

## **Safe and Effective Use**

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### **Introduction**

#### ***The Pest Management Guide Series***

The Virginia Pest Management Guide (PMG) series lists options for management of major pests: plant diseases, insects, nematodes, and weeds. These guides are produced by Virginia Cooperative Extension and each guide is revised annually. PMG recommendations are based on research conducted by the Research and Extension Division of Virginia Tech, in cooperation with other land-grant universities, the USDA, and the pest management industry.

These guides are not a comprehensive control plan for all pests in Virginia. However, they do provide management tactics for major pest problems. For specific recommendations beyond the scope of these guides, please contact the Extension specialist(s) associated with the particular commodity or specialty area.

Chemicals listed in the PMG's are registered by the U.S. Environmental Protection Agency (EPA) and the Virginia Department of Agriculture and Consumer Services (VDACS). When used in accordance with label directions, residues should be within tolerance limits set by the EPA. Pesticide users must follow label directions with regard to application site(s), rates of application, number of applications, and minimum time interval between application and harvest. Violation of label directions may result in unsafe residues, fines to the applicator and grower, crop seizure, and loss of public confidence and product marketability.

***Use pesticides only on labeled sites, and follow all label directions to the letter!***

#### ***How To Get Help with a Pest or Pesticide Management Problem***

The first rule in solving any problem is to identify the cause before you seek a solution. This is especially true for pest management. You **MUST** identify the pest before you make any attempt to control it. If you need assistance with pest identification, contact your local Extension office. Extension offices are located in local county or city governmental units throughout Virginia. The agents and staff members of these units are dedicated professionals. They are part of a unique alliance between the United States Department of Agriculture, Virginia's land-grant universities, and local government. Local Extension offices are listed in the telephone directory. There is also a complete list of all Virginia Cooperative Extension offices at [www.ext.vt.edu/offices/](http://www.ext.vt.edu/offices/) on the Internet.

If a pest is especially difficult to identify or if you need more information, your agent will send a specimen and/or samples to Virginia Tech. Services available include: the Plant Disease Diagnostic Clinic, the Insect Identification Laboratory, the Weed Identification Laboratory, the Soil Testing Laboratory, and the Forage Testing Laboratory. One or more of these services may help to solve pest—or pesticide—management problems.

#### ***Alternative Pest Controls***

Pest management includes more than the use of pesticides. Virginia agriculture employs a number of non-chemical methods. Alternative controls are an integral part of any production system. However, where chemical controls are necessary, they must be used in such a way as to provide for a safe food supply, a clean and healthy environment for humans and wildlife, and a productive and profitable agricultural industry.

#### ***Integrated Pest Management (IPM)***

Integrated Pest Management (IPM) is an ecological approach to pest control, based on the life cycle and habitat of the pest. It combines all appropriate pest management techniques into a single, unified program or plan. The goal of any IPM program is to reduce pest populations to an acceptable level in a way that is practical, cost-effective, and safe for people and the environment.

Virginia Tech has developed a number of specific IPM programs with precise monitoring (scouting) tactics and thresholds. Each is based on scientific studies of local pest populations and the crops/sites these pests damage. Specific IPM protocols take time and resources to generate; as a result, there is not a prescribed program for each and every pest + site combination in the Commonwealth. However, an experienced pest manager can apply IPM principles to any situation by: identifying the pest; learning about its life cycle, basic needs, and the environmental conditions that influence its population size and activity;

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assessing pest population size and distribution by monitoring (scouting); deducing what attracted or brought the pest to the site; acquiring accurate information about management tactics, both chemical and non-chemical; and making long-term plans to prevent or suppress this pest in years to come. For more information about IPM, contact your local Extension agent.

### ***Pesticide Management in Virginia***

Virginia Cooperative Extension offers educational programs for the public in pest management and pesticide safety. Examples are commodity production meetings and pesticide safety workshops, including pesticide applicator training and recertification.

Issues and programs such as farmworker protection, recordkeeping, endangered species protection, food and water quality, and re-registration of pesticides often result in additional state and federal regulations affecting pesticide users. In Virginia, the Virginia Pesticide Control Act and regulations drafted under the act affect growers and commercial pesticide applicators. State and federal pesticide laws and regulations are enforced by the VDACS, Office of Pesticide Services (VDACS-OPS).

Growers and applicators are responsible for meeting all requirements imposed by state and federal agencies. For more information about programs, laws, and regulations, contact your local Extension office and/or VDACS-OPS.

### **Pesticide Applicator Certification**

In Virginia, most commercial pesticide users, all aerial applicators, and growers who use restricted-use pesticides must be certified. The Virginia Pesticide Control Act and regulations drafted under the act define “pesticide use” as the application or supervision of an application of a pesticide. This includes the routine activities that are part of a pesticide application, such as mixing, loading, clean-up, storage, and disposal. Handling, transfer, or transport after the manufacturer’s original seal is broken is also considered “use.” (Pesticide handling typically managed by persons other than the mixer/loader/applicator, such as long-distance transport, long-term storage, or ultimate disposal, is not considered part of routine use.)

### **Pesticide Applicator Training Manuals**

Pesticide applicator training manuals are sold by Virginia Tech. Orders can be placed online: <https://resources.ext.vt.edu/>. Alternatively, government purchase orders can be arranged by email: [vcdistributioncenter@vt.edu](mailto:vcdistributioncenter@vt.edu)

Certification procedures differ for Private Pesticide Applicators, Commercial Pesticide Applicators, and Registered Technicians. For the most up-to-date information about certification requirements, categories, initial certification procedures, and how to keep a certificate in force, contact your local Extension office, Virginia Tech Pesticide Programs, or VDACS-OPS.

### ***The Virginia Pesticide Control Act***

The Virginia Pesticide Control Act is enforced by the VDACS. The act and regulations which support it affect pesticide use in Virginia. Information concerning regulatory changes affecting pesticide use is available from VDACS-OPS, Virginia Tech Pesticide Programs, and your local Extension office.

## ***Responsibilities of Pesticide Applicators in Virginia***

### **I. Follow the Pesticide Label**

The pesticide label is a legal agreement between the Environmental Protection Agency (EPA), the product manufacturer, and the user. Pesticide product labels provide instructions for all stages/phases of use. Applicators must read, understand, and follow label directions carefully. Pesticides may not be applied to any site not listed on the product label. Materials may not be applied more often, or at rates higher than the label directs. Pesticide applicators must follow all label directions for transport, mixing, loading, application, storage, and disposal of pesticide products and containers. State and federal laws prohibit the use of any pesticide in a way that is not consistent with its label. There are state and federal penalties for violations.

### **II. Adhere to Certification Requirements**

#### **Private Pesticide Applicators:**

- In Virginia, a private pesticide applicator is a person who uses or supervises the use of any restricted use pesticide (RUP) for purposes of producing an agricultural commodity on property owned or leased by the applicator, or their employer. A

private pesticide applicator may also apply a RUP to the property of another agricultural producer so long as they receive no compensation except for trading of personal services between them.

**Commercial Pesticide Applicators:**

- The Virginia Pesticide Control Act defines a person who, as part of his or her job duties, uses or supervises the use of any pesticide for any purpose (other than production of agricultural commodities on private property) as a commercial pesticide applicator.
- Certification options for commercial pesticide applicators include:
  - registered technician
  - commercial pesticide applicator
- Certification requirements depend on the commercial pesticide applicator class and scope of pesticide use. In addition, The Virginia Business License Regulation requires that people who make pesticide recommendations for-hire be certified as a commercial pesticide applicator. There are four classes of commercial pesticide applicator:
  - *Government employees* must be certified to use any pesticide for any purpose.
  - *For-hire* commercial pesticide applicators must be certified to use any pesticide for any purpose, and to make pesticide recommendations for hire (ex. as a crop consultant). Certified commercial applicators working *for hire* must have a pesticide business license or work for someone who does. Registered technicians working *for hire* must work for a licensed pesticide business.
  - *Not-for-hire* commercial pesticide applicator certification requirements vary. People who do not work for hire but do use pesticides on the job must be certified if:
    - Using restricted-use pesticides, or
    - Using any pesticides on the sites in the following list:
      - on any area open to the public at the following establishments:
        - \* Educational institutions,
        - \* Health-care facilities,
        - \* Day-care centers, or
        - \* Convalescent facilities;
      - where open food is stored, processed or sold; or
      - on any recreational land over five acres.
  - *Inactive* status is a way to maintain certified pesticide applicator status while not employed as a pesticide user.

VDACS-OPS is responsible for the certification of applicators and for all enforcement aspects of the Virginia Pesticide Control Act and its regulations. The most current information on how to obtain and maintain pesticide certification can be found at the VDACS website: <https://www.vdacs.virginia.gov/pesticide-applicator-certification.shtml>

**III. Recertification**

Private and commercial pesticide applicators and registered technicians must participate in an ongoing pesticide education program. At a minimum, commercial pesticide applicators and registered technicians must attend at least one fully approved recertification session, per category, every two years before their certificate expires. Private pesticide applicators must accumulate three credits per category every two years before their certificate expires. Pesticide applicators may accumulate up to four years of recertification credit. Persons who fail to recertify will not be able to renew their certificates.

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Virginia Cooperative Extension (VCE), pesticide-related trade and professional organizations, and others offer pesticide recertification courses. A listing of all Virginia-approved courses may be obtained from the following:

Virginia Cooperative Extension offices

Virginia Tech Pesticide Programs (VTPP):

[www.vtpp.ext.vt.edu/](http://www.vtpp.ext.vt.edu/) (private applicator courses; searchable database)

VDACS-OPS/Certification, Licensing, Registration, and Training Unit:

<http://www.vdacs.virginia.gov/pesticide-applicator-training.shtml> (commercial applicator courses only)

Program availability varies by time of year and by category. Most courses are offered between September and March. Applicators are advised to keep in touch with Virginia Cooperative Extension and/or professional organizations to avoid missing recertification opportunities.

Certified applicators based out of state may be able to become certified and recertify in Virginia by reciprocity. Contact the VDACS-OPS for more information.

Failure to maintain a certificate, either due to failure to respond to the renewal notice or failure to recertify, will result in expiration. Persons who allow their certificate(s) to lapse (for more than 60 days) must retest.

*Applicators must inform VDACS-OPS if their address changes.*

### IV. Supervise Employees

#### A. Registered Technicians by Commercial Pesticide Applicators

Certified commercial pesticide applicators must provide on-the-job training, instruction, and supervision of registered technicians employed by them or assigned to them by their employer. Registered technicians may use restricted-use pesticides only under the direct supervision of a commercial pesticide applicator. Certified pesticide applicators are responsible for the work of registered technicians under their supervision and must provide the registered technicians with clear, specific instructions on all aspects of pesticide use. A registered technician may apply general-use pesticides unsupervised.

Uncertified persons may apply pesticides commercially while in training to become registered technicians *only* when under the direct, *on-site* supervision of a properly certified commercial pesticide applicator.

#### B. Uncertified Handlers by Private Pesticide Applicators

Uncertified but competent persons may apply restricted-use pesticides in the production of agricultural commodities on private property when under the direct supervision of a certified private pesticide applicator. The certified private pesticide applicator is responsible for the actions of the uncertified person.

*Direct supervision* means the act or process by which the application of a pesticide is made by a competent person acting under the instructions and control of a certified pesticide applicator who is responsible for the actions of that person. The supervising certified pesticide applicator must be accessible to the applicator by either being physically present nearby or within reach by telephone or radio.

### V. Handle Pesticides Safely

Although there are no specific storage and disposal regulations in Virginia, unsafe use/handling/storage/disposal practices can be cited under the enforcement regulation: 2 VAC 20-20-10 through 20-220 (VAC is the Virginia Administrative Code).

Provisions to Note:

#### **Handling and Storage:**

“No person shall handle, transport, store, display, or distribute pesticides in a manner which may endanger humans or the environment, or food or feed or other products...”

#### **Disposal:**

“No person shall dispose of, discard, or store any pesticide or pesticide containers in a manner that may cause injury...or pollute...”

**Application Equipment:**

“...must...be in good working order...dispense the proper amount of material...be leakproof...have cutoff valves and backflow prevention...”

**Service Container Labeling:**

Containers other than the original registrant’s or manufacturer’s containers used for the temporary storage or transportation of pesticide concentrates or end-use dilutions must have abbreviated labeling for identification.

**A. Pesticide Concentrate:**

1. If the pesticide to be temporarily stored or transported is a concentrate to be further diluted, the container shall bear a securely attached label with the following information:
  - a. Product name or brand name from product label;
  - b. EPA registration number from the product label;
  - c. Name and percentage of active ingredient(s) from the product label; and
  - d. Appropriate signal word; i.e., Poison, Danger, Warning, Caution (from the product label).
2. The above labeling is required for concentrate service containers, regardless of container type, size, or capacity. (Note: If possible, keep pesticides in their original container.)

**B. Pesticide End-Use Dilutions or End-Use Concentrates:**

1. If the pesticide to be temporarily stored or transported will be applied without further dilution, its container must bear a securely attached label with the following information:
  - a. Product name (brand name from product label) preceded by the word “Diluted” or “End-Use Concentrate”;
  - b. EPA registration number from the concentrate product label;
  - c. Name of active ingredient(s) and percentage(s) of end-use dilution; and
  - d. Appropriate signal word; i.e., Poison, Danger, Warning, Caution (from the product label).
2. Exemptions: abbreviated service container labeling is not required for:
  - a. End-use dilution containers not exceeding 3 gallons liquid or 3 pounds dry capacity, when such containers are used as application devices; i.e., hand-held sprayers, dusters, puffers, etc.
  - b. Containers used by farm-supply dealers for the temporary storage or transportation of pesticide concentrate or end-use dilution, provided that sales invoices or delivery tickets adequately identifying the pesticide(s) accompany each shipment or delivery.
  - c. Farm concentrate or end-use dilution containers or application equipment used for the temporary storage or transportation of such pesticides for agricultural use.
  - d. Aircraft-mounted containers used for temporary storage or transportation of concentrate or end-use dilution pesticides, provided that aircraft logs or other documents on board adequately identify the pesticide(s).

