These practices are recommended for a monitoring-based IPM program that enhances pest control and reduces environmental quality problems related to pesticide use.

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

This year-round IPM program covers the major pests of cucurbits in the Sacramento, San Joaquin, Coachella, Palos Verde and Imperial valleys, as well as Riverside County. Details on carrying out each practice, example monitoring forms, and information on additional pests can be found in the Cucurbit Pest Management Guidelines (PMG) at http://www.ipm.ucdavis.edu/PMG. Track your progress through the year with the annual checklist form.

<table>
<thead>
<tr>
<th>✔ Done</th>
<th>Preplant activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Special issues of concern related to environmental quality: runoff, drift, volatile organic compounds (VOCs).</td>
</tr>
<tr>
<td></td>
<td>Mitigate pesticide usage to minimize air and water contamination.</td>
</tr>
</tbody>
</table>

Select the field:
- Consider soil type, cropping and pest history, and plantback restrictions from the previous crop.
- Consider crop rotation for fields with high populations of problematic weeds and difficult pathogens/diseases such as:
  - Fusarium crown and foot rot
  - Fusarium wilt (cantaloupe)
  - Fusarium wilt (watermelon)
  - Vine disease decline
  - Vine disease decline (*Monosporascus cannonballus*)
  - Root knot nematodes
- Take a soil sample for:
  - Nutrient, salinity, and pH analysis to determine field suitability and soil nutrient management. Manage salty soils to reduce risk of charcoal rot.
  - Root knot nematode if there is a history of galls on roots of previous crops. If soil sampling indicates the presence of root knot nematodes, the soil should be treated according to the PMG.

Clean equipment and tractors between fields to prevent the spread of some soilborne pathogens and weed seeds.

Identify a planting date that permits harvesting before frost. Consider the following:
- If planting into cover crops or no-till fields with heavy residue, additional germination time may be required, as these soils tend to be cooler.
- Early-planted melons often avoid competition from barnyardgrass. Late plantings in the San Joaquin Valley for fall harvest and fall-planted melons in desert areas have higher insect and disease pressure, especially viruses.
Preplant activities (continued)

Prepare the field in the fall if a spring planting is planned.
- Cultivate crop residues.
- Manage weeds.
  - Preirrigate the field to germinate weed seeds and cultivate, or apply an herbicide, or in special situations, a soil fumigant according to the Cucurbits Pest Management Guidelines.
  - Consider a fallow bed herbicide treatment on pre-formed beds to prevent winter weed growth and allow early spring melon planting.
  - If planting into a cover crop or utilizing conservation tillage or no-till systems, apply a burn-down herbicide prior to planting and before cover crop reaches 1 ft tall.
- If using soil fumigants, for weeds or other pests, check the label for details on the minimum time required between application and planting to prevent crop damage.
- Apply fertilizer, lime, gypsum, or other soil amendments based on soil test results.
  - Most cucurbits grow best at soil pH of 6.0–7.0.
  - If liming is required, applications should be made well in advance of planting to give soil acidity time to adjust.
- Determine bed size and planting configuration.
- Prepare planting beds with proper drainage.
- Choose an irrigation system and schedule.
- Consider the use of solarization or plastic mulches for pest suppression.

Consider selecting a hybrid based on pest history. Purchase seed or transplants from a reliable source to ensure quality, indexed, pathogen-negative seed or pest- and disease-free plants.

Use treated seed:
- If seedling root rots (damping-off), seedcorn maggots, or wireworms were problematic in the previous crop.
- In no-till, conservation-till, and when planting through cover crops to reduce the potential for seedling disease and insect problems.

Set out sticky traps for silverleaf whiteflies, green peach aphid, and melon aphid.

✔ Done

Planting activities

Special issues of concern related to environmental quality: drift.
Mitigate pesticide usage to minimize air and water contamination.

