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Citrus Year-Round IPM Program

(Reviewed 7/08; Corrected 6/13)

ANNUAL CHECKLIST

Supplement to UC IPM Pest Management Guidelines: Citrus

These practices are recommended for a monitoring-based IPM program that reduces water and air quality problems related to pesticide use. Track your progress through the year using this form.

Water quality becomes impaired when pesticides move off-site and into water. Air quality becomes impaired when volatile organic compounds move into the atmosphere. Each time a pesticide application is considered, review the Pesticide Application Checklist at the bottom of this form for information on how to minimize air and water quality problems.

This year-round IPM program covers major pests of citrus grown in California's Central Valley. Details on carrying out each practice, information on additional pests, and additional copies of this form are available from the UC IPM Pest Management Guidelines: Citrus at <http://www.ipm.ucdavis.edu/PMG>.

| ✓ Done | Prebloom (January through March) Special issues of concern related to water quality: Drift and runoff |
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| | Monitor California red scale males using pheromone-baited sticky traps (March through October), plus additional methods depending on the situation. <ul style="list-style-type: none"> • Keep records (example red scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Learn to distinguish male scales from scale parasites and other important insects caught in sticky traps. • Release <i>Aphytis melinus</i> if biological control is compatible with the overall management program. |
| | Look for spider mites and other mites. <ul style="list-style-type: none"> • Monitor leaves for citrus red mite (February through June). • Keep records (example citrus red mite monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Look for natural enemies, especially <i>Euseius tularensis</i>. Manage if needed according to Citrus Pest Management Guidelines. |
| | Look for cottony cushion scale and predatory vedalia beetles (March through July). <ul style="list-style-type: none"> • Collect and relocate vedalia to cottony cushion scale-infested orchards if vedalia have not arrived by the end of March. |
| | Look for other pests and their damage to fruit or damage to leaves and twigs, especially: <ul style="list-style-type: none"> • European earwig (March through June) • Forktailed bush katydid (March through June) • Caterpillars, including amorbia, citrus cutworm, fruittree leafroller, omnivorous leafroller and orange tortrix. Manage if needed according to Citrus Pest Management Guidelines. |
| | Look for brown garden snail. <ul style="list-style-type: none"> • Collect and relocate predatory decollate snails if they were not previously found in the orchard, brown garden snail has been a problem, and decollate introductions are permitted in your county. Manage if needed according to Citrus Pest Management Guidelines. |
| | Look for diseases that cause symptoms on fruit, leaves and twigs, and on limbs, trunks, and roots, especially: <ul style="list-style-type: none"> • Bacterial blast (Citrus blast) • Brown rot and Septoria spot fruit decays • Dry rot • Phytophthora gummosis and Phytophthora root rot Record the date and location of problem trees or sites. Manage if needed according to Citrus Pest Management Guidelines. |

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| ✓ Done | Prebloom (January through March) Special issues of concern related to water quality: Drift and runoff |
| | <p>Survey winter weeds. Identify common winter broadleaves and grasses.</p> <ul style="list-style-type: none"> Keep records (example winter weed survey form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS), survey at least twice annually (during late winter and in summer). <p>Manage vegetation if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for vertebrates, especially ground squirrels, pocket gophers, rabbits, and roof rats. Manage if needed.</p> |
| | <p>Provide proper cultural care and good growing conditions to improve tree health and fruit yield, including:</p> <ul style="list-style-type: none"> Fertilize if needed. Inspect irrigation systems by late winter and irrigate if rainfall has been insufficient. Provide frost protection (PDF) when cold threatens. Prune if needed, but only after frost is no longer a threat. |
| | <p>Harvest mature fruit in coordination with other management activities to ensure good postharvest fruit quality and food safety (PDF).</p> <ul style="list-style-type: none"> Educate and supervise workers regarding fruit-handling Best Management Practices (BMPs) Inspect fruit quality before bins are moved from the picking site to identify grove areas where management practices need improvement. |

