

Regulations and Basic Information

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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: 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/ 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

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pest; learning about its life cycle, basic needs, and the environmental conditions that influence its population size and activity; 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 impacting pesticide users. In Virginia, the Virginia Pesticide Control Act and regulations promulgated under the act affect growers and commercial pesticide applicators. State and federal pesticide laws and regulations are enforced by the Virginia Department of Agriculture and Consumer Services, Office of Pesticide Services.

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 actual application, supervision of an application, or commercial recommendation of a pesticide. This includes the routine activities that are part of a pesticide application, such as mixing, loading, clean-up, and disposal. Handling, transfer, or transport after the manufacturer’s original seal is broken is 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.)

Before preparing for certification, you must first decide if you plan to become a Private Applicator, Commercial Applicator, or Registered Technician. Private and Commercial Applicators must be certified in one or more categories, based on the type(s) of pesticide use planned.

Types of Pesticide Applicators

Two general types of certified pesticide applicator are recognized by the Commonwealth of Virginia. Each is described below. Persons engaged in several sorts of pesticide-related activities may need to be certified as both a private and a commercial applicator.

Private Applicator

A certified applicator who uses or supervises the use of any restricted-use pesticide (RUP) to produce an agricultural commodity. Applications must be made on property owned or rented by the user or his/her employer; or, if applied without compensation other than trading of personal services between producers of agricultural commodities, on the property of another person. Noncertified applicators employed by agricultural producers may use RUPs only when under the direct supervision of a certified Private Applicator. Direct supervision, in this case, means the RUP is used by a competent person who is acting under the instructions and control of a certified Private Applicator. The certified Private Applicator is responsible for the actions of the uncertified farmhand. The certified Private Applicator who is in charge of the pesticide use must either be in close proximity to the pesticide user or within telephone or radio contact.

Commercial Applicator

A person using any pesticide for any purpose on the job other than as described for a Private Applicator (production of an agricultural commodity on property the grower owns or leases). Most commercial applicators must be certified. There are two certification options: Commercial Applicator or Registered Technician.

Certified Commercial Applicator

A person who has fulfilled the competency requirements set for Commercial Applicators in Virginia to use or supervise the use of any pesticide for any purpose or on any property on the job other than as described for a Private Applicator.

Certified Registered Technician

An individual who performs services similar to those of a certified Commercial Applicator. Such a person has completed training and demonstration of those competency standards required for Registered Technicians but not the requirements for Commercial Applicator certification. (Registered Technician trainees receive general pesticide safety training and job-specific instruction in pesticide use.) Registered Technicians may use general-use pesticides without supervision. They may use restricted-use pesticides under the direct supervision of a certified Commercial Applicator. Registered Technicians who work for hire must work for a licensed Pesticide Business.

Pesticide Applicator Training Manuals

Pesticide applicator training manuals are sold by Virginia Tech. Orders can be placed online: www.vtpp.ext.vt.edu or vtpp.org. Alternatively, a government purchase orders can be arranged by email: vcdistributioncenter@vt.edu

Certification procedures differ for Private Applicators, Commercial 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 Office of Pesticide Services.

Pesticide Laws, Regulations, and Restrictions

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) has been amended several times since it was passed in 1947. The amendments to this act are some of the most significant laws impacting American agriculture.

The 1972 amendment is known as the Federal Environmental Pesticide Control Act (FEPCA). FEPCA stipulates that the use of any pesticide inconsistent with its labeling is prohibited; that violations of FEPCA by growers, applicators, and dealers can result in heavy fines and imprisonment; that pesticides must be classified for either general use or for restricted use; that anyone using or purchasing restricted-use pesticides must be certified by their state of residency; that pesticide manufacturing plants must be inspected by the EPA; that states may register pesticides on a limited basis for special local needs; that all pesticides must be registered by the EPA; that all product registrations must be backed by scientific evidence to control the pests on the label; not injure people, crops, animals, or the environment; and not result in illegal residues in food and feed when used according to label directions.

A 1978 amendment was designed to improve the registration processes. It stipulates that efficacy data can be waived and that generic standards can be set for active ingredients rather than for each product. Re-registration of older products is required to make certain that scientific data exists to back them. Pesticides can be given a conditional registration prior to full registration. Registrants can use supporting data supplied from other companies if paid for. Trade secrets are to be protected. States have primary enforcement responsibility for both federal and their own state pesticide laws and regulations. States can register pesticides under a Special Local Needs (SLN or 24C) label. Finally, the phrase “to use any registered pesticide in a manner inconsistent with its labeling” was defined in detail.

It is illegal to use a pesticide in any way not permitted by the labeling. A pesticide may be used only on the plants, animals, or sites named in the directions for use. You may not use higher rates or more frequent applications. You must follow all directions for use, including directions concerning safety, mixing and loading, application, storage, and disposal. You must wear the specified personal protective equipment. Pesticide use directions and label instructions are not advice, they are legal requirements. Persons who derive income from the application, recommendation, sale, or distribution of pesticides CANNOT make recommendations which call for uses inconsistent with labeling.

