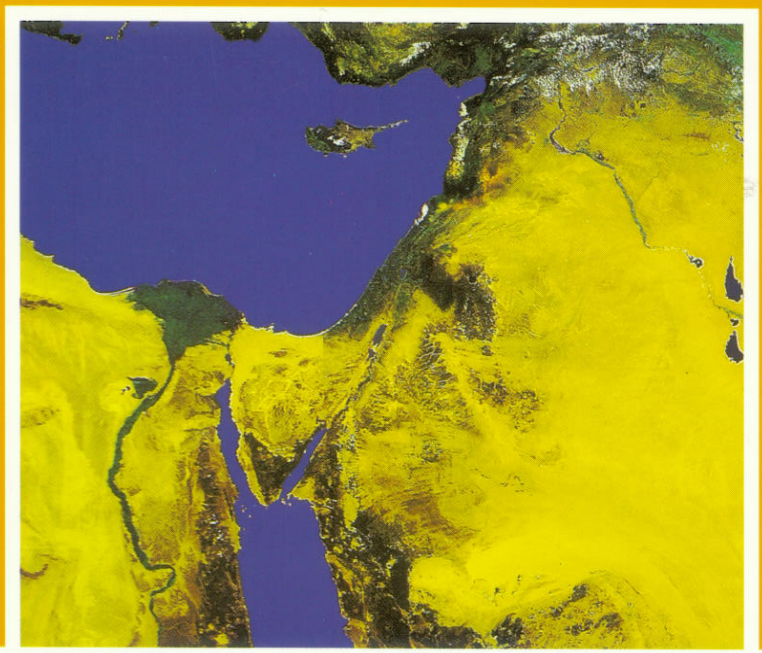
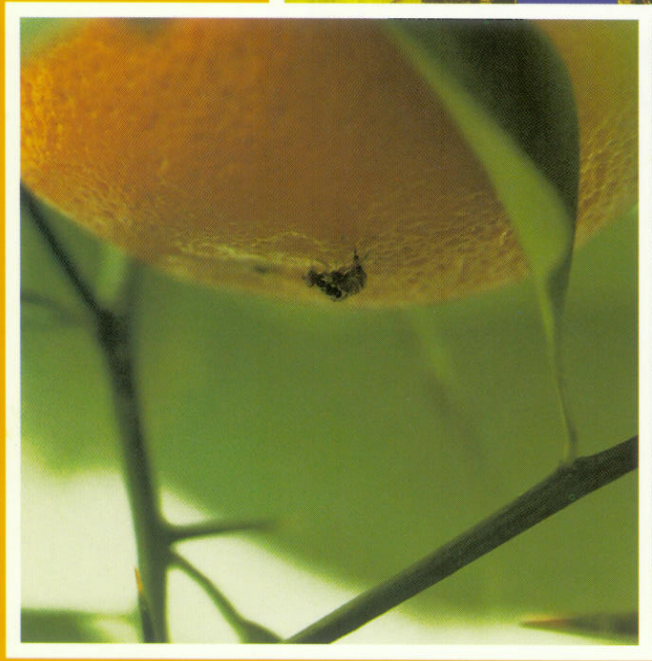
EASTMED

A PROPOSAL FOR MEDFLY CONTROL OR ERADICATION WITH THE STERILE INSECT TECHNIQUE





CYPRUS, EGYPT, ISRAEL, JORDAN, LEBANON, THE SYRIAN ARAB REPUBLIC AND THE TERRITORIES UNDER THE JURISDICTION OF THE PALESTINIAN AUTHORITY

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CYPRUS, EGYPT, ISRAEL, JORDAN, LEBANON, THE SYRIAN ARAB REPUBLIC AND THE TERRITORIES UNDER THE JURISDICTION OF THE PALESTINIAN AUTHORITY

A REPORT OF A CONSULTANTS MEETING
24–27 MAY 1994
IAEA
VIENNA, AUSTRIA

INTERNATIONAL ATOMIC ENERGY AGENCY
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

VIENNA, 1995

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EXECUTIVE SUMMARY

In view of the need to strengthen the links in the field of plant protection, a consultants meeting was convened in Vienna in May 1994 under the auspices of the International Atomic Energy Agency (IAEA) and the Food and Agriculture Organization of the United Nations (FAO) for plant protection officials from Cyprus, Egypt, Israel, Jordan, Lebanon, the Syrian Arab Republic and the Territories under the Jurisdiction of the Palestinian Authority.