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| ✓ Done | Bloom (April) Special issues of concern related to water quality: Drift, runoff, and volatile organic compounds (VOCs) |
| | <p>Monitor California red scale males (March through October) plus additional methods depending on the situation.</p> <ul style="list-style-type: none"> Keep records (example red scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). Distinguish male scales from scale parasites and other important insects caught in sticky traps. Release <i>Aphytis melinus</i> if biological control is compatible with the overall management program. |
| | <p>Look for spider mites and other mites.</p> <ul style="list-style-type: none"> Monitor leaves for citrus red mite (February through June). Keep records (example citrus red mite monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). Look for natural enemies, especially <i>Euseius tularensis</i>, and sixspotted thrips. <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for cottony cushion scale and predatory vedalia beetles.</p> <ul style="list-style-type: none"> Collect and relocate vedalia to cottony cushion scale-infested orchards if vedalia have not arrived on their own during April. |
| | <p>Look for other pests and their damage to fruit or damage to leaves and twigs, especially:</p> <ul style="list-style-type: none"> Ants, including fire ants and gray ants Caterpillars, including amorbia, citrus cutworm, fruittree leafroller, omnivorous leafroller, and orange tortrix Citricola scale honeydew and females on twigs (be sure to distinguish citricola scale from brown soft scale) European earwig (March through June) Forktailed bush katydid (March through June) <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for brown garden snail.</p> <ul style="list-style-type: none"> Collect and relocate predatory decollate snails if they were not previously found in the orchard, brown garden snail has been a problem, and decollate introductions are permitted in your county. |

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| ✓ Done | Bloom (April) Special issues of concern related to water quality: Drift, runoff, and volatile organic compounds (VOCs) |
| | Manage if needed according to Citrus Pest Management Guidelines. |
| | Manage pesticides to avoid killing honey bees. |
| | Look for diseases that cause symptoms on fruit, leaves and twigs, and on limbs, trunks, and roots, especially: <ul style="list-style-type: none"> • Brown rot and Septoria spot fruit decays • Dry rot • Phytophthora gummosis and Phytophthora root rots Record the date and location of problem trees or sites. Manage if needed according to Citrus Pest Management Guidelines. |
| | Provide proper cultural care and good growing conditions to improve tree health and fruit yield, including: <ul style="list-style-type: none"> • Fertilize if needed. • Irrigate and adjust scheduling to meet trees' varying water needs. • Prune if needed. |
| | Harvest mature fruit in coordination with other management activities to ensure good postharvest fruit quality and food safety. <ul style="list-style-type: none"> • Educate and supervise workers regarding fruit-handling Best Management Practices (BMPs) • Inspect fruit quality before bins are moved from the picking site to identify grove areas where management practices need improvement. |

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| ✓ Done | Petal fall (late April through May) Special issues of concern related to water quality: Drift, runoff, and volatile organic compounds (VOCs) |
| | Monitor fruit for immature citrus thrips (late April through June, or through October on lemon). <ul style="list-style-type: none"> • Keep records (example citrus thrips monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Examine leaves for natural enemies, especially <i>Euseius tularensis</i>. Manage if needed according to Citrus Pest Management Guidelines. |
| | Monitor California red scale males using pheromone-baited sticky traps (March through October), plus additional methods depending on the situation. <ul style="list-style-type: none"> • Keep records (example red scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Distinguish male scales from scale parasites and other important insects caught in sticky traps. • Release <i>Aphytis melinus</i> if biological control is compatible with the overall management program. |
| | Look for spider mites and other mites. <ul style="list-style-type: none"> • Monitor leaves for citrus red mite. • Keep records (example citrus red mite monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Look for natural enemies, especially <i>Euseius tularensis</i> and sixspotted thrips. Manage if needed according to Citrus Pest Management Guidelines. |
| | Monitor cottony cushion scale (May) to see if the vedalia beetle is providing biological control; it is too late to relocate vedalia. <ul style="list-style-type: none"> • If threshold is exceeded, manage later according to Citrus Pest Management Guidelines. |
| | Examine twigs for citricola scale females to alert you whether management later may be needed. Be sure to distinguish citricola scale from brown soft scale. |

