TOBACCO INSECT MANAGEMENT

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Several species of insects cause serious damage to tobacco in the field, the greenhouse, and in storage. Insects damage the roots, destroy the leaves and buds, and reduce leaf quality. Others transmit several important tobacco disease pathogens.

Although the use of insecticides is frequently necessary to prevent economic losses from occurring, the avoidance of unwanted residues of crop protection agents (CPAs) in the cured tobacco is critical. The application of insecticides can be especially problematic since they are generally applied in a manner to protect the entire plant and applications may be warranted after topping and thus near harvest time. Although an insecticide is labeled for tobacco and is applied according to label directions at the proper time, the grower is ultimately responsible for the residues present in the cured tobacco. Growers must also be mindful of any contract restrictions for CPA residues in tobacco to be sold. Of particular note is the prohibition of some contractors that acephate (Orthene) not be applied to tobacco. Residues of chlorantraniliprole (Coragen) are a concern to some buyers and thus contracts may prohibit the application of Coragen after layby to limit the occurrence of excessive residues. Additionally, residues of pyrethroid containing insecticides (Acenthrin, Besiege, Karate, Warrrior, Capture, etc.) have long been a problem and growers much use them with caution.

Integrated pest management (IPM) is the best way to manage insect pests on tobacco. It combines cultural, natural, and chemical controls to maintain insect pest populations below levels that cause economic damage to the crop. IPM promotes the use of insecticides only when needed. It emphasizes that a certain amount of insect damage does not reduce crop value enough to pay for the cost of treatment and that tobacco plants often compensate for insect damage. IPM helps to maximize profits, reduce pesticide residue levels, environmental contamination, and human exposure to pesticides. It also optimizes natural control provided by beneficial organisms.

Cultural controls

The following cultural practices help reduce insect infestations and decrease the need for insecticide applications on tobacco.

1. **Early land preparation.** Plow at least 4 weeks before transplanting to reduce cutworm infestations.
2. **Use recommended nitrogen rates**. Excessive rates of nitrogen fertilization may delay maturity and make tobacco a more favorable host for hornworms and aphids after topping.

3. **Adjustments in transplanting date.** Early-planted tobacco is often less favorable for aphids and hornworms, and more favorable for budworms and flea beetles. Late planted tobacco is highly susceptible to hornworm damage and may have reduced yield and quality.

4. **Destroy greenhouse transplants as soon as transplanting is completed to** keep aphids and other insects from developing high populations on the transplants and migrating to nearby tobacco fields.

5. **Manage field borders to reduce insect habitat**. Keep field margins clear of weeds and tall grass to reduce feeding, breeding, and over wintering sites for grasshoppers and other insects that move from these sites into tobacco fields. After tobacco is established and growing, leave uncut barriers between tobacco fields and hay fields that are infested with grasshoppers.

6. **Top tobacco in the button or early flower stage** to eliminate food sources for budworms and make the crop a less desirable host for aphids and hornworms.

7. **Obtain effective sucker control** to reduce food sources for hornworms, budworms, and aphids.

8. **Stalk cutting and root destruction** immediately after harvest reduces feeding and overwintering sites for hornworms, budworms, and flea beetles.

9. **Rotate tobacco with crops that are poor hosts of cutworms, white-fringed beetles, and wireworms.** Beware of cutworm and wireworm infestations following established grass sods and soybeans.

10. **Conservation tillage strategies including no-till and strip-till** reduce aphid and flea beetle populations, but may increase problems with cutworm, vegetable weevil, and slugs.

Natural Control

Beneficial organisms, including predators, parasites and pathogens, help control several insect pests on tobacco. For example, parasites often kill more than 80 percent of the budworms in tobacco fields, control similar to that obtained with the most effective foliar insecticides. Hornworms are parasitized by the larvae of *Cotesia congregata*, which feed inside the caterpillars. When these larvae mature, they emerge and form egg-like cocoons on the backs of the hornworms. Tiny wasps emerge from these cocoons in a few days, mate, and lay eggs in other hornworms. Stilt bugs are long-legged, slender, brown bugs that feed on hornworm and budworm eggs, aphids, and even small amounts of tobacco sap.

Aphids are attacked by the adults and larvae of several species of lady beetles, lacewings, syrphid fly larvae, and a bright red midge larva. A pathogenic fungi frequently controls aphids from July through September,

especially in wet seasons. Although beneficial insects are usually abundant on aphid-infested tobacco, they often have trouble keeping aphid populations below economic threshold levels.

To preserve beneficial insects, scout fields and use economic thresholds to time insecticide applications. Select insecticides with low impact on beneficials. These insecticides include: *Bacillus thuringiensis (Bt)*, chloranthraniliprole (Coragen), emamectin benzoate (Denim), pymetrozine (Fulfill), and spinosad (Blackhawk). Transplant water and tray drench applications of imidacloprid (Admire Pro and generics) and thiamethoxam (Platinum) are associated with increased problems with hornworms and budworms because they affect beneficial parasites that help control these pests.

Chemical control

Economic thresholds and field scouting are important tools in IPM. The economic threshold is that pest population or injury level that requires treatment with an insecticide to prevent economic damage to the crop. Fields are scouted at regular intervals (once a week) to determine when insect pests reach their thresholds. Foliar insecticides are applied when scouting indicates that one or more pests have reached their economic thresholds. Insecticides applied as foliar, transplant water, tray drench, and soil treatments are extremely important tools in an IPM program. Many cultural and natural controls help reduce insect outbreaks, but it is almost impossible to grow a top quality, high yielding tobacco crop without using some insecticides.

Insect Control on Transplants Produced in the Greenhouse

Almost all of the tobacco transplants used in Virginia is produced in greenhouses. So far, insects have caused minor problems in greenhouses. However, if recommended cultural practices are not carried out, several of the following pests could become serious problems.

- **Ants** can remove seeds from greenhouse trays and cause poor stands.
- **Crickets and earwigs** often destroy newly emerged tobacco seedlings, reducing stands and initial growth.
- **Shoreflies** are tiny flies that look like small houseflies. They are frequently numerous in greenhouses. Their larvae (tiny maggots) feed on young seedlings and may reduce stands during the first 2 weeks after germination.
- **Cutworms, crickets, adult and larval vegetable weevils,** and **slugs** usually feed on stems and leaves at night. Cutworms also cut off and destroy plants.

