

Insecticides for Organic Commercial & Backyard Vegetable Production

Selecting insecticides for organic crop production is not an easy task. Producers should always choose the right insecticide after correct pest identification. Proper insecticide rotation is the key to avoid insecticide resistance, whether you are using organic or traditional chemical insecticides. Hundreds of products are available today but finding the right one can be difficult in a typical retail store where a biological or organic insecticide could be displayed next to a conventional product (figure 1). This publication with examples of commercial products can be a handy guide for organic vegetable producers and gardeners. Consult a regional Extension agent for proper insect identification and then ask about integrated pest management options.

Organic Crop Production Is Not Pesticide-Free

Organic crop production is a difficult system in high pest pressure areas and producers must think about pest prevention rather than pest control. The United States Department of Agriculture National Organic Program (NOP) practice standards suggest the use of systems-based practices (cultural practices, sanitation, crop rotation, trap crops) and mechanical practices (insect netting, row covers, handpicking, etc.) to prevent pest colonization and impact on crops. For more information, see the USDA crop pest, weed, and disease management practice standard at the U.S. Government Printing Office website, <http://tinyurl.com/cmr73v4>.

As with traditional chemical insecticides, organic insecticides should be used as a last resort, although they are vital in our battle against insects.

The word *organic* is not synonymous with pesticide-free. *Organic* systems allow the use of approved pesticides that undergo a thorough review process by



a government-approved agency (e.g., Organic Materials Review Institute or OMRI). Organic insecticides are often referred to as low impact insecticides, because of the nature of the formulation and their nonpersistent action. Certain organic-approved insecticides can seriously affect natural enemies, especially the immature stages of lady beetles and lacewings. Alternative insecticides, such as botanicals and microbial organisms, are effective but may require the use of high application rates and numerous repeat applications. This publica-



Figure 1. Biological and chemical insecticides can be hard to distinguish from other insecticides at a typical retail store. Make sure to use our Extension publication for recommendations or consult Extension personnel. (Image: A. Majumdar)

tion briefly describes the various modes of action and formulations of alternative insecticides that have been OMRI approved for organic crop production.

Uniqueness of Organic Insecticides for Producers versus Gardeners

Organic producers have a range of products to choose from. OMRI-approved products are generally sold in bulk packaging and are often quite expensive. Bulk amounts of organic insecticides for crop production are available from some vendors (Helena, Crop Production Services, Monterey AgOrganics) and may not typically be available in retail stores. Visit the company websites for more information.

Few OMRI-approved insecticides are available for gardeners, and they could be hard to find in retail stores. These are typically the ready-to-use products that are priced high for small packages. Home garden pesticides that are not OMRI-approved may bear an “environment-friendly” mark on the package to indicate natural ingredients or low toxicity to nontarget species. Read the label carefully and decide your course of action. Gardeners have the option of purchasing OMRI-approved commercial organic insecticides online, because these are general-use products and do not require restricted-use permits to purchase. Small gardeners can buy products online from various websites including Arbico Organics, Grow Organic, BioControl Network, Gardensalive.com, and other vendors.



Figure 2. DiPel DF is a very popular OMRI-approved microbial insecticide containing *Bacillus thuringiensis* (Bt). (Image: A. Majumdar)

Product Safety

Anything labeled as an insecticide should be considered a poison. Organic insecticides are not necessarily safe to nontarget organisms, such as pollinators, predatory beetles, and parasitoids, so minimize spraying directly over natural enemies. Direct insecticide applications toward the plant pests or specific plant parts. Apply treatments in the evening hours and treat the underside of leaves when the air is calm and pollinators are not active. Application in the evening hours can increase the persistence of the microbial insecticides and let the product dry out. For specific nontarget impacts and application techniques, consult the insecticide label and follow it strictly. The label is the law!

