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STATUS OF RESEARCH/DEVELOPMENT ON TROPICAL AND SUBTROPICAL FRUITS IN CENTRAL AMERICA

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IICA OFFICE IN TRINIDAD & TOBAGO

“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.

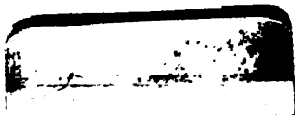
IICA was founded as an institution for agricultural research and graduate training in tropical agriculture. In response to changing needs in the hemisphere, the Institute gradually evolved into an agency for technical cooperation and institutional strengthening in the field of agriculture. These changes 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 its 32 Member States, so as to better promote agricultural development and rural wellbeing.

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

The contributions provided by the Member States and the ties IICA maintains with its 13 Permanent Observer Countries and numerous international organizations provide the Institute with channels to direct its human and financial resources in support of agricultural development throughout the Americas.

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LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|-------------------|--|
| AID | Agency for International Development (USA) |
| ANACAFE | Association of Coffee Producers (Guatemala) |
| ASBANA | Association of Banana Producers (Costa Rica) |
| ASOPROGUA | Association of Soursop Producers (Costa Rica) |
| CAAP | Private Agricultural and Agro-industrial Council (Costa Rica) |
| CECA | Experimental Centre, Campos Azules (Nicaragua) |
| CENTA | National Centre of Agricultural Technology (El Salvador) |
| CHDF | Honduran Forestry Development Corporation |
| DGTA | General Division of Agricultural Techniques (Nicaragua) |
| DIGESA | General Division of Agricultural Services (Guatemala) |
| DIVAGRO | Agricultural Diversification Programme (El Salvador) |
| EEC | European Economic Community |
| ENA | National School of Agriculture (El Salvador) |
| FHIA | Honduran Foundation for Agricultural Research |
| FUSADES | Salvadorean Foundation for Social and Economic Development |
| GTZ/MAG | German/Costa Rican Agricultural Cooperation Programme |
| ICTA | Institute of Agricultural Science and Technology (Guatemala) |
| IDIAP | Institute of Agronomic Research and Stock Breeding (Panama) |
| IFRUGALASA | Fruit Industries of the Gran Lago S A (Nicaragua) |
| INRENARE | Institute of Renewable Natural Resources (Panama) |
| ISCA | Higher Institute of Agronomic Science (Nicaragua) |
| MAG | Ministry of Agriculture (El Salvador) |
| MAGA | Ministry of Agriculture, Livestock and Food (Guatemala) |
| MIDA | Ministry of Agriculture (Panama) |
| MIDINRA | Ministry of Agriculture and Agrarian Reform (Nicaragua) |
| PRODIVERSA | Agriculture Diversification Programme (Honduras) |
| REGEN | Division of Genetic Resources (Nicaragua) |
| RENARE | Secretariat of Renewable Natural Resources (Honduras) |
| UCR | University of Costa Rica (Costa Rica) |
| USA | United States of America |
| USC | University of San Carlos (Guatemala) |

COSTA RICA

I. Production

The Ministry of Agriculture has defined about twenty priority programmes which, along with traditional crops such as bananas and coffee, also include programmes for citrus and mango.

Each programme, led by a manager, considers the organizational aspects of production, finance, technology and commercialization.

1.1 Citrus

In the north-central (Puriscal-Grecia) citrus region this crop is cultivated in the traditional manner. New orange plantations (6.000 ha) have been established in the north of the country to produce fresh fruits and concentrate. It would be necessary to plant an additional 30.000 to 40.000 hectares to maximize use of the facilities installed (eg three processing plants).

This situation has been complicated by the discovery of the virus *tristeza* in the region and the prohibition of use of the sour orange as root stock (October 1988), which points to the need for serious research and reconversion efforts.

In Guanacaste Province on the Pacific Coast, some 300 hectares of Tahiti limes are cultivated for export.

1.2 Mangoes

These have traditionally been cultivated in the Guanacaste Province and the Orotina region. A programme of cultivation for export, financed by the EEC, has recently increased the number of hectares cultivated. At present, 50% of the 3.600 hectares cultivated are producing. The mango pro-

gramme expects to plant 10.000 additional hectares within the next 10 years.

