

## TOBACCO INSECT MANAGEMENT

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Several species of insects pose serious threats to tobacco in the field, the greenhouse, and the curing barn. Insects damage the roots, destroy the leaves and buds, reduce leaf quality, and transmit several important tobacco diseases.

### INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) combines cultural, natural, and chemical controls to maintain insect pest populations below levels that cause economic damage to the crop. IPM promotes using insecticides only when they are needed. A certain amount of insect damage does not reduce crop value enough to pay for the cost of treatment. In addition, tobacco plants often compensate for insect damage. IPM helps to maximize profits; reduce pesticide residue levels, environmental contamination, and human exposure to pesticides; and it optimizes natural control provided by beneficial organisms.

#### Cultural controls

Several cultural practices help reduce insect infestations and decrease the need for insecticide applications. The following cultural practices aid in the management of insect pests on tobacco.

1. **Plow early in the spring** at least four weeks before transplanting to reduce cutworm infestations and aid in wireworm control.
2. **Use recommended rates of nitrogen.** Excessive rates of nitrogen fertilizer may delay maturity and make tobacco a more favorable host for hornworms and aphids after topping.
3. Adjust the **transplanting date** to reduce tobacco susceptibility to insect pests. Early-planted tobacco is often less favorable for aphids, splitworms, and hornworms and more favorable for budworms and flea beetles. Late-planted tobacco is highly susceptible to hornworm and tobacco splitworm damage and may have lower yield and quality. Aphids are usually most serious on tobacco transplanted near the middle of the transplanting period.
4. **Destroy greenhouse transplants immediately after transplanting is completed** to keep aphids and other insects from developing high populations on the transplants and migrating to the field tobacco.

5. **Manage field borders to reduce insect habitat.** Keep field margins clear of weeds and tall grass to reduce feeding, breeding, and overwintering 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 heavily infested with grasshoppers.
6. **Top in the early flower stage** to eliminate food sources for budworms and to 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. Destroy crop residues immediately after harvest is completed. **Stalk cutting and root destruction** reduce feeding and overwintering sites for hornworms, budworms, and flea beetles. This practice is most effective when done on a community-wide basis.
9. Plan **crop rotations to reduce infestations of soil-inhabiting insects.** Rotate tobacco with crops that are poor hosts of cutworms, white-fringed beetles, and wireworms.
10. Use conservation tillage to manage insect infestations. **Conservation tillage**, including no tillage and strip tillage, reduces aphid and flea beetle populations, but it may increase cutworm and slug infestations.

### Natural Control

Beneficial organisms, including predators, parasites and pathogens, provide valuable control of several insect pests. For example, parasites often kill more than 80 percent of the budworms in tobacco fields, control similar to that obtained with foliar insecticides.

Hornworms are parasitized by *Cotesia congregata* whose larvae feed inside the caterpillars. When the larvae mature, they emerge through the backs of the hornworms and form egg-like cocoons. Tiny wasps emerge from these cocoons in a few days, mate, and seek out new hornworms to parasitize.

Stilt bugs are long-legged, slender, brown bugs that feed on hornworm and budworm eggs, aphids, and even small amounts of tobacco sap. Since stilt bugs feed on plant sap, systemic insecticides may kill them.

Aphids are attacked by the adults and larvae of several species of lady beetles, lacewings, and syrphid fly larvae. A red-colored midge larvae also feeds on aphids after topping. A pathogenic fungus fre-

quently controls aphids from July through September, especially in wet seasons. Although lady beetles, lacewings, and syrphid fly larvae are usually abundant on aphid-infested tobacco, they may not keep aphids below levels that will cause economic damage.

To preserve beneficial insects, scout fields and use economic thresholds to time insecticide applications and select insecticides with low impact on beneficials. These insecticides include *Bacillus thuringiensis* (Bt), pymetrozine (Fulfill), emamectin benzoate (Denim), spinosad (Tracer), and methomyl (Lannate). Transplant-water and tray-drench applications of imidacloprid (Admire Pro) and thiamethoxam (Platinum) have limited direct impact on beneficials.

### 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 or sampled at regular intervals (once a week) to determine when insect pests reach their thresholds. Foliar insecticides are then 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 insect species could become serious pests.

**Ants** can remove seeds from the trays and cause poor stands. **Cricket** feeding damage often destroys newly emerged tobacco seedlings, reducing stands and initial growth. **Shoreflies**, tiny flies that look like small houseflies, are frequently numerous in greenhouses. Their larvae (maggots) feed on young seedlings and may reduce stands during the first two weeks after germination. **Mice** also remove the seeds from float trays, seriously reducing plant stands. If stand loss is severe, the entire greenhouses must be reseeded due to this damage. In greenhouses with overhead watering systems, green **June beetle grub** may uproot seedlings in the trays.

**Cutworms, crickets, 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 appears to do little harm. **Vegetable weevil** adults and larvae often feed on the leaves and stems and destroy the buds of seedlings.

**Aphids** often infest tobacco seedlings in the greenhouse building up high populations that reduce plant vigor, and they may be carried to the field on infested plants.

### **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.

- As soon as transplanting has been completed, discard all unused plants and clean out the greenhouse.
- Keep the area in and around the greenhouse clean and free of weeds, decaying plant material, plastic, rocks, wood, metal, and other habitats for insects and other pests to live and feed.
- Do not plant fall and winter gardens near the greenhouse. Aphids can survive on various vegetables and related weeds during the winter and develop winged aphids that can fly into the greenhouse and establish colonies on the tobacco seedlings.
- If greenhouses are used to produce other crops, there should be a fallow period to keep pests from moving from the other crops to the tobacco seedlings. Whiteflies or aphids could become problems if they move from these earlier crops to tobacco.
- Use extreme temperatures to kill insects hiding in the greenhouse. Close the greenhouse in the summer to increase the temperature and promote cold temperatures in the winter to reduce potential pest problems.
- Seed the entire greenhouse at the same time. Do not seed tobacco in greenhouses that are infested with large numbers of shore flies because the shore flies will lay eggs on the seedlings and the larvae will injure the emerging seedlings, reducing stand and seedling uniformity
- Clean the greenhouse thoroughly just before seeding in the spring.

