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# Sapote Fruit Fly Cooperative Eradication Program

## Lower Rio Grande Valley, Texas

## Environmental Assessment
February 2003

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**Agency Contact:**

Stephen A. Knight
Senior Staff Officer
Invasive Species and Pest Management
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 134
Riverdale, MD 20737
Telephone: 301-734-8039


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# I. Introduction

On January 6, 2003, an adult sapote fruit fly, *Anastrepha serpentina* (Wiedemann), was detected in a McPhail trap located south of McAllen in Hidalgo County in a grapefruit orchard. Since then, five additional sapote fruit flies have been collected from traps in Hidalgo County. There have also been a number of detections in adjacent areas of Mexico. The sapote fruit fly is native to Mexico and is a major pest of agriculture throughout many parts of Central and South America. Commercial and home-grown produce that is attacked by the pest is unfit to eat because the larvae tunnel through the fleshy part of the fruit, damaging the fruit and subjecting it to decay from bacteria and fungi. Because of its wide host range (over 28 species of fruits) and its potential for damage, a permanent infestation of sapote fruit fly would be disastrous to agricultural production in the United States. In the past, eradication programs have been implemented successfully that have prevented the pest from becoming established permanently on the U.S. mainland.

# II. Purpose and Need

Sapote fruit fly populations in Mexico represent a periodic threat to the agricultural production areas of the Lower Rio Grande Valley in southern Texas. The recent frequency and proximity of detections of sapote fruit fly in Hidalgo County has been determined to indicate an infestation that threatens to become established and spread to other citrus growing areas of Texas as well as other parts of the United States. The Animal and Plant Health Inspection Service (APHIS), therefore, has proposed a cooperative eradication program to be implemented by APHIS and the Texas Department of Agriculture (TDA) that will include the use of quarantines and treatment efforts to eradicate the sapote fruit fly from the Lower Rio Grande Valley of Texas. To the extent possible, the program will include coordinated control activities in adjacent portions of Mexico; these activities will be accomplished under authority of the government of Mexico.

APHIS' authority to implement and/or cooperate in the proposed program is based upon the Organic Act (7 United States Code (U.S.C.) 147a), which authorizes the Secretary of Agriculture to carry out operations to eradicate insect pests, and the Plant Protection Act (Title 4 of the Agricultural Risk Protection Act of 2000), which authorizes the Secretary of Agriculture to use emergency measures to prevent dissemination of plant pests new to or not widely distributed throughout the United States. The U.S. Environmental Protection Agency has granted registrations under section 3 and quarantine exemptions under the provisions of section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, for the proposed use patterns of these pesticides applied in quarantine programs against exotic fruit fly species in Texas.

This environmental assessment has been completed in compliance with the National Environmental Policy Act of 1969 (NEPA) and to the extent that international activities may be applicable, Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions."

# III. Alternatives

Two alternatives were considered with relation to the need for effective and rapid response to the sapote fruit fly infestation in the Lower Rio Grande Valley region of southern Texas: taking no action or implementing a cooperative eradication program with TDA.

## A. No Action

The no action alternative would be characterized by no efforts by APHIS to control or eradicate the sapote fruit fly infestations detected in Texas. APHIS could continue to provide technical assistance and advice. APHIS could also continue to assist with trapping and monitoring of pest infestations. This alternative would provide no assistance to growers whose losses of produce could be considerable and whose inability to sell produce from the potentially infested areas would be a devastating loss. This alternative would not prevent any actions by TDA, local governments, or local growers to control and eradicate the current infestation. However, the lack of Federal assistance in any eradication efforts could severely limit their success or result in delays in achieving eradication of sapote fruit fly from the Lower Rio Grande Valley.

Any inadequate efforts to eradicate this invasive pest species would be expected to result in a steadily increasing infestation and spread to new locations that are not presently infested. Previous spread of fruit fly species without adequate Federal involvement has resulted in greater damage to host fruits from those species and greater use of pesticides to control them. In the absence of a Federal quarantine regulating movement of host fruits, the sapote fruit fly infestation would be expected to expand readily as the adult flies disseminate from the original area of introduction. This expansion would be expected to occur through both natural dispersal of flies and human spread through movement of infested host fruits. Timely efforts to eradicate small infestations are known to be more effective and less devastating to fruit production and the environment than no action or delayed efforts.

Establishment of the sapote fruit fly would be expected to lead to increased damage to crops and backyard produce, uncoordinated use of insecticides to control that damage, and increased environmental risks from those insecticide applications. The potential adverse impacts from this alternative would be expected to be considerably greater than from the proposed program.

## B. Proposed Cooperative Eradication Program

The proposed cooperative eradication program will continue the technical assistance and advice as well as the assistance with trapping and monitoring of sapote fruit fly populations provided presently and included under the no action alternative. This alternative establishes a quarantine zone for host fruit in the infested areas of Hidalgo County and establishes criteria for declaration of an infestation and associated treatment requirements. Most of the emergency quarantine measures are designed to eliminate the pest risks and to regulate potentially infested commodities to prevent artificial spread of sapote fruit flies. Quarantined articles include the fruit or berries of host plants of the sapote fruit fly. These quarantined articles are prohibited movement from the quarantine area except for certain commercial loads subject to specific handling and treatment procedures in accord with a compliance agreement. These procedures may involve field applications of bait sprays, fumigation of produce, or regulated transport of produce to facilities for juice production. In addition to regulation of host plants in the quarantine zone of Hidalgo County, any shipments of mangoes from Mexico entering this zone will be required to be hot water treated and safeguarded under a compliance agreement.

