

LD
5655
A761
P4
no. 31
c. 2

VIRGINIA COOPERATIVE EXTENSION SERVICE



PEST MANAGEMENT GUIDE 31

JANUARY 1981

V.P.I. & S.U. LIBRARY

MAR 12 1981

BLACKSBURG, VIRGINIA

Insect Control for Commercial Greenhouse and Floral Crops

V.P.I. & S.U. LIBRARY

FEB 9 1981

BLACKSBURG, VIRGINIA

EXTENSION DIVISION



VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

KEYS TO THE PROPER USE OF PESTICIDES

1. Read the label on each pesticide container before each use. Follow the printed instructions to the letter; heed all cautions and warnings; note precautions about residues and withdrawal times.
2. Keep pesticides in the containers in which you bought them. Put them where children and animals cannot get to them; preferably locked-up and away from food, feed, seed, and other materials that may become harmful if contaminated.
3. Dispose of empty pesticide containers in the manner specified on the label.

CONSULT YOUR DOCTOR IF SYMPTOMS OF ILLNESS OCCUR DURING OR AFTER USE OF
PESTICIDES

The names of commercial products and services appear in this publication for information purposes only. The Virginia Cooperative Extension Service does not endorse or warrant these products and services, nor does it imply discrimination against other products and services which also may be suitable.

INSECT CONTROL FOR COMMERCIAL GREENHOUSE AND FLORAL CROPS

J. A. Weidhaas, Jr., Extension Specialist, Entomology
P. B. Schultz, Research Entomologist*
R. S. Lindstrom, Extension Specialist, Horticulture

Relatively few kinds of insects and related pests occur on greenhouse and floral crops, but they attack a wide range of plants and can be highly destructive. Many insecticide and miticide formulations are available to growers, but specific uses may be quite limited for any one and plants vary greatly in susceptibility to chemical injury. Your local Extension Agent may be able to help you or obtain the technical information you need.

PROPER USE OF PESTICIDES.

Insecticides are poisonous and their use in the greenhouse can present a serious danger to both the applicator and plant material if handled carelessly or improperly. Some extremely toxic chemicals are labeled and recommended for greenhouse use. If all precautions are followed meticulously, they are safe, but they should not be used by novices, or unsupervised inexperienced personnel, or in greenhouses used for demonstrations, exhibits, teaching, or horticultural therapy. Restricted pesticides must be applied only by certified pesticide applicators.

In order to use a pesticide safely and effectively, the product label should be read thoroughly each time a control treatment is applied. By law, pesticides must be used in accordance with label directions. The following checklist is a guide to utilizing label information and directions. Prior to the actual application of any chemical treatment, determine which pesticide to use from the recommendations in this Pest Management Guide and become familiar with the general directions and precautions. Then, at the time of application, consult the label as follows.

- 1) Make sure the proper pesticide is being used; by the product name; the Trade or Brand name; the common name, if included; and most importantly, the ingredient statement on the container.
- 2) Ascertain the formulation and concentration of the chemical. The product name may indicate the percentage of the pounds of a.i. (active ingredient); for example, 2E, 4E, or 6E is 2, 4, or 6 lbs. a.i. per gallon of emulsifiable respectively, and 25 EC, 48 EC, or 57 EC is 25%, 48%, or 57% emulsifiable concentrate. A 25 W, 35 WP, or 50 W is 25%, 35%, or 50% wetttable powder. Other formulations include: 5 A or 10 A for 5% and 10% aerosol, or 2 SG for 2% smoke generator. The ingredient statement always indicates the percentage of the active ingredient.
- 3) Find the signal word on the front of the label (caution, warning, danger or poison) and read the caution and hazard statements, as well as the statement of practical medical treatment. Be prepared.
- 4) Look over the entire label for key restrictions such as "for professional use only", "This product is intended to be used only as specified on this label", "for outdoor use only", and statements regarding other restrictions, potential plant injury, and possible indirect effects of usage.
- 5) Among the uses listed find the plant name (carnation, rose, etc.) or plant category (greenhouse, flowers, or ornamentals), if individual plants are not specified. Treat only those plants indicated on the label.
- 6) Read all of the directions for proper treatment, frequency of applications, intervals between treatments, periods necessary before re-entry, etc.
- 7) Determine the correct dosage or mixing rates; make accurate calculations of equivalents for the application equipment to be used; and follow requirements for adequate protective devices and clothing.

Effective application of pesticides depends on: proper timing; favorable treatment conditions of temperature, humidity, moisture, time of day, and plant condition; and thorough coverage, especially the undersides of leaves and in dense or low growing foliage. Thorough wetting is especially important on

*P. B. Schultz, Virginia Truck and Ornamentals Research Station, 1444 Diamond Springs Rd., Va. Beach, VA

waxy foliage and insects such as mealybugs, scales, and aphids. Most insecticides do not act efficiently at temperatures below 50-55°F., and may cause plant injury if used when the temperature is above 90°, especially when coupled with high humidity. Overhead irrigation or watering should be avoided for at least 12 hours after applying pesticide treatments.

Non-chemical control methods should not be overlooked, particularly preventative measures such as making sure not to introduce infested plants into production areas. Weeds and excess plants left around can harbor pests and may be a source of reinfestation.

PLANT INJURY.

Phytotoxicity is a term referring to plant injury caused by chemicals, particularly pesticides. Greenhouse plants seem to be especially prone to this problem, in part because of the wide variety of plants often grown or held in one common area. Signs of phytotoxicity include: 1) tip or marginal burn of leaves; 2) chlorosis in spots, at tips, or on margins of the leaves; 3) leaf distortion, including curling, twisting, or cupping; 4) stunting or growth reduction in the size of entire plants or certain parts; and 5) abnormal or excessive growth of certain plant parts. Flower parts and bracts are especially sensitive in many cases and the most critical to plant sales. New growth is most commonly affected when systemic chemicals are improperly used. Soil drenches and granular treatments may cause root injury resulting in decline, stunting, and damage to older leaves.