Plant seeds or transplants considering:
- Soil temperature, depth, moisture level, and seed rate or transplant density to reduce incidence of seedling root rots (damping-off).
- Precision planting to promote crop uniformity and close-to-seedline cultivation.

Check sticky traps for silverleaf whiteflies, green peach aphid, and melon aphid according to the Cucurbits Pest Management Guidelines.

In the desert production areas of southern California, use row covers over fall planting beds to exclude:
- Leafhoppers
- Squash bugs
- Silverleaf whiteflies
- Virus-transmitting green peach and melon aphid. Alternatively, consider applying reflective mulch to repel melon aphids and whiteflies. Silver reflecting mulches have been found to be the most effective. In the desert remove when temperatures are excessive.

Clean equipment and tractors between fields to prevent the spread of some soilborne diseases and weed seeds.
### Planting activities (continued)

After planting but before hand weeding or cultivation, survey and identify germinated weeds.
- Keep records, noting the presence of problematic weeds. (See example form online.)
- Manage according to the Cucurbits Pest Management Guidelines
- If herbicides will be used, customize the susceptibility to herbicide table for the weed complex in your field. Learn how.

If root knot nematodes (*M. incognita, M. javanica, M. arenaria*) are a problem, and the soil was not fumigated before planting, treat according to the Cucurbits Pest Management Guidelines.

### Seedlings (cotyledons to 4 leaves)

**Special issues of concern related to environmental quality: runoff, drift, risk to bees and native pollinators, and volatile organic compounds (VOCs).**

Mitigate pesticide usage to minimize air and water contamination.

Look for the following pests or their damage and manage as needed according to the Cucurbits Pest Management Guidelines:

- **Aphids** (green peach and melon)
- **Beet armyworm**
- **Cabbage looper**
- **Cucumber beetle** (adults)
- **Cutworms**
- **Flea beetles**
- **Squash bugs** (in squash, pumpkin, and melon)
- **Whiteflies**

If needed, manage weeds when small according to the Cucurbits Pest Management Guidelines. Selective herbicides can be used to control emerged grasses and nutseedes. Customize the susceptibility to herbicide table for the weed complex in your field. Learn how.

Other pests or damage you may see:

- **Arthropods**
  - Darkling beetles (not in desert)
  - Leafminers
  - Seedcorn maggot
  - Wireworms (especially on transplants)
  - Yellowstriped armyworm

- **Diseases/Nematodes**
  - Seedling root rots (usually more prevalent in cool, wet soils)
  - Stunted seedlings, galled roots (root knot nematodes)

### Vegetative growth

**Special issues of concern related to environmental quality: runoff, drift, risk to bees and native pollinators, and volatile organic compounds (VOCs).**

Mitigate pesticide usage to minimize air and water contamination.

Monitor for the following pests or their damage and treat if needed according to the Cucurbits Pest Management Guidelines:

- **Arthropods**
  - Aphids (green peach and melon)
  - Cabbage looper
  - Cucumber beetles (adults)
  - Cutworm (in honeydew, crenshaw, and casaba melon)
  - Leafminers
  - Spider mites
  - Squash bugs (in squash, pumpkin, and melon)
    - Whiteflies

- **Diseases**
  - Downy mildew
  - Powdery mildew
### Vegetative growth (continued)

Note symptoms or damage from the following and manage prior to future planting:

- Charcoal rot
- Fusarium wilt (in cantaloupe, watermelon)
- Root knot nematodes
- Root rots
- Sudden wilt
- Verticillium wilt

- Vine decline-like symptoms caused by *Pythium*
- Viruses (Cucumber mosaic, Cucurbit aphid-borne yellows, Potyviruses, *Squash mosaic virus*)

If needed, manage weeds with cultivation or herbicide applications according to the Cucurbits Pest Management Guidelines. Controlling weeds prior to vining has the most potential to minimize yield impacts. During cooler seasons or for crops with a long growing season, a layby herbicide can be beneficial. If herbicides will be used, customize the susceptibility to herbicides table for the weed complex in your field. Learn how.

