Agriculture: Tomato Pest Management Guidelines

Stink Bugs

Consperse stink bug: *Euschistus conspersus*
Redshouldered stink bug: *Thyanta custator accerra*
Say stink bug complex: *Chlorochroa sayi* and *Chlorochroa uhleri*
Southern green stink bug: *Nezara viridula*

Description of the Pest

Several kinds of stink bugs feed on tomatoes, but all are similar in life history and damage. The most common species statewide is the consperse stink bug(/PMG/E/I-HM-ECON-AD.001.html), which tends to be the most important species in the Sacramento and northern San Joaquin valleys. The redshouldered stink bug(/PMG/T/I-HM-TPAL-AD.001.html) is considered the most prevalent species in the southern San Joaquin Valley. *Chlorochroa sayi*(/PMG/C/I-HM-CSAY-AD.001.html) and *C. uhleri* are most prevalent on the west side of the San Joaquin Valley. The southern green stink bug(/PMG/N/I-HM-NVIR-AD.007.html), *Nezara viridula,* occurs in parts of the Sacramento and northern San Joaquin valleys, but is kept at relatively low levels by an imported parasite. Two exotic stink bugs, the bagrada bug(/Invasive-and-Exotic-Pests/Bagrada-bug/), *Bagrada hilaris,* currently found only in southern California, and the brown marmorated stink bug(/Invasive-and-Exotic-Pests/Brown-marmorated-stink-bug/), *Halyomorpha halys,* are also capable of damaging tomatoes but neither have been found in commercial fields.

Adult stink bugs are distinctly shield shaped and either brown or green. Some species have red, pink, or yellow markings. Adults overwinter on the ground under leaves, in protected areas such as woodpiles in orchards, legume crops, blackberries, or on certain weeds such as Russian thistle, mustards, and little mallow (cheeseweed). They become active in March and April and begin laying eggs at this time. Eggs(/PMG/E/I-HM-ECON-EG.003.html) are drum-shaped with circular lids and are laid in clusters on foliage. Immatures(/PMG/E/I-HM-ECON-EG.001.html) resemble adults but do not have developed wings.

Damage

On green fruit, damage appears as dark pinpricks(/PMG/N/I-HM-NVIR-CD.007.html), surrounded by a light discolored area(/PMG/E/I-HM-ECON-CD.004.html) that turns yellow or remains light green on ripe fruit. Fissures(/PMG/E/I-HM-ECON-CD.008.html) below the surface turn corky. Stink bugs may also carry yeast and other pathogens on their mouthparts that may cause fruit decay when introduced during feeding. A few fields have been significantly damaged by yeast introduced by stink bugs; this damage is scored as "mold" by state graders.

Management

Monitoring stink bug populations and their levels of parasitism are important for making treatment decisions. Treatment thresholds vary according to the market for which the crop is grown.

Cultural Control

Destroy weeds (legumes, blackberries, Russian thistle, mustards, and little mallow) that are good overwintering hosts for adult stink bugs around fields that are to be planted to tomatoes in spring.

Biological Control

Both predators and parasites attack stink bug egg masses. One parasitic wasp(/PMG/N/I-HM-NVIR-TB.003.html), *Trissolcus basalis*, has been introduced into California for control of the southern green stink bug. Examine stink bug eggs to determine levels of parasitization. Parasitized eggs are dark; if parasites have emerged, the emergence holes(/PMG/E/I-HM-ECON-TE.001.html) will be irregular as opposed to round holes caused by stink bugs pushing off the top cap of the eggs to emerge. *Trissolcus basalis* does not appear to parasitize the other stink bug species in the field. However, a large complex of native parasites do parasitize these native stink bug species; these parasites occur in most growing areas and can result in parasitism in excess of 80% late in the season. Although not commercially available, monitoring for stink bug egg masses to detect black eggs (those that are parasitized) is a useful practice. If parasitized egg masses are found, treatment for newly hatched nymphs might not be necessary. If damaging levels of nymphs and adults are present, treatment will still be needed. Parasitism can be enhanced for short distances from plantings of nectar plants such as alyssum and others as long as the flowering of these plants begins early in the season (April–June).