The following suggestions will reduce phytotoxic potential:

1. Do not apply pesticides to plants under stress.
2. Avoid spraying under extremely hot, sunny, humid conditions.
3. Apply sprays in the mornings between 6 and 10 a.m.
4. Avoid treating when temperature extremes are likely.
5. Apply pesticides when foliage is dry and conditions are conducive to drying.
6. Use wettable powders rather than emulsifiable concentrates.
7. Do not mix pesticides without prior experience; check compatibility.
8. Keep nozzles of aerosols or mist blowers at least 18-24" from plants treated.
9. Never spray insecticides in equipment that has been used for applying herbicides (tanks, pumps, hoses, guns).
10. Clean sprayer, tank, pump, hose, and gun after each use.
11. Do not let spray mixes stand in the sprayer; do not expose spray concentrates to extreme heat or freezing.
12. Read ALL of the label directions every time you use each pesticide.

FORMULATIONS AND APPLICATION METHODS

Pesticides are available in various formulations: as concentrates for spraying or producing vapors, and ready-to-use dusts, granular soil treatments, aerosols, smokes, and fogs. In some cases only one or a few application methods may be registered for use of a specific pesticide. If only a single formulation is recommended, such as a fog, do not use other formulations of that pesticide as a spray or for other types of treatment.

Dilute sprays are applied with pressurized tank sprayers or high-pressure powered spraying machines. Formulations to be used may be wettable powders (WP), emulsifiable concentrates (E or E.C.), soluble powders (SP), liquids or liquid concentrates (L, LC), or flowables (F). Wettable powders are less likely to cause phytotoxicity problems. Dusts (D) are convenient, but wash off more readily than sprays.

Concentrate sprays are applied with motor-driven or electric mist machines and deliver sprays 5 to 20 times as concentrated as dilute sprayers. Extreme care and skill is necessary for the proper use of mist blowers to achieve effective, safe, non-phytotoxic treatments.

Aerosols, smokes, thermodusters and foggers create pesticide concentrations in air that are lethal to pests. Rates of application from aerosol bombs, generators, and foggers are based on air volume in closed greenhouses in terms of amount of pesticide per X number of cubic feet of air. It is important to close the greenhouse tightly for the appropriate length of time followed by adequate prescribed ventilation time periods.

Granular formulations are used for soil treatment only. Apply with mechanical spreaders for large bench areas, or by treatment with small volume measures to individual pots or containers. Granules should not be allowed to fall or remain on foliage, nor be washed out of pots or treated benches. Liquid concentrates may be diluted for use as soil drenches in some cases.

COMPATIBILITY AND COVERAGE

The pesticides in these recommendations are compatible with each other, but care should be taken in mixing different chemicals. Mixing different formulations such as wetttable powders and emulsifiable concentrates, or oils and pesticides are not recommended. Never mix a herbicide with insecticides or fungicides, nor use a sprayer that has been used to apply herbicides.

For especially waxy foliage, the addition of a wetting agent or spreader-sticker may be desirable when applying sprays. However, it is unnecessary if two or more pesticides are added together, since a greater amount of wetting agent or emulsifier will result in the tank. The use of two or more emulsifiable concentrates mixed together in the same quantity of water results in twice as much or more solvent applied to the plants and may cause plant injury. Read the pesticide label carefully for compatibility statements and mixing precautions. Highly alkaline water or solutions (pH 8.0 or higher) will cause rapid or immediate breakdown of most pesticide chemicals.

SAFETY AND TOXICITY

Modern pesticides are readily absorbed through the skin, as well as being poisonous by ingestion, by inhalation or by contact in the eyes. Penetration of the skin occurs immediately on contact and is most hazardous when handling undiluted concentrates. It is essential to wear protective clothing, proper gloves, boots, and adequate face shields and respirators or gas masks when directed on the label. Frequent changes to clean clothing and protective devices are essential. With the newer organic tin chemicals, (Plictran, Orthomite, Vendex) the LD₅₀ values are higher, in the caution category, but potential eye damage warrants a danger warning on the label.

The signal word on the pesticide label (caution, warning, danger or poison) and the LD₅₀ values are helpful as a guide to relative toxicities of pesticides. The LD₅₀ is the lethal dosage, orally (ingestion) or dermally (skin absorption), necessary to kill one-half of a test population and is expressed in milligrams of chemical per kilogram of body weight (mg/kg).

Signal Word	LABEL CATEGORIES		
	Toxicity Category	mg/kg Dermal LD50	mg/kg Oral LD50
DANGER POISON (skull and crossbones)	Highly toxic	0-50	0-200
WARNING	Moderately toxic	51-500	201-2000
CAUTION	Slightly toxic	501-5000	2001-20,000
CAUTION	Relative non-toxic	over 5000	over 20,000

RELATIVE TOXICITIES

Pesticide	Toxicity LD50 (mg/kg)		Pesticide	Toxicity LD50 (mg/kg)	
	oral	dermal		oral	dermal
diazinon	400	900	Orthene	945	866
Dibrom	430	1100	Orthomite	2631	2000+
Dipel	none	none	Pentac	3160+	-
Dithion	7-10	-	Pramex, Pounce	4000	2000-4000
Dylox	470	2000	Pirimor	147	500+
ethion	96	-	Plictran	540	2000+
Kelthane	809	2100	resmethrin	4240	2500
lindane	125	1000	Sevin	850	4000
malathion	1375	4100	Systox	12	14
Mesuro1	87-130	2000+	Tedion	14,700	-
metaldehyde	250-1000	-	Temik	0.9	5
Metasystox-R	65-75	250	Thiodan	110	359
methoxychlor	6000	6000	Vapona, DDVP	56-80	107
nicotine	50	50-60	Vendex	2631	2000+

HOW TO USE THESE RECOMMENDATIONS

Once the pest problem has been identified, consult Table I. Find the pest or pest group (arranged alphabetically) to determine which control measures are available, the formulations that are registered, and the crops labelled. Then consult Table II for specific use and precautionary information on the control measure chosen. Be sure to check the potential phytotoxicity statements. If in doubt about a crop, treat a small sample area and observe the plants for several days, or up to 2 or 3 weeks for systemic or soil treatments.

