Insect Pest Management

Hannah Burrack

Insect Management

Insect pests can attack tobacco from transplant through harvest. Hornworms and budworms reduce yields by feeding directly on plant leaves. Aphids cause indirect losses; their feeding reduces plant vigor, they may spread viruses, and sooty mold produced when large populations of aphids are present reduces tobacco quality. Flea beetles cause stress when feeding on young plants and directly damage harvestable leaf when feeding on mature plants. Tobacco insect pests are active at predictable times during the growing season (Table 1). Timely field checks and use of treatment guidelines will allow early detection and assessment of problems, so sound pest management decisions can be made.

Refer to the tables in this article for insecticides recommended for control of important pests of tobacco. A list of pesticides (including generic alternatives for some insecticides) can be found in Appendix II, along with additional information that may be useful for GAP record keeping requirements.

Soil Insect Management

Wireworms. Wireworms are already present in the soil at transplanting. Eggs are laid on the soil in the summer and early fall of the previous year, and larvae can live in soil for several years. They damage tobacco by tunneling into the stalk below

Table 1. Insect management calendar—treatment guidelines for key tobacco insect pests.

Insect	Treatment Guidelines
1-4 weeks after transplant	
Cutworms	Five or more freshly cut plants per 100 plants checked.
Flea Beetles	Four or more beetles per plant on new transplants, 10 or more beetles on 2-4 week-old plants,
3 weeks after transplant until topping	
Aphids	Colonies of 50 or more aphids on at least one upper leaf of 10% or more of the plants from three weeks after transplant until topping.
Budworms	Five or more budworms per 50 plants from three weeks after transplant until one week before topping.
Hornworms	Five or more hornworms (1 inch or longer) per 50 plants from three weeks after transplant until topping. Do not count hornworms with white cocoons on their backs.
Topping until harvest	
Hornworms	Five or more hornworms (1 inch or longer) per 50 plants. Do not count hornworms with white cocoons on their backs.
Flea Beetles	60 or more beetles on plants more than 4 weeks old.

Table 2. Pre-transplant soil applications for tobacco fields.

Pre-plant Insecticides	Rate/Acre	Labeled Pests
Lorsban Advanced chlorpyrifos (and generics)	2 pt	Cutworms, Wireworms
Restricted Use Pesticides		
Brigade EC (bifenthrin) Capture LFR	4 to 6.4 fl oz 3.4 to 8.5 fl oz	Cutworms, White grubs, Wireworms

Broadcast and incorporate spray or granules according to label instructions immediately before transplant.
Pre-transplant soil applications are only recommended for high risk fields and should be avoided when possible.

the soil surface. This may kill or stunt plants and may open even resistant varieties to soilborne diseases. Plant death, replanting, and stunting can result in an uneven, difficult-to-manage crop. Under good growing conditions, tobacco usually recovers from wireworm damage with no yield loss. However, if conditions are less favorable or if certain diseases are present, yield may be reduced.

It is not possible to control wireworms in tobacco with post-transplant rescue treatments; you must decide in advance whether you need to use soil-applied insecticides. If there is a history of wireworms, if the field was weedy or fallow, or if the field is heavily infested with soilborne diseases such as black shank and Granville wilt, a preventive treatment may be justified. In other cases, preventative management is not recommended. Insurance treatments for wireworms add to the costs of production and add pesticides to the environment.

Either pre transplant soil applied insecticides (Table 2; Lorsban/Warhawk, Capture) or systemic insecticides (Tables 3 & 4; Admire, Platinum, Brigadier) can be used for wireworm control. Both types have provided good control in tests, but systemic materials also provide control of aphids and flea beetles. Use either a pre transplant or a systemic insecticide for wireworms, not both. Whether you choose a contact or a systemic, the proper application technique is important.

Pre transplant soil applied materials should be thoroughly incorporated. It is also important to give broadcast insecticides time to work before transplanting; at least two weeks are recommended, unless the label says otherwise. For systemic greenhouse-applied insecticides, apply materials evenly and wash them off thoroughly to move the insecticide to the potting soil. Transplant water treatments should only be applied if application equipment can be accurately calibrated. Pressurized tanks fitted with nozzles to apply transplant water treatments are advised, and growers are cautioned not to apply transplant water treatments using gravity flow tanks.