**VI. Keep Accurate Records**

**A. Commercial Pesticide Applicators**

Virginia regulations require all commercial pesticide applicators to keep records of all pesticide applications. These records must be maintained for two years following the pesticide use. Commercial pesticide applicator records must contain the following information:

1. Name, address, and telephone number (if applicable) of the treatment site property owner, and address/location of the application site, if different;

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2. Name and certification number of the person making or supervising the application;
3. Date of application (day, month, year);
4. Type of plants, crops, animals, or sites treated;
5. Principal pest(s) to be controlled;
6. Acreage, area, number of plants or animals treated, or size of structure treated;
7. Identification of pesticide used:
  - Brand name or common name of pesticide used, and
  - EPA product registration number;
8. Amount of pesticide concentrate and amount of diluent (water, etc.) used, by weight or volume, or the volume and concentration applied to a structure as defined in #6; and
9. Type of application equipment used.

### Commercial Pesticide Applicators and WPS Compliance:

Commercial pesticide applicators who apply pesticides to agricultural commodities on farms, forests, nurseries, and greenhouses should be sure their record data elements conform to those required by both the **Worker Protection Standard (WPS)** and the **Food, Agriculture, Conservation, and Trade (FACT) Act**, also known as the 1990 Farm Bill.

- If a grower hires a commercial pesticide applicator to apply a restricted-use pesticide, the applicator is responsible for making and maintaining all appropriate pesticide application records.
- If a grower with farm-worker or pesticide-handler employees hires a commercial pesticide applicator to apply any pesticide, the commercial pesticide applicator must provide the grower with information about the application in advance. This is necessary so that the grower can comply with WPS notification, restricted-entry, and record-keeping requirements.

A sample commercial pesticide applicator record-keeping form follows at the end of this section.

### B. Private Pesticide Applicators

The Food, Agriculture, Conservation and Trade (FACT) Act, also known as the 1990 Farm Bill, requires certified private pesticide applicators to record applications of restricted-use pesticides (RUPs). RUP applications made by a private pesticide applicator must be recorded within 14 days and maintained for a period of two years. Private pesticide applicator records must contain the following nine data elements:

1. The restricted-use pesticide brand or product name;
2. The EPA registration number;
3. The total amount of the restricted-use pesticide product applied;
4. The month, day, and year of application;
5. The location of the treated area;
6. The crop, commodity, stored product, or site to which the restricted-use pesticide was applied;
7. The size of area treated;
8. The name of the certified applicator who applied or supervised the application of the restricted-use pesticide; and
9. The certificate number of the person named in number 8, who made or supervised the application.



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Records of spot-treatments may require less information. A spot application is a treatment of an area totalling less than one-tenth of an acre made on the same day. For spot applications record:

1. Brand or product name;
2. EPA registration number;
3. Total amount applied;
4. Month, day, and year of application; and
5. Location of treated area, designated as a “spot application” (with a brief but concise description of the site).

Recording the name and certificate number of the certified private pesticide applicator who made or supervised the RUP spot treatments is recommended, although it is not required by federal law.

**(Note: Nursery and greenhouse RUP applications do NOT qualify as spot treatments. Greenhouses and nurseries must record all required recordkeeping data elements.)**

Certified pesticide applicators are required to make records available, upon request, to any Federal or State agency that deals with pesticide use or any health or environmental issue related to the use of RUPs. In addition, medical professionals may require access to records in the event of an exposure.

The FACT Act requires commercial pesticide applicators to provide a copy of a restricted-use pesticide application record to the person for whom the application was made within 30 days of the application. However, if a grower has employees, he/she should obtain the record information prior to any for-hire application — RUP or not — to ensure compliance with WPS posting and notification requirements.

The Federal Worker Protection Standard (WPS) also involves some recordkeeping. Growers who employ field workers or pesticide handlers must display pesticide use and safety information at a central location. WPS requires growers who employ agricultural workers to make, maintain, and post pesticide application records. WPS application records must be kept for every pesticide used on the farm, not just for those that are restricted-use. Growers must post information about each application for 30 days after the expiration of the restricted-entry interval (REI). In addition, this information must be kept on file for two years. A WPS application list must record:

1. Brand or product name;
2. EPA registration number;
3. Active ingredient(s) of the product used;
4. Location of the treated area;
5. Time and date of the application; and
6. Restricted entry interval for the pesticide (duration and expiration).

WPS application information and safety data sheets (SDSs) must be displayed at a central location within 24 hours of the end of an application, and before workers enter the treated area. Application information and SDSs must be posted for 30 days after the restricted-entry interval (REI) expires—and kept on file for two years following. On-file application information and SDSs must be available to workers, handlers, designated/authorized representatives (identified in writing), or treating medical personnel upon request.

Additionally, employers will be required to keep records of WPS training. Please keep in touch with your local Extension agent for the latest information on record-keeping. Your agent will also know about WPS and other pesticide laws and regulations affecting agricultural producers. A sample record-keeping form for producers follows at the end of this section.







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### **VII. Report Pesticide Accidents**

Pesticide accidents or incidents that constitute a threat to any person, to public health or safety, and/or to the environment must be reported. Telephone notification is required within 48 hours. A written report describing the accident or incident must be filed within 10 days of the initial notification.

Telephone contacts and written reports should be directed to:

Virginia Department of Agriculture and Consumer Services  
Office of Pesticide Services/Enforcement and Field Operations  
P. O. Box 1163, Richmond, VA 23218  
(804) 371-6560

In the event of an emergency release, notify local authorities immediately, and contact the Virginia Department of Emergency Management (VDEM) Operations Center at 1-800-468-8892 or (804) 674-2400.

If the accident or incident involves a spill which may pose a threat to people and/or the environment, the applicator should contact VDACS-OPS to determine whether the release is governed under SARA Title III (the Community Right-to-Know Law). The chemical hazard and the volume of the released chemical determine reporting under SARA Title III, which involves notifying the National Response Center at 1-800-424-8802.

### **Sources of Information**

Questions regarding federal and state pesticide regulations, the legal responsibilities of pesticide users, and certificate/license status:

Virginia Department of Agriculture and Consumer Services (VDACS)  
Office of Pesticide Services (OPS)  
P.O. Box 1163  
Richmond, VA 23218

(804) 786-3798

<https://www.vdacs.virginia.gov/pesticides.shtml>

Questions regarding federal and state pesticide regulations, legal responsibilities of pesticide users, pesticide management techniques, and sources of approved preparatory training sessions and recertification workshops:

Virginia Cooperative Extension (VCE)  
Virginia Tech Pesticide Programs (MC 0409)  
302 Agnew Hall  
460 West Campus Drive  
Virginia Tech  
Blacksburg, VA 24061

(540) 231-6543

<https://vtpp.ento.vt.edu/>

Other questions regarding pesticide safety or pest management can be directed to your local Virginia Cooperative Extension office:

Local Offices: <https://ext.vt.edu/offices.html>

### **The Hazard Communication Standard**

As of May 23, 1988, all employers must adhere to restrictions under the OSHA Hazard Communication Standard. This standard is a worker right-to-know law, which requires employers to train and inform all workers who may be exposed to hazardous chemicals in the workplace. The new law especially targets operations, including agricultural operators, with 10 or more employees. These employers must file a Hazard Communication Plan in their offices and inform their employees of the content of this plan. These employers must obtain and file Safety Data Sheets (SDS) for all chemicals used by their employees. In addition, employers must provide training on the information in the plan, the SDS, and chemical labeling to each employee who may be potentially exposed to a chemical hazard. This training is very specific to each operation and therefore must be

conducted by the employer. Also, when new chemical hazards are introduced into the workplace, the employer must provide new training to protect the employee.

For agricultural operators with fewer than 10 employees, it is not necessary to develop and file a Hazard Communication Plan. However, SDS and Labeling should be maintained, and employees must be informed of proper use and safe handling according to the SDS and labeling information. For more information on the standard, contact your local Extension office or the Virginia Department of Labor and Industry.

### **Community Right To Know (SARA Title III)**

The Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) was drafted to require industries and others producing or storing hazardous chemicals to provide communities with the identity and amounts of chemicals located in their vicinity. The law also addresses the need for communities to establish emergency response plans to follow in the event of an emergency.

Section 302 requires a facility to send a one-time written notification to the Virginia Emergency Response Council (VERC) and its jurisdictional local Emergency Planning Committee (LEPC) if the presence of an Extreme Hazardous Substance (EHS) at the facility, at any time, exceeds or equals the threshold planning quantity (TPQ) for that material. For more information, visit this section of the Virginia Department of Environmental Quality website: <https://www.deq.virginia.gov/land-waste/superfund-amendments-and-reauthorization-act-sara>.

### **Worker Protection Standard for Agricultural Pesticides**

The EPA's Worker Protection Standard for Agricultural Pesticides (WPS) was developed to protect workers and pesticide handlers from exposures to agricultural pesticides, thus reducing the risks of pesticide poisonings and injuries. The WPS targets workers who perform hand-labor operations in agricultural fields, nurseries, greenhouses, and forests treated with pesticides. It also affects employees who handle pesticides (mix, load, apply, etc.) for use in those locations. Labels of pesticides used in agricultural plant production, nursery/greenhouse operations, and forestry refer to WPS requirements.

WPS has requirements referenced (*but NOT explained in detail*) on pesticide labels. You will find general information about WPS in the Virginia Core Manual: *Applying Pesticides Correctly*. For comprehensive information, consult the EPA manual: *How to Comply with the Worker Protection Standard for Agricultural Pesticides*. If you have questions about the WPS, please contact your local Extension agent or call the VDACS-OPS at (804) 786-4845.

### **Groundwater Restrictions**

The EPA and Congress have placed special emphasis on protection of water resources. Water quality programs are being implemented in education and research programs throughout the country. Federal and state efforts to protect groundwater are resulting in revised pesticide product label instructions and new use restrictions. Applicators should expect a continued emphasis on protection of water supplies.

As an applicator and landowner, you must adhere to label restrictions and should follow the best management practices in handling pesticides. Particular attention should be given to prevention of spills, backsiphoning, and disposal of pesticides. Applicators can do much to prevent contamination by following label directions and maintaining and calibrating application equipment. In Virginia, it is against the law to use equipment in poor repair or to fill tanks directly from a water source without an anti-siphon device in use on the spray equipment.

For more information on anti-siphon devices, sometimes referred to as back-flow preventers, contact your local water authority. (*Note: most check valves do not qualify as "anti-siphon" devices because they do not break the siphon.*)

### **Endangered Species Pesticide Use Restrictions**

Under the authority of the Endangered Species Act and FIFRA, the U.S. Fish and Wildlife Service and the EPA may restrict pesticide use where such use jeopardizes a federally listed threatened or endangered species.

The EPA's Endangered Species Protection Program (ESPP) is designed to protect federally listed endangered and threatened species from exposure to pesticides. The program's goal is to ensure that pesticide use does not adversely affect the survival, reproduction, and/or food supply of listed species.

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The agency will inform users of enforceable use limitations by means of ESPP Bulletins. Bulletins will provide product users with information about geographically-specific pesticide use restrictions. Bulletins will be referenced on pesticide product labels and available on the internet at [www.epa.gov/espp](http://www.epa.gov/espp). (Internet search tip: At the main ESPP page, click on “Bulletins Live! Two” to view pesticide use limitations for a specific county or active ingredient.)

Applicators using a product with an ESPP reference on the label must check for—and access—a bulletin no more than 6 months prior to applying this pesticide. Failure to follow label-referenced bulletin instructions and provisions, whether or not that failure results in harm to a listed species, is subject to enforcement under the misuse provisions of FIFRA and state law.

Note that not all pesticide active ingredients will have restrictions, and not all pesticide uses are banned in restricted areas.

Please observe pesticide labeling for changes and keep up to date on this topic. Information is available through your local Extension office or VDACS.

### ***Guidelines for Disposal of Pesticides and Empty Containers***

Always dispose of pesticides and empty containers so they pose no hazard to humans or the environment. Follow label directions and consult your local Extension agent if you have questions. The best solution to the problem of what to do with excess pesticide is to avoid having any. Waste minimization strategies include:

- Buy only the amount needed for a year or a growing season.
- Minimize the amount of product kept in storage.
- Calculate how much diluted pesticide you will need for a job, and mix only that amount.
- Apply pesticide with properly calibrated equipment.
- Use all pesticides in accordance with label instructions.
- Purchase pesticide products packaged in such a way as to minimize disposal problems, or packaged in containers that have legal disposal operations available in your area.

The best disposal option for excess usable pesticide is to find a way to apply the material as directed by the label. Please note that the total amount of active ingredient applied to a site, including all previous applications, must not exceed the rate and frequency allowed by the labeling.

Other pesticide waste disposal options include:

- Follow valid label disposal directions.
- Return product to the dealer, formulator, or manufacturer.
- Participate in a federal indemnification program for canceled/suspended products.
- Employ a professional waste-disposal firm.
- Participate in a state or local “clean day,” such as the Virginia Pesticide Control Board-sponsored Pesticide Disposal Program.

Pesticide wastes that cannot be disposed of right away should be marked to indicate the contents and then stored safely and correctly until legal disposal is possible.

EPA container and containment regulations require registrants to place instructions for container cleaning on product labels. In addition, users should read the label to learn if a container is refillable or non-refillable. One-way, non-refillable containers will have guidelines for proper cleaning and disposal.

Federal law (FIFRA) requires pesticide applicators to rinse “empty” pesticide containers before discarding them. Pesticide containers that have been properly rinsed can be handled and disposed of as non-hazardous solid waste. However, the containers of some commonly used pesticides are classified as hazardous waste if not properly rinsed. Proper disposal of hazardous waste is highly regulated. Improper disposal of a hazardous waste can result in high fines and/or criminal penalties.

A “drip-drained” pesticide container contains product. Immediate and proper rinsing generally removes more than 99 percent of container residues. Properly rinsed pesticide containers pose minimal risk to people and their environment.

There are two methods for proper rinsing:

- Triple Rinsing, and
- Pressure Rinsing.