However, federal law does allow you to use some pesticides in ways not specifically mentioned in the labeling. You may: apply a pesticide to control a pest not listed on the label (as long as the application is made in accordance with label directions); use any appropriate equipment or method of application not specifically prohibited by the label; mix two or more pesticides if not prohibited by one or more labels and all the dosages are at or below the label rate; and mix a pesticide or pesticides with fertilizer if the mixture is not prohibited by the labeling.

A major change to FIFRA, provided by a 1988 amendment, requires EPA to accelerate the re-registration of all pesticide products registered prior to 1978. As a result, some older pesticide registrations and/or product uses are being dropped.

The Food Quality Protection Act (FQPA) of 1996 amends both the Federal Food, Drug, and Cosmetic Act (FFDCA) and FIFRA. FQPA provides a unified, comprehensive health-based plan for pesticide residues. Because it requires the EPA to consider pesticide use and safety data in new ways, it will result in significant changes in U.S. pesticide use patterns.

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In 2006, EPA initiated a program to re-evaluate all pesticide registrations on a regular cycle. Re-registration and FQPA will impact pesticide availability and labels.

The Virginia Pesticide Control Act

The Virginia Pesticide Control Act is enforced by the Virginia Department of Agriculture and Consumer Services (VDACS). The act and regulations which support it affect pesticide use in Virginia. Information concerning regulatory changes impacting pesticide use is available from Virginia Tech, VDACS Office of Pesticide Services, 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

Pesticide use means actual application and/or supervision of an application. “Use” includes the routine activities that are part of a pesticide application, such as mixing, loading, cleanup, and disposal. Handling, transfer, or transport after the manufacturer’s original seal is broken is 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.)

Private Applicators:

- In Virginia, a private applicator is a person engaged in producing an agricultural commodity on private property (owned, rented, or leased by the producer).
- Growers using restricted-use pesticides (RUP) must be certified or work under the direct supervision of a certified private applicator.

Commercial 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 land) as a commercial pesticide applicator.
- Certification options for commercial applicators:
 - registered technician
 - commercial applicator
- Certification requirements depend on the commercial applicator class and scope of pesticide use. In addition, The Virginia Business License Regulation requires that people who make recommendations for-hire be certified. There are four classes of commercial applicator:
 - *Government employees* must be certified to use any pesticide for any purpose.
 - *For-hire* commercial applicators must be certified to use any pesticide for any purpose, and to make recommendations for hire (ex. as a crop consultant).
 - *Not-for-hire* commercial 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 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 applicator status while not employed as a pesticide user.

The Virginia Department of Agriculture and Consumer Services (VDACS) is responsible for the certification of applicators and for all enforcement aspects of the Virginia Pesticide Control Act and its regulations.

Certificates may be suspended or revoked if the holder, in the eyes of VDACS, presents a substantial danger or threat of danger to public health and safety or to the environment. A suspension may be issued on an emergency basis, and a certificate may be revoked after a hearing has taken place. If a person's certificate is revoked, he or she may not reapply for Virginia certification for two years.

Persons who have a history of repeat violations of any federal, state, or local pesticide law may not apply for certification. In addition, persons who have had a Virginia applicator certificate revoked may not be granted certification within a two-year period following that action. However, persons in either of these circumstances may petition for certification.

III. Keep Your Certificate in Force

A. Renewal of Certificates

Commercial: Commercial applicator certificates must be renewed every two years. They expire June 30 of the second year after issue. VDACS Office of Pesticide Services will send each commercial applicator a renewal notice when it is time to renew. Return the notice with the \$70 renewal fee on or before June 30 to avoid a \$14 penalty. No late renewals will be accepted after August 29. (See the last paragraph in this section for special conditions for certified applicators who work for federal, state, or local government.)

Applications for renewal will not be processed unless the applicator has met the requirements for recertification credit in the proper category or categories (see section B, which follows). If you allow your certificate(s) to lapse by more than 60 days, you must retest in both the core material and the specific category or categories to reinstate your certificate(s).

All applicators must inform the VDACS-OPS/Certification, Licensing, Registration, and Training Section if their mailing address or employment status changes.

Commercial applicators who work for hire will not be issued renewed certificates unless they have, or work for someone who has, a valid Virginia pesticide business license.

Government applicators do not have to pay application and renewal fees. For this reason, VDACS Office of Pesticide Services does not send renewal notices to government employees who are certified Commercial Applicators and Registered Technicians. Government employee applicators who have met their recertification requirements will receive their renewed certificates automatically.

Private: Private applicator certificates are automatically renewed biennially at recertification. There is no fee. Private applicator certificates expire on December 31, two years following issue. Late renewals will not be accepted after March 1.

