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2022–2023 Florida Citrus Production Guide: Citrus Leafminer[1]

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Citrus Leafminer Biology

Citrus leafminer (CLM) adults, *Phyllocnistis citrella,* are tiny moths that hide within the canopy during the day, emerging at dusk and at night to lay eggs individually on young, expanding leaf flushes. The egg first appears as a tiny dew drop, usually alongside the midvein on the underside of the unexpanded leaf. The larva emerges directly into the leaf tissue, mining first along the midvein, then back and forth as it makes its way to the leaf margin, where pupation occurs.

Leafminer populations decline to their lowest levels during the winter due to cool temperatures and the lack of flush for larval development. Populations of leafminer build rapidly on the spring flush, although their presence is not apparent until late spring as populations increase while the amount of new flush decreases. Throughout the ensuing warm season, leafminer populations vary with the flushing cycles, and subsequent flushes are often severely damaged.

The spring and summer period of high leafminer damage coincides with the rainy season, when canker spread is most likely. CLM greatly exacerbates the severity of citrus canker caused by *Xanthomonas axonopodis* pv. *citri* (see Chapter 31 of this guide, PP-182, *Citrus Canker*). CLM is not a vector of the disease, although tunnels made by its larvae are especially susceptible to infection, and tunnels infected by canker pathogen produce many times the amount of inoculum than in the absence of leafminer. Control of leafminer should be optimized where infection by canker is high, especially in young trees and susceptible varieties such as grapefruit and, to a lesser extent, early oranges.

Leafminer Management

Nonbearing Trees

Leafminers are effectively controlled in young trees by systemic insecticides applied against Asian citrus psyllid (ACP). Soil applications of neonicotinoids should be made about 2 weeks prior to leaf expansion to allow time for the pesticide to move from the roots to the canopy. Applications of neonicotinoids in summer should be timed to avoid rain events within 24 hours, which would cause leaching of product away from the root zone. The appearance of leafminers in young flush of these trees is an indication that

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residual effects have worn off and reappearance of ACP is soon to follow. Foliar applications of products effective against CLM target larvae and at best provide no more than 3 weeks protection. Therefore, timing is important, and sprays directed against CLM should be applied when flush is about halfway extended to kill the maximum number of larvae.

Bearing Trees

Healthy trees with leafminer-damaged leaves are more likely to become sites for new canker infection if canker is already present nearby. The only products currently available for leafminer control on large trees are for use as foliar sprays (Table 1). While several products are effective against this pest, achieving control of leafminer using foliar sprays on large trees is difficult due to the unsynchronized flush typically encountered during summer and fall. However, because leafminers affect only developing leaves, coverage of peripheral leaves in the canopy should be adequate to achieve suppression with foliar pesticides. Foliar sprays are directed against the larvae and should be timed to coincide with the appearance of the first visible leaf mines, which occur immediately following the feather leaf stage, or about 13 days after budbreak. At this time, insecticide applications will provide protection for most of the leaves in the new flush. Pheromone traps are also available commercially to help monitor CLM population trends. The pheromone itself has been used for control by mating disruption with some success.

Historically, natural enemies present in Florida respond to leafminer infestations, causing up to 90% mortality of larvae and pupae. These natural enemies include the introduced parasitoid *Ageniaspis citricola*,which has established throughout most of Florida and has been responsible for up to 30% of this mortality, mostly later in the year.

Recommended Chemical Controls

READ THE LABEL!

Some product labels specify rates per acre, while others specify rates per volume delivered (e.g., per 100 gallons). Refer to the label for details on how product should be mixed for desired targets.

Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted. When treating smaller trees with commercial application equipment including handguns, mix the per-acre rate for mature trees in 100 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

Table 1. Recommended chemical controls for citrus leafminer.