Organically Acceptable Methods

Preserving naturally occurring biological control agents, good weed management around the field, and kaolin clay and insecticidal soap sprays are acceptable for use on organically certified produce.

Monitoring and Treatment Decisions

Stink bugs are often not observed until damage has begun. When the bugs are common, they may be found by beating or by shaking the vines. After shaking, look for stink bugs on the ground and between clods of soil. Or place a 16-inch cafeteria-style tray on the ground and shake the plant onto that. The presence of stink bugs can also be detected by their brown liquid frass, which dries into spots (0.06–0.12 inch) on leaves and fruit where they are active. Treatment is more likely to be necessary in fresh market plantings and in processing fields committed to solid-pack or dice canning. Treatment is generally not recommended in processing tomatoes intended for paste or juice unless conditions, such as wet, dense canopies, are favorable for the development of yeast or fungal pathogens introduced by the bugs during feeding.

To monitor consperse stink bug activity and distribution in a field, place clean, double-cone traps(/PMG/E/I-HM-ECON-MO.001.html) baited with an aggregation pheromone in fields at flowering. (Pheromones are not commercially available for the other species. A pheromone is commercially available for brown marmorated stink bug to be used with a rocket-type trap.) In areas of the field where stink bugs are consistently found in traps, take samples beginning when fruit reach one inch in diameter. Sample with a beating sheet or tray, and also examine the soil under the beating.

Degree-days

A phenology model has been developed for consperse stink bug that can help predict nymphal emergence. Newly hatched nymphs are most easily controlled by pesticides. To use the phenology model(/WEATHER/DDTABLE/consperse_stink_bug.html), begin calculating degree-days (/calludt.cgi/DDMODEL?MODEL=CSB&CROP=tomatoes) from the date adult stink bugs are first captured in pheromone traps. The lower developmental threshold is 53.6°F (12°C); no upper developmental threshold has been established, although it is believed to be near 98.6°F (37°C). Most nymphs will be present at about 558 DD (°F) or 310 DD (°C), and shake sampling as described previously to determine the need for treatment should be made at this time.

Calculate degree-days(/calludt.cgi/DDMODEL?MODEL=CSB&CROP=tomatoes) for consperse stink bug for your location using the consperse stink bug pest model. To learn more about using degree-days to time insecticide applications, watch the degree-days video(https://www.youtube.com/watch?v=RNYevBVIhYQ).

Treatment Decisions

Treatment thresholds vary according to the use of the tomatoes, but a good rule is that one-third to one-half of a stink bug per tray shake on average will result in about 5% damaged fruit. Distribution of samples within the field depend on whether an area of the field can be treated separately from the whole field. If an infested portion of the field cannot be spot treated, average tray shake samples from the entire field to make a treatment decision.

Be aware of the following to improve stink bug control with insecticides.

- Good canopy penetration of insecticides is essential because most stink bugs are located on the ground at any given time of day.
- Apply via ground equipment; ground applications provide much better coverage than do aerial sprays that cannot reach bugs deep within the plant canopy or on the soil under the plants.
- Use hollow-cone nozzles or air-assist sprayers to improve canopy penetration.
- Consider reducing tractor speed and increasing application volume to improve coverage.
- If water volume is increased, use the highest label rate of pesticide.

	Common name	Amount per acre**	REI‡	PHI‡
	(Example trade name)		(hours)	(days)

Pesticide precautions

Protect water

Calculate VOCs

Protect bees

Not all registered pesticides are listed. The following are ranked with the pesticides having the greatest IPM value listed first—the most effective and least harmful to natural enemies, honey bees(/agriculture/tomato/Relative-Toxicities-of-Insecticides-and-Miticides-Used-in-Tomatoes-to-Natural-Enemies-and-Honey-Bees/), and the environment(/mitigation/index.html) are at the top of the table. When choosing a pesticide, consider information relating to air and water quality, resistance management, and the pesticide's properties and application timing. Always read the label of the product being used.