Pesticide containers should be rinsed as soon as they are emptied. So, the time to rinse is during mixing/loading. If containers are rinsed as soon as they are emptied, the rinse water (rinsate) can be added to the spray tank. This avoids the problem of rinsate disposal and makes sure that nothing is wasted. If containers are rinsed immediately, residues do not have time to dry inside. Dried residues are difficult (or impossible!) to remove. Never postpone container rinsing!

***Be sure to wear protective clothing when rinsing pesticide containers. See the product label for information on what to wear.***

## **Pesticide Internet/Phone Sales – Buyers Beware**

As a general rule, applicators should be wary about buying pesticide products “sight unseen.” Here is a general description of problems often associated with sales offers:

1. The product actually contains a very low percentage of pesticide active ingredient per unit volume. So, it is actually quite expensive to use on a per-area basis.
2. Weed control products containing a small proportion of herbicide formulated with diesel fuel or some other petroleum product. These are generally not recommended and not usable in many situations.
3. The product name is similar to the trade name of another well-known pesticide product or sounds like one from a major pesticide manufacturer’s line.
4. The solicitor gives an EPA establishment number but not an EPA registration number. In many cases, this is because the product is not registered with EPA.
5. The product is not registered with VDACS, despite being offered for sale in the commonwealth. This is an illegal practice.

If the potential buyer wishes to follow up on a sales solicitation, he/she should ask for the following information: company name, address, and telephone number; name of salesperson; product name; product registration number; percent active ingredient(s) per unit volume; use site(s); and use rate(s). It is wise to ask for a copy of the label and product MSDS before making a commitment to purchase. If a salesperson does not provide the information you request, the “bargain” is better passed.

Information given over the internet/telephone can be verified, and the claims for the product can be compared to industry standards or known performance data for the product’s active ingredient(s). To check federal and state product registrations, call:

VDACS-OPS (804) 786-3798 or your local Virginia Cooperative Extension office.

If you receive what you suspect to be an improper sales offer, you’re encouraged to get as much information as possible and make a complaint to VDACS-OPS by calling (804) 786-3798.

Based on the difficulties associated with internet/telephone solicitations, pesticide users are advised to buy from established dealers and from sellers they know.

## **Pesticide Use Precautions**

Efficient and economical control of insects, plant diseases, and weeds is a factor in the production of all crops. Both management costs and losses resulting from inadequate control can reach tremendous proportions. The use of today’s pesticides requires a great degree of precision. In some instances, rates are given in ounces per acre. This requires that pesticide users know how to calibrate equipment and follow detailed directions on product labels.

All pesticides should be used with care. The following suggestions will help minimize the likelihood of injury (from exposure to such chemicals) to people, animals, and the environment.

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*Read the Label:* Before buying and applying pesticides, always read all label directions. Follow them exactly when you handle and apply the product. Notice warnings and cautions before opening the container. Repeat the process every time, no matter how often you use a pesticide. The label directions for pesticides often change. Apply materials only on crops specified, at the rate(s) and times indicated on the product label.

*Store Pesticides Properly:* A suitable storage site for pesticides protects:

- People and animals from accidental exposure.
- The environment from accidental contamination.
- Stored products from damage (from temperature extremes and excess moisture).
- The pesticides from theft, vandalism, and unauthorized use.

All pesticides should be stored under lock and key, outside the home. Storage facilities should be well-ventilated and well-lit. Pesticide storage areas should be located away from water sources such as ponds or wells. However, a supply of clean water for decontamination is recommended. Use non-porous materials for flooring and shelving. It is important to arrange materials in the storage site so cross-contamination does not occur. Do not store pesticides with food, feed, seed, or fertilizer. An emergency plan should be worked out with local authorities, notifying them of the contents of pesticide storage facilities. If substantial quantities of highly toxic pesticides are stored, you must notify (according to law) your local Emergency Response Council. Proper records should be maintained to provide an up-to-date list of contents at all times. Always store pesticides in their original containers and keep them tightly closed. Never keep pesticides in unmarked containers.

*Avoid Physical Contact with Pesticides:* Never smoke, eat, chew tobacco, or use snuff while handling or applying pesticides. Use the protective clothing and equipment the label requires. Protect your eyes from pesticides at all times. Avoid inhaling sprays or dusts. Do not spill pesticides on skin or clothing. If they are accidentally spilled, remove contaminated clothing immediately and wash exposed skin thoroughly. Wash hands and face and change to clean clothing after applying pesticides. Wash protective clothing, separate from the family laundry, each day, before re-use. Do not spray with leaking hoses or connections. Do not use the mouth to siphon liquids from containers or to blow out clogged lines, nozzles, etc. **See a doctor if symptoms of illness occur during or after the use of pesticides.** A list of Poison Control Centers located in and around Virginia is included in this guide.

*Apply Pesticides Carefully:* Successful pest control requires application of the correct amount of pesticide uniformly over a targeted area. Pesticide application is a precise operation requiring reliable, properly calibrated equipment. For example, many herbicides have narrow ranges of selectivity. At the suggested rates of application, they will generally control weeds without damaging the crop, but at a slightly higher rate they may damage or kill the crop.

*Dispose of Pesticides Correctly:* All pesticides should be disposed of according to container directions. All empty containers should be triple rinsed (or equivalent), crushed/punctured (to make the container unusable), and disposed of as directed by the product label. Rinsate should be placed in the spray tank at the time of mixing. Leftover diluted pesticides should be used according to label directions. Leftover concentrates should be disposed of according to EPA guidelines only after exhausting other options. Amounts of chemicals that do not qualify for disposal under these guidelines must be disposed of by an approved hazardous-waste handler.

*Protect Pets, Fish, and Wildlife:* To protect fish and other wildlife, do not apply pesticides to streams or areas where drainage may be expected to enter waterways unless the product is labeled for use in such areas. Incorporate all granular pesticides into the soil to prevent birds and other animals from eating particles. Scout fields for dead animals and birds before and after application. Remove any carcasses to prevent poisoning of birds-of-prey and scavengers. Report any wildlife poisonings to the Virginia Department of Wildlife Resources. Be aware of bee cautions; see section to follow on protecting honeybees from pesticides.

Cover food and water containers when treating around livestock or pet areas. Do not discard leftover materials into drainage channels. Confine chemicals to the property and crop being treated.

*Prevent Drift:* Drift can be a problem with any pesticide. However, herbicide drift is the most commonly encountered cause of pesticide damage to susceptible crops. No pesticide can be applied by either aerial or ground equipment without some drift. Spray drift is influenced by a number of factors, including, droplet size, environmental conditions, and equipment configuration and operation.



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To minimize particle drift, application should be made as close to the ground as possible using spray nozzles which produce large droplets and eliminate “fines.” In some instances, spray additives may be used to reduce drift.

Some highly volatile herbicide products are capable of causing injury to off-target plants by movement in the vapor phase after the spray has dried. Use low-volatility formulations and avoid making spray applications when the temperature is high and humidity is low to reduce the possibility of vapor drift.

The farmer and the applicator are liable for damages caused by particle drift or volatility.

*Select Pesticide Products Wisely:* Two or more pesticides may be equally effective in a given situation. Also, the same active ingredient may be available in a variety of formulations. Your selection of a pesticide and its formulation will be determined by the:

1. Site/crop to be treated.
2. Pest species involved.
3. Product availability.
4. Equipment availability.
5. Hazards to humans, domestic animals, wildlife, and desirable plants.
6. Time of application.
7. Relative total costs of materials and application.

All recommended rates of application are based on the amount of active ingredient in a given product. Many commercial products vary in the percentage of active ingredient. The label will give the exact amount of active ingredient in the container and the amount of product to be used in a given area.

To make an accurate cost comparison, it is wise to calculate the cost per area. In general, concentrated products are more economical. However, they may require more handling (measuring, mixing, and loading) than ready-to-use products.

## **Poisonings**

The procedure to be followed *in case of suspected poisoning*:

- (1) Call a physician immediately. If a doctor is not available, take the exposed person to the nearest hospital emergency room along with the product label and safety data sheet. (If you take a label affixed to a product container, do not carry it in the passenger compartment of a vehicle.)
- (2) If necessary, the attending physician will call the nearest poison control center for further information on toxicity of the suspected agent, treatment, and prognosis. The EPA publication *Recognition and Management of Pesticide Poisonings* is an invaluable resource and can be viewed, downloaded here: <https://www.epa.gov/pesticide-worker-safety/recognition-and-management-pesticide-poisonings>, or ordered online.
- (3) You may call a poison control center for information. However, don't delay seeking medical attention.

NOTE: This information is correct to the best of our knowledge. Listings below were checked for this revision. Please note that this information is subject to change. You should confirm locations and phone numbers of nearby emergency contacts now rather than at the time of a poisoning incident.

## **Poison Information and Treatment Resources For Virginians**

### ***National Poison Control Center***

Toll-Free Number for all U.S.: (800) 222-1222

**Calls to this number will be routed to the closest Regional/Area Poison Control Center.**

Website for the American Association of Poison Control Centers is: [www.aapcc.org/](http://www.aapcc.org/)

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### **Regional Poison Control Center**

Provides 24-hour information and consultation services by Poison Information Specialists and board-certified Medical Toxicologists. Located in a hospital equipped for all toxicologic (poison) emergencies.

#### **CHARLOTTESVILLE, VA.**

##### **Blue Ridge Poison Center**

University of Virginia Health Systems

Jefferson Park Place

1222 Jefferson Park Avenue

Charlottesville, VA 22908

**(800) 222-1222 or (800) 451-1428**

<https://med.virginia.edu/brpc/>

### **Area Poison Control Centers**

Hospitals with staff who will provide poison information by telephone. Hospitals equipped for most toxicologic emergencies.

#### **WASHINGTON, D.C.**

##### **National Capital Poison Center**

3201 New Mexico Ave., NW, Suite 310

Washington, DC 20016

**(800) 222-1222**

<https://www.poison.org/>

#### **CHARLESTON, W.V.**

##### **West Virginia Poison Center**

3110 MacCorkle Ave., SE

Charleston, WV 25304

**(800) 222-1222**

[www.wvpoisoncenter.org/](http://www.wvpoisoncenter.org/)

#### **RICHMOND, VA.**

##### **Virginia Poison Center**

Virginia Commonwealth University Medical Center, VCU Health System

1250 East Marshall Street

PO Box 980522 - Richmond, VA - 23298-0522

**(800) 222-1222 or (804) 828-9123**

(Calls from Central and Eastern Va. only)

<https://poison.vcu.edu/>

A complete list of Poison Control Centers is available on the World Wide Web at [www.aapcc.org/](http://www.aapcc.org/)

### **Pesticide Information Directory**

This directory is intended for use by persons who need assistance with general and emergency pesticide-related information. We hope that it will save time and money by directing you to the proper government and industry sources.

The pages that follow include **Emergency Information, General Information, and Industry Associations**. In the blank lines provided, please take time to list your local phone numbers for these sources. In the case of an emergency, it might save a life, as well as possible added expense and inconvenience. Keep a copy of this guide, with this directory section marked, near your phone and/or in your service vehicle for future reference.



## 1-18 Regulations and Basic Information: Safe and Effective Use

<b>Community Right-to-know Environmental Programs</b>	<b>Department of Environmental Quality</b> 629 East Main Street P.O. Box 1105 Richmond, VA 23218 <a href="https://www.deq.virginia.gov/">https://www.deq.virginia.gov/</a>	(804) 698-4000 (800) 592-5482
<b>EPA Cooperator</b> for general pesticide information	<b>National Pesticide Information Center (NPIC)</b> Ag. Chemistry Extension Oregon State University 310 Weniger Hall Corvallis, OR 97331-6502 <a href="http://npic.orst.edu/">http://npic.orst.edu/</a>	(800) 858-7378 M-F 11:00 am – 3:00 pm ET
<b>Animal Poisonings Assistance</b>	<b>Va.-Md. Regional College of Veterinary Medicine</b> 265 Duck Pond Drive Virginia Tech (0442) Blacksburg, VA 24061 <a href="https://vetmed.vt.edu/">https://vetmed.vt.edu/</a>	(540) 231-4621 (hospital) Ask your veterinarian to call on your behalf
	<b>ASPCA Animal Poison Control Center</b> University of Illinois at Urbana-Champaign College of Veterinary Medicine 2001 S. Lincoln Ave. Urbana, IL 61802 <a href="https://www.asPCA.org/pet-care/animal-poison-control">https://www.asPCA.org/pet-care/animal-poison-control</a>	(888) 426-4435
<b>Toxicology Information</b>	<b>Virginia Dept. of Health</b> Division of Environmental Epidemiology/Toxicology Program 109 Governor Street P.O. Box 2448 Richmond, VA 23218 <a href="https://www.vdh.virginia.gov/">https://www.vdh.virginia.gov/</a>	(804) 864-8127 (toxic substance information)
<b>EPA Safe Drinking Water Hotline</b>	For information on drinking water regulations and pesticides in drinking water. <a href="https://www.epa.gov/ground-water-and-drinking-water">https://www.epa.gov/ground-water-and-drinking-water</a>	(800) 426-4791 M-F 10:00 am-4:00 pm
<b>Hazard Communication/OSHA Compliance Information</b>	<b>Virginia Dept. of Labor &amp; Industry</b> 600 East Main Street Suite 207 Richmond, VA 23219 <a href="https://www.doli.virginia.gov/">https://www.doli.virginia.gov/</a>	(804) 371-2327 M-F 8:15 am – 5:00 pm

## Industry Associations

<b>Croplife America</b> 4201 Wilson Boulevard, Suite 700 Arlington, VA 22203	(202) 296-1585 <a href="http://www.croplifeamerica.org/">www.croplifeamerica.org/</a>
<b>Virginia Crop Production Association, Inc. (VCPA)</b> 6442 Cross Keys Road Mt. Crawford, VA 22841	(540) 234-9408 <a href="http://www.vacropproduction.com">www.vacropproduction.com</a>
<b>Responsible Industry for a Sound Environment (RISE)</b> 4201 Wilson Boulevard, Suite 700 Arlington, VA 22203	(202) 872-3860 <a href="http://www.pestfacts.org/">www.pestfacts.org/</a>

This directory neither endorses the groups listed nor intends to exclude those not listed. To be included in future revisions contact Virginia Tech Pesticide Programs, 302 Agnew Hall (0409) Virginia Tech, Blacksburg, VA 24061, telephone: (540) 231-6543.