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| ✓ Done | Petal fall (late April through May) Special issues of concern related to water quality: Drift, runoff, and volatile organic compounds (VOCs) |
| | <p>Look for other pests and their damage to fruit or damage to leaves and twigs, especially:</p> <ul style="list-style-type: none"> • Ants, including fire ants and gray ants • Caterpillars, including amorbias, citrus cutworm, fruittree leafroller, omnivorous leafroller, and orange tortrix • European earwig (March through June) • Forktailed bush katydid (March through June) <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for brown garden snail.</p> <ul style="list-style-type: none"> • Heading into warm weather, relocation of decollates is not advised. <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Manage pesticides to avoid killing honey bees.</p> |
| | <p>Look for diseases that cause symptoms on fruit, leaves and twigs, and on limbs, trunks, and roots, especially:</p> <ul style="list-style-type: none"> • Dry rot • Phytophthora gummosis and Phytophthora root rot <p>Record the date and location of problem trees or sites. Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Survey weeds. Manage vegetation if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for vertebrates, especially ground squirrels, pocket gophers, rabbits, and roof rats. Manage if needed.</p> |
| | <p>Provide proper cultural care and good growing conditions to improve tree health and fruit yield, including:</p> <ul style="list-style-type: none"> • Fertilize if needed. • Irrigate and adjust scheduling to meet trees' varying water needs. • Prune if needed, such as removing dead twigs and branches to reduce bacterial blast (citrus blast) inoculum. |
| | <p>Determine whether application of plant growth regulator is warranted, such as in mandarins.</p> |
| | <p>Harvest mature fruit in coordination with other management activities to ensure good postharvest fruit quality and food safety.</p> <ul style="list-style-type: none"> • Educate and supervise workers regarding fruit-handling Best Management Practices (BMPs). • Inspect fruit quality before bins are moved from the picking site to identify grove areas where management practices need improvement. |

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| ✓ Done | Fruit development (June through September) Special issues of concern related to water quality: Insecticide application, fungicide application, drift, runoff due to irrigation. |
| | <p>Monitor California red scale males using pheromone-baited sticky traps, plus additional methods depending on the situation.</p> <ul style="list-style-type: none"> • Keep records (example red scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Distinguish male scales from scale parasites and other important insects caught in sticky traps. • Begin checking fruit for scale infestation and percentage parasitism by <i>Aphytis melinus</i> and <i>Comperiella bifasciata</i> (August through October). <ul style="list-style-type: none"> • Keep records (example red scale fruit count monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). • Release <i>Aphytis melinus</i> if biological control is compatible with the overall management program. |

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| ✓ Done | Fruit development (June through September) Special issues of concern related to water quality: Insecticide application, fungicide application, drift, runoff due to irrigation. |
| | Monitor fruit for immature citrus thrips (late April through June). <ul style="list-style-type: none"> Keep records (example citrus thrips monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). Examine leaves for natural enemies, especially <i>Euseius tularensis</i>. Manage if needed according to Citrus Pest Management Guidelines. |
| | Monitor leaves for citricola scale nymphs (August-September). <ul style="list-style-type: none"> Be sure to distinguish citricola scale from brown soft scale. Keep records (example citricola scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). Manage if needed according to Citrus Pest Management Guidelines. |
| | If monitoring for cottony cushion scale adult females in May showed that the threshold was exceeded, manage according to Citrus Pest Management Guidelines. |
| | Look for citrus peelminer and examine fruit for its damage. <ul style="list-style-type: none"> If susceptible variety of citrus, manage according to Citrus Pest Management Guidelines. |
| | Monitor (August through November) for bean thrips in navel oranges that may be exported to Australia. Plan ahead by ordering monitoring traps. <ul style="list-style-type: none"> Check for revisions to regulatory export protocol, currently: adult trapping and cutting fruit preharvest and at the packinghouse. If trapping, distinguish bean thrips from other thrips species caught in sticky traps. |
| | Look for other pests and their damage to fruit or damage to leaves and twigs, especially: <ul style="list-style-type: none"> European earwig (March through June) Forktailed bush katydid (March through June) Yuma spider mite (July through September) Manage if needed according to Citrus Pest Management Guidelines. |
| | Look for diseases that cause symptoms on fruit, leaves and twigs, and on limbs, trunks, and roots, especially: <ul style="list-style-type: none"> Brown rot and Septoria spot fruit decays Dry rot Phytophthora gummosis and Phytophthora root rot Record the date and location of problem trees or sites. Manage if needed according to Citrus Pest Management Guidelines. |
| | Survey summer weeds. Identify common summer broadleaves and grasses and sedges. <ul style="list-style-type: none"> Keep records (example summer weed survey form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS); survey at least twice annually (during late winter and in summer). Look for and remove favored weed hosts of bean thrips if navels might be exported to Australia. Manage vegetation if needed according to Citrus Pest Management Guidelines. |
| | Look for vertebrates, especially ground squirrels, pocket gophers, rabbits, and roof rats. Manage if needed. |
| | Provide proper cultural care and good growing conditions to improve tree health and fruit yield, including: <ul style="list-style-type: none"> Sample leaf nutrient levels at least once mid-August through October. Fertilize if needed. Irrigate and adjust scheduling to meet trees' varying water needs. Prune if needed. |

