

E-5A
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**Suggested
Insecticides
for
Managing
Cotton
Insects**

**in the Southern, Eastern and
Blackland Areas of Texas
2008**

This publication is to be used with E-5, "Managing Cotton Insects in the Southern, Eastern and Blackland Areas of Texas, 2008."

Suggested Insecticides for Managing Cotton Insects in the Southern, Eastern and Blackland Areas of Texas

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A committee of state and federal research scientists and Extension specialists meets annually to review cotton pest management research and management guidelines. Guidelines are revised at this meeting to reflect the latest proven techniques for maximizing profits for the Texas cotton producer by optimizing inputs and production.

Management of Cotton Pests

The proper management of cotton pests is dependent upon the use of pest management principles. Pest management does not rely solely on insecticides. Therefore, the USER of this insert is strongly encouraged to refer to E-5 for discussion of pest biology, scouting techniques, economic thresholds, insecticide resistance management, conservation of existing natural control agents, overall crop management practices which do not promote pest problems, ovicide use, microbial insecticide use, and guidelines for protecting bees from insecticides.

Insecticide Resistance Management

Experience has shown that relying on a single class of insecticides that act in the same way may cause pests to develop resistance to the entire group of insecticides. To delay resistance, it is strongly recommended that growers use IPM principles and integrate other control methods into insect or mite control programs. One way to help prevent pest resistance is to rotate the use of insecticide groups in order to take advantage of different modes of action. In addition, do not tank-mix products from the same insecticide class. These management practices should delay the development of resistance and provide better overall insect control.

Insecticides with similar chemical structures act on insects in similar ways. For example, pyrethroids (including esfenvalerate, bifenthrin, cyfluthrin, lambda cyhalothrin and tralomethrin) all act on an insect's nervous system in the same way. Other types of insecticides such as organophosphates (methyl parathion, dicrotophos) or carbamates (thiodicarb) also affect the insect's nervous system, but in a different way than do the pyrethroids.

The Insecticide Resistance Action Committee (IRAC) has developed a mode of action classification system that is based on a *numbering system* (see <http://www.irac-online.org/>). This system makes it simpler for producers and consultants to determine different modes of action among the insecticides. Insecticides with the same number (e.g., 1) are considered to have the same mode of action. Producers should rotate among different numbers where appropriate to delay resistance. The IRAC numbering system is used in this publication to assist producers with their choices.

Policy Statement for Making Insecticide Use Recommendations

This is not a complete listing of all products registered for cotton or their uses. The insecticides and their suggested use patterns included in this publication reflect a

consensus of opinion of Extension entomologists based on field tests. The data from these field tests met the minimum requirements as outlined in the Guidelines for the Annual Entomology Research Review and Extension Guide Revision Conference. Products listed must conform to our performance standards and avoid undue environmental consequences.

Suggested insecticide use rates have exhibited sufficient efficacy in tests to be effective in providing adequate control in field situations. However, it is impossible to eliminate all risks. Conditions or circumstances which are unforeseen or unexpected may result in less than satisfactory results. The Texas AgriLife Extension Service will not assume responsibility for such risks. Such responsibility shall be assumed by the user of this publication. Suggested pesticides must be registered and labeled for use by the Environmental Protection Agency and the Texas Department of Agriculture. The status of pesticide label clearances is subject to change and may have changed since this publication was printed.

The USER is always responsible for the effects of pesticide residues on his livestock and crops, as well as problems that could arise from drift or movement of the pesticide. Always read and follow carefully the instructions on the container label. Pay particular attention to those practices which ensure worker safety. For additional information, contact your county Extension staff or write the Extension Entomologist, Department of Entomology, Texas A&M University, College Station, TX 77843; or call (979) 845-7026.

Endangered Species Regulations

The Endangered Species Act is designed to protect and to assist in the recovery of animals and plants that are in danger of becoming extinct. In response to the Endangered Species Act, many pesticide labels now carry restrictions limiting the use of products or application methods in designated biologically sensitive areas. These restrictions are subject to change. Refer to the Environmental Hazards or Endangered Species discussion sections of product labels and/or call your local county Extension agent or Fish and Wildlife Service personnel to determine what restrictions apply to your area. Regardless of the law, pesticide users can be good neighbors by being aware of how their actions may affect people and the natural environment.

Worker Protection Standard

The Worker Protection Standard (WPS) is a set of federal regulations that applies to all pesticides used in agricultural plant production. If you employ any person to produce a plant or plant product for sale and apply any type of pesticide to that crop, WPS applies to you. The WPS requires you to protect your employees from pesticide exposure. It requires you to provide three basic types of protection: you must inform employees about exposure, protect employees from exposure, and mitigate pesticide exposures that employees might receive. The WPS requirement will appear in the "DIRECTIONS FOR USE" part of the label. For more detailed information, consult EPA publication 735-B-93-001 (GPO #055-000-0442-1) *The Worker Protection Standard for Agricultural Pesticides -- How to Comply: What Employers Need to Know*, or call Texas Department of Agriculture, Pesticide Worker Protection program, (512) 463-7717.

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Table 1. Insecticide suggestion table.

