INVERTEBRATE CONSERVATION FACT SHEET

# Organic Farming Practices

## Reducing Harm to Pollinators from Farming

**Organic agriculture offers many benefits to pollinators.**

**Despite this, some common organic farming practices can harm these valuable insects.**

**An awareness of the needs of native bees will help farmers balance production practices with efforts to conserve this vital resource.**

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An essential activity on farms, tillage can impact beneficial insect populations. *Photograph by USDA-ARS/Keith Weller*

The reduced use of pesticides, as well as more sustainable management practices makes organic farms important partners in pollinator conservation efforts. Despite this, some practices that are used by organic growers can be detrimental to pollinators.

For example, in the absence of readily available conventional herbicides, many organic growers depend heavily on tillage as a primary weed control strategy. Since approximately 70 percent of our native bees nest underground, increased tillage may be detrimental on farms where these insects are needed for pollination.

This fact sheet provides an overview of how common organic farming practices might affect pollinators. It may not be possible to incorporate all of the recommendations outlined here in particular cropping systems, especially when other priorities such as weed control and pest management need to be considered. Where particular recommendations can be followed however, growers are likely to benefit from improved pollination services, a reduced need for rental honey bees, and greater farm biodiversity.

For information on the effects of organic-approved pesticides on pollinators, see the companion fact sheet, *Organic-Approved Pesticides. Minimizing Risks to Pollinators.*

## NATIVE BEE DIVERSITY

North America is home to approximately 4,000 species of native bees. These insects provide pollination services for many crops, and have been estimated to contribute $3 billion annually to America's agricultural economy. In California alone, more than sixty native bee species have been documented as important pollinators of tomato, watermelon, and sunflower. In the northeastern U.S., more than eighty species have been observed pollinating various berry crops.

While the non-native, European honey bee (*Apis mellifera*) is the most important managed crop pollinator, its numbers are in decline in the U.S. because of disease and other factors. This makes the role of native bees more important than ever. Native bees may also be preferred by some organic farmers who


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## Impact of Common Organic Farming Practices On Pollinators

The following table summarizes some of the known interactions between bees and common organic farm practices. Please note that this is not an exhaustive list. For more information on each practice, see the Notes on Farm Practices that follows.

| Farm Practices | Beneficial | Neutral | Detrimental |
|---|---|---|---|
| **Weed Control Practices** | | | |
| Primary Tillage | | | X |
| Secondary Tillage | | X | |
| Flame Weeding | | | X |
| Hand Weeding | | X | |
| Plastic Mulch | | | X |
| Straw/Wood Mulch | | X | |
| **Cultural Management of Pests** | | | |
| Floating Row Covers | | X | |
| Fruit Bagging | | X | |
| Classical Biological Control | | | X |
| Conservation Biological Control | X | | |
| Crop Rotation | | X | |
| Crop Diversity | X | | |
| Trap Crops | | X | |
| Sanitation | | X | |
| Resistant Varieties | | X | |
| Sticky Traps | | X | |
| Pheromone Traps/Mating Disruption | | X | |
| **Other Management Practices** | | | |
| Cover Crops | | X | |
| Haying | | X | |

N.B. For information on chemical methods of pest control see the companion fact sheet, *Organic Farming for Bees: Reducing Harm from Organic-Approved Pesticides*.


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need a dependable source of pollination but are wary of the chemical inputs (such as antibiotics and miticides) which are often used to maintain managed honey bees.

Many organic farms already have healthy populations of native bees. In some cases, these wild insects can effectively provide all necessary crop pollination services when enough habitat is available and bee-friendly management practices are implemented. As an additional benefit, many of the same practices that protect pollinators also protect other beneficial insects that may help manage pests.