Table 3. Tray-drench application of insecticides.

Insecticide	Rate	Target pests
Admire 2F (and generic imidacloprid formulations)	1 fl oz/1,000 plants 1.4 to 2.8 fl oz/1,000 plants	Aphids, flea beetles (lowest rate), wireworms (high rate)
Admire Pro 4.6F	0.5 fl oz/1,000 plants 0.6 to 1.2 fl oz/1000 plants	
Orthene 97	3/4 lb/A	Flea beetles, cutworms
Platinum 2 SC	0.8 fl oz/1,000 plants	Aphids, flea beetles (lowest rate)
	1.3 fl oz/1,000 plants	Wireworms

Other soil insect pests. Growers may have occasional problems with sod webworms. These caterpillars tunnel in the underground stem much like wireworms, but they are almost always found in the stem, and they line the cavity with silk. These strands of silk, covered by dirt particles, often hang out of the entry hole. Problems with webworms are rare but sometimes occur in fields recently converted from sod. Vegetable weevil larvae may also feed on tobacco seedlings and are light green legless grubs. Adult vegetable weevils may feed on tobacco leaves following transplant and are grey-brown with a v-shaped mark on their wings. Soil-dwelling pests can be controlled after transplant, but growers should note fields where damage has occurred to develop preventative management strategies the next time they plant tobacco.

Cutworms. Preventive chemical control is not recommended for cutworms. Cutworms are occasionally a problem post transplant, and effective rescue treatments are available. Growers can reduce the likelihood of cutworm problems by preparing the soil four to six weeks before transplanting and should scout fields for damage regularly during the first three to four weeks after transplant. Cutworm feeding first presents as small, webless holes on young leaves. As the larvae grow, they begin their typical cutting behavior. Cutworm larvae can be distinguished from other caterpillars because they curl into a circle when disturbed. Because most cutworm species are active only at night, suspected damage should be confirmed with evening observations to determine if caterpillars are present.

Treat with a foliar spray (Table 2) if 5 percent or more of the plants are damaged and live caterpillars are observed. Stand losses of 10 percent or less will not typically result in reduce yields. Fields are more likely to be infested if they were weedy the previous fall and winter or if they are low-lying with heavier soils.

Pretransplant: Tray Drench Applications

Tray drench applied neonicotinoid insecticides can provide long term control of flea beetles and aphids and can suppress wireworm injury (Table 3). Imidacloprid (most commonly used as Admire Pro 4.6F) and thiamethoxam (Platinum) are systemic insecticides labeled for application as a drench to float trays prior to transplant. It is important to note that formulations of the same active ingredient may have different rates. Read the label for the product you plan to use carefully to ensure that you are using the correct rate. The lowest labeled rate for your target pest is recommended. When applying, agitate or mix the insecticide frequently to keep it from settling in the tank. Plants should be watered from above after application to wash the insecticide from the foliage into the soilless media. Failure to wash the insecticide from the foliage may result in reduced control. Adverse growing conditions may cause a delay in the uptake of the product into the plants and delay control.

Transplant: Setter-Water Applications

Soil-applied insecticides labeled for use in transplant (setter) water include Admire Pro (or generic equivalents), Orthene 97 (or generic equivalents containing the active ingredient acephate), Verimark, Durivo and Coragen (Table 4). Coragen is labeled for caterpillar control only. When applied in transplant water, the active ingredient in Coragen and Durivo (chlorantraniliprole) will provide residual control of hornworms and budworms for between 4 to 6 weeks, depending upon environmental conditions. A minimum of 100 gal/A is recommended to ensure adequate distribution of pesticide solution in the root zone, and control may be improved with higher volumes of water used. With all transplant water treatments, it is important to ensure that the solution is evenly distributed for effective insect control. For application equipment that has minimal agitation, such as tobacco transplanters, give proper attention to mixing. Keep the water suspension agitated or mix regularly to avoid settling in the transplant tank. Adverse growing conditions may cause a delay in the uptake of Admire (or a generic equivalent) into the plants and a delay in control.