In Hidalgo Counties, where wild sapote fruit flies have been detected, APHIS and TDA have designated a quarantine area based upon delimitation of the present infestation. The proposed area encompasses 224 square miles and includes parts of Alamo, Donna, Hidalgo, Lopezville, Mission, McAllen, Pharr, San Juan, and Weslaco. Continuing trapping may detect further spread of the sapote fruit fly infestation into surrounding areas including parts of nearby Cameron County. Any expansion of the infestation would require some adjustment of the borders of the quarantine area. The intent of establishing the quarantine zone is to prevent artificial spread of the flies, but eradication measures must be taken within this zone in a timely manner to preclude movement of flies into adjacent areas. Other than restrictions placed on growers and movement of backyard produce, quarantine requirements apply to citrus packing sheds, gift fruit companies, produce warehouses, grocery stores, flea markets, open air markets, McAllen International Airport, and other transporters (*e.g.*, post office). The required fumigation and safeguarding of produce are designed to preclude artificial movement of flies in potentially infested produce.

The field applications of bait sprays serve to both preclude artificial movement and lower pest levels to facilitate eradication. Field treatments of potentially infested groves with malathion or spinosad bait spray will employ a protocol for a combination of aerial and ground applications of the insecticides which have been found to be highly effective against the sapote fruit fly. Treatments will be required for host plants of the sapote fruit fly within the quarantine zone for at least a 30 day period prior to harvest and continuing until harvest is complete or for the duration of quarantine. The treatments during this period will occur at a 10-day interval, depending upon the length of fly generations and acceptable weather conditions for pesticide application. The formulation of malathion bait applications used in the program is 0.175 pounds (1.2 fluid ounces) of active ingredient per acre mixed with 9.6 fluid ounces of protein hydrolysate bait per acre, for both aerial and ground applications. Aerial applications will be conducted primarily for grove situations. Ground applications will be conducted for locations close to sensitive sites and residential areas. For spinosad, the application rate will be 52 ounces of formulated product per acre. If the detection site and projected treatment area involve houses, program personnel will consult with the Aircraft and Equipment Operations unit to determine what part of the treatment area must be treated by ground application equipment.

The primary environmental consequences of the proposed program relate to impacts from the bait spray applications. Timely applications do eliminate the pest risk from sapote fruit flies and thereby decrease the damage to host plant fruit. This also prevents expansion of the infestation with associated adverse effects to host plants and the environment. The placement and timing of the pesticide applications are designed to maximize control of the sapote fruit fly and minimize unintended impacts to nontarget wildlife and the environment. Site-specific mitigations will be applied near sensitive sites and residential areas to minimize potential exposures and associated risks. The potential adverse environmental impacts from actions taken from a coordinated eradication program are considerably lower than and of less persistent duration than the potential impacts resulting from no action.

Program personnel will notify the public (via English and Spanish fliers), the local police, and the public health authorities of the treatments. They will notify area beekeepers of the treatments. Program personnel also will be responsible for monitoring the treatment sites and detection trapping after the treatments.

# IV. Affected Environment and Potential Environmental Consequences

## A. Affected Environment

The affected environment includes areas of the Lower Rio Grande Valley of Texas near the Mexican border where sapote fruit fly detections were made. This will occur most likely include citrus groves or backyard plantings. Although the recent detections have all occurred in Hidalgo County, adjacent counties such as Cameron County could also have infestations not yet detected by the program. The Lower Rio Grande Valley consists of plains areas and various water bodies associated with the Rio Grande River. The current program area is primarily suburban and rural in character. There are, however, several small cities including Brownsville and Harlingen near the potential program area.

Detections of sapote fruit fly in this area have occurred in and near the fruit orchards. Applications to control fly outbreaks in these areas are often made by aerial application. There areas are known to be adjacent to residential areas. Some of the adjacent subdivisions (colonias) are inhabited by individuals of Mexican origin with limited financial resources. Many of the colonias have weak housing construction and lack an adequate source of clean drinking water. These conditions adjacent to program sites make it necessary to assess conditions to ensure that the low-income residents of these colonias are not disproportionately affected by program actions.

There are several natural areas primarily associated with the Rio Grande River and the Gulf of Mexico. This includes the Laguna Atascosa National Wildlife Refuge, the Santa Ana National Wildlife Refuge, the Bentsen-Rio Grande Valley State Park, and the Rio Grande National Wildlife Refuge. These protected areas are home to a number of endangered and threatened species of wildlife.

## B. Potential Environmental Consequences

The analysis of potential environmental consequences will consider the alternatives of no action and the proposed cooperative eradication program. Because the principal environmental concern over this program relates to its use of chemical pesticides, this assessment will focus on the potential environmental consequences of the pesticide applications on human health, nontarget species, and endangered and threatened species.

## 1. No Action

Under the no action (no APHIS effort) alternative, sapote fruit fly control would continue through the efforts of growers to prevent losses to the fruit production in their groves. APHIS could provide technical advice and assistance under this alternative, but there would be no control actions or financial support provided by APHIS.

