temperature extremes are also small. The temperature rarely falls below 18°C or climbs above 32°C.

There is very little seasonal variation in humidity in Barbados, which averages about 71% during the, dry season and 76% during the wet season.

The daylength varies by an hour or two in the northern winter and summer months of the year.

The prevailing winds across Barbados are the north-east trades which blow with varying intensity and are persistent for most of the year. Wind direction remains dominantly within an arc from ESE through E to ENE.

The period between November and April is marked by east Northeast to east winds, while the May to October period is marked by a variable easterly wind system.

Wind speeds show a single cycle regime except if storms or hurricanes occur during the June to November rainy season. Speeds vary between 13 and 21 km per hour. The wind speed during a hurricane may be in excess of 150 km per hour.

Most of the soils on the overlying coral of Barbados were formed from the weathering products of volcanic ash deposited in the coral. This ash originated from volcanic eruptions in the neighbouring islands and was carried in the anti-trades to Barbados. The soils of Barbados are classified into two groups, the Scotland district formation and the coral region formation.

1.1 POPULATION OF BARBADOS

The population of Barbados is approximately 262,000 placing it in the category of one of the most densely populated nations in the world.

1.2 AGRICULTURE IN BARBADOS

Agriculture in Barbados has been for the past 300 years or so, mainly sugarcane. However, there has been a rapid decline in sugarcane acreage and production over the past thirty years to the extent that the viability of the sugar industry is now threatened.

Arable acreage has declined from about 70,000 acres in the 1960's to approximately 50,000 acres at present. Over the past twenty years, there has been an increased emphasis on non-sugar agriculture which has now surpassed sugar agriculture in terms of contribution to the island's gross domestic product.

The major crops produced over the last fifteen years have been sugarcane, cotton, sweet potato, yam, an assortment of vegetables including carrot, cabbage, bean, cucumber, okra, pumpkin, sweet pepper, and a range of fruit, the main ones being papaya, banana, plantain, fig, and grapefruit.

Most of the sugar, molasses and cotton lint produced are exported. Variable quantities of non-sugar crops are exported depending on the level of production and demand in the export markets.
There are approximately 17,000 agricultural holdings in Barbados. The vast majority of these (over 15,000) are less than one hectare in size. Approximately one hundred of these are over 50 hectares and just one is larger than 500 hectares. Most of the larger holdings are commercial and are engaged in sugarcane production. The smaller holdings range from subsistence to commercial agriculture. Management of the larger holdings is by hired management while the smaller holdings are predominantly owner managed.

Sugarcane "seed" is self generated after new cultivars are released by the local Variety Testing Unit. "Seed" for fruit and flower production are also the result of local activities after an initial distribution of material which could have been derived from local or international sources. Vegetable seeds are primarily obtained from international seed companies.

Recent trends in plant production have been towards reversing the decline in sugar production and towards crops with export potential. Reversal of the sugar decline is a result of better world market prices in addition to preferential markets.

CHAPTER 2
Indigenous Plant Genetic Resources

The country's naturally occurring plant genetic resources have not been fully documented. Early visitors to Barbados reported that very thick forests were present on their arrival. As a result of rapid development of the island's sugar industry, mass deforestation took place. The only areas where original vegetation occurs are Turner's Hall woods, Foster Hall Wood and possibly in some of the natural gullies and water courses.

2.1 LANDRACES AND OLD CULTIVARS

The Bajan cucumber and garden pumpkin are two old cultivars which are still being used by farmers. Use of the former has declined considerably as a result of a preference by farmers for higher yielding hybrids which are imported from international seed companies. A number of old sugarcane cultivars still exist and are maintained in the sugarcane breeding collection.

CHAPTER 3
National Conservation Activities

There is no national programme for conserving plant genetic resources in the country. Conservation activities are conducted by various institutions which are involved in breeding or other activities with various crops. Sugarcane conservation is practiced by the West Indies Central Sugarcane breeding station. Sweet potato conservation is done by both the Ministry of Agriculture and Rural Development (MARD) and the Caribbean Agricultural Research and Development Institute (CARDI). Cassava, yam, pineapple, onion, pigeon pea and maize germplasms are also conserved by CARDI. Fruit crop and cut flower conservation are in the hands of the Ministry of Agriculture. Some private farmers also practice conservation activities for cut flowers but the extent to which this is being done is uncertain. Table 1 gives a list of known germplasm collections in Barbados.