Restricted pesticides are marked with "+".

Pramex and Pounce are State 24-C registrations, for which restricted or supplemental labeling must be in the possession of the applicator in addition to the regular label on the container.

After using the recommendations here, read and follow the label directions at the time of application.

Chemicals labeled "for restricted use" or "Danger-poison" should be used only by certified applicators and only for specified uses.

TABLE I. GUIDE TO CONTROL MEASURES FOR PESTS
FORMULATIONS REGISTERED FOR TREATMENT¹

PESTICIDE	SIGNAL WORD	FOLIAR SPRAY	AEROSOL	SMOKE FOG VAPOR	SOIL	CROPS LABELLED*
APHIDS						
Orthene	caution	75 SP	3A	-	-	carnation, chrysanthemum, rose. Aerosol is labeled for most crops.
MSR	warning	25 SC	-	-	25 C	all crops.
+Temik	poison	-	-	-	10 G	carnation, chrysanthemum, Easter lily, gerbera, rose, snapdragon
Pirimor	warning	50 W	-	-	-	aphelandra, chrysanthemums, dieffenbachia, Gynura, rose
Thiodan	warning	50 W	-	SG	-	all crops.
+Dithio	poison	-	5A	SG F-EC	-	all crops.
malathion	caution	50 EC	15A	F-EC	-	numerous crops, but injury may occur on many. Fog is safest for carnation, chrysanthemum, geranium, rose, snapdragon.
diazinon	warning	50 W 48 EC	-	F-EC	-	azalea, carnation, chrysanthemum, rose.
lindane	warning	25 W 18.5 EC	-	SG F	-	all crops.
nicotine	warning	-	-	V-40 EC SG	-	all crops.
Dibrom	warning	-	-	F-8 EC	-	all crops.
Vapona	poison	-	10A	V,F,SG	-	all crops.
Systox	poison	2E 6E	-	-	2E 6E	chrysanthemum, dahlia, rose

+Restricted use chemical

*Be sure to check precautions for phytotoxicity for each pesticide in Table II.

¹Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor.

PESTICIDE	SIGNAL WORD	FORMULATIONS REGISTERED FOR TREATMENT ¹				CROPS LABELLED*
		FOLIAR SPRAY	AEROSOL	SMOKE FOG VAPOR	SOIL	
CATERPILLARS, CUTWORMS, LOOPERS						
<u>B. thuringiensis</u>	non-toxic	WP	-	-	-	Consult label of brands available for specific pest uses.
Sevin	caution	50W 80 S	-	-	-	All susceptible crops.
lindane	warning	25 W 18.5 EC	-	-	-	azalea, carnation, chrysanthemum, geraniums, rose, snapdragon
Dylox	caution	80 SP	-	-	-	crops listed on label.
methoxychlor	caution	50 W	-	-	-	crops listed on label
CENTIPEDES (see MILLIPEDES)						
CYCLAMEN MITE						
Thiodan	warning	50 W 2 E	-	-	-	african violet, cyclamen, snapdragon, begonia, gerbera.
Kelthane	caution	18.5 EC	-	-	-	african violet, cyclamen, snapdragon, gerbera.
diazinon	warning	50 W AG 500	-	-	-	crops listed on label.
FUNGUS GNATS (ADULTS)						
Resmethrin	caution	-	1A	-	-	all crops.
Vapona	poison	-	10A	V-41.4EC F - EC	-	all crops.
+Dithio	poison	-	15A	-	-	all crops.
LEAFMINERS						
Pramex	warning	13.3 EC	-	-	-	chrysanthemum only.
Pounce	danger	3.2 E	-	-	-	chrysanthemum only.
+Temik	poison	-	-	-	10G	chrysanthemum, gerbera.
Dibrom	warning	-	-	V-58 EC	-	all crops.
Vapona	poison	-	10A	-	-	all crops.
diazinon	warning	-	-	F	-	aster, carnation, chrysanthemum, snapdragon.
LEAFROLLERS						
Orthene	caution	75 SP	-	-	-	rose
Vapona	poison	-	10A	F	-	all crops.
Dibrom	warning	-	-	V	-	all crops.
MEALYBUGS (FOLIAR)						
+Temik	poison	-	-	-	10G	poinsettia only.
Vapona	poison	-	10A	S,F	-	all crops.
+Dithio	poison	-	5A	S,F	-	all crops.
Dibrom	warning	-	-	F,V	-	all crops.
Orthene	caution	75 SP	3A	-	-	foliage plants, orchids, anthurium, cacti, poinsettia
malathion	caution	-	15A	-	-	all crops.
+Systox	poison	2E 6E	-	-	2E 6E	chrysanthemum, dahlia, rose

+Restricted use chemical.

*Be sure to check precautions for phytotoxicity for each pesticide in Table II.

¹Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor.

