



The following is being provided for informational purposes only and does not authorize, permit, endorse, or in any way approve the use, sale, cultivation, or any other activity associated with marijuana. Any such activity is subject to prosecution under federal law.

PESTICIDE REGISTRATION REQUIREMENTS

- Pesticides must be registered by both the U.S. Environmental Protection Agency (U.S. EPA) and the California Department of Pesticide Regulation (DPR) before they can be sold and used in California.
- There are no pesticides registered specifically for use directly on marijuana and the use of pesticides on marijuana plants has not been reviewed for safety or human health effects.
- Under California law, the only pesticide products not illegal to use on marijuana are those that contain an active ingredient that is exempt from residue-tolerance requirements; and
 - Registered and labeled for a use that is broad enough to include use on marijuana (e.g. unspecified green plants); or
 - Exempt from registration requirements as a minimum risk pesticide under FIFRA section 25(b) and 3 CCR § 6147. (FAC §§ 12973, 12995; 3 CCR § 6490.)

PESTICIDE USE REQUIREMENTS

- Before using any pesticide, ALWAYS read and follow the pesticide label. **The label is the law**
- If you apply pesticides to a field, you must obtain an operator identification number from the County Agricultural Commissioner and submit monthly pesticide use reports to that office. (FAC § 11408; 3 CCR § 6622; 3 CCR § 6627.) Note: No operator identification number will be issued in any local jurisdiction that prohibits marijuana cultivation.
- U.S. EPA designates certain pesticide products as federally “Restricted Use” products when they determine those products may cause unreasonable adverse effects even when used as directed on the product labeling. Restricted Use pesticides are limited to use by certified applicators, or to those under the supervision of a certified applicator.
- DPR designates certain pesticide active ingredients as California “Restricted Materials” when they determine those pesticides are especially hazardous to human health or the environment. Restricted Materials require a permit issued by the County Agricultural Commissioner. Permits will not be issued for marijuana cultivation sites. (FAC § 14001, et seq.; 3 CCR § 6400.)
- Employers must protect their workers from exposure to pesticides. State law requires that employers follow the pesticide label and:
 - Provide required personal protective equipment;
 - Provide required training and access to pesticide labels and safety information; and
 - Properly store, handle, and dispose of pesticides.

(See Compliance Assistance Booklet; 3 CCR § 6670, et seq.; 3 CCR § 6700, et seq.;

< <http://www.cdpr.ca.gov/docs/enforce/cmpliaast/bkltmenu.htm> >.)

RODENTICIDE USE

- Rodenticides that are designated as California Restricted Materials cannot be used; and those that are only designated as federally Restricted Use products can only be used by a certified commercial applicator. See Above.
- There are some rodenticides labeled for below ground applications that are not designated as California Restricted Materials or federally Restricted Use pesticides that can be used if consistent with the label.
- The following rodent repellants may be used in and around marijuana cultivation sites consistent with the label: Capsicum Oleoresin, Putrescent Whole Egg Solids, Garlic



LEGAL PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWERS IN CALIFORNIA

Department of Pesticide
Regulation

PESTS OF MARIJUANA IN CALIFORNIA

Marijuana pests vary according to cultivar (variety), whether the plants are grown indoors or outdoors, and where the plants are grown geographically. The pests included in this review are preliminary and based on the following sources: a presentation given in 2013 by Whitney Cranshaw, an extension entomologist at Colorado State University, and a review article by John M. McPartland, a professor of family medicine at the University of Vermont. We also received input from Kevin Hoffman, Primary State Entomologist, California Department of Food & Agriculture (CDFA).

HOW TO INTERPRET THE TABLES

Table 1 lists active ingredients not illegal to use on marijuana and the pests that these active ingredients target.

These active ingredients are exempt from **residue tolerance requirements**¹ and either exempt from **registration requirements**² or registered for a use that's broad enough to include use on marijuana. Residue tolerance requirements are set by U.S. EPA for each pesticide on each food crop and is the amount of pesticide residue allowed to remain in or on each treated crop with "reasonable certainty of no harm." Some pesticides are exempted from the tolerance requirement when they're found to be safe. Some of these pesticides are bacterial-based insect pathogens (e.g., *Bacillus thuringiensis*) or biofungicides (e.g., *Bacillus subtilis*, *Gliocladium virens*).