The main problems are related to the choice of cultivars, physiology of the trees and sanitary aspects (*Erwinia* bacteria and Mexican fruit flies).

1.3 Other Species

Some other species, though not the object of specific programmes, are considered very promising. The most important are the following:

1.3.1 Soursop

There are some 100 hectares of soursop in commercial cultivation and an association of producers (ASOPROGUA). This species has been the focus of research.

1.3.2 Apple

At present, expanded production in the higher regions is assured principally through the *Anna* variety. Some problems of pollination and root stock still exist.

1.3.3 Avocado

During recent years, some 300 hectares of the *Hass* cultivar have been planted. The main problem is *Phytophthora* (Root rot).

1.3.4 Guava

A Brazilian guava, (*Eugenia estipitata*) is also being considered as a commercial venture.

1.4 Other Production Features

The Association of Banana Producers (ASBANA) has a diversification programme for the humid tropical zone and is testing soursop, pejobaye and *Eugenia estipitata*.

In this same region, the private firm *Walkyria* develops plantations of *Ortanique*, *Ugly* fruit and *Pulasan* for export. Finally,

the reforestation project GTZ/MAG/Ministry of Natural Resources is considering the use of fruit species such as tamarind and cashew for reforestation in the Puriscal and Turrucares regions.

II. Research

A national commission for research and extension defines priorities and coordinates the activities of the various research projects.

MAG has three experimentation centres: in the humid tropics (Guapiles), in the dry tropics (Taboga/Cañas) and in the highlands (Tierra Blanca) respectively. Only Diamantes Centre in Guapiles currently works with tropical fruit.

The major part of research on tropical and subtropical fruits is carried out by the Faculty of Agronomy of the University of Costa Rica (UCR) in its experimental stations Fabio Baudrit in Alajuela, Fraijanes on the slopes of the Poas volcano, Rio Frio in the north, Santa Cruz de Guanacaste and Liberia on the Pacific Coast. The Alajuela Centre has an interesting stock of fruit trees from the dry and humid tropical zones.

The University also has an excellent network of laboratories, especially a tissue culture laboratory and a post harvest laboratory. The Japanese Government is providing financing for laboratory equipment.

The University trains agronomic engineers and expects to launch a short term course of specialization in tropical and subtropical fruits.

AID, through the Private Agricultural and Agroindustrial Council (CAAP), is financing projects on research and development.

III. Principal Problems, Constraints, and Places of Interest

Of principal interest to the authorities are citrus viruses, especially for the recovery of infested collections and the choice of rootstocks.

In mangoes, it is the definition of export varieties, and control of the Mexican fruit fly and bacteria.

For all other fruits, including those grown at high altitudes, there remains the need for varietal selection, introduction of new rootstocks and studies on the physiology of species and fruit quality according to climatic zones.



(*Eugenia estipitata*) Guapiles — Costa Rica, April, 1989.

GUATEMALA

I. Production

The Ministry of Agriculture, Livestock and Food (MAGA) is made up of several departments including those of Agricultural Services (DIGESA) responsible for the transfer of technology and extension and the decentralized Institute of Agricultural Science and Technology (ICTA), responsible for research. DIGESA is developing an agricultural diversification programme in which fruit and vegetables play an important part.

MAGA has identified 14 priority projects and programmes among which the following are noteworthy:

- development of tropical and subtropical fruit: 1.500ha of plantations expected in 1989 (DIGESA)
- agroindustrial development of fruit and vegetables

- research (ICTA)
- multiplication of planting material (DIGESA)
- control of fruit flies MOSCAMED

The Association of Coffee Producers (ANACAFE) at Retalhuleu is leading a fruit diversification programme based on cashew, macadamia, avocado and citrus, as well as managing old introductions of mangosteen, cashew and sapodilla.

On the agro-industrial side, one factory produces orange juice, one apple juice, another mango puree (currently suffering from shortage of raw material), and one zapote pulp.

II. Research

At present very little research is being carried out on tropical and subtropical fruit, yet



Citrus nursery — Retalhuleu, Guatemala, April, 1989.

paradoxically DIGESA, a service organization is far ahead of ICTA, the official research institute which at present is paying special attention to annuals.

The DIGESA experimental centre Brillantes near Retalhuleu maintains an important collection of mango, citrus and cashew trees. Recently, such humid tropical species as mangosteen, hairy litchi, (Rambutan), and durian have been introduced from Honduras (Lancetilla) to observe their adaptation.