B. Recertification

Private and commercial applicators and registered technicians must participate in an ongoing pesticide education program. At a minimum, commercial applicators and registered technicians must attend at least one fully approved recer-

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tification session, per category, every two years. Private applicators must accumulate three credits per category every two years before their certificate expires. Applicators may accumulate up to four years of recertification credit. Persons who fail to recertify will not be able to renew their certificates.

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

Virginia Cooperative Extension offices or
Virginia Tech Pesticide Programs (VTPP) Unit:

www.vtpp.ext.vt.edu/ (private applicator courses; searchable database)

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

www.vdacs.virginia.gov/pesticides/categories.shtml (commercial applicator courses)

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 Virginia Department of Agriculture and Consumer Service Office of Pesticide Services 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 Applicators

Certified commercial 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 applicator. The supervising commercial applicator must either be physically present or be where the registered technician may contact the applicator by telephone or radio. Certified 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 applicator.

B. Uncertified Handlers by Private 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 applicator. The certified private 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 applicator who is responsible for the actions of that person. The certified applicator must be accessible to the applicator by being 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).

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VI. Keep Accurate Records

A. Commercial Applicators

Virginia regulations require all commercial applicators to keep records of all pesticide applications. These records must be maintained for two years following the pesticide use. Commercial 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;
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, or number of plants or animals 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 applicators and WPS compliance:

Commercial 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 applicator to apply an RUP, the commercial applicator is responsible for making and maintaining the application records required by the FACT Act.
- If a grower with farm-worker or pesticide-handler employees hires a commercial applicator to apply any pesticide, the commercial 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 applicator record-keeping form follows at the end of this section.

B. Private Applicators

The Food, Agriculture, Conservation and Trade (FACT) Act of 1991, 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 applicator must be recorded within 14 days and maintained for a period of two years. Private 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;

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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.

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 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 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 restricted-use pesticides. In addition, medical professionals need access to records in the event of an exposure.

The certified applicator who applies a RUP is responsible for making and maintaining the application records required by the FACT Act. However, if a grower hires a commercial applicator to apply a RUP, the commercial applicator is responsible for the FACT Act recordkeeping.

The FACT Act requires commercial 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 private applicator 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.

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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.

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.

VIII. Obtain a Pesticide Business License

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 properly licensed pesticide business.

The Virginia Department of Agriculture and Consumer Services is responsible for all enforcement aspects of the Virginia Pesticide Control Act and its regulations. Business licenses may be suspended or revoked if the holder, in the eyes of VDACS, presents a substantial danger or threat of danger to public health and safety or to the environment.

IX. Ensure Financial Responsibility

The commercial applicator *for hire*, or his/her employer, must provide VDACS with evidence of financial responsibility protecting persons who may suffer legal damages as a result of use of any pesticide by the applicator. The coverage must provide for liability that may result from the operation of a pesticide business and for liability relating to completed operations (for businesses that *apply* pesticides). The Commonwealth insures Virginia's state employees for activities performed as official job duties.

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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

www.vdacs.virginia.gov/pesticides/

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

www.vtpp.ext.vt.edu/ or vtpp.org

Pest management information available on the World Wide Web from Virginia Tech:

Department of Entomology: www.ento.vt.edu

Department of Plant Pathology, Physiology, and Weed Science: www.ppws.vt.edu/

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 Material Safety Data Sheets (MSDS) for all chemicals used by their employees. In addition, employers must provide training on the information in the plan, the MSDS, 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, MSDS and Labeling should be maintained, and employees must be informed of proper use and safe handling according to the MSDS 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: VAEmergencyResponsePlanningOrganizations.aspx (Navigation: DEQ, Programs, Air, Air Quality Planning & Emissions, SARA Title III, VA Emergency Response & Planning Organizations.)

The amount of formulated product that may be stored but not reported depends on the active ingredient itself and percent active ingredient in the product. If a product was 10 percent active ingredient and the TPQ was 10 pounds, then you could store up to 100 pounds of the formulated product before you would be required to report to local authorities.

In the event of a spill, contact local authorities immediately. For help with spill management, contact the Virginia Department of Emergency Management's Operations Center at (800) 468-8892 or (804) 674-2400. Spills that pose a threat to people and/or the environment must be reported to VDACS Office of Pesticide Services at (804) 371-6560. If the spill is of a reportable quantity (information available from VDACS), then contact the National Response Center (800) 424-8802.

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 impacts 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: *The Worker Protection Standard for Agricultural Pesticides – How to Comply*. In addition, a *WPS Summary Guide* produced by VDACS Office of Pesticide Services is available on the agency's website. It provides a great deal of compliance assistance information, including a self inspection checklist. If you have questions about the WPS, please contact your local Extension agent or call the Virginia Department of Agriculture and Consumer Services/Office of Pesticide Services 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.

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 or by calling 1-800-447-3813. (Internet search tip: At the main ESPP page, click on "Bulletins Live!" 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.

