

Insect Control

D.A. Herbert, Jr., Extension Entomologist, Tidewater AREC

Thrips

Insect pests such as aphids, spider mites, cutworms, plant bugs, and thrips affect cotton in the early stages of development. At present, only thrips must be controlled annually. These tiny, spindle-shaped insects complete several generations per season under favorable conditions. They feed primarily by puncturing and rasping the outer cells of the young leaves and buds. Damage results in ragged looking plants with crinkled or “possum-eared” leaves. The damage associated with thrips feeding can stunt growth, resulting in fruiting at higher positions and delayed maturity. Damage is most severe if young cotton is subjected to adverse growing conditions such as cool or dry weather or when alternate thrips hosts, such as small grains, dry down prematurely, forcing large numbers of thrips to seek other hosts. Adverse growing conditions during the early stages of cotton development may reduce the uptake of systemic insecticides; therefore, early inspection of the crop is important due to the length of the growing season in most of Virginia.

Temik 15G: Temik has consistently provided good control of thrips and suppression of other early-season cotton insect pests for up to six weeks. Field tests in Virginia and North Carolina have shown that Temik at the 5-lb rate has provided a yield advantage and in some cases has provided early maturity, especially important for Virginia growers. If cotton planting is delayed past May 15, a 3-lb rate will usually be sufficient.

Di-Syston 15G, Thimet 20G: These products provide good thrips control for three or four weeks. If cotton development and thrips populations are delayed, additional control may be needed.

Orthene 97 in-furrow: Orthene 97 can be dribbled or sprayed in-furrow during the planting operation. Orthene provides good thrips control for up to five weeks if applied at 12 to 16 oz of product/A. Applications are usually made at 5 to 10 gal/A and are compatible with several liquid fungicides.

Imidacloprid (Gaucho Grande, Aeris) and thiamethoxam (Avicta CP, Cruiser 5FS) seed treatment: Gaucho and Cruiser treated seed provide good thrips control, but a foliar treatment may be needed to provide season-long control.

There is no formal threshold for thrips based on insect numbers or plant injury. Treatment is thought to be justified if the following conditions are met: 1) thrips injury is common, 2) 10 percent or more plants show extensive bud damage, 3) immature thrips can be easily found, and 4) plant growth is poor.

Table 8. Recommended insecticides for thrips control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
In-furrow	acephate (Orthene 97)	12.0-16.0 oz	21	Apply as a liquid into the seed furrow in 5-10 gal of water/A with a system that insures good seed coverage. Do not feed treated forage or hay to livestock or allow animals to graze treated areas.
	aldicarb (Temik 15G)	3.0-5.0 lb	90	RESTRICTED USE. Apply granules in seed furrow and cover with soil. Do not feed cotton forage to livestock or allow livestock to graze in treated area.
	disulfoton (Di-Syston 15G)	5.0-6.7 lb	--	RESTRICTED USE. Place granules in a band on each side of the seed furrow at planting.
	disulfoton (Di-Syston 8E)	12.0-16.0 oz	--	RESTRICTED USE. Apply directly into the seed furrow as a low-pressure spray or dribble at planting before closing of press wheel.
	phorate (Thimet 20G)	3.75-5.0 lb	--	RESTRICTED USE. Distribute granules in seed furrow and cover with soil. Do not graze or feed treated hay or forage to livestock.
	imidacloprid (Gaucho Grande) seed treatment	0.375 mg ai/seed	--	
	thiamethoxam (Cruiser 5FS)	0.30-0.34 mg ai/seed	--	

2009 Virginia Cotton Production Guide

Table 8. Recommended insecticides for thrips control. (cont.)

