Quick Reference: Alternatives to Synthetic Pesticides

Pesticides- whether organic or conventional- can harm pollinators. To minimize pesticide use, apply ***Integrated Pest Management*** (IPM) principles: identify & monitor pests, establish thresholds for management, and prioritize preventative practices and non-chemical controls. If using pesticides, choose least toxic organic options, and use spot treatments. This is not an endorsement of the products listed below, rather they are examples of Integrated Pest Management (IPM), organic herbicide and organic insecticide solutions.

Note: *Some* ***organic herbicides*** *may cost more and may have varied efficacy, depending on weed species, environmental conditions, and the concentration applied.*

	WEED CONTROL	USE
IPM	**Smothers:** Shade cloth, tarps or clear solarization plastic	Leave tarp or cloth in place for 3 months-1 year, remove and reseed with native vegetation or crops. Leave solarization plastic in place for entire growing season, remove and seed in late fall.
IPM	**Fire:** Flame-weeding/blow torch; controlled burns	Flame-weeding can be used for weed control in crevices, on roadsides & trails, restored areas, and gardens. Controlled burns encourage diversity, regeneration, and soil health in larger areas.
IPM	**Grazing/Browsing:** Goats, sheep, cattle, bison, pigs	Grazing animals offer many opportunities for targeted weed control and vegetation management on both large and small areas, in prairie, wooded, and savanna ecosystems. For example, goats can be highly effective against invasive buckthorn.
IPM	**Mowing**	Spot mowing can be used for weed control and to prevent weed seed set. Do not over-mow. Where possible, minimize mowing of native vegetation on roadsides (e.g., reduce mowing beyond clear zone, reduce frequency of mowing (one side per year)).
IPM	**Mechanical weed control**: Soil inversion, repeat cultivation, smother cropping with buckwheat or other cover crops	Can be used to manage weeds on larger sites w/equipment available. Not recommended for weeds that respond favorably to cultivation (e.g., Canada thistle). Follow with smother cropping (buckwheat, oats or other cover crops) or follow with native seeding dependent on weed load.
IPM	**Soil testing/augmentation**	Weed issues provide insight into soil nutrient imbalances; for example, excessive nitrogen can result in flushes of ragweed, pigweed, velvetleaf, etc. Nutrient changes to soil can be applied to promote natives and reduce weeds.
Org. Herb-icide	**Acetic acid (horticultural vinegar)** (e.g., Weed Pharm, Nature's Wisdom Vinegar, Vinagreen Vinegar)	Non-selective herbicide for weeds and grasses including poison ivy. Apply during hot sunny months. High concentrations can be toxic to pollinators upon direct contact.
Org. Herb-icide	**Acetic acid + citric acid*** (e.g., AllDown by Summerset)	Non-selective for annual and perennial grasses and broadleaves, including Canada thistle. Will not translocate.
Org. Herb-icide	**Perlargonic acid*** (e.g., Scythe by DOW AgroSciences)	Non-selective, post-emergent for grasses and broadleaf weeds. Will not translocate.
Org. Herb-icide	**Citric acid + malic acid + clove oil*** (e.g., Phydura by Soil Tech Corp)	Non-selective herbicide for grasses and broadleaf weeds including garlic mustard and leafy spurge.
Org. Herb-icide	**D-limonene*** (e.g. Avenger Weed Killer by Avenger Products, LLC)	Non-selective herbicide for grasses and broadleaf.
Org. Herb-icide	**Corn gluten***	Pre-emergent herbicide for germinating weed seeds for broadleaf and grassy weeds.

Caution: ***Organic insecticides*** *can harm pollinators and beneficial insects. Never spray flowers or plants that are in bloom. Apply in the evening when bees are not foraging. Use spot treatments.* ***Never use systemic insecticides.***

	INSECT PEST CONTROL	USE
IPM	**Build healthy soils** to promote healthy plants and **choose pest or disease-resistant varieties**	Vigorous plants can tolerate pest damage better than weakened or stressed plants.
IPM	**Tolerate some pests and pest damage. Use pesticides only when absolutely necessary**	Pests are food for many predators and parasitoids, so allowing some pests can help boost natural enemy populations. When scouting plants, check for both pests, and good bugs such as lady beetles and bees. If beneficial insects are present, wait to treat.
IPM	**Increase native or annual habitat for beneficial insects** (e.g., ground beetles, lady beetles, spiders, parasitic wasps, hover flies, tachinid flies, and lacewings)	Many beneficial insects feed on flowers during part of their life cycle. Habitat such as insectary strips, native hedgerows, and flowering cover crops provide important food, shelter, nesting, and overwintering sites for beneficial insects.
IPM	**Rotate crops** (on farms) **and ornamental plantings** (in annual landscaping)	Diverse rotations can help break pest and disease cycles.
Org. Insec-ticide	**Bacillus thuringiensis (Bt)**	Naturally occurring soil bacterium toxic to certain insect larvae. Different *Bt* strains act upon different types of insects; for example, *Bt* var. *kurstaki* targets caterpillars while *Bt* var. *israelensis* targets flies and mosquitoes. Caution: *Bt* var. *kurstaki* is toxic to a variety of butterfly larvae.
Org. Insec-ticide	**Kaolin clay (Surround)**	Leaves a protective powdery film to the surface of leaves, stems, and fruits, acting as a physical barrier to a variety of plant pests. Caution: Can also harm beneficial insects and pollinators.
Org. Insec-ticide	**Insecticidal soaps**	Toxic to a variety of insect pests when applied directly (e.g., aphids, mealybugs, mites, thrips, whiteflies). Caution: Can also harm beneficial insects and pollinators when applied directly.
Org. Insec-ticide	**Neem oil**	Has both insecticidal and fungicidal properties and provides organic control of powdery mildew, leaf spot, aphids, spider mites, and whiteflies. Caution: Can harm beneficial insects and pollinators - apply when not present.

OTHER RESOURCES

- Organic Site Prep for Wildflower Establishment: www.xerces.org/guidelines-organic-site-preparation/
- Organic-Approved Pesticides: Minimizing Risks to Bees: www.xerces.org/wp-content/uploads/2009/12/xerces-organic-approved-pesticides-factsheet.pdf
- Roadside Best Management Practices: www.xerces.org/wp-content/uploads/2016/08/BMPs_pollinators_landscapes.pdf
- Guidance to Protect Habitat from Pesticide Contamination: www.xerces.org/wp-content/uploads/2016/10/ProtectingHabitatFromPesticideContamination_oct2016-02.pdf
- Bee Precaution Pesticide Rating: www2.ipm.ucanr.edu/beeprecaution
- Organic Materials Review Institute: www.omri.org
- PAN Pesticide Database: www.pesticideinfo.org
- Swarm Catchers: Minnesota statewide honey bee swarm and wild bee colony rescue. **651-436-7915**.

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