- **Crickets**, **cutworms**, **slugs**, and **yellow-striped armyworms** may destroy individual leaves on larger seedlings; this damage does little harm unless populations are very high.
- **Aphids** often build up high populations on tobacco seedlings in the greenhouse reducing plant vigor, and they may be carried to the field on infested plants.
- **Mice** remove the seeds from float trays seriously reducing plant stands. If stand loss is severe, the entire greenhouse may require reseeding.

Cultural controls in the greenhouse

Sanitation is the most important practice for managing insect pests in tobacco greenhouses. The following practices reduce the potential for insect infestations in greenhouses.

- Discard all unused plants and clean out the greenhouse immediately after transplanting has been completed.
- Keep the area in and around the greenhouse clean and free of weeds, decaying plant material, plastic, boards, metal, and other items that provide food and/or shelter for insects and other pests.
- Do not plant fall and winter gardens near the greenhouse. Aphids can survive on various vegetables and related weed species during the winter and develop winged forms that fly into greenhouses and establish colonies on tobacco seedlings. Cutworms, armyworms, vegetable weevils, and slugs may hide in these sites, migrate into the greenhouse, and injure tobacco seedlings.
- If greenhouses are used to produce other crops, a fallow period should be followed to keep pests from moving from those crops. Use extreme temperatures to kill insects hiding in the greenhouse. Close the greenhouse to increase the temperature in the summer and promote cold temperatures in the winter.

Clean the greenhouse thoroughly just before seeding in the spring. Seed the entire greenhouse at the same time.

Chemical control in the greenhouse

Acephate (Orthene and generics) is the only effective insecticide labeled for use on tobacco transplants grown in greenhouses (Table 1). It should be applied as a foliar spray when insect infestations are observed. Acephate provides good to excellent control of aphids, yellow-striped armyworms, cutworms, flea beetles, and vegetable weevils. It should not be applied in the irrigation water or in the float water. Acephate also gives effective control of ants when applied in the greenhouse before the float beds are set up. Excessive rates of acephate can injure or kill young seedlings.

Metaldehyde (Deadline Bullets) and iron phosphate (Suggo) baits control slugs and snails in the greenhouse. In the early evening, apply methaldehyde along walkways and the outside margins of the float beds. Do not apply baits directly to seedlings or use them in float water.

Mice should be controlled with traps or baits approved for their control.

Table 1. Insecticides for use on Transplants Grown in Greenhouses[a]

Insect	Insecticide and formulation	Rate per 1,000 sq ft
Aphids, cutworms, flea beetles	Acephate (Acephate AG) 75SP	1 tbs/3 gal of water (1 lb/acre)
	(Acephate) 97UP	¾ tbs/3 gal of water (¾ lb/acre)
	(Orthene) 97PE	¾ tbs/3 gal of water (¾ lb/acre)
Remarks and precautions: Apply as a spray. **Excessive rates of acephate can injury tender young plants. Do not apply through an irrigation system or in the float water.**		
Snails and slugs	Metaldehyde (Deadline Bullets) 4% bait	¼ to ½ lb
	Iron phosphate (Sluggo Bait) 1% bait	1 lb
Remarks and precautions: Slug damage is usually associated with shiny slime trails. Apply to alleys, walkways and vacant areas in late afternoon. **Do not apply to float water or directly on foliage** /They are deactivated by water.		
Ants	Acephate (Acephate AG) 75SP	1 oz/5 gal of water
	(Acephate) 97UP	¾ oz/5 gal of water
	(Orthene) 97PE	¾ oz/5 gal of water
Remarks and precautions: Apply 1 gal of mix to each mound area by sprinkling the mound until it is wet. Treat a 4 ft diameter circle around the mound. Treat only once during the season.		

[a] Always read and follow the directions on the insecticide label before use.

Insect Control on Newly Transplanted Tobacco

Wireworms

Wireworms are hard, white to yellowish-brown, wire-like larvae of click beetles. These pests live in the soil, feed on the roots, and tunnel the piths of young tobacco plants. This injury stunts plant growth, causing irregular stands and lower yields. Although wireworms feed throughout the growing season, the most serious damage occurs when the plants are becoming established during the first month after transplanting. Wireworms take 1 to 5 years to complete their life cycle. Most of this time is spent in the larval stage. The larvae emerge from eggs in the summer and fall, feed on the roots of various host plants, and overwinter into the next year. Larvae then feed on the newly transplanted tobacco seedlings. Pupation and emergence as adult click beetles occur in late spring and early summer.

Wireworms are most common in fields with a history of wireworm problems, or in those previously planted after grass sod, weeds, corn, clover, or small grains. In these situations, apply an insecticide labeled for their control (Table 2). Apply soil insecticides as broadcast treatments and incorporate them at least 2 weeks before transplanting. Another option is to use Admire Pro or generics, Platinum, or Brigadier at the wireworm rates as transplant water or transplant drench treatments. The most effective cultural practice is to use sturdy, healthy transplants that are less susceptible to wireworm damage than tender, young transplants. After wireworm damage has occurred, it is too late to apply an insecticide. Where damage is light to moderate, cultivation and irrigation may help injured plants recover and produce near normal yields.

Cutworms

Cutworms are active at night feeding on roots or leaves or cutting off entire plants. This injury can cause enough damage and stand loss to require replanting. However, since tobacco compensates well, less than five percent stand loss usually has no impact on yield. Cutworm infestations are very sporadic and difficult to predict, but they are most likely to occur in low, wet areas, and in weedy fields that are plowed less than a month before transplanting. Plowing fields in the early spring usually destroys the cover crop and weed hosts, and reduces cutworm populations. Scout fields for cutworm damage once or twice a week during the first month after transplanting to determine whether a remedial foliar treatment is needed (Table 11). For optimum control of this night-feeding pest, apply a foliar insecticide in late afternoon or early evening when five percent or more of the plants in a field have recent cutworm damage.

Soil-incorporated insecticides

Pretransplant soil applications of insecticides can provide effective control of cutworms and wireworms on tobacco. Several factors should be considered before selecting a soil insecticide.