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵		
Cutworms	Bifenthrin**** (Fanfare® 2 EC) (Bifenthrin 2 EC) (Brigade® 2 EC)	3	0.04-0.10 0.04-0.10 0.04-0.10	2.6-6.4 oz 2.6-6.4 oz 2.6-6.4 oz	W W W	12 12 12	H H H		
	Chlorpyrifos (Chlorpyrifos 4 E) (Lock-on® 2 E) (Lorsban® 4 E)	1B	0.75-1.0 0.50 0.75-1.0	1.5-2.0 pt 2.0 pt 1.5-2.0 pt	W W W	24 24 24	H H H		
	Beta-cyfluthrin**** (Baythroid® XL)	3	0.0625-0.0125	0.8-1.6 oz	W	12	H		
	Lambda-cyhalothrin**** (Karate® 1 EC) (Karate® Z 2.08 CS) (Lambda 2.08 CS) (Lambda-Cy 1 EC) (LambdaStar 1 EC) (Lambda-T 1 CS) (Silencer® 1 EC)	3	0.015-0.02 0.015-0.02 0.015-0.02 0.015-0.02 0.015-0.02 0.015-0.02 0.015-0.02	1.92-2.56 oz 0.96-1.28 oz 0.96-1.28 oz 1.92-2.56 oz 1.92-2.56 oz 1.92-2.56 oz 1.92-2.56 oz	D W W W D W W	24 24 24 24 24 24 24	H H H H H H H		
	Cypermethrin**** (Ammo® 2.5 EC) (Cypermethrin 2.5 EC)	3	0.025-0.1 0.025-0.1	1.3-5.0 oz 1.3-5.0 oz	C C	12 12	H H		
	Esfenvalerate**** (Asana® XL 0.66 E)	3	0.03-0.05	5.8-9.6 oz	W	12	H		
	Gamma cyhalothrin**** (Proaxis® 0.5 E) (Prolex® 1.25 E)	3	0.0075-0.01 0.0075 -0.01	1.92-2.56 0.07-1.02	C C	24 24	H H		
	Methyl Parathion (Methyl 4EC)	1B	0.5-1	1-2 pt	D	4 days***	H		
	Zeta-cypermethrin**** (Mustang® 1.5 E) (Mustang® Max 0.8 E)	3	0.008-0.012 0.016-0.024	1.28-1.92 oz 1.4-2.0 oz	W W	12 12	H H		
	Zeta-cypermethrin + Bifenthrin**** (Hero® 1.24 EC)	3	0.05-0.10	5.2-10.3 oz	C	12	H		
	Thrips Seed	Acephate (Orthene® 97 SI)	1B	per 100 lbs seed 22.5-25 oz	per 100 lbs seed 21.5-24 oz	C	*	**	
		Imidacloprid (Gaucho Grande® 5 FS)	4A	per seed 0.375 mg-ai	per 100 lbs seed 25.6 oz	C	*	**	
		Thiamethoxam (Cruiser® 5 FS)	4A	per seed 0.3-0.34 mg-ai	per 100,000 seeds 1.7-1.9 oz	C	*	**	
	Planter Box	Acephate (Acephate 75 S) (Acephate 90 S) (Acephate 97) (Orthene® 75 S) (Orthene® 90 S) (Orthene® 97)	1B	0.18 0.18 0.18 0.18 0.18 0.18	4 oz 3.25 oz 3 oz 4 oz 3.25 oz 3 oz	C C C C C C	* * * * * *	** ** ** ** ** **	
		In-furrow	Aldicarb (Temik® 15 G)	1A	0.3-0.75	2-5 lb	D	48***	**
			Disulfoton (Di-Syston® 15 G)	1B	0.6	4 lb	D	48***	**
			Phorate (Thimet® 20 G)	1B	0.5	2.5 lb	D	48***	**
		Foliar	Acephate (Acephate 75 S) (Acephate 90 Prill) (Acephate 90 S) (Acephate 97) (Orthene® 75 S) (Orthene® 90 S) (Orthene® 97)	1B	0.5-1.0 0.248-0.748 0.5-1.0 0.5-1.0 0.5-1.0 0.5-1.0 0.5-1.0	10.66-21.33 oz 4.4-13.3 oz 9-17.77 oz 8-16 oz 10.66-21.33 oz 9-17.77 oz 8-16 oz	C C C C C C C	24 24 24 24 24 24 24	H H H H H H H
			Dicrotophos (Bidrin® 8 E)	1B	0.05-0.2	0.8-3.2 oz	D	48***	H

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵	
Thrips (and nematodes) Seed	Dimethoate (Dimethoate 2.67 E) (Dimethoate 4 E) (Dimethoate 5 E)	1B	0.11-0.22 0.125-0.25 0.125-0.25	5.3-10.5 oz 4-8 oz 3.2-6.4 oz	W W D	12 12 48	H H H	
	Methyl Parathion (Methyl 4 EC) (Pennncap-M® 2 F)	1B	0.125-0.25 0.125-0.25	0.25-0.5 pt 0.5-1 pt	D W	4 days*** 4 days***	H H	
	Aeris® Thiodicarb + Imidacloprid (Gaucho Grande® 5 FS)	1A+ 4A	per seed 0.375 mg-ai + 0.375 mg-ai	per 100 lbs seed 25.6 oz + 25.6 oz	C C	* *	** **	
	Avicta Complete Cotton® Abamectin (Avicta® 500 FS) + Thiamethoxam (Cruiser® 5 FS)	6 + 4A	per seed 0.1-0.15 mg-ai + 0.3-0.34 mg-ai	per 100,000 seeds 0.68-1.0 oz + 1.7-1.9 oz	D C	* *	** **	
	Cotton Fleahopper	Acephate (Acephate 75 S) (Acephate 90 Prill) (Acephate 90 S) (Acephate 97) (Orthene® 75 S) (Orthene® 90 S) (Orthene® 97)	1B	0.5-1.0 0.248-0.748 0.5-1.0 0.5-1.0 0.5-1.0 0.5-1.0 0.5-1.0	10.66-21.33 oz 4.4-13.3 oz 9-17.77 oz 8-16 oz 10.66-21.33 oz 9-17.77 oz 8-16 oz	C C C C C C C	24 24 24 24 24 24 24	H H H H H H H
		Acetamiprid (Intruder® 70 WP)	4A	0.025-0.05	0.6-1.1 oz	C	12	H
		Chlorpyrifos (Chlorpyrifos 4 E) (Lock-on® 2 E) (Lorsban® 4 E)	1B	0.188-0.5 0.50 0.188-0.5	0.375-1.0 pt 2.0 pt 0.375-1.0 pt	W W W	24 24 24	H H H
		Chlorpyrifos + Gamma cyhalothrin (Cobalt®)	1B + 3	0.37-0.74 + 0.007-0.013	19-38 oz	D	24	H
		Dicrotophos (Bidrin® 8 E)	1B	0.05-0.2	0.8-3.2 oz	D	48***	H
		Dimethoate (Dimethoate 2.67 E) (Dimethoate 4 E) (Dimethoate 5 E)	1B	0.11-0.22 0.125-0.25 0.125-0.25	5.3-10.5 oz 4-8 oz 3.2-6.4 oz	W W D	12 12 48	H H H
Flonicamid (Carbine® 50 WG)		9C	0.054-0.089	1.7-2.8 oz	W	12	R	
Imidacloprid (Provado® 1.6 F) (Trimax® Pro 4.4 SC)		4A	0.047 0.031-0.062	3.75 oz 0.9-1.8 oz	C C	12 12	H H	
Indoxacarb (Steward® 1.25 SC)		22	0.09-0.11	9.2-11.3 oz	C	12	H	
Lambda-cyhalothrin + Thiamethoxam (Endigo® ZC)		3 + 4A	0.028-0.038 + 0.03-0.05	3.5-5.5 oz	W	24	H	
Methomyl (Lannate® 2.41 LV)		1A	0.113-0.225	6-12 oz	D	72	H	
Methyl Parathion (Pennncap-M® 2 F)		1B	0.125-0.25	0.5-1 pt	W	4 days***	H	
Oxamyl (Vydate® 2 L) (Vydate® 3.77 C-LV)		1A	0.25 0.25	1 pt 8.5 oz	D D	48 48	H H	
Thiamethoxam (Centric® 40 WG)		4A	0.031-0.0625	1.25-2.5 oz	C	12	H	
Boll Weevil (Overwintered)		Endosulfan 3 E	2A	0.5-1.5	21-64 oz	D	24	M
		Malathion (Fyfanon® ULV 9.9)	1B	0.61 -0.92	8-12 oz	C	12	H
		Methyl Parathion (Methyl 4 E) (Pennncap-M® 2 F)	1B	0.25-0.75 0.25-0.75	0.5-1.5 pt 1-3 pt	D W	4 days*** 4 days***	H H

