

Pesticide Information and Safety

Ohio's Restricted Pesticides

Under the state's Pesticide Use and Applicator law, certain pesticides are restricted and can be obtained and used only by:

- Applicators or public operators licensed by the Ohio Department of Agriculture.
- Individuals obtaining a user's permit from their county Extension agent.

Some restricted pesticides require that notification of at least 24 hours before application be given occupants of land within 1,000 ft of the boundaries of the area to be treated. Occupants also must be notified of precautions necessary for the safety of livestock and humans.

Specific pesticide formulations can be listed "Restricted Use Only" by the U.S. Environmental Protection Agency, Ohio Environmental Protection Agency or the registrant company.

Copies of the Ohio Pesticide Use and Applicator Law and other regulations can be obtained from the Ohio Department of Agriculture, Pesticides Regulation, Reynoldsburg 43068.

Empty Containers

Hazardous waste regulations became effective November 19, 1980. The regulations require containers that held chemicals classified as hazardous be disposed of in a designated hazardous-waste site, unless triple-rinsing and other requirements are met by the commercial pesticide applicator.

However, farmers or private applicators are exempt from the regulations, providing that they follow all label instructions when disposing of waste pesticides and containers.

For information on disposal of chemicals and pesticides in your area, contact:

Art Coleman

Ohio Environmental Protection Agency

Hazardous Materials Section

1800 Watermark Dr.

Columbus 43266

614-644-2956

8:00 a.m. to 4:30 p.m.; Monday through Friday

Safety Tips for Using Pesticides

1. Don't use any pesticide without thoroughly reading and understanding the label instructions.
2. Don't use any pesticide not stored in the original container; always store pesticides in the original container.
3. Don't breathe pesticide spray, mist or dust.
4. Don't smoke when handling or applying pesticides.
5. Don't get pesticides in eyes, on skin or on clothing.
6. Wear an approved respirator. Some pesticides require specific respirators. Use only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mining Enforcement and Safety Administration (MESA). Look for NIOSH approval numbers, which begin with "TC." Read the label on the pesticide container and on the respirator cartridge cannister. Make sure all proper equipment is used.
7. Wear natural rubber gloves and freshly laundered protective clothing.
8. If a pesticide is spilled on skin or clothing, wash thoroughly with soap and water and change clothes.
9. Bathe promptly after working with pesticides and wash clothing with soap and water before re-use. However, don't wash contaminated clothing along with other clothing.
10. Don't take pesticides internally.
11. Wash hands and face thoroughly before eating, drinking, smoking or urinating.

12. Dispose of pesticides and containers according to label instructions. Remember that it is much safer to spray the pesticide than to drain the tank.
13. Keep pesticides securely locked, away from food and animal feed and out of the reach of children.
14. Call a physician at once in any case of suspected poisoning.

Using the Pesticide Recommendations

In this bulletin, common names of pesticides are listed first, with trade names following in parentheses. Common names of pesticides are used in cases where it would be impractical or confusing to list all trade names. No endorsement is intended for products mentioned, nor is criticism implied for products not listed.

As much as possible, information has been provided for application rates, days from last application to harvest, application methods, restrictions on the number of applications, precautions and timing.

However, the label on the pesticide container is the final source for all application information, as well as all other restrictions and suggestions. Use this bulletin as a guide for registered pesticides, but be sure to consult the label prior to application.

Growers should use the fungicide recommendations in this bulletin by: (1) identifying the disease problems they have or anticipate having, (2) checking this bulletin for the registered fungicide effective against the disease and (3) applying the registered fungicide consistent with the label on the chemical package, taking into consideration crop, disease, fungicide rate, spraying interval, method of application and safe use.

In most cases, the fungicides are compatible with insecticides, but limitations and label directions should be checked carefully before mixing materials.

Toxicity of Vegetable Insecticides, Fungicides and Herbicides

All pesticides are poisonous. However, some are much more toxic and/or hazardous than others. The pesticide label usually states in its precaution section the toxicity of the insecticide.

For example, a “skull-and-crossbones” figure always is found on the label of highly toxic (Toxicity Class I) materials. Those of medium toxicity (Toxicity Class II) carry less severe warning statements.