Monitoring of fly populations suggests that this approach allows residential infestations of sapote fruit fly to continue and threatens the crops with greater infestations. A heavy infestation could ultimately lead to spread of sapote fruit fly and intensive pesticide application by the State, grower groups, or individuals. Any response to control such an expanded infestation by individuals or organizations would probably result in a greater magnitude of environmental impact than would be associated with the cooperative eradication program proposed to be coordinated by APHIS. Under those conditions, any available controls (including more hazardous chemical pesticides) could be used, resulting in greater environmental impact than is associated with the action alternative analyzed within this assessment.

### a. Human Health

Under the no action alternative, APHIS would continue to monitor feral flies in commercial groves and provide technical assistance, but would take no control actions. Private homeowners and commercial growers would have few options other than pesticides to reduce the sapote fruit fly damage to their crops if the State and local program were ineffective. Any pesticides registered for use could be applied in an unsupervised and uncoordinated manner. Accordingly, greater pesticide amounts and higher frequencies of application are likely to be used than would be expected with a coordinated, cooperative government program. In addition to the direct toxic effects of those pesticides, humans could also be affected by cumulative impacts resulting from synergistic effects of combining various pesticides for use against sapote fruit fly. Human exposure to pesticides and the resulting adverse consequences probably would be greater than if pesticides were applied in a cooperative government program. The spread of the sapote fruit fly infestation would reduce the amount of locally available produce and may restrict the fruit consumption of some members of the public. Some members of the public may depend upon this source of fruit as a substantial portion of their diet.

### b. Nontarget Species

Broader pesticide use resulting from ineffective efforts to combat sapote fruit fly would increase the pesticide load to the environment and, therefore, increase the probability of effects to nontarget species. The potential expansion and establishment of the pest also would have unknown effects on insect community structure and on predators in those systems. Coordinated efforts by APHIS as described in the cooperative eradication program would limit the effects to nontarget species to those locations where control is needed and would prevent excessive use of insecticide that would be expected without a coordinated approach.

#### c. Endangered and Threatened Species

Further expansion of the sapote fruit fly's range would be likely to include endangered and threatened species habitats, with unquantified risk to those species from uncoordinated pesticide use. No adverse impacts to endangered or threatened species would result directly from APHIS' implementation of the no action alternative.

### 2. Proposed Cooperative Eradication Program

The proposed cooperative eradication program will continue to provide technical assistance and monitor the sapote fruit flies in areas of the Lower Rio Grande Valley as described in the no action alternative. The potential reduction in damage from eradication of fruit flies under this alternative is considerable. In Hidalgo County, where detections of wild sapote fruit flies have been detected, APHIS and TDA will employ a protocol for applications of quarantine treatments and bait spray applications for eradication of the present infestation.

The component of the proposed program which potentially has the greatest impact on the environment is the use of chemical pesticides. Special registration procedures are required for pesticides used against exotic pests, such as the sapote fruit fly which is not native to this country. Regular registrations and section 18 (emergency) registrations under the Federal Insecticide, Fungicide, and Rodenticide Act have been approved by EPA for the use of bait spray in the State of Texas. Because of the limited and restricted nature of the spinosad bait spray applications necessary for this program, the effects have been analyzed within the framework of an environmental risk assessment.

Three major factors influence the risk associated with pesticide use: fate of the pesticide in the environment, its toxicity to humans and nontarget species, and the exposure of humans and nontarget species to the pesticide. These factors will be evaluated for each of the chemicals analyzed.

#### a. Malathion Bait Spray

#### (1) Fate

Malathion is an amber-colored liquid that is combined with a protein bait to form a sticky spray. The formulation used in the program is 0.175 pounds

(1.2 fluid ounces) of active ingredient per acre mixed with 9.6 fluid ounces of protein hydrolysate bait per acre, for both aerial and ground applications. The half-life of malathion in soil or on foliage ranges from 1 to 6 days; in water, from 6 to 18 days. Malathion bait spray is applied from the ground, generally as a spot treatment to individual trees, or from the air. Trees, shrubs, and other surfaces such as soil, roads, and ponds are likely to receive spray from aerial applications, although efforts, including the use of buffers, are made to avoid directly spraying water bodies. Malathion is generally of more concern in aquatic areas because of its high toxicity to aquatic organisms.

### (2) Toxicity

Malathion is an organophosphate that acts by inhibiting acetylcholinesterase. Mildly acutely toxic, malathion is classified by EPA as category III (Caution) based on oral, dermal, and inhalation exposure routes. At high doses, toxic effects from malathion may include headache, nausea, vomiting, blurred vision, weakness, and muscular twitching. In humans and other mammals, metabolism by one degradation pathway leads to the formation of malaoxon, a more potent cholinesterase inhibitor than malathion. The more common degradation pathways yield nontoxic intermediates.

EPA has recently evaluated the carcinogenic potential of malathion. Their new classification describes malathion as having "suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential." This indicates that any carcinogenic potential of malathion is so low that it cannot be quantified based upon the weight of evidence. The low exposures to malathion from program applications would not be expected to pose any carcinogenic risks to workers or the general public. Malathion may have synergistic effects when used with other organophosphate or carbamate pesticides.

