

Table 3. Insect Pest-Specific Strategies, Trends, Tools, Biological Controls, and Pesticides for Five Insect Pests on Phil Foster Ranches, 1997-2014.

Insect pest ¹	Pest trend ²	Helpful Tools (numbers refer to tools described in Table 2). Note: all of the tools not mentioned in this column are considered neutral or non-helpful.	Neutral/non-helpful Tools: comments	Biological controls ³	Pesticides
<p>Cucumber beetles on watermelon Western spotted cucumber beetle: <i>Diabrotica undecimpunctata undecimpunctata</i> Western striped cucumber beetle: <i>Acalymma trivittatum</i> Banded cucumber beetle: <i>Diabrotica balteata</i>. http://ipm.ucanr.edu/PMG/r116300511.html</p>	<p>NO TREND, HIGH YEAR-YEAR VARIABILITY</p>	<p>(2): Crop diversity. (3b): Spatial crop rotation. Also, not planting watermelon after susceptible crops prevents soil-dwelling pupa from hatching directly into the watermelons. (6a): Row covers until female flowers open.(6b): High tunnels. Delays damage somewhat. (9): Scouting. threshold: > 10 beetles per 10 ft of half row usually results in significant loss. (Other): Hand-held propane burner for killing gangs of beetles at field edges can delay damage. Tractor-mounted propane burners kills many beetles after final harvest reducing the number moving to younger blocks. Barriers of yellow sticky tape at the ends of high tunnels trap many beetles, delaying damage.</p>	<p>(4): Natural enemies. Only a few natural enemies have been found in California, and do not affect populations significantly. (10): Vacuums do not work properly on vine crops. (Other): Yellow sticky tape suspended above the crop can catch large, but insignificant, numbers in the field.</p>	<p>PFR has not observed biological control at work although a parasitic tachinid fly, <i>Celatoria diabroticae</i>, is reported by UCANR to have efficacy in CA. http://ipm.ucanr.edu/PMG/r116300511.html. Other predators may include spiders, ground beetles, bats and mites. https://eorganic.org/node/5307</p>	<p>Cidetrak (feeding stimulant) + Pyganic (insecticide). Discontinued due to ineffectiveness in 2012. Surround sprayed about 2 weeks before harvest on fruit suppresses rind feeding. Expensive because Surround must be removed from fruit before sale. Pyganic can kill a few beetles, but not enough to be worthwhile.</p>

<p>Brassica flea beetle on broccoli and cabbage Phyllotreta cruciferae http://ipm.ucanr.edu/PMG/r108300511.html</p>	<p>NO TREND, HIGH YEAR-YEAR VARIABILITY</p>	<p>(2): Crop diversity. (3abc): Spatial and temporal crop rotation. The cooler summer temperatures in San Juan result in less flea beetle damage. (Other) Daily sprinkling if the well system can handle it (San Juan only) results in less damage. (6a): Row covers when young. Row covers exclude natural enemies and can result in cabbage aphid problems. (8): Use of transplants can result in less damage. (9): Scouting.</p>	<p>(10): Vacuums are not effective on tiny insects such as flea beetles.</p>	<p>PFR has not observed biological control at work and UCANR does not list biological control agents as a control measure http://ipm.ucanr.edu/PMG/r108300511.html</p>	<p>Pyganic and soaps have been tried as a tank mix and can kill some beetles when populations are devastatingly high, but are mostly not useful.</p>
<p>Cabbage aphids on broccoli and cabbage Brevicoryne brassicae http://ipm.ucanr.edu/PMG/r108300811.html</p>	<p>DOWN (link to figure)</p>	<p>(2): Crop diversity. (4abc) Insectary plants, hedgerows, and cover crops (11): Mowing of field margins. (3abc): Temporal and Spatial crop rotation. Avoiding times such as spring harvest in San Juan. Planting younger blocks upwind. Isolating blocks from each other. (7): Compost tea (9): Scouting.</p>	<p>(6a): Row covers can protect aphids from natural enemies. Aphids may arrive on transplants or through rips in the covers.</p>	<p>*Syrphid flies (Diptera:Syrphidae), spiders (Araneae), particularly <i>Erigone</i> spp, green and brown lacewing adults and larvae (Neuroptera:Chrysopidae), lady beetles (Coleoptera:Coccinellidae), parasitoid wasps (<i>Diaeretiella rapae</i>), Fungal pathogen <i>Pandora neoaphidis</i></p>	<p>A tank mix of Pyganic, neem-containing material such as AZA-direct, M-pede and a spreader sticker was tried but discontinued due to poor results.</p>

<p>Cabbageworms on broccoli and cabbage Imported cabbageworm (<i>Pieris rapae</i>), diamondback moth (<i>Plutella xylostella</i>), and cabbage looper (<i>Trichoplusia ni</i>) http://ipm.ucanr.edu/PMG/r108301111.html http://ipm.ucanr.edu/PMG/r108301311.html http://ipm.ucanr.edu/PMG/r108301011.html</p>	DOWN	(2): Crop diversity. (4ab): Insectary plants and hedgerows. (3c): Spatial crop rotation (9): Scouting. Thresholds. (12): Suppressive materials: Bt (<i>Bacillus thuringiensis</i>)	(Other): Brassica family weeds are common and unmanaged outside the farm's borders and may provide alternate hosts for lepidopterans.	*birds. **lady beetles, green and brown lacewing adults and larva, damsel bugs (<i>Nabidae</i>), Carabid beetles (<i>Carabidae</i>), minute pirate bugs (<i>Perillus</i> species), spiders (particularly <i>Erigone</i> spp), <i>P. rapae</i> GV.	Bt (<i>Bacillus thuringiensis</i>) based on farm-developed thresholds
<p>Onion thrips on onion Onion thrips: Thrips tabaci Western flower thrips: <i>Frankliniella occidentalis</i> http://ipm.ucanr.edu/PMG/r584300111.html</p>		(4abc): Insectary plants, hedgerows and cover crops probably support thrips natural enemies. (11): Mowing of field margins. (3b): Spatial crop rotation. Planting younger blocks upwind. (9): Scouting. (12): Suppressive materials: Entrust and GranDevo.	(4abc): Insectary plants, hedgerows and cover crops may also harbor thrips.	Predaceous mites, minute pirate bugs, and lacewings have been observed feeding on thrips in CA. http://ipm.ucanr.edu/PMG/r584300111.html	Entrust (spinosad) is effective, but needs frequent application when thrips are reproducing quickly or migrating after hay and cover crops are mowed. GranDevo is less effective, but easier on natural enemies. Thresholds vary from a few thrips/plant when plants are young to >20 when close to harvest

¹For a more information about these pests and their management in California, see the UCipm guide <http://ipm.ucanr.edu/index.html>

²Supporting data is from scouting reports, spray records, farmer observation.

³* = detected feeding on or parasitizing pests; ** = observed and hypothesized as control