## Notes on Farming Practices

### Weed Control Practices

**Primary Tillage:** Primary tillage is an essential first step in most cropping systems, and cannot be avoided. Since most (roughly 70 percent) of native bees nest underground, it is also unfortunately a practice that is detrimental to both actively nesting, and dormant or developing bee larvae. Consider using no-till seed bed preparation where possible, and consider leaving areas fallow where large numbers of ground nesting bees are concentrated. Often these will be sandy areas with poor cropping potential anyway. An example is the large concentrations of alkali bees found in some western states.

**Secondary Tillage:** In the absence of conventional herbicides, many organic growers are dependent on secondary tillage as their main weed control strategy. As with primary tillage, this can be detrimental to ground-nesting bee populations. Deep running secondary tillage implements (more than ~3 inches) such as heavy spring-tooth harrows are more disruptive to underground nesting bees than light surface disking, basket weeding, and raking.

**Flame Weeding:** No research has been performed on the effect of flame weeding on ground nesting bees. However, even if active nesting is temporarily disrupted, underground nests containing dormant or developing bees are unlikely to be affected.

**Hand Weeding:** Hand-weeding, performed either manually or from a lay-down work cart tractor, is unlikely to significantly affect pollinator populations.

**Plastic Mulch:** Ground nesting bees may be adversely affected by the widespread use of plastic mulch, both by limiting access to potential nest sites, and by inhibiting emergence of underground bees. These issues may be especially relevant in cucurbit production where specialist ground nesting bees are important, and plastic is widely used. If plastic mulch is used, photodegradable and biodegradable products are greatly preferred to limit the potential long-term impact to scrap sections buried in the field.

**Straw/Wood Mulch:** As with plastic mulch, straw or wood mulch may limit soil access for ground nesting bees. However, emergence by dormant underground bees should still be possible. In addition, thick layers of organic mulch may provide nest sites for bumble bees, or even potential hibernation sites for overwintering bumble bee queens.

Physical barriers such as plastic mulch or row covers offer control of weeds or insects. However, smothering the ground may prevent nesting by ground nesting bees and covers can hinder predation of pests by beneficial insects. Photograph by Eric Mader.

## Cultural Management of Pests

**Floating Row Covers:** Fabric row covers may be an effective alternative to pesticides for some situations, and can be used as a season extending device. One potential downside is that these covers can trap emerging ground-nesting bees, and can prevent bees from accessing flowering crops. A potential solution is to periodically monitor and release trapped bees, and to temporarily discontinue use when crops are in bloom.

**Fruit Bagging:** Specially designed cloth bags with wire closures are widely used in Asia for apple and pear production. These devices are an extremely effective pest barrier, and are becoming more widely available in the U.S. Attaching these bags is a very time consuming process (and may be most appropriate for small operations), but it becomes easier with practice and can be incorporated into existing hand-thinning duties. The use of these bags can significantly reduce the need for pollinator-harming pesticides, while producing extremely high-quality fruit.

**Classical Biological Control:** The traditional approach to biological control has been to rear and release predators or pathogens of pest insects. These are typically introduced species because the pests are usually themselves non-native. Examples include the multi-colored Asian lady beetle to control aphids, various parasitic wasps and nematodes to control caterpillars and beetles, and diseases like codling moth granulosis virus, milky spore powder (for Japanese beetles), *Beauveria bassiana* (an insect-attacking fungus), and *Nosema locustae* (a disease-causing parasite of grasshoppers). This strategy has the potential for large-scale disruption of ecosystems by displacing existing native beneficial insects and killing non-target organisms. Once released into the environment these predators and pathogens cannot be re-captured. A better option may be to encourage existing populations of beneficial organisms. Furthermore, some products, such as *Beauveria*, do attack bees.

**Conservation Biological Control:** Instead of releasing beneficial insects, this approach provides habitat to boost populations of resident predatory insects. Examples include the planting of small-flowered or umbelliferous plants (for example, dill, caraway, Queen Anne's lace) for *Trichogramma* wasps and syrphid flies. Similarly, the creation of beetle banks (mounded piles of soil planted with bunch grasses) may encourage predatory ground beetle populations. These efforts may reduce the need for pesticides, and provide additional food and nest habitat for bees.