The toxicity of a pesticide is expressed through the terms oral and dermal LD₅₀. LD₅₀ is the dosage of poison that kills 50% of test animals (usually rats or rabbits) with a single application of the undiluted pesticide for a given weight of animal (mg/kg of body weight). The lower the LD₅₀ value, the more toxic the material.

Oral LD₅₀ is the measure of the toxicity of pesticide when administered internally to test animals.

Dermal LD₅₀ is the measure of the toxicity of pesticide when applied to the skin of test animals. Generally, oral application is more toxic than dermal application.

The LD₅₀ value of a pesticide should be interpreted with care. Keep these facts in mind:

- Hazards presented by any compound depend on how it is used rather than its toxicity.
- Toxicity can vary with species, age, sex, nutritional state and poison formulation as well as with the type of application. Because LD₅₀ values are determined only for test animals, they must be applied with reservation to humans.
- An LD₅₀ value is a statistic that in itself gives no information about the dosage that might be fatal to a small proportion of a large group of animals.
- LD₅₀ values usually are expressed in terms of single dosages only. Thus, these values give no information about the possible cumulative effects of a compound.

Despite some shortcomings, the LD₅₀ value provides a general measure of the relative toxicity of a compound. Many publications are available that list LD₅₀ values of major pesticides. County Extension agents can provide information on the relative toxicity of an insecticide. Or, information is available from the Department of Entomology, The Ohio State University, 1991 Kenny Road, Columbus 43210, or the Department of Plant Pathology, The Ohio State University, 2021 Coffey Road, Columbus 43210.

Listed in the table on the next page are insecticides, fungicides and restricted-use herbicides commonly recommended for vegetable insect and disease control and their oral and dermal LD₅₀ values. **Remember, the lower the LD₅₀ value, the more toxic the pesticide.** Materials with an LD₅₀ value of less than 100 should be considered highly toxic and handled with extreme caution.

Insecticide, Fungicide and Herbicide Toxicity: LD₅₀ Values

	Restricted?	Oral LD ₅₀ (mg product per kg body wt) ¹	Dermal LD ₅₀ (mg product per kg body wt) ¹
Insecticide			
Acramite (bifenazate)	no	>5000	>5000
Actara 25WDG (thiamethoxam)	no	>5000	>2000
Admire 2F (imidacloprid)	no	4870 (M), 4143 (F)	>2000
Admire Pro (4.6F)	no	609	>2000
Agri-Mek 0.15EC (abamectin)	yes	300	>1800
Ambush 25WP (permethrin)	yes	>5000	>2000
Ammo 2.5EC (cypermethrin)	yes	137	>2000
Asana XL 0.66EC (esfenvalerate)	yes	458	>2000
Assail 30SG (acetamiprid)	no	886 (M), 805 (F)	>2000
Avaunt 30WDG (indoxacarb)	no	1867 (M), 687 (F)	>5000
Aza-Direct (azadirachtin)	no	>5000	>2000
Aztec 2.1G (tebupirimphos + cyfluthrin)	yes	190 (M), 132 (F)	>2000
<i>Bacillus thuringiensis</i> (B.t.; Javelin WG)	no	>5100	5000
Baythroid XL 1EC (beta-cyfluthrin)	yes	1015 (M), 826 (F)	>2000
Belay 2.13SC (clothianidin)	no	3044	>5000
Beleaf 50SG	no	>2000	>2000
Belt	no	>2000	>4000
Brigadier	yes	175	>5000
Capture 2EC (bifenthrin)	yes	262	>2000
Concur (imidacloprid)	no	>500	>20,000
Confirm 2F (tebufenozide)	no	>5000	>5000
Coragen	no	>5000	>5000
Counter 15G (terbufos)	yes	12	10
Courier (buprofezin)	no	>5000	>2000
Cruiser 5FS (thiamethoxam)	no	5523	>2000
Cryolite 96WP (Kryocide)	no	>5000	>2100
Danitol 2.4EC (fenpropathrin)	yes	66	>2000
Decis (deltamethrin)	yes	42.9	>2000
Diazinon 4EC (D-Z-N AG500)	yes	2040	2020
Diazinon 50WP	yes	1960	>2020
Diazinon 14G	yes	1700	>5800
Dibrom 8EC (naled)	no	430	1100
dimethoate 4EC (Cygon)	no	425	2020
dimethoate 2.67EC	no	230	1000
Dimilin 25WP (diflubenzuron)	yes	>10,000	>20,000
Di-Syston 8EC (disulfoton)	yes	13 (M), 3 (F)	9 (M), 17 (F)
Di-Syston 15G (disulfoton)	yes	52 (M), 14 (F)	1000 (M), >1000 (F)
Durivo	no	>5000	>5000
Entrust (spinosad)	no	>5000	>2000
Esteem (pyriproxyfen)	no	>5000	>5000
Force 3G (tefluthrin)	yes	969 (M), 1213 (F)	>2000
Fortress 5G (chlorethoxyfos)	yes	44-124	>2000
Fulfill 50WDG (pymetrozine)	no	>5000	>2000