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits:		Remarks
			Amount product per acre	days before harvest	
Foliar	bifenthrin (Brigade 2EC)	1.3-6.4 oz	14		RESTRICTED USE.
	acephate band (Orthene 97) broadcast (Orthene 97)	2.5 oz	21		May be tank mixed with Roundup Ultra or Roundup Ultra Max (on Roundup Ready cotton) or Glyphosate materials labeled for use on Roundup Ready Cotton, Buctril (on BXN cotton), or Staple.
	lambda-cyhalothrin (Warrior T) (Karate Z) (Karate EC) (Kaiso 24WG)	1.92-2.56 oz 0.96-1.28 oz 1.92-2.56 oz 1.0-1.33 oz	21 21 21 21		RESTRICTED USE. Do not graze livestock in treated areas.
	beta-cyfluthrin (Baythroid XL)	0.8-1.6 oz	0		RESTRICTED USE.
	gamma-cyhalothrin (Proaxis) (Prolex)	1.92-2.56 oz 0.77-1.02 oz	21 21		RESTRICTED USE. Do not graze livestock in treated fields.
	zeta-cypermethrin (Mustang Max)	1.28-1.92 oz	14		RESTRICTED USE. Do not graze or feed cotton for forage.
	chlorpyrifos + gamma-cyhalothrin (Cobait)	19.0-38.0 oz	21		RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.
	spinetoram (Radiant SC)	4.25-8.0 oz	28		

Plant Bugs

Prebloom: Prior to bloom, plant bugs, or Lygus, damage cotton by feeding on tender terminals and small squares causing the squares to turn black and abort. Excessive square loss can reduce yields or slow plant maturity. In prebloom cotton, Lygus has required treatment on an average of only 6 percent of the cotton acreage in North Carolina over the past 8 years, and on only a few hundred acres in Virginia. The best way to determine the need for prebloom plant bug control is to assess square retention rates (percent missing squares). Treatment should be considered if square retention drops below 80 percent (see threshold table below) and plant bugs are still active.

After blooming: Once blooming begins, plant bugs continue feeding on smaller squares and blooms, both of which can cause “dirty blooms” (white blooms with brown pollen anthers or brown-streaked petals). The presence of dirty blooms indicates that plant bugs are, or have very recently been, active. Levels at or above 1 percent dirty bloom indicate a large and active plant bug population and the need for sampling of bolls for damage (see threshold chart below).

Boll damage: Once bolls are formed, plant bugs prefer feeding on small bolls up to three weeks old. Damage to bolls can range from warts or calluses on the insides of boll walls, to small areas of stain lint, to deformed and rotting fruit that is due to direct feeding on seed. This damage is identical to damage caused by stink bugs. Virginia studies indicate that treatments may be justified if boll damage by plant bugs (and/or stink bugs) exceeds 15 percent of a random sample of quarter-size bolls (see threshold table below).

Untreated or minimally treated cotton, such as Bollgard cotton, is most susceptible to plant bug damage. Also, fields treated later in the season are open to invasion for a longer period of time.

Sampling for plant bugs and thresholds in cotton.

Prebloom	below 80% square retention and plant bugs active
After blooming	15% dirty blooms indicates the presence of an active population 8 plant bugs per 100 sweeps indicates a large, active population
Boll damage	15% or more damaged quarter-size bolls (up to 14 days old) and plant bugs active

Table 9. Recommended insecticides for plant bug control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar	acephate (Orthene 97)	4.0-16.0 oz	21	GENERAL. Treatment not recommended if square retention is in excess of 80%. If square retention is less than 80%, confirmation of threshold levels of plant bugs should be met prior to treatment. Although cotton fields exceeding the treatment thresholds for plant bugs are relatively rare, fields adjacent to Irish potatoes, weed fields, and other sources of plant bugs may be at higher risk of plant bug injury.
	chlorpyrifos (Lorsban 4EC)	6.1 oz	14	
	chlorpyrifos + gamma-cyhalothrin (Cobalt)	19.0-38.0 oz	21	RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.
	dicrotophos (Bidrin 8)	4.0-8.0 oz	30	RESTRICTED USE.
	imidacloprid (Provado 1.6F) (Trimax Pro)	3.75 oz 0.9-1.8 oz	14 14	
	thiamethoxam (Centric 40WG)	1.25-2.0 oz	21	
	acetamiprid (Assail 70WP)	1.1-2.3 oz	28	
	methyl parathion (4EC) (PennCap-M 2F)	0.5-2.0 pt 0.5-1.0 pt	7 7	RESTRICTED USE.
	methomyl (Lannate 2.4 LV) (Lannate 90SP)	12.0 oz 0.5 lb	15 15	RESTRICTED USE.