- If a tobacco field has been in sod, weeds, or small grains during the previous year or has a history of wireworm problems, apply an insecticide for wireworm control.
- Brigade/Capture is a broadcast soil treatment for wireworm control (Tables 2 and 3).
- Admire Pro, Platinum, or Brigadier applied as transplant water or transplant drench treatments may be better choices for wireworm control because they also control aphids, thrips, and flea beetles (Tables 2, 4, and 5).
- Soil fumigants applied at the nematicide rate provide little control of insects in the soil because many insects are below the zone being fumigated.

Table 2. Ratings of soil, greenhouse tray drench, and transplant water treatments for control of insects on flue-cured tobacco.

Insecticide	Application method [1]	Leaf feeding insects			Soil insects		
		Aphids	Bud-worms	Flea beetles	Horn-worms	Cut-worms	Wire-worms
Acephate/ (Orthene 97 and generics)	TW	1	0	2	0	3	0
Imidacloprid (Admire Pro and generics) [2]	TW	5	0	2	0	0	3
Imidacloprid (Admire Pro and generics) [2]	TD	5	0	4	0	0	3
Bifenthrin (Brigade/ Capture and generics) [2]	TW PPI	0	0	0	0	3	3
Chlorantraniliprole (Coragen)	TPW	0	2	0	3	0	0
Cyantraniliprole 1.67F (Verimark)	TD	0	2	4	2	0	0
Cyantraniliprole 1.67F (Verimark)	TPW	0	2	4	2	0	0
Lambda cyhalothrin (Karate, Warrior II and others)	PPI	0	0	0	0	3	0
Thiamethoxam (Platinum) 2F	TW	5	0	3	0	0	3
Thiamethoxam (Platinum) 2F	TD	5	0	4	0	0	3

Ratings are based on a scale of 0 to 5 where 0 = not labeled or no control, 1 = poor control, 2 = fair control, 3 = good control, 4 = very good control, and 5 = excellent control.
[1] TW = Transplant water, TD = Transplant drench, PPI=Preplant soil incorporated.
[2] There are many generic formulations of imidacloprid and bifenthrin.

Table 3. Insects on Field Tobacco - Pretransplant Soil Treatments

Insect	Insecticide and formulation	Rate per acre
Wireworms	Lambda cyhalothrin (Warrior II with Zeon and generics) 2.1EC	1.92 fl oz
	Bifenthrin (Brigade/Capture and generics) 2EC	2.56 to 6.4 fl oz

Remarks and precautions: Make broadcast application 24 to 48 hours before bedding. Banded applications are usually less effective than broadcast applications. Bifenthrin is also registered for cutworm and flea beetle larvae. **These chemicals are restricted use**.

Table 4. Insects on Field Tobacco-Drench Application to Greenhouse Transplants

Insects	Insecticide and formulation	Rate per 1,000 plants
Aphids, flea beetles	Imidacloprid (Admire Pro) 4.6SC	0.5 to 0.6 fl oz
	(various generics) 2F	1.0 fl oz
	Thiamethoxam (Platinum) 2SC	0.5 to 0.8 fl oz
	(Platinum) 75SG	0.17-0.43 oz
Flea beetles, budworms, hornworms	Cyantraniliprole (Verimark SC)	10 to 13.5 fl. oz/acre
Wireworm, Thrips for suppression of tomato spotted wilt virus	Imidacloprid (Admire Pro) 4.6SC	0.6 to 1.2 fl oz
	(various generics) 2F	1.4 to 2.8 fl oz
	Thiamethoxam (Platinum) 2SC	0.6 to 1.3 fl oz
	() 2SC	0.6 to 1.3 fl oz
	(Platinum) 75SG	0.43 oz

Remarks and precautions: Apply as a drench to plants in trays prior to transplanting. Mix with water before application. Keep agitated or mix regularly to avoid settling in tank. Water the plants in the trays before treatment and again immediately after application using enough water to wash the residue from the foliage into the media. Transplant within 3 days.

[a] **Always read and follow the directions on the insecticide label before use.**

Table 5. Insects on Field Tobacco - Transplant Water Treatments

Insect	Insecticide and formulation	Rate
Flea beetles, cutworms, thrips, suppression of aphids	Acephate (Acephate AG) 75SP	1 lb/acre
	(Acephate) 97UP	0.75 lb/acre
	(Orthene) 97PE	0.75 lb/acre
	Bifenthrin (Brigade/Capture) 2EC	2.56 to 6.4 fl oz/acre
Flea beetles, budworms, hornworms	Cyantraniliprole (Verimark SC) 1.67F	10 to 13.5 fl. oz/acre
Aphids, flea beetles	Imidacloprid (Admire Pro) 4.6SC	0.5 to 0.6 fl oz/1,000 plants
	(various generics) 2F	1.0 fl oz/1,000 plants
	Thiamethoxam (Platinum) 2SC	0.5 to 0.8 fl oz/1,000 plants or (3 to 5 fl oz/acre)
	(Platinum) 75SG	0.17-0.43 oz/1,000 plants
Budworms, hornworms	Chlorantraniliprole (Coragen) 1.67SC	5.0 to 7.5 fl oz/acre
Remarks and precautions: Apply in at least 100 gallons of water per acre. Coragen must be applied uniformly in the root zone for optimum performance.		
Wireworms, thrips for suppression of tomato spotted wilt virus	Imidacloprid (Admire Pro) 4.6SC	0.8 to 1.2 fl oz/1,000 plants
	(various generics) 2F	1.4 to 2.8 fl oz/1,000 plants
	Thiamethoxam (Platinum) 2SC	0.8 to 1.3 fl oz/1,000 plants or (5 to 8 fl oz/acre)
	(Platinum) 75SG	0.43 oz/1,000 plants
Remarks and precautions: Admire Pro and Platinum usually give excellent season-long control of aphids. Apply treatments in at least 100 gal of water/acre. **Calibrate transplanters and allow tanks to run low before refilling.**		

[a] Always read and follow the directions on the insecticide label before use.

Remedial Control of Insects on Larger Tobacco

Scouting for Insects

Tobacco fields should be scouted at least once a week throughout the season to determine when insecticide applications are needed.