Brillantes also performs plant propagation on a large scale and possesses excellent mango, citrus, avocado, sapodilla, zapotes, and soursop nurseries among others. Citrange is often used as a citrus rootstock though *Tristeza* has not been reported.

At the Quetzaltenango Centre in the highlands, DIGESA maintains a collection of apple and peach trees, and recently introduced the Japanese prune, European prunes, cherry and pear trees. Some important temperate fruit nurseries, especially marcotting of apple rootstocks MM106 and propagation of the nematode tolerant peach rootstock *Nemaguard* are carried out by DIGESA around Quetzaltenango and Guatemala City.

ICTA has begun research on temperate fruits at Quetzaltenango.

The Faculty of Agronomy at the University of San Carlos (USC) in Guatemala has initiated a programme of prospection, conservation and characterization of native fruit

species (mamey, zapotes, sapodilla, soursop and other annonas). The collections are being established at the experimental centre *Bulbuxya* near Mazatenango.

DIGESA, ICTA, USC and ANACAFE all have their own laboratories.

ANACAFE's are quite complete, offering services in phytopathology, entomology, nematology, and tissue culture.

ICTA is in the process of setting up a fruit physiology laboratory at Quetzaltenango.

III. Principal Problems, Constraints, and Places of Interest

The main problems confronting the authorities are:

- choice of species and cultivars of tropical fruit for cultivation for export, either fresh or processed, especially in mangoes, cashew nuts, citrus, zapote and West Indian apricot *Mammea americana*
- testing their adaptation in zones considered optimal
- development of temperate fruits for local consumption. In this case, a special effort must be made to look for cultivars which can thrive in warm conditions, research for the best performing rootstocks, control of the flowering process and post-harvest preservation of fruits
- fruit fly control (mango and citrus)
- techniques of recollection and conservation of fruit species (USC)

HONDURAS

I. Production

The Secretariat of Renewable Natural Resources (RENARE) carries out the functions of the Ministry of Agriculture. Within its Department of Agriculture, three divisions and programmes deal with fruit development:

- the agricultural diversification programme (PRODIVERSA)
- the research division
- the extension division

RENARE and PRODIVERSA are particularly interested in import substitution, of apples, peaches and grapes. Besides, efforts are being made to identify tropical fruits for export. Efforts are focused on mango, tamarind, cashew, and on a smaller scale, guava and soursop.

Another of PRODIVERSA's goals is the development of citrus (oranges and manda-

rines) and avocados in the lower zones (600 to 1500 m). In these regions, the problem is citrus viruses and finding improved rootstocks for both species.

The Honduran Foundation for Agricultural Research FHIA, a private organization with its Headquarters in San Pedro Sula, offers a Certification Service for Citrus Planting Material to satisfy the needs of commercial plantations in the North of the Country. It has also launched a fruit diversification programme, especially in mango.

II. Research

Except research conducted by FHIA, tropical fruit research is a very undeveloped field. RENARE is doing some lowland cultivation at Comayagua.

RENARE has a high altitude research centre



Marcottes of 'MM 106' apple rootstock at 1.800 m above sea level — La Esperanza, Honduras. April, 1969.

at La Esperanza, in the Intibuca Department, near the Salvadorean border. There, for the past three years, the research department has been working on high altitude fruits, and PRODIVERSA is developing apple and peach nurseries to satisfy producers' demands.

Several laboratories have recently been built and equipped with the aid of the Japanese Government.

The International School of Agriculture, El Zamorano, offers training programmes of one year's duration to agronomists, but does not offer fruit specialization courses.

Honduras provides other Central American countries with seeds and some fruit planting material from its collections at Lancetilla, the centre which is at present part of the Honduran Forestry Development Corporation (CHDF), but scarcely seems to benefit itself.

