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## POTENTIAL USE OF THE STERILE INSECT TECHNIQUE AGAINST THE SOUTH AMERICAN FRUIT FLY

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### Abstract

#### POTENTIAL USE OF THE STERILE INSECT TECHNIQUE AGAINST THE SOUTH AMERICAN FRUIT FLY.

The Latin American countries have a strong interest in increasing fruit production and quality to facilitate commercialization within and outside the region. Various fruit fly control programmes in South America and their objectives and benefits are described here. Specific priorities to improve fruit fly control and eradication technologies include strengthening of quarantine, development of pre- and post-phytosanitary measures, and harmonization of the most effective and advanced technical procedures/methodologies to control fruit flies. A subregional strategy to control fruit flies in South America would promote technical co-operation among the South American countries and strengthen the activities of less advanced fruit fly programmes. Effective use can be made of local/regional infrastructure, expertise, sterile fly production and human/technical resources. In Argentina, advanced technology related to the use of medfly genetic sexing strains for SIT programmes has been successfully introduced. Joint efforts between technicians and scientists would contribute to developing new technology to control important pests in South America.

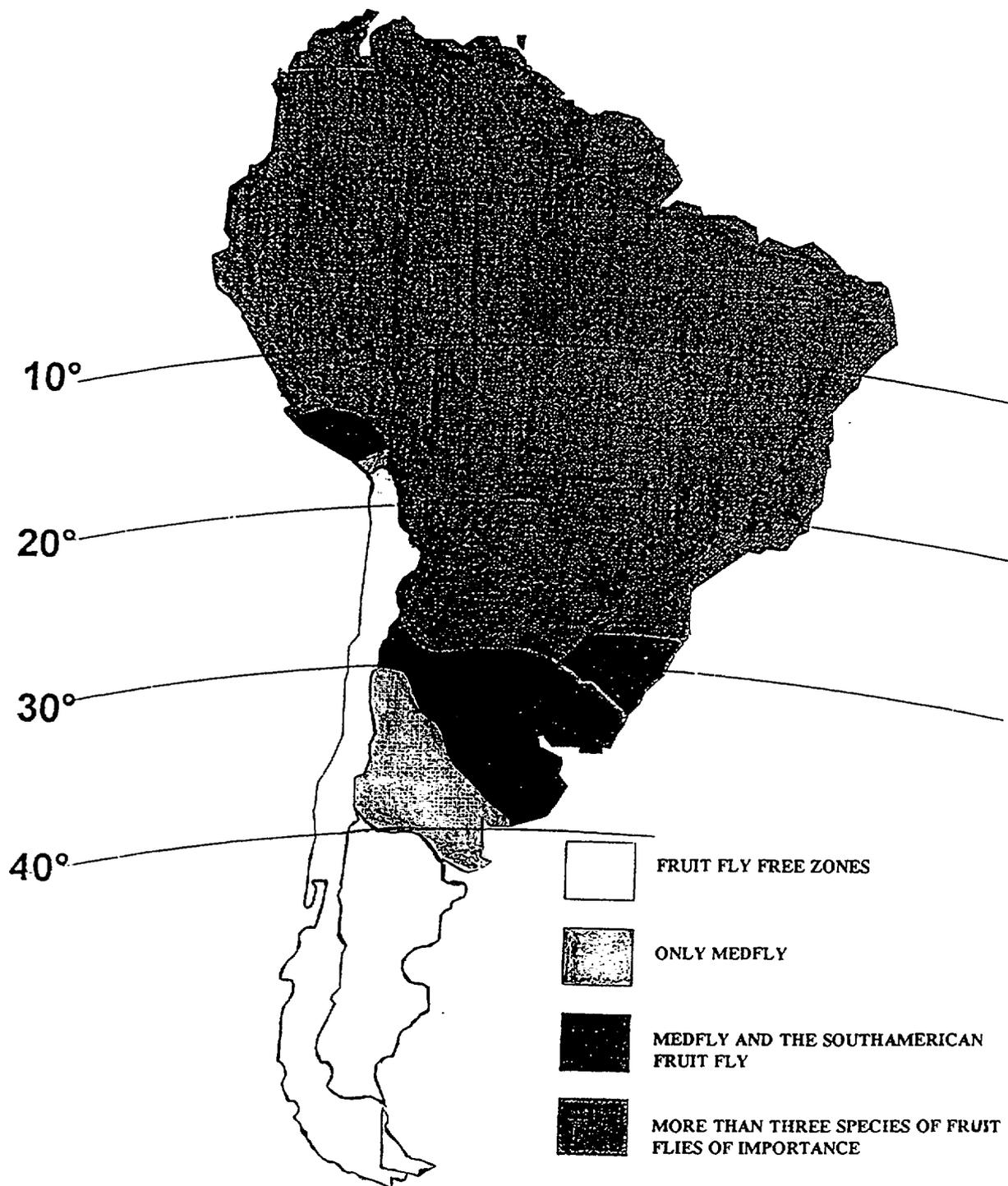
### 1. INTRODUCTION

Over the last four years, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture has been directly involved in the development of programmes and technology transfer on the use of the Sterile Insect Technique (SIT) in South America. Two national-IAEA Technical Cooperation Projects with the aim of eradicating the Mediterranean fruit fly (medfly) are being successfully implemented in Argentina and Chile. Other South American countries suffering similar fruit fly problems, have expressed interest in also obtaining technical support in the environment-friendly control of these pests.

The medfly and other fruit flies of economic and quarantine importance are causing important economic losses to the countries of the region. These losses can be divided into two categories: a) those caused by the direct attack of the pest to fruits and vegetables in the field (from 3 to 50%) in spite of insecticide applications, and b) the indirect damage to the fruit industry by preventing fresh fruit and vegetables exports to fruit fly free countries (considerable losses, not calculated). Other associated problems in fruit production are the excessive use of insecticides (in most cases to control fruit flies), the problem of pesticide residues on fruits and vegetables and the possible selection for fruit flies resistant to insecticides.