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Please observe pesticide labeling for changes and keep up to date on this topic. Information is available through your local Extension office or the Virginia Department of Agriculture and Consumer Services.

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 Phone Sales – Buyers Beware

Telephone solicitation of pesticides is a chronic problem for growers and applicators in Virginia. As a general rule, applicators should be wary about buying pesticide products “sight unseen.” Here is a general description of problems often associated with telephone 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. Often, weed control products contain 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 telephone 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 telephone salesperson does not provide the information you request, the “bargain” is better passed by.

Information given over the 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/Office of Pesticide Services (804) 786-3798 or VCE/Virginia Tech Pesticide Programs (540) 231-6543

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 Office of Pesticide Services by calling (804) 786-3798.

Based on the difficulties associated with 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 non-target plants and animals.

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.

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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, 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 Game and Inland Fisheries. 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.

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, 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/

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

www.medicine.virginia.edu/community-service/centers/brpc

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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

www.poison.org/

CHARLESTON, W.V.

West Virginia Poison Center

3110 MacCorkle Ave., SE

Charleston, WV 25304

(800) 222-1222

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)

www.virginiapoison.org or www.vapoison.org

A complete list of Poison Control Centers is available on the World Wide Web at www.aapcc.org/

General Information

<p>General Information about pest identification and management and about pesticide safety and use patterns</p>	<p>Virginia Tech Your Local Extension Office www.ext.vt.edu/offices/ Virginia Tech Pesticide Programs (0409) Blacksburg, VA 24061 www.vtpp.ext.vt.edu/ or vtpp.org</p>	<p>(540) 231-6543</p>
<p>Regulatory Information including certificate or license status</p>	<p>Virginia Dept. of Agriculture and Consumer Services Office of Pesticide Services 102 Governor Street P.O. Box 1163 Richmond, VA 23218 www.vdacs.virginia.gov/pesticides/</p>	<p>(804) 786-3798</p>
<p>Community Right-to-know Environmental Programs</p>	<p>Department of Environmental Quality 629 East Main Street P.O. Box 1105 Richmond, VA 23218 http://www.deq.virginia.gov</p>	<p>(804) 698-4000 (800) 592-5482</p>
<p>EPA Cooperator for general pesticide information</p>	<p>National Pesticide Information Center (NPIC) Ag. Chemistry Extension Oregon State University 310 Weniger Hall Corvallis, OR 97331-6502 npic.orst.edu/</p>	<p>(800) 858-7378 M-F 11:00 am – 3:00 pm ET</p>
<p>Animal Poisonings Assistance</p>	<p>Va.-Md. Regional College of Veterinary Medicine 265 Duck Pond Drive Virginia Tech (0442) Blacksburg, VA 24061 www.vetmed.vt.edu/</p>	<p>(540) 231-4621 (hospital) Ask your veterinarian to call on your behalf</p>
	<p>ASPCA Animal Poison Control Center \$65.00 consultation fee, credit cards accepted University of Illinois at Urbana-Champaign College of Veterinary Medicine 2001 S. Lincoln Ave. Urbana, IL 61802 aspca.org/pet-care/animal-poison-control</p>	<p>(888) 426-4435</p>
<p>RCRA & Superfund Industry Assistance Hotline</p>	<p>EPA - Resource Conservation Recovery Act (Superfund regulations) www.epa.gov/rcraonline/ and http://www2.epa.gov/rcra</p>	<p>(800) 424-9346</p>
<p>Toxicology Information</p>	<p>Virginia Dept. of Health Division of Environmental Epidemiology/Toxicology Program 109 Governor Street P.O. Box 2448 Richmond, VA 23218 www.vdh.virginia.gov/</p>	<p>(804) 864-8127 (toxic substance information)</p>

General Information (cont.)

EPA Safe Drinking Water Hotline	For information on drinking water regulations and pesticides in drinking water. www.epa.gov/safewater/	(800) 426-4791 M-F 10:00 am-4:00 pm
Hazard Communication/OSHA Compliance Information	Virginia Dept. of Labor & Industry 600 East Main Street Suite 207 Richmond, VA 23219 www.doli.virginia.gov/	(804) 371-2327 M-F 8:15 am – 5:00 pm