The objective of the meeting was to assess the feasibility of a regional approach to a common pest problem, the Mediterranean fruit fly, *Ceratitis capitata* (medfly), which is the most significant threat to fruit production in the eastern part of the Mediterranean and a major pest of fruits and vegetables.

Fruit production is a major industry in the region, with about 530 000 hectares under production, and fruit is an important component of local diets. For some areas fruit exports further represent a significant part of foreign exchange earnings. The value of citrus and other fruit produced in the region is nearly US $1500 million per year.

Medfly causes enormous damage in the more than two hundred species of fruit and vegetables it attacks, and its control costs large sums of money everywhere in the region. There is at present a complete dependence on aerial or ground insecticide applications; these are frequently necessary from ten to twelve times a year. The annual volume of insecticide used for controlling the medfly in the region amounts to hundreds of tonnes.

Intensive insecticide use has resulted in insecticide residues on fruit, a high insecticide load in the environment and the outbreak of new insect pests as a consequence of the elimination of their natural enemies. The large scale application of insecticides also discourages the use of biological control methods to deal with other pest problems. Furthermore, the presence of the medfly discourages investments in improved fruit production and the introduction of new species of fruit to the region. Finally, as medfly is a feared quarantine pest in certain countries importing fresh fruit, its presence in the region represents the loss of these important export markets.

Throughout the region, there is growing economic and environmental pressure to reduce the use of insecticides, as important trading blocs and countries that import fresh fruits are changing regulations governing the acceptable treatment of fruits and vegetables. Agricultural development is accelerated by responding to these problems on a regional basis, particularly when the countries involved are relatively small. The required insecticide reduction as well as improvement of medfly control could be achieved with a regional area-wide control programme. Currently, only Israel and the portion of the Territories under the Jurisdiction of the Palestinian Authority known as the 'Gaza Strip' have organized area-wide control programmes.

The sterile insect technique (SIT) is a non-insecticide method which has been used successfully in North America, Japan, Australia, Central America and recently in South America. It is essentially a type of area-wide birth control of insects and is therefore the most environmentally friendly method available to control insects.

A recent example in the Mediterranean region of the effectiveness of the SIT is the eradication of the New World Screwworm from the Libyan Arab Jamahiriya. This successful project, which was co-ordinated and executed by the FAO and the IAEA, eliminated this devastating pest from North Africa, thereby saving the African continent as well as southern Europe and the Middle Eastern region from losses amounting annually to hundreds of millions of dollars.

Factories producing sterile medflies exist in Hawaii (United States of America), Mexico, Guatemala, Costa Rica, Chile, Peru and Argentina, with a joint capacity of more than 1500 million sterile medflies per week. Recently, important technical advances have improved the use of the SIT against medfly to ensure more cost effective control of the pest and to prevent fruit in the targeted areas from being blemished.

As the SIT can replace the current insecticide control system against medfly and can also be used for eradication, the consultants suggested that, if economically competitive with insecticides, this technique should be used in a regional area-wide control programme called 'Eastmed'. The final objective of Eastmed should be the eradication of the pest from the whole region.

The plant protection officials at the meeting recommended that the IAEA prepare a draft proposal of a regional SIT control/eradication programme against medfly, as well as an economic analysis of the losses and costs of medfly control in comparison with alternative control/eradication methods. They also specified the requirements for the location of a medfly mass rearing factory to be constructed in the Mediterranean region.

Successful implementation of a regional project on the scale of Eastmed requires the strong support and co-operation of each of the political entities in the region. They will need to attach high priority to the project and give high level support to all activities involved in carrying out the area-wide control/eradication programme, whose success would hold considerable economic benefits for national and regional agricultural sectors.

I. INTRODUCTION

Agricultural development is frequently accelerated by solving problems on a regional basis, rather than an individual country basis. This is particularly true when the countries are relatively small. All too frequently, political difficulties prevent successful implementation of regional projects. Furthermore, the successful implementation of regional projects requires that all of the involved political entities establish a high priority for solving the problem under consideration.

Recent political developments offer the opportunity to consider regional projects which are of importance to Cyprus, Egypt, Israel, Jordan, Lebanon, the Syrian Arab Republic and the Territories under the Jurisdiction of the Palestinian Authority, hereafter referred to either as the Eastmed political entities, or Eastmed entities.

Fruit production is a major industry in the Eastmed political entities. In some of these entities, fruit exports are a significant part of foreign exchange earnings. In all of the Eastmed entities fruit is a major component of the local diet.