PESTICIDE	SIGNAL WORD	FORMULATIONS REGISTERED FOR TREATMENT ¹				CROPS LABELLED*
		FOLIAR SPRAY	AEROSOL	SMOKE FOG VAPOR	SOIL	
MEALYBUGS - ROOT						
diazinon	warning	-	-	-	4E 25 WP	see label directions.
MILLIPEDES, CENTIPEDES, SOWBUGS						
ethion	warning	-	-	-	4M	bench or ground treatment
malathion	caution	-	-	-	57 EC	bench or ground treatment
diazinon	warning	-	-	-	AG 500	bench or ground treatment
SCALE INSECTS						
Orthene	caution	75 W	3A	-	-	see crops listed on label
+Dithio	poison	-	5A	S,F	-	all crops
malathion	caution	-	-	F	-	all crops
+Systox	poison	2E 6E	-	-	2E 6E	see crops listed on label
SLUGS, SNAILS						
metaldehyde	caution	-	-	-	bait D,EC	all crops
Mesuro1	warning	-	-	-	bait	all crops except food plants
SOWBUGS (see MILLIPEDES)						
SPIDER MITES						
+Temik	poison	-	-	-	10G	carnation, chrysanthemum, Gerbera, Cymbidium orchid, poinsettia, rose, snapdragon or (see crops listed on label).
Plictran	danger	50 WP	-	-	-	carnation, chrysanthemum, poinsettia, rose
Pentac	caution	50 WP	-	F	-	azalea, carnation, chrysanthemum, delphinium, gardenia, poinsettia, snapdragon, zinnia.
Vendex	danger	50 WP	-	-	-	all crops
Orthomite	danger	50 WP	-	-	-	all crops
Kelthane	caution	35 WP	-	-	-	all crops
Tedion	caution	25 WP	-	-	-	all crops
+Dithio	poison	-	5A	-	-	all crops
Dibrom	warning	-	-	F,V	-	all crops
+Systox	poison	2E 6E	-	-	2E 6E	chrysanthemum, dahlia, rose
Vapona	poison	-	10A	-	-	all crops
MSR	warning	2E	-	-	2E	all crops
SPRINGTAILS						
malathion	-	-	-	-	57 EC 25 WD	bench and ground treatment
THRIPS						
Orthene	caution	75 WP	3A	-	-	all crops
diazinon	warning	-	-	F	-	aster, carnation, chrysanthemum, snapdragon
Vapona	poison	-	10A	F	-	all crops
lindane	warning	18.5 EC 25 W	-	F	-	all crops

+Restricted use chemical.

*Be sure to check precautions for phytotoxicity for each pesticide in Table II.

¹Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor.

PESTICIDE	SIGNAL WORD	FORMULATIONS REGISTERED FOR TREATMENT ¹				CROPS LABELLED*
		FOLIAR SPRAY	AEROSOL	SMOKE FOG VAPOR	SOIL	
resmethrin	caution	-	2A	-	-	
Dibrom	warning	-	-	V	-	all crops
MSR	warning	25 SC	-	-	-	all crops
+Dithio	poison	-	5A	S,F	-	all crops
malathion	caution	-	15A	F	-	carnation, chrysanthemum, geranium, rose, snapdragon
+Temik	poison	-	-	-	10G	chrysanthemums
WHITEFLIES						
resmethrin		-	2A	-	-	all crops
		-	-	F	-	azalea, begonia, bird of paradise, coleus, dieffenbachia, geranium, Indian rubber tree, lily, Norfolk Island pine, palm, poinsettia, snapdragon, wandering jew
		2E	-	-	-	argeratum, azalea, aster, begonia, calendula, chrysanthemum, coleus, geranium, ivy, petunia, poinsettia, rose, salvia
Orthene	caution	75 SP	3A			
Thiodan	warning	50 WP	-	S	-	all crops
+Temik	poison	-	-	-	10G	chrysanthemum, gerbera, poinsettia
Vapona	poison	-	10A	S,F	-	all crops
Dibrom	warning	-	-	S,V	-	all crops
+Dithio	poison	-	5A	S,F	-	all crops
+Systox	poison	2E 6E	-	-	2E 6E	
lindane	warning	25 W 18.5 EC	-	S,F	-	all crops

TABLE II. GUIDE TO PESTICIDE USAGE

CROSS-REFERENCE TO PESTICIDE NAMES

acephate - see Orthene	hexakis - see Orthomite, Vendex
aldicarb - see Temik	methiocarb - see MesuroI
Bacillus thuringiensis - see Dipel	naled - see Dibrom
carbaryl - see Sevin	oxydemeton-methyl - see MetaSystox-R
cyhexatin - see Plictran	pirimicarb - see Pirimor
Cythion - see malathion	permethrin - see Pramex, Pounce
demeton - see Systox	SBP-1315 - see Pramex
DDVP - see Vapona	SBP-1382 - see resmethrin
dichlorvos - see Vapona	Spectracide - see diazinon
dicofol - see Kelthane	sulfotepp - see Dithio
dienochlor - see Pentac	tetradifon - see Tedion
endosulfan - see Thiodan	trichlorfon - see Dylox
fenbutatin - oxide - see Orthomite, Vendex	

+Restricted use chemical.

*Be sure to check precautions for phytotoxicity for each pesticide in Table II.

¹Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor.

PESTS LABELLED	FORMULATION	Rates of Application			Precautions and Remarks
		50 gal.	10 gal.	3 gal.	
DIAZINON					
aphids, carnation bud mite and shoot mite, leafhoppers	50 W	1/2 lb.	3-1/3 T	1 T	Sprays may be used as labeled, but in greenhouses fog is preferred.
leafminers, leaf-tiers, certain scale crawlers, thrips	AG 500	1/2 pt.	3-1/3 T	1 T	
	Fog	Use 1 oz. E.C./3000 cu. ft.			For fog, foliage should be dry, repeat in 4-7 days if necessary. Vents closed for 1-1/2 hrs. Maintain 70-85° and ventilate for 1 hr. before reentry.