Microbial Insecticides

A number of microbial insecticides are available for organic farming or gardening. Handle microbial insecticides carefully and apply during low pest presence. Avoid applying microbial pesticides on a hot day. Apply these products as close as possible to the target insect or apply at weekly intervals, if necessary. Always mix microbial insecticides immediately before application and agitate the tank during spraying, as the spores may settle. Application of living spores to the underside of leaves and stems is recommended to increase persistence of these products and to protect them from washing off. Many microbial insecticides can be purchased directly from a distributor or manufacturer’s website, while some, such as *Bacillus thuringiensis* (Bt), may be available at retail stores. Remember to check



Figure 3. Mycotrol-O (organic formulation) and BotaniGard ES contain live spores of the fungus, *Beauveria bassiana*. (Image: A. Majumdar)



For more information

Crop producers who are transitioning to organic systems should consult their certification agency for a list of approved products.

Additional resources are available as follows:

www.omri.org

Organic Materials Review Institute (OMRI)
The most up-to-date list of approved organic products

www.attra.ncat.org

National Sustainable Agriculture Information Service (ATTRA)
Pest-specific scouting and ecological pest management tactics

www.aces.edu/go/273

Alabama IPM Communicator, the ACES integrated pest management (IPM) newsletter
Weekly pest alerts and management recommendations
To subscribe, send e-mail to bugdoctor@auburn.edu

<http://www.southernsare.org/SARE-in-Your-State/Alabama>

Alabama Sustainable Agriculture Research and Education (SARE)
Information about events, project reports, and social media channels

the expiration date on the containers before purchasing, and store products under cool, dry conditions.

Formulation Acronyms

Many of the commercial insecticide labels use the following acronyms.

D = Dust

DF = Dry Flowable

EC = Emulsifiable Concentrate

WDG = Water Dispersible Granule

WG = Wettable Granule

WP = Wettable Powder

RTU = Ready-to-Use

Following are common approved insecticides that are available to commercial producers and gardeners. Product names are given as examples. Some products may become unavailable over time. All commercial product names are highlighted. Mention of product names does not mean endorsement of these products.

Bacillus thuringiensis (Bt)

Bacillus thuringiensis (Bt) is the largest-selling commercial biological insecticide in the world. Commercial Bt products contain fermentation solids, bacterial spores, and insecticidal toxins. Bt is a stomach poison that paralyzes the insect's gut and causes infection, which kills the insect in 10 to 14 days. The smaller the insect when Bt is applied, the better the control will be. Large caterpillars are difficult to



Figure 4. Neemix 4.5 (Certis USA) is a popular azadirachtin-containing insecticide that acts as a contact poison against soft-bodied sucking insect pests and small caterpillars. (Image: Arbico Organics)

control and may have already done economic damage to crops. Liquid and water soluble formulations are easier to apply (at variable rates) to the underside of leaves using regular garden sprayers than the Bt dust commonly sold for home use. Apply living insecticides on the lower leaf surfaces to increase the persistence of these products. Bt should be prepared fresh before each application so the infective spores are alive in solution. Certis USA and Valent BioSciences have several Bt formulations that are pest specific and have low nontoxic effects. For example:

- **Agree WG** contains Bt subspecies aizawai GC-91 for controlling caterpillar pests in ornamental, fruit, and vegetable crops.
- **CoStar** and **Deliver** contain Bt subspecies kurstaki SA-12 for controlling caterpillar pests in row crops and vegetables.
- **Crymax WDG** contains Bt subspecies kurstaki EG7841 for controlling caterpillar pests in vegetables, herbs, fruits, and field crops.
- **Javelin WG** contains Bt subspecies kurstaki SA-11 for controlling caterpillar insect pests in many fruit, vegetable, and field crops.
- **Lepinox WDG** contains Bt subspecies kurstaki EG7826 and is not OMRI approved for organic production. In addition to use in fruit, vegetable, and field crop production, Lepinox can be applied in pasture and hay crops.
- **DiPel DF** (54 percent active ingredient) contains Bt subspecies kurstaki ABTS-351 and is OMRI approved for use in organic vegetable production. This product can also be safely used on herbs

and forage crops. **DiPel Pro** DF is labeled for greenhouse ornamental and nursery production. Dipel dust sold for home garden pest control is not OMRI approved, has less than 1 percent Bt, and may not work for commercial organic growers.

