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TECHNICAL GUIDELINES FOR PESTICIDE USE IN ORD PROJECTS

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ECOTECNIA, CONSULTORES ASOCIADOS, 4 AVENIDA 6-20 ZONA 10, GUATEMALA

INTEGRATED PEST MANAGEMENT AND ENVIRONMENTAL PROTECTION PROJECT

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1. Introduction

These guidelines address the question of pesticide use in current ORD projects, as identified during survey. They discuss, by crop, the main places of cultivation, pests and pesticides, main pesticide problems identified and recommended pesticides. They provide a starting point for developing a handbook for pesticide use in ORD projects which needs to include agromedical aspects as well.

As such, they are no substitute for an adequate IPM approach to crop protection. They are a starting point for developing a crop-by-crop systematic approach that should include agromedical, IPM and regulatory aspects including registration status and safeguards.

There is no "easy remedy" to pesticide problems. They require an integrated, interdisciplinary approach. No "recipe" for safe and effective pesticide use is known to exist.

Agromedical aspects will have to include: a) risk status of pesticides, including chronic effects, b) precautions that need to be taken when using particular pesticides, c) first aid and first action recommendations, and, d) alternatives to pesticide use, as they become available.

2. Use of Pesticides in Agricultural Production

The key to effective use of an insecticide without injury to the treated plant, animal, or agricultural product is to follow directions on the label. Do not use any pesticide preparation for any purpose for which it is not specified.

Only general information can be given here on the effective application of pesticides since much depends on the characteristics of the pest, the kind of damage that it causes, the nature and condition of the infested plants, and commodities to be treated, weather conditions, and application equipment as well as the type and formulation of the pesticide to be applied.

Weather Conditions:

Wind, rain, and sun play an important part in the control you get from outdoor use of pesticides. Some air movement is helpful. Winds, however, can cause an pesticide dust or spray to be unevenly distributed on the plants and to drift away from target areas.

If rain is predicted, postpone treatment if possible. Rain falling soon after you treat may reduce the effectiveness of an

pesticide deposit. Cold weather may have same effect. Some pesticides must be applied at temperatures above 50 F to be effective.

Condition of Host Plant:

The type and density of plant foliage, as well as the extent of coverage needed, may influence the choice of formulation that is applied. In some instances, a coarse spray will control pests more effectively; in others, a fine spray, mist, or fog will be more effective. Plants with smooth leaves are likely to have a quicker runoff of spray material than those with rough leaves. However, adherents that are included in the formulation, or that may be added, help the material adhere to the plants.

Calibration of Equipment for Applying Insecticides:.

At the start of each growing season, thoroughly inspect and calibrate all equipment you will use to apply pesticides. Repeat whenever you use a different rate of application. Apply the correct dosage, not only to control the pests effectively but also to avoid plant injury and to be certain that any residue remaining at the time of harvest or feeding does not exceed the tolerance established for that particular chemical on the crop you treat.

This use of pesticides is governed in Guatemala by Vegetable Sanitation Law (Decree 446), with the following regulations:

- Regulation of the importation, creation, storage, transportantion, sale and use of pesticides (Decree 43-74)

- Institutional Regulation Research and evaluation of Agricultural Chemicals

The user is cautioned to read and follow all directions and precautions given on the label of the pesticide formulation being used and in the past regulations.

Protective Equipment:

The laws of Guatemala (Social Security Institute and Pesticide Use Law) mandates that the following protective equipment must be worn whenever pesticides are applied:

* Rubber boots
* Mask with double activated charcoal filter
* Goggles
* Wide brimmed hat
* Overalls
* Gloves

Guidelines regarding use of this equipment are found on

pesticide labels.

Treatment for Poisoning:

If a person is poisoned by a pesticide, first aid should be administered immediately, the initial mechanisms to assist a victim while medical help is on the way.

Usually, pesticides produce acute symptoms of intoxication easy to be detected by the victim and an observer.

If the victim swallowed an unknown pesticide it's better to give an antidote such as activated charcoal with water, scrambled eggs white, clayey soil, not contaminated. After vomiting give an antidote and take him to the hospital. Don't give salt or baking soda.

If the victim inhales the pesticide, remove him an adequate distance, outdoors or to a room free of gas, to breathe fresh air, loosen clothing and remove contaminated clothing and draw out strange bodies from the mouth (food, saliva, teeth...) to avoid an obstruction lay him sloping down and on one side. Cover the victim with blankets to keep him warm. If breathing has stopped, give artificial respiration. Take the victim to the physician immediately.

If the intoxication was through the skin, remove him from the contaminated area and take off the clothing that contains the chemical, cleaning him, including nails, hair and skin, with water and soap or dry the affected area. Don't rub hard because it increases absortion.

After first aid, the victim must be taken to a physician even if he has recuperated.

Don't give any medicine to the victim (such as athropine pills) because the diagnosis and treatment can be retarded and the exposure may be greater and fatal.

In all cases have the insecticide container and any attached label available. Information provided by them is extremely valuable to the physician. Inform him of recent contacts with pesticides. The one most obvious to you may not be the one to blame.

In many places there are IGSS clinics or Health Centers that have information concerning symptoms and treatment of actual or suspected poisonings by pesticides.

Protection of Fish and Wildlife:

No chemical control of insects should be undertaken unless the expected benefits outweigh possible hazards to other animals. To minimize damage to fish and wildlife, do not use persistent chlorinated hydrocarbon pesticides when alternative pesticides of lesser hazard are available. Select pesticides and methods of application that are least hazardour and apply them at minimum effective dosages.

Avoid drift of insecticides as much as possible and limit applications of insecticides to the target area. To prevent damage to fish, birds, and other animals, be careful not to contamine streams, lakes, marshes, and grazing or browsing areas by improper application or excessive drift of insecticides. Where drift is difficult to control, use sprays or granules instead of dust, and ground application instead of air applications.

Field borders, hedgerows, ditchbanks, stream margins, and wood edges are prime wildlife habitat. Insofar as feasible, avoid treating them. "Dressing the field margins" can be very hard on desirable animal life. Be careful to avoid leaving treated seed or insecticide granules on the surface.

Do not clean spray equipment or dump excess spray materials in or near streams or other water areas where drainage could contaminate water.

Protection of Insect Parasites and Predators:

A program of crop pest control should be designed to take maximum advantage of any biological control factors that may be present. Whenever possible, the pesticides should be selective against the pest species concerned and of minimum danger to benefical insects. If parasites or predators are abundant , it may be advantageous to defer or omit pesticide treatment. The following pesticides do not harm the predators:

Bacillus thuringiensis, fenbutatin oxide, benzoximate, diflubenzuron, tetradifon, dicofol, pyrethrum with piperonyl butoxide, pirimicarb, bupirimate, triadimefon, vinclozolin, captan, thiphanatmetyl, captafol, carbendazim, chlorothalonil, dithiram, mancozeb, diclofobmethyl, desmetryn, phenmedipham, propyzamid, chlormequat, and naphtyl acetic acid. Substances considered harmless or slightly harmless to beneficial arthropods and entomopathogenic Verticillium included the plant growth regulators Cycocel Extra and Rhodofix, the herbicides Hyvar X and Gesatop 50, the acaricide Tedion V 18 (slight persistency against Thrichogramma adults and harm to Encarsia adults, but not harmful to pupal stage in the host of the 4 species of predatory mites), and the fungicide Daconil 500. Resistance to various pesticides

was noted in certain strains of predatory mites exposed to pesticides during mass rearing and used in greenhouse biological control.

Protection of Honey bees and Other Insect Pollinators:

Many of the crops listed in this guideline are dependent on insect pollination. A pesticide applied to these crops is of doubtful value if it destroys the pollinators while destroying the harmful pests. Most of this pollination is performed by honey bees. Protect them. Much of the damage to bees by pesticides can be prevented if you do not treat crops in bloom while bees are visiting the field. Treatment at night is safest for protecting pollinators. Other steps that will reduce bee losses are:

* Use pesticides only when needed.
* Use the lowest effective dosage and make a minimum number of applications.
* Use a material that is least hazardous to bees but will control the pest, if application must be made while bees are actively visiting the area.
* Use granules or dilute sprays instead of dusts. They are usually less hazardous. Application with ground equipment is less hazardous to bees than application with aerial equipment.
* Avoid drift of insecticides into bee yards and adjacent crop or wild plants in bloom.
* Do not apply insecticides if apiaries are near enough to be unavoidably affected; notify the beekeper so he can move or cover the hives in time.