• indicates restricted-use pesticide
¹M = male; F = female

Insecticide, Fungicide and Herbicide Toxicity: LD₅₀ Values

	Restricted?	Oral LD ₅₀ (mg product per kg body wt) ¹	Dermal LD ₅₀ (mg product per kg body wt) ¹
Insecticide			
Furadan 4F (carbofuran)	yes	7	6783
Gaucho 480 (imidacloprid)	no	4350	>5050
Guthion Solupak 50WP (azinphosmethyl)	yes	75 (M), 55 (F)	350
Hero	yes	550	>5000
Imidan 70WP (phosmet)	no	128-681	>4640
Intrepid 2F (methoxyfenozide)	no	>5000	>2000
Kelthane 50WP (dicofol)	no	3060	>5000
Lannate 90SP (methomyl)	yes	30-34	>2000
Lannate LV 2.4EC (methomyl)	yes	160	>2016
Larvin 3.2F (thiodicarb)	no	166	>2000
Leverage (imidacloprid + cyfluthrin)	yes	200	>5000
Lorsban 75WG	no	>500	>5000
Lorsban 50WP (chlorpyrifos)	no	382	>2000
Lorsban 4EC (chlorpyrifos)	yes	776 (M), 300 (F)	>5000
Malathion 8EC (Cythion)	no	370	4100
Malathion 5EC (Cythion)	no	3946	>2000
metaldehyde	no	227	2275
Mocap 15G (ethoprop)	no	250	>2000
Mocap 6EC (ethoprop)	yes	47 (M), 16 (F)	369 (M), 166 (F)
Monitor 4L (methamidophos)	yes	17 (M), 21 (F)	987 (M), 516 (F)
MSR (Metasystox-R) 2SC (oxydemetonmethyl)	yes	125 (M), 138 (F)	253 (M), 359 (F)
Movento	no	>2000	>4000
Mustang Max 0.8EC (zeta-cypermethrin)	yes	157	>5000
Neemix 4.5 EC (azadirachtin)	no	>5000	-
Oberon (spiromesifen)	no	>2000	>4000
Orthene 75SP (acephate)	no	1447 (M), 1030 (F)	>10,000
PennCap-M 2F (methyl parathion)	yes	>2000	>5450
Platinum 2SC (thiamethoxam)	no	>5000	>2000
Poncho 600 (clothianidin)	no	>5000	>5000
Pounce 3.2EC (permethrin)	yes	1030	>2000
Pounce 25WP (permethrin)	yes	1100	>2000
Pounce 1.5G (permethrin)	yes	>5000	>2000
Proaxis 0.5EC (gamma cyhalothrin)	yes	>2500	>5000
Proclaim 5SG (emamectin benzoate)	yes	1516	>2000
Provado 1.6F (imidacloprid)	no	>4870 (M), 4143 (F)	>2000
pyrethrins (Evergreen)	no	>5000	>2000
Rimon 0.83EC	no	>5000	>2000
Sevin 4EC (carbaryl)	no	649	>2000
Sevin 80S (carbaryl)	no	281	>2000
Sevin 4F (carbaryl)	no	590	>2000
soap (M-Pede)	no	>5000	>2000
SpinTor 2SC (spinosad)	no	>5000	>5000
Synapse	no	>2000	>2000

