

PN- AAQ-592
(SN: 35842)



POSTHARVEST INSTITUTE FOR PERISHABLES

REPORT OF USAID FACT-FINDING TEAM ON
ETHYLENE DIBROMIDE QUARANTINE PROGRAM USES
ON TROPICAL FRUITS IN
CARIBBEAN BASIN INITIATIVE COUNTRIES

by

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PIP/Caribbean/Feb-Mar 84/No. 39



University of Idaho

in cooperation with
**United States Agency for
International Development**

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February 13 to March 1, 1984

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I. INTRODUCTION

The Environmental Protection Agency (EPA) in December, 1977 initiated an RPAR process (Rebuttable Presumption Against Registration) to consider whether the pesticide registrations for ethylene dibromide (EDB) should be cancelled or modified. This was based on a National Cancer Institute study demonstrating the potential of EDB to induce cancer in rats and mice. The basis for the RPAR was the presumed risk of cancer to humans as a result of pesticidal exposure to EDB. The RPAR was further supported by additional evidence submitted to the Agency showing EDB to be mutagenic and capable of producing adverse reproductive effects.

In December 1980, the Agency issued a Position Document 2/3 and a Notice of Preliminary Determination concerning the RPAR which concluded that EDB poses significant risk of oncogenic, mutagenic and adverse reproductive effects in the human population. They proposed several regulatory actions to reduce the human health risks resulting from the pesticidal use of EDB. The proposed actions were based on the Agency's risk/benefit analysis of each registered use of EDB.

EPA proposed that on July 1, 1983, EDB registration for postharvest fumigation of citrus, tropical fruits and vegetables be cancelled. The interim period was to provide time for the development and implementation of efficacious alternatives. On September 28, 1983, a notice of decision and emergency order was issued by EPA suspending the registrations of pesticide products containing EDB for use as a soil fumigant for agricultural crops. At the same time, the EPA announced the cancellation and phase-out of all other major pesticide use of EDB, including the quarantine fumigation of citrus fruits, tropical fruits such as mango and papaya, and other fruits and vegetables which can be hosts for tropical fruit flies. The use of EDB was to be phased out by September 1, 1984. During this phase-out period, EPA has the authority to issue interim tolerances on permissible residue limits to protect public health.

On October 1, 1983, Department of State sent a cable to all diplomatic posts explaining the EPA regulatory action. In response to this cable, USAID San Jose replied "Request that EPA take immediate action to extend the deadline on the ban of EDB for quarantine fumigation of fruit entering the

United States to allow more time to develop or change fumigation procedures that are acceptable to PPQ, FDA and EPA".

The Costa Rica response was seconded by Honduras, Belize, El Salvador, Haiti and Dominican Republic.

The detection of EDB in ground water in Florida and California and in processed grain products in several states by FDA caused EPA to reassess its position. EPA set a date of February 29, 1984 for the establishment of temporary tolerances on tropical fruits and a final date for intervention of March 4, 1984.

To follow up on the USAID San Jose request ST/AGR established a fact-finding team to determine the economic impact on the Caribbean Basin Initiative (CBI) nations; analyze the applicability of possible alternatives treatments; evaluate existing and possible modified techniques for fumigation with EDB; evaluate available EDB analytical methodology and capability of regional laboratories with a view toward a possible certification program; and develop a position for AID consideration with respect to possible intervention. The fact-finding team composed of William Bolton, Postharvest Institute for Perishables (PIP), and George Cavin and Joseph Cummings, Consortium for International Crop Protection (CICP), assembled in Washington, D.C. on February 13, 1984, to meet with ST/AGR as a prelude to this assignment. Due to the short time frame available, members of the team worked individually to develop the needed information in accordance with their respective disciplines, reassembling in Washington, D.C. on February 27, 1984, to prepare a final report with conclusions for AID consideration.

II. THE PEST PROBLEM

Fumigation of fruits and vegetables produced in Latin America and the Caribbean is required to kill all life stages of a number of genera and species of fruit flies and other pests known to be present and to attack these agricultural products. Of the fumigants approved for these regulatory treatments, only ethylene dibromide (EDB) and methyl bromide (MeBr) are in general use. Ethylene dibromide is the most widely used and approved as only a relatively few fruits and vegetables are tolerant to methyl bromide at the dosage rates and time intervals necessary to eliminate the pest problem.

The fruit flies of quarantine importance in Latin America include the Mediterranean fruit fly Ceratitidis capitata and various species of the genus Anastrepha including the Mexican fruit fly, A. ludens; the South American fruit fly, A. fraterculus; the sapodilla fruit fly, A. serpentina; the guava fruit fly, A. striata; and the A. grandis (no common name). Some of the fruit flies infest a wide variety of fruits and vegetables, while for others the host list is limited.