The following list indicates which insecticides are hazardous to honey bees, as determined by laboratory and field tests. These materials are hazardous to bees when applied as foliar treatments to agricultural plants. The materials are not hazardous when used as soil applications. For further information consult the pesticide container label.

The following materials are highly toxic to bees exposed to direct treatment or residues; do not apply these materials while plants are in bloom:

Aldicarb, azinphosmethyl, benzene hexacloride, chloropyrifos, crotoxyphos, Dasanit, diazinon, dichlorovos, dicrotophos, dimethoate, dyfonate, EPN, famphur, fenthion, imidan, calcium arsenate, carbaryl, carbofuran, lead arsenate, lindane, malathion(as ULV or dust), methyl parathion, Methil Trithion, mevinphos, mexacarbate, monocrotophos, naled, parathion, phosphamidon, prosphamidon, tepp, (Trichlorfon as a dust).

The following materials are toxic to bees and should not be

The following materials are toxic to bees and should not be applied when bees are actively visiting the area:

Carbaryl, carbophenotion, coumaphos, crotoxyphos, demeton, disulfoton, endosulfan, malathion as E.C. mirex, naled as E.C., perthane, phorate, phosalone, propoxur, ronnel, TDE.

Avoiding Harmful Residues in or on Food and Feed:

Excessive residues can be avoided by applying only those pesticides specified for use on the crop and by following indicated schedules. Do not exceed recommended dosages. Observe carefully the safety restrictions, especially the required interval between the last application and the harvest or feeding.

Avoid drift of pesticides sprays or dust to nearby crops or livestock.

Certain root crops, such as beets, peanuts and carrots, are susceptible to contamination from residues of certain organochloride pesticides in the soil. Do not apply them to soils where the crop rotation includes one of these crops unless a finite tolerance has been established for the pesticide.

Byproducts from a number of crops treated with insecticides may be safely fed to livestock or poultry if the crops are harvested or fed after the specified waiting period. Before using a pesticide carefully read the label restrictions.

In silos and other storage areas apply only those pesticides registered for the purpose.

Safe Disposal of Empty Pesticide Containers and Surplus Pesticides:

The careful disposal of empty containers and surplus pesticides is an important part of safe pesticide use. When possible, growers should carry their empty pesticide containers to a sanitary landfill and have them buried. Do not abandon them on the landfill. Inform residents of the nature of the residues in the containers. Warn them of any danger of poisonous vapors if burned. Crush or puncture containers to prevent reuse.

If a suitable landfill is not available, break or crush glass and metal containers (except pressurized cans) and bury them in an isolated place where they will not contaminate water supplies. Pour excess pesticides into a hole at least 18 inches deep, dug in level ground in an isolated place where they will not contaminate water supplies. Cover with dirt and charcoal powder. Do not dump containers or leftover chemicals in gullies, ditches, streams, woods, or trash heaps. For more specific

information on the safe use of pesticides read the GREPAGRO-DTSV-GIFAP's Guidelines available in the pesticide stores.

3. Toxicity of Pesticides

All pesticides must be considered potentially toxic to man and animals. However, the degree of toxicity is one of several factors in the use of pesticides that determine the hazard to man. The primary hazard lies in failure to follow the precautions and directions for use indicated on the pesticide label. Many factors must be considered in selecting a pesticide for a specific purpose. Whenever possible, preference should always be given to pesticides that have low toxicity, persist only a short time, and do not accumulate in animal tissues. The following tables provide information on the acute toxicity of various pesticides. Values are given for most of the compounds included in this Guideline. An LD50 value is a statistical estimate of the dosage neccessary to kill 50% of a population of white rats or other test animals within a specified period under standarized conditions in the laboratory. The toxicity of a chemical to such animals may vary, however, with species, age, sex, and nutritional state, and with the formulation of the pesticides and the manner of administration. Also the LD50 values are usually expressed in terms of a single dosage, which provides little or no information on possible cumulative effects of repeated dosages of the compound. In addition the toxicity class, the cronics effects and observations are included.

LD50 or LC50 values are useful in comparing different chemical compounds. However, they have certain limitations, and caution must be used in interpreting them in relation to actual use hazards. Since the values are obtained for other animals or fish, they can be applied to man only with reservations. Under comparable conditions and dosages, highly toxic substances are more hazardous than less toxic substances. However, such factors as dosage, frequency of application, and characteristics with respect to accumulation and persistence in animal tissues must be considered. For example, highly toxic material applied at a low dosage may be less hazardous than a much less toxic one applied at a high dosage.

Acute effect in humans can appear within 24 hours and delayed effects can appear after various days or weeks and be equally serious.

DL50 Acute Oral	Quantity to kill an adult man
5	A few drops
5-50	Up to 1 teaspoon
50-500	One or two tablespoons
500-5000	1 oz to 12 oz (3/4 lb.)
5000-15000	12 oz to 1/2 gallon.

TOXICITY CATEGORIES

HAZARD INDICATORS	I	II	III	IV
ORAL LD_{50}	Up to and including 50 mg/kg	From 50 mg/kg thru 500 mg/kg	From 500 thru 5000 mg/kg	Greater than 5000 mg/kg
INHALATION LD_{50}	Up to and including 0.2 mg/liter	From 0.2 thru 2 mg/liter	From 2.0 thru 20 mg/liter	Greater than 20 mg/liter
DERMAL LD_{50}	Up to and including 200 mg/kg	From 200 thru 2000 mg/kg	From 2000 thru 20000 mg/liter	Greater than 20000 mg/liter
EYE EFFECTS	Corrosive corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No Irritation
SKIN EFFECTS	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

In Guatemala the following World Health Organization color clasification system is used to designate toxicity categories of pesticides:

Red = Extremely toxic

Yellow = Highly toxic

Blue = Moderately toxic

Green = Low toxicity

AVAILABLE INFORMATION ON TOXICITY CATEGORY, LD_{50}'s AND CHRONIC EFFECTS OF SOME PESTICIDES USED IN ORD PROJECTS

AREA

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Actellic	*Pirimiphos-Methil*	I	III	>5000	> 4592		
Afalon	*Linuron*	H	III	4000			
Afugan	*Pyrazophos*	F	II III	151-758			
Agallol	*MEMC*	F	I	22-44		Mercury salts.	
Agrimicyn	*Streptomycin*	F		9000	May cause allergic reactions.		
Agrosol	*Maneb + Captan*	F	I			Captan: "Probable carcinogenic" (NRDC).	Class I toxicity for birds and Fish. (F.C)
Akar	*Chlorobenzilate*	A	III	2784-3880 (F.C)	10,200	Reproductive toxicity; carcinogenic (NRDC)	
Aldrin		I	II	38-67 67 (3)	98 (F.C.) 98-200 (3)	In general, organochlorines accumulates in human tissue. They are toxic for the liver, kidneys and nervous system. They alter lipid methabolism, causing artherioscrelosis and hipertension. They produce severe skin lessions. (CR).	Protective equipment is very important
Ambush	*Permethrin*	I	III	430-4,000	>4,000 (rats) >2,000 (rabits)	Reproductive toxicity carcinogenic (NRDC).	
Antracol	*Propineb*	F	II	>5000	>5000		
Azodrin	*Monocrotophos*	I, A	I	8-23 21 (3) (F.C)	354 (F.C) 450 (3)	Inhalation or contact with skin may, without apparent symptoms, progressively increase susceptibility to Azodrin poisoning. (NMF)	Residual effects in Birds and Mamals. Complete protective Equipment. EPA recommends using respirator

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Sulfur		F	II				In case of intoxication do not induce vomit. (F.C.)
Basudin	*Diazinon*	I, N	III	300-400	3,600	Neurological effects Sulfotepp is carcinogenic. (NRDC)	Under special review because wildlife effects (NMF).
Baycor	*Bitertanol*	F	III	>5000	>5000		
Bavistin	*Carbendazin*	F	III	>10000	>2000		
Belmark	*Fenvalerate*	I	III	451-3200	2,500-5,000	Probable carcinogenic (EPA). Reproductive toxicity (NRDC).	Very toxic to Fish (F.C.)
Benlate	*Benomyl*	F	III	>10000	>10000	Mutagénic, teratogenic, cancerigenic (NRDC) (CR)	
Brassicol	*Quintosene*	F	II	1700	4000		
Bravo	*Chlorothalonil*	F	III	>10,000	>10,000	Probable carcinogenic evidence of chronical effects including changes in kidneys, stomach, liver, thyroid. (NRDC). HCB is carginogenic (NRDC).	
Brestan	*Triphenyltin acetate*	F	II	140-298			
Calixin	*Tridezorph*	F	III	1410			
Captan	*Captan*	F	III			Probable carcinogenic; evidence of mutagenic effects. (NRDC). In general, Dicarboximides cause changes in liver and kidney functions. They may cause aenemia.	Toxic to Fish.
Chlorahep	*Heptachlor*	I		147-220	119-320	Carcinogenic, evidence that accumulates in the adiposites and human milk and can be transfered to the fetus.(NMF)	Toxic to Fish, Birds and Wildlife.