III. Principal Problems, constraints, and Places of Interest

Research on tropical and subtropical fruit is in its initial stages in Honduras; the authorities would like to satisfy local and export demands rapidly, but basic working foundation must first be established in all areas and for most species including:

- work in varietal research and selection in avocados, mangoes cashews etc
- the establishment of a trial network
- the introduction of rootstocks and cultivars, since the genetic base is very narrow, especially for temperate fruit
- staff training
- control of parasites and diseases, especially fruit flies, avocado and citrus Phytophthora and citrus viruses

NICARAGUA

I. Production

In Nicaragua, the Ministry of Agriculture and Agrarian Reform (MIDINRA) has organized agricultural production around corporations by production sector. There are banana, sugar, meat corporations etc. There is still no fruit and vegetable corporation though the idea has been discussed. MIDINRA seeks to diversify traditional exports and tropical fruit as part their strategy. State farms, private farms and cooperatives have been thrown into this venture and the most promising products are mango (about 600 ha in production), Tahiti limes (250 ha), granadilla, pitahaya (*Hylocereus undatus*, 200 ha), carambola (80 ha), pineapple (1.400 ha) and papaya (50 ha).

Some private producers already export mangoes and Tahiti limes to Western Europe.

A fruit project **Los Patios** for internal and export supplies, is currently financed by the EEC; and expects to plant 3.000 ha of oranges, mandarines, avocados, granadillas, chocho (Christophene) and pitahaya in three years.

On the agroindustrial side, the fruit industries of Gran Lago (IFRUGALASA) is now the sole alternative. This factory produces juice from local produce (mango, papaya, granadilla, pineapple and tamarind).

II. Research

Agronomic research is carried out by one division within MIDINRA, the General Division of Agricultural Techniques (DGTA). This division runs a network of experimental stations of which one **Campos Azules** at Masatepe (CECA) is the axis of tropical fruit.



Selections of pitahaya (*Hylocereus undatus*) cultivars from the Ticuantepe — San Ignacio production area. Nicaragua, 1989.

CECA has some interesting citrus collections (established with help from the French), of avocado and mango; a collection of secondary tropical fruit includes pitahaya, Jamaican plums, guavas and is soon to be completed. Out of this, varietal selection, plant propagation, research on behaviour of the varieties and control of insects and disease are being carried out.

The Higher Institute of Agronomic Science (ISCA), an autonomous body, affiliated to the Ministry of Education, maintains relations with MIDINRA through the Board of Directors of this Ministry in which it participates. ISCA does research and teaching and agronomists are trained there.

ISCA also runs fruit tests on pineapple and papaya in collaboration with IFRUGALASA.

Within ISCA's School of Plant Production is its division of Genetic Resources (REGEN), in charge of exploration, collection, conservation and evaluation of planting material, therefore of fruit collections. REGEN also has laboratories one of which, the tissue

culture laboratory, is entirely financed by Italy (Government and NGO).

III. Principal Problems, Constraints, and Places of Interest

In Nicaragua, the main problems to be resolved in the area of tropical fruit cultivation are:

- in citrus, the choice of rootstocks in relation to fungal and viral diseases
- the establishment of behavioral trials in high potential areas (citrus, mango, avocado)
- clonal selection is yet to be made from among the new species (carambola and pitahaya)
- improvement of propagation techniques for planting material
- training of staff
- the frequently notorious contradiction between the abundance of certain fruits and the lack of preservation techniques or artesanal or industrial preservation.

PANAMA

I. Production

The Ministry of Agriculture (MIDA) includes general divisions such as the Agricultural Division, the Agroindustrial Division, the Division of Technology Transfer as well as such decentralized organizations as the Institute of Agronomic Research and Stockbreeding (IDIAP) and the Institute of Renewable Natural Resources (INRENARE).

Some activities such as sugar, bananas from the Atlantic Coast and citrus from Chiriqui are regrouped within state corporations.

The principal directives on agricultural policy from the Ministry deal with:

- import substitution of food products with temperate fruit
- export diversification, especially the export of non-traditional products, but priorities have still not been defined

- in the area of non-traditional fruits, citrus from the Chiriqui zone (one processing factory) and high altitude fruits from the north of the country (apples and pears) are being examined. The authorities realize that mango, cashew, avocado, soursop (one plantation is 75 ha) and papaya have tremendous potential. The factory for this latter product is however closed due to lack of raw material.

The Institute of Renewable Natural Resources (INRENARE) hopes to carry out reforestation with certain fruit species: pejobaye and the coconut palm in the humid tropical zone, and tamarind and cashew in the dry tropical zone. An important project, "the integral development of Mayano" is the object of INRENARE's attention which produces fruit plants for the project: citrus, mango, avocado, cashew, pejobaye and coconut palms.