Oral doses of malathion are slightly to moderately acutely toxic to mammals and birds (table 1). Signs of poisoning are similar to the reactions of humans. Malathion is highly toxic to some forms of aquatic life, including invertebrates, amphibians, and fish (table 2). EPA has established a chronic water quality criteria of 0.1 micrograms per liter (µg/L) for protection of freshwater and marine aquatic life. Fish kills that may have been associated with aerial malathion bait spray applications have been documented.

**Table 1. Acute Oral $LD_{50}$s[1] for Selected Species Dosed with Malathion (mg/kg)**

| | |
|---|---|
| Mouse | 720 - 4,060 |
| Female rat | 1,000 |
| Male rat | 1,375 |
| Mallard | 1,485 |
| Pheasant | 167 |

[1]$LD_{50}$ = Lethal dose for 50% of animals treated

**Table 2. Malathion 96-hour $LC_{50}$s[1] for Selected Aquatic Species (µg/L)**

| | |
|---|---|
| Tadpole | 200 |
| Rainbow trout | 4.1 - 200 |
| Bluegill | 20 - 110 |
| Daphnia | 1 - 1.8 |
| Stone flies | 1.1 - 8.8 |

[1]$LC_{50}$ = Lethal concentration for 50% of animals treated

## (3) Exposure and Risk

### Human Health

Potential exposure to humans is by dermal absorption, inhalation, or ingestion of residues. Due to the potential for aerial application of malathion bait spray, dermal absorption from direct application or contact with treated surfaces is the primary exposure route for the public. Public exposure from a ground malathion bait spray application will be lower than exposure from an aerial application because less area is treated and less pesticide is used. Workers, such as ground applicators and the ground crew for aerial applications, may have inhalation exposure as well as dermal exposure.

Results of the quantitative risk assessment of malathion bait suggest that exposures to pesticides from comparable program operations are not likely to result in substantial adverse human health effects. Residues on commodities or backyard fruits resulting from the malathion bait spray application are unlikely to greatly increase exposure to the consuming public. Malathion concentrations on vegetation estimated by the California Department of Health Services (Kizer, 1991) indicate that levels of malathion on vegetation are not likely to exceed the residue tolerance levels set by EPA. Residue tolerances for malathion on many food items are established (40 CFR 180.11) and most are 8 parts per million (ppm). The provisional acceptable daily intake is 0.02 mg/kg per day.

The human health risks of comparable treatments are evaluated quantitatively in the Human Health Risk Assessment for Fruit Fly Cooperative Control Programs (USDA, APHIS, 1998a). Results suggest that exposure from normal program operations will not present a human health risk either to workers or the public. In addition, risks to humans have been analyzed qualitatively, with reliance on information from past fruit fly eradication programs in California. The exposure scenarios from previous fruit fly eradication efforts will not differ substantially from the current program.

### Nontarget Species

Malathion bait spray will kill insects other than the Mexican fruit fly. Malathion is highly toxic to bees, and direct application to areas of blooming plants can be expected to result in a high bee kill. Although malathion is not phytotoxic, there could be potential indirect effects on plant populations due to lower pollination rates if bee or other pollinator populations are reduced. This is a concern of aerial application. Secondary pest outbreaks have occurred occasionally with the use of aerial applications of malathion bait spray. In 1981, fish kills also occurred from a similar treatment method. Since then, the State of California has instituted procedures to reduce the likelihood of fish kills. None have been known to occur from aerial applications of malathion bait spray since the procedures were implemented.

Terrestrial animals are exposed to malathion primarily through dermal and oral routes. Ingesting prey containing residues, rubbing against treated vegetation, and grooming contribute to total dose. Aquatic species can be exposed to direct application and runoff. Exposure of malathion bait spray by aerial application poses high risk to nontarget invertebrates and some aquatic species. Some insectivores may be affected. Ground application of malathion bait spray has far fewer environmental consequences because the treated area is smaller and delivery is more accurate. Fewer species would be exposed and thus the treatment poses less total risk to nontarget species than does aerial application.

### b. Spinosad Bait Spray

### (1) Fate

Spinosad is a mixture of macrocyclic lactones produced naturally by an actinomycete bacteria. The active ingredients in spinosad are spinosyn A and spinosyn D. The bait formulation includes sugars and attractants that are of low toxicity and do not contribute to the overall hazard, but these substances may decrease the rate of degradation, particularly photodegradation by blocking the penetration of sunlight. The actual concentration of spinosad used by the program in the bait spray formulation is very low (0.008%). Spinosad is registered for use on various crops and has permanent EPA-approved tolerances for some fruits (including citrus), nuts, vegetables, cotton, and meat.

Thorough risk assessments have been prepared for human health (USDA, APHIS, 1999a) and nontarget species (USDA, APHIS, 1999b) for spinosad bait spray applications. Information from those assessments is incorporated by reference into this document and is summarized here.

The hazards of spinosad to environmental quality are minimal. This is primarily a function of the environmental fate. Spinosad persists for only a few hours in air and water. The low vapor pressure of spinosad indicates that it is not volatile. The aerobic soil half-life of both spinosyn A and D is 14.5 days. The photolysis half-life in soil is 8.68 days for spinosyn A and 9.44 days for spinosyn D (Dow Agrosciences, 1998). Although spinosyn A is water soluble, the compound readily binds to organic matter and no leaching to groundwater is anticipated for either spinosyn. The spinosyns bind readily to organic matter on leaf surfaces also. The photodegradation of spinosad residues occurs readily on plants, and tolerances on crops are not of great concern to EPA (EPA, 1998a). The rapid breakdown and lack of movement in the environment ensure that there will be no permanent effects on the quality of air, soil, and water for the program applications.