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Clortosip	*Chlorothalonil*	(see *Chlorothalonil*)					
Cobre Sandoz	*Copper Oxide*	F	III	1000	8000		
Counter	*Terbufos*	N, I	I	3.5-9.2	900-1425		
Cuprosan	*Copper Oxychloride*	F	III	1000			
Curaterr	*Carbofurnan*	I, N	II				It is extremely toxic to Birds, Fish, Shrimp, Crab and other wildlife. May cause human death if ingested thru the eyes. (NAF).
Daconil	*Chlorothalonil*		(see *Chlorothalonil* under *Bravo*)				
Decis	*Delthametrin*	I	III	128->5000	>2000		
Diazinon	*Diazinon*	N, I	II	200-400	3600		
Difolatan	*Captafol*	F	II	5,000-6,200		In general dicarboximides may affect liver and kidney functions. They may cause anemia and hypertension (CR).	
Dipterex	*Trichlorfon*	I	II	150 400	>2100		
Dithane M-45	*Mancozeb*	F	III	>11,200	>15,000	Some of the dithiocarbamates produce cronic sores in skin and eyes. Others have effects on sexual glands and the thyroid. They may be toxic to the liver, kidneys and nervous systems. (CR).	

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Folidol	*Methyl Parathion*	I	I	9-25	300-400	Evidence of cronic effects, carcinogenicity mutagenicity (NRDC). Recurring exposure to none lethal doses of Parathion may increase a person's susceptibility to organophosphorous pesticide poisoning and may cause other cumulative toxic effects.(NMF)	
Formol	*Formaldehide*	F, B				Some evidence of carcinogenicity exist.	
Furadan	*Carbofuran*		(see *Curaterr*)				
Gramoxone	*Paraquat*	H	I	150		It has the potential to cause long term chronic effects. EPA is reviewing data from recent studies that suggest a relationship between Parkinson's desease and contact with pesticides and herbicides such as Paraquat. (NMF).	Because of its high toxicity and lack of antidotes, Gramoxone is one of the most dangerous pesticides. (NMF).
Kelthane	*Dicofol*	A	III	821-960	1,000-2,100	DDT, a dicofol metabolite is carcinogenic and very persistent in the environment (NRDC).	
Hedonal Amina	*2-4-D*	H	III	375-805		Results of study by the national council institute show an 8-fold increase of Cancer incidence in Persons who mix and/or apply 2-4-D more than 20 days per year. (NMF).	
Lannate	*Methomyl*	I	I	17-24	5,830 (24% liquid formulation).	Evidence of chronic effects, mutagenic, carcinogenic. (NRDC).	
Lorsban	*Chlorpyrifos*	I	II	96-504	2,000		Very toxic to fish and wildlife (NMF).

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Manzate	*Mancozeb*	F	III	7,990		In general dithiocarbamates may produce chronic sores in skin and eyes. Others had effects on sexual glands and thyroid. They may be toxic to the liver, kidneys and nervous systems. (CR).	
Malathion		I	III	1,000-1,375	4,100		Two intoxication incidents related to malathion, were caused by isomalathion, a contaminant from poor manufacture (Medfly).
Metasystox	*Demeton-S-methil-sulfoxid*	I	III	65-75	350		
Mirex	*mirex*	I	II	306	800	It is carcinogenic. Once inside the body it is very resistant to degradation and it is not easily excreted. Experiments have shown that mirex permeates the placenta from the mother to the fetus. (NMF).	It bioaccumulates in wildlife and their food.
Monitor	*Methamidophos*	I, A	I	18-21	118 (75% a.i.)	It is highly toxic to humans, birds, bees, and other wildlife (NMF).	Residues can not be removed; therefore consumers may be exposed to residues in food.
Morestan 25WP	*Oxythioquinox*	I	II	1520-2070	>2000		
Nemacur	*Fenamiphos*	N	I	8.1-9.6	178-275		
Omite	*Propargite*	A	I	2200			
PCNB	(see *Brasicol*)						
Ridomil	*Metalaxil*	F	II	669	3600		

TRADE NAME	COMMON NAME	TYPE (SEE NOTE)	TOXICITY CATEGORY	LD50 ORAL	LD50 DERMAL	CHRONIC EFFECTS	COMMENTS
Ripcord	*Cypermethrin*	I	I	590-5000			
Ronilan	*Vinclozolin*	F	III	>10000	>2000	Evidence of mutagenicity (NRDC).	
Sevin	*Carbaryl*	I	III	246	238	Evidence of mutagenicity and effects on kidneys (NRDC). The WHO has conducted studies that exposure by persons with low protein diets is more risky (NWF).	
Tamaron	*Methamidophos*	(see *Monitor*)					
Tecto	*Thiabendazole*	F	III	3100			
Temik	*Aldicarb*	I, A, N	I	1-17.8	<2000	Evidence of effects on the immunological system (NRDC)	
Tersan 1991	*Benomyl*	(see *Benlate*)					
Thiodan	*Endosulfan*	I, A	I	30-110	359	Evidence exists that endosufan causes problems to kidneys and liver and testicle atrophy (NRDC). Is is possible that toxicity increases in people with low protein diets.	There is no known antidote specific for endosulfan. (NWF)
Tricarbamix	*ziram*	F	III	1400	>6000		
Triniltox Forte	*Mancozeb + 3 Copper salts*	F	III	4100			
Volaton L,G,P	*phoxim*	I	III	1845	>1000		

NOTE: A = Acaricide
F = Fungicide
H = Herbicide
I = Insecticide
N = Nematicide
(F.C.) = Farm Chemical handbook.
(Medfly) = Consortium for International Crop Protection, Environmental Impact Assesment of the Guatemalan Medfly Program, (Guatemala July, 1988)

(NWF) = National Wildlife Fund.
(NRDC) = National Research Defense Council
(CR) = Costa Rica.

NOTE: The use of trade names in this document does not constitute a warranty or endorsement of the products by the CICP/ECOTECTNIA/EA Team.