Active ingredients exempt from registration requirements are mostly food-grade essential oils such as peppermint oil or rosemary oil.

Tables 2 and 3 list pests of marijuana grown outdoors and indoors, and **Table 3** shows pests arranged by the portion of the plant they attack. An explanation of the column labels for Tables 2 and 3 follow.

PESTS. The tables show the most likely pests in California based on Cranshaw's presentation and McPartland's list and gleaned from California-based web sites and blogs. Some pests that drew attention on several blogs (e.g., russet mites) may be worse during drought years. Many have cyclic population

fluctuations and others are mainstays of general greenhouse cultivation (e.g., whiteflies, thrips, and fungus gnats). We'll add weeds to this compendium when we have more information.

DAMAGE. For damage caused by greenhouse pests, we derived information from Cranshaw's presentation; for that of outdoor pests when there wasn't any overlap, McPartland's list was used and information from UC IPM for various crops. Accounts of damage by rodents is anecdotal.

PESTS NOT OFFICIALLY IDENTIFIED IN CALIFORNIA. Kevin Hoffman of CDFA notes that several marijuana pests in other states are not yet known in California. These pests would add to the russet mites, aphids, cutworms, budworms, borers, and flea beetles already in California. As more and more marijuana is planted throughout the state, collecting potential pests will enable entomologists to identify new species.

THE IMPORTANCE OF CORRECT IDENTIFICATION. It's essential to identify the potential pest, or you may launch a futile program for a mite or insect that isn't a pest. And likewise, you need to know the correct species or you may use the wrong management strategy. For accurate identification, take specimens to an entomologist.

HOW TO PRESERVE SPECIMENS FOR IDENTIFICATION. If the mite or insect specimen is hard bodied (e.g., beetles, moths) carefully place it in a small pill vial and cushion with crumpled tissue paper. If your specimen isn't yet dead, put it in a jar and place in a freezer overnight. Do not wrap specimens in tissue and seal them in plastic bags or you'll end up with smashed bug parts.

Place soft-bodied specimens (e.g., mites, leafhoppers, aphids, caterpillars) in a jar filled with rubbing alcohol. Include written information such as where on the plant you found the specimen, the general location of the plant, and date captured. Note original color and texture, since these will change once you immerse the specimen in alcohol. Also helpful are photographs of the specimen in its original habitat.

IPM PRACTICES. Most of these are standard practices for pests on hosts other than marijuana. For more detailed explanations, see information compiled by the

¹ 40 CFR (Code of Federal Regulations)

² under FIFRA section 25(b) and 3 CCR section 6147

University of California Statewide IPM Program (UC IPM) at www.ipm.ucdavis.edu. You can enter a pest name in the search box (e.g., cutworm) and read about IPM practices for the pest on crops other than marijuana. For marijuana grown indoors, go to the UC IPM [home page](#), click on [Agricultural Pests](#) and scroll down the alphabetical list until you reach [ornamental nurseries](#).

Some practices were excluded because they apply to nearly all of the pests. For example, when targeting aphids, whiteflies, and thrips, growers can attract predaceous and parasitic arthropods by planting strips or borders of cover crops (e.g., California buckwheat) and insectary plants—especially those in the carrot, mustard, and sunflower families (Pickett & Bugg, 1998).

LEGAL PESTICIDES. These are covered above in the Table 1 description and are exempt from **residue tolerance requirements** and either exempt from

registration requirements or registered for a use that is broad enough to include use on marijuana.

Table 4 shows representative marijuana pests by plant part. Not all of these pests are important, but their collective damage may affect the overall health of the plant.

REFERENCES

- Cranshaw, Whitney. 2013. Challenges and opportunities for pest management of medical marijuana in Colorado. Presentation.
- McPartland, J.M. 1996. *Cannabis* pests. *J. Internatl. Hemp Assoc.* 3(2): 49, 52–55.
- Pickett, C.H. & R.L. Bugg, eds. 1998. *Enhancing Biological Control: Habitat management to promote natural enemies of agricultural pests*. UC Press, Oakland, Calif.