• indicates restricted-use pesticide

¹M = male; F = female

Insecticide, Fungicide and Herbicide Toxicity: LD₅₀ Values

	Restricted?	Oral LD ₅₀ (mg product per kg body wt) ¹	Dermal LD ₅₀ (mg product per kg body wt) ¹
Insecticide			
Temik 15G (aldicarb)	yes	5	283
Thimet 15G (phorate)	yes	27 (M), 31 (F)	207 (M), 247 (F)
Thionex 3EC (endosulfan)	no	45	256
Thionex 50WP (endosulfan)	no	41	>2000
Trigard 75WP (cyromazine)	no	4460	>2010
Vendex 50WP (fenbutatin-oxide)	yes	2631	>2000
Venom 70SG	no	~>5000	~>5000
Vydate 2L (oxamyl)	yes	37	2960
Warrior T 1EC (lambda-cyhalothrin)	yes	351 (M), 354 (F)	>2000
Fungicide			
Botran		>5,000	-
Captan		9,000	-
Chlorothalonil (Bravo)		>10,000	>10,000
Copper hydroxide		1,000	-
Dinocap (Karathane)		980	-
Mancozeb (Dithane M-45) (Manzate 200)		11,200	>15,000
Maneb		7,990	-
PCNB (Terraclor)		1,700	4,000
Azoxystrobin (Quadris)		>5,000	-
Polyram		6,400	-
Thiophanate methyl (Topsin M)		7,500	-
Herbicides (only restricted use listed)			
alachlor (Lasso)		1,800	3,500
atrazine (several)		1,780	7,500
cyazifluthrin (Bladex)		288	>2,000
diquat (Diquat)		215-235	>400
paraquat (Gramoxone Extra)		150	-
pronamide (Kerb 50W)		8,350	5,620
<p><i>* indicates restricted-use pesticide</i> ¹M = male; F = female</p>			

Poisoning Information

Information needed to contact poison information centers is provided on the inside front cover of this bulletin. Each vegetable producer's doctor should have this list and the "Note to Physicians" that is placed on the labels of dangerous pesticides. Doctors should know in advance what dangerous pesticides are planned for use in order to relay the correct chemical name to the poison information center in an emergency.

Treatment for pesticide poisoning is very precise. In an emergency, call the poison information center, but it is preferable to let a doctor consult the center in order to avoid mistakes.

For information on cholinesterase testing, doctors should contact:

Mr. Jeff McKenney
CLC Laboratory
1046 Crupper Avenue
Columbus 43229
614-888-1663
8:00 a.m. to 5:00 p.m. (Monday through Friday)

Mr. Dan Gregory
Toxicology Associates, Inc.
3728-B Olentangy River Road
Columbus 43214
614-459-2307
24 hours a day (7 days a week)

Grower Responsibilities

1. Use only those pesticides that are labeled for the crop and use needed.
2. Apply materials according to label directions, in the amounts specified at the times specified and adhere to time limitations between last application and harvest.
3. Avoid drift of pesticides onto nontarget areas.
4. Keep accurate records of materials used, amounts used and dates of applications.

Early Treatment

The application of most pesticides should be regarded as a preventive practice. Best results are obtained when the first application is made before an infestation or infection is apparent. It is suggested that growers apply two or more insecticides in an alternating schedule to help prevent development of pesticide-resistant insects and mites.

Fungicides should be applied to keep a protective coating on both old and new growth. When plants are actively growing, application intervals may have to be shortened. This usually will occur during the early part of the growing season. Good protection at this time will aid in controlling disease later in the season.

Days to Harvest

In using insecticides, and in several cases, fungicides, the grower must adhere to the interval (as indicated in parentheses by the abbreviation: days-PHI (see page 3). "Days" refers to the time between the last application and harvest. This time period provides a safe cushion from potentially harmful residues.

Reentry to Pesticide-Treated Fields

The U.S. EPA has published health and safety standards to protect persons working in fields treated with pesticides.