## **Protective Clothing and Equipment**

Dermal exposures account for most of all handler exposures that occur during liquid spray applications. Wearing protective clothing will prevent pesticides from coming into contact with the skin. Any body covering will provide some protection, because dermal absorption is reduced to some degree by a fabric barrier. Protective clothing may be classified according to the part of the body it protects; i.e., feet (boots and shoes), hands (gloves), eyes (goggles and faceshields), head (hats and hoods), and trunk and arms and/or legs (jackets, shirts, pants, coveralls, overalls, and raincoats).

Because of its comfort, conventional work clothing is worn most often. Wearing cotton clothing with a stain-repellent finish provides some protection from dusts and spray mists. However, cotton fabric will provide little or no protection from accidental spills of concentrated pesticides.

Use chemical-resistant garments when handling pesticide concentrates and applying liquids. Adjust work habits and take precautions to prevent heat exhaustion.

## **Cleaning/Laundering Recommendations**

Before laundering pesticide-contaminated clothing, read the pesticide label. Key words on all pesticide labels identify the toxicity of the product: **DANGER POISON** (highly toxic), **WARNING** (moderately toxic), and **CAUTION** (slightly toxic). Wear chemical-resistant gloves when handling pesticide-contaminated clothing and equipment.

1. **Cotton or Denim Fabric** - Hold and wash contaminated clothing separately from the family wash. Pesticide residues may be transferred from contaminated clothing to other clothing in a hamper, and clothing worn when handling pesticides requires extra washing steps.

Note: Regular laundering will not clean fabric contaminated with highly toxic and/or concentrated pesticide. Clothing saturated with either should be discarded, after slashing/cutting to make the item unusable.

Pre-treating contaminated clothing before washing will help remove pesticide particles from the fabric. This can be done by:

1. Pre-soaking in a suitable container.
2. Pre-rinsing with agitation in an automatic washing machine.
3. Spraying/hosing garments outdoors.
4. Pretreating soiled areas with heavy-duty liquid detergent or a stain-removal product.

Clothing worn while using slightly toxic pesticides may be effectively laundered in one machine washing. It is strongly recommended that multiple washings be used on clothing worn while applying more toxic pesticides. Also, multiple wash cycles are recommended for protective clothing treated with starch or water/stain repellents.

When machine-washing, use a full tank of hot water. Choose heavy-duty liquid detergent. Heavy-duty detergents are particularly effective in removing oily soils (the kind emulsifiable concentrate formulations make). In addition, their performance is not affected by water hardness. Increasing the amount of detergent used is recommended, especially if the fabric has been treated with a stain/water repellent finish.

If several garments are contaminated, wash only one or two garments in a single load. Wash garments contaminated by the same pesticide(s) together. Use a full water level to allow the water to thoroughly flush the fabric.

Clothing exposed to pesticides should be laundered daily. It is much easier to remove pesticides from clothing by daily laundering than attempting to remove residues that have accumulated over a period of time.

Pesticide carry-over to subsequent laundry loads is possible because the washing machine may retain residues, which are then released in following loads. Rinse the washing machine with an "empty load," using hot water, the same detergent, and machine settings and cycles used for laundering contaminated clothing.

Line drying is recommended for these items. Many pesticides break down when exposed to heat and sunlight. Line drying eliminates the possibility of residues collecting in the dryer.

When dry, apply fabric starch or stain repellent on clothing.

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2. **Vinyl-coated fabric, neoprene, or rubber** - This type of outer protective clothing should be pan-washed in warm water using a good detergent. Double or triple washing of heavily contaminated outer protective clothing is desirable. Rinse through two water changes and hang up to air dry. Wash after each use.
3. **Chemical-resistant gloves and boots** should be rinsed before taking them off, then pan-washed inside and out using a good detergent with several rinses. Remember, gloves must be clean inside because the inner surface will be in contact with your skin. Wash boots the same as gloves.
4. **Respirators** require special care. Wash inside with a cloth, detergent, and warm water. Change filters according to instructions on the original container. Keep the respirator in a plastic bag, original container, or some other suitable container when it is not being used. Keep the respirator properly adjusted to your face. Filters and prefilters should be kept sealed in a plastic bag when not in use.
5. **Goggles** should be washed with a mild detergent so as not to scratch the lens.

Give all of your protective clothing and equipment the best of care. They may save your life.

### **Chemical Resistance**

Many pesticide labels require the use of specific personal protective equipment (PPE) — clothing and devices that protect the body from contact with pesticides or pesticide residues. Some labels call for **chemical-resistant** PPE — items that the pesticide cannot pass through during the time it takes to complete the task. The labels of a few pesticides, such as some fumigants, prohibit the use of chemical-resistant PPE. Please refer to specific product labels for details.

Most chemical-resistant PPE items are plastic or rubber. But not all these materials are equally resistant to all pesticides and under all conditions.

Three factors affect a material's chemical resistance: the exposure time, the exposure situation, and the chemical properties of the pesticide product to which the material is exposed.

Unless the pesticide label directs otherwise, do not use items that are made of — or lined with — absorbent materials such as cotton, leather, or canvas. These materials are not chemical-resistant, and they are difficult or impossible to clean after a pesticide gets on them. Even dry formulations can move quickly through woven materials and may remain in the fibers.

Look for PPE items whose labels state that the materials have been tested using American Society for Testing Materials (ASTM) test methods for chemical resistance, such as test method F739-91. Footwear — and in most cases, gloves — should be at least **14 mils** thick.

Pesticides can leak through stitching holes and gaps in seams. For chemical resistance, PPE should have sealed seams.

**Most waterproof materials are resistant to dry and to water-based pesticides.**

Dry pesticides include dusts, granules, pellets, wettable powders, dry flowables (water-dispersible granules), microencapsulated products, soluble powders, and some baits. Water-based pesticides include soluble powders and some solutions.

**The type of material that is resistant to non-water-based liquid pesticides depends on the contents of the formulation.**

Liquid pesticides that are not water-based may be emulsifiable concentrates, ultra-low-volume and low-volume concentrates, flowables, aerosols, dormant oils, and invert emulsions. Common solvents are xylene, fuel oil, petroleum distillates, and alcohol.

### **Choosing Chemical-Resistant PPE**

**If PPE Materials or Chemical-Resistance Category are not Listed on Label.**

If the pesticide label requires the use of chemical-resistant PPE but does not indicate the types of materials that are resistant to the product, select sturdy barrier-laminate, butyl, or nitrile materials. Then watch for signs that the material is not resistant to the product. If it is not, it may:

- Change color.
- Become soft or spongy.
- Swell or bubble.



- Dissolve or become jelly-like.
- Crack or develop holes.
- Become stiff or brittle.

If any of these changes occur, discard the item and choose another type of material for the task.

**If PPE Materials or Chemical-Resistance Category are Listed on Label.**

If the pesticide label specifies the PPE materials that **must** be worn when using the product, follow those instructions.

Some labels may list **examples** of PPE materials that are highly resistant to the product. The label may say, for example: “Wear chemical-resistant gloves, such as barrier laminate, butyl, nitrile, or viton.” You may choose PPE items made from any of the listed materials.

Pesticide labels sometimes specify a chemical-resistance category (A through H) for PPE to use when working with the product. This allows you to consult an EPA chemical-resistance chart (see below) for PPE material options.

**Table 1.3 - EPA Chemical Resistance Category Selection Chart**

For use when PPE section on pesticide label lists chemical resistance category

Selection Category Listed On Pesticide Label	Type Of Personal Protective Material							
	Barrier Laminate ≥ 14 mils	Butyl Rubber ≥ 14 mils	Nitrile Rubber ≥ 14 mils	Neoprene Rubber ≥ 14 mils	Natural Rubber <sup>1</sup>	Polyethylene	Polyvinyl Chloride (PVC) ≥ 14 mils	Viton ≥ 14 mils
<b>A</b> (dry and water-based formulations)	high	high	high	high	high	high	high	high
<b>B</b>	high	high	slight	slight	none	slight	slight	slight
<b>C</b>	high	high	high	high	moderate	moderate	high	high
<b>D</b>	high	high	moderate	moderate	none	none	none	slight
<b>E</b>	high	slight	high	high	slight	none	moderate	high
<b>F</b>	high	high	high	moderate	slight	none	slight	high
<b>G</b>	high	slight	slight	slight	none	none	none	high
<b>H</b>	high	slight	slight	slight	none	none	none	high

<sup>1</sup>Includes natural rubber blends and laminates

**HIGH:** Highly chemical resistant. Clean or replace PPE at end of each day’s work period. Rinse off pesticides at rest breaks.

**MODERATE:** Moderately chemical resistant. Clean or replace PPE within an hour or two of contact.

**SLIGHT:** Slightly chemical resistant. Clean or replace PPE within ten minutes of contact.

**NONE:** No chemical resistance. Do not wear this type of material as PPE when contact is possible.

When choosing an appropriate material, consider the dexterity needed for the task and whether the material will withstand the physical demands of the task. The PPE will protect you if:

- the item is in good condition, and no punctures, tears, or abrasions allow pesticide to penetrate the material, and
- pesticide does not get inside the PPE through careless practices, such as allowing pesticide to run into gloves or footwear or putting the PPE on over already-contaminated hands or feet.

**Highly Resistant PPE**

A rating of **high** means that the material is highly resistant to pesticides in that category. PPE made of this type of material can be expected to protect you for an 8-hour work period. The outside of the PPE, especially gloves, should be washed at rest breaks — about once every 4 hours. Highly resistant PPE is a good choice when handling pesticides, especially concentrates, for long periods of time.

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### Moderately Resistant PPE

A rating of **moderate** means that the material is moderately resistant to pesticides in that category. PPE made of this type of material can be expected to protect you for 1 or 2 hours. After that, replace the PPE with clean chemical-resistant PPE or thoroughly wash the outside of the PPE with soap and water. Moderately resistant PPE may be a good choice for pesticide handling tasks that last only a couple of hours.

### Slightly Resistant PPE

A rating of **slight** means that the material is only slightly resistant to pesticides in that category. PPE made of this type of material can be expected to protect you for only a few minutes after exposure to the pesticide product. Slightly resistant PPE is not a good choice for most pesticide handling tasks.

Inexpensive disposable gloves or shoe covers, such as those made from polyethylene, may be useful for such brief tasks as:

- Adjusting contaminated parts of equipment.
- Unclogging or adjusting nozzles.
- Opening pesticide containers.
- Moving open pesticide containers or containers with pesticides on the outside.
- Handling contaminated PPE.
- Climbing in and out of cabs or cockpits where the outside of the equipment is contaminated.
- Operating closed systems.

These disposable PPE items should be used only once, for a very short-term task, and then discarded. At the end of the task, it is a good idea to wash the outside of the gloves or shoe covers first, and then remove them by turning them inside out. Discard them so they cannot be reused.

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### Table 1.4 - Tables of Weights and Measures

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#### Weights:

28.35 grams = 1 ounce  
16 ounces = 1 pound = 453.6 grams  
1 pint of water = 1.04 pounds  
1 gallon of water = 8.34 pounds  
1000 micrograms = 1 milligram  
1000 milligrams = 1 gram = 0.035 ounce avoirdupois  
1000 grams = 1 kilogram = 2.2 pounds

#### Volume And Liquid Measure:

3 teaspoons = 1 tablespoon = 14.8 cubic centimeters (cc)  
2 tablespoons = 1 fluid ounce = 29.6 cc  
8 fluid ounces = 16 tablespoons = 1 cup = 236.6 cc = 1/2 pint  
2 cups = 32 tablespoons = 1 pint = 473.1 cc = 16 fluid ounces  
2 pints = 64 tablespoons = 1 quart = 946.2 cc = 0.946 liter  
4 quarts = 256 tablespoons = 1 gallon = 3785 cc  
1 gallon = 128 fluid ounces = 231 cubic inches = 3785 cc  
1 milliliter (ml) = 1 cubic centimeter = 0.034 fluid ounces  
1000 milliliters = 1 liter = approximately 1 quart, 1 fluid ounce  
1 liter of water = 1 kilogram  
1 bushel soil = 1.25 cubic feet

#### Land Measure:

43,560 square feet = 1 acre = 0.404 hectare  
1 mile = 5280 feet = 1609.35 meters  
10 millimeters = 1 centimeter = 0.3937 inches  
100 centimeters = 1 meter = 39.37 inches

#### Length Of Row Required For One Acre:

Row Spacing	Length or Distance
24 inch	7260 yards = 21,780 feet
30 inch	5808 yards = 17,424 feet
36 inch	4840 yards = 14,520 feet
40 inch	4356 yards = 13,069 feet
42 inch	4149 yards = 12,446 feet
48 inch	3630 yards = 10,890 feet

**Table 1.5 - Common Abbreviations For Pesticide Formulations**

A	=	Aerosol	M	=	Microencapsulated
B	=	Bait	P	=	Pellet
C	=	Concentrate	RTU	=	Ready to Use
D	=	Dust	S	=	Solution
DF	=	Dry Flowable (see WDG)	SP	=	Soluble Powder
E or EC	=	Emulsifiable Concentrate	ULV	=	Ultra Low Volume
F	=	Flowable	W or WP	=	Wettable Powder
G	=	Granule	WDG	=	Water Dispersible Granule (see DF)
H/A	=	Harvest Aid	WS	=	Water Soluble
IE	=	Invert Emulsion	WSP	=	Water Soluble Packet
LC	=	Liquid Concentrate			

## Calibration Tables And Information

**Table 1.6 - Travel Speed Chart**

Time Required in Seconds to Travel				
Miles per				
Hour	100 ft	200 ft	300 ft	
1	68	136	205	
2	34	68	102	
3	23	46	68	
4	17	34	51	
5	14	27	41	
6	11	23	34	
7	10	20	29	
8	9	17	26	
9	8	15	23	
10	7	14	21	

1 mph = 88 feet per minute

1 mph = 1.466 feet per second

Speed in mph = Number of 35-inch steps per minute/30

**Table 1.7 - Equivalent Quantities of Liquid Materials (Emulsifiable Concentrates, Etc.) for Various Quantities of Water**

Water	Quantity of Material					
100.0 gal <sup>1</sup>	0.5 pt	1.0 pt	2.0 pt	3.0 pt	4.0 pt <sup>1</sup>	5.0 pt
50.0 gal	4.0 fl oz	8.0 fl oz	1.0 pt	24.0 fl oz	1.0 qt	2.5 pt
5.0 gal	0.4 fl oz (2.5 tsp) <sup>2</sup>	0.8 fl oz	1.6 fl oz	2.4 fl oz	3.2 fl oz	4.0 fl oz
1.0 gal <sup>1</sup>	0.08 fl oz (0.5 tsp) <sup>2</sup>	0.16 fl oz (1.0 tsp) <sup>2</sup>	0.32 fl oz (2.0 tsp) <sup>2</sup>	0.48 fl oz (3.0 tsp) <sup>2</sup>	0.64 fl oz <sup>1</sup> (4.0 tsp) <sup>2</sup>	0.8 fl oz (5.0 tsp) <sup>2</sup>

<sup>1</sup>Example: If 4 pints of a liquid concentrate is recommended to 100 gallons of water, approximately 4 teaspoonsful of the chemical to 1 gallon of water will give a mixture of approximately the same strength.