Table 9. Recommended insecticides for plant bug control. (cont.)

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar (cont.)	oxamyl (Vydate 2.4 LV)	8.5 oz	21	RESTRICTED USE.
	lambda-cyhalothrin (Warrior T)	2.56-3.84 oz	21	RESTRICTED USE.
	(Karate Z)	1.28-1.92 oz	21	Do not graze livestock on treated fields.
	(Karate EC)	2.56-3.84 oz	21	
	(Kaiso 24WG)	1.33-2.0 oz	21	
	lambda-cyhalothrin + thiamethoxam (Endigo ZC)	3.5-5.5 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.
	beta-cyfluthrin (Baythroid XL)	1.6-2.6 oz	0	RESTRICTED USE.
	bifenthrin (Brigade 2EC)	2.6-6.4 oz	14	RESTRICTED USE.
	gamma-cyhalothrin (Proaxis)	2.56-3.84 oz	21	RESTRICTED USE.
	(Prolex)	1.02-1.54 oz	21	
	zeta-cypermethrin (Mustang Max)	2.64-3.6 oz	14	RESTRICTED USE.
	esfenvalerate (Asana XL 0.66EC)	5.8-9.6 oz	21	RESTRICTED USE.
	dinotefuran (Venom 20SG)	0.44-0.67 oz	14	

Tobacco Budworm/Cotton Bollworm

Bollworms (corn earworms) occur primarily on field corn during their first two generations. Third generation moths usually emerge in large numbers from mid-July to early August when corn is drying, and fly to the more attractive blooming cotton.

Regular weekly scouting for the bollworm and its cousin, the tobacco budworm, should begin in early to mid-June. Weekly scouting is adequate until egg laying or blacklight trap catches increase. Fields should then be scouted twice a week, with the emphasis placed upon finding eggs, until insecticide treatments begin. After that, a four- to seven-day scouting schedule will usually suffice. A four- to five-day scouting schedule is suggested for conventional pyrethroid rates and a six- to seven-day schedule for high rates. Once the egg threshold has been met and treatments made, the primary focus of scouting shifts toward finding small bollworms feeding on squares and bolls, including those under bloom tags, and boll damage.

Tobacco budworm adults are not readily attracted to backlight traps and sometimes begin laying eggs on cotton prior to the time at which the bollworm egg threshold has been met. Occasional fields may reach a 3 percent larval threshold prior to bollworm treatment initiation. Under these circumstances, tobacco budworm pheromone trap deployment and correct sight identification of adult tobacco budworms can assist in recognition of this situation.

After the upper bolls that will be harvested have become difficult to cut with a pocketknife (approximately three weeks after bloom), they are normally safe from bollworm attack. Bollworm scouting can normally be stopped at that time – usually in late August to early September. Spot scouting for fall armyworms and European corn borers should continue through early September, especially in fields of late-maturing cotton or in green areas.

Table 10. Bollworm and tobacco budworm thresholds in conventional cotton.

Timing Stage	Infestation Level	Remarks
Prebloom	8 bollworms/100 terminals or 6 bollworms/100 squares	Limiting this treatment to one well-timed non-pyrethroid application is strongly recommended.
Egg threshold	10+ eggs/100 terminals or 2 eggs/100 fruiting forms	After the onset of the major (third generation) bollworm moth flight.
Postbloom larval threshold	3 live worms/100 terminals, or 3% fresh damage, squares, blooms, or bolls	Usually after the egg threshold has been employed; also used after blooming begins and before major bollworm flight, particularly if tobacco budworms present.

Table 11. Bollworm and tobacco budworm thresholds in Bollgard cotton.