1. Take representative samples from the entire field except for the outside rows. As you walk through the field, try to sample areas throughout the field. Do not sample the same plants each week. Look for insect pests and their damage on at least 50 plants in a field (1 to 10 acres) by making counts and recording the data for 5 consecutive plants at 10 locations throughout the field. Select the plants before you see them. If a field is planted on two different dates or if there are great differences in plant size within the field, divide the field into two or more sections and sample each section separately. Take more samples in larger fields.
2. During the first 4 weeks after transplanting, check tobacco for feeding holes or missing, stunted, or cut plants. Cutworms, flea beetles, wireworms, and other insects may have damaged these plants.
3. Beginning 3 to 4 weeks after transplanting, aphids, budworms, flea beetles, and hornworms are the primary targets of an insect scouting program.
4. When a field is being scouted for insects that feed on tobacco foliage, individual plants should be examined and the observations recorded in a notebook as follows:

   a. Check the bud region for budworm damage. If damage is present, look carefully for budworms and the white cocoons of budworm parasites. Do not count plants without a live budworm.

   Examine the entire plant for hornworm damage, locate, and count the hornworms that are at least 1 inch long, and determine whether they have the white egg-like cocoons of *Cotesia congregata* on their backs. Check the undersides of the upper leaves for aphids and the upper surfaces of the middle and lower leaves for honeydew, flea beetles, flea beetle feeding holes, and splitworm mines.

   If you find an unidentified insect that appears to be damaging the crop, collect the insect and samples of its damage, and take them to a local Extension agent for identification. This is important because beneficial insects are often mistaken for pests and the misidentification of a pest may lead to the selection of the wrong insecticide for its control.
5. Tobacco fields should be treated when one or more insect pests meet or exceed the threshold levels shown in Table 6.

Table 6. Economic thresholds for various insects on tobacco.

Insect	Economic threshold	Time when insect is a problem
Aphids	50 or more aphids on any upper leaf of 5 of 50 plants.	4 weeks after transplanting to final harvest
Budworms	5 plants with one or more budworms per 50 plants until 1 week before topping.	3 weeks after transplanting to 1 week before topping
Cutworms	5 of 100 plants with recent cutworm damage.	1 to 4 weeks after transplanting
Flea beetles	4 beetles per plant on tobacco less than 3 weeks old and 60 beetles per plant on plants more than 4 weeks old.	Transplanting to 4 weeks after transplanting and from topping to final harvest
Grasshoppers	10 grasshoppers per 50 plants.	4 weeks after transplanting to final harvest
Hornworms	5 larvae (worms) at least 1 inch long per 50 plants. Count parasitized worms with the egg-like cocoons on their backs as 1/5 hornworm.	3 weeks after transplanting to final harvest. Can be a problem on air-cured tobacco in curing structures
Wireworms	Not determined	1 to 4 weeks after transplanting

Tobacco Budworms

Tobacco budworms feed in the buds of young tobacco plants causing many holes in the tiny developing leaves. As the leaves grow, the feeding holes become larger and give the plants a ragged, distorted appearance. Tobacco plants usually compensate for this damage so yield and quality may not be affected. However, budworms sometimes top the plants prematurely causing early sucker growth that may stunt the plants and require extra labor to remove the suckers. After the button stage, budworms rarely cause economic damage although they may burrow into the stalk. Apply foliar sprays for budworm control with 1 or 3 solid-cone or hollow-cone nozzles over each row using 40 to 60 psi to deliver 10 to 25 gallons of spray mixture per acre. The tobacco rows must be planted evenly so that the nozzles can be oriented directly over each row. See insecticide performance ratings in Table 7 and insecticide options for budworm control in Table 10. When checking tobacco for budworms, look on the leaves near the bud for the cocoons of two species of wasp that parasitize budworms. These cocoons are about ¼ inch long and white or grayish in color with two black bands or dots. These parasites provide good natural control of budworms on tobacco in Virginia.

Hornworms

Tobacco and tomato hornworms are large caterpillars (up to 4 inches long) that eat considerable amounts of tobacco leaf. Infestations may develop anytime from transplanting until harvest is completed, but damage is usually

most severe during June, August, and September. Predators also kill large numbers of small larvae that are less than 1 inch long. For this reason, hornworms less than 1 inch long are not considered when determining the economic threshold because they cause very little damage and have no effect on yield or quality. However, if a field has large numbers of hornworms less than 1 inch long, the field should be rechecked in 3 to 4 days. For optimum hornworm control, direct insecticide sprays to the upper one-half of the plants. See insecticide ratings in Table 7 and the labeled insecticides in Table 10. Several cultural practices help reduce the susceptibility of tobacco to hornworms. Early topping, early transplanting, effective sucker control, and recommended rates of nitrogen help reduce late-season infestations. When used on an area-wide basis, stalk cutting and root destruction immediately after harvest reduces overwintering hornworm populations.

Aphids

The green peach aphid is a severe pest of tobacco in Virginia. Under favorable conditions, aphid populations increase rapidly, doubling in size about every two days. High populations of aphids can cause serious reductions in yield and quality. As aphids feed, they excrete honeydew that contains the excess sugars provides a food source for a dark, sooty mold. The combination of sooty mold and honeydew interferes with curing, reduces leaf quality, and often remains on the leaves after aphids have been controlled. Aphids are most severe on field tobacco before topping, but they can be a problem after topping in some years. Watch for increases in aphid populations from early June to the end of August. Examine the undersides of leaves from all portions of tobacco plants to assess the extent of aphid infestation.

The following practices can be used to manage aphids on tobacco.

1. **Preventive control**

   Apply systemic insecticides before or at transplanting.
   Admire Pro or Platinum applied as transplant drench or transplant water treatments usually provide excellent season-long control of aphids (Table 2).

2. **Remedial control of aphids**

   Make remedial applications of a foliar insecticide at the economic threshold level before populations become too high (Table 3). This will make aphid control much easier for the rest of the season.

   Rotate insecticides for resistance management. The continuous use of the same insecticide year after year increases the chances that aphids and other pests will develop resistance to it. Rotating insecticides with different IRAC modes of action (MOA) reduces the chances that resistance will develop (Table 9). When applying several insecticides

for aphid control over the growing season, change from one MOA to another. Do not apply a neonicotinoid (group 4) such as Provodo, Actara, or Assail to tobacco already treated with another neonicotinoid (group 4) such as Admire or Platinum. Instead, apply Orthene (group 1B) or Fulfill (group 9).

Assess control after 3 or 4 days. It takes 1 to 3 days after application of most insecticides for the aphids to die. If control is not adequate, determine whether the weather conditions, spraying equipment, improper calibration, etc. contributed to the poor control. If another application is needed, apply an insecticide in another MOA group (Table 9).