### (2) Toxicity

Spinosad acts as a contact and stomach poison against insects, and it is particularly effective against all stages of flies (Adan *et al.*, 1996). The mode of toxic action of this compound against insects has been shown to relate to the widespread excitation of isolated neurons in the central nervous system (Salgado *et al.*, 1997). This is caused by persistent activation of nicotinic acetylcholine receptors and prolongation of acetylcholine responses. The symptoms of intoxication are unique and are typified by initial flaccid paralysis followed by weak tremors and continuous movement of crochets and mandibles (Thompson *et al.*, 1995). The receptors affected by spinosyns in insects are not present or vital to nerve transmission in most other taxa, so toxicity to most other organisms is low. There have been no reported human illnesses from the manufacturing or pesticide applications of spinosad.

Acute hazards from exposure to spinosad are low to mammals by all routes of exposure. The acute oral $LD_{50}$ to rats is greater than 5,000 milligrams (mg) of spinosad per kilogram (kg) body weight (Dow Agrosciences, 1998; EPA, 1998a). The acute dermal $LD_{50}$ to rats is greater than 2,800 mg/kg. Primary eye irritation tests in rabbits showed slight conjunctival irritation. Primary dermal irritation studies in rabbits showed slight transient erythema and edema. Spinosad was not found to be a skin sensitizer.

Subchronic and chronic studies also indicate low hazard. The systemic NOEL for spinosad from chronic feeding of dogs was determined to be 2.68 mg/kg/day (EPA, 1998a). The LOEL for this study (8.22 mg/kg/day) was based upon vacuolated cells in glands (parathyroid) and lymphatic tissues, arteritis, and increases in serum enzymes. The regulatory reference values selected for spinosad are based upon this study applying a safety factor of 10 for occupational exposure to make allowance for inter-species variability. An additional safety factor of 10 was applied for general public exposure to make allowance for intra-species variability and potential for wider ranges in sensitivity in the general public than in the occupational population. A neuropathology NOEL of 46 mg/kg/day was determined for male rats. EPA has classified the carcinogenic potential of spinosad as Group E **n** no evidence of carcinogenicity based upon chronic studies of mice and rats (EPA, 1998b). There has been no evidence of mutagenic effects from spinosad. The reproductive NOEL from a 2-generation study of rats was determined to be 10 mg/kg/day (EPA, 1998a).

The primary active ingredients in spinosad are spinosyn factor A and spinosyn factor D. All other substances in the formulated products of spinosad are of lower toxicity. Spinosyns are relatively inert, and their metabolism in rats resulted in either parent compound or N- and O- demethylated glutathione conjugates as excretory products (EPA, 1998a). Studies have found that 95% of the spinosad residues in rats are eliminated within 24 hours.

Acute oral doses of spinosad are very slightly toxic to mammals and practically nontoxic to birds (table 3). Spinosad is slightly to moderately toxic to fish and most aquatic invertebrates, but highly toxic to marine molluscs (table 4). Spinosad is of slight to moderate acute toxicity to algae.

**Table 3. Acute Oral $LD_{50}$s[1] for Selected Species Dosed with Spinosad (mg/kg)**

| | |
|---|---|
| Rat | >5,000 |
| Mouse | 23,100 |
| Shrew | 3,400 |
| Mallard | >2,000 |
| Pheasant | >2,000 |

[1]$LD_{50}$ = Lethal dose for 50% of animals treated

**Table 4. Spinosad 96-hour $LC_{50}$s[1] for Selected Aquatic Species (µg/L)**

| | |
|---|---|
| Grass shrimp | 9,760 |
| Rainbow trout | 30,000 |
| Bluegill | 5,900 |
| Daphnia | 92,600 |
| Eastern oyster | 295 |

[1]$LC_{50}$ = Lethal concentration for 50% of animals treated

## (3) Exposure and Risk

### Human Health

Potential exposure to humans is by dermal absorption, inhalation, or ingestion of residues. Dermal contact with treated surfaces is the primary exposure route for the public. Public exposure from ground bait spray application is less than exposure from an aerial application because less area is treated and less pesticide is used. Workers, such as ground applicators and the ground crew for aerial applications, may have inhalation exposure as well as dermal exposure.

Results of the quantitative risk assessment prepared for spinosad bait spray applications suggest that potential exposures are not likely to result in substantial adverse human health effects. The highest potential occupational exposure was determined to occur in the extreme exposure scenario for ground personnel. The margin of safety for these program workers is about 100-fold. The highest potential exposure to spinosad for the general public occurs in the extreme scenario of a child consuming contaminated runoff water. The margin of safety for this individual exceeds 1,000-fold. No adverse effects are anticipated to human health from spinosad bait spray applications, even under extreme or accidental exposure scenarios.

Risks to human health from spinosad bait spray applications were also analyzed qualitatively for some chronic and subchronic effects. Since EPA has determined that there is no evidence of mutagenicity or any carcinogenic potential for spinosad, these outcomes are not expected to be of any concern. Most of the potential outcomes tested in laboratory tests required much higher exposures than would be anticipated from program applications. Outcomes such as reproductive and developmental toxicity, teratogenicity, and neurotoxicity are highly unlikely to occur from exposures to program applications. Spinosad is not a skin sensitizer, but other immunotoxic responses could occur if allergic reactions or hypersensitive conditions exist. Based upon experience in past programs, it must be kept in mind that the source of any immunotoxic responses to exposure may relate to a reaction to the bait in the formulation rather than the pesticide.