IRAC MOA[1]	Pesticide Trade Name	Rate/Acre[2]	Comments	Other Pests Controlled
4A	**Clothianidin (soil drench)**			
	Belay 50 WDG	3.2–6.4 oz	For use on nonbearing trees only. Do not apply within 1 year of fruit harvest. Do not exceed 12.8 oz/ac (0.4 lb a.i./ac) of Belay 50 WDG per acre per year. Do not apply this product to blooming, pollen-shedding, or nectar-producing parts of plants if bees may forage on the plants during this time period.	Asian citrus psyllid, aphids
	Imidacloprid (soil drench)			
	Various products, 2F, 4F and 4.6F		Limit of 0.5 lb a.i. per acre per growing season regardless of application type (soil or foliar) and trade name of imidacloprid product used.	Asian citrus psyllid, aphids, scales
	Thiamethoxam (soil drench)			
	Platinum 75 SG	1.83–3.67 oz	Do not exceed a total of 3.67 oz/ac (0.172 lb a.i./ac) of Platinum 75 SG or 0.172 lb a.i. of thiamethoxam-containing products per acre per growing season. Do not apply during prebloom or during bloom when bees are actively foraging.	Asian citrus psyllid, aphids, scales
5	**Spinetoram**			
	Delegate WG + horticultural mineral oil 97+% (FC 435-66, FC 455-88, or 470 oil)	6 oz + 2% v/v	Do not apply more than 12 oz of Delegate WG in a growing season. Do not make more than 3 applications in a growing season. Do not apply within 7 days of last treatment.	Asian citrus psyllid, orange dog, thrips
	Spinosad			
	Entrust	1.25–6 oz	Recommended to include 2% horticultural mineral oil. Approved for organics.	Orange dog, thrips
6	**Abamectin**			
	Various 0.15 EC products	5 fl oz	Always apply with a minimum of 1 gal horticultural mineral oil 97+% (FC 435-66, FC 455-88, or 470 oil). Do not apply any abamectin-containing product, (1) within 30 days of last treatment, (2) more than 3 times in any one growing season, or (3) more than 0.47 lb a.i./ac in a growing season. Do not apply in citrus nurseries.	Citrus rust mite, Asian citrus psyllid at higher rates.
	Agri-Mek SC	1 fl oz	Always apply with a minimum of 1 gal horticultural mineral oil 97+% (FC 435-66, FC 455- 88, or 470 oil). Do not apply any abamectin-containing product, (1) within 30 days of last treatment, (2) more than 3 times in any one growing season, or (3) more than 0.47 lb A.I./ac in a growing season. Do not apply in citrus nurseries.	Citrus rust mite, Asian citrus psyllid at higher rates
15	**Diflubenzuron**			
	Micromite 80 WGS	6.25 oz	Do not apply more than 3 applications per season. See restrictions on label. Do not apply when temperatures exceed 94°F. Recommended to apply with 2% horticultural mineral oil.	Citrus root weevils, citrus rust mites, citrus psyllids

IRAC MOA[1]	Pesticide Trade Name	Rate/Acre[2]	Comments	Other Pests Controlled
18	**Methoxyfenozide**			
	Intrepid 2 F	8 fl oz	Do not apply more than 16 fl oz/ac per application or 64 fl oz/ac per season. Do not apply within 14 days of last application. No bloom restriction. Recommended to apply with 2% horticultural mineral oil.	Orange dog
28	**Cyantraniliprole (foliar application)**			
	Exirel	16 fl oz + 1% v/v	Do not apply a total of more than 0.4 lb a.i./ac of Cyazypyr or cyantraniliprole-containing products per year. Recommended to apply with 2% horticultural mineral oil. See label for bloom restrictions.	Asian citrus psyllid, orange dog
	Cyantraniliprole (soil application)			
	Verimark	15–30 fl oz	Use the lower rate for trees 3 ft or less in height.	Asian citrus psyllid, orange dog
	Chlorantraniliprole			
	Altacor	3–4.5 oz	No more than 3 applications per season. Not more than 9 oz or 0.2 lb a.i. of chlorantraniliprole-containing products per acre per year. Minimum treatment interval 7 days.	Orange dog
	Thiamethoxam + Chlorantraniliprole			
	Voliam Flexi	7 oz	Always apply with a minimum of 1 gal horticultural mineral oil 97+% (FC 435-66, FC 455-88, or 470 oil). Do not exceed 14 oz/ac/season of VoliamFlexi or 0.172 lb a.i. of thiamethoxam-containing products per growing season. Do not apply during prebloom or during bloom when bees are actively foraging.	Aphids, citrus psyllids
4A + 6	**Thiamethoxam + Abamectin**			
	Agri-Flex	8.5 fl oz + 2% v/v	Do not exceed a total of 17 fl oz/ac or 3 applications per season of Agri-Flex or 0.172 lb a.i./ac of any thiamethoxam-containing products or 0.047 lb a.i./ac of abamectin-containing products per growing season. Must be mixed with a minimum of 0.2 percent oil. Do not apply during prebloom or during bloom when bees are actively foraging.	Aphids, citrus leafminer, citrus rust mites
UN[3]	**Horticultural Mineral Oil**			
	97+% (FC 435-66, FC 455-88, or 470 oil) NR3	5 gal	Do not apply when temperatures exceed 94°F. 470-weight oil has not been evaluated for effects on fruit coloring or ripening. These oils are more likely to be phytotoxic than lighter oils.	Asian citrus psyllid, aphids, mites, scales

[1] Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification V.10.1 (2021).
[2] Lower rates may be used on smaller trees. Do not use less than the minimum label rate.
[3] Mode of action unknown. No resistance potential exists for these products.