Registered Pesticides Used in ORD projects, Other Registered Pesticides not Commonly Used in ORD Projects and Toxicity class of These Pesticides

LIST OF PESTICIDES THAT ARE RESTRICTED, CANCELED AND IN REVIEW IN THE ORD PROJECTS

NAME	COMMON NAME	OBSERVATIONS	TOXICITY CLASS
1. Restricted:			
1.1 Fungicides:			
Difolatan	Captafol	R	II
Agallol	MEMC	R	I
1.2 Insecticides/Acaricides:			
Ambush	Permetrin	R	II
Azodrin	Monocrotophos	R	I
Belmark	Fenvalerate	R	III
Counter	Terbufos	R	I
Folidol	Methil/Parathion	R	I
Furadan G.	Carbofuran	R	II
Gusathion	Azinphos Methil	R	I
Lannate	Methomyl	R	I
Lorban 4E	Chlorpyrifos	R	II
Metasystox R	demeton methyl	R	I
Nemacur	Fenamiphos	R	I
Tamaron/ Frubit/ Manitor/ MTD-600	Methamidophos	R	I
Temik	Aldicarb	R	I
Thiodan	Endosulfan	R	I
Omite	Propargite	R	I
Baytroid	Cyfluthrin	R	I
1.3 Herbicides:			
Gramoxone	Paraquat	R	I
2. Cancelled:			
2.1 Insecticides:			
Aldrin	Aldrin	C	II
3. Under Review:			
3.1 Fungicides:			
Captan	Captan	Rev	III
3.2 Insecticides:			
Diazinon	Diazinon	Rev	III

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LIST OF PESTICIDES USED IN ORD PROJECTS
(U.S. EPA Registered, Not Restricted)

NAME	COMMON NAME	TOXIC CLASS
1. Fungicides:		
Antracol	Propineb	II
Dithane M-45	Mancozeb	III
Trimiltox forte	Mancozeb + 3 copper sals	III
Bravo 500	Chlorotalonil	II
Daconil W-75	Chlorotalonil	II
Cuprosan	Copper Oxychloride	III
Manzate 200	Mancozeb	III
Azufre	Sulfur	III
Afugan	Pyrazophos	II
PCNB	Quintozene	II
Benlate	Benomyl	III
Cupravit forte	Copper Oxychloride	III
Calixin	Tridemorph	III
Agrimicin 500	Streptomycin	III
Ridomil	Metalaxyl	II
Cobre Sandoz	Cuprous Oxide	III
Tecto	Thiabendazole	III
Bavistin	Carbendazin	III
Mancozeb	Mancozeb	III
Tricharbamix	Ziram	III
Baycor 25 WP	Bitertanol	III
Copper Oxychloride	Copper Oxychloride	III
Brestan	Triphenyltim acetate	II
Ronilan	Vinclozolin	III
2. Insecticides/ Acaricides:		
Kelthane	Dicofol	II
Decis	Deltamethrin	II/IV
Dipterex	Trichlorfon	II
Malathion	Malathion, Mercapthothion	III
Sevin	Carbaryl	III
Volaton Powder	Phoxim	III
Volaton Granulated	Phoxim	III
Volaton Liquid	Phoxim	III
Actellic	Pirimiphos-Methil	III
Morestan 25 WP	Oxythioquinox	II
3. Herbicides:		
Afalon	Linuron	III
Hedonal ester	Dichloropropioric acid ester	I/III
Hedonal amine	Dichloropropionic acid amine salt	I/III

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RECOMMENDED PESTICIDES NOT COMMONLY USED IN ORD PROJECTS

NAME	COMMON NAME	TOXIC CLASS
Bacillus thruringiensis	Bacillus thuringiensis	III
Vegetable Oil	Vegetable Oil	III
Mineral Oil	Mineral Oil	III
Orthene	Acephate	III
Pirimor	Pirimicarb	II
Ripcord	Cypermethrin	III

5. List of Crops, Pests Commonly Found, Pesticides Reportedly Used in ORD Projects, Pesticides Restricted in Guatemala and by USEPA and Recommended Pesticides

i. Apple

a) Scientific name: Malus spp.

b) Family: Rosaceae.

c) Where grown:
Quiche, Quetzaltenango, Solola, Chimaltenango, Jalapa.

d) A.I.D. projects:

030, 037, 026.

e) Pests:

Quadraspidiotus perniciosus, Phyllophaga sp, Erysoma lanigerum, Alternaria sp, Glomeralla cingulata, Nectria galligena, Venturia inaequalis.

f) Pesticides reported:

Baycor, Bitertanol; Benlate, Benomyl; Cupravit forte, Copper Oxychloride; Dithane, Mancozeb; Folidol (R), Methyl Parathion; Gusathion (R), Azinphos Methyl; Manzate 500, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; Thiodan (R), Endosulfan; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Pesticides restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Baycor, Bitertanol; Cupravit forte, Copper Oxychloride; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Ripcord, Cypermethrin; Triona Oil, Mineral Oil; Volaton powder, Phoxim.

. 2. Bean

a) Scientific name: Phaseolus vulgaris.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Chiquimula, Quiche, Huehuetenango, Jalapa, Quetzaltenango, Santa Rosa, Solola, Totonicapan, Jutiapa, Peten.

d) A.I.D projects

520, 037, 036, 034, 026.

e) Pests:

Xanthomonas phaseoli, Uromyces phaseoli, Alternaria spp., Yellow mosaic, Colletotrychum lindemuthianum spp., Liriomyza spp., Empoasca sp., Saissetia sp., Phyllophaga sp., Spodoptera sp., Agromyza sp., Estigmene acrea, Apion godmani, Trialeurodes sp., Aphis sp., Macrosiphum sp., Diabrotica sp., Thrips sp., Bemisia tabaci.

f) Pesticides reported:

Afugan, Pyrazophos; Aldrin (C), Aldrin; Ambush (R), Permethrin; Antracol, Propineb; Calixin, Tridemorph; Cupravit forte, Copper Oxychloride; Daconil, Chlorothalonil; Decis, Deltamethrin; Dipterex, Trichlorfon; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Malathion, Malathion; Manzate 500, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; Sevin, Carbaryl; Tamaron (R), Methamidophos; Tecto, Thiabendazole; Thiodan (R), Endosulfan; Tricarbamix, Ziram; Trimiltox forte, Mancozeb; Volaton L., Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = restricded in the U.S. on the basis of user hazards.
(C) = Cancelled pesticide.

h) Recommended pesticides:

Afugan, Pyrazophos; Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Calixin, Tridemorph; Cotton seed oil, Cotton seed oil; Cupravit forte, Copper Oxychloride; Daconil, Chlorothalonil; Decis, Deltamethrin; Dipterex, Trichlorfon; Dithane M-45/Manzate 500, Mancozeb; Malathion, Malathion; Soybean oil, Soybean oil; Tecto, Thiabendazole;

Trimiltox forte, Mancozeb + 3 copper salts; Tricarbamix, Ziram; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

3. Beet

a) Scientific name: Beta vulgaris.

b) Family: Quenopodiaceae.

c) Where grown:

Quetzaltenango, Quiche, Sn Marcos, Solola, Chimaltenango, Sacatepequez, Guatemala.

d) A.I.D. projects:

037, 036, 034, 034, 026.

e) Pests:

Spodoptera spp., Myzus persicae, Vertebrates, Trichoplusia ni, Phyllophaga sp., Agrotis sp., Plutella xylostella, Thrips spp., Cercospora beticola, Peronospora schachtii, Phytium ultimun, Rhizoctonia solani, Alphanomices cochloides, Phoma beta, Uromyces beta.

f) Pesticides reported:

Antracol, Propineb; Benomil, Benomil; Cupravit forte, Copper Oxychloride; Decis, Deltamethrin; Folidol (R), Methyl Parathion; Furadan (R), Carbofuran; Mancozeb, Mancozeb; Manzate 500, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; Ridomil, Metalaxyl; Tamaron, Methamidophos; Tecto, Thiabendazole; Thiodan (R), Endosulfan; Trimiltox forte Dithane M-45, Mancozeb + 3 Copper salts; Volaton G, Chlorphoxim; Volaton liquid, Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Cupravit forte, Copper Oxychloride; Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Ridomil, Metalaxyl; Ripcord, Cypermethrin; Tecto, Thiabendazole; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton Powder, Phoxim.