NOTES: Do not use diazinon on ferns, poinsettia, hibiscus, papaya, pilea, and gardenia. Plant injury may occur on anthurium, asparagus fern, begonia, black olive, Cissus (kangaroo vine), crape myrtle, Cyclamen, Dianthus, Dracaena, Euphorbia, Hoya (wax plant), peperomia, Scindapsis (pothos), Saintpaulia, rose, violet.

DIBROM					
aphids, leafrollers	8 E	Vaporize 1 fl. oz. per 10,000 cu. ft.			Apply when foliage is dry. Close vents for 2 hrs. Can be applied to steam pipes heated to 160° F. Prolonged use corrodes pipes. Use 2-3 treatments at 4-7 day intervals. See label for detailed directions on use and safety precautions. Smokes may also be available for aphid control.
mealybugs, spider mites, whiteflies (adults)	Fog	Use 1 fl. oz. per 3,000 cu. ft. in fog generator			

NOTES: May injure: rose varieties, especially White Butterfly and Golden Rapture; Pink Champagne chrysanthemum; green wandering jew, dutchman's pipe, poinsettia. Concentrate is highly corrosive to metals.

DIPEL					
caterpillars, loopers, tobacco budworm, omnivorous leafroller, armyworms	16,000 IU WP	4-8 oz.	2.5-5 T	1-1/4 to 2-1/2 T	Full coverage foliar spray when larvae are small. Use lower rate for light, higher rate for severe infestations. Double the rate for armyworms.

NOTES: B.t. is non-toxic to man, animals, birds, fish, bees, and is exempt from tolerance on crops.

+DITHIO					
aphids, mealybugs	5% Aerosol	4 lb. bomb treats 200,000 cu.ft. or use a 2-4 second exposure for each 1000 cu. ft.			Treat when foliage is dry with vents closed at least 2 hours or overnight. House temperature should be 70-80°F. Often formulated with Tedion (tetradifon), a miticide. Use according to label directions. Where needed, retreat at 7 day intervals. Aerosol may be less effective against mites.
scales, spider mites	15% Smoke	3.5 oz. smoke generator treats 10,000 cu. ft.			

DYLOX					
armyworms, cutworms, leafminers, plant bugs, tobacco budworm, webworms	80 SP	10-15 oz.	1-1.5 oz.	4-6 t	Spray plants until thoroughly wet, repeat as necessary.
Narcissus bulb fly	80 SP	10 oz.	1 oz.	4 t	Apply mixture as drench per 500 feet of row. Direct stream to base of plants at beginning of adult fly activity (early May to June). Repeat annually.

NOTES: Phytotoxicity has occurred on certain varieties of carnations, chrysanthemums, hydrangeas, and zinnias. May injure Brassia actinophylla (Schefflera), Dracaena (Gold Dust Plant), Saintpaulia (African violet), Syngonium. When large plantings are to be sprayed for the first time, treat only a few plants and observe for 4 to 5 days before spraying the entire planting.

+Restricted use chemical.

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound, pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet;c-cup; T-tablespoon;t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
ETHION					
millipedes	8 Aqua	6-2/3 T	1-1/3 T	1 t	Soil treatment: Apply mixture at a rate of 3 gal. per 100 square feet of bench space. Wear approved mask or respirator.
	4 Misc.	13-1/3 T	2-2/3 T	2 t	
KELTHANE					
spider mites Cyclamen mite	35 WP	1/2 lb.	15 T	4.5 T	Apply 2 to 3 times at 4-7 day intervals. Works best at cool temperatures. Use EC for cyclamen mite. Not compatible with sulfur.
	18.5 EC	1/2-1 pt.	3-6 T	1-2 T	
spider mites	fog	1 oz. EC/3000 cu. ft.			For carnations, mums, roses. Foliage should be dry. Close vents for 1-1/2 hr. Ventilate 1 hr. before re-entry. Maintain temperature 70-80°F.
NOTES: Phytotoxicity: May cause injury to Anthurium, Asparagus plumosus (Asparagus fern), Begonia, <u>Brassaia actinophylla</u> (Schefflera), <u>Chamaedorea elegans</u> (Neanthe Belle Palm), Chrysanthemum, <u>Cissus antarctica</u> (Kangaroo Vine), <u>Codiaeum</u> (Croton), <u>Cordylone</u> (Ti Plant), Cyclamen, Dianthus, Epiphyllum, Euphorbia, <u>Ficus benjamina</u> , Gardenia, Geranium, Hibiscus, Kalanchoe, Peperomia, Poinsettia, Saintpaulia, <u>Scindapsus</u> (Pothos), Streptocarpus, Sweet pea.					
LINDANE					
aphids, caterpillars fleabeetles, leaf-hoppers, leafrollers, plant bugs, psyllids, thrips, whiteflies	20% EC	1/2 pt.	3-1/3 T	1 T	Apply as full coverage foliar spray.
	25% WP	1/2 lb.	10 T	3 T	
	fog	1 oz. EC/3,000 cu. ft.			Foliage should be dry. Close vents for 1-1/2 hrs. Ventilate 1 hr. before re-entry. Temperature 70-85°F.
	smoke	see label			
weevils, black vine, fuller rose	20% liquid	1 pt.	6.6 T	2 T	Spray to saturate soil around plants in beds. For potted plants spray soil surface lightly, comparable to a light watering.
NOTES: May cause injury to: Adiantum, Anthurium, Aphelandra, Aralia, carnation, <u>Cissus antarctica</u> , Cyclamen, Dizygotheca, Ferns, Fuchsia, Gardenia, Gerbera, <u>Hedera helix</u> (English Ivy), Hibiscus, Hydrangea, Iris, Kalanchoe, Monstera deliciosa, Narcissus, Poinsettia, Rose, Sathiphyllum Tulip.					
MALATHION					
aphids, mealybugs, spider mites, thrips whiteflies	15% aerosol	Use 1 lb. bomb/50,000 cu. ft.			2-3 treatments at 4-7 day intervals. Foliage must be dry. Close vents for at least 2 hours or overnight.
	Fog	Use 1 oz. EC/3,000 cu. ft.			
aphids, mealybugs, scale crawlers, spider mites, whiteflies	25 W	1-1/2 lbs.	4.8 oz.	6 T	Apply 1-2 times at 4-7 day intervals or as needed.
	50% EC	1-1/2 C	5 T	1-1/2 T	
millipedes, springtails, sowbugs	50% EC	1 C	3-1/3 T	1 T	Apply mixture at rate of 1 gal./150 sq. ft. of soil surface.
NOTES: May cause plant injury to Adiantum, Anthurium, Aralia, Aster, Begonia, <u>Brassaia actinophylla</u> (Schefflera), Camellia, Carnation, Chrysanthemum, <u>Cissus antarctica</u> (Kangaroo Vine), Crassula (Jade Plant), Cyclamen, Dahlia, Dianthus, Dieffenbachia, <u>Euphorbia</u> , Ferns, Ficus, Fuchsia, Gardenia, Gloxinia, Hibiscus, Hydrangea, Ilex, Impatiens, Kalanchoe, Liliium, Orchids, Peperomia, Petunia, Pilea, Poinsettia, Rose, Saintpaulia, <u>Scindapsus aureus</u> , Sweet pea, Syngonium (Nephytis), Violet					