## Chemical control in the greenhouse

Acephate (Orthene) 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. It provides good to excellent control of aphids, yellow-striped armyworms, cutworms, flea beetles, and vegetable weevils. Do not apply acephate in the irrigation water or the float water. Acephate also gives effective control of ants when applied in the greenhouse before the float beds are set up. Apply the proper rate because too much acephate can injure or kill young plants.

Metaldehyde (Deadline Bullets) bait controls 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 methaldehyde directly to seedlings or use it in float beds. Mice should be controlled with baits labeled for their control.

**Table 1.** Insecticides for use on transplants grown in greenhouses

| Insect   | Insecticide and formulation            | Rate per 1,000 sq ft                   |
|--|--|--|
| Aphids,<br>cutworms,<br>flea<br>beetles  | Acephate (Acephate AG) 75SP            | 1 tbs/3 gal of water (1 lb/acre)       |
|  | (Acephate) 97UP                        | 0.75 tbs/3 gal of water (0.75 lb/acre) |
|  | (Orthene) 97PE                         | 0.75 tbs/3 gal of water (0.75 lb/acre) |
| <hr/> <b>Remarks and precautions:</b> Apply as a spray. Over application can cause plant injury. Do not apply through an irrigation system or in the float water.  |  |  |
| Snails and<br>slugs  | Metaldehyde (Deadline Bullets) 4% bait | 0.25 to 0.5 lb                         |
| <hr/> <b>Remarks and precautions:</b> 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. It is deactivated by water. |  |  |
| Ants   | Acephate (Acephate AG) 75SP            | 1 oz/5 gal of water                    |
|  | (Acephate) 97UP                        |  |
|  | (Orthene) 97PE                         | 0.75 oz/5 gal of water                 |
| <hr/> <b>Remarks and precautions:</b> Apply 1 gal of mix to each mound area by sprinkling the mound until it is wet and treat a 4 ft diameter circle around the mound. Treat only once during the season.                                      |  |  |

## INSECT CONTROL ON NEWLY TRANSPLANTED TOBACCO

### Wireworms

Wireworms are hard, yellowish-brown, wire-like larvae of click beetles that live in the soil, feeding on the roots and tunneling 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 during the first month after transplanting. Wireworms take one to five 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. Pupation and emergence as adult click beetles occurs 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, or small grains. In these situations, apply an insecticide labeled as soil, tray-drench, or transplant-water treatments for wireworm control (Table 2). Apply soil insecticides (Lorsban or Mocap) as broadcast treatments and incorporate them at least two weeks before transplanting. Another option is to use Admire Pro or Platinum applied at the wireworm rates as transplant water or transplant-drench treatments. The most effective cultural practice for wireworm control 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 although crop maturity may be delayed. If wireworms seriously reduce the stand replanting may be necessary. The field can be rebedded or turned under and replanted after a recommended soil insecticide is applied.

### **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 5 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 weedy fields that are plowed less than a month before transplanting. Plowing fields in the early spring usually reduces cutworm populations. Scout fields for cutworm damage once or twice a week during the first month after transplanting to determine when a remedial foliar treatment is needed (Table 8). For optimum control of this night-feeding pest, apply a foliar insecticide in the late afternoon or early evening when 5 percent or more of the plants in a field have recent cutworm damage.

### **Whitefringed beetles**

Whitefringed beetle grubs have become serious problems in some flue-cured and burley tobacco fields. Outbreaks usually occur in tobacco grown in rotation with clover, soybeans, or alfalfa. Most legumes are excellent food plants for the grubs, while most grasses are unfavorable hosts. Grubs feed on the outer surface of the taproots and tunnel into the pith of newly transplanted tobacco killing or stunting the plants and causing serious yield reductions. Whitefringed beetles spread very slowly because all adult beetles are flightless female weevils. They are transported to new fields on farm equipment, water, and hay and other crops. No insecticides are currently registered for the control of whitefringed beetles on tobacco. The rotation of tobacco with good stands of grass containing few legumes or broadleaf weeds may help reduce grub damage.

### **Soil-incorporated insecticides**

Pretransplant soil applications of insecticides can provide effective control of aphids, cutworms, flea beetles, wireworms, and nematodes on tobacco. However, foliar insecticides applied at the economic thresholds usually control insects feeding on the foliage and cost less than systemic insecticides applied to the soil.

Several factors should be considered before selecting a soil insecticide.

- Is there a field history of wireworms or nematode problems? If so, sample the field for nematodes as described in the disease control section of this guide and submit the samples to your local Extension office to be sent off for analysis. Fall sampling is best.
- 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.
- Mocap, Capture, and Lorsban are broadcast soil treatments for wireworm control (Tables 2 and 3).
- Admire Pro or Platinum applied as transplant water or transplant drench treatments may be a better choice for wireworm control because they also control aphids and flea beetles (Tables 2, 4, and 5).
- Soil fumigants provide little control of insects in the soil or on the foliage 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 and nematodes on burley tobacco.

| Insecticide   | Leaf feeding insects |              | Soil insects |           | Nematodes <sup>1</sup> |              |
|---|----------------------|--------------|--------------|-----------|------------------------|--------------|
|   | Aphids               | Flea beetles | Cutworms     | Wireworms | Root-knot and other    | Tobacco Cyst |
|   |                      |              |              |           |                        |              |
| Acephate AG/TW <sup>2</sup> ;<br>Acephate UP;<br>Orthene 97 (TW) <sup>2</sup> | 2                    | 3            | 3-4          | 0         | 0                      | 0            |
| Admire Pro/Nuprid (TW) <sup>2</sup>   | 5                    | 2            | 0            | 3         | 0                      | 0            |
| Admire Pro/Nuprid (TD) <sup>2</sup>   | 5                    | 4            | 0            | 3         | 0                      | 0            |
| Capture 2EC PPI, TPW  | 0                    | 0            | 3            | 3         | 0                      | 0            |
| Lorsban 4E PPI  | 0                    | 1            | 3            | 4         | 1 (5 qt/acre)          | 0            |
| Mocap 6EC PPI   | 0                    | 1            | 2-3          | 3-4       | 1                      | 0            |
| Platinum/TMOXX 2F (TW) <sup>2</sup>   | 5                    | 3            | 0            | 3         | 0                      | 0            |
| Platinum/TMOXX 2F (TD) <sup>2</sup>   | 5                    | 4            | 0            | 3         | 0                      | 0            |

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.