The Mediterranean fruit fly (medfly) has a host list of over 200 fruits and vegetables including most tropical fruits, citrus, except lemons and limes, and vegetables such as tomatoes, bell peppers and eggplant. It can survive a wide variety of climatic conditions. It is present in all five Central American nations, Panama and the southern tip of Mexico. It is not in Belize. It infests all nations of South America except Colombia. It is not present in the island nations of the Caribbean.

Species of fruit flies of the genus Anastrepha, of which there are over 125, do not have as wide and varied a host list as the medfly. The Mexican fruit fly (mexfly) is present in the lower Rio Grande valley of Texas and throughout Mexico and Central America including Belize. It is not present in the Caribbean island nations. It attacks citrus, except lemons and limes, and many tropical fruits, but is not a pest of papaya or vegetables such as tomatoes, bell peppers and eggplant.

The South American fruit fly exists in climatic zones similar to the mexfly and its host list is similar. It overlaps with mexfly in Central America. Since it is not a pest of papaya and since medfly is not present in Colombia, papaya from Colombia can be exported to the United States without fumigation.

The sapodilla fruit fly and the guava fruit fly inhabit some of the zone occupied by the mexfly. They have a more restricted host list than mexfly and the fumigation treatment effective against mexfly is also effective against these two flies.

The other fruit fly of regulatory significance in Latin America, A. grandis, has a restricted host list which includes cucurbits and occupies some of the same area in the Caribbean basin as do the medfly and the South American fruit fly. The EDB fumigation schedule effective against the aforementioned fruit flies is also believed effective against A. grandis.

The fruit flies of regulatory importance in the Caribbean island nations are the Caribbean fruit fly, A. suspensa; the West Indian fruit fly, A. obliqua (formerly A. mombin praeoptans); and the papaya fruit fly, Toxotrypana curvicauda. Their hosts lists are limited to tropical fruits. All three are present in Florida.¹

Although Japan and the state of California require EDB fumigation of citrus from Caribbean fruit fly infested areas, it is not considered of regulatory significance in citrus by USDA. Therefore, citrus from the Caribbean island nations, upon receipt of a permit from USDA, can enter the U.S. market without fumigation, except that citrus from Trinidad and Tobago is prohibited entry into the U.S. due to a black spot disease.²

Since melons and other cucurbits are no longer considered hosts of the medfly nor are they hosts for any of the Anastrepha spp. present in Central America and the Caribbean island nations, they do not require fumigation to meet U.S. plant quarantine requirements.

Reference to the United States does not include the U.S. possessions in the Caribbean. Mangoes from the West Indies, Jamaica and Dominican Republic are enterable into the Virgin Islands without treatment.

Several of the small island nations of the West Indies such as St. Vincent maintain they are free of the three fruit flies based on surveys conducted by Dr. Fred Bennett, Commonwealth Institute of Biological Control, and they have petitioned USDA for relief from the quarantine.

In the Latin America nations (Mexico, Central and South America) a curtailment of the use of EDB on exportations to the United States would impact immediately on citrus (except lemons and limes), mangoes and papaya, and planned future exportations of other tropical fruits such as carambola,

1 Fruit Flies of the Genus Anastrepha, A. Stone, USDA miscellaneous publication 439, 1942.

2 Recent studies indicate this is not a pathogenic form. (Personal communication, F. Cooper, USDA/APHIS.) Therefore, if USDA were to receive a new request to export citrus to the U.S. from Trinidad it would probably receive favorable consideration.

anona, and mamey among others.

In the Caribbean island nations, a curtailment of the use of EDB would presently impact heavily only on the exportation of mangoes. Moreover, several nations have reported the initiation or expansion of commercial plantings of other tropical fruits such as carambola, anona, sour sop, guava and various sapotes with an eye towards exportation to the United States. These fruits will also be affected by a suspension of EDB.

Papaya is not a host of the two Anastrepha species of regulatory significance in the Caribbean island nations. Papaya is a host of Toxotrypana curvicauda. However, since papaya is not a commercial crop in the continental United States and since the tropical fruit producing areas of south Florida are infested by T. curvicauda, papaya from the Caribbean island nations can enter the continental United States without EDB fumigation.

There is no Federal domestic quarantine to regulate the marketing of tropical fruit produced in south Florida to other parts of the continental United States. California maintains a state quarantine against these fruits due to the presence of A. suspensa and A. obliqua in south Florida. The fact-finding group questions the USDA requirement for EDB fumigation of tropical fruit from the Caribbean island nations when there is no federal quarantine on these fruits from south Florida.

A variety of other fruits and vegetables presently in export to the United States from Latin America and the Caribbean, such as yams and okra, require fumigation as a condition of entry to the United States because of insect pests other than fruit flies. However, these products are tolerant to methyl bromide and are not affected at the present time.

Other fruits and vegetables produced in the Caribbean Basin nations that are potential export commodities, such as tomatoes, peppers and eggplant, do not tolerate fumigation by either MeBr or EDB and thus have not found a market place in the United States. For these products to be marketed in the United States, alternative treatment methods, not presently available, would be required.