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4. Broccoli

a) Scientific name: Brassica oleracea Var. italica.

b) Family: Cruciferaceae.

c) Where grown:

Chimaltenango, Chiquimula, Quetzaltenango, Quiche, Sta Rosa, Solola, Salamá, Sololá, Sacatepequez and Guatemala.

d) A.I.D. projects:

036, 037, 026.

e) Pests:

Peronospora parasitica, Xanthomonas campestris, Fusarium oxysporium f. conglutinans, Phoma lingam, Tetranychus sp., Plutella xylostella, Phyllophaga sp., Agriotes sp., Agrotis sp., Spodoptera sp., Bemisia tabaci, Trichoplusia ni, Brevicoryne brassicae, Ascia monuste, Atta sp., Leptophobia aripa, Macrosiphum sp., Myzus sp.

f) Pesticides reported:

Agrimicin 500, Estreptomycin; Ambush (R), Permethrin; Antracol, Propineb; Belmark, Fenvalerate; Decis, Deltamethrin; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Lorsban (R), Chlorpyrifos; Metasystox (R), Demeton-S-Methyl Sulfoxid; PCNB, Quintozene; Ridomil, Metalaxyl; Sulfur, Sulfur; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper Salts; Volaton, Phoxim; Volaton G., Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides

(R) = Restricted in the U.S. on the basis of user hazards

h) Special pesticide problems reported:

Plutella xylostella present resistance to pyrethroids in some areas of Chimaltenango.

i) Recommended pesticides:

Agrimicin 500, Streptomycin; Antracol, Propineb; Bacillus Thuringiensis, Bacillus thurigiensis; Decis, Deltamethrin; Dithane M-45, Mancozeb; PCNB, Quintozene; Ridomil, Metalaxyl; Ripcord, Cypermethrin; Sulfur, Sulfur; Trimiltox forte,

Mancozeb + 3 Copper Salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

5. Brussel sprouts

a) Scientific name: Brassica oleracea Var. gemnifera.

b) Family: Cruciferaceae.

c) Where grown:

Chimaltenango, Solola, Jalapa, Sacatepequez.

d) A.I.D. projects:

037, 0343.

e) Pests:

Hellula phidilealis (Walk), Ascia monuste, Plutella xylostella, Macrosiphum sp., Brevicoryne brassicae, Myzus sp., Agrotis sp., Estigmene acrea, Prodenia sp., Leptophobia aripa, Phoma lingam, Xanthomonas campestris, Peronospora parasitica, Trichoplusia ni.

f) Pesticides reported:

Agrimicin 500, Streptomycin; Ambush (R), Permethrin; Bavistin, Carbendazin; Brassicol, Quintozene; Calixin, Tridemorph; Decis, Deltamethrin; Dithane M-45, Mancozeb; Metasystox (R), Demeton-S-Methyl; Mancozeb, Mancozeb; PCNB, Quintozene; Tamaron (R), Metamidophos; Thiodan (R), Endosulfan.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

i) Recommended pesticides:

Agrimicin 500, Streptomycin; Bacillus Thuringiensis, Bacillus thuringiensis; Bavistin, Carbendazin; Brassicol, Quintozene; Calixin, Tridemorph; Decis, Deltamethrin; Dithane M-45, Mancozeb; Mancozeb, Mancozeb; PCNB, Quintozene; Ripcord, Cypermethrin.

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6. Cabbage

a) Scientific name: Brassica oleracea var. capitata.

b) Family: Cruciferaceae.

c) Where grown:

Jutiapa, El Quiche, Sn Marcos, Solola, Totonicapan, Guatemala, Sacatepequez, Chimaltenango.

d) A.I.D. projects:

037, 036, 034, 026.

e) Pests:

Trichoplusia ni, Phyllophaga sp., Ascia monuste, Leptophobia aripa, Spodoptera sp., Meloidogyne spp., Hellula phidilealis, Plutella xylostella, Mycosphaerella brassicola, Fusarium oxyporium f. conglutinans, Plasmodiophora brassicae, Xanthonomas campestris, Phoma lingam, Alternaria sp., Sarasinula plebeia.

f) Pesticides reported:

Ambush (R), Permethrin; Antracol, Propineb; Benomyl, Benomyl; Cupravit forte, Copper Oxychloride; Decis, Deltamethrin; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Manzate 500, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; Ridomil, Metalaxyl; Tamaron (R), Methamidophos; Tecto, Thiabendazole; Thiodan (R), Endosulfan; Volaton G., Phoxim, Volaton L., Phoxim, Volaton powder, Phoxim.

g) Recommended pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Cupravit forte, Copper Oxychloride; Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Metasystox, Demeton-S-Methyl Sulfoxid (low dosages); Ridomil, Metalaxyl; Ripcord, Cypermethrin; Tecto, Thiabendazole; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

7. Cauliflower

a) Scientific name: Brassica oleracea Var. botritis.

b) Family: Cruciferaceae.

c) Where grown:

Chimaltenango, Huehuetenango, Quetzaltenango, Sacatepequez, Sn Marcos, Solola, Totonicapan, Guatemala.

d) A.I.D. projects:

037, 034, 026.

e) Pests:

Mycosphaerella brassicola, Plasmodiophora brassicae, Phoma lingam, Alternaria brassicae, Hellula phidilealis, Spodoptera sp., Phyllophaga sp., Ascia sp., Leptophobia sp., Trichoplusia ni, Agrotis sp.

f) Pesticides reported:

Benomyl, Benomyl; Calixin, Tridemorph; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Metasystox (R), Demeton-S-Methyl Sulfoxid; Ridomil, Metalaxyl; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper Salts; PCNB, Quintozene; Volaton powdered, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Calixin, Tridemorph; Dithane M-45, Mancozeb; PCNB, Quintozene; Ridomil, Metalaxyl; Ripcord, Cypermethrin; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

8. Carnation

a) Scientific name: Dhiantus sp.

b) Family: Cariophiliaceae.

c) Where grown:

Sn Marcos, Guatemala, Sacatepequez, Chimaltenango.

d) A.I.D. projects:

034.

e) Pests:

Myzus persicae, Pratylenchus sp., Meloidogyne sp., Botritis cinerea.

f) Pesticides:

Volaton, Phoxim; Antracol, Propineb.

g) Restricted pesticides:

None among those reported.

h) Recommended pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Calixin, Tridemorph; Dithane M-45, Mancozeb; Ferban, Ferric dimethyldithiocarbamate; Furadan 5%, Carbofuran; PCNB, Quintozene; Ripcord, Cypermethrin; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

9. Carrot

a) Scientific name: Daucus carota.

b) Family: Umbeliferaceae.

c) Where grown:

Chimaltenango, Chiquimula, Huehuetenango, Quetzaltenango, El Quiche, Sn Marcos, Solola, Sacatepequez, Guatemala.

d) A.I.D. projects:

026, 037, 036, 034.

e) Pests:

Systena basalis, Caliothrips fasciatus, Thrips tabaci, Phyllophaga sp., Agrotis ipsilon, Diabrotica sp., Herpentograma bipuntalis, Aphis spp., Myzus persicae, Alternaria dauci, Cercospora carotae, Stemphyllium radicium, Erwinia carotovora.

f) Pesticides reported:

Antracol, Propineb; Aldrin (C), Aldrin; Decis, Deltamethrin; Mancozeb, Mancozeb; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Volaton G, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.
(C) = Cancelled.

h) Recommended pesticides:

Antracol, Propineb; Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Ripcord, Cypermethrin; Volaton 1., Phoxim; Volaton powder, Phoxim.

10. Celery

a) Scientific name: Apiun graveolens L.

b) Family: Umbeliferaceae.

c) Where grown:

Sn Marcos, Quetzaltenango, Solola.

d) A.I.D. projects:

026

e) Pests:

Agromyza sp., Septoria apiicola.

f) Pesticides:

Folidol (R), Methyl Parathion; Antracol, Propineb.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Decis, Deltamethrin; Ripcord, Cypermethrin.

11. Chrisantemum

a) Scientific name: Crisantemun sp.

b) Family: Compuestaceae.

c) Where grown:

Chimaltenango, Quiche, Sacatepequez, Guatemala.

d) A.I.D. projects:

026.

e) Pests:

Tetranichus sp., Aphis spp., Myzus spp., Botrytis cinerea.

f) Pesticides reported:

Antracol, Propineb; Folidol (R), Methyl Parathion; Kelthane, Dicofol.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Actellic, Pirimiphos-methyl; Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Bavistin, Carbendazim; Calixin, Tridemorph; Decis, Deltamethrin; Ripcord, Cypermethrin.