<sup>1</sup>Ratings for nematode control were made by Dr. Charles S. Johnson.

<sup>2</sup> TW = Transplant water, TD = Transplant drench, PPI=Preplant soil incorporated.

**Table 3.** Insects on field tobacco - pretransplant soil treatments

| Insect                     | Insecticide and formulation | Rate per acre     |
|----------------------------|-----------------------------|-------------------|
| <b>Wireworms, Cutworms</b> | Ethoprop                    | 1.33 to           |
|                            | (Mocap) 6EC                 | 4 qt              |
|                            | (Mocap) 15G                 | 13 lb             |
|                            | Chlorpyrifos (Lorsban) 15G  | 13.5 to 20 lb     |
|                            | (Lorsban) 4E                | 2 to 3 qt         |
|                            | Bifenthrin (Capture) 2EC    | 2.56 to 6.4 fl oz |

**Remarks and precautions:** Make broadcast applications at least 2 weeks before transplanting. Band applications are usually less effective than broadcast treatments. Use a suitable device to incorporate insecticides into the soil to a depth of at least 4 inches immediately after application. Lorsban and Capture are also registered for cutworms and flea beetle larvae. **These chemicals are restricted use.**

**Table 4.** Insects on field tobacco - transplant-water treatments

| Insect   | Insecticide and formulation | Rate per acre or 1,000 plants  |
|--|-----------------------------|--------------------------------|
| <b>Flea beetles, cutworms, thrips,</b><br>suppression of aphids  | Acephate (Acephate AG) 75SP | 1 lb/acre                      |
|  | (Acephate) 97UP             | 0.75 lb/acre                   |
|  | (Orthene) 97PE              | 0.75 lb/acre                   |
| <b>Aphids, flea beetles</b>  | Imidacloprid (Admire Pro)   | 0-5 to 0.6 fl oz/ 1,000 plants |
|  | 4.6SC                       |                                |
|  | (Nuprid) 2F                 | 1.0 fl oz/ 1,000 plants        |
|  | Thiamethoxam                | 0.5 to 0.8 fl oz/1,000 plants  |
|  | (Platinum/TMOXX) 2SC        | or 3 to 5 fl oz/acre           |
| <b>Wireworms, thrips</b><br>for suppression of tomato spotted wilt virus   | Imidacloprid (Admire Pro)   | 0.8 to 1.2 fl oz/ 1,000 plants |
|  | 4.6SC                       |                                |
|  | (Nuprid) 2F                 | 1.4-2.8 fl oz/ 1,000 plants    |
|  | Thiamethoxam                | 0.8 to 1.3 fl oz/1,000 plants  |
|  | (Platinum/TMOXX) 2SC        | or 5 to 8 fl oz/acre           |
| <b>Remarks and precautions:</b> Acephate provides flea beetle control for 3 to 4 weeks after transplanting and suppresses aphid infestations for 4 to 6 weeks. Admire Pro and Platinum usually gives excellent season-long control of aphids. Apply treatments in at least 100 gal of water/acre. Higher amounts of water should be used for greenhouse transplants. <b>Calibrate transplanters and allow tanks to run low before refilling.</b> |                             |                                |

**Table 5.** Insects on field tobacco-drench application to greenhouse transplants

| Insects   | Insecticide and formulation | Rate per 1,000 plants          |
|---|-----------------------------|--------------------------------|
| <b>Aphids, flea beetles</b>   | Imidacloprid (Admire Pro)   | 0.5 to 0.6 fl oz/ 1,000 plants |
|   | 4.6SC                       |                                |
|   | (Nuprid) 2F                 | 1.0 fl oz/ 1,000 plants        |
|   | Thiamethoxam (Platinum) 2SC | 0.5 to 0.8 fl oz               |
|   | (TMOXX) 2SC                 |                                |
| <b>Wireworm, Thrips</b> for suppression of tomato spotted wilt virus  | Imidacloprid (Admire Pro)   | 0.6 to 1.2 fl oz/ 1,000 plants |
|   | 4.6SC                       |                                |
|   | (Nuprid) 2F                 | 1.4 to 2.8 fl oz/ 1,000 plants |
|   | Thiamethoxam (Platinum) 2SC | 0.6 to 1.3 fl oz               |
|   | (TMOXX) 2SC                 | 0.6 to 1.3 fl oz               |
| <b>Remarks and precautions:</b> Apply as a drench to plants in trays or flats 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. |                             |                                |

## 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. Take samples in Z or N patterns across 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). Make counts and record the data for five consecutive plants at ten 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. Large fields (more than 10 acres) will require larger samples. Sample an additional ten plants for every 2 additional acres.
2. During the first four weeks after transplanting, check tobacco for feeding holes or missing, stunted, or cut plants. Cutworms, flea beetles, wireworms, and other insects may damage these plants.
3. Beginning about three to four 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 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 the budworms parasite, *Campoletis sonorensis*. If there is budworm damage, but no worm, do not count the plant as infested.
  - b. Examine the entire plant for hornworm damage, locate, count the hornworms at least 1 inch long, and determine whether they are parasitized by *Cotesia congregata* (white egg-like cocoons on hornworm's back).