Fruit flies are widely distributed in South America. The Mediterranean fruit fly is an exotic pest for this subregion, having been introduced only this century. It is considered the most important threat to fruit production and fruit industry development. The importance of

MAP 1: Hypothetical distribution of the important fruit flies in South America



medfly is due to its great reproductive potential, wide range of fruit hosts and its great adaptation capacity to extreme weather conditions. In South America, medfly is established even at 40° southern latitude in Patagonia, Argentina. Most of the other endemic fruit flies are found north of 32° southern latitude (some exceptions can be found in the southernmost valleys of Perú and in other specific or isolated valleys of the countries). This situation allows the technical feasibility to maintain a fruit fly free status in Chile and the creation of important fruit fly free zones in Argentina and Perú by eradicating medfly using the SIT (see Map 1).

Chile has successfully eradicated medfly several times, maintaining a fruit fly free zone for the most important fruit production areas of the country located from 20° southern latitude to the south. This phytosanitary status has been decisive in the strong development of the Chilean fruit export industry, with a current value of more than US\$ 1 billion per year. Recently, using SIT, Chile eradicated the pest from the geographically isolated and northernmost part of the country, the Arica valley, at the border with Peru. Then, Chile was officially declared a medfly free country in December, 1995, and the eradication efforts are being moved to the southernmost valleys in Perú, the Tacna and Moquegua valleys.

The use of SIT has been demonstrated to be an effective and sustainable way to control the pest, generating great interest in neighboring countries, which are very interested in obtaining this technology to deal with their fruit fly pests.

Argentina is currently conducting an important programme using the SIT to eradicate medfly from more than 700,000 ha of cultivated land in the isolated fruit-producing valleys of the Patagonia region as well as in Mendoza and San Juan provinces.

Perú has embarked on an ambitious fruit fly control and eradication project mainly oriented to the coastal fruit producing valleys of the country. The government is investing important resources to build 3 fruit fly and parasitoid mass rearing facilities, one in the north, the refurbishment of the "La Molina" mass rearing facility in Lima and another in the south of the country. In addition, Perú and Chile have established an active bilateral agreement to eradicate medfly and the South American fruit fly from the southernmost valleys of Perú.

The rest of the countries in South America are interested in increasing fruit production and exports, because the fruit fly problem is one of the most important limitations to be overcome.