Operational EDB fumigation chambers in the Caribbean Basin nations which have USDA certification are located as follows: Haiti 7, Puerto Rico 1, Belize 1. Three additional chambers, that have been built to USDA specifications, but not yet certified by USDA since they are being used at

present for internal regulatory action, are located in Guatemala. Additional fumigation chambers are present in Costa Rica and El Salvador for regulatory purposes to allow product movement between nations of Central America. Whether these chambers meet USDA specifications and would be certifiable has not been determined.

Other chambers, in various stages of construction, proposed specifically for exports to the United States, but presently on hold awaiting a final decision on the continued use of EDB are located in Haiti 3, Dominican Republic 2, Costa Rica 1, and Jamaica 1. Nicaragua, Honduras and Guatemala have indicated an interest in EDB fumigation chamber construction, but as far as could be determined, no construction activity has yet been initiated.

The Andean Pact is financially supporting an EDB fumigation facility in each of its five member nations: Venezuela, Colombia, Ecuador, Peru and Bolivia. Design work has been completed, and at least in some instances construction is believed to be well under way.

Brazil recently completed the first of six proposed EDB fumigation facilities at Campinas Airport near Sao Paulo.

All of these chambers are being constructed in anticipation of export of tropical fruits, principally to the United States.

Most nations of the western hemisphere follow the lead of the United States with respect to pesticide use policy. Thus, a suspension of the use of EDB in the United States will likely result in suspension of its use in most other hemispheric nations. Not only will their exports to the United States be affected, but also exports to Canada and Japan that transit the United States, European exports and trade between neighboring western hemisphere nations which have dissimilar fruit fly and other pest complexes.

III. RESEARCH ON ALTERNATIVES

Research conducted to find alternatives to EDB is largely conducted by the Agriculture Research Service (ARS) of the United States Department of Agriculture (USDA). This ARS effort is principally channeled toward U.S. exports such as citrus and papaya, the internal (domestic) marketing of citrus among the citrus producing states, mangoes and papaya from U.S. possessions and the state of Hawaii to the continental United States. Some research can

be expected on the minor tropical fruits of south Florida such a guava, carambola and anona.

This research is centered at the Hawaiian fruit fly laboratory in Honolulu; the Sub-Tropical Research Stations at Miami, Florida and Mayaguez, Puerto Rico; and ARS laboratories in Weslaco, Texas and Fresno, California.

The tolerance of tropical fruits to the various possible alternatives such as irradiation, vapor heat, cold treatment, other fumigants and their combinations will vary by plant variety. Also, the ability of the target pests to tolerate the treatment will vary between genus and species. Therefore, a regulatory treatment developed in Hawaii against the medfly in mangoes may not be applicable to the medfly in sapotes in Central America. Nor can treatments developed in Florida to eliminate its Anastrepha sp. complex be assured of providing similar results for the Anastrepha and Ceratitidis complex in Central or South America. Therefore, USDA/APHIS cannot be expected to blanket approve for all situations the regulatory treatments developed only at United States locations. Likely they will require results of extensive testing by recognized researchers conducted on site in the various habitats within the Caribbean Basin nations.

There appear to be no short term viable alternatives to EDB fumigation for the regulatory treatment of tropical fruit. Tropical fruits do not tolerate methyl bromide treatment. Most tropical fruits ripen rapidly and thus have a short shelf life. Magnesium or aluminum phosphide fumigation requires 3 to 4 days in order to kill the target pest. The fumigation would further shorten shelf life and could make the product unmarketable from a quality standpoint. Tropical fruits will not tolerate the chilling requirements and time involved to eliminate the target pest through cold treatment (personal communications with Dr. M. Ouye and D. Spaulding, ARS). The equipment and technology is unavailable in the CBI nations nor is it expected that tropical fruits can withstand all presently approved hot water dips nor vapor heat treatment nor hot/cold combinations. Some modifications in present EDB fumigation practices such as fumigation in field boxes rather than commercial packs and a longer aeration period using forced air following fumigation could substantially reduce but not completely eliminate EDB residue levels in treated fruit.

For the longer term the development of new, effective and non-mutagenic or carcinogenic fumigants holds some promise.

Fruit irradiation also holds high promise and will undoubtedly receive wide use in the future. The team believes that major effort should be directed by AID at postharvest irradiation in the development of acceptable regulatory treatments of exportable agricultural crops from tropical regions and other nonchemical regulatory treatments that can be accurately monitored through instrumentation and thus reduce the need for APHIS supervision of treatments in-country.

IV. ANTICIPATED NEAR-TERM REGULATORY ACTIONS ON IMPORTED TROPICAL FRUIT

The Environmental Protection Agency establishes official residue tolerances for pesticides on raw agricultural commodities under Section 408 of the Federal Food, Drug, and Cosmetic Act. Only citrus, mango and papaya are under consideration of EDB tolerances at this time (Feb. 1984).