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| ✓ Done | Fall (October through December) Special issues of concern related to environmental quality: Drift, runoff, and volatile organic compounds (VOCs). |
| | <p>Monitor California red scale males using pheromone-baited sticky traps (March through October), plus additional methods depending on the situation.</p> <ul style="list-style-type: none"> Keep records (example red scale monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). Distinguish male scales from scale parasites and other important insects caught in sticky traps. <p>Monitor fruit for scale infestation and percentage red scale parasitism by <i>Aphytis melinus</i> and <i>Comperiella bifasciata</i> (August through October).</p> <ul style="list-style-type: none"> Keep records (example red scale fruit count monitoring form (PDF) available online at http://www.ipm.ucdavis.edu/FORMS). <p>Release <i>Aphytis melinus</i> if biological control is compatible with the overall management program.</p> |
| | <p>Monitor (August through November) for bean thrips in navel oranges that may be exported to Australia.</p> <ul style="list-style-type: none"> Check for revisions to regulatory export protocol, currently: adult trapping and cutting fruit preharvest and at the packinghouse. If trapping, distinguish bean thrips from other thrips species caught in sticky traps. |
| | <p>Look for citrus leafminer (June through November) and citrus peelminer.</p> <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for other pests and their damage to fruit or damage to leaves and twigs, especially:</p> <ul style="list-style-type: none"> Brown garden snail Citricola scale Potato leafhopper (September through December) Texas citrus mite (October through December) <p>Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Look for diseases that cause symptoms on fruit, leaves and twigs, and on limbs, trunks, and roots, especially:</p> <ul style="list-style-type: none"> Armillaria root rot Bacterial blast (Citrus blast) Brown rot and Septoria spot fruit decays Dry rot Phytophthora gummosis and Phytophthora root rots Rind disorder (Mandarin rind disorder) Stubborn disease <p>Record the date and location of problem trees or sites. Manage if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Survey weeds. Manage vegetation if needed according to Citrus Pest Management Guidelines.</p> |
| | <p>Determine whether preventive application of certain materials are warranted, including:</p> <ul style="list-style-type: none"> Fruit rot, rind disorder, and twig blight (bacterial blast) protectants for diseases listed above. Plant growth regulator to reduce fruit drop. Whitewash to preserve fruit quality and to reduce fruit drop and sunburn. <p>Treat if warranted according to Citrus Pest Management Guidelines.</p> |
| | <p>Provide proper cultural care and good growing conditions, including:</p> <ul style="list-style-type: none"> Sample leaf nutrient levels at least once mid-August through October. Fertilize if needed. Irrigate and adjust scheduling to meet trees' varying water needs. Provide frost protection when cold threatens. |

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| ✓ Done | Fall (October through December) Special issues of concern related to environmental quality: Drift, runoff, and volatile organic compounds (VOCs). |
| | Harvest mature fruit in coordination with other management activities to ensure good postharvest fruit quality and food safety. <ul style="list-style-type: none"> Educate and supervise workers regarding fruit-handling Best Management Practices (BMPs). Inspect fruit quality before bins are moved from the picking site to identify grove areas where management practices need improvement. |