The most significant problem in fruit production in the eastern part of the Mediterranean, is the Mediterranean fruit fly, *Ceratitis capitata* (medfly). This pest of more than 200 species of fruit and vegetables causes enormous damage or costs large sums of money to control. The control method used is the application of insecticide, frequently from 10 to 12 times per year. The annual amount of insecticide used for controlling the medfly in the Eastmed entities is of the order of hundreds of tonnes.

The sterile insect technique (SIT) is a proven method of medfly control or eradication which is environmentally friendly and requires little or no insecticide use. It has been successfully used to control or eradicate the medfly from Mexico, part of Guatemala and accidental introductions into the United States of America, and is currently being used in Argentina, Chile, Peru and Costa Rica. The SIT also is used against a significant number of other insect pests, including the New World Screwworm, pink bollworm, codling moth, melon fruit fly, Mexican fruit fly, Caribbean fruit fly, gypsy moth and oriental fruit fly.

Factories to produce sterile medflies exist in Hawaii (USA), Mexico, Guatemala, Costa Rica, Chile, Peru and Argentina. These factories currently produce more than 1500 million sterile medflies per week. There is a need for approximately 500 million more sterile medflies per week in the New World. There are no large medfly facilities in other regions of the world.

Consultants from Cyprus, Egypt, Israel, Jordan, Lebanon, the Syrian Arab Republic and the Territories under the Jurisdiction of the Palestinian Authority were invited to Vienna in May 1994 to discuss the opportunities for medfly control on a regional basis using the SIT.

II. THE MEDFLY PROBLEM IN THE MIDDLE EAST

The medfly occurs throughout the Mediterranean region, including all Eastmed entities (see figure). If not effectively controlled, the medfly will cause losses of from 20 to 100% of tropical and subtropical fruit in the area. The only medfly control technology currently being used is aerial or ground poisoned bait applications. These are applied either as low volume or as cover sprays. A bait spray utilizes a food attractant plus an insecticide to control the adult medfly. The adults are attracted to the spray droplets, absorb the bait and die from insecticide poisoning. The cover spray is an application of insecticide to every tree over an entire orchard. The bait spray is usually applied in large droplets and frequently to every second or third tree or row.

The medfly is a quarantine pest in certain countries which import fresh fruit. Therefore, complete control of the medfly is required to meet the standards of these countries.

If insecticide control is used against the medfly, other hosts are affected and insects formerly of no economic importance frequently become major pests, requiring additional pesticide applications. This has occurred frequently in Israel and the portion of the Territories under the Jurisdiction of the Palestinian Authority known as the Gaza Strip during the past several years in cases where very intensive bait spray programmes have been used for complete control of the medfly.