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
MESUROL					
snails, slugs, sowbugs, crickets, millipedes	2% granules	1 lb./1000 sq. ft.			Apply bait to soil around plants or flats but not on plant foliage. Do not apply to food crops
METALDEHYDE					
snails, slugs	3.25% pellets	1 lb./1000 sq. ft.			Apply bait only to soil surface around plants, not foliage or other plant parts.
NOTE: May cause injury to Cattleya, Phalaenopsis orchids, Gerbera, Ferns.					
METASYSTOX-R					
aphids, leafhoppers, mites, thrips, white-flies	SC	3/4 pt.	5 T	1.5 T	Foliage spray. Apply as full coverage spray. Repeat as necessary. Soil drench: Apply 1/2 cup mixture per 6 to 8 inch pot. Repeat as necessary. For control of aphids, mites, thrips
NOTES: Do not handle plants until spray deposit has dried. When large plantings are to be sprayed, treat only a few plants and observe for sensitivity before treating the entire planting. May damage: Adiantum, Anthurium, Aralia, Asparagus fern, Begonia, <u>Brassaia actinophylla</u> (Schefflera), Bromeliaceae, Chrysanthemum (Hurricane, Iceburg, Whitetop, and Pennant varieties), <u>Cissus antarctica</u> (Kangaroo Vine), Crassula, <u>Fatshedera lizei</u> (Botanical Wonder Plant), Ferns, Ficus, Fuchsia, Geranium, <u>Hedera helix</u> (English Ivy), Lilium, Peperomia, Spathiphyllum, Syngonium (Nephytis), Zinnia.					
METHOXYCHLOR					
beetles, thrips, caterpillars, leafhoppers, rose chafer	50% WP	1 to 1-1/2 lb. 2/5-1/3 lb. 6-9 T			Outdoor use only.
NOTE: May cause injury to chrysanthemums.					
NICOTINE					
aphids, thrips, mealybugs	14% smoke generator	6 oz/10,000 cu. ft.			Foliage should be dry. Close vents for 2-3 hrs. or overnight. Maintain temperatures between 70-80°F.
	40% EC	1/2-1 pt.	3-1/3 to 6-2/3 T	1-2 T	Apply 2-3 treatments at 4-7 day intervals as needed.
NOTES: Do not use smoke on open blooms of snapdragons or geraniums. May injure: Adiantum, Anthurium, Aster, Carnation, Chrysanthemum, Cissus antarctica, Crassula, Cyclamen, Ferns, Gardenia, Gladiolus, Gloxinia, Kalanchoe, Saintpaulia, Salvia, Streptocarpus.					
ORTHENE					
aphids, leafroller, mealybugs, scale crawler, thrips, whitefly	75 SP	1/3 lb.	6-2/3 T	2 T	Repeat in 7-10 days as needed. Greenhouse use on roses, carnations, mums. Do not respray mums or carnations within 28 days.
aphids, leafroller, mealybug, scale crawler, thrips, whitefly, leafminer, cabbage looper	3% aerosol	spray 5 seconds per 100 sq. ft.			Apply 5-10 seconds/100 sq.ft. Do not use under high temperature and humidity conditions or where gas heating systems are unvented.
NOTES: Do not use 15.6% liquid formulation in the greenhouse. Phytotoxicity may occur on <u>Bletchum gibbum</u> , <u>Brassaia actinophylla</u> (Schefflera), <u>Chamaedorea elegans</u> , <u>Cissus antarctica</u> , <u>Ficus triangularis</u> , <u>Fittonia verschaffeltii</u> , Gloxinia, Hibiscus, <u>Maranta leuconeura kerchoveana</u> , <u>Nephrolepis exaltata</u> (Florida Ruffle Fern), <u>Pachystachya lutea</u> , <u>Plectranthus australis</u> , <u>Polypodium aureus</u> , Philodendron, Polystichum, <u>Pteris ensiformis</u> , Salvia, <u>Tolmiea menziesii</u> , and many varieties of chrysanthemums. Before treating large plantings spray only a few plants and observe 2 weeks for phytotoxicity.					