- **XenTari** contains Bt subspecies aizawai strain ABTS-1857 and provides excellent caterpillar control by itself or as a tank-mix partner with other insecticides (e.g., pyrethrum).

For organic producers: **DiPel DF** (figure 2), **Xentari** (Valent BioScience), **Agree WG**, **CoStar**, **Crymax**, **Javelin WG** (Certis USA), **Safer Brand Caterpillar Killer** (Woodstream), **XenTari** (Valent)

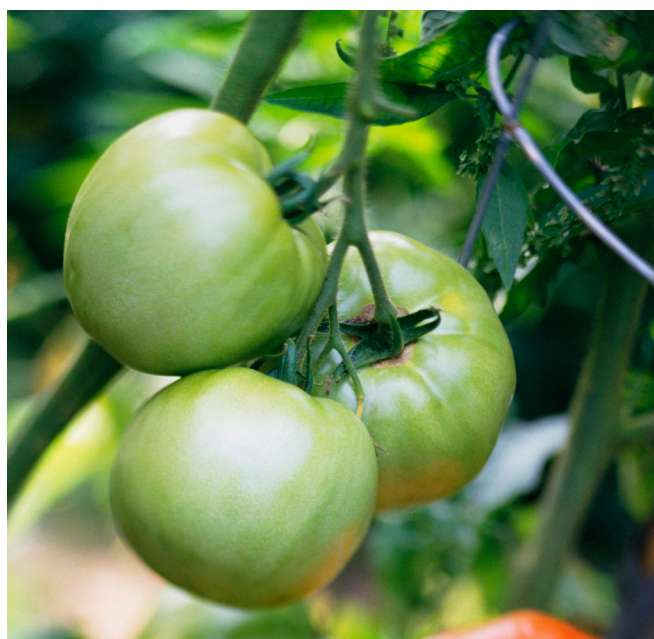
For home gardeners: **BT Worm Killer Concentrate** (Green light, 15 percent Bt), **Dipel D**, **Thuricide Concentrate** (Bonide), **Safer Brand Caterpillar Killer RTU** (Woodstream)

Beauveria bassianais

Beauveria bassianais is a living insecticide that has spores of a fungus and is effective against aphids, thrips, whiteflies, caterpillars, etc. Do not tank mix *Beauveria* with fungicides, because it may kill the living spores. Agitate the spray solution before spraying, as the spores may settle out. *Beauveria* penetrates the exoskeleton (skin) of the target insects and enters the bloodstream thereby poisoning the host.



Figure 5. Molt-X is a relatively new neem-based insecticide containing 3.0 percent azadirachtin. Use neem products for controlling small and immature insects. (Image: A. Majumdar)



For organic producers: **Mycotrol-O** (BioWorks, figure 3) is an organic formulation available in the United States; **BotaniGard** is not approved for organic production.

For home gardeners: None available specifically. Home gardeners can purchase approved products from online retailers.

Neem-based insecticides

Neem-based insecticides are sold in two forms: (1) products primarily containing neem oil (with traces of azadirachtin), and (2) products containing neem extract with 3 percent or higher of azadirachtin. Neem oil is a physical poison that can be applied against small and soft-bodied insects. Azadirachtin, an insect growth regulator, is the active ingredient in some neem formulations named below. Neem formulations can be rotated and/or tank mixed with other organic insecticides. Repeat application may be necessary to keep certain insects, such as aphids, in check. Certain formulations (Neemazad and Azatin, for example) are approved for greenhouse pest control and may not be OMRI approved. Target immature stages (small caterpillars) with azadirachtin formulations of spray during low populations.