Papaya production in white sands, with irrigation, near Panama city — Panama, April, 1989.

The main obstacles to development of fruit production identified by the MIDA authorities can be summarized in three points:

- lack of continuity within the programmes
- obsolescence of important technologies
- lack of external cooperation in this area

II. Research

For the past two years, IDIAP has been trying to ameliorate this situation by organizing research on tropical fruit; the species being studied are: citrus, mango, papaya, avocado and soursop. At the Rio Hato experimental station, some cashew, mango and soursop collections are being established. Cashew selection has begun.

With respect to the National University of Panama, its Faculty of Agronomy is leading research on tropical fruit in two centres, Tocuman (papaya) and Chiriqui (citrus). On the whole, the University has a good phytotechnological, entomological, phytopathological, soil, radioisotopic and tissue

culture laboratories (in fact the last one belongs to IDIAP).

III. Principal Problems, Constraints, and Places of Interest

Fruit research in Panama suffers from lack of literature, trained specialists and a narrow range of cultivars for each species.

In Citrus, the tristeza vector has been identified, but so far, the disease has not appeared. This means that measures must be implemented to safeguard the stock and guarantee the health of the propagated plants. The important task of selecting mango, avocado, cashew and soursop varieties remains to be done.

Propagation techniques can be considerably improved.

Artisanal or industrial preservation of some fruit is hazardous (cashew apples, indigenous mangoes) and there are considerable losses.

Finally, fruit (especially mango) suffers heavily from parasite attacks.

EL SALVADOR

I. Production

The Ministry of Agriculture (MAG) has developed an import substitution plan for fruits and vegetables in an effort to increase the availability of these products in El Salvador. At the same time, efforts are being made to diversify exports and certain tropical fruits have been included in this strategy; their efforts are based on citrus, (the tristeza virus has recently been detected) avocado, mango, cashew (there is one 2,000 ha plantation and one false fruit and nut processing factory), papaya and coconut palm.

Temperate fruit (apples, peaches, Japanese prunes and pears) are also cultivated at high altitudes, on the Honduran frontier (currently the war zone).

The agricultural diversification programme (DIVAGRO) which depends on the Salvadorean Foundation for Social and Economic

Development (FUSADES), is a private programme. Its objective is the development of non-traditional agricultural cultivations for export.

DIVAGRO concentrates on the production of legumes and melons, but considers the tropical fruit sector very promising and is considering developing cashew nut and coconut palm. There are conversion factories for these two crops but cultivation will have to be considerably increased for this venture to be profitable.

II. Research

The organization responsible for research is the National Centre of Agricultural Technology (CENTA), which, unlike other Central American countries, enjoys relative institutional stability which allows for the collection of numerous results.



Dieback in citrus — San Andreas Research Centre, El Salvador, April, 1989.

With respect to fruits, the Phylogenetic Resources Unit of CENTA administers an excellent and important collection of tropical fruit trees at its San Andreas experimental station; this is also the leading unit in the areas of varietal selection, characterization and study of citrus, avocado, mango and papaya at its San Andreas, Santa Cruz Portillo and Izalco stations. Temperate fruit is researched at the Las Pilas station at an altitude of 2,000 m.

The San Andreas Centre also ensures the production of nursery plants for sale.

CENTA has a complete range of laboratories including one food laboratory, which works in strict coordination with the vegetable pilot unit of the National School of Agriculture (ENA) to which it is in close proximity.

ENA trains agronomists who benefit from a course in fruticulture. A course in post-harvest technology is also offered.

The agronomists themselves are trained at the University of San Salvador. Besides, the

University leads in research on tropical fruit at its experimental stations Comalapa and San Luis Talpa, but is currently experiencing a period of uncertainty due to political circumstances.

III. Principal Problems, Constraints, and Places of interest

In El Salvador, the main obstacles faced by the authorities include:

- access to scientific and technical information
- training of staff
- control of viral citrus diseases, and possibility of regenerating and augmenting the collections in such a way as to start again on a healthy base
- selection of healthy papaya now heavily infested with the ring spot virus
- development of temperate fruits as an import substitute
- extension of cashew and coconut cultivations to supply factories, and export the finished products

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