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
ORTHOMITE two-spotted spider mite	50 WP	4-8 oz.	5-10 T	1-1/2 to 3 T	Do not get in eyes, on skin or clothing. Do not add oil to spray solution. Apply when mites appear. Repeat as necessary to maintain control, but not more than once every 28 days. Apply to the foliage of chrysanthemums (prebloom) and poinsettias (prebract). Use goggles and face mask during application.
NOTES: Corrosive; may cause skin irritation, respiratory, irritation, and eye damage.					
PENTAC spider mites	50% WP	1/4 lb.	5 T	1-1/2 T	Apply 2 times at 2 week intervals. Thorough coverage of both leaf sides is necessary. Works best at 68-75°F.
	Fog	1 oz EC/3,000 cu. ft.			Apply 2 times at 12-day intervals. Foliage should be dry. Close vents for at least 1-1/2 hrs. Maintain temperatures at 70-80°F. Ventilate 1 hour before reentry. May require 3-5 days to show effects.
NOTES: May injure chrysanthemum foliage. Do not apply to open blooms. May injure Gloxinia, Kalanchoe.					
PIRIMOR aphids	50% WP	2-4 oz.	1-1/3 T	1-1/2 to 3 t	Apply as soon as pest is noticed and at 7-day intervals. Do not apply more than 4 times. Use the higher rate for severe infestations. Add a non-ionic wetting agent only for roses. Use only one application for greenhouse roses.
NOTES: Do not spray ferns, peperomia, vines, and schefflera. Do not apply to 'Icecap', 'Goldcap', or related chrysanthemum varieties. May injure <u>Bellis</u> spp., <u>Delphinium</u> , <u>Lilium longiflorum</u> .					
PLICTRAN two-spotted spider mite	50 WP	2-3 oz.	2.5 T	2 t	Do not add a wetting agent. Thorough coverage is essential. Apply 2-3 times at 7-14 day intervals. Do not get in eyes, on skin or inhale mist.
NOTES: Phytotoxicity to chrysanthemum blossoms and poinsettia bracts. Make applications only to the foliage (prebloom or prebract). Do not add surfactant when applying to roses. May injure carnation, <u>Cissus rhombifolia</u> (grape Ivy), <u>Crassula oleracea</u> (Jade Plant), <u>Croton Ivesine herbstii</u> , <u>Kalanchoe</u> .					
POUNCE leafminer	3.2 E	10 fl. oz	3.3 T	1 T	Avoid spraying blooms; use on foliage only. May be applied weekly if necessary.
NOTES: Plant injury may occur on some mum cultivars. If uncertain, test on a small number of plants to determine plant safety prior to large scale use. This is a special State registration (24-C) and supplemental labelling must accompany the regular label when in use.					

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
PRAMEX leafminer	13.2% EC	1/2 pt.	3.3 T	1 T	Apply as full coverage foliar spray at 4 day intervals to achieve population control. Apply as full coverage foliar spray at 8 day intervals after population control has been achieved and/or for preventive control.
		1/6 pts.	10.5 T	3.2 T	

NOTES: This is a special State registration (24-C) and supplemental labeling must accompany the regular label when in use.

RESMETHRIN whiteflies	24% liquid	1/2-1 pt.	3-1/3 to 6-2/3 T	1-2 T	Spray weekly to point of run-off for 4 weeks. Best results at 70°F. When fewer applications preferred, use higher rates.
	Fog	1 oz. EC/3000 cu. ft.			Foliage should be dry. Close vents for at least 1-1/2 hr. Maintain temperature of 70°F. Ventilate before reentry for 1 hr. Apply at weekly intervals for at least 4 weeks.
whiteflies, fungus gnats, thrips, cucumber beetles	1% aerosol (prescription treatment 1200)	Apply 5-10 sec./100 sq.ft. of bench			Apply in early evening when foliage is dry and temperature is 7-80°F. Keep greenhouse closed 2-4 hours following treatments.

NOTE: Treat poinsettias prebract only. Do not use on red calceolaria or open blooms of 'Shoesmith' chrysanthemum.

SEVIN blister beetle, flea beetle, leafhoppers, leafrollers, mealybugs, plant bugs, thrips (exposed)	10 D	Apply a light covering of dust barely visible when completed.			Treat when plants are dry and humidity is low. Use caution for greenhouse treatments if conditions are not suitable.
	50 W	1 lb.	3.3 oz.	6 T	
	80 S	10 oz.	2 oz.	3-3/4 T	

NOTES: Do not use on Boston ivy or Virginia creeper. Injury may occur on tender growth if plants are wet or humidity is high. Plant injury may occur on Adiantum (maidenhair fern) Brassia (shefflera), black olive, Boston fern, Cuban laurel, English ivy, hibiscus, peperomia, pilea, syngonium.

+SYSTOX aphids, mealybugs, mites, whiteflies	2 E	1/2-3/4 pts.	3-1/3 to 4-2/3 T	1-1.5 T	Foliage spray. Spray plants until thoroughly wet.
	6 E	1/6-1/4 pt	3-1/3 to 4-2/3 t	1-1.5 t	Soil drench. Apply 1 pint of mixture per each square foot of bench or bed area. For potted plants apply 1/4 pint of mixture per 6 inch pot.
camellia scale, Rhododendron scale, soft brown scale, tea scale	2 E	1 pt.	6-2/3 T	2 T	
	6 E	1/3 pt.	6-2/3 t	2 t	

NOTES: Extremely toxic. Systox is a systemic insecticide in plants. Do not apply within 5 days of hand-picking, pruning, transplanting, or other handling. Phytotoxicity may occur on African violets, cibotium ferns, croft lilies, Adiantum, Alternanthera, Amaryllis, Anthurium, Asparagus fern, Azalea, Begonia, Camellia, Cattleya, Chrysanthemum, Cineraria, Coleus, Cyclamen, Euphorbia, ferns, Ficus, Fittonia, Fuschsia, Gardenia, Geranium, Gerbera, Helxine soleivolii, Hibiscus, Hydrangea, Ilex, Impatiens, Kalanchoe, Monstera, Poinsettias, Scindapsus, Spironema.