The following points should be followed:

1. Under most circumstances, worker employers must make sure that workers are notified about areas where pesticide applications are taking place or where restricted-entry intervals are in effect. Some pesticide labels require you to notify workers BOTH orally and with signs posted at entrances to treated areas.
2. Unless the pesticide labeling requires both types of notification, notify workers either orally or by the posting of signs at entrances to treated areas. The restricted-entry interval (REI) is the time immediately after a pesticide ap-

plication when entry into the treated areas is limited. When two or more pesticides are combined, the longer REI must be followed.

Location of the REI's is on pesticide labeling under the heading Agricultural Use Requirements in the Directions for Use section or next to the crop or application method to which it applies. Also, for your convenience, see the inside back cover of this publication for Restricted Entry Intervals (REI's) for the pesticides discussed in this bulletin.

3. Exemptions to worker notification: You do not need to notify any worker on your farm who will not be in the treated area, or walk within 0.25 miles of a treated area, during the pesticide application or while the restricted-entry interval is in effect.
4. For complete details and responsibilities on Worker Protection Standards, you should consult the publication: "The Worker Protection Standard for Agricultural Pesticides—How To Comply, What Employers Need to Know," Bulletin 843 available from Ohio State University Extension.

Insecticides for Use on Vegetables in Ohio

	Biological action	Group ¹	General characteristics	Toxicity class (to mammals) (I = most toxic)	Typical target pests	Impact on beneficial insects
ORGANO-PHOSPHATES:	central nervous system synaptic poison: acetylcholinesterase inhibitor					
Counter (terbufos)		1B	systemic action	I	soil pests	moderate
diazinon		1B		III	soil pests, aphids, caterpillars, beetles, thrips	moderate
Dibrom (naled)		1B	some short residual fumigant action	I	caterpillars	moderate/disruptive
dimethoate (Dimate, Cygon)		1B	local systemic	II	aphids, leafhoppers, mites	disruptive
Di-Syston (disulfoton)		1B	systemic action	I	aphids	moderate
Fortress (chlorethoxyfos)		1B		I	soil pests	moderate
Guthion (azinphos-methyl)		1B		I	maggots, caterpillars, beetles	disruptive
Imidan (phosmet)		1B		II	caterpillars	moderate
Lorsban, Govern, Hatchet, Nufos, Pilot, Saurus, Warhawk, Whirlwind, Yuma (chlorpyrifos)		1B	long residual	I (WP), II (WG, EC), III (G)	soil pests, caterpillars	moderate
malathion		1B	short residual	II, III	broad spectrum	low/moderate
Mocap (ethoprop)		1B	contact action	I	wireworms & other soil pests	low/moderate
Monitor (methamidophos)		1B	long residual	I	aphids, caterpillars, & other pests	disruptive
MSR (Metasystox-R) (oxydemetonmethyl)		1B	systemic; contact & stomach action	II	aphids, thrips & other sucking insects	moderate
Orthene, Bracket (acephate)		1B	contact action & local systemic action	III	aphids, caterpillars	moderate/disruptive
Penncap-M (methyl parathion)		1B	contact & fumigant action; slow release formulation	II	caterpillars, thrips	disruptive
Thimet (phorate)		1B	systemic action	I	soil pests	low/moderate

¹Group is the mode of action classification, developed by the Insecticide Resistance Action Committee (IRAC) for use in insecticide resistance management programs.