Timing Stage	Infestation Level	Remarks
Egg threshold	75 to 100 eggs/100 terminal or 15 to 20 eggs/100 blooms or bloom tags	Applies only following a period of high egg deposition. Should not be used within 1 week or less of an insecticide application.
Larval threshold	3 second-stage (1/8 inch or larger) bollworms/100 squares or bolls or 2 second-stage bollworms on 2 consecutive scouting trips or 1 second-stage bollworm on 3 consecutive scouting trips	Use against the major bollworm generation. Pay particular attention to bollworms in or under yellow, pink, or dried blooms, but only sample in proportion to their occurrence.
Damage threshold	3-6% significantly damaged squares (would cause square to abort) or bolls	

Table 12. Recommended insecticides for bollworm control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar (pyrethroids)	cypermethrin (Ammo 2.5EC)	3.1*-5.1** oz	14	RESTRICTED USE. High-pressure (50-70 psi) and low-volume (6-10 gpa) advised for pyrethroid application.
	esfenvalerate (Asana XL 0.66EC)	5.8*-9.7** oz	21	RESTRICTED USE.
	beta-cyfluthrin (Baythroid XL)	1.6*-2.6** oz	0	RESTRICTED USE.
	bifenthrin (Brigade 2EC)	3.2*-6.4** oz	14	RESTRICTED USE.
	zeta-cypermethrin (Mustang Max)	2.64*-3.6** oz	14	RESTRICTED USE.
	lambda-cyhalothrin (Warrior T)	3.2*-5.1** oz	21	RESTRICTED USE.
	(Karate Z)	1.6*-2.56** oz	21	Do not graze livestock on treated fields.
	(Karate EC)	3.2*-5.1** oz	21	
	(Kaiso 24WG)	1.67*-2.67** oz	21	
	lambda-cyhalothrin + thiamethoxam (Endigo ZC)	3.5-5.5 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.
	tralomethrin (Scout X-Tra 0.9EC)	2.6*-3.4** oz	28	RESTRICTED USE.

*Standard rate

**High rate

Table 12. Recommended insecticides for bollworm control. (cont.)

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
	deltamethrin (Decis 1.5EC)	1.9*-2.56** oz	21	RESTRICTED USE.
	fenpropathrin (Danitol 2.4EC)	10.6*-16.0** oz	21	RESTRICTED USE.
	gamma-cyhalothrin (Proaxis)	3.2*-5.12** oz	21	RESTRICTED USE. Do not graze livestock in treated fields.
	(Prolex)	1.28*-2.05** oz	21	
	chlorpyrifos + gamma-cyhalothrin (Cobalt)	19.0-38.0 oz	21	RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.
Foliar (others)	spinosyn (Tracer 4SC)	2.14-2.9 oz	28	For second generation tobacco budworms, 1.4 oz is adequate; for postbloom bollworms, use the 2.9 oz rate.
	indoxacarb (Steward EC)	11.3 oz	14	RESTRICTED USE. Do not allow livestock to graze treated areas.
	emamectin benzoate (Denim)	8.0-12.0 oz	21	RESTRICTED USE.
Foliar (others) cont.	profenophos (Curacron 8EC)	1.0 pt	14	

*Standard rate

**High rate

Table 12. Recommended insecticides for bollworm control. (cont.)

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
	thiodicarb (Larvin 3.2F)	24.0-36.0 oz	28	
	methomyl (Lannate 2.4LV) (Lannate 90SP)	1.5 pt 8.0 oz	15 15	RESTRICTED USE.

*Standard rate

**High rate

European Corn Borer

European corn borer (ECB) larvae damage cotton by feeding on large bolls from early August through mid-September. In rank or late-maturing cotton, this damage can be significant. An earlier tunneling type of damage may occur within stems and leaf petioles, usually in mid-July through late August. Although this damage looks serious, with wilting and eventual death of the tissue above the feeding site, it causes no known economic loss. The major moth flight for the ECB often occurs a few days to three weeks later than the major bollworm flight. The female moths lay egg masses that contain 15 to 75 eggs each. These small, flat, scale-like masses are deposited on the underside of cotton leaves deep within the canopy. At first, early instars feed within the leaf petioles and stems, but they begin to enter and feed upon large bolls, sometimes within 48 hours, particularly after mid-August. Although the caterpillars of this species generally do not feed as extensively within the bolls as do bollworms, most bolls are destroyed.