Industry Associations

Croplife America 1156 15 th St., N.W. Washington, DC 20005		(202) 296-1585 www.croplifeamerica.org/
Virginia Crop Production Association, Inc. (VCPA) 6442 Cross Keys Road Mt. Crawford, VA 22841		(540) 234-9408 www.vacropproduction.com
Responsible Industry for a Sound Environment (RISE) 1156 15th Street, N.W., Suite 400 Washington, DC 20005		(202) 872-3860 www.pestfacts.org/
National Pest Management Association (NPMA) 10460 North Street Fairfax, VA 22030		(703) 352-6762 (800) 678-6722 www.pestworld.org/ (consumer info.) www.npmapestworld.org (PMPs)
Virginia Pest Management Association (VPMA) 102 Bell Road Fredericksburg, VA 22405 P. O. Box 7161 Fredericksburg, VA 22404-7161		(540) 374-9200 (877) 875-8722 www.vpmaonline.com/
National Association of Landscape Professionals (NALP) 950 Herndon Parkway, Suite 450 Herndon, VA 20170		(800) 395-2522 (703) 736-9666 www.landscapeprofessionals.org
Virginia Turfgrass Council (VTC) P.O. Box 5989 Virginia Beach, VA 23471		(757) 464-1004 www.vaturf.org/
Virginia Nursery and Landscape Association 383 Coal Hollow Road Christiansburg, VA 24073-6721		(800) 476-0055 (540) 382-0943 www.vnla.org/

This directory neither endorses the groups listed nor intends to exclude those not listed. To be included in future revisions contact P.A. Hipkins, Virginia Tech Pesticide Programs, 302 Agnew Hall (0409) Virginia Tech, Blacksburg, VA 24061, telephone: (540) 231-8957.

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

Laundering Information for Pesticide-contaminated Clothing - Before laundering, 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 waterproof 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.

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. **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 rubber 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.

Any waterproof material is 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

Materials 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.

Chemical-Resistance Category 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 ¹	Polyethylene	Polyvinyl Chloride (PVC) ≥ 14 mils	Viton ≥ 14 mils
A (dry and water-based formulations)	high	high	high	high	high	high	high	high
B	high	high	slight	slight	none	slight	slight	slight
C	high	high	high	high	moderate	moderate	high	high
D	high	high	moderate	moderate	none	none	none	slight
E	high	slight	high	high	slight	none	moderate	high
F	high	high	high	moderate	slight	none	slight	high
G	high	slight	slight	slight	none	none	none	high
H	high	slight	slight	slight	none	none	none	high

¹Includes 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.

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 heavily 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.

Table 1.4 - Tables of Weights and Measures

<p>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</p> <p>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</p>	<p>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</p> <p>Length Of Row Required For One Acre: <i>Row Spacing Length or Distance</i> 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</p>
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Table 1.5 - 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 ¹	0.5 pt	1.0 pt	2.0 pt	3.0 pt	4.0 pt ¹
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 (1.0 tbsp) ²	0.8 fl oz	1.6 fl oz	2.4 fl oz	3.2.0 fl oz	4.0 fl oz
1.0 gal ¹	0.08 fl oz (0.5 tsp) ²	0.16 fl oz (1.0 tsp) ²	0.32 fl oz (2.0 tsp) ²	0.48 fl oz (3.0 tsp) ²	0.64 fl oz ¹	0.8 fl oz (5.0 tsp) ²

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

²Approximate 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 ¹	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

¹1 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 ¹	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

¹Based on 8.34 pounds per gallon (weight of water).

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

<i>Liquid</i>																
Cubic centimeters (ml) per 100 square feet necessary to apply the following pounds of active ingredients per acre																
Concentrate lbs/A																
lbs/gal	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
<i>Dry</i>																
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 1/128th of an acre, and an ounce is 1/128th 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 manufacturers, their actions, and their acute toxicity rating (oral LD₅₀). Pesticides which have been canceled are given only as a reference to their toxicity and should not be used.

This list is for information purposes only and was 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:

A	- acaricide	IGR	- insect growth regulator
Anti	- antibiotic	M	- molluscicide
Av	- avicide	Mi	- miticide
B	- bactericide	N	- nematocide
F	- fungicide	PGR	- plant growth regulator
Fum	- fumigant	R	- rodenticide
H	- herbicide	Rep	- repellent
H A	- harvest aid (defoliant)	T	- termiticide
I	- insecticide	V	- vertebrate control

Toxicity

Toxicity is the quality, state, or degree of being poisonous. The toxicities listed here are oral. Oral LD₅₀ (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 LD₅₀, the higher the toxicity. Dermal LD₅₀ ratings are in most cases higher (lower in toxicity) than oral ratings.

When registering pesticides, the Environmental Protection Agency (EPA) uses acute LD₅₀ values 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 ₅₀ (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 LD₅₀ ratings due to some special property of the chemical. For example, chlorothalonil has a very low toxicity (LD₅₀ 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 (LD₅₀) is relative to the concentration of active ingredient in question and the body weight of the victim.