Insecticides for Use on Vegetables in Ohio

	Biological action	Group ¹	General characteristics	Toxicity class (to mammals) (I = most toxic)	Typical target pests	Impact on beneficial insects
CARBAMATES:	central nervous system synaptic poison: acetylcholinesterase inhibitor					
Furadan (carbofuran)		1A	systemic action	I	beetles, some caterpillars	moderate
Lannate (methomyl)		1A	very short residual	I	caterpillars, leafhoppers	disruptive
Larvin (thiodicarb)		1A	larvicide & ovicide	II	caterpillars	moderate
Sevin (carbaryl)		1A	use can result in aphid outbreaks	II (S, WP), III (EC, F)	beetles, leafhoppers, caterpillars	disruptive
Temik (aldicarb)		1A	systemic action	I	aphids, mites, some beetles	moderate
Vydate (oxamyl)		1A	contact action; systemic if applied to soil	I	aphids, thrips, some beetles	disruptive
ORGANOCHLORINES:						
Thiodan, Thionex (endosulfan)	central nervous system synaptic poison: blocks chloride channel	2A	fairly long residual	II	aphids, beetles, caterpillars	moderate
PYRETHROIDS:	axonic nerve poisons: affect sodium channel		long residual; work best in cool weather (<75F)		broad spectrum	disruptive
Ammo, Battery, UP-Cide (cypermethrin)		3		III	caterpillars, beetles, leafhoppers, thrips	disruptive
Asana, Adjourn (esfenvalerate)		3		II	caterpillars, beetles, leafhoppers	disruptive
Baythroid, Tombstone (cyfluthrin)		3		I	caterpillars, beetles, leafhoppers, thrips	disruptive
Capture, Brigade, Bifenture, Discipline, Fanfare, Sniper, Tundra (bifenthrin)		3		II	caterpillars, beetles, thrips, bugs, mites	disruptive
Danitol (fenpropathrin)		3		II	caterpillars, leafhoppers	disruptive
Decis, Delta Gold, Battalion (deltamethrin)		3		I	caterpillars, beetles, leafhoppers, thrips	disruptive
Force (tefluthrin)		3		III	soil pests	disruptive
Mustang, Mustang Max (zeta-cypermethrin)		3		II	caterpillars, beetles, leafhoppers, thrips	disruptive
Pounce, Ambush, Arctic, Perm-UP (permethrin)		3		II (WP); III (EC)	caterpillars, beetles, leafhoppers, thrips	disruptive
Proaxis (gamma-cyhalothrin)		3		III	caterpillars, beetles, leafhoppers, thrips	disruptive
Warrior, Lambda-Cy, Silencer, Taiga (lambda-cyhalothrin)		3		II	caterpillars, beetles, leafhoppers, thrips	disruptive

¹Group is the mode of action classification, developed by the Insecticide Resistance Action Committee (IRAC) for use in insecticide resistance management programs.

Insecticides for Use on Vegetables in Ohio

	Biological action	Group ¹	General characteristics	Toxicity class (to mammals) (I = most toxic)	Typical target pests	Impact on beneficial insects
NEONICOTINOIDS (CHLORONICOTINYLS):	nerve poisons: nicotinic acetylcholine receptor agonists/antagonists	4A				
Actara (thiamethoxam)		4A	foliar applied, contact and translaminar activity	III	aphids, whiteflies, flea beetles	low/moderate
Admire, Alias, Couraze, Advise, Macho, Nuprid, Imida E-AG, Montana, Torrent, Widow (imidacloprid)		4A	soil applied, systemic	III	aphids, some beetles, leafhoppers, whiteflies	low/moderate
Assail (acetamiprid)		4A	contact and systemic activity; translaminar	III	aphids, whiteflies, leafhoppers	low/moderate
Cruiser (thiamethoxam)		4A	systemic seed treatment	III	beetles, maggots	low
Gaicho, Latitude, Concur (imidacloprid)		4A	systemic	III	beetles, maggots	low
Platinum (thiamethoxam)		4A	soil applied, systemic	III	aphids, flea beetles	low/moderate
Poncho, Belay (clothianidin)		4A	systemic seed or soil treatment	III	beetles, maggots	low
Provado, Couraze, Prey, Impulse, Imida E-AG, Nuprid, Pasada (imidacloprid)		4A	foliar applied, local systemic	III	aphids, some beetles, leafhoppers, whiteflies	low/moderate
Venom (dinotefuran)		4A	systemic	III	aphids, whiteflies, some beetles	low/moderate
OTHER INSECT NERVE POISONS:						
Acramite (bifenazate)	neuronal inhibitor	25		III	spider mites	low
Agri-Mek, Abba, Epi-Mek, Reaper, Zoro (abamectin)	ionotropic receptor modulator	6	active once ingested; some contact action; mostly stomach poison	II	mites, leafminers, some beetles	low/moderate
Avaunt (indoxacarb)	sodium channel blocker, bioactivated	22A	acts by ingestion	III	caterpillars	low/moderate
Beleaf (flonicamid)	neural inhibition of feeding behavior	9C	acts by contact and ingestion	III	aphids, plant bugs	
Fulfill (pymetrozine)	neural inhibition of feeding behavior	9B	translaminar & systemic	III	aphids, whiteflies	low
Kelthane (dicofol)	axonic nerve poison	un		III	spider mites	low/moderate
Proclaim (emamectin benzoate)	affects chloride channels	6	ingestion & topical; translaminar, not systemic	III	caterpillars	low/moderate

¹Group is the mode of action classification, developed by the Insecticide Resistance Action Committee (IRAC) for use in insecticide resistance management programs.