Controlling ECB damage presents an unusual problem. The flat egg masses are almost impossible to find, even by the trained scouts searching heavily infested fields. By the time the larvae are found feeding on or within bolls, insecticide treatments usually are ineffective. Thus, scouting for this pest benefits the producer little during the present year. However, scouting to detect the caterpillars is advised. If small larvae are present (3 percent or more), treatment may be prescribed if an active flight is confirmed. This situation may indicate a late, rank-cotton crop that should be avoided in the future.

No control threshold has been developed since finding the egg masses is virtually impossible, and live caterpillars are spotted too late to achieve effective control. Growers must depend on another observation as a trigger for directing insecticide against the pest. Fortunately, because corn earworm egg laying usually occurs somewhat earlier than the ECB flight, employing the egg threshold for bollworm control usually works well for ECB if treatments are extended into the ECB infestation period. An insecticide should be selected that is effective against both insects. If the major part of the ECB flight occurs after the bollworm flight has subsided and spraying has been completed, fields can be particularly susceptible. Under this condition, three to six total applications may be required for adequate suppression. This approach is recommended only where late rank growth points toward a high probability of ECB damage. Finding moths of this species in local light of pheromone traps or flushing the adults from around or within cotton fields can help confirm the need for this extended treatment.

Table 13. Recommended insecticides for European corn borer control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limit: days before harvest	Remarks
Foliar	cypermethrin (Ammo 2.5EC)	3.1-4.1 oz	14	RESTRICTED USE. European corn borer populations are generally higher in rank cotton. Multiple applications may be necessary for control. Other bollworm materials may provide some control.
	beta-cyfluthrin (Baythroid XL)	1.6-2.6 oz	0	RESTRICTED USE.
	bifenthrin (Brigade 2EC)	1.3-6.4 oz	14	RESTRICTED USE.
	deltamethrin (Decis 1.5EC)	1.9-2.6 oz	14	RESTRICTED USE.
	zeta-cypermethrin (Mustang Max)	2.64-3.6 oz	14	RESTRICTED USE.
	lambda cyhalothrin (Warrior T)	3.2 oz	21	RESTRICTED USE.
	(Karate Z)	1.6 oz	21	Do not graze livestock on treated fields.
	(Karate EC)	3.2 oz	21	
	(Kaiso 24WG)	1.67-2.67 oz	21	
	lambda cyhalothrin + thiamethoxam (Endigo ZC)	3.5-5.5 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.
	tralomethrin (Scout X-Tra 0.9EC)	2.6-3.4 oz	28	RESTRICTED USE.

Table 13. Recommended insecticides for European corn borer control. (cont.)

Treatment	Insecticide (Formulation)	Amount product per acre	Time limit: days before harvest	Remarks
	gamma-cyhalothrin (Proaxis)	3.2-5.12 oz	21	RESTRICTED USE. Do not graze livestock in treated fields.
	(Prolex)	1.28-2.05 oz	21	
	chlorpyrifos + gamma-cyhalothrin (Cobalt)	19.0-38.0 oz	21	RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.

Stink Bugs

Stink bugs typically begin invading cotton fields in mid-July and build to damaging levels in August. The insecticide applications for the bollworm usually keep stink bug numbers below damaging levels. Problems with stink bugs usually develop where the bollworm applications are limited or not applied at all. Stink bugs damage cotton by puncturing the carpal walls of bolls and feeding on the soft developing seeds. If bolls are small when feeding occurs, the boll will dry up, turn brown, and either remain on the plant or be shed. Boll rot pathogens are sometimes introduced when feeding is concentrated on medium and larger bolls, resulting in portions of the boll being destroyed, hardlock, and lower grades. External feeding damage appears as small round purplish depressions about the size of a pencil point. The feeding sites are slightly larger but closely resemble the spots that naturally appear on maturing bolls. Stink bug feeding sites can be confirmed by slicing the bolls open under the depressions. The damaged bolls will have a brown stain (boll rot organisms) in the seed area under these spots.