Premix Orthene 97 (or a generic equivalent) in water to form a slurry before putting it into the transplant water tank. If premixing is not done, allow time for the product to dissolve. Use of more than the label rate may result in some plant damage. Orthene 97 has a 2ee label for a transplant water tank-mix with Admire. See the label for more information.

Table 4. Transplant water applied insecticides.[a]

Insecticide	Rate	Target pests
Imidacloprid 2F formulations (many generic materials)	1.4 fl oz/1,000 plants	Aphids, flea beetles (lowest rate), wireworms (high rate)
	1.8 to 2.8 fl oz/1,000 plants	
Admire Pro 4.6F	0.6 to 1.2 fl oz/1,000 plants	
Coragen SC	5 to 7.5 fl oz	Budworms, hornworms
Durivo	0.6 to 1.6 fl oz/1,000 plants	Aphids, budworms, flea beetles (lowest rate), hornworms, thrips, wireworms
Orthene 97	3/4 lb/A	Flea beetles, cutworms
Platinum 2 SC	0.8 to 1.3 fl oz/1,000 plants	Aphids, flea beetles (lowest rate)
	1.3 fl oz/1,000 plants	Wireworms
Verimark	10 to 13.5 fl oz	Aphids (suppression), flea beetles
Restricted Use Pesticides		
Brigade 2E Capture LFR	4 to 6.4 fl oz/A 5.3 to 8.5 fl oz/A	Cutworms, wireworms

[a]Either a greenhouse tray drench or a transplant water insecticide application should be made. Efficacy of these materials is not improved when multiple such applications are made, and multiple applications may results in plant injury.

Foliar Treatments for Tobacco Fields

The numbers of tobacco pests per plant or the percentage of infested plants in a field determines whether a control measure is justified. Pest numbers can vary due to factors such as weather, natural enemies, and transplant date. Early set fields are prone to attack by flea beetles and tobacco budworms, while late-set fields are at greater risk to aphids. Careful field monitoring is necessary to determine whether or not an insecticide application will provide an economic return through yield or quality protection.

The treatment guidelines listed in Table 1 allow proper timing of insecticide applications. Weekly field scouting is necessary to collect the information needed to use them. Check at least 100 plants per field—10 groups of 10 or five groups of 20 in up to 5 acres. Add two locations for each additional 5 acres of field size. Pick scouting locations randomly. Examine the plants carefully for damage or live insects. Record the counts, calculate the average, and compare them to the table values. Keep these counts so that trends in insect numbers can be spotted easily during the season.

Aphid infestations begin when winged adults fly into fields and deposit live young on plants, which happens about four to six weeks after transplant. Offspring of these "colonizers" mature in seven to 10 days and begin to produce 60 to 70 live young each. Aphid numbers in infested fields double about every two to three days. In conventionally grown tobacco, aphids can be managed via greenhouse tray drench or transplant water applications of products containing imidacloprid or thiamethoxam (Tables 3 and 4) or with foliar applications in the field (Table 5). If greenhouse or transplant water applications are made, additional field applications are rarely needed. Fields should be checked weekly by examining the bud area of 10 consecutive plants in at least five locations for colonies (clusters) of aphids on the underside of leaves. *Foliar applications should only be made if colonies of about 50 aphids are found on 10% or more of the plants that are examined.* Thorough coverage with sprays directed to the underside of leaves at the top of the plant is essential to obtain satisfactory aphid control. Aphid infestations tend to be higher when topping is delayed and in later-set fields, where more than minimum recommended rates of nitrogen are used.

Budworms chew rounded holes in developing leaves of the upper third of the plant. Infestations tend to be greatest in the earliest-set fields in an area. Moths lay single eggs, so infestations

Table 5. Tobacco Aphids.