Insecticides for Use on Vegetables in Ohio

	Biological action	Group ¹	General characteristics	Toxicity class (to mammals) (I = most toxic)	Typical target pests	Impact on beneficial insects
pyrethrins (Pyronyl, Pyganic)	axonic nerve poisons: affect sodium channel	3	contact, stomach, & fumigant action; extract from chrysanthemums	II, III	broad spectrum	moderate
Radiant (spinetoram)	activates nicotinic acetylcholine receptors	5		III	caterpillars, thrips	
SpinTor, Entrust (spinosad)	activates nicotinic acetylcholine receptors	5	ingestion & contact; enters leaf but does not translocate	III	caterpillars, some beetles and thrips	low
INSECT GROWTH REGULATORS:						
azadirachtin (Neemix, Aza-Direct, Ecozin, Azatin)	molting disruptor	18B	slow acting	II, III	immatures; broad spectrum	low/moderate
Confirm (tebufenozide)	molt accelerating	18	slow acting	III	caterpillars	low
Courier (buprofezin)	chitin biosynthesis inhibitor	16	long residual activity; contact and vapor activity	III	whiteflies	low/moderate
Dimilin (diflubenzuron)	chitin biosynthesis inhibitor	15		III	caterpillars	low
Esteem (pyriproxyfen)	juvenile hormone mimic	7C		III	scales, whiteflies, caterpillars	low
Intrepid (methoxyfenozide)	molt accelerating	18A	slow acting	III	caterpillars	low
Rimon (novaluron)	chitin inhibitor	15		II	caterpillars, some beetles	low
Trigard (cyromazine)	chitin inhibitor	17		III	leafminer flies, some beetles, maggots	low/moderate
MISCELLANEOUS:						
<i>Bacillus thuringiensis</i> (B.t.): Dipel, Javelin, Xentari	gut disruptor	11B	pest must ingest; slow acting but feeding stops long before death	III	caterpillars or beetles, depending on strain	very low
Belt, Synapse (flubendiamide)	disrupts calcium balance in muscle cells	28	active via ingestion	III	caterpillars	low
Coragen (chlorantraniliprole)	disrupts calcium balance in muscle cells	28	translaminar activity	III	caterpillars, whitefly nymphs, some beetle and leafminer larvae	low
cryolite (Kryocide)	gut disruptor	9A	pest must ingest; not rainfast; an inorganic fluorine compound	III	beetles, caterpillars	low
Movento (spirotetramat)	inhibits lipid synthesis	23	two-way systemic activity; active via ingestion	II	aphids, whiteflies	low
Mycotrol, Naturalis (<i>Beauveria</i>)	fungal spores pierce cuticle	-	contact; slow acting	III	whiteflies, aphids, leafhoppers	low
Oberon (spiromesifen)	inhibits lipid synthesis	23	-	III	spider mites, whiteflies, psyllids	-

¹Group is the mode of action classification, developed by the Insecticide Resistance Action Committee (IRAC) for use in insecticide resistance management programs.

Insecticides for Use on Vegetables in Ohio

	Biological action	Group ¹	General characteristics	Toxicity class (to mammals) (I = most toxic)	Typical target pests	Impact on beneficial insects
oil (SunSpray Ultra Fine Spray Oil)	smothers insect; plugs respiratory system	-	contact activity	III	mites, aphids	low
rotenone	respiration disruptor: mitochondrial electron transport inhibitor	21	contact activity, slow-acting, short residual; extract from the cube plant	III	broad spectrum	moderate/ disruptive
soap (M-Pede)	attacks cell membranes	-	contact activity; phytotoxic at high temperatures	II	aphids and other soft-bodied arthropods	low
Vendex (fenbutatin-oxide)		12B		I	mites	moderate

¹Group is the mode of action classification, developed by the Insecticide Resistance Action Committee (IRAC) for use in insecticide resistance management programs.