Stink bugs often occur in a clumped distribution within a cotton field; therefore, at least ten samples should be taken throughout a field to determine if a problem exists. Both sweep nets and shake cloths can be used to sample for stink bugs, but research is showing that of the two, shake cloths tend to do a better job. A sweep net sample should consist of 25 hard sweeps using a pendulum-like motion with enough speed and force to end up with some leaves and small bolls in the net. An average of one stink bug per 25 sweeps could indicate a problem. A shake cloth sample should consist of placing a 3-foot long cloth on the ground between the rows, bending the bordering plants on either side (first one side, then the other) and vigorously shaking those plants to dislodge any insects. An average of one bug per 6 row feet (one 3-foot long shake cloth sample, both sides of the cloth) could indicate a problem.

However, because of recent trends in other eastern cotton states and results of ongoing field research, the recommendation is to base the decision to treat for stink bug on the percentage of damaged bolls, and presence of stink bugs (see threshold table below).

Sampling for stink bugs and thresholds in cotton

Indicates presence	an average of 1 per 6 row feet using a 3-foot shake cloth an average of 1 per 25 sweeps using a 15-inch diameter sweep net
Boll damage	15% or more damaged quarter-size bolls (up to 14 days old) and stink bugs active

Table 14. Recommended insecticides for control of stink bugs.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limit: days before harvest	Remarks
Foliar	methyl parathion (4EC) (Pennacp-M 2F)	1.0 pt 1.0-3.0 pt	7 7	RESTRICTED USE.
	Pyrethroids (see product labels)			Pyrethroids, when applied 2 or more times against bollworms, usually provide adequate suppression of stink bugs. Pennacp is highly toxic to bees. Do not apply this product or allow to drift to blooming cotton if bees are in treated areas.
	acephate (Orthene 97)	8.0-12.0 oz	21	Do not feed treated forage or hay to livestock or allow animals to graze treated areas. Use for brown and green stink bugs.
	dicotophos (Bidrin 8)	4.0-8.0 oz	30	RESTRICTED USE. Use for brown and green stink bugs.
	oxamyl (Vydate C-LV)	8.5 oz	21	RESTRICTED USE.
	thiamethoxam (Centric 40 WG)	2.0 oz	21	
	lambda-cyhalothrin + thiamethoxam (Endigo ZC) (green stink bug) (brown stink bug)	3.5-5.5 oz 5.5 oz	21 21	RESTRICTED USE. Do not graze livestock in treated areas.
	imidacloprid (Trimax Pro)	0.9-1.8 oz	14	
	chlorpyrifos + gamma-cyhalothrin (Cobalt)	26.0-38.0 oz	21	RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.

Aphids

A number of beneficial insects and fungal diseases can hold aphid numbers below economic threshold levels. By limiting early-season insecticide applications, the grower is allowing beneficial insect populations to build, decreasing the chances of developing resistant aphid populations (observed in North Carolina and Virginia), and possibly reducing or eliminating the need for insecticide applications later in the season. An aphid rating level of four or more just before boll opening, plus the presence of honeydew, is probably a good indicator of the need to treat.

Aphid Rating Scale

0	No aphids
1	Occasional plants with low numbers of aphids
2	Plants with low numbers common; heavily infested plant rare; honeydew visible occasionally
3	Most plants with some aphids; occasional plants heavily infested; honeydew visible in most areas of the field
4	Heavily infested plants common; aphids clumped on upper leaves
5	Many heavily infested plants

Table 15. Recommended insecticides for aphid control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar	imidacloprid (Provado 1.6F) (Trimax Pro)	3.75 oz 0.9-1.8 oz	14 14	Aphid control with insecticides should be attempted only as a last resort, particularly in early season (before major bollworm flight).
	dicrotophos (Bidrin 8)	4.0 oz	30	RESTRICTED USE.
	dimethoate (Cygon 4EC)	8.0 oz	14	
	phosphorothioate (Metasystox-R 2EC)	16.0 oz	14	RESTRICTED USE.
	bifenthrin (Brigade 2EC)	2.6-6.4 oz	14	RESTRICTED USE.
	acetamiprid (Assail 70WP)	0.6-1.1 oz	28	
	thiamethoxam (Centric 40WG)	1-25-2.0 oz	14	

Table 16. Recommended insecticides for aphid/bollworm control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
	cyfluthrin + imidacloprid (Leverage 2.7)	3.0-3.75 oz	21	RESTRICTED USE.
	lambda-cyhalothrin + thiamethoxam (Endigo ZC)	3.5-5.5 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.