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵	
Boll Weevil (In-Season)	Oxamyl (Vydate® 2 L) (Vydate® 3.77C-LV)	1A	0.25 0.25	1 pt 8.5 oz	D D	48 48	H H	
	Synthetic pyrethroids****	3						
	Dicrotophos (Bidrin® 8 E)	1B	0.5	8 oz	D	48***	H	
	Endosulfan 3 E	2A	0.5-1.5	21-64 oz	D	24	M	
	Malathion (Fyfanon® ULV 9.9)	1B	0.61 -0.92	8-12 oz	C	12	H	
	Methyl Parathion (Methyl 4 EC) (PennCap-M® 2 F)	1B	0.25-0.75 0.25-0.75	0.5-1.5 pt 1-3 pt	D W	4 days*** 4 days***	H H	
Grasshoppers	Oxamyl (Vydate® 2 L) (Vydate® 3.77C-LV)	1A	0.25 0.25	1 pt 8.5 oz	D D	48 48	H H	
	Synthetic pyrethroids****	3						
	Chlorpyrifos (Chlorpyrifos 4 E) (Lorsban® 4 E)	1B	0.25-0.5 0.25-0.5	0.5-1.0 pt 0.5-1.0 pt	W W	24 24	H H	
	Chlorpyrifos + Gamma cyhalothrin (Cobalt®)	1B + 3	0.25-0.51 + 0.0045-0.009	13-26 oz	D	24	H	
	Beta-cyfluthrin**** (Baythroid® XL)	3	0.016-0.022	2.0-2.8 oz	D	12	H	
	Dicrotophos (Bidrin® 8 E)	1B	0.25	4 oz	D	48***	H	
	Esfenvalerate**** (Asana® XL 0.66 E)	3	0.03-0.05	5.8-9.6 oz	W	12	H	
	Malathion (Fyfanon® ULV 9.9)	1B	0.61-0.92	8.0-12.0 oz	C	12	H	
	Zeta-cypermethrin**** (Mustang® 1.5 E) (Mustang® Max 0.8 E)	3	0.0375-0.05 0.01875-0.025	3.2-4.3 oz 3.0-4.0 oz	W W	12 12	H H	
	Zeta-cypermethrin + Bifenthrin**** (Hero® 1.24 EC)	3	0.035-0.10	3.6-10.3 oz	C	12	H	
	Beet Armyworm	Chlorpyrifos (Chlorpyrifos 4 E) (Lock-on® 2 E) (Lorsban® 4 E)	1B	0.75-1.0 0.50 0.75-1.0	1.5-2.0 pt 2.0 pt 1.5-2.0 pt	W W W	24 24 24	H H H
		Chlorpyrifos + Gamma cyhalothrin (Cobalt®)	1B + 3	0.51-0.74 + 0.009-0.013	26-38 oz	D	24	H
		Diiflubenzuron (Dimilin® 2 L) (Dimilin® 25 W)	15	0.0313-0.125 0.0313-0.125	2-8 oz 2-8 oz	C C	12 12	R R
		Emamectin benzoate (Denim® 0.16 EC)	6	0.0075	6.0 oz	D	48	H
Indoxacarb (Steward® 1.25 SC)		22	0.09-0.11	9.2-11.3 oz	C	12	H	
Methomyl (Lannate® 2.4 LV)		1A	0.45	1.5 pts	D	72	H	
Methoxyfenozide (Intrepid® 2 F)		18	0.06-0.16	4-10 oz	C	4	R	
Profenofos (Curacron® 8 E)		1B	0.75-1.0	12-16 oz	W	48***	H	
Spinosad (Tracer® 4 SC)		5	0.067-0.089	2.14-2.9 oz	C	4	H	
Tebufenozide (Confirm® 2 F)		18	0.06-0.25	4-16 oz	C	4	R	
Thiodicarb (Larvin® 3.2 F)		1A	0.6-0.9	1.5-2.25 pt	W	12	M	

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵
Bollworm & Tobacco Budworm (Eggs) For use only in combination with a larvicide	Methomyl (Lannate® 2.4 LV)	1A	0.113-0.225	6-12 oz	D	72	H
	Profenofos (Curacron® 8 E)	1B	0.125-0.25	2-4 oz	W	48***	H
	Thiodicarb (Larvin® 3.2 F)	1A	0.125-0.25	5-10 oz	W	12	M
Bollworm (Larvae)	Bacillus thuringiensis (Dipel® DF)	11	NA	0.5-2 lbs	C	4	R
	(Dipel® Pro ES)			1-6 pt	C	4	R
	(Javelin® WG)			0.25-1.5 lbs	C	4	R
	(Xentari®)			0.5-2 lbs	C	4	R
	(Agree® WG)			0.25-2 lbs	C	4	R
	Bifenthrin**** (Fanfare® 2 EC)	3	0.04-0.10	2.6-6.4 oz	W	12	H
	(Bifenthrin 2 EC)			2.6-6.4 oz	W	12	H
	(Brigade® 2 EC)			2.6-6.4 oz	W	12	H
	Beta-cyfluthrin**** (Baythroid® XL)	3	0.0125-0.02	1.6-2.6 oz	W	12	H
	Chlorpyrifos + Gamma cyhalothrin (Cobalt®)	1B + 3	0.37-0.74 + 0.007-0.013	19-38 oz	D	24	H
	Cyfluthrin + Imidacloprid (Leverage® 2.7 SE)	3 + 4A	0.034-0.043 + 0.0475-0.0625	3.8-5 oz	W	12	H
	Cypermethrin**** (Ammo® 2.5 EC)	3	0.04-0.1	2.0-5.0 oz	C	12	H
	(Cypermethrin 2.5 EC)			2.0-5.0 oz	C	12	H
	Esfenvalerate**** (Asana® XL 0.66 E)	3	0.03-0.05	5.8-9.6 oz	W	12	H
	Gamma cyhalothrin**** (Proaxis® 0.5 E)	3	0.0125 -0.02	3-2-5.12	C	24	H
	(Prolex® 1.25 E)			1.28-2.05	C	24	H
	Indoxacarb (Steward® 1.25 SC)	22	0.09-0.11	9.2-11.3 oz	C	12	H
	Lambda-cyhalothrin**** (Karate® 1 EC)	3	0.025-0.04	3.2-5.12	W	24	H
	(Karate® Z 2.08 CS)			1.6-2.56	W	24	H
	(Lambda 2.08 CS)			1.6-2.56	W	24	H
	(Lambda-Cy 1 EC)			3.2-5.12	W	24	H
	(LambdaStar 1 EC)			3.2-5.12	D	24	H
	(Lambda-T 1 CS)			3.2-5.12	W	24	H
(Silence® 1 EC)	3.2-5.12			W	24	H	
Lambda-cyhalothrin + Thiamethoxam (Endigo® ZC)	3 + 4A			0.028-0.038 + 0.03-0.05	3.5-5.5 oz	W	24
Methomyl (Lannate® 2.4 LV)	1A	0.45	1.5 pt	D	72	H	
Methyl Parathion (Methyl 4 EC)	1B	0.75	1.5 pt	D	4 days***	H	
Profenofos (Curacron® 8 E)	1B	0.5-1.0	8-16 oz	W	48***	H	
Spinosad (Trace® 4 SC)	5	0.067-0.089	2.14-2.9 oz	C	4	H	
Thiodicarb (Larvin® 3.2 F)	1A	0.6-0.9	1.5-2.25 pt	W	12	M	
Zeta-cypermethrin**** (Mustang® 1.5 E)	3	0.033-0.045	2.8-3.8 oz	W	12	H	
(Mustang® Max 0.8 E)			2.64-3.6 oz	W	12	H	
Zeta-cypermethrin + Bifenthrin**** (Hero® 1.24 EC)	3	0.05-0.10	5.2-10.3 oz	C	12	H	