A.	**LAMBDA-CYHALOTHRIN***			
	(Warrior II with Zeon)	1.28–1.92 fl oz	24	5
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	. . . PLUS . . .			
	NOVALURON			
	(Rimon 0.83EC)	12 fl oz	12	1
	MODE-OF-ACTION GROUP NUMBER[1]: 15			
	. . . OR . . .			
	ACETAMIPRID			
	(Assail 70WP)	1.7 oz	12	7
	MODE-OF-ACTION GROUP NUMBER[1]: 4A			

	Common name	Amount per acre**	REI‡	PHI‡
	(Example trade name)		(hours)	(days)
	COMMENTS: Do not use pyrethroids (Group number 3) if leafminers are present because it is destructive to their parasites. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			
B.	**METHOMYL***			
	(Lannate SP)	0.5 lb	48	1
	MODE-OF-ACTION GROUP NUMBER[1]: 1A			
	. . . PLUS . . .			
	FENPROPATHRIN*			
	(Danitol 2.4EC)	10.66 fl oz	24	3
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	COMMENTS: Do not use group number 1A insecticides if psyllids are in the field as carbamates tend to promote development of their populations. Do not use either product if leafminers are present because it is destructive of their parasites. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i.			
C.	**KAOLIN CLAY#**			
	(Surround)	30–50 lb	4	0
	MODE OF ACTION: An inorganic insecticide.			
	COMMENTS: Kaolin clay does not appear to kill stink bugs directly but is quite effective in protecting the fruit surface from feeding. Begin applications when stink bugs are present and fruit are mature green to pink. Apply to protect the surface of the fruit; canopy penetration is essential. A repeat application may be needed if fruit reaching the susceptible stage are not coated. Kaolin clay application results in a thick, white deposit that coats the foliage and fruit and must be washed from the fruit, limiting its potential for use.			
D.	**FLONICAMID**			
	(Beleaf 50SG)	2–2.8 oz	12	0
	MODE-OF-ACTION GROUP NUMBER[1]: 29			
	COMMENTS: Research is lacking on the effectiveness on this insecticide in tomato, but it has proven to be effective against lygus bug in other crops such as cotton and strawberry and not as detrimental to natural enemies as other products.			
E.	**CLOTHIANIDIN**			
	(Belay 50WDG)	1.6–2.1 fl oz	12	7
	MODE-OF-ACTION GROUP NUMBER[1]: 4A			
	COMMENTS: Apply as a foliar spray. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging. Can be tank-mixed with a pyrethroid insecticide.			

	Common name	Amount per acre**	REI‡	PHI‡
	(Example trade name)		(hours)	(days)
F.	**FENPROPATHRIN***			
	(Danitol 2.4EC)	10.66 fl oz	24	3
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	. . . ***PLUS*** . . .			
	PYRIPROXYEN			
	(Knack)	8 fl oz	12	14
	MODE-OF-ACTION GROUP NUMBER[1]: 7C			
	COMMENTS: Do not use this product if leafminers are present because it is destructive of their parasites. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i.			
G.	**FENPROPATHRIN***			
	(Danitol 2.4EC)	10.66 fl oz	24	3
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	. . . ***PLUS*** . . .			
	ACETAMIPRID			
	(Assail 70WP)	1.7 oz	12	7
	MODE-OF-ACTION GROUP NUMBER[1]: 4A			
	COMMENTS: Do not use this product if leafminers are present because it is destructive of their parasites. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			
H.	**BETA-CYFLUTHRIN***			
	(Baythroid XL)	2.8 fl oz	12	0
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	. . . ***PLUS*** . . .			
	IMIDACLOPRID			
	(various foliar products)	Label rates	See label	See label
	MODE-OF-ACTION GROUP NUMBER[1]: 4A			
	COMMENTS: Do not use this product if leafminers are present because it is destructive of their parasites. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			