Spider Mites

Spider mites can occur at anytime during the season, but are favored by dry weather and/or the removal of alternative hosts. Mite damage first appears as a slight yellowing of the leaves, which later changes to a purplish or bronze color and is usually associated with webbing. Damage occurs especially in spots or on field edges but widespread defoliation is not uncommon if favorable conditions persist.

Spider mites can be checked while scouting for other insect pests. Active mite populations should be confirmed before applications are made. Delaying treatment should also be considered if rainy, humid conditions are predicted in the near future. Rainy, humid conditions favor a fungus that preys upon mites and may greatly reduce mite numbers.

Table 17. Recommended insecticides for spider mite control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar	bifenthrin (Brigade 2EC)	3.8-6.4 oz	14	RESTRICTED USE.
	propargite (Comite 6.55EC*)	1.0-2.0 pt	14	
	dicofol (Kelthane MF 4E)	1.5-3.0 pt	30	Do not make more than 2 applications/season. Do not feed cotton stalks or trash to meat or dairy animals.
	methidathion (Supracide 2E*)	2.0 qt	60	RESTRICTED USE.
	fenpropathrin (Danitol 2.4EC)	10.6-16.0 oz	21	RESTRICTED USE.
	etoxazole (Zeal)	0.66-1.0 oz	28	Apply with adequate water for uniform coverage (3-10 gal/A by air or 10-50 gal/A by ground). Best results are achieved if applied when mite populations are low. ZEAL is predominately an ovicide/larvicide and should be used early in the life cycle of mites.
	spitomesifen (Oberon 4SC)	3.0 oz (early season) 4.0-8.0 oz (mid-late season)	30	

* not after bolls begin to open

Loopers

Cabbage and soybean loopers rarely damage cotton because they prefer foliage, are prone to virus attack, and occur sporadically. Scouting for this pest, which normally appears late in the season, is done by observing foliage during scouting for other pests. As a general rule, if defoliation exceeds 3 percent in cotton with a significant portion (25 percent or more) of the bolls still immature and filling out, treatment may be needed. Soybean loopers are difficult to control with insecticides. Because foliage feeding typically begins at the bottom of the cotton plant and proceeds upward and outward, foliage feeding may be beneficial in preharvest cotton that has begun to open. The brownish larval frass (droppings) can be plentiful and temporarily stain opening cotton; however, this is not thought to be an economic problem. Since loopers are usually controlled by naturally occurring diseases and chemical controls are sometimes not effective due to resistance, recommendations will be available on a year-to-year basis through your local Extension office.

Fall Armyworms

The presence of fall armyworms (FAW) and their damage is recorded as part of bollworm scouting. Additional samples are unnecessary. FAW migrate into Virginia from the south so numbers are generally highest in the southern part of the state. FAW prefer blooms and bolls of all sizes. These caterpillars can be extremely damaging if present in moderate numbers and can become established late in the season. They can feed on mature bolls normally resistant to bollworm penetration. Because FAW are not always controlled effectively by the same insecticides as bollworms, it is very important that they be identified correctly. Also, because fall armyworms are difficult to control with insecticides, treatments are best applied at an early boll bract feeding stage. Fall armyworms have a more difficult time becoming established under a bollworm spray regime with certain pyrethroids.