Consistent with Executive Order 12898, “Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations,” and with Executive Order 13045, “Protection of Children From Environmental Health Risks and Safety Risks,” APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations, low-income populations, and children. In particular, the close proximity of the program actions to some colonias was an issue of concern.

Bait spray applications are made at very low application rates, and potential human exposures are less than those associated with any adverse effects. Although some individuals may have allergic or hypersensitive reactions to malathion or spinosad or the bait in the formulated product, this response to exposure has not been shown to relate to income level, ethnic origins, or age. Determination of the reference doses for these pesticides did not include any additional safety factor for children based on the lack of evidence for differences in susceptibility based upon age. Therefore, no disproportionate effects on children, minority populations, and low-income populations in the Lower Rio Grande Valley are anticipated as a consequence of implementing the preferred alternative.

### Nontarget Species

The estimated doses to wildlife are based on the environmental concentrations determined from exposure models and scenarios. These results are described in greater detail in the nontarget risk assessment (USDA, APHIS, 1999b). The exposure of nontarget organisms to spinosad from bait spray applications is lower than to malathion. As a result of low exposure and low toxicity, the potential for adverse effects is expected to be negligible to mammals, birds, reptiles, fish, and amphibians from spinosad bait spray applications. Unlike malathion (toxic to all organisms by all routes of exposure), the active ingredients in spinosad are only toxic to certain invertebrates primarily by dermal and oral exposure. Any invertebrate that is attracted to and feeds upon the spinosad bait will be affected, but most species are not attracted to the bait. A small number of phytophagous invertebrates (particularly Lepidoptera caterpillars) may be killed by consumption of residues on leaves from spinosad bait spray applications. Predatory invertebrates in treated areas are not expected to have much mortality. Although spinosad bait spray is not attractive to honey bees, their susceptibility to spinosad toxicity is high. Studies of spinosad bait applications indicate that the repellant nature of spinosad results in negligible exposures to honey bees and other pollinators, so no toxic effects or mortality to honey bees have been observed in field studies at locations where spinosad bait spray has been applied.

Aquatic species are at very low risk of adverse effects. The calculated concentration of spinosad in water is several orders of magnitude less than any concentration known to adversely affect aquatic organisms. Residues of spinosad are not expected to bioconcentrate based upon the water solubility and short residual half-life in water.

### c. Methyl Bromide Fumigation

#### (1) Fate

Methyl bromide is an odorless, colorless, volatile gas which is three times as heavy as air. Its half-life is 3 to 7 days. Methyl bromide is released when a fumigation chamber is aerated. Because methyl bromide is heavier than air, the gas can collect in isolated pockets, which could create hazardous conditions when there is little air circulation or mixing, such as during thermal inversions or periods of low wind.

#### (2) Toxicity

Methyl bromide gas and liquid are acutely toxic to humans. Contact with liquid or vapors can cause serious skin or eye injury. Inhalation can cause acute illness, including pulmonary edema (fluid buildup in the lungs), gastrointestinal distress, and convulsions which can be fatal. The $LD_{50}$ of rats to methyl bromide is 2,700 ppm for a 30-minute exposure. In humans, 1,583 ppm (6.2 mg/L (milligrams per liter)) methyl bromide is lethal after 10 to 20 hours of exposure and 7,890 ppm (30.9 mg/L) is lethal after 1½ hours of exposure (EPA, 1986). EPA has derived an RfC (reference concentration) of 0.48 $mg/m^3$ (milligrams per cubic meter) for general population exposure to methyl bromide (EPA, 1992).

Methyl bromide is rapidly absorbed by the lungs and affects both the lungs and kidneys. Increased exposure to methyl bromide results in elevation of bromine levels in the blood; poisoning symptoms occur at a level of 2.8 mg/100 ml of blood (Curley, 1984). Symptoms of acute exposure typically are headache, dizziness, visual problems, gastrointestinal disturbances, and respiratory problems. In more extreme cases, muscular pain, numbness, or twitching precede convulsions, unconsciousness, and possibly death.

Chronic exposure can result in behavioral changes, loss of ability to walk, neurological damage, and renal and liver function disturbances (Verberk *et al.*, 1979). Because there are a number of toxicity data gaps, the chronic and subchronic toxicity of methyl bromide is not well characterized. For this reason, and the implication of its contribution to ozone depletion, EPA has issued a call-in notice to provide this information for reregistration. Manufacturers must supply more information.

Based on laboratory studies of the effects of methyl bromide inhalation and ingestion, nontarget species of mammals and birds exhibit symptoms similar to humans: weakness, lack of muscular coordination, neurological and behavioral abnormalities, and death from high doses. Due to its restricted use as a fumigant, wild animals are rarely exposed to methyl bromide and toxicity data is limited to farm animals. Residues in hay ranging from 6,800 ppm to 8,400 ppm caused symptoms of intoxication in cattle, horses, and goats (Knight and Costner, 1977).