The Food and Drug Administration is responsible for the enforcement of official pesticide tolerances. Where there are no official tolerances on specific fruits, the FDA is guided by administrative "action levels" (personal communication with Dr. W. Klassen, ARS). No tolerances or action levels are in effect for EDB in fruits at this time.

The FDA Field Districts' actions on pesticide residues in commodities at ports of entry or interstate commerce are guided by "compliance programs" which are issued by FDA Washington headquarters to district offices. The applicable compliance program for EDB on tropical fruits is dated February 3, 1984. This program is of some importance in estimating the immediate economic impact on CBI countries exporting tropical fruit to the U.S. The FDA compliance program of February 3, 1984 instructs district offices to sample and analyze unspecified varieties of "tropical fruit" at continental U.S. entry ports, including Los Angeles which is to examine Hawaiian papaya. The program states that no regulatory action on tropical fruit can be taken by FDA on the basis of EDB residues because EDB residues do not presently constitute a violation of the FFD & C Act. This presumably is based on an interpretation that the existing dietary exposure to EDB is controlled by the original official tolerances for inorganic bromides resulting from U.S. plant quarantine fumigations with EDB (CFR-40, part 180.3).

The significance of this interpretation is that EDB fumigated fruit can continue to be imported into the U.S. until such time as EPA announces official tolerances on specific fruit or revokes the existing inorganic bromide tolerances. This interpretation was confirmed in a conversation February 27, 1984 with John Wessel, Office of Assistant Commissioner for Compliance, FDA.

No benefit would accrue to papaya or citrus export from the above interpretation because an EDB tolerance of 30 ppb appears imminent on these commodities. However, other fumigated tropical fruit exports could continue to move into the U.S., and some breathing time could be realized for mangoes (present information is that EPA will delay action until additional research is completed on depletion of residues on mangoes).

The immediate economic impact on CBI exporting countries will, therefore, derive from the pending EPA tolerance of 30 ppb on papaya and citrus. Of these two crops, citrus will be of minor concern because (a) certain citrus varieties do not require fumigation, (b) MeBr is a possible interim substitute for EDB on some varieties, (c) citrus can be held for longer aeration periods, and (d) present volumes of trade in citrus.

Major concern for immediate economic impact therefore centers on papaya. The team has been advised that the 30 ppb contemplated by EPA is based on assurance by APHIS that a treatment has been devised for Hawaiian plant quarantine purposes that employs reduced EDB dosages in conjunction with a hot water dip. However, it is the opinion of the team that this treatment could not be adopted in CBI countries because of (a) varietal differences, (b) pest differences, and (c) available equipment. Therefore, the team emphasizes that the contemplated EPA tolerance of 30 ppb for papaya could not be met under CBI conditions and will cause serious economic hardships on CBI area exporters.

Tolerances established by EPA under Section 408(e), "on the initiative of the Administrator", require a 30-day period for comment after publication in the Federal Register before becoming effective. Assuming that efforts to obtain a higher tolerance level before the EPA announcement will not prevail, U.S. AID should make known the specific needs for a higher tolerance on papaya during the comment period. Argument should center on the use of a lower diet factor for papaya (and tropical fruits in general) in the risk assessment process, i.e. dietary exposure equivalency to the 30 ppb for finished grain

products which was deemed adequate to protect the public health (EPA Decision Document 2/3/84). The diet factor for grain products is 10%, which assumes that the total diet of the general U.S. population comprises 10% grain products. The citrus diet factor is about 2%. Figures on consumption of tropical fruits in the U.S. are not readily available. However, on a national basis they would certainly be less than 0.1%. On simple equivalency to the tolerance of 30 ppb on ready-to-eat grain products, a tolerance of 150 ppb could be supported for citrus and about 300 ppb on papaya. Consumption of tropical fruits is higher in Hawaii, Puerto Rico, and other tropical fruit sources. However, diet exposure would be insignificant because only export fruit are normally fumigated.

All USDA certified fumigation chambers in the CBI nations have now been equipped with a closed system fumigant injection system to appreciably reduce worker exposure during volatilization of the fumigant. It is estimated that use of respirators can further reduce worker exposure by 90%. (Ethylene Dibromide Position Document Number 4, Office of Pesticide Programs, U.S. Environmental Protection Agency, September 27, 1983.) Fumigation in the CBI nations for products in export to the United States is supervised by USDA/APHIS, so such precautionary measures can be enforced.

V. EVALUATION OF REGIONAL LABORATORY FACILITIES FOR CHEMICAL ANALYSES OF FRUIT SHIPMENTS

The tolerances to be established by EPA will be as low as possible from the standpoint of public health. Research is now (or shortly will be) under way to determine how present EDB fumigation treatments can be modified to reduce residues. Under any compromise, it is likely that some shipments may exceed the tolerance. The team was asked to survey laboratories for capability of EDB analyses of fruits before shipment.