All LD₅₀ ratings listed here are for technical grade compounds; however, pesticide products are not sold as 100 percent concentrations. To find the LD₅₀ 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 (¹)

Those active ingredients having some or all products designated as **restricted use** are marked with a **superscript one (¹)** in Table 1.15. 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 (¹=restricted use)	Trade Names Other Names	Action	Company	Acute LD₅₀ Values for White Rats- Oral (mg/kg) Technical
abamectin ¹	Agri-Mek, Avid, various	I/Mi	Syngenta, various	300
acephate	Orthene, various	I	Amvac, BASF, various	866-945
acetamiprid	Assail, Tristar	I	United Phosphorus, Cleary	314-417
acetic acid	vinegar	H	various	331
acetochlor	Breakfree, Confidence, Degree, Harness, Surpass	H	Dow AgroSciences, DuPont, Monsanto	2,953
acifluorfen	Blazer, Storm	H	United Phosphorus	2,025
<i>Agrobacterium radiobacter</i>	Galltrol-A	B	AgBioChem	low toxicity
alachlor ¹	Bullet, Intro, Lariat, Micro-Tech	H	Monsanto	~1,000
aldicarb ¹	Meymik, Temik	I	Ag Logic, Bayer	1
allethrin	various	I	various	680-1,000
allyl isothiocyanate	Dominus	Rep	Engage Agro USA	151
aluminum phosphide ¹	Phosfume, Phostoxin, Weevil-Cide	Fum	Degesch, Douglas, United Phosphorus	0.3
ametryn	Evik	H	Syngenta	1,110
ametoctradin	Orvego, Zampro	F	Bayer	> 2,000
amicarbazone	Xonerate	H	Arysta	> 2,000
aminocyclopyrachlor	Method	H	Bayer	> 5,000
4-aminopyridine ¹	Avitrol	Av	Avitrol Corp	20-29
aminopyralid	Milestone	H	Dow AgroSciences	> 5,000
amitraz ¹	Apivar	H	Arysta	800
ancymidol	A-Rest, Abide	PGR	Fine Americas, Sepro	4,500
asulam	Asulox	H	United Phosphorus	5,000
atrazine ¹	Aatrex	H	Syngenta, various	3,080
avitrol ¹	Avitrol	AV	Avitrol Corp.	20
azadirachtin	Amazin, Aza-Direct, Azatin, Azatrol, Ecozin, Ornazin	IGR, I, F, Rep	Amvac, Certis, Gowan, Olympic, PBI Gordon, Sepro	> 5,000
azoxystrobin	Abound, Dynasty, Headway, Heritage, Quadris	F	Syngenta, various	> 5,000
<i>Bacillus cereus</i>	Pix Plus	PGR	Arysta	> 5,000
<i>Bacillus firmus</i>	Nortica, Vovito	N	Bayer	> 5,000
<i>Bacillus licheniformis</i>	Roots Ecoguard	F	Novozymes	> 5,000
<i>Bacillus pumilus</i>	Ballad Plus, Sonata, Yield-Shield	F	Bayer	> 5,000

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
<i>Bacillus sphaericus</i>	Fourstar, Vectolex, Vectomax, Spheratax	I	Advanced Microbiologics, Fourstar, Valent	> 5,000
<i>Bacillus subtilis</i>	Companion, Serenade, Rhapsody	F	AgraQuest, Growth Products	> 5,000
<i>Bacillus thuringiensis</i>	DiPel, various	I	various	> 5,000
<i>Beauveria bassiana</i>	balEnce, Botaniguard, Mycotrol, Naturalis	I	Jabb, LAM, Troy Biosciences	> 5,000
benefin (benfluralin)	Balan, Team	H	Dow AgroSciences, various	> 10,000
bensulide	Prefar	H	Gowan, various	770
bentazon	Basagran, Rezult	H	Arysta, BASF, various	1,100
bifenazate	Acramite, Floramite, Sirocco	Mi	Chemtura, OHP	> 5,000
bifenthrin ¹	Talstar, various	I	FMC, various	54.5
bispyribac-sodium	Tradewind, Velocity	H	Valent	4,111
BLAD	Fracture	F	FMC	> 5,000
borax	various	I	various	4,500-6,000
Bordeaux Mixture	Copper/Sulfur	F	various	low toxicity
boric acid	various	I	various	low toxicity
boscalid	Emerald	F	BASF	> 2,000
brodifacoum	Final, Talon, various	R	Bell Labs, Syngenta, various	0.27
bromacil	Hyvar, various	H	Bayer, various	5,200
bromadiolone	Contrac, various	R	Bell Labs, various	0.56-0.84
bromethalin	Assault, Fastrac, various	R	Bell Labs, various	2.0
bromoxynil	Buctril, various	H	Bayer	190
buprofezin	Applaud, Talus, various	IGR	Nichino, Sepro	180-400
butralin	Butralin	H, PGR	Chemtura	890-1,540
capsaicin	Hot Sauce, various	Rep	various	> 2,500
captan	Captan, various	F	various	9,000
carbaryl	Sevin, various	I/Mi	various	850
carbendazim	Fungisol, Imisol	F	J.J. Mauget	> 15,000
carbofuorfen	Acifluorfen 2, Avalanche, Leivity	H	various	> 5,000
carboxin	Vitavax	F	various	3,820
carfentrazone-ethyl	Aim, various	H	FMC, various	> 5,000
chlorantraniliprole	various	I	DuPont, Syngenta, various	> 5,000
chlorethoxyfos ¹	SmartChoice	I/Mi	Amvac	1.8-4.8
chlorfenapyr	Phantom, Pylon	I/Mi	BASF	441
chlorimuron ethyl	Cemax, Classic	H	Agsurf, DuPont	4,102
chlormequat chloride	Citadel, Cycocel, Chlormequat	PGR	various	> 5,000
chlorophacinone ¹	Rozol	R	Liphatech	3.15
chloropicrin ¹	Tri-Pic	Fum	Triest	250
chlorothalonil	Bravo, Chloronil, various	F	Syngenta, various	> 10,000
chlorpropham	Shield, various	H, PGR	Aceto Ag, Decco	3,800