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵	
Tobacco Bollworm (Larvae)	Acephate	1B						
	(Acephate 75 S)		0.5-1.0	10.67-21.3 oz	C	24	H	
	(Acephate 90 Prill)		0.5-0.748	8.9-13.3 oz	C	24	H	
	(Acephate 90 S)		0.5-1.0	9-17.77 oz	C	24	H	
	(Acephate 97)		0.5-1.0	8-16 oz	C	24	H	
	(Orthene® 75 S)		0.5-1.0	10.67-21.3 oz	C	24	H	
	(Orthene® 90 S)		0.5-1.0	9-17.77 oz	C	24	H	
	(Orthene® 97)		0.5-1.0	8-16 oz	C	24	H	
	<i>Bacillus thuringiensis</i>	11						
	(Dipel® DF)			0.5-2 lbs	C	4	R	
	(Dipel® Pro ES)			1-6 pt	C	4	R	
	(Javelin® WG)		NA	0.25-1.5 lbs	C	4	R	
	(Xentari®)			0.5-2 lbs	C	4	R	
	(Agree® WG)			0.25-2 lbs	C	4	R	
	Emamectin benzoate (Denim® 0.16 EC)	6		0.01-0.015	8.0-12.0 oz	D	48	H
	Indoxacarb (Steward® 1.25 SC)	22		0.09-0.11	9.2-11.3 oz	C	12	H
	Methomyl (Lannate® 2.4 LV)	1A		0.45	1.5 pt	D	72	H
	Methoxyfenozide (Intrepid® 2 F)	18		0.25-0.38	16-24 oz	C	4	R
	Methyl Parathion (Methyl 4 EC)	1B		0.75	1.5 pt	D	4 days***	H
	Profenofos (Curacron® 8 E)	1B		0.5-1.0	8-16 oz	W	48***	H
Spinosad (Tracer® 4 SC)	5		0.067-0.089	2.14-2.9 oz	C	4	H	
Thiodicarb (Larvin® 3.2 F)	1A		0.6-0.9	1.5-2.25 pt	W	12	M	
Cotton Aphids§§	Acetamiprid (Intruder® 70 WP)	4A		0.025-0.05	0.6-1.1 oz	C	12	H
	Chlorpyrifos (Chlorpyrifos 4 E) (Lock-on® 2 E) (Lorsban® 4 E)	1B	0.125-1.0 0.50 0.125-1.0	0.5-2.0 pt 2.0 pt 0.5-2.0 pt	W	24	H	
	Diclotophos (Bidrin® 8 E)	1B	0.25-0.5	4-8 oz	D	48***	H	
	Diclotophos + Bifenthrin (Bidrin® XP)	1B+ 3	0.25-0.4 + 0.063-0.1	4-6.4 oz + 4-6.4 oz	D	48***	H	
	Fonicamid (Carbine® 50 WG)	9C	0.044-0.089	1.4-2.8 oz	W	12	R	
	Lambda-cyhalothrin + Thiamethoxam (Endigo® ZC)	3 + 4A	0.028-0.038 + 0.03-0.05	3.5-5.5 oz	W	24	H	
	Profenofos (Curacron® 8 E)	1B	0.125-0.25	2-4 oz	W	48***	H	
	Imidacloprid (Provado® 1.6 F) (Trimax® Pro 4.4 SC)	4A	0.047 0.031-0.062	3.75 oz 0.9-1.8 oz	C C	12 12	H H	
	Methomyl (Lannate® 2.4 LV)	1A	0.225	12 oz	D	72	H	
	Profenofos (Curacron® 8E)	1B	0.5	8 oz	W	48***	H	
	Thiamethoxam (Centric® 40 WG)	4A	0.031-0.05	1.25-2 oz	C	12	H	
	Creontiades Plant Bug & Tarnished Plant Bug (Lygus spp.)	Acephate	1B					
		(Acephate 75 S)		0.5-1.0	10.66-21.33 oz	C	24	H
(Acephate 90 Prill)			0.248-0.748	4.4-13.3 oz	C	24	H	
(Acephate 90 S)			0.5-1.0	9-17.77 oz	C	24	H	
(Acephate 97)			0.5-1.0	8-16 oz	C	24	H	
(Orthene® 75 S)			0.5-1.0	10.66-21.33 oz	C	24	H	
(Orthene® 90 S)			0.5-1.0	9-17.77 oz	C	24	H	
(Orthene® 97)			0.5-1.0	8-16 oz	C	24	H	

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵
	Bifenthrin**** (Fanfare® 2 EC) (Bifenthrin 2 EC) (Brigade® 2 EC)	3	0.04-0.10 0.04-0.10 0.04-0.10	2.6-6.4 oz 2.6-6.4 oz 2.6-6.4 oz	W W W	12 12 12	H H H
	Beta-cyfluthrin**** (Baythroid® XL)	3	0.0125-0.02	1.6-2.6 oz	W	12	H
	Chlorpyrifos + Gamma cyhalothrin (Cobalt®)	1B + 3	0.37-0.74 + 0.007-0.013	19-38 oz	D	24	H
	Cyfluthrin + Imidacloprid (Leverage® 2.7 SE)	3 + 4A	0.034-0.043 + 0.0475-0.0625	3.8-5 oz	W	12	H
	Cypermethrin**** (Ammo® 2.5 EC) (Cypermethrin 2.5 EC)	3	0.04-0.1 0.04-0.1	2.0-5.0 oz 2.0-5.0 oz	C C	12 12	H H
	Dicrotophos (Bidrin® 8 E)	1B	0.5	8 oz	D	48***	H
	Dimethoate (Dimethoate 2.67 E) (Dimethoate 4 E) (Dimethoate 5 E)	1B	0.22 0.25 0.25	10.7 oz 8 oz 6.4 oz	W W D	12 12 48	H H H
	Esfenvalerate**** (Asana® XL 0.66 E)	3	0.03-0.05	5.8-9.6 oz	W	12	H
	Fonicamid (Carbine® 50 WG)	9C	0.054-0.089	1.7-2.8 oz	W	12	R
	Gamma cyhalothrin**** (Proaxis® 0.5 E) (Prolex® 1.25 E)	3	0.01-0.015 0.01-0.015	2.56-3.84 1.02-1.54	C C	24 24	H H
	Imidacloprid (Provado® 1.6 F) (Trimax® Pro 4.4 SC)	4A	0.047-0.0625 0.046-0.062	3.75-5.0 oz 1.35-1.8 oz	C C	12 12	H H
	Indoxacarb (Steward® 1.25 SC)	22	0.065-0.09	6.7-9.2 oz	C	12	H
	Lambda-cyhalothrin**** (Karate® 1 EC) (Karate® Z 2.08 CS) (Lambda 2.08 CS) (Lambda-Cy 1 EC) (LambdaStar 1 EC) (Lambda-T 1 CS) (Silencer® 1 EC)	3	0.02-0.03 0.02-0.03 0.02-0.03 0.02-0.03 0.02-0.03 0.02-0.03 0.02-0.03	2.56-3.84 1.28-1.92 1.28-1.92 2.56-3.84 2.56-3.84 2.56-3.84 2.56-3.84	D W W W D W W	24 24 24 24 24 24 24	H H H H H H H
	Lambda-cyhalothrin + Thiamethoxam (Endigo® ZC)	3 + 4A	0.028-0.038 + 0.03-0.05	3.5-5.5 oz	W	24	H
	Methomyl (Lannate® 2.4 LV)	1A	0.225	0.75 pt	D	72	H
	Methyl Parathion (PennCap-M® 2 F)	1B	0.125-1.0	0.5-4 pt	W	4 days***	H
	Oxamyl (Vydate® 2 L) (Vydate® 3.77 C-LV)	1A	0.25 0.375-1.00	1 pt 12.7-34.0 oz	D D	48 48	H H
	Zeta cypermethrin**** (Mustang® 1.5 E) (Mustang® Max 0.8 E)	3	0.035-0.05 0.0175-0.025	2.99-4.26 oz 2.8-4.0 oz	W W	12 12	H H
	Zeta-cypermethrin + Bifenthrin**** (Hero® 1.24 EC)	3	0.10	10.3 oz	C	12	H
Brown Stink Bug	Acephate (Acephate 75 S) (Acephate 90 Prill) (Acephate 90 S) (Acephate 97) (Orthene® 75 S) (Orthene® 90 S) (Orthene® 97)	1B	0.75 0.748 0.8 0.72 0.75 0.8 0.72	16 oz 13.3 oz 14.2 oz 12 oz 16 oz 14.2 oz 12 oz	C C C C C C C	24 24 24 24 24 24 24	H H H H H H H