The only CBI area laboratory found to have the required capability was the Inciensa Laboratorio de Alimentos at Tres Rios, Costa Rica. However, there may be others that were not visited such as ICIATI and INCAP in Guatemala. The laboratory in Costa Rica was visited on February 24 and discussions held with Dr. Rafael Murillo. Dr. Murillo presently does analyses of Costa Rican meat exports for the Ministry of Agriculture in a self certification program

for steroids and pesticide residues (organochlorine and phosphated insecticides which are detected by the FDA multi-residue method). He was enthusiastic about expanding operations to include fruit for EDB residues if such a program is required. The team furnished the analytical method of choice for EDB to Dr. Murillo. This laboratory has excellent facilities and staff, and would be capable of carrying out a type of certification analysis on a national or regional basis. Some funding would probably have to be provided.

Official tolerances are normally set on a whole fruit basis. There is precedent for certain exceptions to this, e.g. "x ppm on bananas of which no more than y ppm shall be in the edible pulp". As far as can be determined, no tolerances have been expressed in that manner for citrus, papaya, or mangoes. Available data on distribution of residues in mango and papaya suggest that residues are much lower in the edible pulp. It is suggested that the tolerances for these commodities be set on edible pulp (as well as whole fruit basis) to assure that dietary intake is not exaggerated in the risk assessment process.

AID provides funds, through CICIP, to an analytical laboratory for pesticide residue analyses at the University of Miami (Perrine) under Bruce Mann. This laboratory has the capability to perform a similar function if logistics on sample shipping and analyses can be worked out. It is important to note that holding time for tropical fruit after fumigation is very short and transmission of samples and analytical results would have to be rapid.

If it becomes feasible to set up national or regional laboratories for certification of export fruits, the analytical method of choice would probably be the "Clower Method" described in FDA Laboratory Information Bulletin No. 2338C. The method has a sensitivity of 1 ppb EDB on citrus and is simple and straightforward, requiring no exotic equipment. Several other methods are also available for EDB residues in fruits.

VI. ECONOMIC IMPACT - COMMENTS

Belize and Haiti are examples, supported by data from USDA and local exporters, of growth in exports of EDB treated tropical produce. From 1982 through 1983, exports of mangoes from Haiti have increased by some 28 percent.

Belize is expecting mango exports to more than double this year over the 664 MT exported in 1983, and possibly triple by 1984 (1800-2000 MT, worth an estimated U.S. \$2.2 million). Haiti advised that U.S. \$5 million should be realized from mango exports alone in 1984. Similar trends were indicated for many other CBI countries - examples:

Costa Rica - citrus and mango projects. Mango exports should exceed 320 MT this year, also there are new joint venture citrus (oranges) plans with foreign capital participation. Papaya exports, only insignificant tonnage to date, are expected to reach 4500 MT by 1988.

Jamaica - Agro-21 has 3000 additional acres of mangoes in a three-year plan along with citrus and papaya expansion.

Honduras - orange and grapefruit joint ventures, some involving juice extraction, all with emphasis on exports. Present north coast orange production of 250 million units should increase by 40-50 percent within four years.

Belize - over 1100 acres (32,000 trees) of improved varieties constitute the major portion of Belize's exportable mangoes. This small, new industry of a small country (population 150,000) absorbed the cost of an EDB chamber designed and approved by USDA/APHIS.

Dominican Republic - 500,000 kgs of mangoes for export to U.S. anticipated for 1984, increasing to 2 million kgs in 1986.

Note: Cost of all chambers presently in operation throughout the Caribbean Basin and Mexico have been absorbed by the industry.

These are only a few examples, and interest in the CBI program is widespread throughout the Caribbean Basin. Some of these projects are AID assisted, most had as their major incentive the benefits of the CBI program. Although some of these new CBI projects are in final planning, development or early operational phase, substantial R and D expenses, agronomic and quality improvement expenses along with EDB chambers and related capital expenses, were encouraged again by AID and CBI programs.

Crop	World Production	Caribbean Production	Percent
Citrus	49 million tonnes	270,000 tonnes	0.5
Mango	13 million tonnes	200,000 tonnes	1.5
Avocado	1.22 million tonnes	20-25,000 tonnes	2.0
Papaya	1.24 million tonnes	15,000 tonnes	1.0
Guava	450 thousand tonnes	n/a	n/a
Cashew	540 thousand tonnes	n/a	n/a

In spite of the relative insignificance of most of the region's fruit crops, their consumption in recent years has grown from mere curiosity, through demand as exotics, to genuine preference.

As the following table shows, most Caribbean tree fruits contain higher vitamin contents than temperate zone fruits. In addition these tropical fruits have unusually high mineral contents: viz, calcium, phosphorus and iron.