12. Coffee

a) Scientific name: Coffea spp.

b) Family: Rubiaceae.

c) Where grown:

All of Guatemala.

d) A.I.D. projects:

0343, 036.

e) Pests:

Pellicularia koleroga, Fusarium spp., Phythophthora sp., Phyllophaga sp., Paroecantus guatemalae, Leucoptera coffeella, Agriotes sp., Hypotenemus hampei, Rhizoctonia solani, Pellicularia filamentosa, Thanatephorus cucumeris, Mycena citricolor, Hemileia vastatrix.

f) Pesticides reported:

Antracol, Propineb; Copper-Sandoz, Cuprous Oxychloride; Cupravit forte, Copper Oxychloride; Daconil, Chlorotalonil; Difolatan (R), Captafol; Lannate (R), Methomyl; Manzate 500, Mancozeb; PCNB, Quintozene; Ridomil, Metalaxyl; Tecto, Thiabendazole; Temik (R), Aldicarb; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper salts.

g) Restricted pesticides:

(R) = Restrictead in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Cooper-Sandoz, Cuprous Oxychloride; Cupravit forte, Copper Oxychloride; Daconil, Chlorotalonil; Difolatan, Captafol; Lannate, Methomyl; Manzate 500, Mancozeb; PCNB, Quintozene; Ridomil, Metalaxyl; Tecto, Thiabendazole; Temik, Aldicarb; Thiodan, Endosulfan; Trimiltox forte, Mancozeb + 3 Copper salts.

Cultural control can be used to avoid use of Thiodan. Grafting on varieties of Coffea canephora can help reduce the use of Temik.

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13. Corn

a) Scientific name: Zea mays.

b) Family: Graminaceae.

c) Where grown:

All country.

d) A.I.D. projects:

036, 037, 026, 034.

e) Pests:

Sitotroga cerealea, Spodoptera frugiperda, Phyllophaga sp., Agrotis sp., Agriotes sp., Diatrea lineolata, Heliothis zea, Rhopalosiphum maidis, Spodoptera sp., Diabrotica sp., Vertebrates, Listonotus dietrichi, Euxesta mayor, Helminthosporium turcicum, Ustylago maydis, Phytium spp.

f) Pesticides reported:

Aldrin (C), Aldrin; Antracol, Propineb; Azodrin (R), Monocrotofos; Belmark (R), Fenvalerate; Calixin, Tridemorph; Cupravit forte, Copper Oxychloride; Dipterex, Trichlorfon; Folidol (R), Methyl Parathion; Furadan (R), Carbofuran; Gramoxone (R), Paraquat; Lannate (R), Methomyl; Mancozeb, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; PCNB, Quintozene; Thiodan (R), Endosulfan; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.
(C) = Cancelled.

h) Recommended pesticides:

Bacillus Thuringiensis, Bacillus thuringiensis; Decis, Deltamethrin; Furadan 5G, Carbofuran; Ripcord, Cypermethrin; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

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14. Cucumber

a) Scientific name: Cucumis sativus.

b) Family: Cucurbitaceae.

c) Where grown:

El Progreso, Zacapa, B. Verapaz, Jutiapa, Chiquimula, Jalapa.

d) A.I.D. projects:

037.

e) Pests:

Diaphania spp., Trichoplusia ni, Phyllophaga sp., Spodoptera spp.

f) Pesticides reported:

Tamaron (R), Methamidophos; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Bacillus Thuringiensis, Bacillus thuringiensis; Stiletto oil, petroleum oil; Antracol, Propineb.

15. Fava bean

a) Scientific name: *Vicia faba*.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Huehuetenango, Quetzaltenango, Sn Marcos, Solola, Quiche, Totonicapan.

d) A.I.D. projects:

037, 034.

e) Pests:

Alternaria fabae, *Empoasca* sp., *Phyllophaga* sp., *Agriotis* sp., *Aphis fabae*.

f) Pesticides reported:

Aldrin (C), Aldrin; Antracol, Propineb; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) Restricted in the U.S. on the basis of user hazards.
(C) Cancelled.

h) Recommended pesticides:

Decis, Deltamethrin; Furadan 5G, Carbofuran; Ripcord, Cypermethrin; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

16. Garlic

a) Scientific name: *Allium sativum*

b) Family: Liliaceae

c) Where grown:

Huehuetenango, Quetzaltenango, Solola.

d) A.I.D. projects:

037 HAD

e) Pests:

Trichoplusia ni, *Phyllophaga* sp., *Agrotis ipsilon*, *Agriotes* sp., *Prodenia* sp., *Thrips* spp., *Alternaria porri*, *Peronospora destructor*.

f) Pesticides reported:

Antracol. Propineb; Bravo, Chlorotalonil; Cuprosan, Copper Oxychloride; Daconil, Chlorotalonil; Decis, Deltamethrin; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Furadan (R), Carbofuran; Lorsban (R), Chlorpyrifos; Malathion, Mercapthothion; Manzate 500, Mancozeb; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) Restricted in the U.S. on the basis of user hazards.

h) Special pesticide problems:

Alternaria porri and *Peronospora destructor* are reported to have developed resistance to Antracol.

i) Recommended pesticides:

Cuprosan, Copper Oxychloride; Decis, Deltamethrin; Dithane M-45, Mancozeb; Malation, Mercapthothion; Manzate 500, Mancozeb; Ripcord, Cypermethin; Trimiltox forte, Mancozeb + Copper Salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

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17. Ground Cherry

a) Scientific name: Physalis spp.

b) Family: Solanaceae.

c) Where grown:

Chimaltenango, Jutiapa, Guatemala, Sacatepequez.

d) A.I.D. projects:

None reported.

e) Pests:

Agrotis sp., Aleurodes sp., Aphis sp., Phytophtora infestans.

f) Pesticides reported:

Antracol, Propineb; Tamaron (R), Methamidophos; Volaton powder, Phoxim.

(R) = Restricted on the basis of user hazards.

g) Recommended pesticides:

Low doses of Metasystyox (350 cc) can be used in place of Tamaron. Decis Deltamethrin; Ripcord, Cypermethrin.

18. Leek

a) Scientific name: *Allium porrum*.

b) Family;: Liliaceae.

c) Where grown:

Sn Marcos, Quetzaltenango.

d) A.I.D. projects:

034.

e) Pest:

Alternaria porri, *Agrotis repleta*, *Agrotis malefida*.

f) Pesticides reported:

Antracol, Propineb, Folidol (R), Methyl Parathion.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Recommended pesticides Antracol, Propineb; Dipterex bait, Trichlorfon; Bacillus Thuringiensis, *Bacillus thuringiensis*.

19. Lime

a) Scientific name: Citrus spp.

b) Family: Rutaceae.

c) Where grown:

El Progreso, Quiche.

d) A.I.D. projects:

026.

e) Pests:

Aphis spp., Toxoptera auranti.

f) Pesticides reported:

Lannate (R), Methomyl.

(R) = Restricted in the U.S. on the basis of user hazards.

g) Recommended pesticides:

Decis, Deltamethrin; Petroleum oils; Ripcord, Cypermethrin; Triona oil, Mineral oils.

20. Oat

a) Scientific name: *Avena* spp.

b) Family: Graminaceae.

c) Where grown:

Huehuetenango.

d) A.I.D projects:

034.

e) Pests:

None reported.

g) Pesticides:

h) Recommended pesticides:

None.

21. Onion

a) Scientific name: Allium cepa.

b) Family: Liliaceae.

c) Where grown:

Hueheuetenago, Jutiapa, Quetzaltenango, Quiche, Sn Marcos, Solola.

d) A.I.D. projects:

037, 036, 026.

e) Pests:

Peronospora destructor, Agrosoma placetis, Phyllophaga sp., Prodenia sp., Agrotis sp., Myzus spp., Diabrotica spp., Ihrips spp.

f) Pesticides reported:

Ambush (R), Permethrin; Antracol, Propineb; Daconil, Chlorotalonil; Decis, Deltamethrin; Lannate (R), Methomyl; Malathion, Mercapthothion; Manzate 500, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; Ridomil, Metalaxyl; Tamaron (R), Methamidophos; Tecto, Thiabendazole; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton powder, Phoxim.