**Crop Rotation:** Alternating cropping systems can rapidly eliminate pest insect populations. For example, the Colorado potato beetle attacks solanaceous crops like potatoes, eggplants, and tomatoes; beetle numbers can be drastically reduced by rotating wheat with these crops. However, to maintain consistent pollinator populations within this changing farmscape, some kind of bee-friendly flowering crop or flowering cover crop should be grown each season.

**Crop Diversity:** Multiple crop species in close proximity, especially flowering bee-pollinated crops, provides more abundant forage opportunities for pollinators throughout the season. Diverse cropping systems also encourage beneficial insect predators, and limit available food sources for pest insects. Such systems can also include livestock. For example, sheep or hog grazing below apple trees reduces windfall fruit that harbors over-wintering apple maggots, and reduces the need for pesticides.

**Trap Crops:** Some growers intentionally place plants that are highly attractive to pest insects adjacent to less attractive crops to draw pests away. An example is eggplant planted as a trap crop near tomatoes and peppers, or serviceberry maintained as a plum curculio weevil trap crop near apples. In many cases, growers then apply insecticides to the trap crop to control pest populations. If this strategy is used, avoid spraying trap plants that are in bloom, and apply insecticides in the late evening when pollinators and predatory insects may be less active.

Conservation biological control focuses on ensuring there is adequate habitat to support populations of predatory insects, such as this syrphid fly. Syrphid flies eat aphids bot as adults and larvae. Photograph by Mace Vaughan.

Cover crops offer several benefits: they build soil fertility and tilth, disrupt pest populations when used in rotation, and they can provide an alternative source of forage for pollinators. Red clover cover crop photographed by Toby Alexander, USDA-NRCS.

**Sanitation:** Removal and disposal of crop residue at the end of the season can reduce pest populations, and thus reduce the need for pesticides. Sanitation can include the removal of nearby alternate host plants for crop pests. Excessively clean landscapes on the other hand may remove potential nest sites (such as hollow stems) for solitary bees. Where possible, aim for a balance between clean fields and adjacent natural habitat.

**Resistant Varieties:** Crop varieties that are unpalatable to pest insects can be used as a way to reduce the need for pesticides, and thus benefit pollinator and beneficial insect populations.

**Sticky Traps:** Various trap types are available for different pests and crop systems: yellow sticky cards and tape can be used to capture aphids and leafhoppers in both greenhouse and field settings, red sticky globes can be used in orchards to capture fruit flies, and blue sticky cards are used to capture thrips. Alone these types of traps may not be completely effective, but they can contribute to pest control efforts. Blue and yellow traps however may also attract and kill bees, and it may be useful to minimize their use if large numbers of bees appear to be captured. Adhesive pastes are also available to apply to the base of trees and vines, preventing crawling insects from ascending trunks. These are typically safe for pollinators.

**Pheromone Traps/Mating Disruption:** These chemical products work by mimicking the mating pheromones of pest insects, attracting them to traps where they drown or are captured on a sticky card. They are generally very safe to bees, but used alone they may not be sufficient to control all pests. Pheromone traps are available for codling moth, cabbage looper, tomato fruitworm, corn earworm, cucumber beetle, oriental fruit worm, cutworm, and peach twig borer.

## OTHER MANAGEMENT PRACTICES

**Cover Crops:** While they are typically used to build soil tilth and fertility, flowering cover crops (buckwheat, clover, alfalfa, borage, mustard) can also provide alternative forage for bees. Grass cover crops on the other hand (such as oats or sorghum) do not provide nectar or pollen for bees. When used in rotation between other crops, cover cropping can disrupt pest populations reducing the need for pesticides.

**Haying:** To maintain high protein content, alfalfa and clover hay are often cut prior to 10 percent bloom. If it is possible to allow part of the hay to remain uncut, it can provide additional forage for resident pollinators.

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