Table 1. Active ingredients that are exempt from residue tolerance requirements^a and either exempt from registration requirements^b or registered for a use broad enough to include use on marijuana.

ACTIVE INGREDIENT	PEST OR DISEASE
azadirachtin ^a	aphids, whiteflies, fungus gnats, leafminers, cutworms
<i>Bacillus subtilis</i> QST ^{a1}	root diseases, powdery mildew
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>aizawai</i> or <i>kurstaki</i>	moth larvae (e.g., cutworms, budworms, borer)
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>israelensis</i>	fly larvae (e.g., fungus gnats)
<i>Beauveria bassiana</i> ^{a3}	whiteflies, aphids, thrips
cinnamon oil ^b	whiteflies
<i>Gliocladium virens</i> ^{a1}	root diseases
horticultural oils ^a (petroleum oil)	mites, aphids, whiteflies, thrips; powdery mildew
insecticidal soaps ^a (potassium salts of fatty acids)	aphids, whiteflies, cutworms, budworms
iron phosphate ^a , sodium ferric EDTA ^a	slugs and snails
neem oil ^a	mites; powdery mildew
potassium bicarbonate ^a ; sodium bicarbonate ^a	powdery mildew
predatory nematodes ^a	fungus gnats
rosemary + peppermint essential oils ^b	whiteflies
sulfur ^a	mites, flea beetles
<i>Trichoderma harzianum</i> ^{a1}	root diseases

^a 40 CFR (Code of Federal Regulations)

^b FIFRA §25(b) and 3 CCR §6147 [FIFRA = the Federal Insecticide, Fungicide, and Rodenticide Act; CCR = California Code of Regulations]

¹ Biofungicides

² Bacterial-based insect pathogen

³ Fungal-based insect pathogen

Table 2. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN OUTDOORS

PEST		DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
MITES & INSECTS				
two-spotted spider mites <i>Tetranychus urticae</i> (and other Tetranychidae)		Suck plant sap; stipple leaves	<ul style="list-style-type: none"> ▪ Keep dust down by hosing off plants (if dust is a problem) ▪ Release predatory mites 	neem oil, horticultural oil
russet mites <i>Aculops</i> spp.		Suck plant sap; kill leaves and flowers	<ul style="list-style-type: none"> ▪ Release predatory mites 	neem oil, horticultural oil, sulfur
crickets (field & house)		Eat seedlings	<ul style="list-style-type: none"> ▪ Use floating row covers or cones on individual plants 	—
termites		Eat roots	<ul style="list-style-type: none"> ▪ Flood nests 	—
leafhoppers		Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
aphids <i>Myzus persicae</i> , <i>Aphis fabae</i>		Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Hang up yellow sticky cards (alates) ▪ Hose off plants 	azadirachtin, horticultural oil, insecticidal soaps, <i>Beauveria bassiana</i>
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>		Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Hang up yellow sticky cards ▪ Use reflective plastic mulch 	azadirachtin, horticultural oil, insecticidal soaps, rosemary + peppermint oils, <i>Beauveria bassiana</i>
leafminers <i>Liriomyza</i> spp.		Bore into roots and leaves	<ul style="list-style-type: none"> ▪ Remove older infested leaves ▪ Use biocontrol: release <i>Diglyphus</i> parasitoids 	azadirachtin
LEPIDOPTERA	cutworms <i>Agrotis ipsilon</i> , <i>Spodoptera exigua</i> (Noctuidae)	Eat seedlings	<ul style="list-style-type: none"> ▪ Use pheromone traps to detect adults. ▪ Remove weeds, which serve as a reservoir for cutworms and other noctuids 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> if egg-laying adults found, insecticidal soap; azadirachtin
	budworms <i>Helicoverpa zea</i> (Noctuidae)	Eat flowering buds	<ul style="list-style-type: none"> ▪ Shake plants to dislodge larvae ▪ Remove infested buds ▪ Plant corn as trap crop 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> , insecticidal soap