- c. Examine the undersides of upper leaves for aphids and the upper surfaces of the middle and lower leaves for honeydew, flea beetles, flea beetle feeding holes, and mines of the tobacco splitworm.
  - d. If you find an unidentified insect that appears to be damaging the crop, collect the insect and samples of its damage, put them in a container, and take them to a local Extension agent for identification. This is important because beneficial insects are often mistaken for pests. In addition, 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.

| <b>Insect</b>       | <b>Economic threshold</b>   | <b>Time when insect is a problem (weeks after transplanting)</b>  |
|---------------------|---|---|
| <b>Aphids</b>       | 50 or more aphids on any upper leaf on 5 of 50 plants.  | 4 weeks after transplanting to final harvest  |
| <b>Budworms</b>     | 10 plants with one or more budworm per 50 plants until 1 week before topping.   | 3 weeks after transplanting to 1 week before topping  |
| <b>Cutworms</b>     | 5 out of 100 plants with recent cutworm damage.   | 1 to 4 weeks after transplanting  |
| <b>Flea beetles</b> | 4 beetles per plant on tobacco less than 2 weeks old, 8 to 10 beetles per plant on 2 to 4 week-old plants, 60 beetles per plant on plants more than 4 weeks old.  | Transplanting to 4 weeks after transplanting and from topping to final harvest                            |
| <b>Grasshoppers</b> | 10 grasshoppers per 50 plants.  | 6 weeks after transplanting to final harvest  |
| <b>Hornworms</b>    | 5 larvae (worms) at least 1 inch long per 50 plants. Do not count parasitized worms with the egg-like cocoons on their backs. For hornworms 1/2 to 3/4 inch long, treat when there is 1 hornworm per plant. | 3 weeks after transplanting to final harvest. Can be a problem on air-cured tobacco in curing structures. |
| <b>Wireworms</b>    | Not determined  | 1 to 6 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, these 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. Apply foliar sprays for budworm control with one or three 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. Control with foliar sprays rarely exceeds 80 percent. See insecticide performance ratings in Table 3 and insecticide options for budworm control in Table 8. When checking tobacco for budworms, look for the cocoons of a wasp (*Camponotus*) that parasitizes budworms on the leaves near the bud. These cocoons are about 1/4 inch long and white or grayish in color with two black bands or dots. *Camponotus* and other 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 large amounts of tobacco leaf. Infestations may develop anytime from transplanting until harvest, but damage is usually most severe during August and September. Treat for hornworm control where there are five hornworms 1 inch long or longer per 50 plants. Do not count parasitized hornworms. Parasitized hornworms with the white egg-like cocoons of the parasitic wasp, *Cotesia congregata*, on their backs eat much less than healthy hornworms and they provide a food source for parasites that help reduce the next generation of hornworms. Predators also kill large numbers of 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 three to four days. For optimum control of hornworms, direct the spray to the upper one-half of the plants. See insecticide ratings in Table 3 and the labeled insecticides in Table 9. Several cultural practices help reduce the susceptibility of tobacco to hornworms. Early topping, early transplanting, effective sucker control, and fertiliza-

tion with recommended rates of nitrogen help reduce late-season infestations. When used on an area-wide basis, stalk cutting and root destruction immediately after harvest reduce overwintering hornworm populations.

## **Aphids**

The tobacco or green peach aphid has been the most severe insect pest of tobacco in Virginia. Aphid populations increase rapidly, doubling in size in about every two days under favorable conditions. High populations of aphids can reduce tobacco yield by 5 percent to 25 percent (100 to 500 pounds per acre) or more. As aphids feed, they excrete honeydew that contains the excess sugars obtained from the plant sap. This sticky, shiny honeydew and tiny white exoskeletons are deposited on the leaves below the feeding aphids. A dark, sooty mold that gives the leaves a dark tint often grows on the honeydew. The combination of sooty mold and honeydew interferes with curing, reduces leaf quality, and often remains on tobacco after aphids have been controlled. Aphids are most severe on field tobacco from late June to September. Tobacco plants become infested when winged aphids fly into fields and deposit young wingless nymphs on the upper leaves. 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**

#### **a. 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**

#### **a. Make remedial applications of a foliar insecticide at the economic threshold level** before populations become too high (Table 3). Aphids are then much easier to control for the rest of the season.

- b. **Rotate insecticides for resistance management.** The continuous use of the same insecticide year after year increases the chances that aphids will develop resistance to it. Rotating insecticides with different modes of action reduces the chances that resistance will develop. The insecticides available for aphid control on tobacco are in several different groups based on their modes of action (the way they kill aphids). Orthene/Acephate is in group 1b, Lannate is in group 1a, Fulfill is in group 9a; and Admire, Platinum, Nuprid, Provado, and Actara are in group 4a. When applying several insecticides for aphid control over the growing season, change from one group to another. Do not apply a neonicotinoid such as Provado, Actara, or Assail to tobacco already treated with another neonicotinoid such as Admire or Platinum. Instead, apply Orthene or Fulfill because they are in different chemical groups.
- c. **Assess control after three or four days.** It takes one to three 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, or other factors contributed to the poor control.
- d. **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 concentrated on the undersides of the leaves.
- e. **Continue to scout the crop** after satisfactory control is obtained because aphid populations 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:

- a. **Not 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.
- b. **Controlling aphids in greenhouses.** Destroy greenhouse transplants immediately after transplanting is completed.

- c. **Transplanting early.** Early planted tobacco may become infested with aphids earlier, but it matures earlier and the aphids have less impact on it than they do on tobacco planted near the middle of the recommended planting period.
- d. **Use recommended nitrogen rates on burley 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.
- e. **Topping early and controlling 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 Beetle**

Adult tobacco flea beetles feed on the leaves and stalks of tobacco, while the grubs or larvae feed on tobacco roots. Extensive feeding by both beetle stages on newly set transplants 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 beetles on 20 plants (two per field-sample location). **Apply treatments for flea beetles on newly set tobacco when there are four or more beetles per plant.** Larger plants can tolerate very high flea-beetle densities. Apply an insecticide when the base of the lower leaves have a netted appearance or densities exceed 60 beetles per plant. 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 9). Harvesting at the normal time and stalk cutting and root destruction immediately after the last harvest are the most effective cultural practices for reducing flea-beetle damage. Tobacco with nitrogen deficiency appears to be more susceptible to flea-beetle damage after topping.