Fruit	Calories	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Vitamin C (IU)	Phosphorous (mg)
Orange ¹	53	0.8	22.0	0.5	10	50	na
Banana ¹	116	1.0	7.0	0.5	100	10	na
Mango ¹	63	0.5	10.0	0.5	600	30	16
Avocado ¹	165	1.5	10.0	1.0	200	15	na
Guava ¹	58	1.0	15.0	1.0	200	200	28
Papaya ¹	39	0.6	20.0	0.5	1,000	50	15
Cashew ¹	590	20.0	50.0	5.0	40	5	na
W.I. Cherry ¹	36	1.5	8.7	0.2	1,017	1,500	16
Passion Fruit ²	51	0.7	3.6	0.2	717	30	12
Soursop ²	64	1.7	8.8	0.8	na	20	29
Tamarind ²	272	3.1	54.0	2.0	5	10	27
Apple ³	58	0.3	6.0	0.4	5	6	na
Peach ³	38	0.6	9.0	0.5	135	7	na

Sources:

- 1 Tropical Fruits by J.A. Samson, Longmans, London (1980)
- 2 Tropical and Sub-Tropical Fruits by S. Nagy and P.E. Shaw, AVI Publ. Conn., U.S.A. (1980)
- 3 Food Composition Tables, Caribbean Food and Nutr. Inst., Jamaica (1974)

This information is utilized in further promoting the utilization of the tree fruits, both within and outside the Caribbean region. As the team was told by the Assistant Minister of Agriculture in Costa Rica, scientists, producers, politicians and exporters from Caribbean countries represented at Postharvest Technology and Export Strategies for Perishable Caribbean Crops Conference in Kingston and technical personnel at Instituto Interamericano de Cooperacion para la Agricultura (IICA), "any decision by the U.S. government which would result in an embargo on these major exports from the Caribbean Basin countries would bankrupt the CBI program. As no alternatives can be offered by agencies of the U.S. government at this time, such a decision is incomprehensible". It is widely known that U.S. government agencies have been assisting these LDCs with projects having as their priority "increases in agricultural production/quality and emphasis on exports" - the U.S. market being their number one outlet. A decision on EDB which would immediately restrict Caribbean Basin exports of citrus, mangoes and papaya would cause obvious financial losses and be considered as highly inconsistent with previous policy - yet another negative reaction could be political in this most unstable area. Time is needed to research alternative chemicals and or methods for fruits and vegetables now requiring fumigation with EDB. At least a two-year period with "acceptable to industry" tolerance levels is strongly suggested. After two years, alternatives should be in place to be offered to CBI and other affected countries.

CBI

MANGOES

Origin	01/82-12/82 MT	01/83-12/83 MT	01/82-12/82 Values in 1000 U.S. \$	01/83-12/83
<hr/>				
CARIBBEAN:				
Jamaica	36	12	22	8
Haiti	4,848	6,194	2,452	3,392
Dominican Republic	70	161	19	69
Leeward Islands	2	0	2	0
	<hr/>			
SUBTOTAL	4,956	6,367	2,469	3,469
CENTRAL AMERICA:				
Belize	10	664	0	338
Honduras	0	11	0	6
	<hr/>			
SUBTOTAL	0	675	0	344
	<hr/>			
TOTAL	4,956	7,042	2,469	3,813

Source: "U.S. Agricultural Imports-Period: January 1982-December 1983"
USDA/FAS/H&TP

CBI

EDB CITRUS

(Grapefruit, oranges, tangerines, and 'other' citrus)

Origin	01/82-12/82 MT	01/83-12/83 MT	01/82-12/82 Values in 1000 U.S. \$	01/83-12/83
CARIBBEAN:				
Bahamas	0	56	0	5
Jamaica	372	494	104	281
Haiti	8	11	4	5
Dominican Republic	39	511	10	100
Trinidad-Tobago	0	2	0	1
SUBTOTAL	419	1,074	118	391
CENTRAL AMERICA:				
Honduras	204	0	28	0
Costa Rica	16	0	4	0
SUBTOTAL	220	0	32	0
TOTAL	639	1,074	150	391

Source: "U.S. Agricultural Imports-Period: January 1982-December 1983"
USDA/FAS/H&TP

CBI

PAPAYA

Origin	01/82-12/82 MT	01/83-12/83 MT	01/82-12/82 Values in 1000 U.S. \$	01/83-12/83
<hr/>				
CARIBBEAN:				
Bahamas	13	32	13,196	11,932
Jamaica	1	0	877	0
Haiti	0	2	0	1,500
Dominican Republic	32	23	9,524	6,091
	<hr/>			
SUBTOTAL	46	57	23,597	19,523
CENTRAL AMERICA:				
Costa Rica	1	23	418	10,883
	<hr/>			
TOTAL	47	80	24,015	30,406

Source: "U.S. Agricultural Imports-Period: January 1982-December 1983"
USDA/FAS/H&TP

CENTRAL AMERICAN AND CARIBBEAN PRODUCTION

Products	1969-71	1979	1980	1981
Mangoes	552	681	683	696
Oranges	563	698	841	888
Mandarins	31	31	50	46
Lemons/Limes	95	114	118	122
Grapefruit	n/a	n/a	n/a	n/a

Includes: Antigua, Bahamas, Belize, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Honduras, Jamaica, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent, Trinidad and Tobago.