Take leaf tissue samples for nutrient analysis and apply nutrients as necessary.

<table>
<thead>
<tr>
<th><strong>Arthropods</strong></th>
<th><strong>Diseases</strong></th>
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</thead>
<tbody>
<tr>
<td>Darkling beetle</td>
<td><em>Cucurbit yellow stunting disorder virus</em></td>
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<tr>
<td>Flea beetles</td>
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<tr>
<td>Grasshoppers and crickets</td>
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<tr>
<td>Leafhopper</td>
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<tr>
<td>Seedcorn maggot</td>
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<td>Thrips</td>
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</table>

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<th><strong>Diseases</strong></th>
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</thead>
<tbody>
<tr>
<td>Aphids (green peach and melon)</td>
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</tr>
<tr>
<td>Beet armyworm</td>
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<tr>
<td>Cabbage looper</td>
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<tr>
<td>Cucumber beetle</td>
<td></td>
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<tr>
<td>Cutworm (in honeydew, crenshaw, and casaba melon)</td>
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<tr>
<td>Spider mites</td>
<td></td>
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<tr>
<td>Squash bug (in squash, pumpkin, and melon)</td>
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<tr>
<td>Yellowstriped armyworm</td>
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<tr>
<td>Whiteflies</td>
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</tr>
</tbody>
</table>

### Bloom

Special issues of concern related to environmental quality: runoff, drift, risk to bees and native pollinators, and volatile organic compounds (VOCs).

Mitigate pesticide usage to minimize air and water contamination.

Remove row covers before first bloom.

Look for the following pests or their damage and manage if needed according to the Cucurbits Pest Management Guidelines.

<table>
<thead>
<tr>
<th><strong>Arthropods</strong></th>
<th><strong>Diseases</strong></th>
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<tbody>
<tr>
<td></td>
<td>Downy mildew</td>
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<tr>
<td></td>
<td>Powdery mildew</td>
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</tbody>
</table>
### Bloom (continued)

Note symptoms or damage from the following and manage prior to future planting:

- Charcoal rot
- Fusarium wilt (in cantaloupe and watermelon)
- Root knot nematodes
- Root rots
- Sudden wilt
- Verticillium wilt

- Vine decline-like symptoms caused by *Pythium*
- Viruses (Cucumber mosaic, Cucurbit aphid-borne yellows, Potyviruses, *Squash mosaic virus*)

#### Other pests or damage you may see:

**Arthropods**

- Darkling ground beetles
- Flea beetles
- Leafhoppers
- Leafminer
- Thrips

### Fruit development

Special issues of concern related to environmental quality: runoff, drift, risk to bees and native pollinators, and volatile organic compounds (VOCs).

Mitigate pesticide usage to minimize air and water contamination.

Look for the following pests or their damage and treat if needed according to the Cucurbits Pest Management Guidelines:

**Arthropods**

- Cabbage looper
- Cucumber beetle
- Cutworms (in honeydew, crenshaw, and casaba melons)
- Darkling beetles
- European earwig
- Stink bugs
- Squash bug (in squash, pumpkin, and melon)
- Whiteflies
- Yellowstriped armyworm

**Diseases**

- Downy mildew
- Powdery mildew

Note symptoms or damage from the following and manage prior to future planting:

- Charcoal rot
- Fusarium wilt (in cantaloupe, watermelon)
- Root knot nematodes
- Root rots
- Sudden wilt (*Pythium*)
- Verticillium wilt

- Vine decline-like symptoms caused by *Monosporascus* (melons) *Macrophomina, Pythium*
- Viruses (Cucumber mosaic, Cucurbit aphid-borne yellows, Potyviruses, *Squash mosaic virus*)

Just before harvest survey weeds and record their location for future management. (See example form online.)
### Fruit development (continued)

Other pests or damage you may see:

**Arthropods**
- Aphids (green peach and melon)
- Darkling beetles
- Flea beetles
- Grasshoppers and crickets
- Leafminer
- Thrips