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

### **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 serious stand reductions in tobacco fields in parts of Virginia in 2002 but it has occurred at very low rates 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 and Platinum suppress TSWV. Tray drenches are more effective than transplant water treatments.

### **Tobacco splitworm**

The tobacco splitworm, or potato tuberworm, is a leaf-mining caterpillar that is sometimes a late-season problem on tobacco. Splitworms live in tunnels or mines that appear as 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, no insecticides are registered for splitworm control on tobacco. However, Denim, Tracer, and Acephate applied in high volumes of water provide fair to good control. Denim was the most effective treatment. Early-season applications of Warrior appear to be effective but are rarely necessary and no early-season thresholds have been established. Therefore, it is important to avoid planting or storing Irish potatoes near tobacco fields because they are an important source of this pest in tobacco. If splitworm mines are observed on the lower leaves, the leaves should be harvested and cured as soon as possible. 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.

### **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 feet tall, use one or three cone nozzles per row. If three nozzles are used, orient the two side nozzles at a 45-degree angle toward the upper one-third of the plant. Use 40 to 60 psi and 20 to 50 gallons of spray mixture per acre. 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 insect pests on burley tobacco.

| Insecticide                  | Aphid | BW <sup>1</sup> | CW <sup>1</sup> | FB <sup>1</sup> | G <sup>1</sup> | HW <sup>1</sup> |
|------------------------------|-------|-----------------|-----------------|-----------------|----------------|-----------------|
| Actara/TMOXX                 | 4     | 0               | 0               | 3               | 0              | 0               |
| Assail                       | 4     | 2               | 0               | 2               | 0              | 4*              |
| Bacillus thuringiensis Spray |       |                 |                 |                 |                |                 |
| Agree, Crymax/Dipel/Javelin/ |       |                 |                 |                 |                |                 |
| Lepinox/XenTari              | 0     | 2               | 0               | 0               | 0              | 5               |
| Capture                      | 1     | 3-4             | 4               | 3               | 3              | 5               |
| Denim                        | 0     | 4               | 0               | 0               | 0              | 4               |
| Fulfill                      | 3     | 0               | 0               | 0               | 0              | 0               |
| Lannate                      | 2     | 3               | 0               | 3               | 0              | 5               |
| Orthene/Acephate/            |       |                 |                 |                 |                |                 |
| Acephate 97UP                | 4     | 3               | 4               | 3               | 4              | 5               |
| Provado/Nuprid               | 4     | 0               | 0               | 3               | 0              | 0               |
| Sevin                        | 0     | 2               | 3               | 3               | 3              | 4               |
| Tracer                       | 0     | 4               | 0               | 0               | 0              | 4               |
| Warrior                      | 1     | 3               | 3               | 3               | 3              | 5               |

<sup>1</sup> BW = Budworm; CW = Cutworm; FB = Flea Beetle; G = 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.

**Table 8.** Restricted entry intervals and preharvest intervals for various insecticides used on burley tobacco in Virginia.

| Insecticide  | Restricted entry intervals (REI) (hours) | Preharvest interval (PHI) (days)   |
|--|--|------------------------------------|
| <b>Foliar treatments</b>   |  |                                    |
| Acephate (Orthene/Acephate AG/Acephate UP)   | 24                                       | 3                                  |
| Acetamiprid (Assail) 70WP, 30WG  | 12                                       | 7                                  |
| <i>Bacillus thuringiensis</i> (Agree/Crymax/Dipel/Javelin/XenTari)                         | 4  | 0                                  |
| <i>Bacillus thuringiensis</i> (Lepinox)  | 12                                       | 0                                  |
| Bifenthrin (Capture)   | 12                                       | Do not apply after layby           |
| Carbaryl (Sevin)   | 12                                       | 0                                  |
| Endosulfan (Golden Leaf Tobacco Spray/Phaser/Thiodan)                                      | 24                                       | 5                                  |
| Imidacloprid (Nuprid/Provado) 1.6F   | 12                                       | 14                                 |
| Methomyl (Lannate)   | 48                                       | 7                                  |
| Pymethozine (Fulfill)  | 12                                       | 14                                 |
| Spinosad (Tracer)  | 4  | 3                                  |
| Thiamethoxam (Actara/TMOXX)  | 12                                       | 14                                 |
| <b>Soil treatments</b>   |  |                                    |
| Aldicarb (Temik) (Check label for reentry restrictions after first rainfall or irrigation) | 48                                       | Applied before transplanting       |
| Bifenthrin (Capture)   | 12                                       | Do not apply after layby           |
| Chlorpyrifos (Lorsban)   | 24                                       | “                                  |
| Ethoprop (Mocap)   | 48                                       | “                                  |
| Metaldehyde (Deadline Bullets)   | 12                                       | “                                  |
| <b>Greenhouse float tray or transplant water treatments</b>                                |  |                                    |
| Acephate (Orthene/Acephate)  | 24                                       | Applied at or before transplanting |
| Bifenthrin (Capture)   | 12                                       | Do not apply after layby           |
| Imidacloprid (Admire Pro/Nuprid)   | 12                                       | Applied at or before transplanting |
| Thiamethoxam (Platinum/TMOXX) 2F   | 12                                       | “                                  |
| Acephate (Orthene 97/Acephate 97UP)  | 24                                       | “                                  |