Azadirachtin for organic producers: **Neemix 4.5** (Certis USA, figure 4), **AZA-Direct** (Gowan), **Molt-X** (BioWorks, figure 5), **Azatrol** (PBI/Gordon), **GOS Neem 7 Way** (Georgia Organic Solutions)

Azadirachtin for home gardeners: (cold-pressed neem): **GreenNeem Oil** (GreenNeem Agri), **70 percent Neem Oil** (Monterey)

Neem oil for organic producers: **Trilogy** (Certis), **Monterey 70 percent Neem Oil** (Lawn and Garden Products)

Neem oil for home gardeners: **Green Light Neem Concentrate** (Green Light), **Neem Oil RTU** (Monterey))

Insect killing soap (neem derivative): **Concern Insect Killing Soap RTU** (Woodstream)

Spinosad

Spinosad is derived from a bacterial fermentation process, and commercial formulations contain a mixture of spinosyns. Spinosad has a fast knockdown and is an excellent insecticide for alternating with other softer products like oils and Bt. Spinosad is a very effective insecticide against caterpillars, flea beetles, and thrips. Spinosad can be highly toxic to pollinators. To reduce environmental impacts, products should be applied during evening hours when bees are not around. At least one product called **Seduc** (Certis, United States) is available as a granular bait that can be applied around the perimeter of the vegetable crops to serve as a barrier against cutworms and earwigs. Seduc can also be scattered between rows if insects have entered the area before application.



Figure 6. Entrust is the organic formulation of a mixture of spinosyn A and D. It is very effective against thrips, armyworms, pinworms, leaf miners, etc. (Image: Arbico Organics)

For organic producers: **Entrust Naturalyte** with 80 percent spinosad (Dow Agrosciences, figure 6), **Monterey Garden Insect Spray** (Lawn and Garden Products), **Seduce Insect Bait** (Certis USA)

For home gardeners: **Spinosad Garden Insect Spray** (Monterey), **Conserve Naturalyte Insect Control** (Southern Agricultural Insecticides), **Monterey Garden Insect Spray RTU** (Lawn and Garden Products)

Pyrethrum

Pyrethrum (pyrethrin) is a popular botanical insecticide that provides quick knockdown of a number of small insects. Larger insects may recover from treatment. Pyrethrin is a contact poison and needs to be applied several times throughout the season to get full control of target pests. Pyrethrin formulations with piperonyl butoxide (PBO) are not approved for organic production.

For organic producers: **PyGanic Crop Protection 1.4EC, 5EC** (MGK Company), **Concern Multi-Purpose Insect Killer II** (Woodstream)

For home gardeners: **Concern Multi-Purpose Insect Killer RTU, Concern Tomato & Vegetable Insect Killer II RTU** (Woodstream)

Garlic extract

Garlic extract is an insect repellent and does not necessarily kill insects. Check online for availability of garlic-based products, and try them on a limited area in your garden before heavy usage. Extremely mobile insects will recolonize the plants when the product wears off.

For organic producers: **Garlic Barrier AG+** (Garlic Research Lab), **BioRepel** with 10 percent garlic oil (JH Biotech), **GC-Mite** with cottonseed oil, clove oil, and garlic oil (JH Biotech)

For home gardeners: **Garlic Barrier AG+** (Garlic Research Lab)

Other natural oils and blends

Other natural oils and blends are available for home gardeners to control insect pests and mites. Bayer's Natria brand products contain plant oils that act as physical poisons. Some are available in ready-to-use spray bottles only and may not be suitable for large organic farmers. Apply formulations to a few plants to check for phytotoxicity before applying to a large area.

For organic producers: **Bayer Advanced Natria Multi-insect Control Concentrate** (96 percent canola oil), **Golden Pest Spray Oil** (Stoller Enterprises, 93 percent soybean oil)



Figure 7. Suffoil-X is a product containing 80 percent petroleum oil that can be used as an insecticide, miticide, and fungicide. (Image: A. Majumdar)



For home gardeners: **Monterey All Natural General Purpose Garden Spray RTU** (blend of rosemary, peppermint, clove oil, sesame oil, thyme, and cinnamon oil), **Bayer Advanced Natria Multi-insect Control RTU** (96 percent canola oil)

Paraffinic oil products

Paraffinic oil products contain highly refined petroleum oil or distillates and can be used as organic insecticides. These products do not kill the target pests (e.g., aphids, mites, and whiteflies) but affect their ability to feed and transmit diseases. Treatments need to be initiated at the first detection of target insects and applied weekly. In certain crops, such as cucurbits, sprays may be needed right after germination. Do not apply paraffinic oils when temperatures exceed 90 degrees F or when plants are drought stressed.