Insecticides	Rate/A	Harvest Interval (days)
Actara 25% WDG	2 to 3 oz	14
Assail 30 G	1.5 to 4 oz	7
Admire Pro 4.6 F	0.7 to 1.4 fl oz	14
Fulfill 50 WDG	2.75 oz	14
Orthene 97*	3/4 lb	3
Voliam Flexi WDG*	2.5 to 4 oz	14
Restricted Use Pesticides		
Besiege*	5 to 10 fl oz	40
Brigade 2EC*	2.56 to 6.4 fl oz	Do not apply later than layby
Brigadier*	3.8 to 6.4 fl oz	
Capture LFR*	3.4 to 8.5 fl oz	
Endigo ZC*	4 to 4.5 fl oz	40
Lannate 90 SP*	½ lb	14

Materials indicated by * are associated with pesticide residue concerns by purchasers. If these are materials of choice, growers are strongly encouraged to communicate with potential buyers before treating to ensure that their use will not limit crop marketability.

Table 6. Budworms and Hornworms.

Insecticides	Rate/A	Harvest Interval (Days)	Comments
Agree WG (3.8% Bt aizawai)	1 to 2 lb	0	This material contains Bt as the active ingredient and is more effective against hornworms than budworms.
Assail 30 SG	2.5 to 4.0 oz	7	Most effective against eggs and young larvae. Will not control large larvae.
Biobit HP (6.4% Bt kurstaki)	½ to 1 lb	0	These materials contain Bt as the active ingredient and are more effective against hornworms than budworms.
Coragen SC*	3.5 to 7.5 fl oz	1	
Dipel 10 G	5 to 10 lb	0	These materials contain Bt as the active ingredient and are more effective against hornworms than budworms.
Dipel DF	½ to 1 lb		
Dipel ES	1 to 2 pt		
Javelin WG	1/8 to 1¼ lb		
Orthene 97*	3/4 lb	3	
Blackhawk	1.6 to 3.2 oz	3	Lower labeled rate recommended.
Voliam Flexi WDG*	4 oz	14	
XenTari DF	½ to 2 lb	0	This material contains Bt as the active ingredient and is more effective against hornworms than budworms.
Restricted Use Pesticides			
Besiege*	5 to 10 fl oz	40	
Brigade 2EC*	2.56 to 6.4 fl oz	Do not apply later than layby	
Capture LFR*	6.8 to 8.5 fl oz		
Endigo ZC*	4 to 4.5 fl oz	40	
Warrior II*	0.96 to 1.92 fl oz	40	

Materials indicated by * are associated with pesticide residue concerns by purchasers, particularly when used late in the growing season. If these are materials of choice, growers are strongly encouraged to communicate with potential buyers before treating to ensure that their use will not limit crop marketability.

are scattered randomly over a field. Examine the bud area carefully for the black ground pepper-like droppings, small holes, and caterpillars. Damage will increase as the budworms feed and grow. If the bud is destroyed, the plant will develop new terminal growth, but this injury is not common. Direct leaf damage and stunting rarely reduces yields. Examine the buds for feeding damage and the small green-to-black worms. *Treat if there are five or more live budworms (less than 1.25 inches long) per 50 plants and topping is more than one week away.*

Tobacco plants can compensate for budworm damage, so follow treatment guidelines to avoid unnecessary treatments. Do not count the plant as infested if you cannot find a budworm. Sprays are most effective if applied when larvae are small and actively feeding. Use 25 to 50 gal of water/A and spray in the morning or early evening when the bud area is open and the budworms are most exposed to sprays. A list of insecticides and restricted-use pesticides labeled for the control of budworms is available in Table 6.

Hornworms eat large amounts of tobacco foliage. The first generation typically occurs in June. A second generation is active from late July through late August. Weekly field checks will allow detection of infestations that would benefit from treatment. Examine the entire plant, particularly the upper third, for signs of damage and live worms. *Treat if there are five or more hornworms (1 inch or longer) per 50 plants and topping is at least one week away.* Treatments applied before most worms exceed 1.5 inches in length will greatly reduce yield loss. Hornworms with white egg-like cocoons on their back are parasitized by a small wasp. These worms will not contribute to yield loss and should not be included in counts to determine economic thresholds. By late August or early September as much as 90% of the hornworm population may be parasitized.