Higher gallonage, higher sprayer pressure, drop nozzles, and spreader-stickers can improve coverage. For optimum aphid control with foliar insecticides, the sprays must come in contact with the aphids. Drop nozzles improve control if aphids are abundant on the undersides of the lower leaves.

Continue to scout the crop after satisfactory control is obtained. Aphid infestations may return to damaging levels and require additional insecticide applications.

3. Cultural control of aphids

Most cultural practices do not keep aphid populations below the economic threshold, but they can improve the effectiveness of foliar insecticides and reduce the need for insecticide applications after topping. Useful cultural practices include:

Avoid planting cole crops such as cabbage and turnips near greenhouses. These plants are sources of aphids that can infest tobacco plants early in the growing season.

Control aphids in greenhouses. Make sure seedlings are aphid-free before they are transplanted. Destroy greenhouse transplants immediately after transplanting is completed.

Transplant early. Early planted tobacco may become infested with aphids earlier, but it matures earlier and the aphids have less impact on early-planted tobacco than they do on tobacco planted near the middle of the recommended planting period.

Use recommended nitrogen rates on flue-cured tobacco. Too much nitrogen fertilizer causes the leaves to remain green later in the year and it promotes excessive sucker growth that favors aphid infestations.

Top early and control suckers. Aphid populations often decline rapidly after topping, especially in hot, dry weather. However, aphids may still reach damaging levels that require insecticide treatment.

Tobacco Flea Beetles

Adult tobacco flea beetles feed on the leaves and stalks of tobacco, while the tiny grubs feed on the roots. Extensive feeding on newly set transplants by both beetle stages may cause stunting and uneven stands. When checking tobacco fields for flea beetles, look for the characteristic shot-hole feeding damage, and then count the beetle as described earlier under field scouting. Flea beetle control ratings for systemic and foliar insecticides are listed in Tables 2 and 7, respectively. Insecticides for flea beetle control are listed in Tables 3, 4, 5, and 10. Harvesting at the normal time, and stalk cutting and root destruction immediately after the last harvest are the most effective cultural practices for reducing overwintering flea beetle populations and the resulting damage the next year. Nitrogen deficient tobacco appears to be more susceptible to flea beetle damage after topping.

Flea beetles are difficult to control after topping because most insecticides that can be used at this time provide only short residual control while flea beetles emerge from the soil over an extended period of time.

Managing thrips to control tomato spotted wilt virus

The tobacco thrips, *Frankliniella fusca,* is the primary vector of the tobacco pathogen, tomato spotted wilt virus (TSWV). TSWV caused moderate stand reductions in tobacco fields in parts of Virginia in 2002 but it has been a minor problem since then. Foliar treatments for thrips control are not effective for managing TSWV after the disease is observed in the field. However, tray drench or transplant water applications of Admire Pro or generic forms of imidacloprid and Platinum suppress TSWV. Tray drenches are more effective than transplant water treatments.

Tobacco splitworm

The tobacco splitworm or potato tuberworm, a leaf-mining caterpillar is sometimes a late season problem on tobacco. Splitworms live in tunnels or mines that appear as brown, tan, or grayish, translucent blotches on the leaves. Splitworms can also feed in the midvein and stalk. Old mines turn brown and brittle and may destroy over 50 percent of the leaf. Although the mines are most common on the lower leaves, they can occur on any leaf. Splitworm damage increases the amount of dead leaf tissue and may reduce crop yield and value. Since splitworms feed within the leaves, they are difficult to control with insecticides. Currently, only Coragen is registered for splitworm control on tobacco. However, Denim, Blackhawk, and acephate applied in high volumes of water may provide fair to good control. Denim was the most effective treatment for splitworms in one trial in Virginia.

Irish potatoes should not be planted or stored near tobacco fields because they can be an important source of this pest in tobacco. Since splitworms continue to develop inside the leaves after they are harvested, removing infested leaves and dropping them on the ground will not reduce the problem and may make it worse. Air-cured and fire-cured tobacco stalks are also a

source of overwintering splitworm moths so they should not be discarded near tobacco fields.

Insecticide Application Methods

Apply insecticides properly for optimum insect control. On small tobacco, obtain effective control by directing one solid-cone or hollow-cone nozzle per row to the bud. Operate equipment at 40 to 60 psi, do not exceed 5 miles per hour, and use at least 6 to 8 gallons of finished spray per acre. After tobacco is 2 ft. tall, use one or three nozzles per row. If three nozzles are used, orient the two side nozzles at 45 degree angles toward the upper $^1/_3$ of the plant. Use 20 to 50 gallons of spray mixture per acre at 40 to 60 psi. Set the nozzles 8 to 12 inches above the tobacco. Drop nozzles oriented to the undersides of the leaves and used in combination with one or three nozzles over the row may improve aphid, splitworm, and flea beetle control. Plant tobacco uniformly so that the space between rows is constant. This makes it easier to orient the spray nozzles over the plants during the spraying operation.

Table 7. Rating of foliar insecticides for control of common insect pests on flue-cured tobacco.

Insecticide	Aphids	BW[1]	CW[1]	FB[1]	GH[1]	HW[1]
Actara (thimethoxam)	4	0	0	4	0	0
Assail / **Anarchy** (acetamiprid)	4	1	0	4	0	3*
Besiege (Chloranthiliprole and Lambda cyhalotrin)	1	4	3	3	3	5
Blackhawk (Spinosad)	0	4	0	0	0	4
Brigade / **Capture** (Bifenthrin)	3	3	4	3	3	5
B.t.	0	2	0	0	0	5
Coragen (Chloranthiliprole)	0	4	0	0	0	5
Denim (Emamectrin benzoate)	0	4	0	0	0	4
Exirel Cyantraniliprole)	0	4	0	4	0	4
Fulfill (Pymetrozine)	3	0	0	0	0	0
Karate / **Warrior** (Lambda cyhalotrin)	1	3	3	3	3	5
Orthene / **Acephate** (Acephate)	4	2	4	2	4	5
Provado (Imidacloprid)	4	0	0	3	0	0
Steward (Indoxacarb)	0	4-	0	4	0	5

[1] BW = Budworm; CW = Cutworm; FB = Flea Beetle; GH = Grasshopper; HW = Hornworm.

Rating is as follows: 0 = not labeled, 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent. *effective, but not labeled.