## 2. ADVANTAGES OF ESTABLISHING A SUBREGIONAL STRATEGY TO CONTROL THE FRUIT FLIES IN SOUTH AMERICA.

Many countries in South America have expressed a strong interest in developing updated technology to control and to eradicate fruit flies of economic and/or quarantine importance. Among the objectives that these countries would like to achieve are:

- To increase quality and production of fruits and vegetables in order to facilitate commercialization within and outside the region.
- To protect the environment by reducing the use of pesticides by promoting environment-friendly pest control strategies in fruit and vegetable production .

- To promote technical cooperation among the countries to take advantage of the infrastructure and the human/technical resources presently available in the subregion to strengthen the activities of less advanced fruit fly programmes.

Among the specific priorities to be addressed to improve fruit fly control and eradication technologies in the countries are:

- The harmonization of the most effective and advanced technical procedures/methodologies to control fruit flies, especially the medfly and the South American fruit fly,
- To strengthen knowledge on integrated fruit fly control techniques and the use of the Sterile Insect Technique to control and eradicate medfly and other fruit flies of economic and quarantine importance,
- Use of the present infrastructure in Argentina and Chile as specialized SIT training centers in the subregion.
- Development of the necessary pre- and post-harvest phytosanitary measures, including fruit fly quarantine treatments for fresh fruit and vegetables, to overcome quarantine restrictions during the export process.
- Strengthening of the national quarantine infrastructure to reduce the risks of introduction of exotic pests and to avoid the movement of established pests inside the subregion to protect the fruit fly eradication programmes.

In view of the above mentioned points, a subregional strategy is needed to promote activities for the establishment of an effective technical coordination among the interested countries. The countries can already take advantage of the existing infrastructure, the sterile fly production and the experience on medfly SIT area-wide control and eradication programmes and plant quarantine systems presently available and successfully developed in Chile and Argentina.

The current National Fruit Fly Programmes in Chile, Argentina, Perú, Ecuador, Colombia, Uruguay and Brasil, managed under the National Plant Protection Organizations of the Ministries of Agriculture, would be the framework within which to develop a subregional project strategy. The countries would continue assuming the responsibility for their own national fruit fly programmes with their specific objectives. However, the technical cooperation and active interaction/communication among the different National Fruit Fly Programme Coordinators and/or the National Plant Protection counterparts is very low or, in many cases, does not exist. Efforts should be made to encourage technical cooperation among neighboring countries in the subregion with the assistance of the Regional or International Organizations such as COSAVE, IICA, FAO, IAEA, USDA, GTZ, EU, etc. in order to promote the following activities and policies:

- Assemble the National Fruit Fly Coordinators of the interested countries in a first meeting to review the programmes and find points of interest/collaboration/training, etc. and establish a chronogram for periodic meetings (every 3 months, for example).
- Support the organization and execution of subregional technical meetings and training courses.

- Request economic support for research and specific technical advice through regional and international experts to develop the SIT in *Anastrepha fraterculus*.
- Provide specialized training to the key professional staff of the national fruit fly programmes in the countries through the provision of fellowships and scientific visits in and outside the subregion.
- Promote the establishment of specific agreements for the provision of sterile flies and technical assistance among the countries.
- Provide specific equipment and materials not available in the subregion to strengthen the field and laboratory fruit fly programmes Prepare and distribute an inventory of experts on fruit flies available in the subregion, Latin America and the U.S.

The interaction of the existing valuable human resources and the use of physical and technical resources now available in the subregion will be of great acceptance and will result in important benefits to the on-going and future fruit fly programmes in the South American countries.

### 3. PHYTOSANITARY CONCEPTS TO BE CONSIDERED

The countries interested in improving productivity and increasing exports of their fresh fruit production should establish concrete activities/programmes on an area-wide pest management basis. This concept should be very well understood by Plant Protection leaders and fruit growers' organizations. Policies oriented to promote the fruit growers' organization are indispensable in the process to apply phytosanitary programmes on an area-wide basis.

An indispensable and important action to secure these intentions is the creation of "Fruit Fly Free Areas" (FFFA) and "Fruit Fly Low Prevalence Areas" (FFLPA). The establishment of these technical and protocolar concepts will be a very important step in the process to eliminate the current quarantine restrictions imposed to the fruit and vegetable produce of the countries by fly free countries/markets.

