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## Strawberry Year-Round IPM Program Annual Checklist

**Supplement to UC IPM Pest Management Guidelines: Strawberry**

These practices are recommended for a monitoring-based IPM program that reduces water and air quality problems related to pesticide use. 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 program covers the major pests of strawberry fruit-production fields in California. Pest management activities for strawberry nurseries are discussed only as they impact pest problems in the field. Details on carrying out each practice and information on additional pests can be found in the guidelines. Track your progress through the year with this annual checklist form. Color photo identification sheets and examples of monitoring forms can be found online at: <http://www.ipm.ucdavis.edu/PMG/C734/m734yiformsphotos.html>.

✓ Done	<b>Preplant</b>
	<b>Mitigate pesticide usage to minimize air and water contamination.**</b>
	Make arrangements with the nursery to obtain transplants of the desired cultivar and certification level.
	Survey previous crop and adjacent areas for: <ul style="list-style-type: none"> <li>▪ Weeds—keep records (<i>example form available online</i>)</li> <li>▪ Lygus bug hosts</li> <li>▪ Whiteflies</li> <li>▪ Vertebrates</li> </ul>
	Review the cropping history of the field.
	Analyze soil for nutrients and salts; consider an application of slow-release fertilizer.
	Consider analyzing irrigation water for salinity and nitrogen content.
	Consider soil treatments for soilborne pests and weeds. <ul style="list-style-type: none"> <li>▪ Soil fumigation</li> <li>▪ Drip fumigation</li> <li>▪ Soil solarization</li> </ul>
	Prepare the field by making sure it is properly graded with good drainage.
	Shape beds to minimize water retention on bed tops.
	Consider visiting the transplant nursery in the last month of the propagation cycle (before it gets cold) to evaluate nursery fields for: <ul style="list-style-type: none"> <li>▪ Pest problems that may be carried on transplants:               <ul style="list-style-type: none"> <li>• Spider mites</li> <li>• Cyclamen mite</li> <li>• Anthracnose</li> <li>• Angular leaf spot</li> <li>• Botrytis fruit rot</li> <li>• Powdery mildew</li> </ul> </li> <li>▪ Uniformity in planting, indicating possible disease or plant quality issues</li> <li>▪ Pesticide usage</li> </ul>

<b>✓ Done</b>	<b>Preplant (continued)</b>
	Apply herbicides, if needed, before applying mulch.
	Apply plastic mulch appropriate to your needs for: <ul style="list-style-type: none"> <li>▪ Weed control</li> <li>▪ Managing soil temperature</li> <li>▪ Controlling plant size</li> </ul>

<b>✓ Done</b>	<b>Planting</b> <b>Mitigate pesticide usage to minimize air and water contamination.**</b>
	Inspect transplants for gray mold, uniformity, quality, and proper root length. Follow proper procedures for placement of strawberry transplants.
	Consider fungicide dips and/or water wash to reduce fungal diseases. <ul style="list-style-type: none"> <li>▪ Anthracnose</li> <li>▪ Phytophthora crown rot</li> <li>▪ Red stele</li> </ul>
	Consider monitoring salinity of irrigation water.
	Irrigate as needed.
	Apply fertilizer at planting if preplant application was not made.
	Confirm correct planting depth of transplants.

<b>✓ Done</b>	<b>Prebloom</b> <b>Mitigate pesticide usage to minimize air and water contamination.**</b>								
	Monitor for spider mites and caterpillars, including: <ul style="list-style-type: none"> <li>▪ Spider mites</li> <li>▪ Cutworms</li> <li>▪ Armyworms</li> </ul> Keep records ( <i>example form available online</i> ) and treat as needed according to PMGs.								
	Confirm correct planting, note any need for replanting.								
	Look for Insects and mites, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Aphids</li> <li>▪ Cyclamen mite</li> <li>▪ Whiteflies</li> </ul>								
	Look for diseases, flag locations with problems: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">▪ Angular leaf spot</td> <td style="width: 50%;">▪ Phytophthora crown and root rot</td> </tr> <tr> <td>▪ Anthracnose</td> <td>▪ Powdery mildew</td> </tr> <tr> <td>▪ Common leaf spot</td> <td>▪ Red stele root rot</td> </tr> <tr> <td>▪ Leaf blotch</td> <td></td> </tr> </table>	▪ Angular leaf spot	▪ Phytophthora crown and root rot	▪ Anthracnose	▪ Powdery mildew	▪ Common leaf spot	▪ Red stele root rot	▪ Leaf blotch	
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▪ Leaf blotch									
	Look for vertebrates, flag locations with problems: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">▪ Deer</td> <td style="width: 50%;">▪ Pocket gophers</td> </tr> <tr> <td>▪ Ground squirrels</td> <td>▪ Voles</td> </tr> <tr> <td>▪ Moles</td> <td></td> </tr> </table>	▪ Deer	▪ Pocket gophers	▪ Ground squirrels	▪ Voles	▪ Moles			
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✓ Done	<b>Prebloom (continued)</b>
	Survey for weed emergence. <ul style="list-style-type: none"> <li>▪ Apply preemergent herbicide as needed according to PMGs.</li> <li>▪ Handweed as needed.</li> </ul>
	Remove runners in summer plantings as needed.
	Consider monitoring salinity of irrigation water.
	Monitor soil moisture and irrigate as needed.
	Apply fertilizer as needed.