### (3) Exposure and Risk

### Humans

Inhalation is the primary exposure route for methyl bromide. Concentrations of methyl bromide are electronically monitored during the fumigation. Because the gas is odorless and nonirritating during exposure and the onset of symptoms is delayed, leaks and spills causing extreme exposure can occur without persons being aware of its presence. Protective clothing and self-contained breathing apparatus are worn whenever concentrations of methyl bromide are anticipated to reach or exceed 5 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) has established exposure standards (threshold limit value) of 5 ppm (20 $mg/m^3$) to protect against adverse neurotoxic and pulmonary effects (ACGIH, 1990). Dermal exposure to workers could occur in the unlikely event of a spill of liquid methyl bromide.

Ingestion of methyl bromide residues and its degradation products is a third exposure route. Following aeration of the commodity, the small amount of methyl bromide that remains dissipates and degrades, leaving only inorganic bromide residues. However, residues from the methyl bromide fumigation will remain on the commodity. EPA tolerances for residues of methyl bromide, measured as inorganic bromides (40 CFR 180.123), range from 5 ppm (for apples, pears, and quinces) to 240 ppm (for popcorn), with most commodities at 50 ppm or less. Ingestion of these small amounts of residues is considered to have no adverse toxicological effect.

EPA has classified methyl bromide as a class I ozone depleting chemical in a manner consistent with the Montreal Protocol. EPA is expected to require the phaseout of most uses of methyl bromide by 2005. There is, however, an exemption to this phaseout for Quarantine and Pre-shipment uses. The relative importance of methyl bromide to ozone depletion, however, is subject to fundamental uncertainties.

Workers will have little exposure to methyl bromide because fumigations are contained. The public will be restricted from access to the fumigation chamber by a 30-foot wide barrier zone. Residues in fumigated commodities will be within tolerance limits. There is very little risk to human health from a methyl bromide fumigation.

### Nontarget Species

Few nontarget species will be exposed to methyl bromide directly. The aeration duct will deliver a plume which will disperse quickly. Species within this plume, such as insects which inadvertently fly in, might die. However, these effects are restricted to areas within the 30-foot wide barrier zone. In addition, ground-dwelling organisms immediately outside the fumigation chamber vent are not anticipated to survive.

## d. Cumulative Impacts

Cumulative impacts are those impacts, either direct or indirect, that result from incremental impact of the program action when added to other past, present, and reasonably foreseeable future actions. It is difficult to quantitatively predict the cumulative impacts for a potential emergency program such as this. The impacts are generated by program actions for only a short period of time and none of those impacts are associated with persistent adverse effects. The impacts can be considered from a subjective perspective.

Some chemicals, when used together, have been shown to act in a manner that produces greater toxicity than would be expected from the addition of both. This effect is known as potentiation or synergism. Malathion and other organophosphates have been observed increase intoxication by synergism or potentiation (Murphy, 1980), but such effects are less likely when the application of program treatments is not close in time or proximity to other applications of organophosphate pesticides. Concurrent exposure to malathion from program treatments and other organophosphate insecticides is highly unlikely. The mechanism of intoxication from exposure to spinosad is unique and unlike other pesticides. Theoretically, spinosad is not expected to have any synergistic or potential effects from other potential chemical exposures.

Because most nontarget species are mobile, it is unlikely that an individual will be exposed to more than one treatment.

Domestic animals and less mobile organisms, such as those dwelling near the soil surface, could be exposed. Although there could be effects from exposure to spinosad bait spray, spinosad is effective only by ingestion. Most species are not attracted to spinosad bait and are not expected to ingest sufficient quantities for toxicity effects, so cumulative impacts are considerably less likely with spinosad bait than malathion bait.

Impacts from implementation of the program are expected to be temporary, with potential adverse effects ending shortly after the infestation is eradicated. No bioaccumulation or environmental accumulation of malathion or spinosad is foreseen due to the rapid degradation rates. In contrast, the ongoing applications expected from the no action alternative would be expected to have cumulative effects. Therefore, any cumulative impacts of the program are expected to be less than those that might occur under the no action alternative, an alternative which most likely would result in escalating use of pesticides by the public.

The cumulative impacts from fumigations with methyl bromide have been discussed in detail in an environmental impact statement designed to address these issues (USDA, APHIS, 2002). This document included analysis of the limited use of methyl bromide in local eradication programs, such as this one, and determined that their potential cumulative contribution to ozone depletion is not significant.

In terms of the cumulative effects of pesticide use from the proposed action with pesticide use from other fruit fly programs, the small area requiring treatment for this program should not substantially increase exposure to workers, public, or nontarget species.

### e. Methods To Reduce Risk

Human pesticide exposure would be primarily to workers. Methyl bromide is used only in certified fumigation chambers or under tarpaulins (enclosures). Residents within the eradication area will be exposed to malathion or spinosad bait spray to an extent, depending on where the pesticides are applied. The public could be exposed to residues on any treated material moved out of the eradication area.

Current worker safety measures protect fumigators and other pesticide applicators from excessive exposure to methyl bromide, malathion, and spinosad during routine operations. To minimize worker exposure to methyl bromide, the fumigation chamber is opened only after concentrations are reduced below 5 ppm. Proper sealing of fumigation enclosures and proper aeration facilitate dispersal of the fumigant. Dermal exposure of workers to malathion and spinosad can also be substantially reduced by the use of protective clothing. Written public notification will provide information about the schedule for pesticide treatments and applications, and about specific precautions that residents should take to avoid excessive exposure such as remaining indoors during bait spray applications or not harvesting malathion-treated produce for 3 days after application. However, individuals with greater sensitivity to cholinesterase inhibitors or the protein bait may need to take extra precautions to avoid even minimal exposure.