Hornworms pose the greatest threat at the end of the growing season. Those present on plants at harvest will continue to feed on wilting and curing tobacco. Check fields for hornworms about one week before harvest. If an insecticide will be applied preharvest to prevent taking significant numbers of hornworms to the barn, be sure to avoid materials with residue concerns (Table 6). There are no treatments to control hornworms effectively on housed tobacco.

Flea Beetles. Tobacco flea beetles are present in every field each season. Damage tends to be most severe in fields that are set first, especially following a mild winter when beetle survival is greatest. Flea beetles move frequently, chewing small round holes (shot holes) in the leaves. Extensive damage can occur when beetles feed in the bud of the plant. This injury can add to transplant stress and slow plant establishment. Flea beetles can be controlled with systemic insecticides applied in the transplant water or by a foliar spray if a preventive treatment was not used. *An average of four or more beetles per plant is enough to cause significant damage. Treat if there are four or more beetles per plant during the first two weeks after transplant.* Table 7 provides information on insecticides and restricted-use pesticides labeled for flea beetle control. Established plants rarely need protection from this insect.

Occasional Pests

Armyworms may be present in no-till tobacco fields transplanted into burned-down grass or small-grain cover crop. Besiege, Brigade, Brigadier, Endigo ZC, and Capture are labeled for control.

Grasshoppers usually remain in hayfields and along waterways, but under dry conditions, they may move from these into tobacco when pastures or hayfields are clipped. Treatment

Table 7. Flea beetles.

Insecticides	Rate/A	Harvest Interval (Days)
Actara 25% WDG	2 to 3 oz	14
Assail 30SG	2.5 to 4 oz	7
Admire Pro 4.6F	1.4 fl fl oz.	14
Orthene 97*	½ lb	3
Voliam Flexi* WDG	2.5 to 4 oz	14
Restricted Use Pesticides		
Besiege*	5 to 10 fl oz	40
Brigade 2EC*	2.56 to 6.4 fl oz	Do not apply later than layby
Brigadier*	5.1 6.4 fl oz	
Capture LFR*	3.4 to 8.5 fl oz	
Endigo ZC*	4 to 4.5 fl oz	40
Warrior II*	0.96 to 1.92 fl oz	40

Materials indicated by * are associated with pesticide residue concerns by purchasers. If these are materials of choice, growers are strongly encouraged to communicate with potential buyers before treating to ensure that their use will not limit crop marketability.

Table 8. Grasshoppers.

Insecticides	Rate/A	Harvest Interval (Days)
Orthene 97*	1/4 to ½ lb	3
Restricted Use Pesticides		
Besiege*	5 to 10 fl oz	40
Brigade 2EC*	2.56 to 6.4 fl oz	Do not apply later than layby
Capture LFR*	3.4 to 8.5 fl oz	
Endigo ZC*	4 to 4.5 fl oz	40
Warrior II*	0.96 to 1.92 fl oz	40

Materials indicated by * are associated with pesticide residue concerns by purchasers. If these are materials of choice, growers are strongly encouraged to communicate with potential buyers before treating to ensure that their use will not limit crop marketability.

of field borders to prevent mass migration into the field should be considered (Table 8). When selecting an insecticide for this use, consider the possibility of residues and time from application to cutting or grazing of hay. Treat when grasshoppers are active along field margins, or if 10 or more grasshoppers are found per 50 plants.

Japanese beetles can feed on tobacco. The damage usually is confined to a small number of plants. Contact your local extension agent or specialist for specific management recommendations

Stink bugs can feed on tobacco and cause the wilting or collapse of individual leaves, which can become scalded. Generally, the symptoms do not show until a day or two after feeding. The damage usually appears worse than it actually is, and plants often recover. Treatment is not justified unless stink bugs are found in the field.

Thrips can feed on tobacco plants but usually are only a temporary problem. Several insecticides are labeled as foliar sprays for thrips control. Contact your local extension agent or specialist for specific recommendations.