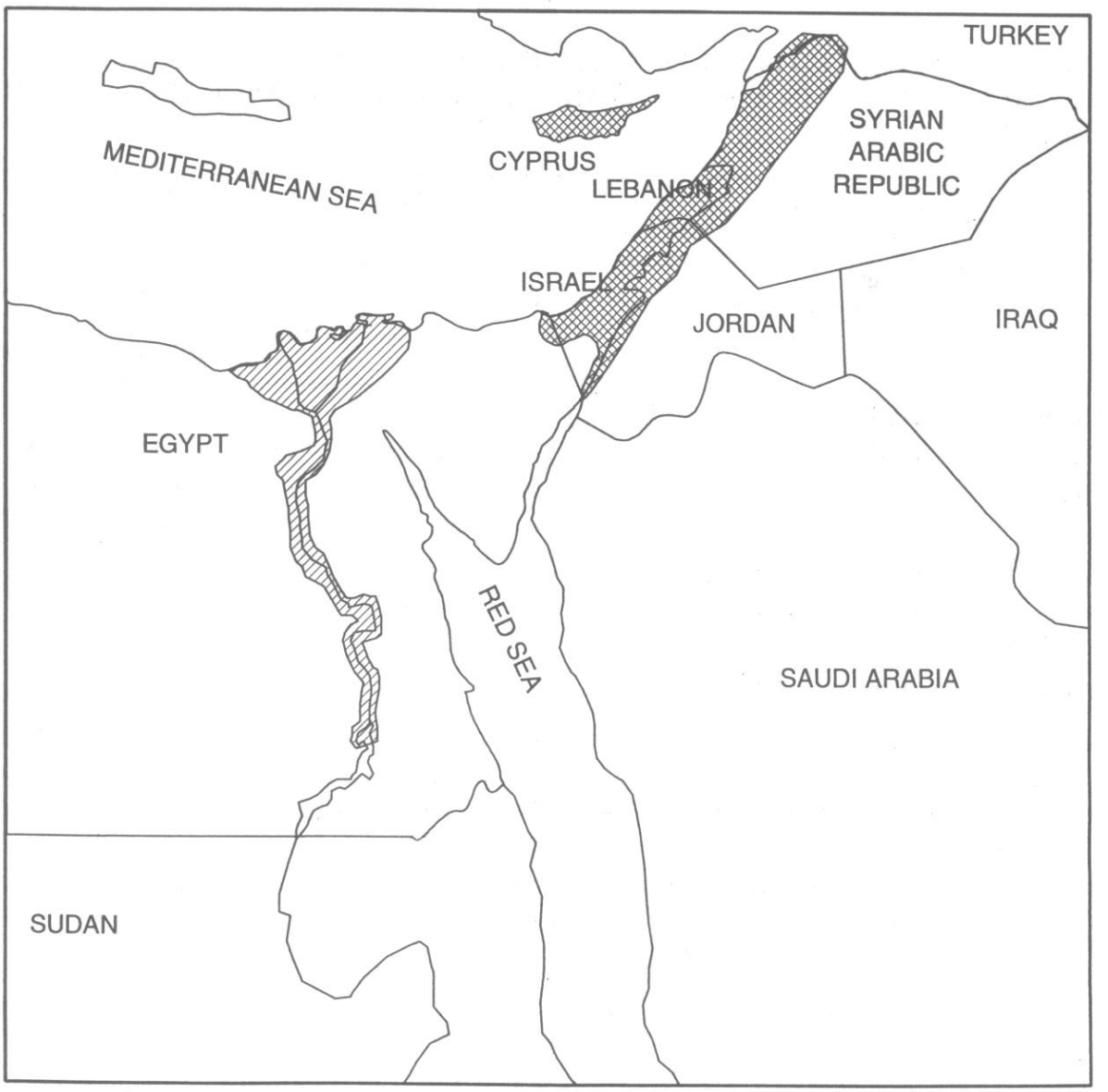
There is sufficient interest among the countries involved that if a source of sterile medfly males had been available, large field evaluations would have been conducted several years ago. However, in the Mediterranean Basin, and in fact, in all of Europe, there are no medfly mass production factories to produce sterile medfly males, or for that matter, any other insect species for which the SIT could be used. This situation is partially the result of the small size of individual countries and an almost complete dependence upon insecticides for controlling nearly all insect pests. Moreover, at present, there is no factory in the world that was expressly designed for the production of a male-only medfly strain, because the development of genetic sexing strains is quite recent.

The presence of the medfly discourages investments in improved fruit production systems or the introduction of new species of fruit which would increase foreign exchange earnings. Thus, the medfly is a significant factor in agricultural development in the Eastmed political entities.

III. MEDFLY HOSTS AND THE EXTENT OF COMMERCIAL HOST PRODUCTION IN EASTMED POLITICAL ENTITIES

The total area involved in the Eastmed entities (Cyprus, Egypt, Israel, Jordan, Lebanon, the Syrian Arab Republic and the Territories under the Jurisdiction of the Palestinian Authority) is 1 314 360 km^2. Of this, 9 828 000 hectares are cultivated, with fruit production areas totalling about 530 000 hectares. Citrus is produced in slightly less than one-half of this area.

MAIN AGRICULTURAL AREAS INFESTED BY THE MEDFLY IN THE NEAR EAST REGION*



Proposed implementation sequence of a regional control / eradication programme:

First Area

Second Area

* This map does not express any opinion whatsoever on the part of the IAEA concerning the legal status of any country or territory, or of its authorities or concerning the delimination of frontiers. The map also includes the Territories under the Jurisdiction of the Palestinian Authority.

The dollar value of citrus produced in Eastmed political entities is approximately US $393 million per year. The value of other fruit grown in the region is slightly less than US $1000 million per year. These values are at the farm gate. See Table I for country statistics.