<sup>2</sup>Approximate figure.

**Table 1.8 - Pounds of Active Ingredients per Gallon, Pounds per Pint of Liquid, and the Number of Pints for Various per Acre Rates**

Pounds of Active ingredients in one gallon of commercial product	Pounds of active ingredients per pint <sup>1</sup>	Pints of commercial product needed each acre to give the following pounds of active ingredient					
		0.25 lb/A	0.50 lb/A	0.75 lb/A	1.0 lb/A	1.50 lb/A	2.0 lb/A
2.00	0.25	1.00	2.00	3.00	4.00	6.00	8.00
2.64	0.33	0.75	1.50	2.25	3.00	4.50	6.00
3.00	0.375	0.67	1.33	2.00	2.67	4.00	5.33
3.34	0.42	0.60	1.20	1.80	2.40	3.60	4.80
4.00	0.50	0.50	1.00	1.50	2.00	3.00	4.00
6.00	0.75	0.33	0.67	1.00	1.33	2.00	2.67

<sup>1</sup>1 pint = 16 liquid ounces.

**Table 1.9 - Available Commercial Materials in Pounds Active Ingredients per Gallon Necessary to Make Various Percentage Concentrate Solutions**

Pounds of active ingredients in one gallon of commercial product	Pounds of active ingredients per pint <sup>1</sup>	Liquid ounces of commercial product per one gallon of solution to make:				
		1/2%	1%	2%	5%	10%
2.00	0.25	2.68	5.36	10.72	26.80	53.60
2.64	0.33	2.02	4.05	8.10	20.25	40.44
3.00	0.375	1.78	3.56	7.12	17.80	35.58
3.34	0.42	1.59	3.18	6.36	15.90	31.96
4.00	0.50	1.34	2.67	5.33	13.34	26.69
6.00	0.75	0.89	1.78	3.56	8.90	17.79

<sup>1</sup>Based on 8.34 pounds per gallon (weight of water).

**Table 1.10 - Converting Pounds Active Ingredients per Acre to Smaller Units for Small Plots**

*Liquid*

Cubic centimeters (ml) per 100 square feet necessary to apply the following pounds of active ingredients per acre

lbs/gal	Concentrate lbs/A															
	1/8	1/4	1/2	3/4	1	2	3	4	5	6	7	8	9	10	11	12
8.00	0.14	0.27	0.54	0.81	1.08	2.16	3.24	4.32	5.40	6.48	7.56	8.64	9.72	10.80	11.88	12.96
7.00	0.16	0.31	0.62	0.93	1.24	2.48	3.72	4.96	6.20	7.44	8.68	9.92	11.16	12.40	13.64	14.88
6.66	0.16	0.33	0.65	0.99	1.30	2.60	3.91	5.21	6.51	7.80	9.10	10.40	11.70	13.03	14.30	15.60
6.00	0.18	0.36	0.72	1.10	1.45	2.89	4.34	5.78	7.23	8.70	10.15	11.60	13.05	14.46	15.95	17.40
5.00	0.22	0.44	0.87	1.31	1.74	3.47	5.21	6.94	8.68	10.44	12.18	13.92	15.66	17.35	19.14	20.88
4.00	0.27	0.54	1.09	1.64	2.17	4.34	6.51	8.68	10.85	13.02	15.19	17.36	19.53	21.69	23.87	26.04
3.33	0.33	0.65	1.31	1.97	2.61	5.21	7.82	10.42	13.03	15.66	18.27	20.88	23.49	26.06	28.71	31.32
3.00	0.36	0.72	1.45	2.16	2.89	5.78	8.67	11.56	14.45	17.34	20.23	23.12	26.01	28.90	31.79	34.68
2.50	0.43	0.87	1.74	2.61	3.47	6.94	10.41	13.88	17.36	20.82	24.29	27.76	31.12	34.71	38.17	41.64
2.00	0.54	1.09	2.17	3.25	4.34	8.68	13.01	17.35	21.69	26.04	30.38	34.72	39.06	43.38	47.74	52.08
1.00	1.08	2.17	4.34	6.51	8.68	17.35	26.03	34.71	43.39	52.08	60.76	69.44	78.12	86.76	95.48	104.16

*Dry*

Grams per 100 square feet necessary to apply the following pounds of active ingredient per acre

% Active ingredients	lbs										
	1/2	3/4	1	2	3	4	5	7.5	10	20	50
100.0	0.52	0.78	1.04	2.08	3.12	4.15	5.19	7.79	10.39	20.77	51.94
90.0	0.58	0.87	1.15	2.31	3.46	4.62	5.77	8.66	11.54	23.08	57.71
80.0	0.65	0.97	1.30	2.60	3.90	5.19	6.49	9.74	12.98	25.97	64.92
75.0	0.69	1.04	1.38	2.77	4.15	5.54	6.92	10.39	13.85	27.70	69.25
50.0	1.04	1.56	2.08	4.15	6.23	8.31	10.39	15.58	20.77	41.55	103.87
25.0	2.08	3.12	4.15	8.31	12.46	16.62	20.77	31.16	41.55	83.10	207.75
22.5	2.31	3.46	4.62	9.23	13.85	18.46	23.08	34.62	46.17	92.33	230.83
20.0	2.60	3.90	5.19	10.39	15.58	20.77	25.97	36.37	51.94	103.87	259.69
18.5	2.81	4.21	5.61	11.23	16.84	22.46	28.07	42.11	56.15	112.30	280.74
12.5	4.15	6.23	8.31	16.62	24.93	33.24	41.55	62.32	83.10	166.20	415.50
10.0	5.19	7.79	10.39	20.77	31.16	41.55	51.94	77.91	103.87	207.75	519.37
7.5	6.92	10.39	13.85	27.70	41.55	55.40	69.25	103.87	138.50	277.00	692.50
5.0	10.39	15.58	20.77	41.55	62.32	83.10	103.87	155.81	207.75	415.50	1038.74
4.0	12.98	19.48	25.97	51.94	77.91	103.87	129.84	194.76	259.69	519.37	1298.43
2.0	25.97	38.95	51.94	103.87	155.81	207.75	259.69	389.53	519.37	1038.74	2596.86
1.0	51.94	77.91	103.87	207.75	311.62	415.50	519.37	779.06	1038.74	2077.49	5193.72

**Table 1.11 - Determination of Product Rate per Acre from Active Ingredient Rate**

(Liquid Formulations)

Active Ingredient per gallon					
Active Rate lb/A	1.5 lb	2.0 lb	3.0 lb pt/A	4.0 lb	6.0 lb
0.25	1.33	1.0	0.83	0.5	0.33
0.5	2.67	2.0	1.33	1.0	0.67
1.0	5.33	4.0	2.67	2.0	1.33
2.0	10.67	8.0	5.33	4.0	2.67
3.0	16.00	12.0	8.00	6.0	4.00
4.0	21.33	16.0	10.67	8.0	5.50
5.0	27.00	20.0	13.33	10.0	6.67

**Table 1.12 - Determination of Product Rate per Acre from Active Ingredient Rate**

(Dry Formulations)

Percentage of Active Ingredient in Product										
Active Rate lb/A	5	10	20	25	50	65	70	75	80	90
	lb/A									
0.25	5.0	2.5	1.2	1.0	0.5	0.37	0.36	0.32	0.3	0.28
0.5	10.0	5.0	2.5	2.0	1.0	0.75	0.72	0.65	0.6	0.55
1.0	20.0	10.0	5.0	4.0	2.0	1.50	1.40	1.30	1.2	1.10
2.0	40.0	20.0	10.0	8.0	4.0	3.00	2.90	2.60	2.4	2.20
3.0	60.0	30.0	15.0	12.0	6.0	4.50	4.30	3.90	3.6	3.30
4.0	80.0	40.0	20.0	16.0	8.0	6.00	5.80	5.20	4.8	4.40
5.0	100.0	50.0	25.0	20.0	10.0	7.50	7.20	6.50	6.0	5.50

## Calibration of Boom Sprayers

Be sure to calibrate your sprayer properly. NEVER exceed the labeled rate. Using too much pesticide is illegal and may injure your crop. Using too little may result in little or no pest control. Pressure, nozzle orifice size, spacing of nozzles, and speed all affect the application rate. Be sure that all of your spray equipment is in good working order and your sprayer is configured properly.

### Large-area Method

1. Measure and stake off one acre (43,560 sq ft) in the field to be treated.
2. Fill sprayer tank with water.
3. Maintain constant pressure and speed while spraying the acre. Mark pressure, throttle, and gear settings.
4. Measure the amount of water used. The amount of water necessary to refill the tank is equal to gallons per acre applied.
5. Make up the spray solution with the correct amount of chemical, based on the amount of water applied per acre.
6. Make the application at pressure, throttle, and gear settings used in calibrating.



**“Ounce” Method**

1. Mark off a test course, based on the chart below.  
(Measure nozzle spacing for booms; row spacing for directed and band rigs.)
2. Fill your tank half full (average weight). Set the throttle for spraying. Get a running start. Drive the test course three times while operating the equipment under field conditions. Record driving times (# of seconds) for each trial.
3. Calculate the average time in seconds required to drive the measured distance.
4. Run the equipment for the average time it took to drive the course, using the same settings (RPMs, pressure). Catch output during that time in a container marked in ounces. (If you are using a boom sprayer, catch the output from one nozzle. If you are using a directed/band rig, catch the spray from all nozzles per row for the prescribed time.)
5. Output in ounces = gallons per acre (GPA) applied.

**Table 1.13 - “Ounce” Method Distances**

Row Width or Nozzle Spacing (inches)	Distance (feet)	Row Width or Nozzle Spacing (inches)	Distance (feet)
48	85	30	136
46	89	28	146
44	93	24	170
42	97	20	204
40	102	18	227
38	107	15	272
36	113	10	408

This method works because the test course is 1/128<sup>th</sup> of an acre, and an ounce is 1/128<sup>th</sup> of a gallon — the proportions are the same.

**A word of caution:** Be sure to use the right nozzle (and pressure) for the job. Check ALL nozzles (or sets of nozzles, in the case of banding/directed applications) to be sure the pattern and output from each one (or each set) is the same. To check pattern, use a tray designed for this purpose or spray a hard surface and observe how the wetted area dries. Check output with a flow meter, or by catching the output from each for a short time (ex. 10 seconds). Replace any nozzles that do not match the pattern and flow rate of the one(s) you used in the calibration test.

For more information and/or for guidance on calibration methods for other types of equipment, contact your local Extension agent.

**Chemical Information Chart**

This section contains a chart listing commonly used pesticides (chemical name/trade name), their actions, their chemical resistance group number (FRAC for fungicides, IRAC for insecticides, and WSSA for herbicides), and signal word (based on acute toxicity rating).

This list is for information purposes only and is not meant to endorse or exclude any manufacturers or their products. The names are correct to the best of our knowledge. If mistakes were made, they were unintentional. Please notify the authors if corrections or additions are needed for the next edition.

**Names**

The common chemical name is the approved name given a pesticide by the American National Standards Committee. An active ingredient may have many trade names, given to a pesticide by the manufacturers/producers.

## Action

The specific actions of the pesticides listed are abbreviated as follows:

F	- fungicide	M	- molluscicide
Fum	- fumigant	Mi	- miticide
H	- herbicide	N	- nematocide
HA	- harvest aid (defoliant)	PGR	- plant growth regulator
I	- insecticide	Rep	- repellent
IGR	- insect growth regulator		

## Toxicity

Toxicity is the quality, state, or degree of being poisonous. The toxicities listed here are oral. Oral LD<sub>50</sub> (mg/kg) is the dosage in milligrams per kilogram of body weight required to kill 50 percent of test animals when given as a single dose by mouth. A milligram/kilogram (mg/kg) is equal to 1 part per million (1 lb in 500 tons). The lower the LD<sub>50</sub>, the higher the toxicity. Dermal LD<sub>50</sub> ratings are in most cases higher (lower in toxicity) than oral ratings.

When registering pesticides, the Environmental Protection Agency (EPA) uses acute LD<sub>50</sub> values based on the pesticide formulation as it is sold, to determine the toxicity category, words, and symbols that must be placed on the label. For this purpose the test animals are usually mice, rats, or rabbits. The letters LD stand for lethal dose.

**Table 1.14 - Toxicity Categories**

Toxicity Category	Signal Words* Required on Label by EPA	Oral LD <sub>50</sub> (mg/kg)	Probable Lethal Adult Human Dose
I Highly Toxic	DANGER and POISON, plus skull and crossbones symbol	0 to 50	A few drops to 1 teaspoon
II Moderately Toxic	WARNING	50 to 500	1 teaspoon to 2 teaspoons
III Slightly Toxic	CAUTION	500 to 5,000	1 ounce to 1 pint (1 pound)
IV Almost non-toxic	CAUTION	more than 5,000	1 pint (1 pound)

\***Please note:** certain products may use signal words which do not correlate with LD<sub>50</sub> ratings due to some special property of the chemical. For example, chlorothalonil has a very low toxicity (LD<sub>50</sub> 10,000 mg/kg) yet has DANGER and WARNING signal words on many of its formulations, due to a possibility of an extreme allergic reaction in some people. Also, toxicity (LD<sub>50</sub>) is relative to the concentration of active ingredient in question and the body weight of the victim.