3.1 *IN SITU* CONSERVATION ACTIVITIES

There is no programme for *in situ* conservation of germplasm in Barbados. No doubt, forest species and other plant species may still exist in localized, natural environments, particularly in the Scotland District where some areas have remained undisturbed for hundreds of years. However, there have been no concerted efforts to protect these areas or determine their extent.

3.2 *EX SITU* COLLECTION

All of the germplasm resources being used in Barbados are maintained as *ex situ* collections. Most of the activities are managed by technical experts. The oldest and most organized of these *ex situ* conservation activities is that of sugarcane which is regionally owned and has an international clientele. The various crops for which *in situ* conservation is used are given in Table 1.

Ex situ collection of plant genetic resources is maintained by MARD, CARDI and WICSCBS. This *ex situ* collection is primarily made up of introductions from various sources.

Table 1 Germplasm Collections in Barbados

Crop	No. of Accessions	Location	State of Germplasm Collection
Sugarcane	2567	WISCBS	In field
Cotton	52	MARD	Seed
Sweet potato	59	CARDI	*In Vitro*
Sweet potato	63	MARD	Field
Cassava	31	CARDI	*In Vitro* & Field
Yam	24	CARDI	*In Vitro* & Field
Pineapple	10	CARDI	*In Vitro*
Pineapple	2	MARD	Field
Onion	1	CARDI	Seed
Pigeon pea	2	CARDI	Seed
Mango	13	MARD	Field
Avocado	9	MARD	Field
Carambola	7	MARD	Field
Citrus	-	-	-
Lime	3	MARD	Field
Mandarin	2	MARD	Field
Tangerine	1	MARD	Field
Tangelo	1	MARD	Field
Orange	3	MARD	Field
Grapefruit	4	MARD	Field
Cherry	2	MARD	Field
Papaw	2	MARD	Field
Passion fruit	2	MARD	Field
Plum	1	MARD	Field
Ginger lilies	3	MARD	Field
Guava	2	MARD	Field
Orchids	18	MARD	Field
Heliconia	35	MARD	Field
Anthurium	14	MARD	Field
Bird of Paradise	1	MARD	Field
Tube roses	2	MARD	Field

3.3 STORAGE FACILITIES

Facilities for storing cottonseed from germplasm lines are located at MARD. Seed is stored at a temperature of 21° ± 1°C and a relative humidity of 65 ± 2% which comply with internationally recommended conditions. Seed, however, are contained in paper bags and not hermetically sealed containers.

There is no duplicated collection of this cotton material in Barbados. However, as most of the lines were obtained from IRCT-CIRAD, duplicates are maintained by those institutions.

The facilities for storage have significant capacity for expansion in the future and can meet requirements for at least another five years. It would, however, be desirable to upgrade these facilities in the short term.

There is one botanical garden, "Andromeda Gardens", which has a large collection of indigenous and other plants. This is a private sector endeavor and not linked to Government's programmes or activities. However, the University of the West Indies (UWI) at Cave Hill is involved with the operations of that botanical garden.

3.4 DOCUMENTATION

The various collections are documented in computer database and files. The most comprehensive documentation is that for sugarcane. Agronomic evaluation information accompanies some of the records. Information pertaining to the data is variable, but incomplete with respect to passport, characterization and evaluation data. Indigenous knowledge and breeder's records are non-existent, except for a modest collection in sugarcane.

Some two hundred (200) sugarcane accessions, fifty-two (52) cotton lines, most of the sweet potato, yams, pineapples and fruit accessions have been characterized and evaluated.

Characterizations and evaluations have been done by technical personnel from the various agencies and have utilized at least some of the internationally recommended descriptors.

3.5 REGENERATION

Accessions are regenerated as frequently as is required to obtain good germination or regrowth, so as to maintain genetic integrity and avoid loss of the materials. Facilities at the various agencies vary. Papaw has posed some problems of regeneration because of a rapid loss in viability of seed material under existing storage conditions, the reasons for which are not yet known.

The length of time between regenerations vary depending upon the crop species involved. For example, regeneration of sugarcane germplasm is practiced every five years; cotton every 3 to 5 years; sweet potato in field, every 3-5 months; *ex situ* germplasm every 3-6 months; and most fruit crops, every
5 to 10 years.