List of product categories approved for use by organic growers for insect control, as listed by the Organic Materials Review Institute (OMRI)^a

Status ^b	Class	Generic category on OMRI list	Target pest	Representative product name
Allowed	Insect pathogens	<i>Bacillus thuringiensis</i>	Caterpillars of all species	<ul style="list-style-type: none"> • Agree • Biobit HP • DiPel DF • Javelin WG • XenTari DF
Allowed	Insect pathogens	Virus sprays	Caterpillars of certain species only	<ul style="list-style-type: none"> • GemStar (corn earworm) • Spod-X (beet armyworm)
Restricted	Insect pathogens	<i>Beauveria bassiana</i> (fungus)	Broad spectrum ^c but most effective against pests in soil	<ul style="list-style-type: none"> • Mycotrol • Naturalis
Allowed	Behavior disruptant	Pheromones (for mating disruption treatment)	Moths of certain species only	<ul style="list-style-type: none"> • CheckMate TPW (tomato pinworm) • MSTRS ECB-2 (corn borer)
Allowed	Miscellaneous	Spinosad	Caterpillars, thrips, certain beetles	<ul style="list-style-type: none"> • Entrust
Allowed	Miscellaneous	Mined minerals, unprocessed (particle films)	Beetles, leafhoppers, grasshoppers, thrips	<ul style="list-style-type: none"> • Surround
Allowed	Abrasive agent	Diatomaceous earth	Broad spectrum ^c but most effective against soft-bodied pests	<ul style="list-style-type: none"> • Insecta Kill
Allowed	Smothering agent	Oils, non-synthetic sources	Eggs, mites, aphids, whiteflies	<ul style="list-style-type: none"> • GC-Mite (cottonseed, clove, garlic oils) • Lilly Miller Vegol Spray Oil (canola oil) • SeaCide (fish oil, cottonseed oil) • Golden Pest Spray Oil (soybean oil)
Restricted	Smothering agent	Oils, petroleum-based, narrow range	Leafhoppers, mites, whiteflies	<ul style="list-style-type: none"> • Organic JMS Stylet Oil
Restricted	Smothering agent	Soap	Aphids and other soft-bodied insects	<ul style="list-style-type: none"> • M-Pede
Allowed	Botanicals	Neem and neem derivatives, natural	Broad spectrum ^c	<ul style="list-style-type: none"> • Neem Cake
Restricted	Botanicals	Neem extract and derivatives	Broad spectrum ^c	<ul style="list-style-type: none"> • Agroneem • Aza-Direct • Azatrol • Neemix
Allowed	Botanicals	Garlic	Repels aphids, beetles, caterpillars	<ul style="list-style-type: none"> • BioRepel • CropGuard • Garlic Barrier • Repeller
Allowed	Botanicals	Plant Pesticides, Allowed	Aphids and other soft-bodied insects	<ul style="list-style-type: none"> • Organic BioLink Insecticide (garlic) • Phyta-Guard Citronella • Phyta-Guard Concentrate Liquid (citronella, clove oil, geranium) • Phyta-Guard Phyta-oil (cottonseed oil)
Restricted	Botanicals	Pyrethrum	Broad spectrum ^c	<ul style="list-style-type: none"> • Pyganic Crop Protection EC
Restricted	Botanicals	Botanical insecticides	Broad spectrum ^c	<ul style="list-style-type: none"> • EcoTrol (rosemary oil) • Hexacide (rosemary oil) • Organocide (sesame oil)

^a Full list can be found on internet: http://www.omri.org/crops_generic.pdf

^b Growers should consult with state groups such as the Ohio Ecological Food and Farm Association for current rules on using allowed versus restricted materials; as a general rule, restricted materials are not permitted until attempts have been made to prevent pest infestations from developing by use of cultural, mechanical, and physical controls.

^c Broad spectrum usually includes sucking pests such as aphids, leafhoppers, and thrips, as well as chewing pests such as beetles and caterpillars.