(R) = restricted on the basis of user hazards.

g) Special pesticide problems:

Lepidoptera resistance to Lannate was reported in Retana.

h) Recommeded pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Cupravit forte; Copper Oxychloride; Decis Deltamethrin: Malathion, Mercapthothion; Manzate 500, Mancozeb; Tecto, Thiabendazole; Trimiltox forte, Mancozeb + 3 Copper salts; Ripcord, Cypermethrin; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

22. Orange

a) Scientific name: *Citrus sinensis*.

b) Family: Rutaceae.

c) Where grown:

Zacapa, El Progreso.

d) A.I.D. projects:

037.

e) Pests:

Lepidosaphes beckii, *Planococcus citri*, *Saissetia* spp., *Coccus* sp., *Ceratitis capitata*, *Anastrepha* spp., *Unaspis citri*, *Capnodium citri*.

g) Pesticides reported:

Copper Oxychloride, Copper Oxychloride, Metasystox (R),Demeton-S-Methyl Sulfoxid; Tamaron (R), Methamidophos.

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Rogor Dimethoate; Cupravit forte, Copper Oxychloride; Malathion bait, Mercaptothion; Petroleum oils; Sulfur, Sulfur.

Use Triona oil against scales and malathion bait against Tephritidae.

23. Pea

a) Scientific name: Pisum sativum.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Sacatepequez, Quezaltenango, Solola.

d) A.I.D. projects:

037, 036, 026.

e) Pests:

Phyllophaga sp, Agrotis sp, Agriotes sp, Trichoplusia ni, Aphis sp, Diabrotica sp, Ascochyta pisi, Erysiphe poligoni, Empoasca sp, Agromyza sp, Bruchus pisorum, Fusarium solani f. pisi.

f) Pesticides reported:

Afugan, Pyrazophos; Cupravit forte, Copper Oxychloride; Decis Deltamethrin; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Lannate (R), Methomyl; PCNB, Quintozene; Sulfur, Sulfur; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Afugan, Pyrazophos; Bacillus Thuringiensis, Bacillus thurigiensis; Cupravit forte, Copper Oxychloride; Decis Deltamethrin; Dithane M-45, Mancozeb; PCNB, Quintozene; Sulfur, Sulfur; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

Those not restricted.

24. Peach

a) Scientific name: Prunus persica.

b) Family: Rosaceae.

c) Where grown:

Quetzaltenango, Solola, Chimaltenango.

d) A.I.D. projects:

037.

e) Pests:

Viruses.

f) Pesticides reported:

Antracol, Propineb; Folidol (R), Methyl Parathion.

(R) = Restricted in the U.S. on the basis of user hazards.

g) Recommended pesticides:

Antracol, Propineb; Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Petroleum oils; Ripcord, Cypermetrhin.

25. Pineapple

a) Scientific name: *Ananas comosus*.

b) Family: Bromeliaceae.

c) Where grown:

Escuintla, Sta Rosa, Izabal.

d) A.I.D. projects:

0343

e) Pests:

Erwinia carotovora, *Ceratocystis paradoxa*, *Thecla* sp, *Grillidae*, *Podysos agenor*.

f) Pesticides:

Agrimicin 100, Streptomycin; Aldrin (C), Aldrin; Counter (R), Terbufor; Tamaron (R), Methamidophos.

(R) = Restricted in the U.S. on the basis of user hazards.

(C) = Cancelled.

g) Special pesticide problems:

Thecla and Grillidae resistance to Tamaron was reported.

h) Recommended pesticides:

Agrimicin 100, Estreptomycin; Decis, Deltamethrin; Dipterex bait, Trichlorfon; Ripcord, Cypermethrin.

Mechanical control and light traps for *Podysos agenor*.

26. Plum

a) Scientific name: *Prunus americana*.

b) Family: Rosaceae.

c) Where grown:

Quetzaltenango, Chimaltenango, Quiche, Sacatepequez, Jalapa, Totonicapan, S ola.

d) A.I.D. projects:

026.

e) Pests:

Myzus sp.

f) Pesticides:

Metasystox (R), Demeton-S-Methyl Sulfoxid.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Decis, Deltamethrin; Metasystox (R) (low dosage), Demeton-S-Methyl Sulfoxid; Ripcord, Cypermethrin.

27. Potato

a) Scientific name: Solanum tuberosum L.

b) Family: Solanaceae.

c) Where grown:

Chimaltenango, Chiquimula, Huehuetenango, Quetzaltenango, Sn Marcos, Solola, Totonicapan, Guatemala, Sta Rosa, Jalapa.

d) A.I.D. projects:

037, 036, 026.

e) Pests:

Empoasca sp, Phyllophaga sp. Scrobipalpopsis solanivora, Agriotes sp, Agrotis sp, Phtorimaea operculella, Trialeurodes sp, Aphis gossypii, Diabrotica sp, Spodoptera exigua, Macrosiphum euphorbia, Myzus persicae, Ropalosiphum maidis, Alternaria solani, Phythophthora infestans, Fusarium solani, Pseudomonas solanacearum, Rhyzoctonia solani, Phythium deboryanum, mosaic virus.

f) Pesticides reported:

Antracol, Propineb; Aldrin (C), Aldrin; Benlate, Benomyl; Cupravit forte, Copper Oxychloride; Cuprosan, Copper Oxychloride; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Furadan (R), Carbofuran; Lannate (R), Methomyl; Manzate 500, Mancozeb; Mancozeb, Mancozeb; Metasystox (R), Demeton-S-Methyl Sulfoxid; MTD-600 (R), Methamidophos; Ridomil, Metalaxyl; Tamaron (R), Methamidophos; Thiodan (R), Endosulfan; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.
(C) = Cancelled.

h) Recommended pesticides:

Antracol, Propineb; Cupravit forte, Copper Oxychloride; Cuprosan, Copper Oxychloride; Decis, Deltamethrin; Dipterex bait, Trichlorfon; Dithane M-45, Mancozeb; Kocide, Copper Hydroxide; Manzate 500, Mancozeb; Ripcord, Cypermethrin; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

Use virus free seeds. To control moths, use healthy seeds and

cultural control (deeper planting in loose soils). Use bacteria free seed to control Pseudomonas. For potato blight, use Toyoacan variety.

28. Sesame

a) Scientific name: Sesamun indicum L.

b) Family: Pedaliaceae.

c) Where grown:

Escuintla, Suchitepequez, Retalhuleu, San Marcos, Quetzaltenango.

d) A.I.D. projects:

034.

e) Pests:

Agrotis sp, Spodoptera sp, Spodoptera sunia, Loxa viridis, Aphis sp, Aleurodes sp, Cercospora sesami, Alternaria sp.

f) Pesticides reported:

Antracol, Propineb; Dithane M-45, Mancozeb; Tamaron (R), Methamidophos; MTD-600 (R), Metamidophos; Trimiltox forte, Mancozeb + 3 Copper salts.

g) Restricted pesticides:

(R) = Restricted on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Bacillus Thuringiensis, Bacillus thuringiensis; Decis, Deltamethrin; Dithane M-45, Mancozeb; Furadan 5G, Carbofuran; Ripcord, Cypermethrin; Trimiltox forte, Mancozeb + 3 Copper salts.

29. Snow pea

a) Scientific name: Pisum sativum.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Sacatepequez, Guatemala

d) A.I.D. projects:

037, 036, 026.

e) Pests:

Phyllophaga sp, Agrotis sp, Agriotes sp, Trichoplusia ni, Aphis sp, Diabrotica sp, Ascochyta pisi, Erysiphe poligoni.

f) Pesticides reported:

Antracol, Propineb; Benlate, Benomyl; Calixin, Tridemorph; Cupravit forte, Copper Oxychloride; Dithane M-45, Mancozeb; Lannate (R), Methomyl; Lorsban (R), Chlorpyrifos; Trimiltox forte, Mancozeb + 3 Copper salts.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Special pesticide problems:

Excesive pesticide use for the control of Ascochyta blight.

i) Recommended pesticides:

A program based on Benomyl - Mn, Zn and Bisditiocarbamate ethylene ion has been tested by ICTA with good results to replace pesticides currently used. A reduction from 40 to 15 applications has been achieved with this program (Morales, J.R., 1986).

Antracol, Propineb; Calixin, Tridemorph; Copper Hydroxide; Cupravit forte, Copper Oxychloride; Dithane M-45, Mancozeb; Trimiltox forte, Mancozeb + 3 Copper Salts; Polirem Combi, Metiram.