TABLE I. ESTIMATED FRUIT PRODUCTION AND ITS FARM GATE VALUE IN THE EASTMED REGION. IN SOME INSTANCES, OLIVES AND AVOCADOS MAY BE INCLUDED

	ha (× 1000)	ha (× 1000)	ha (× 1000)	ha (× 1000)	MT (× 1000)	MT (× 1000)	US$ ($\times 10^6$)	US$ ($\times 10^6$)
Political entity	Total area[a]	Cultivated area[a]	Fruiting area	Citrus area	Citrus production[a]	Other fruit production[a]	Value of citrus production[a]	Value of other production[a]
Cyprus	924	159	9[b]	8	179	8	35	8
Egypt	99 545	2 730	240	171	2 425	266	120	178
Israel	2 033	412	48[a]	30	1 000	300	100	200
Jordan	8 893	327	50[c]	6	133	116	50	55
Lebanon	1 023	330	56	10	375	346	38	230
Syrian Arab Republic	18 418	5 672	100	20	192	386	20	257
Territories*	600	198	24[a]	7	170	75	30	47
Total	131 436	9 828	527	252	4 474	1 497	393	975

* Territories under the Jurisdiction of the Palestinian Authority, as well as the territory known as the 'West Bank'.

[a] FAO Annual Yearbook Production — 1992 — Vol. 46. Dollar values are at the farm gate.

[b] Apricots, peaches, plums, pomegranates, loquats, quince, figs and citrus.

[c] Not including olives and avocados but including grapes.

An estimate was made of the total area which would be involved in a regional medfly control/eradication programme. The grand total was about 100 000 km^2. Cyprus is about 9000 km^2, Egypt 26 000 km^2 and the balance (about 65 000 km^2) in Israel, Jordan, Lebanon, the Syrian Arab Republic, the Territories under the Jurisdiction of the Palestinian Authority, and the territory known as the 'West Bank'. The total land area of the latter and Cyprus, the vast majority of Israel and the irrigated areas of Egypt, Jordan and the Syrian Arab Republic are included. In the case of the last two countries, it is primarily the areas west of longitude 37 that are involved.

Medfly hosts exist continuously along the Mediterranean coast from the Gaza Strip area through Turkey, and inland in all irrigated areas with fruit trees, including date palm, plus wild and semi-wild host plants such as opuntia cactus and buckthorn.

An area-wide medfly control programme throughout the region or eradication if it appeared feasible, would include medfly control of door-yard hosts. Unfortunately, the only medfly control technology available for home owners to use in controlling medfly on door-yard hosts is the use of insecticides. Within an area-wide control context, all door-yard hosts would have to be considered as sources of medfly infestation and the pest would need to be controlled in these door-yard hosts. An estimate was made of the numbers of door-yard hosts in the 100 000 km^2 area. It was assumed that there were about 80 million people in the region, 7 people per family, 25% of the families have door-yard hosts, each with 4 medfly host trees. Thus there are 10–12 million medfly host trees in the region in door-yards and gardens. These present a significant problem as far as medfly control or eradication is concerned and special efforts must be made to deal with this problem. It is interesting to note that an identical problem exists in the medfly eradication programme in the Los Angeles Basin of California, USA. The presence of door-yard hosts in area-wide medfly control programmes is a significant factor which has received little attention as far as medfly control by the individual home owner is concerned.

IV. CURRENT MEDFLY CONTROL PRACTICES

Throughout the region, chemical control is the sole method used against the medfly. Bait sprays are most common, particularly in commercial production areas targeted for export. In Cyprus, about 3 tonnes of insecticide (active ingredient) are used annually for medfly control. In the Territories under the Jurisdiction of the Palestinian Authority, plus the territory known as the 'West Bank', a total of 14 tonnes are used. Israel uses 125 tonnes of insecticide annually for its extensive medfly control programme. Data are not available from the other political entities.

Israel and the Territories under the Jurisdiction of the Palestinian Authority have very effective organized area-wide medfly control programmes. In both cases, the programme is overseen by officials, but parts of each programme are contracted to the private sector. These organized programmes form an effective infrastructure on which to build area-wide medfly control practices utilizing other technologies.

In the other Eastmed entities fruit producers are free to control or not to control medfly as they see fit. In nearly all cases, however, insecticides are used, since without them what fruit is produced is frequently too badly infested with worms to sell or to consume.

On the basis of current prices, the cost of medfly control throughout the region varies from approximately US $40 to over US $100 per hectare per year, depending upon the host and the political entity involved.

V. ESTIMATED LOSSES AND COSTS OF MEDFLY CONTROL

An average of US $60 per hectare per year was established for effective medfly control throughout the region. This amount seemed to be a reasonable and conservative estimate considering that control costs vary from US $40 to over US $100 within the region.