PEST		DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
COLEOPTERA	flea beetles (Chrysomelidae)	Bore into stems (grubs); feed on seedlings and leaves of larger plants (adults)	<ul style="list-style-type: none"> ▪ Use reflective mulches ▪ Plant trap crops (e.g., radish or Chinese mustard) 	sulfur
	scarab grubs (possibly other beetles)	Bore into stems	<ul style="list-style-type: none"> ▪ Use parasitic nematodes 	—
MAMMALS				
mice (e.g., house mice)		Eat young sprouts and seeds	<ul style="list-style-type: none"> ▪ Double wrap a 3'-tall chicken wire fence around plants ▪ Trap (minus rodenticides) ▪ Mount barn owl boxes 	rodenticides*
roof rats, <i>Rattus rattus</i> wood rats, <i>Neotoma</i> spp.		Strip bark from stems to build nests		
pocket gophers, <i>Thomomys</i> spp.		Tunnel through planting areas; feed on plants; gnaw on irrigation lines		
Columbian black-tailed deer, <i>Odocoileus hemionus</i> <i>columbianus</i>		Knock over plants; leave dander, droppings, and ticks behind	<ul style="list-style-type: none"> ▪ Install deer fencing 	—
black bears, <i>Ursus americana</i>		Knock over plants	<ul style="list-style-type: none"> ▪ Install electric fencing 	—

* If using a rodenticide, use products that are not DPR-restricted materials or federally restricted-use pesticides *and* are registered for a broad enough use to include use in or around marijuana cultivation sites. If using a rodenticide always read and follow the label and check to make sure that the target rodent is listed. Second-generation anticoagulant products (contain the active ingredients brodifacoum, bromadiolone, difenacoum, and difethialone) are DPR-restricted materials not labeled for field use and should never be used in or around marijuana cultivation sites.

Table 3. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN INDOORS
(e.g., greenhouses, sheds, and grow rooms)

PEST	DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
DISEASES			
powdery mildew <i>Sphaerotheca macularis</i>	Grow on leaves as white and gray powdery patches	<ul style="list-style-type: none"> Use fans to improve air circulation 	horticultural oil; neem oil; sodium bicarbonate, potassium bicarbonate; <i>Bacillus subtilis</i>
pythium root rots <i>Pythium</i> spp.	Attack root tips and worsens when plants grow in wet soil	<ul style="list-style-type: none"> Avoid hydroponic production or wet soil conditions 	Incorporate biocontrol agents into root-growing media (e.g., <i>Gliocladium virens</i> , <i>Trichoderma harzianum</i> , <i>Bacillus subtilis</i>)
MITES & INSECTS			
two-spotted spider mite <i>Tetranychus urticae</i> (and other Tetranychidae)	Suck plant sap; stipple leaves	<ul style="list-style-type: none"> Disinfest cuttings before introducing to growing area Release predatory mites 	neem oil, horticultural oil, sulfur
leafhoppers	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Hang up yellow sticky cards Use biocontrol: <i>Encarsia formosa</i> 	azadirachtin, <i>Beauveria bassiana</i> , cinnamon oil, horticultural oil
thrips <i>Heliethrips haemorrhoidalis</i> , <i>Frankliniella occidentalis</i> , <i>Thrips tabaci</i>	Stipple leaves and vector viruses	<ul style="list-style-type: none"> Hang up yellow or blue sticky cards 	
dark-winged fungus gnats (Diptera: Sciaridae) <i>Bradysia</i> spp.	Damage roots and stunt plant growth	<ul style="list-style-type: none"> Avoid overwatering Use growing media that deters gnat development Hang up yellow sticky cards Use biocontrol: soil-dwelling predatory mites 	<i>Bacillus thuringiensis israelensis</i> (BTI); predatory nematodes; azadirachtin soil drenches

Table 4. PESTS OF MARIJUANA BY PLANT PART

Seedlings	Flower & Leaf (grown outdoors)	Flower & Leaf (grown indoors)	Stalk & Stem	Root
crickets	flea beetles	spider mites	rats	flea beetles
cutworms	leafminers	leafhoppers		white root grubs
flea beetles	budworms	aphids		root maggots
slugs		whiteflies		termites & ants
rodents		thrips		fungus gnats
birds				wireworms