FFFA and FFLPA that are officially and internationally recognized are the phytosanitary instruments approved by the International Plant Protection Convention (IPPC) and adopted or in course of adoption by the Regional Plant Protection Organizations (RPPOs) and the National Plant Protection Agencies (NPPAs) to allow free commercialization of healthy commodities to competitive markets. In addition, and as a result of the adoption of the GATT agreement and the latest developments within the regional common market MERCOSUR, these phytosanitary instruments are becoming increasingly important for trading agricultural produce.

The participating countries will benefit significantly by increasing fresh fruit production and exports through the establishment of such phytosanitary measures. A coordinated technical effort between the countries will make effective use of the local/regional infrastructure, expertise, sterile fly production and the wide experience in fruit fly control and eradication technology now available in Chile and Argentina. Moreover, Chile could provide advice in plant quarantine technology and postharvest treatments of fresh fruit and vegetables.

#### 4. FUTURE OF FRUIT FLY SIT PROGRAMMES IN THE SUBREGION:

Presently, the use of the SIT in South America is oriented only to the eradication of medfly, in fruit-producing zones where medfly is the only fruit fly of economic and quarantine importance. These zones are located only in the southern part of Argentina and Perú and are feasible candidates to be FFFA. There are other important fruit-producing areas in Argentina, Uruguay, Brasil and Perú, where Medfly coexists with the South American fruit fly (SAFF)(*Anastrepha fraterculus*), that are candidates to create FFFA but only by developing the SIT to eradicate the SAFF. An immediate alternative to succesful control of these fruit flies in these zones is the creation of FFLPA. This strategy will be valid if the costs of the fruit fly control programmes are lower than those of traditional control programmes through the use of insecticides presently applied by the fruit growers. For the long term, SIT control programmes against Medfly and SAFF will allow an important reduction of insecticide use, resulting not only in a more effective control of these species, but with benefits to the environment and the quality of the fruits and vegetables.

Medfly SIT eradication programmes to create FFFA are feasible when the following specific conditions are accomplished: geographical isolation, minimum road communications to the zone, high values of the fruit produced and the active participation of the fruit growers and governments to establish the necessary strict quarantine regulations. These conditions together are not easy to find in most of the fruit-producing zones of the countries. So, the future of Medfly SIT eradication programmes are limited to the zones in which these factors are met. Joint SAFF and medfly SIT eradication programmes are not possible to establish at this time, due mainly to the lack of SIT technology to eradicate the SAFF. If a strong research programme to develop the SIT for SAFF is now established in South America, the technology could be available for area-wide application in as little as two to three years.

Control programmes to create FFLPA rather than FFFA are, at this time, technically and economically feasible for implementation in many fruit-producing areas of the countries. The FFLPA concept should be developed and well understood by Plant Protection leaders in the subregion in order to establish the conditions to succesfully apply the phytosanitary regulations, field activities and participation of fruit growers and governments that are required. By developing and strengthening this concept, the fruit and vegetable production of a determined zone/region or country, can be exported to the present restricted markets through the bilateral negotiations between the countries involved. These bilateral negotiations must result in the establishment of a mutually agreeable protocol which normally states:

- The phytosanitary and quarantine measures (quarantine treatments) that should be accomplished by the exporting country,
- The participation of the growers/organizations/authorities involved (fruit growers, packing enterprises, plant quarantine inspectors of both countries, etc),
- The field activities to maintain the status of FFLPA
- The actions to be taken in case of pest outbreaks in the field, pest detection during packing, or in the shipments to the international market.

## 5. CURRENT STERILE FLY PRODUCTION IN SOUTH AMERICA

Both, Argentina and Chile have medfly mass rearing and sterilization facilities in full operation with a present production capacity of 280 million sterile flies per week. Moreover, with the improvements currently being made by Peruvians to their facility at "La Molina," the production potential will be increased to 340 million sterile flies per week. The present production of sterile flies is being released in the current medfly eradication programmes in Argentina, Chile and Perú. Technicians and scientists from these medfly rearing facilities already have the experience to provide technical assistance to neighboring countries. In addition, advanced technology related to the use of medfly genetic sexing strains for SIT programmes has been successfully introduced in Argentina. This new technology, which consists of producing and releasing male-only sterile medflies, is being used with high expectations of success in Mendoza, Argentina.

Chile is in the process of introducing this technology and in 1997 will be producing and releasing male-only sterile medflies using a genetic sexing strain.