Table 18. Recommended insecticides for fall armyworm control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks	
Foliar	protenophos (Curacron 8EC)	0.5-1.0 pt	14	Various rates and combinations may be recommended for armyworm control, depending upon the phenology and the age distribution and population levels of larvae. Pyrethroids will provide some control of fall armyworms hatching from egg masses. Fall armyworms may have more difficulty becoming established following Karate or Capture treatments used for bollworm control.	
	methomyl (Lannate 2.4LV)	1.5 pt	15		
	(Lannate 90SP)	0.5 lb	15		
	thiodicarb (Larvin 3.2F)	1.5-2.0 pt	28		
	chlorpyrifos (Lorsban 4E)	1.0-2.0 pt	14		
	chlorpyrifos + gamma-cyhalothrin (Cobalt)	19.0-38.0 oz	21		RESTRICTED USE. Do not allow meat or dairy animals to graze in treated areas. Do not feed gin trash or treated forage to meat or dairy animals.
	spinosyn (Tracer 4SC)	2.14-2.9 oz	28		
	indoxacarb (Steward EC)	9.2-11.3 oz	14		
	methoxyfenozide (Intrepid 2F)	4.0-10.0 oz	14		
	emamectin benzoate (Denim)	6.0-12.0 oz	21		RESTRICTED USE. Do not allow livestock to graze in treated areas.
lambda-cyhalothrin + thiamethoxam (Endigo ZC)	3.5-5.5 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.		

Beet Armyworms

Table 19. Recommended insecticides for beet armyworm control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar	spinosyn (Tracer 4SC)	2.14-2.9 oz	28	
	indoxacarb (Steward EC)	9.2-11.3 oz	14	
	methoxyfenozide (Intrepid 2F)	4.0-10.0 oz	14	
	emamectin benzoate (Denim)	6.0-12.0 oz	21	RESTRICTED USE. Do not allow livestock to graze in treated areas.

Cutworms

Table 20. Recommended insecticides for cutworm control.

Treatment	Insecticide (Formulation)	Amount product per acre	Time limits: days before harvest	Remarks
Foliar	lambda-cyhalothrin (Karate Z)	0.96 oz	21	RESTRICTED USE. Do not graze livestock in treated areas.
	(Karate EC)	1.92 oz	21	
	(Kaiso 24 WG)	1.0-1.33 oz	21	
	(Warrior T)	1.92 oz	21	
	thiodicarb (Larvin 3.2)	24.0 oz	28	
	beta-cyfluthrin (Baythroid XL)	0.8-1.6 oz	0	RESTRICTED USE.
	esfenvalerate (Asana XL 0.66EC)	5.8 oz	21	RESTRICTED USE.
	cypermethrin (Ammo 2.5EC)	1.3-5.0 oz	14	RESTRICTED USE.
	zeta-cypermethrin (Mustang Max)	1.28-1.92 oz	14	RESTRICTED USE.
	bifenthrin (Brigade 2EC)	2.6-6.4 oz	14	RESTRICTED USE.
	deltamethrin (Decis 1.5EC)	1.1-1.6 oz	21	RESTRICTED USE.
	tralomethrin (Scout X-Tra 0.9EC)	2.28-2.84 oz	28	RESTRICTED USE.
	fenpropathrin (Danitol 2.4 EC)	8.0 oz	21	RESTRICTED USE.
	acephate (Orthene 97)	12.0 oz	21	Control is most effective when ground application is made in the evenings and sprays are directed toward the base and lower portion of plants.
	gamma-cyhalothrin (Proaxis)	1.92-2.56 oz	21	RESTRICTED USE. Do not graze livestock in treated fields.
(Prolex)	0.77-1.02 oz	21		

Beneficial Insects

About a dozen beneficial insects are common in Virginia cotton. Ambush bugs, big-eyed bugs, minute pirate bugs, green lacewings, two species of ladybird beetles, and several types of spiders are examples. They are of two types: 1) predators that prey upon an insect pest, or 2) parasites that live within the host insect. These insects, particularly the predators, reduce the number of eggs and larvae of bollworms, caterpillars, and aphids. Because these allies lessen the impact of pest insects, common sense dictates that producers use them as a management tool. Their presence often means that growers can delay and on occasion, eliminate some insecticide applications.

Many complex factors are involved in determining just how many of each beneficial insect species are needed to influence a given level of pests. Therefore, it is usually not possible to assess the value of these insects except in a very general way. If relatively high numbers of beneficial insects are eating a large portion of aphids or bollworm eggs and larvae, the treatment threshold will be reached later than would otherwise be the case, reducing the number of insecticide applications needed. However, the rapid increase in pest populations, the third generation of bollworms, will often overwhelm the beneficial population and applications become necessary. The careful observation of sound economic thresholds offers the producer the best odds of balancing beneficial insect numbers.