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
chlorpyrifos ¹	Dursban, Lorsban	I	Dow AgroSciences, various	135-163
chlorsulfuron	Telar	H	Bayer	5,545
chlorthal	Dacthal	H	Amvac	3,000
cholecalciferol	Agrid 3, Terad 3	R	Bell	352
clethodim	Envoy, Select, Volunteer	H	Valent, various	1,630
clofentezine	Apollo, Ovation	Mi	Makhteshim-Agan, Everris	> 5,200
clomazone	Command	H	FMC	2,077
clopyralid	Lontrel	H	Dow AgroSciences	> 4,300
cloransulam-methyl	FirstRate	H	Dow AgroSciences	> 5,000
clothianidin	Arena, Belay, Poncho	I	BASF, Valent	> 5,000
copper chelate	Citrine, various	H(aq)	Applied Biochemists	0.50-2.00
copper hydroxide	Kocide, various	F/B	DuPont, Sepro, various	1,000
copper sulfate	Bluestone, various	H(aq), F/B	various	470
coumaphos ¹	Checkmite +, Co-Ral	I/A	Bayer, Mann Lake	56-230
m-cresol	Gallex	B	Agbiochem	242
creosote ¹	coal tar	F/I	various	885
cyantraniliprole	Exirel, Ference, Fortenza, Mainspring, Verimark, Zyrox	I	DuPont, Syngenta	> 5,000
cyazofamid	Ranman, Segway	F	various	> 5,000
cyclanilide	Finish, Stance, Terminate	PGR	Bayer, NuFarm	> 5,000
cycloate	Ro-Neet	H	HelmAgro	2,000-3,190
cyflufenamid	Torino	F	Gowan	> 5,000
cyflumetofen	Nealta, Sultan	Mi	BASF	> 2,000
cyfluthrin ¹	Tempo, Tombstone, various	I	Bayer, Loveland, various	400
(gamma-) cyhalothrin ¹	Declare, Proaxis	I	Cheminova	50
(lambda-) cyhalothrin ¹	Demand, Karate, Warrior, various	I	Syngenta, various	79
cymoxanil	Curzate, Tanos	F	DuPont	1,100
cypermethrin ¹	Ammo, Demon, Fastac	I	various	250-4,150
cyproconazole	Alto	F	Syngenta	1,020
cyprodinil	Vanguard	F	Syngenta	> 2,000
cyromazine	Citation, Trigard	IGR	Syngenta	3,387
2,4-D	various	H/PGR	various	300-700
2,4-DB	various	H	various	370-1,500
DCPA	see chlorthal	—	—	—
daminozide	B-Nine, Dazide	PGR	various	8,400
dazomet	Basamid, various	Fum	various	520
decanol	Royaltac, various	PGR	various	18,000
deet	OFF, various	Rep	SC Johnson, various	8,500