## 6. STERILE SAFF PRODUCTION PLANS

Presently, Perú is the only country in South America with an ambitious plan to eradicate fruit flies of economic and quarantine importance from the fruit-producing valleys of the Peruvian Pacific coast. Fruit fly eradication includes the Medfly, SAFF and *A. obliqua*. In Argentina, important fruit producing zones are technically and economically feasible candidates to apply SIT programmes for medfly in conjunction with SAFF. However, the research efforts to develop the SIT for SAFF are very isolated, and there is not a visible policy in the government to support this activity. For this reason, it is very important to promote regional events among technicians and scientists related to fruit fly programmes in order to join efforts and convince the high level agricultural authorities and plant protection leaders of the importance of developing new technology to control important pests such as the South American fruit fly.

## 7. CURRENT FRUIT FLY PROGRAMMES IN THE SUBREGION:

**Chile**, the only country in South America internationally recognized as a fruit fly free country, has developed an effective and profitable phytosanitary programme to maintain this status. Medfly was finally eradicated from the small and isolated area of Arica, in the northernmost part of the country, at the border with Perú. Here, the Chilean Agricultural Service (SAG), through the National Plant Protection Institute with the support of the IAEA successfully achieved the eradication of this pest using the Sterile Insect Technique. This achievement will allow the Chilean fruit industry to proceed with fruit and vegetable shipments to Asian markets. The government and the private sector provided strong support to the programme to maintain the fruit fly free status and, in consequence, there is a growing fresh fruit export industry.

Currently, Chilean Agriculture authorities are looking to their neighbours to help them protect their fruit industries with the aim of expanding the control of fruit flies and thereby eventually increasing the fly free buffer area around Chile. With Perú, a phytosanitary agreement was established in 1991 to control the medfly in the Peruvian valley of Tacna, the area bordering Chile. Under this bilateral agreement, Chile is providing to Perú in 1995, 20 million sterile flies per week from the new medfly mass rearing and sterilization facility in

Arica as well as operational funds (approx. US\$ 350,000 per year) to eradicate the medfly from the southern valleys in Perú. With Argentina, the establishment of bilateral agreements to support medfly eradication from the neighbouring provinces of San Juan, Mendoza and Patagonia are in progress, including technical support given to upgrade Argentinean fruit fly quarantine procedures. Chile is requesting from IAEA the continuation of the technical assistance to complete medfly eradication in its territory and to strengthen the bilateral medfly programme with Perú.

**Argentina**, with a high potential to export large volumes of fresh fruit, embarked in 1993, with the support of IAEA, on an ambitious National Fruit Fly Programme. Concrete medfly eradication activities are in progress in 500,000 ha of the province of Mendoza. This programme will be expanded in the near future with the support of FAO to the provinces in Patagonia and San Juan province. Expansion to the citrus area in the eastern part of the country, at the border with Uruguay, is also under consideration.

From 1990 to 1995, more than US\$ 25 million have been invested in the establishment and operation of 25 internal quarantine stations, the infrastructure and operation to produce and sterilize more than 200 million insects per week, the training of personnel and the field operations to control the pest over half a million hectares. During 1995, the use of genetic sexing strains to release male-only sterile medflies will significantly improve the SIT and will reduce the operational costs of the eradication programmes. This male-only technology can then be transferred into other facilities in the subregion, including the Arica plant in Chile and the La Molina plant in Peru.

Argentina and Chile would greatly benefit by closer coordination of efforts against fruit flies. On the one hand, Argentina requires Chilean recognition of the fruit fly free areas of Mendoza, San Juan and Patagonia in order to be able to move fruits and vegetables through Chilean territory and to use Chilean ports on the Pacific Ocean. On the other hand, Chile is very interested in the success of the medfly eradication programmes in Argentina because they will allow movement of the quarantine barrier further east into Argentina, thereby providing more protection and drastically reducing the incidence of costly annual pest introductions into Chile.

Argentina is requesting from IAEA the continuation of the technical assistance to finalize eradication of medfly from Patagonia and Cuyo provinces and to expand activities to the important Litoral citrus-producing areas.