The total area of commercial fruit production subject to medfly damage in the region being about 530 000 hectares, the total cost of medfly control may be evaluated at US $32 million per year (Table II).

TABLE II. ESTIMATED COSTS OF MEDFLY CONTROL BY BAIT SPRAY
(average US $60 per hectare per year)

Country	Commercial fruit areas under medfly control (ha × 1000)	Total cost (US $millions)
Cyprus	7	0.4
Egypt	240	14.4
Israel	48	2.9
Jordan	50	3.0
Lebanon	56	3.4
Syrian Arab Republic	100	6.0
Territories*	24	1.4
Total	525	31.5

* Territories under the Jurisdiction of the Palestinian Authority, as well as the territory known as the 'West Bank'.

When these treatments are done correctly and effectively, losses from medfly are very low. A good chemical control programme against the medfly will result in losses of less than 0.1% of the crop. This can increase dramatically, however, if the quality of the control is poor. Therefore, for the purpose of this report, a figure of 1.0% will be used. The total value of the crop (see Table I) is approximately US $1300 million. One per cent of this is US $13 million per year. Thus the total loss including costs of control on commercial hosts of the medfly is about US $45 million per year. This is an extremely conservative figure. Previous data analysing the costs of control and losses attributed to medfly in the Maghreb Union countries total US $90 million per year. A study in Egypt in 1983 of medfly losses identified a figure of US $50 million per year. Thus the figure of US $45 million per year is probably less than one half of the actual losses.

Not included in the figure above are the costs of control and losses of the estimated 10 million fruit trees in door-yards and gardens throughout the region. If these were in cultivated orchards they would represent a total area of 50 000 hectares. An effective medfly control programme in this area would cost US $3 million and the losses would be US $0.3 million, calculated as above. Thus a minimum total loss and control costs for door-yard hosts is US $3.3 million.

The costs of control in door-yards will be much lower as most home owners do not spray against the medfly and fruit losses will be much higher because little is done to protect door-yard hosts. Because the value of host fruit, if it were to be purchased on the market, would exceed, by far, the cost of control, the actual losses resulting from medfly attack of door-yard fruit is estimated to be US $15 million.

Thus the total control costs and losses attributed to medfly in the Eastmed entities can be conservatively estimated at US $60 million per year.

VI. THE STERILE INSECT TECHNIQUE FOR MEDFLY CONTROL/ERADICATION

The SIT has been used successfully for medfly control for more than 15 years. Initial development of SIT components was conducted in Hawaii, Austria and Italy, the latter a co-operative programme between the Joint FAO/IAEA Division and Italian scientists. These tests indicated the technology was suitable for control/eradication of the medfly and work was expanded. When the medfly invaded Mexico from Guatemala in 1977, an emergency programme was initiated which depended upon the SIT. This programme, funded jointly by Mexico, Guatemala and the USA, resulted in eradication of the medfly from Mexico by 1982. The programme continued into Guatemala, where approximately one third of the country is considered free of medfly.

The SIT is essentially birth control of insects. Large numbers of the target species are reared in factories and sterilized by gamma radiation. The sterilizing is done in the late pupal stage, just prior to adult emergence. After adult emergence, the sterile insects are released into the target area by aircraft. In the case of the medfly, the numbers of flies of both sexes released per square kilometer range from 40 000 to about 200 000 per week, depending upon the medfly population in the area, the number of host trees, the quality of the sterile flies and other factors. Matings between the factory produced sterile males and the wild females produce no offspring. When sufficient sterile males are released, the number of fertile matings is very low and the total pest population is reduced exponentially each generation until it reaches zero.

The SIT has been used successfully against a number of insect species in addition to the medfly. The eradication of the New World Screwworm from the southeast and southwest USA, Mexico, Belize and Guatemala is the largest SIT programme in existence, and the eradication programme in the Libyan Arab Jamahiriya was successful. Presently, eradication of this pest is in progress in Honduras, El Salvador and Nicaragua. Two species of fruit flies, the medfly and the Queensland fruit fly, have been successfully eradicated from parts of Australia. The Mexican fruit fly is prevented from becoming established in the USA by releasing sterile flies along the Californian/Mexican and Texan/Mexican border. The SIT is used against the codling moth in Canada and the pink bollworm in California. Large field tests using the SIT have proven very effective against several species of tsetse fly in Africa. The Japanese eradicated the melon fruit fly from their southern islands using the technology.