To find the LD<sub>50</sub> for a specific pesticide product – which takes into account the toxicity of the active ingredients, its concentration, and all other components in the formulation – consult the MSDS. Remember that, if misused, any pesticide can be highly toxic to humans, domestic animals, and wildlife.

## Restricted-Use Pesticides

Products that are restricted usually have a higher toxicity, concentration, or other property which makes them more hazardous than products which are designated for general use. Refer to the product label as a guide. Applicators must be certified to use or purchase restricted-use pesticides. Contact your local Extension agent for information on how to become a certified applicator.

**Table 1.15 - Chemical Information Chart**

Common Name or Designation	Examples of Trade Names (¹=restricted use, ²=premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
2,4-D	various	H	WSSA-4	Caution-Danger
2,4-DB	various	H	WSSA-4	Danger
abamectin	Agri-Mek¹, Avid¹	I, Mi, N	IRAC-6	Warning-Danger (Poison)
acephate	Orthene	I	IRAC-1	Caution

**Table 1.15 - Chemical Information Chart (cont.)**

Common Name or Designation	Examples of Trade Names ( <sup>1</sup> =restricted use, <sup>2</sup> =premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
acetamiprid	Assail	I	IRAC-4	Caution
acetochlor	Breakfree NXT, Harness, Keystone NXT <sup>1,2</sup> , Surpass NXT, SureStart <sup>2</sup> , Warrant	H	WSSA-15	Caution-Warning
acifluorfen	Ultra Blazer, Storm <sup>2</sup>	H	WSSA-14	Danger
aldicarb	AgLogic <sup>1</sup>	I, Mi, N	IRAC-1	Danger (Poison)
ametryn	Evik	H	WSSA-5	Caution
aminopyralid	Milestone	H	WSSA-4	Caution
atrazine	Atrazine <sup>1</sup> , Bicep II Magnum <sup>1,2</sup> , Keystone NXT <sup>1,2</sup> , Lexar <sup>1,2</sup> , Lumax <sup>1,2</sup>	H	WSSA-5	Caution
avermectin	XP 820	I	IRAC-6	Caution
azadirachtin	Azera <sup>2</sup>	I, IGR, Rep	-	Warning
azoxystrobin	Abound, Affiance <sup>2</sup> , Custodia <sup>2</sup> , Dynasty, Elatus <sup>2</sup> , Quadris, Quilt Xcel <sup>2</sup> , Trivapro <sup>2</sup>	F	FRAC-11	Caution-Warning
<i>Bacillus cereus</i>	Pix Plus <sup>2</sup>	PGR	-	Caution
<i>Bacillus firmus</i>	Poncho Votivo	I	-	Caution
<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i>	DiPel	I	IRAC-11	Caution
benefin (benfluralin)	Balan	H	WSSA-3	Warning
bensulide	Prefar	H	WSSA-8	Caution
bentazon	Basagran	H	WSSA-6	Caution-Danger
benzovindiflupyr	Elatus <sup>2</sup> , Trivapro <sup>2</sup>	F	FRAC-7	Caution
bifenthrin	Bifenture <sup>1</sup> , Brigade <sup>1</sup> , Capture <sup>1</sup> , Elevest <sup>1,2</sup> , Hero <sup>1,2</sup> , Steed <sup>1,2</sup>	I	IRAC-3	Caution-Warning
boscalid	Endura	F	FRAC-7	Warning
brofanilide	Cimegra, Nutrizma, Teraxxa	I	IRAC-30	Caution
bromoxynil	Huskie <sup>2</sup> , Maestro	H	WSSA-6	Warning
<i>Burkholderia</i> sp.	BioST	I, N	-	Caution
captan	Captan	F	FRAC-M4	Danger
carbaryl	Sevin	I	IRAC-1A	Caution
carboxin	Rancona <sup>2</sup> , Vitavax	F	FRAC-7	Caution
carfentrazone-ethyl	Aim	H	WSSA-14	Caution
chlorantraniliprole	Besiege <sup>1,2</sup> , Coragen, Elevest <sup>1,2</sup> , Prevathon	I	IRAC-28	Caution-Warning
chlorimuron ethyl	Canopy <sup>2</sup> , Classic	H	WSSA-2	Caution
chloropicrin	Pic-Clor <sup>1</sup> , Tri-Pic <sup>1</sup>	Fum	-	Danger (Poison)
chlorothalonil	Bravo, Echo	F	FRAC-M5	Caution-Danger
chlorpyrifos	Cobalt <sup>1,2</sup> , Eraser <sup>1</sup> , Lorsban <sup>1</sup> , Stallion <sup>1,2</sup> , Vulcan <sup>1</sup>	I	IRAC-1	Caution-Danger
chlorsulfuron	Glean	H	WSSA-2	Caution

**Table 1.15 - Chemical Information Chart (cont.)**

<b>Common Name or Designation</b>	<b>Examples of Trade Names (<sup>1</sup>=restricted use, <sup>2</sup>=premix product with multiple active ingredients)</b>	<b>Action</b>	<b>Resistance Group</b>	<b>Signal Word (may vary depending on formulation and/or concentration of active ingredient)</b>
chlorthal-dimethyl (DCPA)	Dacthal	H	WSSA-3	Caution
clethodim	Select	H	WSSA-1	Caution
clomazone	Command	H	WSSA-13	Caution
clopyralid	Stinger, SureStart <sup>2</sup>	H	WSSA-4	Caution-Warning
clothianidin	Belay, Inovate <sup>2</sup> , NipsIt, Poncho 600, Poncho Votivo <sup>2</sup>	I	IRAC-4	Caution
coumaphos	Co-Ral, Corathon <sup>2</sup>	I	IRAC-1	Caution-Warning
cyclanilide	Finish <sup>2</sup> , Stance <sup>2</sup> , Terminate <sup>2</sup>	PGR	-	Caution-Danger
cycloate	Ro-Neet	H	WSSA-8	Caution
cyfluthrin	Tombstone <sup>1</sup>	I	IRAC-3	Warning-Danger
(beta-) cyfluthrin	Baythroid <sup>1</sup> , Leverage 360 <sup>1</sup>	I	IRAC-3	Caution-Warning
(gamma-) cyhalothrin	Cobalt <sup>1,2</sup>	I	IRAC-3	Danger
(lambda-) cyhalothrin	Besiege <sup>1,2</sup> , Cobalt Advanced <sup>1,2</sup> , Endigo <sup>1,2</sup> , Warrior II <sup>1</sup>	I	IRAC-3	Warning-Danger
cypermethrin	Bite Free <sup>2</sup> , Tri-Tec <sup>2</sup> , UltraShield Red <sup>2</sup>	I	IRAC-3	Caution
(zeta-) cypermethrin	Hero <sup>1,2</sup> , Mustang Maxx <sup>1</sup> , Stallion <sup>1,2</sup> , Steed <sup>1,2</sup>	I	IRAC-3	Caution-Warning
cyproconazole	Alto, Approach Prima <sup>2</sup>	F	FRAC-3	Caution
cyromazine	Flynexx, Flyzine, Larvadex	IGR	-	Caution
DCPA	see chlorthal-dimethyl			
dazomet	Basamid <sup>1</sup>	Fum	-	Danger (Poison)
deltamethrin	DeltaGard	I	IRAC-3	Caution
diazinon	Corathon <sup>2</sup> , Optimizer	I	IRAC-1	Caution
dicamba	Banvel, Clarity, Status <sup>2</sup>	H	WSSA-4	Caution
dichlobenil	Casoron	H	WSSA-20	Caution
(1,3-) dichloropropene	Telone II <sup>1</sup>	Fum	-	Warning
dichlorvos	various	I	IRAC-1	Caution-Danger
diclofop-methyl	Hoelon <sup>1</sup>	H	WSSA-1	Danger
diclosulam	Strongarm	H	WSSA-2	Caution
dicrotophos	Bidrin	I	IRAC-1	Danger (Poison)
difenoconazole	Quadris Top <sup>2</sup> , Warden <sup>2</sup>	F	FRAC-3	Caution
diflubenzuron	various	IGR	IRAC-15	Caution
diflufenzopyr-sodium	Status <sup>2</sup>	H	WSSA-19	Caution
dimethenamid-P	Outlook	H	WSSA-15	Warning
dimethoate	Dimethoate	I, Mi	IRAC-1	Caution-Warning
dinotefuran	Venom	I	IRAC-4	Caution
diquat dibromide	Reglone	H	WSSA-22	Caution
diuron	Direx, Karmex	H	WSSA-7	Caution
endothall	Aquathol	H	-	Danger

**Table 1.15 - Chemical Information Chart (cont.)**

Common Name or Designation	Examples of Trade Names ( <sup>1</sup> =restricted use, <sup>2</sup> =premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
EPTC	Eptam	H	WSSA-8	Warning
esfenvalerate	Asana <sup>1</sup>	I	IRAC-3	Warning
ethaboxam	Intego	F	FRAC-22	Caution
ethalfuralin	Curbit, Sonalan	H	WSSA-3	Danger
ethephon	CottonQuick, Ethephon, Finish, Super Boll	PGR	-	Danger
etoxazole	Zeal	I, Mi	IRAC-10	Caution
fenoxaprop-p-ethyl	Tacoma	H	WSSA-1	Warning
fenpropathrin	Danitol <sup>1</sup>	I, Mi	IRAC-3	Warning
florasulam	Orion <sup>2</sup> , Quelex <sup>2</sup>	H	WSSA-2	Caution
fluazifop-p-butyl	Fusilade	H	WSSA-1	Caution
fluazinam	Omega	F	FRAC-29	Warning
flucarbazone-sodium	Everest	H	WSSA-2	Caution
fludioxonil	Apron Maxx <sup>2</sup> , Cruiser Maxx <sup>2</sup> , Maxim, Warden <sup>2</sup>	F	FRAC-12	Caution
flufenacet	Axiom <sup>2</sup>	H	WSSA-15	Caution
flumetsulam	SureStart <sup>2</sup>	H	WSSA-2	Caution-Warning
flumiclorac-pentyl	Resource	H	WSSA-14	Warning
flumioxazin	Chateau, Valor	H	WSSA-14	Caution
fluometuron	Cotoran	H	WSSA-13	Caution
fluopyram	Ilevo, Propulse <sup>2</sup> , Velum	F	FRAC-7	Caution
fluoxastrobin	Aftershock, Evito, Fortrix, Preemptor	F	FRAC-11	Caution-Warning
flupyradifurone	Sivanto	I	IRAC-4	Caution
fluridone	Brake	H	WSSA-12	Danger
fluroxypyr	Starane, Vista	H	WSSA-4	Warning
fluthiacet-methyl	Cadet	H	WSSA-14	Warning
flutolanil	Artisan <sup>2</sup>	F	FRAC-7	Caution
flutriafol	Fortrix <sup>2</sup> , Preemptor <sup>2</sup> , TopGuard	F	FRAC-3	Caution
fluxapyroxad	Acceleron, Nexicor <sup>2</sup> , Priaxor <sup>2</sup>	F	FRAC-7	Caution
fomesafen-sodium	Flexstar, Prefix <sup>2</sup> , Reflex	H	WSSA-14	Warning-Danger
fosamine-ammonium	Krenite	H	WSSA-27	Caution
gardona	see tetrachlorvinphos			
glufosinate-ammonium	Finale, Liberty, Rely	H	WSSA-10	Warning
glyphosate	Extreme <sup>2</sup> , Halex <sup>2</sup> , Roundup	H	WSSA-9	Caution-Warning
halauxifen-methyl	Elevore, Quelex <sup>2</sup>	H	WSSA-4	Caution
halosulfuron-methyl	Permit, Sandea	H	WSSA-2	Caution-Warning
hexazinone	Velpar	H	WSSA-5	Danger
imazamox	Beyond, Raptor	H	WSSA-2	Caution
imazapic	Plateau	H	WSSA-2	Caution

**Table 1.15 - Chemical Information Chart (cont.)**

Common Name or Designation	Examples of Trade Names ( <sup>1</sup> =restricted use, <sup>2</sup> =premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
imazapyr	Arsenal	H	WSSA-2	Caution
imazaquin	Scepter	H	WSSA-2	Caution
imazethapyr	Extreme <sup>2</sup> , Pursuit	H	WSSA-2	Caution-Warning
imazosulfuron	League	H	WSSA-2	Caution
imidacloprid	Admire Pro, Gaucho 600, Leverage 360 <sup>1</sup> , Velum Total <sup>2</sup>	I	IRAC-4	Caution
indaziflam	Alion	H	WSSA-29	Caution
indoxacarb	Steward	I	IRAC-22	Caution
iodosulfuron	Autumn	H	WSSA-2	Caution
ipconazole	Inovate <sup>2</sup> , Rancona <sup>2</sup>	F	FRAC-3	Caution
isoxaben	Gallery	H	WSSA-21	Caution
isoxaflutole	Balance <sup>1</sup> , Corvus <sup>1,2</sup>	H	WSSA-27	Caution
lactofen	Cobra, Phoenix	H	WSSA-14	Caution-Danger
linuron	Lorox	H	WSSA-7	Caution
malathion	Malathion	I	IRAC-1	Caution-Warning
mancozeb	Koverall	F	FRAC-M3	Caution
MCPA	MCPA, Orion <sup>2</sup>	H	WSSA-4	Caution-Danger
mefenoxam	see metalaxyl-M			
mepiquat chloride	Mepex, Pix, Stance <sup>2</sup>	PGR	-	Caution
mepiquat pentaborate	Pentia	PGR	-	Caution
mesosulfuron-methyl	Osprey	H	WSSA-2	Caution
mesotrione	Callisto, Halex <sup>2</sup> , Lexar <sup>1,2</sup> , Lumax <sup>1,2</sup>	H	WSSA-27	Caution
metalaxyl-M (mefenoxam)	Apron, Allegiance, Cruiser Maxx <sup>2</sup> , EverGol Energy <sup>2</sup> , Inovate <sup>2</sup> , Rancona <sup>2</sup> , Ridomil Gold, Warden <sup>2</sup>	F	FRAC-4	Caution-Warning
metaldehyde	Deadline	M	-	Caution
metam-sodium	Metam <sup>1</sup> , Sectagon <sup>1</sup> , Vapam <sup>1</sup>	Fum	-	Danger (Poison)
metconazole	Cambra, Headline AMP <sup>2</sup> , Quash, TwinLine <sup>2</sup>	F	FRAC-3	Caution-Warning
methomyl	Lannate <sup>1</sup> , Nudrin <sup>1</sup>	I	IRAC-1	Danger (Poison)
(S-) methoprene	various	IGR	IRAC-7	Caution
methoxyfenozide	Intrepid	I	IRAC-18	Caution
(S-) metolachlor	Bicep II Magnum <sup>1,2</sup> , Boundary <sup>2</sup> , Cinch, Dual Magnum, Halex <sup>2</sup> , Lexar <sup>1,2</sup> , Lumax <sup>1,2</sup> , Prefix <sup>2</sup>	H	WSSA-15	Caution-Warning
metribuzin	Axiom <sup>2</sup> , Boundary <sup>2</sup> , Canopy <sup>2</sup> , Glory, Metribuzin, Tricor	H	WSSA-5	Caution
metsulfuron-methyl	Cimarron (Max Part A)	H	WSSA-2	Caution
MSMA	Drexel, Target	H	WSSA-17	Caution
myclobutanil	Laredo	F	FRAC-3	Caution
naled	Dibrom <sup>1</sup>	I	IRAC-1	Danger