The program, properly implemented, represents a relatively low risk to human health except for extremely sensitive individuals who have had problems with similar programs in the past. However, this assessment does contain uncertainties associated with toxicity data gaps and estimations of exposure. Furthermore, synergistic interactions between the pesticides which could be used in this program with other pesticides not associated with the program could increase toxicity and the associated risk. Potential risk will be substantially diminished due to the localized nature and short duration of the program.

Risks to nontarget organisms can be reduced by limiting exposure. If aerial applications are conducted, beekeepers and backyard pond owners should be notified. A survey of water bodies within the treatment area should be conducted and mapped so they will be avoided by establishing "no treatment" zones during aerial operations. Ground application of bait spray poses little direct risk. Pet owners should be notified to limit animals' exposure to treated trees. Timing of the treatment should be considered to reduce exposure. Standard operating procedures for methyl bromide fumigations include fencing or other barriers to limit access to the fumigation and aeration area and preclude exposure of many vertebrates.

The potential environmental impacts of the program's alternatives and component treatment methods have been discussed and analyzed in detail within the risk assessments. In addition, potential cumulative impacts were analyzed as well. Refer to the risk assessments for greater detail.

### f. Endangered and Threatened Species

Section 7 of the Endangered Species Act of 1973 (ESA) requires Federal agencies to consult with the U.S. Department of the Interior, Fish and Wildlife Service (FWS) if species listed or proposed for listing are likely to be adversely affected. The program officials have consulted and will use protective measures to ensure no adverse effects occur to endangered and threatened species and their habitats. The species that could require protection during control efforts are dependent upon the control methods used (i.e., not all control methods affect all species equally). Thus, protective measures will vary depending on the control method being used and the species found within the limited treatment area. Control activities in Mexico are under the control of the Government of Mexico, which has responsibility for the protection of endangered and threatened species on its sovereign soil.

Malathion and spinosad are not selective for sapote fruit fly alone. Malathion may cause intoxication by oral, dermal or inhalation exposures. Ingestion of spinosad by insects other than sapote fruit fly could result in their deaths. If habitats of susceptible insects overlapped with the program treatments, those exposed species could be adversely affected by aerial application of bait spray. Repeated aerial bait spray applications generally reduce insect numbers, particularly with malathion. Reduction of insect populations could reduce pollinator species for threatened and endangered plants, and would reduce potential food resources for endangered and threatened insectivores. Spinosad is not expected to affect any aquatic species or habitats, but potential effects to susceptible terrestrial invertebrates and their habitats must be considered if endangered and threatened species are present. Malathion can affect aquatic species and protective measures are designed to ensure no adverse effects to any threatened or endangered species or their habitats. Fumigation facilities are designed to preclude entry of nontarget wildlife including endangered and threatened species, so no effects are expected from any fumigations with methyl bromide.

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# Appendix B. Consultation

The following agencies were consulted during the preparation of this environmental assessment:

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Program Support
4700 River Road, Unit 134
Riverdale, Maryland 20737-1236

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental Services
4700 River Road, Unit 149
Riverdale, Maryland 20737-1238

**Finding of No Significant Impact**
**for**
**Sapote Fruit Fly Cooperative Eradication Program**
**Lower Rio Grande Valley, Texas**
**Environmental Assessment,**
**February 2003**

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), has prepared an environmental assessment (EA) that analyzes potential environmental consequences of alternatives for control of the sapote fruit fly, an exotic agricultural pest that presents a periodic threat to fruit production in the Lower Rio Grande Valley of Texas. The EA, incorporated by reference in this document, is available from:

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
903 San Jacinto Boulevard, Suite 270
Austin, TX 78701

or

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Program Support
4700 River Road, Unit 134
Riverdale, MD 20737-1236

The EA analyzed alternatives of (1) no action and (2) the proposed cooperative eradication program (the preferred alternative). Each alternative was determined to have potential environmental consequences. The proposed program was preferred because of its capability to achieve the eradication objective in a way that reduces the magnitude of those potential environmental consequences. Program standard operational procedures and mitigative measures serve to negate or reduce the potential environmental consequences of this program.

APHIS has determined that there would be no signficant impact to the human environment from the implementation of the cooperative eradication program, the preferred alternative. APHIS' Finding of No Significant Impact for this program was based upon the limited nature of the program and its expected environmental consequences, as analyzed in the EA. In addition, APHIS anticipates no adverse impacts to threatened or endangered species or their habitats from this action. I find that the cooperative management program poses no disproportionate adverse effects to children or minority and low-income populations and the actions undertaken for this program are entirely consistent with the principles of "protection of children," as expressed in Executive Order 13045, and with the principles of "environmental justice," as expressed in Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations."

Lastly, because I have not found evidence of significant environmental impact associated with the proposed program, I further find that an environmental impact statement does not need to be prepared and that proposed cooperative eradication program may be implemented.

/s/ 03/04/03

Joseph Davidson
State Plant Health Director - Texas
Plant Protection and Quarantine
Animal and Plant Health Inspection Service

Date