✓ Done	<b>Flowering to first harvest</b> <b>Mitigate pesticide usage to minimize air and water contamination.**</b>
	Monitor for spider mites and caterpillars (cutworms, armyworms) Keep records ( <i>example form available online</i> ) and treat as needed according to PMGs.
	Monitor lygus bug in Central Coast plantings and Southern California summer plantings. <ul style="list-style-type: none"> <li>▪ Survey weed hosts.</li> <li>▪ Consider calculating degree-days to time egg hatch.</li> </ul> Keep records ( <i>example form available online</i> ) and treat as needed according to PMG.
	Treat diseases as needed according to PMGs: <ul style="list-style-type: none"> <li>▪ Botrytis fruit rot</li> <li>▪ Powdery mildew</li> </ul>
	Look for Insects and mites, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Aphids</li> <li>▪ Thrips</li> <li>▪ Cyclamen mite</li> <li>▪ Whiteflies</li> </ul>
	Look for diseases, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Angular leaf spot</li> <li>▪ Phytophthora crown and root rot</li> <li>▪ Anthracnose</li> <li>▪ Red stele root rot</li> <li>▪ Common leaf spot</li> <li>▪ Verticillium wilt</li> <li>▪ Leaf blotch</li> </ul>
	Look for vertebrates, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Deer</li> <li>▪ Pocket gophers</li> <li>▪ Ground squirrels</li> <li>▪ Voles</li> <li>▪ Moles</li> </ul>
	Survey for weed emergence; manage as needed according to PMGs.
	Consider monitoring salinity of irrigation water.
	Monitor soil moisture and irrigate as needed.
	Apply fertilizer as needed.



✓ Done	<b>Harvest</b> <b>Mitigate pesticide usage to minimize air and water contamination.**</b>
	Monitor weekly for lygus bug. <ul style="list-style-type: none"> <li>▪ If using degree-days, continue the calculations.</li> <li>▪ Keep records (<i>example form available online</i>).</li> </ul>
	Monitor for spider mites and caterpillars, including: <ul style="list-style-type: none"> <li>▪ Cutworms</li> <li>▪ Armyworms</li> <li>▪ Leafrollers</li> </ul> Keep records and treat as needed according to PMGs.
	Treat diseases as needed according to PMGs: <ul style="list-style-type: none"> <li>▪ Botrytis fruit rot</li> <li>▪ Powdery mildew</li> </ul>
	Look for Insects and mites, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Aphids</li> <li>▪ Cyclamen mite</li> <li>▪ Thrips</li> <li>▪ Vinegar flies</li> <li>▪ Whiteflies</li> </ul>
	Look for diseases, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Angular leaf spot</li> <li>▪ Anthracnose</li> <li>▪ Common leaf spot</li> <li>▪ Leaf blotch</li> <li>▪ Phytophthora crown rot</li> <li>▪ Red stele root rot</li> <li>▪ Verticillium wilt</li> </ul>
	Look for vertebrates, flag locations with problems: <ul style="list-style-type: none"> <li>▪ Deer</li> <li>▪ Ground squirrels</li> <li>▪ Moles</li> <li>▪ Pocket gophers</li> <li>▪ Voles</li> </ul>
	Survey for weed emergence; manage as needed according to PMGs.
	Remove and discard decayed fruit and fruit with water damage.
	Look for bird damage on fruit, especially in locations with a history of bird presence.
	Consider monitoring salinity of irrigation water.
	Monitor soil moisture and irrigate as needed.
	Apply fertilizer as needed.