	Common name	Amount per acre**	REI‡	PHI‡
	(Example trade name)		(hours)	(days)
I.	**LAMBDA-CYHALOTHRIN***			
	(Warrior II with Zeon)	1.28–1.92 fl oz	24	5
	MODE-OF-ACTION GROUPNUMBER[1]: 3A			
	COMMENTS: Timing is essential for success. Use the consperse stink bug phenology model(/calludt.cgi/DDMODEL?MODEL=CSB&CROP=tomatoes) to time treatment against nymphs. Do not use this product if leafminers are present because it is destructive of their parasites. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			
J.	**METHOMYL***			
	(Lannate SP)	0.5 lb	48	1
	MODE-OF-ACTION GROUP NUMBER[1]: 1A			
	. . . PLUS . . .			
	ESFENVALERATE*			
	(Asana XL)	5.8–9.6 fl oz	12	1
	MODE-OF-ACTION GROUP NUMBER[1]: 3A			
	COMMENTS: Neither pesticide is effective against stink bugs alone; must be used in a tank mix. For tank mixes, observe all directions for use on all labels, and employ the most restrictive limits and precautions. Never exceed the maximum a.i. on any label when tank mixing products that contain the same a.i. Do not use Group number 1A insecticides if psyllids are in the field as carbamates tend to promote development of their populations. Do not use either product if leafminers are present because it is destructive of their parasites. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			
K.	**IMIDACLOPRID**			
	(Admire Pro)	7–10.5 fl oz	12	21
	MODE-OF-ACTION GROUP NUMBER[1]: 4A			
	COMMENTS: Most often applied in drip or trickle irrigation water. Can be used preventively as a systemic in areas with chronic infestations. Apply as a sidedress within 4 inches on either side of plants and incorporate to a depth of 2 to 3 inches. Treat at first bloom up to 8 weeks before harvest. Apply sufficient water following application to move into the root zone of the plant. Do not spray directly or allow to drift onto blooming crops or weeds where bees are foraging.			
L.	**INSECTICIDAL SOAP#**			
	(M-Pede)	2.5 oz/gal water	12	0
	MODE OF ACTION: A contact insecticide with smothering and barrier effects.			
	COMMENTS: Not effective against adults; only kills nymphs through direct contact so thorough coverage is critical. Expected field efficacy with excellent coverage is 30 to 50%.			

**	See label for dilution rates.
‡	Restricted entry interval (REI) is the number of hours (unless otherwise noted) from treatment until the treated area can be safely entered without protective clothing. Preharvest interval (PHI) is the number of days from treatment until harvest can take place. In some cases the REI exceeds the PHI. The longer of these two intervals is the minimum time that must elapse before harvest may take place.
*	Permit required from county agricultural commissioner for purchase or use.
#	Acceptable for use on organically grown produce.
1	Rotate chemicals with a different mode-of-action group number, and do not use products with the same mode-of-action group number more than twice per season to help prevent the development of resistance. For example, the organophosphates have a Group number of 1B; chemicals with a 1B group number should be alternated with chemicals that have a group number other than 1B. Mode-of-action group numbers are assigned by IRAC (Insecticide Resistance Action Committee)(http://irac-online.org/).

Important Links

- Degree-day calculator(/calludt.cgi/DDMODEL?MODEL=CSB&CROP=tomatoes)
- Degree-day table(/WEATHER/DDTABLE/consperse_stink_bug.html)
- Using degree-days to time insecticide applications(https://www.youtube.com/watch?v=RNYevBVIhYQ)

UC PEER REVIEWED

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