30. Soy bean

a) Scientific name: Glycine max.

b) Family: Leguminosaceae.

c) Where grown:

Chiquimula, Escuintla, Suchitepequez, Retalhuleu.

d) A.I.D. projects:

037.

e) Pests:

Diabrotica sp, Alternaria sp.

f) Pesticides reported:

Belmark (R), Fenvalerate; Ridomil, Metalaxyl.

(R) = Restricted in the U.S. on the basis of user hazards.

g) Recommended pesticides:

In general, soy bean can withstand heavy defoliation before critical pod filling periods. Varieties in use are resistant to fungi. In case heavy Lepidoptera occurs, use Bacillus thuringiensis.

31. Squash

a) Scientific name: Cucurbita pepo.

b) Family: Cucurbitaceae.

c) Where grown:

Chimaltenango, Sacatepequez.

d) A.I.D. projects:

026.

e) Pests:

Agriotes spp, Alternaria cucumerina.

f) Pesticides reported:

Dithane M-45, Mancozeb; Tamaron (R), Methamidophos.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Ripcord, Cypermethrin.

32. Strawberry

a) Scientific name: Fragaria virginiana.

b) Family: Rosaceae.

c) Where grown:

Chimaltenango, Sacatepequez and Guatemala.

d) A.I.D. projects:

0343, 037.

e) Pests:

Botritis cinerea, Mycospharella fragaria, Cladiosporium folvum, Tetranychus spp, Agrotis sp, Spodoptera sp, Phyllophaga sp.

f) Pesticides reported:

Actelic, Pirimiphos-methyl; Ambush (R), Permethrin; Benlate, Benomyl; Captan, Captan; Diazinon, Diazinon; Lannate (R), Methomyl; Manzate, Mancozeb; MTD-600 (R), Methamidophos; Omite (NG), Propargite; Ronilan, Vinclozolin; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton powder, Phoxim.

(R) = Restricted in the U.S. on the basis of user hazards.

(NG) = This pesticide is not registered in Guatemala.

g) Recommended pesticides:

Acricid, Binapacryl; Actelic, Pirimiphos-methyl; Bacillus Thuringiensis, Bacillus thuringiensis; Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate 500, Mancozeb; Ripcord, Cypermethrin; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

33. String bean

a) Scientific name: Phaseolus vulgaris.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Sacatepequez, Guatemala.

d) A.I.D. projects:

030.

e) Pests:

Tetranychus sp, Agromyza sp, Colletotrichum lindemuthianum.

f) Pesticides:

Dithane M-45, Mancozeb; Lannate (R), Methomyl.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Antracol, Propineb; Decis, Deltamethrin; Dithane M-45, Mancozeb; Malathion, Mercapthothion; Manzate 500, Mancozeb; Ripcord, Cypermethrin.

34. Sweet pea

a) Scientific name: Pisum sativum.

b) Family: Leguminosaceae.

c) Where grown:

Chimaltenango, Sacatepequez, Guatemala.

d) A.I.D. projects:

037, 030.

e) Pests:

Phyllophaga sp, Trichoplusia ni, Aphis sp, Ascochyta pisi.

f) Pesticides reported:

Dithane M-45, Mancozeb; Lannate (R), Methomyl; Lorsban (R), Chlorpyrifos.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Recommended pesticides:

Decis, Deltamethrin; Dithane M-45, Mancozeb; Manzate, Mancozeb; Malathion, Mercapthothion; Ripcord, Cypermethrin. Bacillus Thuringiensis, Bacillus thuringiensis.

35. Tobacco

a) Scientific name: Nicotiana tabacum.

b) Family: Solanaceae.

c) Where grown:

El Progreso, Zacapa, Guatemala, Jalapa, Jutiapa.

d) Proyectos AID:

037.

e) Pests:

Spodoptera exigua, Manduca sexta, Phyllophaga tabaci, Bemisia tabaci, Heliothis virescens, Agriotes sp, Trichoplusia ni, Myzus persicae, phytophtora parasitica.

f) Pesticides reported:

Azodrin (R), Monocrotophos; Lannate (R), Methomyl; Ridomil, Metalaxyl; Tamaron (R), Methamidophos.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.

h) Special pesticide problems:

Whitefly resistance to Tamaron and Lannate.

i) Recommended pesticides:

Bacillus Thuringiensis, Bacillus thuringiensis; Decis, Deltamethrin; Dithane M-45, Mancozeb; Malathion, Mercapthothion; Manzate 500, Mancozeb; Nomolt, Teflubenzuron; Orthene, Acephate; Pirimor, Pirimicarb; Ridomil, Metalaxyl, Ripcord, Cypermethrin.

36. Tomato

a) Scientific name: Lycopersicon sculentum.

b) Family: Solanaceae.

c) Where grown:

Chiquimula, El Progreso, Huehuetenango, Jalapa, Jutiapa, El Quiche, Guatemala, Sacatepequez, Baja Verapaz.

d) A.I.D. projects:

036, 037, 026.

e) Pests:

Pseudomonas tomato, Phythophthora infestans, Alternaria solani, Viruses; Vertebrates, Macrosiphum sp, Myzus sp, Tetranychus sp, Manduca sp, Heliothis sp, Phyllophaga sp, Agrotis sp, Spodoptera exigua, Bemisia tabaci, Aphis sp, Diabrotica sp, Meloidogyne spp.

f) Pesticides reported:

Aldrin (C), Aldrin; Ambush (R), Permethrin; Antracol, Propineb; Azodrin (R), Monocrotophos; Dithane M-45, Mancozeb; Folidol (R), Methyl Parathion; Frubit (R), Methamidophos; Furadan (R), Carbofuran; Lannate (R), Methomyl; Nemacur (R), Fenamiphos; Ridomil, Metalaxyl; Trimiltox forte, Mancozeb + 3 Copper salts; Volaton powder, Phoxim.

g) Restricted pesticides:

(R) = Restricted in the U.S. on the basis of user hazards.
(C) = Cancelled pesticide.

h) Special pesticide problems:

Resistance of whitefly to Lannate was reported in Retana, Jutiapa.

i) Recommended pesticides:

Bacillus Thuringiensis, Bacillus thuringiensis; Decis, Deltamethrin; Ripcord, Cypermethrin; Trimiltox forte, Mancozeb + 3 Copper salts; Vegetal oils against white fly ULV; Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

Do not apply pesticides before fruiting begins. Use soybean or cottonseed oil in ULV against the whitefly. Eliminate Aldrin and

use Volaton powder/granulated against soil pests. Resistant varieties and soil organic matter can reduce nematode problems.

37. Turnip

a) Scientific name: *Brassica napus*.

b) Family: Cruciferaceae.

c) Where grown:
Sn Marcos, Quetzaltenango, Solola, Totonicapan, Chimaltenango.

d) A.I.D. projects:
026.

e) Pests:

Phyllophaga sp.

f) Pesticides reported:

Volaton powder.

g) Recommended pesticides:

Volaton G., Phoxim; Volaton L., Phoxim; Volaton powder, Phoxim.

38. Wheat

a) Scientific name: *Triticum aestivum*.

b) Family: Graminaceae.

c) Where grown:

Chimaltenango, Huehuetenango, Quetzaltenango, Quiche, Sn Marcos, Solola, Totonicapan, Guatemala and Jalapa.

d) A.I.D. projects:

036, 037, 026.

e) Pests:

Fusarium roseum f. *cerialis*, *Puccinia graminis tritici*, *Puccinia tritici*, *Puccinia striiformis*, *Septoria tritici*, *Puccinia recondita*, *Macrosiphum granarium*, *Spodoptera frugiperda*.

f) Pesticides reported:

Afugan, Pyrazophos; Antracol, Propineb; Dithane M-45, Mancozeb; Hedonal Amina, Dichloropropionic Acid Amine Salt; Hester Ester, Dichloropropionic Acid Ester; Lannate, Methomyl; PCNB, Quintozene; Ridomil, Metalaxyl.

g) Recommended pesticides:

Afugan, Pyrazophos; Antracol, Propineb; Decis, Deltamethrin; Dithane M-45, Mancozeb; Orthene, Acephate; PCNB, Quintozene; Hedonal Amina, Dichloropropionic Acid Amine Salt; Ripcord, Cypermethrin;