Initially, medfly control or eradication programmes were based on the release of both sexes after irradiation. However, the release of sterile females is detrimental to the programme. Although they cannot lay eggs, they attempt to oviposit in ripening fruit. These punctures, called 'sterile stings' result in blemishes to the fruit and thus in a lower price being received by the producer. In addition, mating between sterile males and sterile females reduces the number of matings of the sterile males with wild females.

Since the sterile females present no advantage in the SIT, a major effort was undertaken by the Joint FAO/IAEA Division to develop a genetic sexing strain in which only males would be produced. This has been successful with the development of the 'Vienna 42' strain. This strain incorporates a heat sensitive lethal gene, which is sex-linked to the female medfly. By treating the eggs or newly emerged larvae with a slightly elevated temperature (34°C), all females are killed. The resulting surviving eggs and young larvae are placed on rearing media

and only males are obtained. Field trials with genetic sexing strains in which only males are released have demonstrated the clear superiority of male-only releases over releases of both sexes. Thus the future of medfly control/eradication by the SIT is completely tied to medfly genetic sexing.

The requirements for a medfly mass rearing factory are rather specific. In addition to those listed below, there is a necessity that there be political stability within the country where the factory is located. This is particularly important as there is no shelf-life for the product of the factory (sterile medflies), nor is there any margin for error with regard to temperature and humidity within the factory. A simple failure of temperature control can result in the entire medfly production of the factory being killed; it will require several weeks to several months to re-establish a productive medfly colony.The requirements for a medfly factory are as follows:

Required

(1) 1.5 ha of land
(2) 2 250 000 L of water per day
(3) 800 kVA electricity, high voltage, 220, 330 and 440 V 3-phase
(4) Capability to handle 240 000 L sewage per day plus 30–40 m^3 of industrial garbage
(5) No aerial application of insecticides within 3 km of the mass rearing facility and no ground spray insecticides within 0.5 km of the facility
(6) An airport or airstrip not more than 30 minutes drive from the mass rearing facility
(7) Availability of several hundred local workers
(8) Communications by direct telephone, fax, telex to all Mediterranean basin political entities
(9) Availability of local expertise in maintenance of air-conditioners and other equipment utilized in the mass rearing facility
(10) Housing for local staff.

Desirable

(1) Airstrip immediately adjacent to the mass rearing facility
(2) Ready access to a sea port for importing supplies and equipment
(3) Public transport to the mass rearing facility
(4) Ready access to a large city for purchasing supplies and small equipments.

When the medfly mass rearing factory is developed for Eastmed, it could be either a public sector or a commercial undertaking. This question needs to be discussed thoroughly and decisions made at an early date. A determination of the market potential from sterile medflies throughout the Mediterranean would be useful information to attract possible commercial enterprises.

VII. RECOMMENDATIONS

The consultants recommend that the IAEA, through its Joint FAO/IAEA Division, develop a project proposal for medfly control or eradication in the Eastmed political entities (Cyprus, Egypt, Israel, Jordan, Lebanon, the Syrian Arab Republic and the Territories under the Jurisdiction of the Palestinian Authority) based on the SIT. The following aspects should be included:

A. Strategy

The management of medfly populations on an area-wide basis is recommended. This can be accomplished with insecticides. However, the increased use of insecticides to achieve this objective would be difficult to justify. An integrated medfly pest management programme using SIT as the decisive measure would be beneficial to the environment because much less insecticide would be required. This could be achieved through the private sector or the co-operative societies, which should be encouraged to adopt this strategy; otherwise the public sector would be called on for this activity.

The medfly control/eradication programme should involve bait sprays in combination with other control methods when needed, to be followed by the release of sterile males to reduce wild fly populations below the economic threshold or to a level that would permit eradication.

It is recommended that this programme be part of integrated pest management, i.e. to reduce native fly populations through the use of techniques other than insecticide application, such as the release of parasitoids.

The control/eradication activities in such a regional programme should be based on strong country programmes. The programme workplan should match the local organizational context of the political entities in order to be harmoniously inserted within the administrative set-up of the area.

This programme should be supported by a strong plant quarantine component to prevent reinfestation of cleared areas and, at the same time, the introduction of new pests into the region. In addition, quarantine action to prevent the entry of new plant pests, including exotic fruit flies, would further improve plant protection.

Honey bees are particularly susceptible to bait sprays for medfly control. Specific strategies must be employed to protect them.

B. Research and development

A survey programme should be initiated for the medfly to identify its host plants and their distribution, door-yard plants, number of generations and control methods.