**Perú** is up-grading its fruit fly programme. Plant protection officials are interested in acquiring a new irradiator for their mass rearing facility at La Molina, as well as in introducing new rearing technologies. In addition to the medfly control activities in the southern part of Perú under the bilateral agreement with Chile, the government and private sector are interested in creating FFFA or FFLPA in central and northern Perú to increase exports. Fruit production in Perú is developed in more than 176,000 ha in three ecological areas: the coastal area, the central interandean valleys and the eastern jungle. In the coastal areas, there is a significant potential to create FFFA, due to the geographical isolation of the fruit-producing valleys. Mango, grapes, mandarin and other citrus are the main fruits targeted for export. The total value of fruit production in Perú is more than US\$ 500 million per year. It is estimated that fruit flies are causing losses amounting to US\$ 25 million per year, representing approximately 20% of the total losses due to agricultural pests.

Peruvian Plant Protection Officials are seeking technical assistance from IAEA to re-establish their National Fruit Fly Programme.

**Uruguay:** In 1989, in conjunction with Argentina and with the support of FAO, Uruguay developed a bilateral TC project to establish an area-wide programme to control the medfly and the South American fruit fly in the important and relatively isolated citrus area of the Litoral along both sides of the Rio Uruguay. Since that time, due to the lack of continuity, organization and technical assistance, the proposed area-wide project was frozen by the two countries. In this area, on both sides of the border, there are more than 50,000 ha of commercial citrus plantations. On average, 18 to 22 applications of insecticide are sprayed per year by the citrus farmers to obtain control of medfly. This control programme is costing US\$ 5 to 6 million annually. Furthermore, as a result of the excessive pesticide use, there are unpredictable and unquantified side-effects on human health and the environment.

This project along the Rio Uruguay area is technically, economically and environmentally feasible by applying an area-wide control strategy to control the pest over the entire citrus area, including the highly infested fruit trees in urban areas. An important reduction in the use of insecticides and, in consequence, the reduction of environmental pollution and programme costs are the most important factors to consider in this project.

Presently, the citrus growers organization are requesting from their respective governments (Argentina and Uruguay) support for the establishment of an area-wide control programme using the Sterile Insect Technique to effectively control this destructive pest. The government of Argentina is seriously thinking of moving resources to this area and of providing support from the medfly eradication programme in Mendoza.

**Bolivia:** The Government and private sector of this country are interested in developing fruit production as an alternative to coca production. In this case, tropical and subtropical fruit production for export, such as chirimoya, pineapple and citrus, is the general objective. However, fruit flies, mainly medfly and SAFF, are presently the most important quarantine pests that have to be controlled to establish FFLPA and, in some limited cases, FFFA.

**Brazil,** an important fruit-producing country in South America, is seriously looking for environmental-friendly alternatives to control fruit flies in the large citrus areas of the country, because pesticide residue on the fruit is becoming an important problem. Plant protection officials and scientists are strongly thinking of developing biological measures, such as the production and release of large quantities of parasitoids over the fruit fly infested areas. This biological method includes the production of parasitoids on mass reared and irradiated fruit fly larvae. The combination of this technology with SIT will be an excellent alternative to reduce pesticide application and effectively control the pests. In Brasil, there is already a fruit fly free area, allowing the exportation of melons to the northern hemisphere. Furthermore, in the southern part of the country, important agricultural development programmes are in progress, including the expansion of apple and citrus fresh fruit production. In this area, the South American fruit fly and medfly are the targeted pests to be controlled.

**In Colombia** the mango growers are implementing a programme to export this subtropical fruit. Due to the presence of fruit flies, mainly medfly, mango and other tropical fruits can not be exported to the important NAFTA market. For this reason, the fruit growers

are making serious efforts to overcome the quarantine restrictions imposed by the USDA. For the moment, they have built the infrastructure to apply the post-harvest quarantine treatment for mango (hot-water), but fruit fly suppression actions have to be taken at the pre-harvest level. This means the creation and certification of FFLPA. With an internationally recognized FFLPA, the mango growers would then be able to proceed with the fruit to the postharvest treatment so that it finally can be accepted by international markets. For this reason, Colombia is very interested in receiving technical support to establish an effective fruit fly control programme in those areas selected for fruit and vegetable exports. The regional project would supply this required technical assistance.

There are other countries in the region that are independently developing concrete actions against fruit flies. In the future, Ecuador and Venezuela would be very interested in joining a subregional fruit fly project.

In view of the above, a regional fruit fly strategy could be envisioned in which the present successful national TC projects in Chile and Argentina could be the local sources of technology to be transferred to the neighboring countries.