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵
	Dicrotophos (Bidrin® 8 E)	1B	0.25-0.5	4-8 oz	D	48***	H
	Dicrotophos + Bifenthrin (Bidrin® XP)	1B+ 3	0.25-0.4 + 0.063-0.1	4-6.4 oz + 4-6.4 oz	D	48***	H
	Methyl Parathion (Methyl 4EC) (PennCap-M® 2 F)	1B	0.75 0.25-0.75	1.5 pt 1-3 pt	D W	4 days*** 4 days***	H H
	Oxamyl (Vydate® 3.77 C-LV)	1A	0.33-0.5	11.2-17 oz	D	48	H
Green Stink Bug	Acephate (Acephate 75 S) (Acephate 90 Prill) (Acephate 90 S) (Acephate 97) (Orthene® 75 S) (Orthene® 90 S) (Orthene® 97)	1B	0.75 0.748 0.8 0.72 0.75 0.8 0.72	16 oz 13.3 oz 14.2 oz 12 oz 16 oz 14.2 oz 12 oz	C C C C C C C	24 24 24 24 24 24 24	H H H H H H H
	Bifenthrin**** (Fanfare® 2 EC) (Bifenthrin 2 EC) (Brigade® 2 EC)	3	0.04-0.10 0.04-0.10 0.04-0.10	2.6-6.4 oz 2.6-6.4 oz 2.6-6.4 oz	W W W	12 12 12	H H H
	Beta-cyfluthrin**** (Baythroid® XL)	3	0.0125-0.02	1.6-2.6 oz	W	12	H
	Cyfluthrin + Imidacloprid (Leverage® 2.7 SE)	3 + 4A	0.034-0.043 + 0.0475-0.0625	3.8-5 oz	W	12	H
	Dicrotophos (Bidrin® 8 E)	1B	0.25-0.5	4-8 oz	D	48***	H
	Gamma cyhalothrin**** (Proaxis® 0.5 E) (Prolex® 1.25 E)	3	0.0125-0.02 0.0125-0.02	3.2-5.12 1.28-2.05	C C	24 24	H H
	Lambda-cyhalothrin**** (Karate® 1 EC) (Karate® Z 2.08 CS) (Lambda 2.08 CS) (Lambda-Cy 1 EC) (LambdaStar 1 EC) (Lambda-T 1 CS) (Silencer® 1 EC)	3	0.025-0.04 0.025-0.04 0.025-0.04 0.025-0.04 0.025-0.04 0.025-0.04 0.025-0.04	3.2-5.12 1.6-2.56 1.6-2.56 3.2-5.12 3.2-5.12 3.2-5.12 3.2-5.12	D W W W D W W	24 24 24 24 24 24 24	H H H H H H H
	Lambda-cyhalothrin + Thiamethoxam (Endigo® ZC)	3 + 4A	0.038 + 0.05	5.5 oz	W	24	H
	Methyl Parathion (Methyl 4EC) (PennCap-M® 2 F)	1B	0.75 0.25-0.75	1.5 pt 1-3 pt	D W	4 days*** 4 days***	H H
	Oxamyl (Vydate® 3.77 C-LV)	1A	0.33-0.5	11.2-17 oz	D	48	H
	Zeta cypermethrin*** (Mustang® 1.5 E) (Mustang® Max 0.8 E)	3	0.033-0.05 0.0165-0.0225	2.8-4.26 oz 2.64-3.8 oz	W W	12 12	H H
	Zeta-cypermethrin + Bifenthrin**** (Hero® 1.24 EC)	3	0.05-0.10	5.2-10.3 oz	C	12	H
Cabbage Looper	<i>Bacillus thuringiensis</i> (Dipel® DF) (Dipel® ES) (Javelin® WG) (Xentari®) (Agree® WG)	11		0.5-2 lbs 1-6 pt 0.25-1.5 lbs 0.5-2 lbs 0.25-2 lbs	C C C C C	4 4 4 4 4	R R R R R
	Indoxacarb (Steward® 1.25 SC)	22	0.09-0.11	9.2-11.3 oz	C	12	H
	Methoxyfenozide (Intrepid® 2 F)	18	0.06-0.16	4-10 oz	C	4	R
	Spinosad (Tracer® 4 SC)	5	0.067-0.089	2.14-2.9 oz	C	4	H

Table 1. Insecticide suggestion table. (continued)

Pest	Insecticides (listed alphabetically)	Insecticide MOA ¹	Pounds active ingredient per acre ²	Formulated amount per acre	Precaution status ³	Re-entry interval (hrs) ⁴	Honey bee hazard ⁵
Spider Mites	Abamectin (Abba [®] 0.15 EC) (Temprano [®] 0.15 EC) (Zephyr [®] 0.15 EC) (Zoro [®] 0.15 EC)	6	0.0047-0.019	4-16 oz	W	12	H
	Dicofol (Dicofol 3 D) (Dicofol 4 E) (Kelthane [®] MF)	un	0.9-1.2 0.75-1.5 0.75-1.5	30-40 lbs 1.5-3 pt 1.5-3 pt	C C C	12 12 12	R R R
	Profenofos (Curacron [®] 8 E)	1B	0.5-0.75	8-12 oz	W	48***	H
	Propargite (Comite [®] 6.55 E) (Comite [®] II 6 E)	14	0.82-1.64 0.96-1.69	1-2 pt 1.25-2.25 pt	D D	24 24	R R
	Spiromesifen (Oberon [®] 2 SC) (Oberon [®] 4 SC)	23	0.094-0.25 0.094-0.25	6-16 oz 3-8 oz	C C	12 12	R R

¹ Refer to Table 5 for Insecticide Resistance Action Committee (IRAC) Mode of Action classification.