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| ✓ Done | Pesticide application checklist When planning for possible pesticide applications in an IPM program, consult the Pest Management Guidelines, and review and complete this checklist to consider practices that minimize environmental and efficacy problems. |
| | ✓ Choose a pesticide from the Pest Management Guidelines for the target pest, considering: |
| | <ul style="list-style-type: none"> Impact on natural enemies and pollinators. For more information see Protecting Natural Enemies and Pollinators at http://www.ipm.ucdavis.edu/mitigation/protect_beneficials.html. |
| | <ul style="list-style-type: none"> Potential for water quality problems using the UC IPM WaterTox database. See www.ipm.ucdavis.edu/TOX/simplewatertox.html. |
| | <ul style="list-style-type: none"> Impact on aquatic invertebrates. For more information, see <i>Pesticide Choice</i>, UC ANR Publication 8161 (PDF), http://anrcatalog.ucdavis.edu/pdf/8161.pdf. |
| | <ul style="list-style-type: none"> Chemical mode of action, if pesticide resistance is an issue. For more information, see <i>Herbicide Resistance: Definition and Management Strategies</i>, UC ANR Publication 8012 (PDF), http://anrcatalog.ucdavis.edu/pdf/8012.pdf. |
| | <ul style="list-style-type: none"> Endangered species that may be near your site. Find out using the Department of Pesticide Regulation's PRESCRIBE program. (http://www.cdpr.ca.gov/docs/endspec/prescint.htm) |
| | ✓ Before an application |
| | Ensure that spray equipment is properly calibrated to deliver the desired pesticide amount for optimal coverage. (See www.ipm.ucdavis.edu/training/incorporating-calibration.html) |
| | Use appropriate spray nozzles and pressure to minimize off-site movement of pesticides. |
| | Avoid spraying during these conditions to avoid off-site movement of pesticides. <ul style="list-style-type: none"> Wind speed over 5 mph Temperature inversions Just prior to rain or irrigation (unless it is an appropriate amount, such as when incorporating a soil-applied pesticide) At tractor speeds over 2 mph |
| | Identify and take special care to protect sensitive areas (for example, waterways or riparian areas) surrounding your application site. |
| | Review and follow labeling for pesticide handling, personal protection equipment (PPE) requirements, storage, and disposal guidelines. |
| | Check and follow restricted entry intervals (REI) and preharvest intervals (PHI). |
| | ✓ After an application |
| | Record application date, product used, rate, and location of application. |
| | Follow up to confirm that treatment was effective. |

| ✓ Done | Pesticide application checklist |
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| | ✓ Consider water management practices that reduce pesticide movement off-site. |
| | Consult relevant publications <ul style="list-style-type: none"> • <i>Reducing Runoff from Irrigated Lands: Orchard Floor Management Practices to Reduce Erosion and Protect Water Quality</i>, UC ANR Publication 8202 (PDF), http://anrcatalog.ucdavis.edu/pdf/8202.pdf. • <i>Reducing Runoff from Irrigated Lands: Causes and Management of Runoff from Surface Irrigation in Orchards</i>, UC ANR Publication 8214 (PDF), http://anrcatalog.ucdavis.edu/pdf/8214.pdf. • <i>Protecting Surface Water from Sediment-Associated Pesticides in Furrow-Irrigated Crops</i>, UC ANR Publication 8403 (PDF), http://anrcatalog.ucdavis.edu/pdf/8403.pdf. |
| | Consult the Department of Pesticide Regulation Groundwater Protection Program (GWPA) Web site for pesticide information and mitigation measures. (http://www.cdpr.ca.gov) |
| | Install an irrigation recirculation or storage and reuse system. Redesign inlets into tailwater ditches to reduce erosion. |
| | Use drip rather than sprinkler or flood irrigation. |
| | Limit irrigation to amount required using soil moisture monitoring and evapotranspiration (ET). (For more information, see <i>Reducing Runoff from Irrigated Lands: Understanding Your Orchard's Water Requirements</i> , UC ANR Publication 8212 (PDF), http://anrcatalog.ucdavis.edu/pdf/8212.pdf .) |
| | Consider using cover crops. |
| | Consider vegetative filter strips or ditches. (For more information, see <i>Vegetative Filter Strips</i> , UC ANR Publication 8195 (PDF), http://anrcatalog.ucdavis.edu/pdf/8195.pdf .) |
| | Apply polyacrylamides in furrow and sprinkler irrigation systems to prevent off-site movement of sediments. |
| | Redesign inlets and outlets into tailwater ditches to reduce erosion. (For more information, see <i>Reducing Runoff from Irrigated Lands: Tailwater Return Systems</i> , http://anrcatalog.ucdavis.edu/pdf/8225.pdf .) |
| | ✓ Consider practices that reduce air quality problems. |
| | When possible, reduce volatile organic compound (VOC) emissions by decreasing the amount of pesticide applied, choosing low-emission management methods, and avoiding fumigants and emulsifiable concentrate (EC) formulations. |
| | Use the Department of Pesticide Regulation calculators to determine VOC emission rates from fumigant and nonfumigant pesticides. (http://www.cdpr.ca.gov) |

More information about topics mentioned on this checklist is available at the UC IPM Web site:
<http://www.ipm.ucdavis.edu/PMG/selectnewpest.cherry.html>.

For more about mitigating the effects of pesticides, see the Mitigation pages: www.ipm.ucdavis.edu/mitigation/.