## INSECTS ON FIELD TOBACCO

**Table 9.** Insects on Field Tobacco - Foliar Treatments

| Insect   | Insecticide and formulation   | Rate per acre     |
|--|---|-------------------|
| Aphids   | Acephate (Acephate AG) 75SP   | 0.67 to 1 lb      |
|  | (Acephate) 97UP   | 0.5 to 0.75 lb    |
|  | (Orthene) 97PE  | 0.5 to 0.75 lb    |
|  | <b>Remarks and precautions:</b> Apply as a spray in 10 to 50 gal/acre. Use highest rate for heavy infestations or if control was poor with previous application. 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. |                   |
|  | Acetamiprid (Assail) 70WP   | 0.6 to 1.7 oz     |
|  | (Assail) 30WG   |                   |
|  | <b>Remarks and precautions:</b> Apply as a spray in at least 20 gal/acre. Do not apply to tobacco already treated with Admire Pro, Platinum, Provado, or Actara. Also provides fair control of hornworms.   |                   |
|  | Bifenthrin (Capture) 2EC  | 2.56 to 6.4 fl oz |
|  | <b>Remarks and precautions:</b> Do not apply after layby.<br><b>Restricted use.</b>   |                   |
|  | Imidacloprid (Provado) 2F   | 2 to 4 fl oz      |
| (Nuprid) 2F  | 2 to 4 fl oz  |                   |
| <b>Remarks and precautions:</b> Apply as spray. <b>Do not apply to tobacco treated with Admire Pro, Assail, Platinum, Provado, or TMOXX.</b>                             |   |                   |
| Methomyl (Lannate) 90SP  | 0.25 to 0.5 lb  |                   |
| (Lannate) 2.4LV  | 1.5 pt  |                   |
| <b>Remarks and precautions:</b> Apply as a spray. Several applications may be necessary to control aphids. <b>Restricted Use</b>   |   |                   |
| Pymetrozine (Fulfill) 50WG   | 2.75 oz   |                   |
| <b>Remarks and precautions:</b> Do not apply more than 5.5 oz/acre/year. Allow 7 days between applications.  |   |                   |
| Thiamethoxam (Actara) 25WDG  | 2 to 3 oz   |                   |
| <b>Remarks and precautions:</b> Do not apply to tobacco already treated with Platinum, TMOXX, Admire Pro, Assail, or Provado. Apply only once during the growing season. |   |                   |

**Table 9.** Insects on Field Tobacco - Foliar Treatments (Cont'd)

| Insect   | Insecticide and formulation  | Rate per acre     |
|--|--|-------------------|
| <b>Armyworms</b><br>(beet, fall and yellowstriped)   | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz |
|  | <b>Remarks and precautions:</b> Do not apply after layby. Restricted use.  |                   |
|  | Emamectin benzoate (Denim) 0.16EC  | 6 to 12 fl oz     |
|  | <b>Remarks and precautions:</b> Restricted Use. Apply in sufficient water for through coverage.  |                   |
| <b>Budworms</b>  | Lambda-cyhalothrin (Warrrior) 1EC  | 1.9 to 3.8 fl oz  |
|  | <b>Remarks and precautions: Restricted Use.</b> Apply as a spray. Observe the 40-day preharvest interval. Orthene is labeled for armyworms on other crops. |                   |
|  | Acephate (Acephate AG) 75SP  | 1 lb              |
|  | (Acephate) 97UP  | 0.75 lb           |
|  | (Orthene) 97PE   | 0.75 lb           |
| <b>Remarks and precautions:</b> Apply as a spray. When using hand sprayer apply in 10 to 50 gal/acre.  |  |                   |
| <i>Bacillus thuringiensis</i> Sprays   |  |                   |
|  | (Agree) WG   | 1 to 2 lb         |
|  | (Crymax) WG  | 0.5 to 2 lb       |
|  | (Dipel) DF   | 0.5 to 1 lb       |
|  | (Dipel) ES   | 1 to 2 pt         |
|  | (Javelin) WG   | 1 to 1.25 lb      |
|  | (Lepinox) WDG  | 1 to 2 lb         |
|  | (XenTari) WDG  | 0.5 to 2 lb       |
| <b>Remarks and precautions:</b> Apply as a spray. <b>Do not allow diluted sprays to stand in the sprayer more than 12 hours.</b>   |  |                   |
|  | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz |
| <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>   |  |                   |
|  | Carbaryl (Sevin) 80S   | 1.25 to 2.5 lb    |
|  | (Sevin XLR Plus) 4F  | 1 to 2 qt         |
| <b>Remarks and precautions:</b> Apply as a spray. Do not apply until plants are established and growing. The tobacco aphid often becomes a problem on tobacco following two or more applications of Sevin. |  |                   |

Table 9. Insects on Field Tobacco - Foliar Treatments (Cont'd)

| Insect   | Insecticide and formulation   | Rate per acre    |
|--|---|------------------|
| <b>Budworms</b> (cont'd)   | Emamectin benzoate<br>(Denim) 0.16EC  | 8 to 12 fl oz    |
|  | <b>Remarks and precautions:</b> Restricted Use. Apply in sufficient water for thorough coverage. Apply before damaging infestations occur.  |                  |
|  | Lambda-cyhalothrin<br>(Warrior) 1EC   | 1.9 to 3.8 fl oz |
|  | <b>Remarks and precautions: Restricted Use.</b> Apply as a foliar spray after field scouting indicates the population has reached the threshold as indicated by field scouting. Observe the 40-day preharvest interval. |                  |
|  | Methomyl (Lannate) 90SP<br>(Lannate) 2.4LV  | 0.5 lb<br>1.5 pt |
|  | <b>Remarks and precautions:</b> Apply as a spray. Make applications as needed. Direct the spray into the buds before buttoning. <b>Restricted Use.</b>  |                  |
| <b>Cabbage loopers</b>   | Spinosad (Tracer) 4F  | 1.5 to 2 fl oz   |
|  | <b>Remarks and precautions:</b> Use higher rates for large larvae or high infestation. Use at least 20 gal of water per acre.   |                  |
|  | Acephate (Acephate AG) 75SP   | 1 lb             |
|  | (Acephate) 97UP   | 0.75 lb          |
|  | (Acephate) 97UP   | 0.75 lb          |
|  | (Orthene) 97PE  | 0.75 lb          |
| <b>Remarks and precautions:</b> Apply as a spray in 10 to 50 gal of water  |   |                  |
| <i>Bacillus thuringiensis</i>  |   |                  |
| <b>See rates and formulations under budworms</b>   |   |                  |
| <b>Remarks and precautions:</b> Apply as a spray. <b>Do not allow prepared sprays to stand in tank more than 12 hrs.</b> |   |                  |
| Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz   |                  |
| <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>   |   |                  |