<table>
<thead>
<tr>
<th>✓ Done</th>
<th><strong>Harvest and postharvest</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Special issues of concern related to environmental quality: drift and volatile organic compounds (VOCs).</strong></td>
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<tr>
<td></td>
<td>Mitigate pesticide usage to minimize air and water contamination.</td>
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<tr>
<td></td>
<td>Harvest rapidly to reduce exposure of fruit to pest infestations such as pathogens and vinegar flies.</td>
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<tr>
<td></td>
<td>Clean equipment and tractors between fields to prevent the spread of soil borne pathogens and weed seeds.</td>
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<tr>
<td></td>
<td>During harvest, note or record the type of damage on fruit to assess this year’s pest management results and to plan for next year.</td>
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<tr>
<td></td>
<td>Check for root galling if root rot nematode damage is suspected. If galls are present dig up a series of plants to determine distribution and severity. If action is warranted, consider choosing a resistant or non-host crop, or treat the soil according to the Cucurbits Pest Management Guidelines next season.</td>
</tr>
<tr>
<td></td>
<td>Carry out sanitation practices in the field to reduce the spread of:</td>
</tr>
<tr>
<td></td>
<td>- Aphids (green peach and melon)</td>
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<td></td>
<td>- Cutworms</td>
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<td>- Driedfruit beetles</td>
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<td>- Leafhoppers</td>
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<td>- Squash bug</td>
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<td>- Vine disease decline (in melons)</td>
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<td></td>
<td>- Vinegar flies</td>
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<tr>
<td></td>
<td>- Wireworms</td>
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<td></td>
<td>- Yellowstriped armyworm</td>
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<td></td>
<td>Consider fall bed herbicide applications as part of a weed management program. See Cucurbits Pest Management Guidelines for details. If herbicides will be used, customize the susceptibility to herbicide table for the weed complex in your field. Learn how.</td>
</tr>
<tr>
<td></td>
<td>Consider crop rotation next season to reduce pathogen and weed problems.</td>
</tr>
</tbody>
</table>
Pesticide application checklist

When planning for pesticide applications in an IPM Program, review and complete this checklist to consider practices that minimize environmental and efficacy problems.

Choose a pesticide from the UC IPM Pest Management Guidelines for the target pest, considering:

- **Impact on natural enemies and honeybees.** Within each crop guideline is the Relative Toxicities of Insecticides and Miticides table with this information.
- **Potential for water quality problems using the UC IPM WaterTox database.** Where pesticides are suggested in the Pest Management Guidelines, click on the Compare Treatments button to see data for those pesticides from the UC IPM WaterTox database.
- **Impact on aquatic invertebrates.** See Pesticide Choice (PDF).
- **Chemical mode of action** if pesticide resistance is an issue.

**Before an application**

- Reduce the potential for spray drift by using nozzles that produce larger droplet sizes (e.g., 8004 nozzles instead of 8002).
- Choose sprayers and application procedures that keep pesticides on target.
- 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, 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.

**Use irrigation management practices that will minimize off-site movement of pesticides and nutrients**

- Protecting Surface Water from Sediment-Associated Pesticides in Furrow Irrigated Crops (PDF).
- Install an irrigation recirculation or storage and reuse system.
- Use drip rather than sprinkler or flood irrigation.
- Limit irrigation to the amount required by using soil moisture monitoring and evapotranspiration (ET) estimates.
- Consider using cover crops.
- Consider using vegetative filter strips or ditches.
- Install sediment traps.
- Use polyacrylamide (PAM) tablets in furrows to prevent off-site movement of sediments.
- Redesign inlets and outlets into tailwater ditches to reduce erosion.

**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 emulsifiable concentrate (EC) formulations.
- Use the Department of Pesticide Regulation calculators to determine VOC emission rates from fumigant and nonfumigant pesticides.

More information about topics mentioned on this checklist is available at the website:

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