[a] Always read and follow the instructions on the insecticide label before use.

Table 8. Restricted entry intervals (REI) and preharvest intervals (PHI) for various insecticides used on flue-cured tobacco in Virginia.

Insecticide	Restricted entry Intervals (REI)	Preharvest interval (PHI)
Foliar treatments	**(hours)**	**(days)**
Acephate (Orthene/Acephate AG/Acephate UP)	24	3
Acetamiprid (Assail) 70WP, 30WG	12	7
Bacillus thuringiensis (Agree/Crymax/Dipel/ Javelin/XenTari)	4	0
Bacillus thuringiensis (Lepinox)	12	0
Bifenthrin (Brigade/Capture)	12	Do not apply after layby
Bifenthrin + imidacloprid (Brigadier)	12	Do not apply after layby
Chlorantraniliprole (Coragen)	4	1
Emamectin benzoate (Denim)	12	14
Imidacloprid (Nuprid/Provado) 1.6F	12	14
Indoxacarb (Steward)	12	14
Lambda-cyhalothrin (Karate/Warrior 1CS)	24	40
Pymethozine (Fulfill)	12	14
Spinosad (Blackhawk)	4	3
Thiamethoxam (Actara))	12	14
Soil treatments		
Bifenthrin (Brigade/Capture)	12	NA
Metaldehyde (Deadline Bullets)	12	NA
Greenhouse seedling drench or transplant water treatments		
Acephate (Orthene/Acephate)	24	NA
Bifenthrin (Brigade/Capture)	12	NA
Chlorantraniliprole (Coragen)	4	NA
Cyantraniliprole (Verimark SC)	4	NA
Imidacloprid (Admire Pro and generics)	12	NA
Lambda-cyhalothrin (Warrior/Karate)	12	NA
Thiamethoxam (Platinum) 2F	12	NA

Following the PHI for an insecticide application does not ensure that residues on the cured tobacco will be acceptable. Growers are ultimately responsible for residues and must heed contract restrictions for specific insecticides and consider using an insecticide that has the least residue concern. The use of acephate, pyrethroids, and Coragen should be considered carefully.

Minimizing Insecticide Residues

Pesticide residues are an important factor in the quality of cured tobacco that can cause some contractors to reject your crop. The following points help to minimize pesticide residues on the marketed crop.

- **Do not use any insecticides not labeled for use on tobacco.**
- **Do not use carbaryl (Sevin), chlorpyrifos, flubendiaminde (Belt) endosulfan, or methomyl (Lannate).** Some companies specify in their contacts chemicals that must not be used on the crop that they purchase.
- **Follow the preharvest intervals closely.** The pyrethroids, bifenthrin (Brigade) and lambda-cyhalothrin (Karate/Warrior) have very long preharvest intervals. Bifenthrin should not be applied after layby and lambda-cyhalothrin has a 40-day preharvest interval. Some companies are concerned about Orthene (Acephate) residues. Orthene should be applied as far from harvest as possible. **Use insecticides with short preharvest intervals during the harvest period.** *Bacillus thuringiensis* (Bt) and Blackhawk are good options for hornworms,

Resistance Management

The Insecticide Resistance Action Committee (IRAC) has grouped insecticides into mode of action (MOA) groups that are listed on many of the insecticide labels (Table 9). Avoid using insecticides within the same MOA group time after time. Instead, switch to an insecticide in another MOA group. This reduces the chances that an insect will develop resistance and help preserve the insecticides registered for tobacco.

Table 9. Tobacco insecticides by group and mode of action (MOA) for resistance management.

Group #	Mode of action	Chemical sub-group or active ingredient	Product name
1B	Acetylcholine esterase inhibitors	Organophosphates	Orthene
3	Sodium channel modulators	Pyrethroids, Pyrethrins	Brigade/Capture Karate/Warrior
4	Nicotinic Acetylcholine receptor agonists / antagonists	Neoicothinoids	Actara, Admire Pro, Assail, Platinum, Provado
5	Nicotinic Acetylcholine receptor agonists	Spinosyns	Blackhawk
6	Chloride channel activators	Avermectins	Denim
9	Selective feeding blockers	Pymetrozine	Fulfill
11	Microbial disruptors of insect midgut membranes	*Bacillus thuringiensis* var. *kurstaki, Bacillus thuringiensis* var. *tenebrionenses*	Dipel, etc.
22	Voltage dependent sodium channel modulators	Indoxacarb	Steward
28	Ryanodine receptor inhibitor	Chlorantraniliprole Cyantraniliprole	Coragen Exirel Verimark

Insect management on organic tobacco.

The number of insecticides available for use on organic tobacco is very limited and many of those provide marginal control of the target pests. Many of the approved materials are much less effective and provide shorter residual control than non-organic products. The Organic Materials Registry Institute (OMRI) lists materials that are available for use on organic tobacco. Many of the approved materials are much less effective and provide shorter residual control than synthetic insecticides. Many OMRI approved insecticides are expensive.

Aphids are the most challenging insect pest in organic tobacco because the insecticides labeled for their control provide very little control or there is limited information on their efficacy on tobacco. Dipel (Bacillus thuringensis and generics) has been used in conventional tobacco production for many years. It gives good control of hornworms and fair control of budworms when applied as a spray (DF) and the 10G formulation applied directly to the bud gives excellent budworm control. Pyganic gives good control of flea beetles, while the azadractin material (Aza-Direct and GOS Neem T-Way) provide fair control.

Organic growers may use several cultural practices to help manage insects on their crop. Crop rotation and early soil preparation help reduce problems with cutworms and may also help with wireworm control. Growers can plant sunflowers and buckwheat around field margins and in skip rows to attract beneficial insects and to act as barriers to some insect pests.

A PRECAUTIONARY STATEMENT ON PESTICIDES

Pesticides must be used carefully to protect against human injury and harm to the environment. Diagnose your pest problem, and select the proper pesticide if one is needed. The information presented here is not a substitute for pesticide label information. Follow label use directions, and obey all federal, state, and local pesticide laws and regulations.