**Table 1.15 - Chemical Information Chart (cont.)**

Common Name or Designation	Examples of Trade Names ( <sup>1</sup> =restricted use, <sup>2</sup> =premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
napropamide	Devrinol	H	WSSA-15	Caution
nicosulfuron	Accent, Primero, Steadfast <sup>2</sup>	H	WSSA-2	Caution
norflurazon	Solicam	H	WSSA-12	Caution
oryzalin	Surflan	H	WSSA-3	Caution
oxadiazon	Ronstar	H	WSSA-14	Caution-Warning
oxamyl	Vydate <sup>1</sup>	I, N	IRAC-1	Danger (Poison)
oxyfluorfen	Goal	H	WSSA-14	Warning
paraquat	Gramoxone <sup>1</sup>	H	WSSA-22	Danger (Poison)
Pasteuria nishizawae	Clariva	N	-	Caution
pendimethalin	Pendulum, Prowl	H	WSSA-3	Caution
penflufen	EverGol	F	FRAC-7	Caution
penthiopyrad	Fontelis	F	FRAC-7	Caution
permethrin	various	I	IRAC-3	Caution
phenmedipham	Spin-Aid <sup>1</sup>	H	WSSA-5	Danger
phorate	Thimet <sup>1</sup>	I	IRAC-1	Danger (Poison)
phosmet	Imidan	I	IRAC-1	Warning
picloram	Tordon <sup>1</sup>	H	WSSA-4	Caution
picoxystrobin	Approach	F	FRAC-11	Caution
pinoxaden	Axial	H	WSSA-1	Caution-Warning
piperonyl butoxide	(used as a pesticide synergist)			
pirimiphos-methyl	Dominator, Double Barrel	I	IRAC-1	Danger
potassium salts of phosphorous acid	various	F	FRAC-P7	Caution
primisulfuron-methyl	Beacon	H	WSSA-2	Caution
prodiamine	Barricade	H	WSSA-3	Caution
prometon	Pramitol	H	WSSA-5	Caution-Warning
prometryn	Caparol, Suprend	H	WSSA-5	Caution
pronamide	Kerb <sup>1</sup>	H	WSSA-3	Caution
propargite	Comite <sup>1</sup> , Omite <sup>1</sup>	Mi	IRAC-12	Danger
propiconazole	Artisan <sup>2</sup> , Nexicor <sup>2</sup> , QuiltXcel <sup>2</sup> , Stratego <sup>2</sup> , Tilt, Trivapro <sup>2</sup>	F	FRAC-3	Caution-Warning
prosulfuron	Peak	H	WSSA-2	Caution
prothioconazole	Declaro <sup>2</sup> , EverGol Energy <sup>2</sup> , Proline, Propulse <sup>2</sup> , Prosaro <sup>2</sup> , Provost <sup>2</sup> , Stratego <sup>2</sup>	F	FRAC-3	Caution
pydiflumetofen	Miravis	F	FRAC-7	Caution-Warning
pyraclostrobin	Headline AMP <sup>2</sup> , Nexicor <sup>2</sup> , Priaxor <sup>2</sup> , TwinLine <sup>2</sup>	F	FRAC-11	Caution-Warning
pyraflufen-ethyl	ET	H, HA	WSSA-14	Danger
pyrasulfotole	Huskie <sup>2</sup>	H	WSSA-27	Warning



**Table 1.15 - Chemical Information Chart (cont.)**

Common Name or Designation	Examples of Trade Names ( <sup>1</sup> =restricted use, <sup>2</sup> =premix product with multiple active ingredients)	Action	Resistance Group	Signal Word (may vary depending on formulation and/or concentration of active ingredient)
pyrethrins	Azera <sup>2</sup> , Bite Free <sup>2</sup> , Tri-Tec <sup>2</sup> , UltraShield Red <sup>2</sup>	I	IRAC-3	Caution-Warning
pyrithiobac-sodium	Staple	H	WSSA-2	Caution
pyroxasulfone	Zidua	H	WSSA-15	Caution
pyroxsulam	PowerFlex	H	WSSA-2	Caution
quinclorac	Facet	H	WSSA-4, WSSA-26	Caution
quizalofop-p-ethyl	Assure II, Targa	H	WSSA-1	Danger
rimsulfuron	Matrix, Resolve, Steadfast <sup>2</sup>	H	WSSA-2	Caution
saflufenacil	Sharpen	H	WSSA-14	Caution
sedaxane	Cruiser Maxx Vibrance <sup>2</sup> , Vibrance, Warden <sup>2</sup>	F	WSSA-7	Caution
sethoxydim	Poast	H	WSSA-1	Caution-Warning
simazine	Princep	H	WSSA-5	Caution
sodium bentazon	Basagran, Storm <sup>2</sup>	H	WSSA-6	Caution-Danger
sodium chlorate	Defol	H	-	Caution
spinetoram	Intrepid Edge <sup>2</sup> , Radiant	I	IRAC-5	Caution
spinosad	Blackhawk, Tracer	I	IRAC-5	Caution
spiromesifen	Oberon	I, Mi	IRAC-23	Caution
sulfentrazone	Authority <sup>2</sup> , Spartan	H	WSSA-14	Caution
sulfosulfuron	Cryder	H	WSSA-2	Caution
sulfoxaflor	Transform	I	IRAC-4	Danger
tebuconazole	Absolute <sup>2</sup> , Custodia <sup>2</sup> , Prosaro <sup>2</sup> , Provost <sup>2</sup>	F	FRAC-3	Caution-Warning
tebuthiuron	Spike	H	WSSA-7	Caution
tefluthrin	Force <sup>1</sup>	I	IRAC-3	Caution-Danger
tembotrione	Capreno <sup>2</sup> , Laudis	H	WSSA-27	Caution
terbufos	Counter <sup>1</sup>	I, N	IRAC-1	Danger (Poison)
tetrachlorvinphos (gardona)	Rabon	I	IRAC-1	Caution
tetraconazole	Affiance <sup>2</sup> , Eminent, Priaxor D <sup>2</sup>	F	FRAC-3	Caution
tetramethrin	UltraShield Red <sup>2</sup>	I	IRAC-3	Caution
thiabendazole	Mertect	F	FRAC-1	Caution
thiamethoxam	Avicta Duo <sup>2</sup> , Centric, Cruiser Maxx <sup>2</sup> , Endigo <sup>1,2</sup> , Warden <sup>2</sup>	I	IRAC-4	Caution-Warning
thiencarbazone-methyl	Autumn Super <sup>2</sup> , Capreno <sup>2</sup> , Corvus <sup>1,2</sup>	H	WSSA-2	Caution
thidiazuron	various	HA	-	Caution-Danger
thifensulfuron-methyl	Harmony, Resolve Q <sup>2</sup>	H	WSSA-2	Caution
thiodicarb	Aeris <sup>1</sup>	I, N	IRAC-1	Caution
thiophanate-methyl	Topsin-M	F	FRAC-1	Caution
thiram	Spotrete, Thiram	F	FRAC-M3	Caution

**Table 1.15 - Chemical Information Chart (cont.)**

<b>Common Name or Designation</b>	<b>Examples of Trade Names (<sup>1</sup>=restricted use, <sup>2</sup>=premix product with multiple active ingredients)</b>	<b>Action</b>	<b>Resistance Group</b>	<b>Signal Word (may vary depending on formulation and/or concentration of active ingredient)</b>
topramezone	Armexon, Impact	H	WSSA-27	Caution
tribenuron-methyl	Canopy <sup>2</sup> , Express	H	WSSA-2	Caution
triclopyr	Crossbow, Garlon, Remedy Ultra	H	WSSA-4	Caution-Danger
trifloxystrobin	Absolute <sup>2</sup> , Declaro <sup>2</sup> , EverGol Xtend <sup>2</sup> , Stratego <sup>2</sup> , Trilex	F	FRAC-11	Caution-Warning
trifloxysulfuron-sodium	Envoke	H	WSSA-2	Caution
trifluralin	Treflan	H	WSSA-3	Caution
triflusaluron	Upbeet	H	WSSA-2	Caution
triticonzaole	Teraxxa F4 <sup>2</sup>	F	FRAC-3	Caution



## Protecting Honey Bees

James Wilson, Extension Apiculturist, Virginia Tech Department of Entomology

Honey bees are a valuable service to apiculture and agriculture not only because they produce honey and beeswax, but they are the most important pollinators of cultivated crops. Pesticide poisoning of honey bees, and other beneficial insects, can be a serious problem. Every effort should be made to minimize the exposure of honey bees to pesticides in treated areas.

### A Note on Protecting Pollinators in Virginia

Federal guidelines mandate that each state develop a plan for the mitigation of pesticide exposure to managed pollinators in their own state. This mandate came through the United States Environmental Protection Agency and was directed to the pesticide regulatory office of each state. The Virginia Department of Agriculture and Consumer Services (VDACS) has fulfilled that role here. Through 7 regional listening sessions, input from approximately 450 stakeholders, 169 written comments from producers, beekeepers, professional pesticide applicators, and other stakeholders, VDACS developed a representative advisory committee of stakeholders and drafted a plan. The plan is known as the “Voluntary Plan to Mitigate the Risk of Pesticides to Managed Pollinators” and was finalized in May of 2017.

This voluntary plan encourages an increase in communication between pesticide applicators and the managers of pollinators in an effort to reduce the potential for damaging pesticide exposure. Since this plan is voluntary there are additional guiding documents for the majority of involved stakeholders. This plan has been adopted by the Commonwealth of Virginia and can be found in its entirety at the 1st link provided below. A specific list of best management practices appropriate for this pest management guide is provided below. Virginia has employed a communications tool to encourage access and communication between beekeepers and insecticide applicators. This tool is known as Bee Check. For more information on this tool and how you may use it to help prevent the exposure of bees to pesticides please visit <http://www.vdacs.virginia.gov/pdf/BeeCheck-Fact-Sheet.pdf>, or <http://www.vdacs.virginia.gov/plant-industry-services-beekeeping-apiary-inspection.shtml>. Questions and comments should be directed to VDACS with the contact information given below.

Virginia is currently developing a strategy for managing all pollinators. This strategy is focused on identifying the strengths and weaknesses of the conservation and pollinator management efforts in Virginia. Once identified, this plan will outline how we can best manage Virginia’s resources for pollinators. Future developments with that plan will be made available by VDACS, and updated here accordingly.

#### Virginia’s Voluntary Plan to Mitigate the Risk of Pesticides to Managed Pollinators

<http://www.vdacs.virginia.gov/pdf/BMP-plan.pdf>

#### Best Management Practices:

Agricultural Commercial Applicators: <http://www.vdacs.virginia.gov/pdf/BMP-Ag-Commercial-Applicator.pdf>

Agricultural Producers: <http://www.vdacs.virginia.gov/pdf/BMP-Ag-Producer.pdf>

#### VDACS Pesticide Resources:

The Virginia Pesticide Database: <http://www.kellysolutions.com/VA/pesticideindex.htm>

The Office of Pesticide Services: <http://www.vdacs.virginia.gov/pesticides.shtml>

#### VDACS Contact Point:

Liza Fleeson Trossbach, Program Manager  
Office of Pesticide Services  
[liza.fleeson@vdacs.virginia.gov](mailto:liza.fleeson@vdacs.virginia.gov)  
804.371.6559

Keith Tignor, State Apiarist  
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804.786.3515

## Causes of Honey Bee Poisoning

1. The majority of honey bee poisoning occurs when pesticides are applied to crops in bloom. This includes crop plants such as sweet corn, which is routinely sprayed when in tassel. Honey bees do not pollinate corn; however, they will collect pollen from corn tassels and transport it back to the honey bee hive.
2. The application of pesticides to fields with weeds in bloom. The spring application of pesticides to alfalfa fields with flowering weeds is a particular problem in Virginia.
3. The drift of toxic sprays or dusts to adjoining crops or weeds in bloom.
4. The contamination of flowering ground-cover crops in orchards treated with pesticides.
5. The contamination of water or dew on foliage and flowers. This includes the water collected by honey bees for drinking and cooling the honey bee hive.
6. The application of systemic pesticides and the potential contamination of nectar and pollen collected by foraging honey bees. The use of neonicotinoid pesticides (e.g., clothianidin, imidacloprid, and thiamethoxam) is a concern for honey bee poisoning; although, there is a need for more research evidence.