Generally, the regeneration procedures are adequate to maintain the genetic character of the original samples. However, where there is a change of personnel responsible for a particular programme related to a germplasm collection, the regeneration procedures may be relegated in importance and there is some possibility of losing some materials.

In some cases, regeneration is carried out by a qualified breeder/geneticist. In most cases, this responsibility is performed by capable personnel. Adequate land, facilities, and labour are usually available. However, management of these resources may not always be optimal.

CHAPTER 4
In Country Uses of Plant Genetic Resources

Sugarcane genetic materials are most frequently used in Barbados. There has been an ongoing breeding and selection programme in the country for over one hundred years. The main function of successive breeding programmes has been to produce improved local cultivars. The ultimate objectives of these programmes have been to increase production, quality, and in the case of the sugarcane breeding programme, to broaden the genetic base by utilizing related species.

Breeding programmes have been aimed at meeting national and Caribbean regional requirements and in some cases, increasing export opportunities. This is particularly true for sugarcane, cotton, and sweet potato programmes. The amount and quality of scientific plant breeding currently undertaken in the country is inadequate to meet national needs and goals.

Breeding activities are conducted by regional institutions and Government. The products of these breeding programmes are quickly and easily available to farmers. Farmers are Involved in breeding activities to the extent that evaluations are conducted on their farms and enthusiasts are given the information derived from these evaluations.

4.1 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

The WICSCBS is deriving benefits from the use of sugarcane germplasm through the provision of clones to other regional and international institutions. It is the only agency to be doing so at this time.

4.2 IMPROVING PGR UTILIZATION

The main achievements of plant genetic resource activities has been in the improvement of commercial plant production. This was achieved through development of disease resistant, higher quality cultivars with better adaptability to mechanical harvesting.

The relationship between genetic conservation and improvement/ breeding/seed production/and utilization systems has been unsatisfactory to date, in Barbados. This has been as a result of an inadequate institutional setup, financial constraints; and lack of adequate personnel. Plant genetic resources have tremendous potential for both the short and long term. However, National policies, provision of facilities, and the training of personnel should be improved to optimize the utilization and exploitation of these resources.

Technical assistance to improve utilization of these resources in the form of the provision of dedicated expertise to assist in proper documentation, characterization and evaluation of local plant genetic resources is required as a priority. The establishment of a National programme and the training of personnel in the maintenance and utilization of germplasm should follow.

CHAPTER 5
National Programmes

The plant genetic resources activities as exist in Barbados are fragmented and under the control of government, regional institutions and a few individual farmers. As indicated earlier, there is no National programme. The prerequisite for having coordinated plant genetic resource activities would therefore be the establishment of a National committee to oversee and give directions to a National programme while maintaining the *status quo*.

There are also no established goals and objectives regarding maintenance of a national genetic resource programme and hence there is no connection with national plans for sustainable development.

The annual budgets for the plant genetic resources which are currently maintained by the various institutions and private farmers are handled by each of them. They are all therefore subject to fluctuations in allocations depending on the level of funding available. These budgets usually cover the entire operations of the departments, institutions or individual enterprises and are not specifically concerned with maintenance of plant genetic resources. Plant genetic resource maintenance is likely to suffer in times of scarce funds which frequently occurs.

In the case of programmes directly under governmental funding, there is no commitment to providing a secure level of funding since priority could shift from programme to programme or crop to crop. The programmes or crops for which germplasm is currently maintained may some day suffer from this insecurity of funding.

There is currently no legislation to protect plant genetic resources. The various concerns, however, have their own internal policies to ensure that plant genetic resources under their control are "protected" as far as Monetary resources would allow.

5.1 TRAINING

Institutions and individual farmers have a level of training and skills which would allow them to perform an adequate job in conservation of PGRs. However, if and when a National programme is to be implemented, training must be on the list of priorities. There are currently only two locals trained in plant breeding, one of which is involved in a small proportion of PGR maintenance. While the size of our PGRs is not very extensive, there is the need for a minimum number of adequately trained locals in the varied aspects of PGR conservation. This training could best be done in institutions where PGR management is being vigorously pursued.

5.2 NATIONAL LEGISLATION

Quarantine laws affect the importation and export of plant genetic resources accessions in as the transfer of pests and diseases are restricted. However, there is a need for more stringent quarantine control to protect the country from imported pests and diseases. For example, the fields all across the country are plagued with corn grass which is proving to be very dominant on the island's landscape.