Table 11. Insects on Field Tobacco - Foliar Treatments[a,b]

Insect	Insecticide and formulation	Rate per acre
Aphids	Acephate (Acephate AG) 75SP	2/3 to 1 lb
	(Acephate) 97UP	½ to ¾ lb
	(Orthene) 97PE	½ to ¾ lb
	Remarks and precautions: MOA = 1B. Apply as a spray in 10 to 50 gal/acre. Use highest rate for high populations. If tobacco is large and aphids are established on the lower leaves, drop nozzles that orient spray to undersides of leaves improve control. Prime before treating. **Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts.**	
	Acetamiprid (Assail) 70WP	0.6 to 1.7 oz
	(Assail) 30SG	1.5 to 4.0 fl oz
	Remarks and precautions: MOA = 4. Apply as a spray in at least 20 gal/acre. Do not apply to tobacco already treated with imidaclorpid (Admire Pro, Provado,) or thiamethoram (Platinum) (Actara).	
	Bifenthrin (Brigade/Capture) 2EC	2.56 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	
	Bifenthrin + imidaclorpid (Brigadier) 1 + 1EC	3.8 to 6.4 fl oz
	Remarks and precautions: MOA = 3 for bifenthrin and 4 for imidaclorpid. **Restricted use.** Do not apply after layby.	
	Imidacloprid (Provado) 1.6F	2 to 4 fl oz
	(Nuprid and other generics) 1.6F	2 to 4 fl oz
	Remarks and precautions: MOA = 4. Apply as spray. **Do not apply to tobacco treated with Admire Pro, Assail, Platinum, or Provado.**	
	Pymetrozine (Fulfill) 50WG	2 ¾ oz
	Remarks and precautions: MOA = 9. Do not apply more than twice or 5½ oz/acre/year. Allow 7 days between applications.	
	Thiamethoxam (Actara) 25WDG	2 to 3 oz
	Remarks and precautions: MOA = 4. Do not apply to tobacco already treated with Platinum, Admire Pro, Assail, or Provado. Apply only once during the growing season.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)[a]

Insect	Insecticide and formulation	Rate per acre
Armyworms (beet, fall and yellowstripped)	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	
	Emamectin benzoate (Denim) 0.16EC	6 to 12 fl oz
	Remarks and precautions: MOA = 6. **Restricted Use**. Apply in sufficient water for through coverage.	
	Lambda-cyhalothrin (Warrior) 1CS	1.9 to 3.8 fl oz
	(Karate with Zeon, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply as a spray. Observe the 40-day preharvest interval.	
	Orthene is labeled for armyworms on other crops.	
Budworms	Acephate (Acephate AG) 75SP	1 lb
	(Acephate) 97UP	¾ lb
	(Orthene) 97PE	¾ lb
	Remarks and precautions: MOA = 1B. **Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts. Acephate is of limited effectiveness.**	
	Bacillus thuringiensis (Bt)	
	(Agree) WG	1 to 2 lb
	(Crymax) WG	½ to 2 lb
	(Dipel) DF	½ to 1 lb
	(Dipel) ES	1 to 2 pt
	(Dipel) 10G	5 to 10 lb
	(Javelin) WG	1 to 1 ¼ lb
	(XenTari) WDG	½ to 2 lb
	Remarks and precautions: MOA = 11. Apply as a spray. **Do not allow diluted sprays to stand in the sprayer more than 12 hours**. Bt sprays give fair control of budworms. Approved for organic tobacco. MOA=11.	
	Bifenthrin ((Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Budworms (cont'd)	Chlorantraniliprole (Coragen) 1.67SC	5 fl oz
	Remarks and precautions: MOA = 28. Make no more than 4 applications per acre per season. Do not use an adjuvant with Coragen. **Residues of Coragen are a concern and some contracts may limit residues. Do not apply after layby.**	
	Emamectin benzoate (Denim) 0.16EC	8 to 12 fl oz
	Remarks and precautions: MOA = 6. **Restricted Use**. Apply in sufficient water for through coverage. Apply before damaging infestations occur.	
	Indoxacarb (Steward EC)	9.2 fl oz
	Remarks and precautions: MOA=22.	
	Lambda-cyhalothrin (Karate/Warrior) 1CS	1.9 to 3.8 fl oz
	(Karate with Zeon, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply as a foliar spray after field scouting indicates the population has reached the economic threshold. **40-day preharvest interval.**	
	Spinosad (Blackhawk)36WG	1.6 to 3.2 oz
	Remarks and precautions: MOA = 5. Use higher rates for large larvae or high infestations. Use at least 20 gal of water per acre.	
	[a] Always read and follow the insecticide label before use.	
Cutworms	Acephate (Acephate AG) 75SP	1 lb
	(Acephate) 97UP	¾ lb
	(Orthene) 97PE	¾ lb
	Remarks and precautions: MOA = 1B. Apply as a spray overtop of plants in affected areas when 5% of plants are injured by cutworms. Make application during late afternoon using at least 25 gal of spray per acre. **Residues of acephate are a concern and application may be prohibited by some contracts.**	
	Lambda-cyhalothrin Karate (Warrior) 1CS	1.9 to 3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply in the late afternoon when cutworms are causing damage. Do not apply within 40 days of harvest.	
	Bifenthrin (Brigade/Capture)	4.0 to 6.4 fl oz
	MOA=3A. **Restricted Use.** Apply during the late afternoon. Do not apply after layby.	
	Bifenthrin + imidacloprid (Brigadier)	5.1 to 6.4 fl oz
	MOA=3A and 4. **Restricted Use.** Apply during the late afternoon. Do not apply after layby.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Flea beetles	Acephate (Acephate AG) 75SP	2/3 lb
	(Acephate) 97UP	½ lb
	(Orthene) 97PE	½ lb
	Remarks and precautions: MOA = 1B. Apply as a spray. Prime before treating. **Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts. Acephate is of limited effectiveness.**	
	Acetamiprid (Assail) 70WP	1.1 to 1.7 oz
	(Assail) 30SG	2.5 to 4.0 fl oz
	Remarks and precautions: MOA = 4. Apply as a spray in at least 20 gal/acre. Do not apply to tobacco already treated with imidaclorpid (Admire Pro, Provado,) or thiamethoxam (Platinum) (Actara). Also provides fair control of hornworms.	
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	
	Cyantraniliprole (Exeril)	13.5 to 20.5 fl oz
	Remarks and precautions: MOA = 28. Do not apply a total of 0.4 lbs per ac of cyantraniliprole products in one year	
	Imidacloprid (Provado) 1.6F	4 fl oz
	Remarks and precautions: MOA = 4. Apply as spray. **Do not apply to tobacco already treated with imidacloprid, acetimiprid, or thiamethoxam.**	
	Indoxacarb (Steward)	9.2 oz
	Remarks and precautions: MOA=22. Apply as spray.	
	Lambda-cyhalothrin	
	Karate (Warrior) 1CS	1.9 to 3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply in sufficient water for coverage.	
	Thiamethoxam (Actara) 25WDG	2 to 4 oz
	Remarks and precautions: MOA = 4**.** Do not apply to tobacco already treated with Admire Pro, Assail, Platinum, or Provado. Apply only once during the growing season.	
	[a] Always read and follow the insecticide label before use.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Grass-hoppers	Acephate (Acephate AG) 75SP	1/3 to 2/3 lb
	(Acephate) 97UP	¼ to ½ lb
	(Orthene) 97PE	¼ to ½ lb
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA is 1B for acephate and 3 for bifenthrin. **Bifenthrin is restricted use.** Do not apply bifenthrin after layby. **Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts. Acephate is of limited effectiveness.**	
	Indoxacarb (Steward)	9.2 oz
	Remarks and precautions: MOA = 22. Apply as spray.	
	Lambda-cyhalothrin (Warrior) 1CS (Karate with Zion, Warrior II) 2.1SC	1.9 to 3.8 fl oz 0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply in sufficient water for coverage. There is a 40-day preharvest interval.	
Hornworms	Acephate (Acephate AG) 75SP	2/3 lb in water
	(Acephate) 97UP	½ lb
	(Orthene) 97PE	½ lb
	Remarks and precautions: MOA = 1B. Apply as a spray. Treat infested fields before worms are more than 1½ inches long. Direct insecticides toward the upper half of the plants. Prime before treatment**. Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts.**	
	Bacillus thuringiensis (Agree) WG (Crymax) WG (Dipel) DF (Dipel) ES (Javelin) WG	 1 to 2 lb ½ to 2 lb ¼ to 1 lb ½ to 1 pt 1/8 to 1 ¼ lb
	Remarks and precautions: MOA = 11. Apply as a spray. Do not allow dilute sprays to stand in tank more than 12 hours. Dipel can be tank-mixed with maleic hydrazide (Royal MH-30).	
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Hornworms cont'd	Chlorantraniliprole (Coragen) 1.67SC	5.0 fl oz
	Remarks and precautions: MOA = 28 **Residues of Coragen are a concern and some contracts may limit residues.**	
	Emamectin benzoate (Denim) 0.16EC	8.0 fl oz
	Remarks and precautions: MOA = 9. **Restricted Use**. Apply in sufficient water for through coverage before damaging infestations occur.	
	Indoxacarb (Steward EC)	9.2 fl oz
	Remarks and precautions: MOA= 22.	
	Lambda-cyhalothrin (Warrior) 1EC	1.9-3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use**. Apply as a spray. There is a 40-day preharvest interval.	
	Spinosad (Blackhawk)36WG	1.6 to 3.2 oz
	Remarks and precautions: MOA = 5. Apply as a spray in at least 20 gal of water per acre.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Japanese beetles	Acephate (Acephate AG) 75SP	2/3 to 1 lb
	(Acephate) 97UP	½ to ¾ lb
	(Orthene) 97PE	½ to ¾ lb
	Remarks and precautions: MOA = 1B. Apply as a spray in 10 to 50 gal/acre. Prime before treating. **Acephate Residues: Residues of acephate are a concern and application may be prohibited by some contracts.**	
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	
	Imidacloprid (Provado) 1.6F	4 fl oz
	Thiamethoxam (Actara) 25WDG	3 oz
	Remarks and precautions: MOA = 4A. Apply as a spray. Damage is usually less severe than it appears.	
	Lambda-cyhalothrin (Warrior) 1EC	1.9 to 3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use. Apply as a spray. There is a 40-day preharvest interval.**	
Stink bugs	Acephate (Acephate AG) 75SP	2/3 to 1 lb
	(Acephate) 97UP	½ to ¾ lb
	(Orthene) 97PE	½ to ¾ lb
	Remarks and precautions: MOA = 1B. Apply as a spray. Stinkbug injury is usually much less severe than it appears.	
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3. **Restricted use.** Do not apply after layby.	
	Lambda-cyhalothrin (Warrior) 1EC	1.9 to 3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3**. Restricted Use**. Apply as a spray. There is a 40-day preharvest interval.	