The programme will include methods development and mission oriented research so that operations may be continuously improved.

R&D to improve medfly control methods used by individual home owners will be increased.

The use of biological agents and other methods for medfly control will be evaluated for reducing wild populations in preparation for sterile male releases.

C. Public relations

A public relations/information campaign will begin early in the programme. Of particular importance will be the early preparation of information specifically for politicians and managers (both public sector and business), as well as the general public to inform them of the advantages and economic benefits from a regional medfly control/eradication programme, based on the use of SIT. Information specifically prepared for growers and back-door fruit owners should motivate rural and urban people to collaborate in the programme.

D. Training

Training should be an important element of the programme. Normally this will help establish a strong network among scientists and technicians. This programme should facilitate the development of a permanent plant protection and quarantine infrastructure at the national level.

Of particular importance will be a scientific visit for competent high public sector officials to show them ongoing SIT programmes such as those for the medfly in Guatemala, Mexico and the USA, codling moth in Canada and pink bollworm in the USA.

Training will also promote regional interaction, since it will be accomplished on an individual political entity and regional level.

Structured courses should be designed to provide more formal training in plant protection and quarantine concepts, principles, procedures and activities. Advanced training will include all phases of field operations, as well as management and supervisory concepts.

The adoption of a regional training centre for this activity should be carefully considered.

E. Project name

A suggested name for the programme is Eastmed.

VIII. SUMMARY

(1) The medfly is a major pest in the Middle East.
(2) It is being controlled throughout the region with bait sprays and cover sprays of insecticides.
(3) Control could and will be improved by having area-wide programmes.
(4) Repeated applications of chemicals for medfly control are not compatible with integrated pest management.
(5) Future agricultural practices will demand a reduction of insecticide usage and an increase of use of integrated pest management to meet market acceptance and environmental demands.
(6) The release of sterile males could replace chemical control if economically competitive. Therefore, an economic feasibility study is required in the initial phase of the programme.
(7) Eradication should be the final objective of the programme. It should be considered if it enhances the income of the agricultural community in the target region, e.g. by opening new markets.
(8) Immediate steps to be taken:
    (a) The IAEA should prepare a draft proposal for the project, including an executive summary.
    (b) The decision making officials in the respective political entities should be identified and the proposal addressed to these people.
    (c) It should be the task of the participants in this consultancy to identify these people and to promote the acceptance of the programme.

(d) A survey programme should be started on medfly host plants, their distribution and relative seasonal importance, and on the distribution of the pest in the various natural areas of the region. Such surveys should be implemented by the national plant protection services in collaboration with the IAEA.

(9) The person within the IAEA who will co-ordinate the above mentioned activities should be identified.

(10) Steps (6), (8) and (9) and the scientific visits should be completed during 1995.

IX. PROJECT ACTIVITIES BY YEAR

The following table describes in broad terms a tentative schedule of activities for the programme.

TABLE III. SCHEDULE OF ACTIVITIES FOR IMPLEMENTING EASTMED

Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11
Phase I — Preparatory											
(1) Basic data:											
(a) cost–benefit analysis	×	×	×								
(b) host survey and mapping	×	×	×								
(c) medfly population and genetic studies		×	×	×	×						
(2) Co-ordination of the programme:											
(a) establishment of the organization	×	×									
(b) establishment of the infrastructure	×	×	×								
(c) plan integrated medfly management systems	×	×									
(d) plan eradication logistics		×	×								
(e) plan internal quarantine systems		×	×	×							
(3) Mass rearing:											
(a) planning of a facility	×										
(b) construction and rearing		×	×								
(4) Staffing and training											
(a) scientific visits abroad	×										
(b) training abroad	×	×									
(c) in-service training	×	×	×								
(5) Public information:											
(a) general	×	×	×								
(b) regulatory actions		×	×								

TABLE III. (cont.)

Activity	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11
Phase II — Eradication											
(a) reduce wild medfly population (bait sprays)			×	×	×	×	×				
(b) establish a quarantine zone			×	×							
(c) release sterile flies				×	×	×	×	×	×		
(d) back-yard tree control			×	×							
(e) monitoring system			×	×	×	×	×	×	×		
Phase III — Post-eradication											
(a) survey (monitoring) system									×	×	×
(b) establish barrier zone and permanent control measures									×	×	×
(c) prepare an emergency plan for outbreak situation				×	×	×					
(d) programme evaluation		×		×		×		×		×	

Note: Phase I could include a pilot test

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