Incentives for the conservation of traditional plant genetic resources are lacking. Many of these have been preserved, inadvertently, as a result of older farmers, and some consumers having a preference for these vegetable crops.

While the country has Intellectual Property Rights (IPR) legislation, so far, this has not affected the plant genetic resources programme.

5.3 OTHER POLICIES

Because there is no established breeding programme outside of sugarcane and cotton, there are no direct incentives for the production and marketing of improved varieties as certified seed.

However, government has a general incentive scheme for agricultural production from which the conservation and utilization of plant genetic resources could benefit.

CHAPTER 6
International Collaboration

There has been a certain level of international collaboration between the institutions and individuals as far as germplasm management is concerned. The WICSCBS has collaborated with a number of countries such as Australia, India and the USA as far as exchange of sugarcane germplasm is concerned. CARDI and The University of the West Indies (UWI) collaborate with the International Institute of Tropical Agriculture (IITA), the International Potato Center (CIP).

The International Center for Tropical Agriculture (CIAT) and Inter-American Institute for Cooperation in Agriculture (IICA). The Ministry of Agriculture collaborates with organizations in Belgium, Malaysia, Thailand, Holland, USA, IICA, and CIRAD in acquiring germplasm of various crops.

6.1 UNITED NATIONS INITIATIVES

Barbados was among those Countries that have adopted Agenda 21. However, to date, no concrete steps have been taken to implement Chapter 14 (Conservation and sustainable utilization of plant genetic resources) and Chapter 15 (Conservation of biological diversity). It is envisaged that some steps will be taken in the near future to implement aspects these two areas.

6.2 FAO GLOBAL SYSTEM

As a member of the commission, it is expected that advice will be given in the development of clear policies on PGR management. In so doing, there would have to be the establishment of national level procedures and mechanisms for the implementation of such policies. Following the enunciation such policies, assistance will be required in the preparation of model legislation to facilitate implementation of national policies and the harmonization of regional policies. The latter is imperative since there are some common feature to regional agriculture which could be complementary.

Since there is lack of a national system for plant genetic resources, it is imperative that one is established at the earliest possible opportunity.

A critical factor in achieving this will be an awareness of policy makers as to the importance of PGR management to sustainable development.

Funding is also a critical component to the establishment of a national system. An "international fund", if one is established as part of the Global system, would be of assistance to Barbados and other countries in need.

CHAPTER 7
National Needs and Opportunities

7.1 NEEDS

The conservation and utilization of PGR for food and agriculture is yet to become a national priority in Barbados. Outside of sugarcane, there is a dire need to enhance the genetic improvement of new varieties of other crops, the conservation of local genetic resources and germplasm, and to support seed production programmes. Barbados has been and still is heavily dependent on imported hybrids and other cultivars from the USA and Europe. While some of' these have adapted well, do not perform well under local conditions. There is therefore a need to improve germplasm adapted to local conditions and with yield stability and pest tolerance. To achieve these goals, a national programme/system is imperative.

There is also need for a PGR policy, legal and institutional framework.

There is also a need for training in PGR related disciplines and activities such as advanced plant biotechnologies, molecular biology, cell and tissue culture applicable to genetic improvement, conservation technologies for plant genetic resources and methodologies for the diagnosis of' food crop diseases.

The preparation and application of a code of conduct on plant biotechnology as it affects the sustainable conservation and use of plant genetics resources is a necessity. This code should favour, standardize and adapt the use of biotechnology in aspects of biosecurity, regulations and patents, and other socio-economic impact in Barbados.

There is need for greater commitment to agricultural diversity outside of sugarcane. Although there have been efforts towards diversification, these have not had the level of commitment which would ensure their success.

Greater networking is required at the subregional, regional and international levels including access to information systems.

A national inventory of local PGR, including marine plant life in control waters must be established and maintained.

Public awareness activities related to the importance of PGR at the national level must be pursued.

7.2 OPPORTUNITIES

Barbados has a modest but important source of indigenous PGR, which when combined with those of other islands in the region, offers enormous potential opportunities for sustainable socioeconomic development. Although the contribution of agriculture had been declining, it is still an important economic sector in the island. Even with expansion of tourism, industries and services, the linkages between these and agriculture would enhance overall socioeconomic development, including increased gainful employment and foreign exchange levels. If tourism expansion occurs at the expense of agriculture, then the foreign exchange gains will quickly evaporate with huge import bills. Balanced tourism, industry and agricultural linkages could be more rewarding.