² Refer to Table 3 for converting pounds active ingredient per gallon to acres per gallon.

³ C=caution; W=warning; D=danger.

⁴ Time after application before re-entering fields without protective clothing. The wearing of protective clothing as described on the label may shorten the re-entry interval. EPA could grant a shorter re-entry interval than the minimum of 12 hours following application. Re-entry intervals are determined by the product's federal label or by Texas Department of Agriculture regulations and are subject to change.

⁵ H=highly toxic; M=moderately toxic; R=relatively non-toxic

*Refer to federal label for specific field re-entry instructions.

**These products are applied to the seed or to the soil and pose no hazard to honey bees.

***Re-entry interval increases from 48 hours to 72 hours or from 4 days to 5 days in areas where the average annual rainfall is less than 25 inches.

****The pyrethroid insecticides (examples include bifenthrin, esfenvalerate, cyfluthrin, beta-cyfluthrin, lambda cyhalothrin, cypermethrin and zeta-cypermethrin) recommended for control of bollworms also will provide boll weevil control. However, application intervals similar to those recommended for the traditional phosphate insecticides (3 to 5 days under heavy pressure) are necessary to provide adequate control. When treatments are to be made for a bollworm-boll weevil complex a suggested treatment regime is to use a pyrethroid followed 3 to 5 days later by a phosphate boll weevil insecticide.

Since pyrethroids are not more effective than phosphates for boll weevil control, but are more effective for bollworm control, they should be saved for bollworm management.

We do not recommend using pyrethroids for boll weevil control alone or for early-season pests because increased use may enhance the opportunity for insects to develop resistance to pyrethroids.

Bifenthrin may suppress spider mites when used for control of bollworms and tobacco budworms. The use of pyrethroid insecticides may increase cotton aphid numbers.

§1 6-oz rate restricted to fall diapause applications.

§§Difficulty in controlling cotton aphids has been encountered in some areas of Texas. Poor or erratic control can be expected in the High Plains, Trans Pecos, Rolling Plains and Wintergarden areas. Resistance exists to many registered materials and continued excessive use of certain insecticides is apt to expand the resistance problem. Where resistance exists in an area, the initial insecticide application should be made at the higher labeled rate. Poorest control has occurred during cool periods or rapid aphid population growth.

Table 2. Insecticide/miticides listed in Table 1 that are labeled for use in chemigation systems.

Agree [®] WG	Cobalt [®]	Karate [®] 1 EC	Mustang [®] 1.5 E
Ammo [®] 2.5 EC	Cypermethrin 2 EC	Karate [®] 1 CS	Mustang [®] Max 0.8 E
Asana [®] XL 0.66 E	Dimethoate 2.67 E	Lambda 2.08 CS	Oberon [®] 2 SC
Baythroid [®] 2E	Dimethoate 4 E	Lambda-Cy 1 EC	Oberon [®] 4 SC
Baythroid [®] XL	Dimethoate 5 E	LambdaStar 1 EC	PennCap-M [®] 2 F
Bifenthrin 2 EC	Dipel [®] Pro ES	Lambda-T 1 CS	Proaxis [®] 0.5 E
Brigade [®] 2 EC	Endigo [®] ZC	Larvin [®] 3.2 F	Prolex [®] 1.25 E
Carbine [®] 50 WG	Fanfare [®] 2 EC	Leverage [®] 2.7 SE	Silencer [®] 1 EC
Chlorpyrifos 4 E	Hero [®] 1.24 EC	Lorsban 4 E	Xentari [®]

Table 3. Converting pounds active ingredient per gallon to acres per gallon.