The most serious poisonings result with honey bees that collect pesticide-contaminated pollen or nectar and transport these materials to the honey bee hive. Pesticide dusts (e.g., Sevin) and encapsulated pesticides are especially dangerous. These pesticides can adhere to foraging honey bees, be transported to the hive, and stored for long periods of time. Such pesticides may cause honey bee mortality in the hive for several months.

## Ways to Reduce Honey Bee Poisoning

1. Contact beekeepers with honey bee hives near areas to be treated with pesticides that are hazardous to honey bees.
2. Do not apply pesticides that are toxic to honey bees on crops in bloom.
3. Use pesticides that are less toxic to honey bees when such choices are consistent with pest control recommendations (e.g., see table of relative pesticide toxicities).
4. Choose the least hazardous pesticide formulations when possible. Pesticide dusts and encapsulations are more toxic than sprays of the same material. Pesticides applied as wettable powder sprays tend to have longer residual effects (and are more toxic) than the emulsifiable concentrate sprays. Granular applications of pesticides are typically the safest method of treatment in areas with honey bee hives.
5. Avoid drift of toxic pesticide sprays onto ground-cover plants, weeds, and crops in nearby fields.
6. Control weeds in fields and avoid direct pesticide applications to flowering weeds when possible. Mow before pesticide application, if orchards have ground-cover plants in bloom.
7. Apply pesticides in the late evening or early morning when honey bees are not actively foraging. This is important with crops such as corn, since pollen is released in the morning. The evening application of pesticides to such crops are less hazardous and will reduce the unintentional poisoning of honey bees.
8. Do not apply pesticides if temperatures are expected to be unusually low following pesticide treatment. Pesticide residues can remain toxic to honey bees for longer periods of time under low temperature conditions.
9. Avoid the direct application of pesticides over honey bee hives.
10. Allow beekeepers an option to move or confine honey bee hives that are near areas to be treated with pesticides, if there is a potential for honey bee loss.

## Relative Toxicity of Pesticides to Honey Bees by Laboratory and Field Tests

### Group I. Highly Toxic

Severe losses may be expected if these pesticides are used when honey bees are present at treatment time or within a day *thereafter*.

Abamectin	(cyfluthrin)	Denim	Lannate D	Pounce	Supracide
Acramite	Bidrin	(emamectin	(methomyl)	(permethrin)	(methidathion)
(bifenazate)	(dicrotophos)	benzoate)	Lindane	Prallethrin	Swat
Actara, Centric,	Capture, Annex,	Dibrom	Lorsban	Proaxis	(bonyl)
Platinum, Helix,	Brigade	(naled)	(chlorpyrifos)	(gamma-cyhalo-	Synthrin
Cruiser, Adage	(bifenthrin)	Diazinon	Malathion	thrin)	(resmethrin)
(thiamethoxam)	Carzol	(spectracide)	Matacil	Proclaim	Talstar
Acephate	Clutch	Dimecron	(aminocarb)	(emamectin)	Tameron
Admire,	(clothianidin)	(phosphamidon)	Mesuroil	Provado	(methamidophos)
Advantage,	Commodore	Dinotefuran	(methiocarb)	(imidacloprid)	Tefluthrin
Gaucho, Merit,	(lambda-cyhalo-	Dursban, Eradex	Monitor	Pydrin	(Force)
Premise,	thrin)	(chlorpyrifos)	(methamidophos)	(fenvalerate 0.1	Temik
Touchstone	Comply	Endigo	Nexter	lb/A) <sup>2</sup>	(aldicarb)
(imidacloprid)	(fenoxycarb)	Envidor	(pyridaben)	Pylon, Phantom	TEPP
Advantage	Curacron	(spirodiclofen)	Nudrin	(chlorfenapyr)	Tralomethrin
Ambush	(profenofos)	Ethyl guthion	(methomyl)	Pyramite	(Saga)
(permethrin)	Cygon	(azinphos-ethyl)	Orthene	Rebelate	Trimax
Ammo (Fury)	(dimethoate)	Flagship	(acephate)	(dimethoate)	Vapona
(>.025 lb/A)	Cymbush	(thiamethoxam)	Parathion	Resmethrin	(dichlorvos)
(cypermethrin)	Danitol	Fipronil	Pay Off	Scout	Venom
Apollo, Ovation	(fenopropathin)	Furadan F	(flucythrinate)	(tralomethrin)	(dinotefuran)
(clofentezine)	Dasanit	(carbofuran)	Phosphamidon	Sevin	Warrior
Asana	(fensulfothion)	Gardstar	Pirimiphos-methyl	(carbaryl) <sup>3</sup>	(lambda-cyhalo-
(esfenvalerate)	DDVP	(permethrin) <sup>1</sup>	(Execute, Actellic)	Sniper	thrin)
Avaunt (Advion)	(dichlorvos)	Guthion	Poncho,	Spectracide	Zectran
(indoxacarb)	Decis	(azinphos-methyl)	Titan, Clutch,	Steward	(mexacarbate)
Avid	(decamethrin)	Imidan	Acceleron, Arena,	(indoxacarb)	Zephyr (Agri-Mek)
(avermectin)	Delegate, Radiant	(phosmet)	Belay, Celero	Sumithion	(abamectin)
Baygon	(spinetoram)	Karate	(clothianidin)	(fenitrothion)	Zeta-cypermethrin
(propoxur)					
Baythroid					

<sup>1</sup>Can be applied to ground in front of honey bee hives for the control of small hive beetles.

<sup>2</sup>Can be applied in the late evening at rate of 0.1 lb/A or less.

<sup>3</sup>Some formulations of Sevin XLR are rated as moderately toxic to honey bees.

## 1-40 Regulations and Basic Information: *Protecting Honey Bees*

### Group II. Moderately Toxic

These can be used around honey bees if dosage, timing, and method of application are correct, but should not be applied directly on honey bees in the field or at the honey bee hive.

Abate (temophos)	Calypso (thiacloprid)	Decis, Battalion (deltamethrin)	Ethodan (Ethion)	Oil sprays (superior type)	Systox (demeton)
Acramite, Floramite (bifenazate)	Carzol (formetanate)	Di-Syston (disulfoton)	Larvin (thiocarb)	Rimon, Pedestal (novaluron)	Trigard (cyromazine)
Assail (acetamiprid)	Chlordane	Dyfonate (fonofos)	Metasystox (demeton-s- methyl)	SpinTor, Conserve SC, Entrust, Success (spinosad)	Thimet (phorate) <sup>2</sup>
Banol (carbanolate)	Ciodrin (crotoxyphos)	Elgetol (dinitrocresol)	Metasystox R (oxydemeton- methyl)	Spirotetramet (Movento)	Thionex (endosulfan)
Bolstar (sulprofos)	Coumaphos <sup>1</sup> (Agridip, Asunthol)	endrin	Mocap (ethoprop)		Trithion, Thiodan (carbophenothion)
	Counter (terbufos)	Esteem (pyriproxyfen)			Vydate (oxamyl)

<sup>1</sup>Checkmite (coumaphos) strips can be used in honey bee hives to treat for varroa mites and small hive beetles.

<sup>2</sup>Thimet EC should only be applied during late evening.

### Group III. Relatively Nontoxic

These can be used around honey bees with a minimum of injury; safest if applied in the evening or early morning.

Acaraben (chlorobenzilate)	Calypso (thiacloprid)	Ethrel (ethephon)	(halofenozide)	Pyrellin (rotenone/ pyrithrin)	Talus (buprofezin)
Acarol (bromopropylate)	Chlorantraniliprole	Esteem (pyriproxyfen)	Mavrik (tau-fluvalinate) <sup>1</sup>	Pyrethrum (natural)	Tedion (tetradifon)
Agri-Mek (avermectin)	Chlorparacide (chlorbenside)	Fonicamid	Methoxychlor (Marlate)	Rotenone	Tetram
Allethrin	Confirm, Mimic (tebufenozide)	Fujimite, Akari (fenpyroximate)	Mitac (amitraz)	Ryania	Tetrasan
Altosid (methoprene)	Cyd-X (CM granulovirus)	Fulfill (pymetrozine)	Morocide (binapacryl)	Sabadilla	Torak (dialifor)
Amitraz	Cyrolite	Fundal, Galecron (chlordimeform)	Murvesco (fenson)	Saphos (menazon)	Trigard (cyromazine)
Apollo, Ovation (clofentezine)	Delnav (dioxathion)	<i>Heliothis polyhe- drosis</i> virus	Neemix, Align (azadirachtin)	Savey, Onager (hexythiazox)	Vendex (fenbutatin oxide)
Applaud, Centaur (buprofezin)	Demize (D-Limonene)	Herculex	Neotran	Shuttle	Yieldgard
Aza-direct (azadirachtin)	Dessin (dinobuton)	Hexygon	Nicotine	Smite (sodium azide)	Zeal, Secure (etoxazole)
Baam (amitraz)	Dimilin (diflubenzuron)	Intrepid (methoxyfenozide)	Omite (propargite)	Spiromesifen (Oberon, Forbid)	
<i>Bacillus thuringiensis</i> (Accoate, Biotrol, Dipel, Thuricide)	Dinocap (Karathane)	Isomate	Ovotran (ovex)	Spur (fluvalinala)	
	Dylox (trichlorfon)	Kanemite (acequinocyl)	Pentac (dienochlor)	Sucroicide (sucrose octano- ate esters)	
Birlane (chlorfenvinphos)	Endeavor (Pymetrozine)	Kelthane (dicofol)	Plictran [mitacid] (cyhexatin)	Surround (kaolin)	
		Mach 2	Pynamin		

<sup>1</sup>tau-Fluvalinate is used in Apistan strips to treat honey bee hives for varroa mites. It is illegal to use Mavrik in honey bee hives.



## Fungicides

As a general rule, fungicides are safe to use around honey bees.

Afugan (pyrazophos)	Polyphase) Copper oxides	(captafol) Dithane D-14 (nabam)	Indar (butrizol)	Phygon (dichlone)	Sulfur Syllit (dodine)
Arasan (thiram)	Copper oxychloride sulfate	Dithane M (maneb, manzeb)	Iprodoine <sup>2</sup> Karathane	Plantvax (oxycarboxin)	Terraguard <sup>1</sup> , Procure (triflumizole)
Bayleton (triadimefon)	Copper sulfate	Dithane Z (zineb)	Lesan (fenaminosulf)	Polyram (metriam)	Tetraconazole (Domark, Eminent)
Benlate (benomyl)	Cupric hydroxide (Kocide)	Du-Ter (fentin hydroxide)	Maneb Mancozeb	Propiconazole <sup>1</sup> (Alamo, Banner)	Thiram
Bordeaux mixture	Cyprix (dodine)	Dyrene (anilazine)	Morestan (oxythioquinox)	Pyraclostrobin <sup>2</sup>	Thylate
Boscalid (emerald, endura, pristine)	Daconil (chlorothalonil)	Ferbam	Morocide (binapaeryl)	Pyrimethanil <sup>1</sup> (Philabuster, Penbotec)	Vinclozolin <sup>2</sup>
Bravo (chlorothalonil)	Dessin (dinobuton)	Fluoxastrobin	Myclobutanil	Ridomil	Vitavax (carboxin)
Captan	Difenoconazole	Glyodin	Mylone (dazomet)	Rovral (iprodione) <sup>2</sup>	Zineb
Carbendazim (Fungisol,	Difolatan	Hinosan (edifenphos)			

<sup>1</sup> May increase the toxicity of neonicotinoid pesticides to honey bees if used together.

<sup>2</sup> May cause loss of honey bee larvae. Use with caution where honey bees are foraging.

## Herbicides, Defoliants and Desiccants

2,4-D	Basagran (bentazon)	Dual (metolachlor)	Hyvar (bromacil)	Nortron (ethofumesate)	Ronstar (oxadiazon)
2,4-DB	Betanal AM (bentanex)	Endothall (endothall)	IPC (propham)	Oxyfluorfen <sup>1</sup>	Sancap (dipropetryn)
2,4-DP (dichlorprop)	Bladex (cyanazine)	Eptam	Karmex (diuron)	Paarlan (isopropalin)	Sencor (metribuzin)
Alachlor	Blazer (acifluorfen)	Evik (ametryn)	Kerb (proamide)	Paraquat	Sinbar (terbacil)
Alanap (naptalam)	Blazer (acifluorfen)	Evital (norflurazon)	Lasso (alachlor)	Pendimethalin <sup>1</sup> (Prowl)	Surflan (oryzalin)
Alopex (clofop-isobutyl)	cacodylic acid	Exhalt 800	Lorox (linuron)	Phenmedipham (Betanal)	Sutan (butylate)
Amiben (chloramben)	Cambilene (2,3,6-TBA)	Folex (desmedipham)	MCPA	Pramitol (prometone)	Telvar (monuran)
Amitrol	Caparol (prometryn)	Garlon (triclopyr)	Methar, DSMA	Princep (simazine)	Tolban (profluralin)
Ammate	Chloro-IPC (chlorpropham)	Glyphosate	Milogard (propazine)	Probe (methazole)	Tordon (picloram)
Atrex (atrazine)	Cotoran (fluometuron)	Gramoxone (paraquat)	Modown (bitenox)	Propanil <sup>1</sup>	Treflan (trifluralin) <sup>1</sup>
Avenge (difenzoquat)	Daconate (MSMA)	Herbisan (EXD)	MSMA	Prowl (pendimethalin)	Vegadex
Balan (benefin)	Dalapon	Hoelon (diclofop-methyl)	Mylone (dazomet)	Pyramin (chloridazon)	Zorial (norflurazon)
Banvel (dicamba)	Diquat			Ramrod (propachlor)	
	DSMA			Randox	

<sup>1</sup> Slightly toxic to honey bees

## THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators

**PROTECTION OF POLLINATORS**

 **APPLICATION RESTRICTIONS** EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon  in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

**This product can kill bees and other insect pollinators.**  
Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.


When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:  
<http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx>

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: [www.aapco.org](http://www.aapco.org). Pesticide incidents can also be reported to the National Pesticide Information Center at: [www.npic.orst.edu](http://www.npic.orst.edu) or directly to EPA at: [beekill@epa.gov](mailto:beekill@epa.gov)

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

 The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.



Read EPA's new and strengthened label requirements: <http://go.usa.gov/jHH4>