**Table 9.** Insects on Field Tobacco - Foliar Treatments (Cont'd)

| <b>Insect</b>   | <b>Insecticide and formulation</b>   | <b>Rate per acre</b> |
|---|--|----------------------|
| <b>Cabbage loopers</b>  | Lambda-cyhalothrin (Warrior) 1EC   | 1.9 to 3.8 fl oz     |
|   | <b>Remarks and precautions: Restricted Use.</b> Apply as a spray. There is a 40-day preharvest interval.   |                      |
|   | Methomyl (Lannate) 90SP  | 0.5 lb               |
|   | (Lannate) 2.4 LV   | 1.5 pt               |
|   | <b>Remarks and precautions: Apply as a spray. Restricted Use.</b>  |                      |
| <b>Cutworms</b>   | Spinosad (Tracer) 4F   | 1.5 to 2 fl oz       |
|   | <b>Remarks and precautions: Apply as a spray in at least 20 gal of water per acre.</b>   |                      |
|   | Acephate (Acephate AG) 75SP  | 1 lb                 |
|   | (Acephate) 97UP  | 0.75 lb              |
|   | (Orthene) 97PE   | 0.75 lb              |
|   | <b>Remarks and precautions: Apply as a spray ovetop 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.</b> |                      |
| Bifenthrin (Capture) 2EC  | 2.56 to 6.4 fl oz  |                      |
| <b>Remarks and precautions: Do not apply after layby. Restricted use.</b> |  |                      |
| <b>Cutworms</b>   | Lambda-cyhalothrin (Warrior) 1EC   | 1.9 to 3.8 fl oz     |
|   | <b>Remarks and precautions: Restricted Use.</b> Apply in the late afternoon when cutworms are causing damage. Do not apply within 40 days of harvest.  |                      |

Table 9. Insects on Field Tobacco - Foliar Treatments (Cont'd)

| Insect  | Insecticide and formulation | Rate per acre     |
|---|-----------------------------|-------------------|
| Flea beetles  | Acephate (Acephate AG) 75SP | 0.67 lb           |
|   | (Acephate) 97UP             | 0.5 lb            |
|   | (Orthene) 97PE              | 0.5 lb            |
| <b>Remarks and precautions:</b> Apply as a spray. Prime before treating   |                             |                   |
|   | Bifenthrin (Capture) 2EC    | 2.56 to 6.4 fl oz |
| <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>  |                             |                   |
|   | Carbaryl (Sevin) 80S        | 1.25 lb           |
|   | (Sevin XLR Plus) 4F         | 1 qt              |
| <b>Remarks and precautions:</b> Apply as a spray. Do not apply until plants are established and growing. Aphids often become problems on tobacco following two or more applications of Sevin. |                             |                   |
|   | Imidacloprid (Provado) 1.6F | 4 fl oz           |
| <b>Remarks and precautions:</b> Apply as spray. <b>Do not apply to tobacco already treated with Admire Pro, Assail, TMOXX, or Platinum.</b>   |                             |                   |
|   | Lambda-cyhalothrin          | 1.9 to 3.8 fl oz  |
|   | (Warrior) 1EC               |                   |
| <b>Remarks and precautions:</b> Restricted Use. Apply in sufficient water for coverage.   |                             |                   |
|   | Methomyl (Lannate) 90SP     | 0.25 to 0.5 lb    |
|   | (Lannate) 2.4LV             | 1.5 pt            |
| <b>Remarks and precautions:</b> Apply as a spray. <b>Restricted Use.</b>  |                             |                   |
|   | Thiamethoxam (Actara) 25WDG | 2 to 4 oz         |
| <b>Remarks and precautions:</b> Do not apply to tobacco already treated with Admire Pro, Assail, Platinum, Provado, or TMOXX. Apply only once during the growing season.                      |                             |                   |

**Table 9.** Insects on Field Tobacco - Foliar Treatments (Cont'd)

| Insect   | Insecticide and formulation  | Rate per acre         |  |
|--|--|-----------------------|--|
| <b>Grasshoppers</b>  | Acephate (Acephate AG) 75SP  | 0.33 to 0.67lb        |  |
|  | (Acephate) 97UP  | 0.25 to 0.5 lb        |  |
|  | (Orthene) 97PE   | 0.25 to 0.5 lb        |  |
|  | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz     |  |
|  | <b>Remarks and precautions:</b> Do not apply after layby.<br><b>Restricted use.</b>  |                       |  |
|  | Carbaryl (Sevin) 80S   | 0.67 to 1.88 lb       |  |
|  | (Sevin XLR Plus) 4F  | 0.5 to 1.5 qt         |  |
|  | <b>Remarks and precautions:</b> Apply as a spray. Treat crop and a strip around field to reduce grasshopper movement into the field.   |                       |  |
|  | Lambda-cyhalothrin   | 1.9 to 3.8 fl oz      |  |
|  | (Warrior) 1EC  |                       |  |
| <b>Remarks and precautions: Restricted Use.</b> Apply in sufficient water for coverage. There is a 40-day preharvest interval. |  |                       |  |
| <b>Hornworms</b>   | Acephate (Acephate AG) 75SP  | 0.67 lb in water (1.5 |  |
|  | (Acephate) 97UP  | tbs/gal of water      |  |
|  | (Orthene) 97PE   | 0.5 lb                |  |
|  |  | 0.5 lb (1 tbs/gal)    |  |
|  | <b>Remarks and precautions:</b> Apply as a spray. Treat infested fields before worms are more than 1-1/2 inches long. Direct insecticides toward the upper half of the plants. Prime before treatment. |                       |  |
|  | <i>Bacillus thuringiensis</i>  |                       |  |
|  | (Agree) WSP  | 1 to 2 lb             |  |
|  | (Crymax) WG  | 0.5 to 2 lb           |  |
|  | (Dipel) DF   | 0.25 to 1 lb          |  |
|  | (Dipel) ES   | 0.5 to 1 pt           |  |
|  | (Javelin) WG   | 0.13 to 1.25 lb       |  |
|  | (Lepinox) WDG  | 1 to 2 lb             |  |
|  | XenTari WDG  | 0.5 to 2 lb           |  |
|  | <b>Remarks and precautions:</b> 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 (MH-30).                               |                       |  |