Pounds active ingredient needed per acre	Pounds active ingredient per gallon.....																	
	0.15	0.30	0.66	0.90	1.00	1.80	2.00	2.40	2.50	2.67	3.00	3.20	4.00	6.00	6.55	7.50	8.00	9.33
	Acres per gallon*																	
0.01	15.0	30.0	66.0	90.0	100.0	180.0	200.0	240.0	250.0	267.0	300.0	320.0	400.0	600.0	655.0	750.0	800.0	933.0
0.015	10.0	20.0	44.0	60.0	66.7	120.0	133.3	160.0	166.7	178.0	200.0	213.3	266.7	400.0	436.7	500.0	533.3	622.0
0.019	7.9	15.8	34.7	47.4	52.6	94.7	105.3	126.3	131.6	140.5	157.9	168.4	210.5	315.8	344.7	394.7	421.1	491.1
0.02	7.5	15.0	33.0	45.0	50.0	90.0	100.0	120.0	125.0	133.5	150.0	160.0	200.0	300.0	327.5	375.0	400.0	466.5
0.025	6.0	12.0	26.4	36.0	40.0	72.0	80.0	96.0	100.0	106.8	120.0	128.0	160.0	240.0	262.0	300.0	320.0	373.2
0.03	5.0	10.0	22.0	30.0	33.3	60.0	66.7	80.0	83.3	89.0	100.0	106.7	133.3	200.0	218.3	250.0	266.7	311.0
0.04	3.8	7.5	16.5	22.2	25.0	45.0	50.0	60.0	62.5	66.8	75.0	80.0	100.0	150.0	163.8	187.5	200.0	233.3
0.05	3.0	6.0	13.2	18.0	20.0	36.0	40.0	48.0	50.0	53.4	60.0	64.0	80.0	120.0	131.0	150.0	160.0	186.6
0.0625	2.4	4.8	10.6	14.4	16.0	28.8	32.0	38.4	40.0	42.7	48.0	51.2	64.0	96.0	104.8	120.0	128.0	149.3
0.08	1.9	3.8	8.3	11.3	12.5	22.5	25.0	30.0	31.3	33.4	37.5	40.0	50.0	75.0	81.9	93.8	100.0	116.6
0.1	1.5	3.0	6.6	9.0	10.0	18.0	20.0	24.0	25.0	26.7	30.0	32.0	40.0	60.0	65.5	75.0	80.0	93.3
0.11	1.4	2.7	6.0	8.2	9.1	16.4	18.2	21.8	22.7	24.3	27.3	29.1	36.4	54.5	59.5	68.2	72.7	84.8
0.113	1.3	2.7	5.8	7.9	8.8	15.9	17.7	21.2	22.1	23.6	26.5	28.3	35.4	53.1	58.0	66.4	70.8	82.6
0.125	1.2	2.4	5.3	7.2	8.0	14.4	16.0	19.2	20.0	21.4	24.0	25.6	32.0	48.0	52.4	60.0	64.0	74.6
0.17	0.9	1.8	3.9	5.3	5.9	10.6	11.8	14.1	14.7	15.7	17.6	18.8	23.5	35.3	38.5	44.1	47.1	54.9
0.19	0.8	1.6	3.5	4.7	5.3	9.5	10.5	12.6	13.2	14.1	15.8	16.8	21.1	31.6	34.5	39.5	42.1	49.1
0.2	0.7	1.5	3.3	4.5	5.0	9.0	10.0	12.0	12.5	13.4	15.0	16.0	20.0	30.0	32.8	37.5	40.0	48.7
0.22	0.7	1.4	3.0	4.1	4.5	8.2	9.1	10.9	11.4	12.1	13.6	14.5	18.2	27.3	29.8	34.1	36.4	42.4
0.225	0.6	1.3	2.9	4.0	4.4	8.0	8.9	10.7	11.1	11.9	13.3	14.2	17.8	26.7	29.1	33.3	35.6	41.5
0.25	0.6	1.2	2.6	3.6	4.0	7.2	8.0	9.6	10.0	10.7	12.0	12.8	16.0	24.0	26.2	30.0	32.0	37.3
0.33	0.4	0.9	2.0	2.7	3.0	5.5	6.1	7.3	7.6	8.1	9.1	9.7	12.1	18.2	19.8	22.7	24.2	28.3
0.37	0.4	0.8	1.8	2.5	2.7	4.9	5.4	6.5	6.8	7.2	8.1	8.6	10.8	16.2	17.7	20.3	21.6	25.2
0.375	0.4	0.8	1.8	2.4	2.7	4.8	5.3	6.4	6.7	7.1	8.0	8.5	10.7	16.0	17.5	20.0	21.3	24.9
0.45	0.3	0.7	1.5	2.0	2.2	4.0	4.4	5.3	5.6	5.9	6.7	7.1	8.9	13.3	14.6	16.7	17.8	20.7
0.5	0.3	0.6	1.3	1.8	2.0	3.6	4.0	4.8	5.0	5.3	6.0	6.4	8.0	12.0	13.1	15.0	16.0	18.7
0.55	0.3	0.5	1.2	1.6	1.8	3.3	3.6	4.4	4.5	4.9	5.5	5.8	7.3	10.9	11.9	13.6	14.5	17.0
0.58	0.3	0.5	1.1	1.5	1.7	3.1	3.4	4.1	4.3	4.6	5.2	5.5	6.9	10.3	11.3	12.9	13.8	16.1
0.6	0.2	0.5	1.1	1.5	1.7	3.0	3.3	4.0	4.2	4.5	5.0	5.3	6.7	10.0	10.9	12.5	13.3	15.6
0.675	0.2	0.4	1.0	1.4	1.5	2.7	3.0	3.6	3.7	4.0	4.4	4.7	5.9	8.9	9.7	11.1	11.9	13.8
0.75	0.2	0.4	0.9	1.2	1.3	2.4	2.7	3.2	3.3	3.6	4.0	4.3	5.3	8.0	8.7	10.0	10.7	12.4
0.8	0.2	0.4	0.8	1.2	1.3	2.3	2.5	3.0	3.1	3.3	3.8	4.0	5.0	7.5	8.2	9.4	10.0	11.7
0.88	0.2	0.3	0.8	1.0	1.1	2.0	2.3	2.7	2.8	3.0	3.4	3.6	4.5	6.8	7.4	8.5	9.1	10.6
0.9	0.2	0.3	0.7	1.0	1.1	2.0	2.2	2.7	2.8	3.0	3.3	3.6	4.4	6.7	7.3	8.3	8.9	10.4
1	0.1	0.3	0.7	0.9	1.0	1.8	2.0	2.4	2.5	2.7	3.0	3.2	4.0	6.0	6.6	7.5	8.0	9.3
1.17	0.1	0.3	0.6	0.8	0.9	1.5	1.7	2.1	2.1	2.3	2.6	2.7	3.4	5.1	5.8	6.4	6.8	8.0
1.25	0.1	0.2	0.5	0.7	0.8	1.4	1.6	1.9	2.0	2.1	2.4	2.6	3.2	4.8	5.2	6.0	6.4	7.5
1.5	0.1	0.2	0.4	0.6	0.7	1.2	1.3	1.6	1.7	1.8	2.0	2.1	2.7	4.0	4.4	5.0	5.3	6.2
1.6	0.1	0.2	0.4	0.5	0.6	1.1	1.3	1.5	1.6	1.7	1.9	2.0	2.5	3.8	4.1	4.7	5.0	5.8
2	0.1	0.2	0.3	0.5	0.5	0.9	1.0	1.2	1.3	1.3	1.5	1.6	2.0	3.0	3.3	3.8	4.0	4.7

*See Table 1 for specific rates of insecticides for each insect or mite pest.

Table 4. Converting percent active ingredient of dry insecticides to formulated insecticide per acre.

Pounds active ingredient needed per acre	Percent active ingredient					
	5	15	20	50	80	90
	Pounds of formulated product per acre*					
0.09	1.80	0.60	0.45	0.18	0.11	0.10
0.188	3.76	1.25	0.04	0.38	0.24	0.21
0.25	5.00	1.67	1.25	0.50	0.31	0.28
0.3	6.00	2.00	1.50	0.60	0.38	0.33
0.45	9.00	3.00	2.25	0.90	0.56	0.50
0.5	10.00	3.33	2.50	1.00	0.63	0.56
0.6	12.00	4.00	3.00	1.20	0.75	0.67
0.75	15.00	5.00	3.75	1.50	0.94	0.83
1.0	20.00	6.67	5.00	2.00	1.25	1.11
1.25	25.00	8.33	6.25	2.50	1.56	1.39
1.33	26.60	8.87	6.65	2.66	1.66	1.48
1.5	30.00	10.00	7.50	3.00	1.88	1.87
1.6	32.00	10.67	8.00	3.20	2.00	1.78
2.0	40.00	13.33	10.00	4.00	2.50	2.22
2.4	48.00	16.00	12.00	4.80	3.00	2.67

*See Table 1 for specific rates of insecticides for each insect or mite pest.

Table 5. IRAC Mode of Action Classification v5.3, July 2007¹.