Source: IICA

Jamaica, in its official protest from the Minister of Agriculture asked:

1. to extend the use of EDB until viable alternatives are available,
2. for assistance with alternative methods once available, and
3. for assistance with caribfly eradication programs.

Words most often heard at the Kingston Conference and at the team's meetings in Costa Rica to describe pending action on EDB were "trade barrier", "embargo", "nullification of CBI".

Food processing of mangoes or papaya is not considered feasible because present market demands for mango by-products, principally chutney, are very limited. The papaya fresh market itself is small although increasing rapidly. Demands for papaya juice, jellies or canned sections (mix sections - fruit salad types - Mexico has the bulk of this market) are most limited. Papain is not considered a by-product but is really a separate industry. Papain is made by drying the latex exuding from light scratches made in the rind of unripe but nearly mature papaya fruit. Papain yields are reported to be 60 to 120 pounds per acre.

VII. CONCLUSIONS

1. Although the planned EPA restrictions would have a relatively small economic impact on the Caribbean Basin Initiative (CBI) countries as a whole, the immediate economic impact for smaller countries, such as Belize, Haiti and Costa Rica would be very serious. The restrictions would curtail not only exports from these countries to the U.S., but also inter-regional commerce as other countries followed EPA's lead. Processing of large amounts of affected mango and papaya is not a viable solution. While irradiation is not an immediate short-term alternative, feasibility studies to assess its possible use should be initiated at the earliest possible date.

2. The tolerance level of 30 ppb in papaya (edible pulp) contemplated by EPA at this writing would be too low for fumigated fruit arriving at U.S. ports from CBI countries.

3. Under current FDA policy (Compliance Program of February 3, 1984), fumigated fruit imports would be allowed to enter until the EPA establishes an official tolerance level for EDB or revokes the existing inorganic bromide tolerances.

VIII. RECOMMENDATIONS

1. AID, through the Department of State, should advocate the extension of a finite tolerance level for papaya beyond September 1, 1984. This position should be stated during the 30-day comment period which follows the EPA announcement of proposed interim EDB tolerances for citrus and other tropical fruits. Although the tolerance level should adequately protect the U.S. consumer, it would also be sufficient to permit the continuation of present exports and proposed increased exports of citrus and tropical fruits from CBI nations to the U.S. The tolerance levels should remain in effect until suitable alternatives are developed and in place.

2. It is recommended that AID support research to construct residue decline curves on EDB in tropical fruits, particularly papaya and mangoes. As

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part of this process, AID, in cooperation with USDA/ARS, should develop a research plant for data gathering and assist with data analysis. To ensure that Haitian mangoes are of export quality, AID should work with USDA/APHIS. To obtain export-quality mangoes from Costa Rica or other Central American or northern South American nations where mangoes may be readily available, AID should work with IICA. If the research plan for developing a residue decline curve involves fumigation in the country-of-origin, AID, along with USDA/APHIS and IICA, should ensure that this work is carried out by technically qualified personnel acceptable to both USDA and EPA. Since this data is necessary for influencing EPA's decision on EDB tolerance, the work must be completed within the 30-day comment period following publication in the Federal Register.

3. It is recommended that AID initiate studies to do the following:
 - A. Document current and planned agricultural production of all types of fruits and vegetables that have export potential.
 - B. Identify the specific agricultural commodities that will require quarantine treatment.
 - C. Determine the feasibility of developing techniques and procedures that will enable the CBI nations in the long-term to meet quarantine requirements of the United States, Europe and Canada. This study should analyze possible alternatives to both ethylene dibromide and methyl bromide fumigation, such as vapor heat, hot water dips, cold treatment, and other fumigants such as hydrogen cyanide, carbon disulfide, phosphine, and cobalt or cesium irradiation (discussed separately below). The analysis should consider the effect of various treatments on food appearance and quality, shelf life and degree of insect mortality. Also, in the case of regional treatment facilities, transportation logistics should be considered and in the case of pesticides, the rate of pesticide degradation should be studied.
 - D. Explore the feasibility of establishing a model cesium

irradiation facility that would be commercial-size and serve regional needs. Such a facility should be located in a country that is relatively stable and more-or-less typical, both geographically and otherwise. Since the fruit fly problem is more complex in Central America than in the Caribbean island nations, it is recommended that a Central American nation be selected for the site of a feasibility study. Other factors to be considered in selecting a site include the availability of the following:

- a. A well-trained cadre of mid-level technicians to serve as host country collaborators.
- b. A food technology laboratory conducive to analysis of the effect of irradiation on food quality and marketability.
- c. Sufficient volume of export quality crops.
- d. Adequate port facilities and a central location that is readily accessible by means of the region's normal transportation routes.
- e. An active and responsive nuclear energy agency.

The urgency of initiating this activity cannot be overemphasized.