**Table 9.** Insects on Field Tobacco - Foliar Treatments (Cont'd)

| <b>Insect</b>  | <b>Insecticide and formulation</b>   | <b>Rate per acre</b>             |  |
|--|--|----------------------------------|--|
| <b>Hornworms</b><br>(cont'd)   | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz                |  |
|  | <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>   |                                  |  |
|  | Carbaryl (Sevin) 80S<br>(Sevin XLR Plus) 4F  | 1.25 to 2.5 lb<br>1 to 2 qt      |  |
|  | <b>Remarks and precautions:</b> Apply as a spray.  |                                  |  |
|  | Emamectin benzoate<br>(Denim) 0.16EC   | 8 to 12 fl oz                    |  |
|  | <b>Remarks and precautions: Restricted Use.</b> Apply in sufficient water for through coverage before damaging infestations occur. |                                  |  |
|  | Lambda-cyhalothrin<br>(Warrior) 1EC  | 1.9 to 3.8 fl oz                 |  |
|  | <b>Remarks and precautions: Restricted Use.</b> Apply as a spray. There is a 40-day preharvest interval.                           |                                  |  |
|  | Methomyl (Lannate) 90SP<br>(Lannate) 2.4LV   | 0.25 to 0.5 lb<br>0.75 to 1.5 pt |  |
|  | <b>Remarks and precautions:</b> Apply as a spray. <b>Restricted Use.</b>   |                                  |  |
| Spinosad (Tracer) 4F   | 1 to 2 fl oz   |                                  |  |
| <b>Remarks and precautions:</b> Apply as a spray in at least 20 gal of water per acre. |  |                                  |  |

**Table 9.** Insects on Field Tobacco - Foliar Treatments (Cont'd)

| <b>Insect</b>  | <b>Insecticide and formulation</b>  | <b>Rate per acre</b>               |
|--|---|------------------------------------|
| <b>Japanese beetles</b>  | Acephate (Acephate AG) 75SP   | 0.67 to 1 lb                       |
|  | (Acephate) 97UP   | 0.5 to 0.75 lb                     |
|  | (Orthene) 97PE  | 0.5 to 0.75 lb                     |
|  | <b>Remarks and precautions:</b> Apply as a spray in 10 to 50 gal/acre. Prime before treating.   |                                    |
|  | Carbaryl (Sevin) 80S  | 1.25 lb or 3 tbs/<br>gal of water. |
|  | (Sevin) 50W   | 2 lb                               |
|  | (Sevin XLR Plus) 4F   | 1 qt                               |
|  | Bifenthrin (Capture) 2EC  | 2.56 to 6.4 fl oz                  |
|  | <b>Remarks and precautions:</b> Do not apply after layby.<br><b>Restricted use.</b>   |                                    |
|  | Imidacloprid (Provado) 1.6F   | 4 fl oz                            |
| Thiamethoxam (Actara) 25WDG  | 3 oz  |                                    |
| <b>Remarks and precautions:</b> Apply as a spray. Damage is usually less severe than it appears. Repeated applications with sevin or pyrethroids may flare up aphid. |   |                                    |
| Lambda-cyhalothrin<br>(Warrior) 1EC  | 1.9 to 3.8 fl oz  |                                    |
| <b>Remarks and precautions: Restricted Use.</b> Apply as a spray. There is a 40-day preharvest interval.   |   |                                    |
| <b>Slugs</b>   | Metaldehyde (Dealine Bullets) 4 % Bait  | 12 to 40 lb/acre                   |
|  | <b>Remarks and precautions:</b> Apply as a broadcast treatment to the soil surface in the late evening. Metaldehyde is most effective after irrigation or a rain. |                                    |
| <b>Stink bugs</b>  | Acephate (Acephate AG) 75SP   | 0.67 to 1 lb                       |
|  | (Acephate) 97UP   | 0.5 to 0.75 lb                     |
|  | (Orthene) 97PE  | 0.5 to 0.75 lb                     |
|  | <b>Remarks and precautions:</b> Apply as a spray. Stinkbug injury is usually much less severe than it appears.  |                                    |

Table 9. Insects on Field Tobacco - Foliar Treatments (Cont'd)

| Insect                 | Insecticide and formulation  | Rate per acre     |
|------------------------|--|-------------------|
| Stink bugs<br>(cont'd) | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz |
|                        | <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>   |                   |
|                        | Lambda-cyhalothrin<br>(Warrior) 1EC  | 1.9 to 3.8 fl oz  |
|                        | <b>Remarks and precautions:</b> <b>Restricted Use.</b> Apply as a spray. There is a 40-day preharvest interval. <b>Restricted use.</b>   |                   |
| Thrips                 | Acephate (Acephate AG) 75SP  | 0.67 to 1 lb      |
|                        | (Acephate) 97UP  | 0.5 to 0.75 lb    |
|                        | (Orthene) 97PE   | 0.5 to 0.75 lb    |
|                        | <b>Remarks and precautions:</b> 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. |                   |
|                        | Bifenthrin (Capture) 2EC   | 2.56 to 6.4 fl oz |
|                        | <b>Remarks and precautions:</b> Do not apply after layby. <b>Restricted use.</b>   |                   |
|                        | Lambda-cyhalothrin<br>(Warrior) 1EC  | 1.9 to 3.8 fl oz  |
|                        | <b>Remarks and precautions:</b> 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.   |                   |
| Whitefringed beetle    | No chemical controls   |                   |
|                        | <b>Remarks and precautions:</b> Cultural control: Rotate tobacco with grass crops. Control legumes and broadleaf weeds. <b>Do not plant tobacco after legumes.</b>   |                   |
|                        | No insecticides are currently registered for whitefringed beetle control on tobacco  |                   |