Table 11. Insects on Field Tobacco - Foliar Treatments (Cont'd)

Insect	Insecticide and formulation	Rate per acre
Thrips	Acephate (Acephate AG) 75SP	2/3 to 1 lb
	(Acephate) 97UP	½ to ¾ lb
	(Orthene) 97PE	½ to ¾ lb
	Remarks and precautions: MOA = 1A. Apply as a spray in 10 to 50 gal/acre. Use highest rate for heavy infestations or if control was poor with previous application. Prime before treating. Foliar applications for thrips control are not effective for reducing tomato spotted wilt virus after the disease is observed. [a] Always read the insecticide label before use.	
	Bifenthrin (Brigade/Capture) 2EC	4.0 to 6.4 fl oz
	Remarks and precautions: MOA = 3**. Restricted use.** Do not apply after layby.	
	Lambda-cyhalothrin	
	(Warrior) 1EC	1.9 to 3.8 fl oz
	(Karate with Zion, Warrior II) 2.1SC	0.96 to 1.92 fl oz
	Remarks and precautions: MOA = 3. **Restricted Use.** Apply as a spray. Foliar applications for thrips control are not effective for reducing tomato spotted wilt virus after the disease is observed. There is a 40-day preharvest interval.	
Tobacco splitworm/ potato tuberworm	Chlorantraniliprole (Coragen) 1.67SC	3.5 to 7.5 fl oz
	Remarks and precautions: MOA = 28. Make no more than 4 applications per acre per season. Do not use an adjuvant.	
Whitefringed beetle	No chemicals are currently registered for whitefringed beetle control on tobacco. In one trial, imidacloprid and thiamethoxam applied as tray drench and transplant water treatments provided good control.	
	Remarks and precautions: Cultural control: Rotate tobacco with grass crops. Control legumes and broadleaf weeds. Do not plant tobacco after legumes in fields with a history of white-fringed beetle infestations. **[a] Always read the insecticide label before use.**	