+Restricted use chemical.

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
TEDION spider mites	miscible liquid	1 pt.	3-1/3 T	1 T	Apply thoroughly to both sides of leaves. Works best at temperatures above 80°F.

NOTES: Do not use on mums. Injury (leaf drop) has occurred on white butterfly and Cinderella roses. Phytotoxicity on Acalypha, Anemone, Anthurium, Begonia, Brassia actinophylla (Schefflera), Brunfelsia, Calceolaria, Cineraria, Cissus, Cyclamen, Cyprideium, Dahlia, Dianthus, Euphorbia, Ficus, Freesia, Gardenia, Gladiolus, Hibiscus, Hydrangea, Kalanchoe, Lathyrus, Pelargonium, Primula, Rochea, Schlumbergera gaetineri, Senecio, Sinningia, Stephanotis. Tedion is most likely to be available in combination with Dithio as a smoke.

+TEMIK aphids, leafminers, thrips	10% G	50-75 lbs./A	-----	For certified commercial application in commercial production. Use higher rate on heavy organic or clay soils, or if pest populations become severe. If beds are covered with leaf or compost type mulch, remove mulch or place granules beneath mulch, work into soil and water thoroughly. Apply granules evenly around base of plants. Wash off granules adhering to foliage. Do not mix granules with potting soil, nor mix with water. Do not market potted plants for 4 weeks after treatment. Do not plant food crops in soil treated previously with Temik.
		61-92 ozs/linear ft. row		
		18-28 ozs/1000 sq. ft.		
mealybugs, spider mites, whitefly	10 G	75-100 lbs/A	-----	
		92-122 ozs/linear ft. row		
		28-37 ozs/1000 sq. ft.		

Rates for treatment of individual containers:

Container Size (inches diameter)	Grams per container for equivalent rate (lbs/A)		
	50	75	100
4	0.05	0.075	0.10
6	0.1	0.15	0.2
8	0.2	0.3	0.4
10	0.3	0.45	0.6
12	0.5	0.75	1.0

Equivalent weights for teaspoon measures (based on rounded teaspoonfuls)

Size	Approx. wt. in grams
1/8 tsp.	0.45
1/4 tsp.	0.91
1/2 tsp.	1.30
1 tsp.	3.20
2 tsp.	6.40
1 T	9.45

NOTE: Extremely toxic. Do not mix granules with water. Apply after plants are established and as pests appear. Do not apply to foliage. May injure some varieties of chrysanthemums, Freesia spp., Rieger begonia, Vinca major.

THIODAN aphids, Cyclamen mite, whitefly, rose chafer	3 EC	1/3 qt.	4 T	4 t	Use proper mask or respirator EC may injure some chrysanthemums.
	50 WP	1/2 lb.	10 T	3 T	
aphids, thrips, whiteflies	smoke				Foliage should be dry. Close vents for at least 2 hrs. overnight.

NOTES: On chrysanthemums, best results will be obtained if applied before plants flower. Phytotoxicity: Injury may occur on Anthurium, Cissus antarctica (Kangaroo Vine), Crepe Myrtle, Crossandra, Gardenia, Geraniums, Gloxinia, Poinsettia, Rhoicissus rhomboidea, Rose, Saintpaulia, Scindapsus, some varieties of chrysanehtmum.

VAPONA aphids, leafminers, leafrollers, mealybugs, thrips, whiteflies	10% aerosol	Use 2-4 second application for each 1,000 cu.ft.		Treat when foliage is dry. Best and safest at house temperature of 60-65°F. Keep vents closed at least 2 hrs., or overnight.
	4 E	vaporize 1 oz. per 10,000 cu.ft.		

+Restricted use chemical.

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

PESTS LABELLED	FORMULATION	Rates of Application			PRECAUTIONS AND REMARKS
		50 gal.	10 gal.	3 gal.	
VAPONA (continued)					
aphids, mealybugs, spider mite, thrips, whitefly	Fog		1 oz. EC/3,000 cu. ft.		For carnations, mums, roses. Foliage and blooms should be dry. Close vents for 1-1/2 hrs. Ventilate 2 hrs. before reentry. Foliage should be dry. Close vents for at least 2 hrs. overnight.
	Smoke		6 oz. can/10,000 cu. ft.		

NOTES: May injure certain mum varieties, particularly Shasta and Pink Champagne, rose, and snapdragon varieties. Ageratum, Aster, Cissus antarctica, Poinsettia, Tradescantia.

VENDEX					
spruce spider, Oligonychus, two- spotted spider	50 WP		4-8 oz.		Do not add oil to spray solution. Apply when mites appear. Repeat as necessary to maintain control, but not more than once every 28 days.

NOTES: Apply to foliage only of chrysanthemum (pre-bloom) and poinsettia (prebract).

Abbreviations: W, WP-wettable powder; E, EC-emulsifiable concentrate; SP, sprayable or soluble powder; SC-spray concentrate; D-dust; G-granular; A-aerosol; F-fog; SG-smoke generator; V-vapor; lb.-pound; pt.-pint; oz.-ounce; fl.oz.-fluid ounce; cu.ft.-cubic feet; c-cup; T-tablespoon; t-teaspoon.

USEFUL EQUIVALENTS

1 lb. WP/100 Gal. = 1 T/1 gal.
1 pt. EC/100 gal. = 1 t/1 gal.
3 teaspoons = 1 Tablespoon

2 Tablespoons = 1 fl. oz.
16 fl. ounces = 1 pint
2 pints = 1 quart