✓ Done	<b>Postharvest</b> <b>Mitigate pesticide usage to minimize air and water contamination.**</b>																		
	Consider rotation crops for reducing pest problems and improving soil structure, organic matter, and water penetration.																		
	Consider a cover crop to reduce runoff and erosion.																		
	Thoroughly work-in crop residue immediately after harvest, allowing it to completely decompose before the next strawberry crop.																		
	<p>Analyze field records for pest problems:</p> <table border="0"> <tr> <td>▪ Aphids</td> <td>▪ Whiteflies</td> <td>▪ Phytophthora crown rot</td> </tr> <tr> <td>▪ Beet armyworm</td> <td>▪ Angular leaf spot</td> <td>▪ Powdery mildew</td> </tr> <tr> <td>▪ Cabbage looper</td> <td>▪ Anthracnose</td> <td>▪ Red stele</td> </tr> <tr> <td>▪ Cutworms</td> <td>▪ Botrytis fruit rot</td> <td>▪ Verticillium wilt</td> </tr> <tr> <td>▪ Cyclamen mite</td> <td>▪ Phytophthora crown and root rot</td> <td></td> </tr> <tr> <td>▪ Spider mites</td> <td></td> <td></td> </tr> </table> <p>Note yield differences based on management strategies to plan a management program for the next strawberry crop.</p>	▪ Aphids	▪ Whiteflies	▪ Phytophthora crown rot	▪ Beet armyworm	▪ Angular leaf spot	▪ Powdery mildew	▪ Cabbage looper	▪ Anthracnose	▪ Red stele	▪ Cutworms	▪ Botrytis fruit rot	▪ Verticillium wilt	▪ Cyclamen mite	▪ Phytophthora crown and root rot		▪ Spider mites		
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▪ Spider mites																			



✓ Done	<b>**Pesticide application checklist</b>
	<p>When planning for possible pesticide applications in an IPM program, review and complete this checklist to consider practices that minimize environmental and efficacy problems.</p> <ul style="list-style-type: none"> <li>✓ Choose a pesticide from the UC IPM Pest Management Guidelines for the target pest considering:                             <ul style="list-style-type: none"> <li>▪ Impact on natural enemies.</li> <li>▪ Potential for water quality problems using the UC IPM WaterTox database. (For more information, see <a href="http://www.ipm.ucdavis.edu/TOX/simplewatertox.html">http://www.ipm.ucdavis.edu/TOX/simplewatertox.html</a>.)</li> <li>▪ Impact on aquatic invertebrates. (For more information, see <i>Pesticide Choice</i>, UC ANR Publication 8161, <a href="http://anrcatalog.ucdavis.edu/pdf/8161.pdf">http://anrcatalog.ucdavis.edu/pdf/8161.pdf</a>)</li> <li>▪ Chemical mode of action if pesticide resistance is an issue.</li> </ul> </li> <li>✓ Select an alternative chemical or nonchemical treatment when risk is high.                             <ul style="list-style-type: none"> <li>▪ Choose sprayers and application procedures that keep pesticides on target.</li> <li>▪ Identify and take special care to protect sensitive areas (for example, waterways or riparian areas) surrounding your application site.</li> <li>▪ Review and follow label for pesticide handling, storage, and disposal guidelines.</li> <li>▪ Check and follow restricted entry intervals (REI) and preharvest intervals (PHI).</li> <li>▪ After an application is made, record application date, product used, rate, and location of application. Follow up to confirm that treatment was effective.</li> </ul> </li> <li>✓ Consider water management practices that reduce pesticide movement off-site. (For more information, see UC ANR Publication 8214, <i>Reducing Runoff from Irrigated Lands: Causes and Management of Runoff from Surface Irrigation in Orchards</i>, <a href="http://anrcatalog.ucdavis.edu/pdf/8214.pdf">http://anrcatalog.ucdavis.edu/pdf/8214.pdf</a>)                             <ul style="list-style-type: none"> <li>▪ Install an irrigation recirculation or storage and reuse system.</li> <li>▪ Use drip rather than sprinkler or flood irrigation.</li> <li>▪ Limit irrigation to amount required using soil moisture monitoring and evapotranspiration (ET).</li> <li>▪ Consider vegetative filter strips or ditches. (For more information, see <i>Vegetative Filter Strips</i>, UC ANR Publication 8195, <a href="http://anrcatalog.ucdavis.edu/pdf/8195.pdf">http://anrcatalog.ucdavis.edu/pdf/8195.pdf</a>)</li> <li>▪ Redesign inlets into tailwater ditches to reduce erosion.</li> </ul> </li> <li>✓ Consider management practices that reduce air quality problems.                             <ul style="list-style-type: none"> <li>▪ When possible, choose pesticides that are not in emulsifiable concentrate (EC) form which release volatile organic compounds (VOCs). VOCs react with sunlight to form ozone, a major air pollutant.</li> </ul> </li> </ul>