Main group primary site of action	Chemical sub-group or exemplifying active ingredient	Active ingredients
1 Acetylcholine esterase inhibitors	1A Carbamates	Aldicarb, Alanycarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Aldicarb, Alanycarb, Bendiocarb, Benfuracarb, Butocarboxim, Butoxycarboxim, Carbaryl, Carbofuran, Carbosulfan, Ethiofencarb, Fenobucarb, Formetanate, Furathiocarb, Isoprocarb, Methiocarb, Methomyl, Metolcarb, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Thiofanox, Trimethacarb, XMC, Xyllycarb
	Triazemate	Triazemate
	1B Organophosphates	Acephate, Azamethiphos, Azinphos-ethyl, Azinphos-methyl, Cadusafos, Chloretoxyfos, Chlorfenvinphos, I Chlormephos, Chlorpyrifos, Chlorpyrifos-methyl, Coumaphos, Cyanophos, Demeton-S-methyl, Diazinon, Dichlorvos/ DDVP, Dicrotophos, Dimethoate, Dimethylvinphos, Disulfoton, EPN, Ethion, Ethoprophos, Famphur, Fenamiphos, Fenitrothion, Fenthion, Fosthiazate, Heptenophos, Isofenphos, Isopropyl O-methoxyaminothiophosphoryl salicylate, Isoxathion, Malathion, Mecarbam, Methamidophos, Methidathion, Mevinphos, Monocrotophos, Naled, Omethoate, Oxydemeton-methyl, Parathion, Parathion-methyl, Phenthoate, Phorate, Phosalone, Phosmet, Phosphamidon, Phoxim, Pirimiphos-, ethyl, Profenofos, Propetamphos, Prothiofos, Pyraclofos, Pyridaphenthion, Quinalphos, Sulfotep, Tebupirimfos, Temephos, Terbufos, Tetrachlorvinphos, Thiometon, Triazophos, Trichlorfon, Vamidothion
2 GABA-gated chloride channel antagonists	2A Cyclodiene organochlorines	Chlordane, Endosulfan, gamma-HCH (Lindane)
	2B Phenylpyrazoles (Fiproles)	Ethiprole, Fipronil
3 Sodium channel modulators	DDT Methoxychlor Pyrethroids	DDT Methoxychlor Acrinathrin, Allethrin, d-cis-trans Allethrin, d-trans Allethrin, Bifenthrin, Bioallethrin, Bioallethrin S-cyclopentenyl, Bioresmethrin, Cycloprothrin, Cyfluthrin, beta-Cyfluthrin, Cyhalothrin, lambda-Cyhalothrin, gamma-Cyhalothrin, Cypermethrin, alpha-Cypermethrin, beta-Cypermethrin, theta-cypermethrin, zeta-Cypermethrin, Cyphenothrin , (1R)-trans- isomers], Deltamethrin, Empenthrin , (EZ)-(1R)- isomers], Esfenvalerate, Etofenprox, Fenpropathrin, Fenvalerate, Flucythrinate, Flumethrin, tau-Fluvalinate, Halfenprox, Imiprothrin, Permethrin, Phenothrin [(1R)-trans- isomer], Prallethrin, Resmethrin, RU 15525, Silafluofen, Tefluthrin, Tetramethrin, Tetramethrin [(1R)-isomers], Tralomethrin, Transfluthrin, ZXI 8901 Pyrethrins (pyrethrum)
	Pyrethrins	Pyrethrins (pyrethrum)
4 Nicotinic Acetylcholine receptor agonists / antagonists	4A Neonicotinoids	Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiacloprid, Thiamethoxam
	Nicotine	Nicotine
	4C Bensultap Cartap hydrochloride Nereistoxin analogues	Bensultap Cartap hydrochloride Thiocyclam, Thiosultap-sodium
5 Nicotinic Acetylcholine receptor agonists (allosteric) (not group 4)	Spinosyns	Spinosad
6 Chloride channel activators	Avermectins, Milbemycins	Abamectin, Emamectin benzoate, Milbemectin
7 Juvenile hormone mimics	7A Juvenile hormone analogues	Hydroprene, Kinoprene, Methoprene
	7B Fenoxycarb	Fenoxycarb
	7C Pyriproxyfen	Pyriproxyfen

Table 5. IRAC Mode of Action Classification v5.3, July 2007¹. (continued)

Main group primary site of action	Chemical sub-group or exemplifying active ingredient	Active ingredients
8 Compounds of unknown or non-specific mode of action (fumigants)	8A Alkyl halides	Methyl bromide and other alkyl halides
	8B Chloropicrin	Chloropicrin
	8C Sulfuryl fluoride	Sulfuryl fluoride
9 Compounds of unknown or non-specific mode of action (selective feeding blockers)	9A Cryolite	Cryolite
	9B Pymetrozine	Pymetrozine
	9C Fonicamid	Fonicamid
10 Compounds of unknown or non-specific mode of action (mite growth inhibitors)	10A Clofentezine Hexythiazox	Clofentezine Hexythiazox
	10B Etoxazole	Etoxazole
11 Microbial disruptors of insect midgut membranes (includes transgenic crops expressing <i>Bacillus thuringiensis</i> toxins)	11A1 <i>B.t. subsp. israelensis</i>	<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i>
	11A2 <i>B. sphaericus</i>	<i>Bacillus sphaericus</i>
	11B1 <i>B.t. subsp. aizawai</i>	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i>
	11B2 <i>B.t. subsp. kurstaki</i>	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i>
	11C <i>B.t. subsp. tenebrionis</i>	<i>Bacillus thuringiensis</i> subsp. <i>tenebrionis</i>
12 Inhibitors of oxidative phosphorylation, disruptors of ATP formation (inhibitors of ATP synthase)	12A Diafenthion	Diafenthion
	1 2B Organotin miticides	Azocyclotin, Cyhexatin, Fenbutatin oxide
	1 2C Propargite Tetradifon	Propargite Tetradifon
13 Uncouplers of oxidative phosphorylation via disruption of proton gradient	Chlorfenapyr DNOC	Chlorfenapyr DNOC
14 vacant		
15 Inhibitors of chitin biosynthesis, type 0, Lepidopteran	Benzoylureas	Bistrifluron, Chlofluaazuron, Diflubenzuron, Flucycloxuron, Flufenoxuron, Hexaflumuron, Lufenuron, Novaluron, Noviflumuron, Teflubenzuron, Triflumuron
16 Inhibitors of chitin biosynthesis, type 1, Homopteran	Buprofezin	Buprofezin
17 Moulting disruptor, Dipteran	Cyromazine	Cyromazine
18 Ecdysone agonists / moulting disruptors	18A Diacylhydrazines	Chromafenozide, Halofenozide, Methoxyfenozide, Tebufenozide
	18B Azadirachtin	Azadirachtin
19 Octopaminergic agonists	Amitraz	Amitraz

Table 5. IRAC Mode of Action Classification v5.3, July 2007¹. (continued)

Main group primary site of action	Chemical sub-group or exemplifying active ingredient	Active ingredients
20 Mitochondrial complex III electron transport inhibitors (Coupling site II)	20A Hydramethylnon	Hydramethylnon
	20B Acequinocyl	Acequinocyl
	20C Fluacrypyrim	Fluacrypyrim
21 Mitochondrial complex I electron transport inhibitors	METI acaricides	Fenazaquin, Fenpyroximate, Pyrimidifen, Pyridaben, Tebufenpyrad, Tolfenpyrad
	Rotenone	Rotenone
22 Voltage-dependent sodium channel blockers	22A Indoxacarb	Indoxacarb
	22B Metaflumizone	Metaflumizone
23 Inhibitors of lipid synthesis	Tetronic acid derivatives	Spirodiclofen, Spiromesifen
24 Mitochondrial complex IV electron transport inhibitors	24A Aluminium phosphide	Aluminium phosphide
	24B Cyanide	Cyanide
	24C Phosphine	Phosphine
25 Neuronal inhibitors (unknown mode of action)	25 Bifenazate	Bifenazate
26 Aconitase inhibitors	Fluoroacetate	Fluoroacetate
27 Synergists	27A P450-dependent monooxygenase inhibitors	Piperonyl butoxide
	27B Esterase inhibitors	Tribufos (DEF)
28 Ryanodine receptor modulators	Diamides	Flubendiamide, Chlorantraniliprole
un Compounds with unknown mode of action ²	una Benzoximate	Benzoximate
	unb Chinomethionat	Chinomethionat
	unc Dicofol	Dicofol
	und Pyridalyl	Pyridalyl
ns Miscellaneous non- specific (multi-site) inhibitors ³	nsa Borax	Borax
	nsb Tartar emetic	Tartar emetic

¹ Inclusion of a compound in the list above does not necessarily signify regulatory approval

² A compound with an unknown mode of action or an unknown mode of toxicity will be held in category 'un' until evidence becomes available to enable that compound to be assigned to a more appropriate mode of action class

³ Category 'ns' is used for compounds or preparations with a non-specific, multisite action.

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Revised