4. AID should immediately request that USDA/APHIS reassess quarantine requirements for tropical fruit (except citrus and papaya) imported into the continental United States from the Caribbean island nations. It is difficult to accept the USDA position that a quarantine is needed. The quarantine was established before 1965 when Anastrepha suspensa was not known to occur in Florida. Now, however, A. suspensa is firmly established in Florida as are two other fruit flies, A. obliqua and I. curvicauda, which are found in the Caribbean island nations and are the object of regulations. There has been no Federal domestic quarantine to restrict the marketing of fly hosts grown in Florida, e.g. mango, citrus, carambola, guava and anona, to non-host producing areas of the United States. Restriction of fly hosts into host-producing states is governed though state quarantine. Because A. suspensa is established in Florida, the quarantine maintains a double standard of

application -- one for domestic production and a second for imported products. This violates sound biological principles. Elimination of this double standard would eliminate the need for EDB fumigation of tropical fruits from the Caribbean islands and allow these nations to proceed with their present export production as well as planned expansion of tropical fruit exports.

5. AID should encourage Trinidad and Tobago to request USDA to permit entry of their citrus exports to the U.S. on the basis that the black spot disease of citrus found in Trinidad and Tobago is apparently non-pathogenic.

6. AID missions should encourage CBI nations that export okra to the U.S. to ask the USDA to revise methyl bromide treatment requirements imposed for CBI nations so that they parallel restrictions on Mexican okra. Mexican okra is allowed to enter the United States in the winter months without fumigation. Since the same insect pest is involved in okra exports of both the CBI nations and Mexico, the CBI nations should petition for similar quarantine relief.

IX. APPENDICES

Appendix A

Food Irradiation by Jack Sivinski

Food irradiation, although one of the promising options, falls into the category of long-term options. There are two major causes for this. First, the Food and Drug Administration proposal of February 14, 1984 has a sixty-day comment period and then an indeterminate time will be required for review of the comments and the formulation of the final regulation for promulgation at some time in the future. How long this will take is difficult to predict, since the 1981 notice of intent to propose in the Federal Register had a comment period which eventually was extended to 180 days, and then getting the proposed regulation out, dragged out into February 1984. Certainly not a very timely response to the comment period in 1981.

One must realize that until the final Food and Drug Administration proclamation is published it will be reasonably difficult to attract venture capital for the facilities needed worldwide to develop the technology as needed. The second major cause is that the time required for construction and licensing is normally expected to run up to two years. This is certainly different than constructing a fumigation chamber in a matter of a month or two. It appears doubtful to me that these times will be shortened significantly unless major cooperative efforts between various government agencies are used to grease the skids for implementation of the technology and construction of the facilities.

Both the long and short term problems have three major components: technical feasibility, economic feasibility, and institutional issues, such as consumer acceptance or marketability, sovereign state rules and regulations which may or may not follow the Food and Drug Administration regulations, the Codex Alimentarius, International Atomic Energy Agency, etc., which allow or sanction the various technologies including the irradiation.

In order to cope with the three issues for both the long and short term, a feasibility study, quickly organized and efficiently executed should have the highest priority. Issues to be addressed in this study are the short-term options and their technical, economic and institutional issue feasibilities,

such as cold storage, vapor heat treatment, continued use in the short term of ethylene dibromide if a tolerance is promulgated by the Environmental Protection Agency and an extension which might be granted, methyl bromide fumigation, conversion of the EDB chambers for methyl bromide use, other fumigant efficacies, etc. This study will determine what needs to be done in terms of efficacy, phytotoxicity, marketing changes, etc.

Obviously such studies cannot be done in all Caribbean Basin Initiative countries simultaneously, therefore we must optimize the study site where a minimum parameter tweaking will be required to use the results effectively in all Caribbean Basin Initiative countries. This means that the commodity studied should be applicable to most countries, the pest studies should apply to all countries. Prudence demands that the long view also be studied simultaneously and as part of the short-term solution phasing into the long-term solutions. Because irradiation takes so long we must start now in order to have this technology option available at the right time or we will be in the same dire straits as we are now with ethylene dibromide.

Appendix B
Proposed Budget for Recommendation 2 and 3

The team believes these short term costs would amount as follows:

1. Initial research planning meeting to be held in Costa Rica with representatives from AID, EPA, USDA, IICA and selected representatives from the principal exporting nations of the CBI such as Costa Rica, Haiti, Colombia, Venezuela, Dominican Republic, Honduras, and Jamaica.
Cost \$ 30,000.00
2. Analytical work to be conducted at the Sub-tropical Research Station, USDA/ARS, Miami, Florida, in cooperation with the University of Miami.
Cost \$ 50,000.00
3. Conduct research on alternatives - short term.
Personnel including travel \$ 65,000.00
Equipment and materials \$ 50,000.00
4. Feasibility study regarding the establishment of a regional, commercial size, pilot food-irradiation facility.
Cost \$ 100,000.00
5. Documentation of current and planned agricultural commodity production that has export potential and identification of the specific agricultural commodities that will require quarantine treatment.
Cost \$ 25,000.00

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