The brightest economic feature of PGR lies in their use for producing non traditional agricultural commodities. The application of biotechnology could result in developing improved varieties of non-traditional food crops, but more important, new processed and products could surpass in economic value and profit, those obtained directly from agriculture.

Barbados already has two tissue culture laboratories which are functional and if fully utilized could enhance developments in the area of biotechnology.

CHAPTER 8
Recommendations and Proposals of the Barbados

I. Barbados recognizes the existence of a moderate degree of plant biodiversity within the Caribbean subregion. This diversity of plant genetic material exists in crops which are used for food, beverages, medicines, marine plants, pest control and industry. It also recognizes its small, but valuable, forest ecosystems in the Scotland District.

It is considered urgent and necessary to become familiar with and conserve these PGRs for present and future use, as well as efforts must be made to protect them from erosion and loss.

Barbados recommends that FAO develops programs supporting the effort of Barbados which would enable existing national institutions to collect, identify, characterize and document the PRGs available in the island.

II. As a consequence of increasing population growth, tourism and recreational use of the land and water resources, PGRs in Barbados are being eroded or under the threat of loss. An understanding of the dynamics of these fragile ecosystems in which the PGRs are being eroded and threatened is required in order to reverse this negative trend.

Barbados recommends that a program be provided which would enable and assist it to conserve, characterize and document PGRs present in these areas. Such a program should also assist in executing a pilot project in reestablishing PGRs in the island.

III. Barbados has in the past collected and maintained in *ex situ* gene banks and *in situ* plant genetic materials of economically important crops. The systems and technology used in maintaining PGRs are in need of modernization. Man power needed to operate and manage PGRs must be properly trained and increased.

Barbados recommends that FAO develops appropriate programs that Would assist it in improving and modernizing the technology available, increase the number of trained professionals and provide better management to PGRs.

IV. Barbados has a limited land mass and renewal water resources as well as insignificant mineral resources. As a consequence, PGRs utilization requires the necessary preservation, if the inhabitants are to maintain an acceptable level of nutrition, health and well-being.

The leaders of Barbados recognize that in the economic and financial environment of' the world's new economic order, there is an uncompromising approach to market led development, private capital and private capital support systems.

Barbados, in considering these conditions, recommends that FAO seeks funding for programs that would assist it in overcoming the several obstacles which would restrict the identification, promotion and development of new alternative, cost competitive ways of using available PGRs.

V. Barbados, in spite of the limited natural resources, must nevertheless be in a position to produce food, clothing and shelter from its PGRs at competitive costs in comparison with those of larger, more developed countries rich in natural resources. This effort requires the preservation and utilization of existing PGRs, as well as the introduction of new varieties through modern plant breeding and advance genetic engineering.

The states recommend that FAO gives support to national programs which would enhance the capability of their respective states to maximize the benefit of existing PGRs and new varieties.

VI. Barbados commends the effort and support given to it, recently, in the area of seed processing and storage. Nevertheless, it also recognized that there will be a continued reliance on seed import for certain crops.

Unfortunately, there is a significant number of cases of poor germination, disease introduction and other problems related to imported seed which have caused not only crops failure but also foreign exchange losses.

It is, therefore, recommended that FAO continues in supporting and encourage Barbados in developing a national seed program including certification and standards for seed exchange regulations.

VII. Barbados recognizes that there are some under utilized vegetable species which can people. These under utilized species have not received the attention deserved in the past. It is therefore recommended that FAO assists in developing a program that would address PGR activities related to this group of crops.

VIII. Barbados is aware of the importance of information on plant genetic resources for crop in order to prevent PGRs from being lost or seriously eroded. It also recognizes the contribution made by the FAO project for the development of the Caribbean Seed and Germplasm Resources Information Network (CSEGRIN).

It is recommended that this system be expanded to include more crops species in the database.

IX. Barbados recognizes the need for it to make explicit statements with respect to its policy on PGRs. Implicit in such policy statements would be the national view of the world's PGRs. In support of the statements there is a need for gaining public support for the easy and successful implementation of the policy.

It is recommended that FAO provides support and assistance to national efforts in gaining public awareness of the need for action in respect of PGRs conservation, evaluation and utilization. Such support should include the preparation of modern legislation which could be used by Barbados to implement its policies.