For organic producers: **BVA Spray 10** (BVA Inc.), **Organic JMS Stylet-Oil** (JMS Flower Farms), **Suffoil-X** (BioWorks, figure 7)

For home gardeners: **Organic JMS Stylet-Oil** (JMS Flower Farms)

Sulfur

Sulfur is one of the oldest pesticides in the world, and it has a broad mode of action as a contact and stomach poison. It is effective against thrips, psyllids, scales, and spider mites, but some products can cause leaf burn

on hot days. Some RTU formulations are premixes that have low levels of sulfur.

For organic producers: No specific product.

For home gardeners: **Bayer Advanced Insect, Disease, and Mite Control RTU** (sulfur and pyrethrin premix)

Insecticidal soap products

Insecticidal soap products are the potassium salts of fatty acids, and they are specifically labeled for use on crops. Dishwashing detergents, often used by home gardeners, are not labeled for use on fruits and vegetables. Dishwashing detergents are highly reactive products that can damage the crop or leave an off flavor to edible produce. Do not apply insecticidal soap during hot days with temperatures higher than 85 degrees F. Repeat applications of insecticidal soap and thorough coverage of plant parts are essential for keeping soft-bodied insects in check. DES-X (Certis USA) is a product labeled for use in the greenhouses.

For organic producers: **M-Pede** (Dow AgroSciences), **Safer Brand Insect Killing Soap** (Woodstream)

For home gardeners: **Safer Brand Insect Killing Soap RTU** (Woodstream), **Safer Brand End ALL Insect Killer RTU** (Woodstream has insecticidal soap, neem oil, and pyrethrin)

Kaolin clay

Kaolin clay is a natural, white mineral produced in the earth by the weathering of rocks rich in aluminum silicate. It is often used at high rates to protect crops from heat stress or to prevent sunburn to fruiting vegetables. Kaolin clay may not kill insects but repel and confuse them due to the unfamiliar coating on the plant or fruit surface. Heavy rainfall, wind erosion, and new growth will affect product efficacy. Thorough coverage of target plants or plant parts is essential along with repeat spraying after every rainfall. Tank mixing with other insecticides, such as pyrethrin and insecticidal soap, may result in settling of the product. **Screen-Duo** (Certis USA) with 97.5 percent aluminum silicate is not approved for organic vegetable production.

*For organic producers: **Surround WP** (95 percent aluminum silicate, Engelhard Corp.)*

For home gardeners: Only bulk packaging is available.

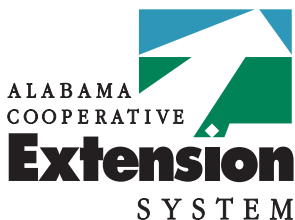
Insect pathogenic viruses

Insect pathogenic viruses are species specific. Commonly available virus formulations target small caterpillars, and infection results from ingestion of virus particles (some nerve damage in insects also occurs due to toxins). The infected caterpillars become sluggish and transparent; in advanced stages of infection, the skin may rupture to release additional virus particles. Because of slow infection, caterpillars may continue to feed. It is best to apply these formulations ahead of an outbreak so pest populations remain below economic thresholds. Proper insect identification is extremely important before using virus formulations because they are very species specific.

*For organic producers: **Spod-X LC** for controlling beet armyworm (Certis USA), Gemstar LC for controlling corn earworm (Certis USA)*

For home gardeners: No specific product.

For updated information on organic insecticides and crop production practices, check with the regional Extension agent in your area. Names of commercial insecticides in this publication do not indicate endorsement of those products by the Alabama Cooperative Extension System. Names of online resources is not all inclusive.



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Use insecticides only according to label directions. Follow all directions, precautions, and restrictions that are listed. Do not use insecticides in ways other than those specified on the label.

Trade and brand names used in this publication are given for information purposes only. No guarantee, endorsement, or discrimination among comparable products is intended or implied by the Alabama Cooperative Extension System.

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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