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹=restricted use)	Trade Names Other Names	Action	Company	Acute LD₅₀ Values for White Rats- Oral (mg/kg) Technical
deltamethrin	Deltadust, Deltagard, various	I/Mi	Bayer, various	> 5,000
diazinon ¹	Diazion	I	various	1,250
dicamba	Banvel, Engenia, Vanquish, various	H	BASF, Syngenta, various	1,707-6,764
dichlobenil	Casoron	H	various	> 3,160
1,3-dichloropropene ¹	Telone	Fum	Dow AgroSciences	250-500
dichlorvos	Vapona, various	I	various	56-80
diclofop-methyl ¹	Hoelon, Illoxan	H	Bayer	563
diclosulam	Strongarm	H	DowAgroSciences	> 5,000
dicrotophos ¹	Bidrin, Inject A Cide	I	Amvac, Mauget	22
difenacoum	various	R	various	<1
difenoconazole	Dividend, Inspire	F	Syngenta	1,453
difethialone	Generation, Hombre, various	R	Liphatech	1-7
diflubenzuron ¹	Advance, Dimilin	IGR, T	BASF, Chemtura	> 4,640
diflufenzopyr-sodium	no stand-alone products	H	BASF	> 5,000
dikegulac sodium	Augeo, Atrimmec, Pinscher	PGR	various	18,000-31,000
dimethoate	Dimethoate	I	various	290-325
dimethomorph	Forum, Stature	F	BASF	3,900
dinotefuran	Venom	I	Valent	2,804
diphacinone	various	R	various	3
diquat dibromide	Diquat, Enforcer, Reward, Weedtrine-D	H	various	231
disulfoton ¹	Di-Syston	I	Bayer	12.7
dithiopyr	Dimension, various	H	Dow AgroSciences, various	3,600
diuron	Karmex	H	various	3,400
dried blood	various	Rep	various	low toxicity
egg solids	various	Rep	various	34,600
emamectin ¹	Enfold, Proclaim	I	Syngenta	76-89
endosulfan	Thionex	I	Makhteshim Agan	40
endothall	Aquathol, Hydrothal	H/H(aq)	United Phosphorus	51
EPTC	Eptam	H	Gowan	1,630
esfenvalerate ¹	Asana, various	I	Valent, various	75-458
ethaboxam	Intego	F	Valent	> 5,000
ethalfuralin	Curbit, Sonalan, Strategy	H	Dow AgroSciences, Loveland	> 10,000
ethephon	Cerone, Ethrel, Florel	PGR	Bayer, various	4,000
ethofenprox	Zenivex	I	Wellmark	> 40,000
ethofumesate	Ethotron, Poa Constrictor, Progress	H	Bayer, United Phosphorus	6,400
ethoprop (ethoprophos) ¹	Mocap	I/N	Amvac	62

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
etoxazole	Beethoven, Tetrasan, Zeal	Mi, IGR, Mi	BASF, Valent	> 5,000
etridiazole	Banrot, Terrazole, Truban	F	various	1,077
famoxadone	Tanos	F	DuPont	> 5,000
fatty acid salts/soaps	various	I/Mi, H, PGR, Rep	various	50 - > 5,000
fenamidone	Fenstop, Reason	F	Bayer, OHP	> 5,000
fenazaquin	Magister, Magus	Mi	Gowan	134
fenbuconazole	Indar	F	Dow AgroSciences	> 2,000
fenbutatin-oxide (hexakis) ¹	Meraz, Vendex	Mi	United Phosphorus	2,630
fenhexamid	Captevate, Decree, Elevate	F	Arysta, Sepro	> 2,000
fenoxaprop-p-ethyl	Acclaim, Double Check, Tacoma	H	Bayer, Loveland, Winfield	4,670
fenpropathrin ¹	Danitol, Tame	A/I	Valent	70
fenpyrazamine	Protexio	F	Valent	> 2,000
fenpyroximate	Akari, Portal	I/Mi	Nichino, Sepro	480
fentin hydroxide ¹	Agri-Tin, Super Tin	F/I/Mi	NuFarm, United Phosphorus	160
ferbam	Ferbam	F	Taminco	> 17,000
ferric sodium EDTA	Slug and Snail Killer	M	various	low toxicity
fipronil ¹	Frontline, Regent, Termidor	I/Mi/T	Bayer, BASF	336
flazasulfuron	Katana	H	PBI Gordon	> 5,000
flonicamid	Aria, Beleaf	I	FMC	> 2,000
florasulam	Defendor	H	Dow AgroSciences	> 5,000
fluazifop-P-butyl	Fusilade	H	Syngenta, various	3,680
fluazinam	Omega, Secure	F	Syngenta	> 5,000
flubendiamide	Belt, Synapse, Turismo, Vetica	I	Bayer, Nichino	> 2,000
flucarbazone-sodium	Finesse, Everest, Sierra	H	Arysta, DuPont, Syngenta	> 5,000
fludioxonil	Maxim, Medallion	F	Syngenta	> 5,000
fluensulfone	Nimitz	N	Makhteshim Agan	> 2,000
flufenacet	Axiom, Define	H	Bayer	589-1,617
flumetralin	Prime +, various	PGR	Syngenta, various	> 5,000
flumetsulam	Python	H	Dow AgroSciences	> 5,000
flumiclorac-pentyl	Action, Resource	H	Amvac, Valent	> 5,000
flumioxazin	Broadstar, Clipper, Gangster, Payload, SureGuard, Valor	H/H(aq)	Valent	> 5,000
fluometuron	Cotoran, Shotaran	H	various	6,416-8,900
fluopicolide	Adorn, Presidio, Stellar	F	Valent	> 5,000
fluopyram	Ilevo	F/N	Bayer	> 2,000
fluoxastrobin	Aftershock, Disarm, Evito	F	Arysta, Loveland	> 5,000

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (*=restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
flupyradifurone	Sivanto	I	Bayer	> 2,000
fluridone	Avast, Sonar	H (aq)	Alligare, Sepro	> 10,000
fluroxypyr	Position, Starane, Vista	H	Dow AgroSciences	> 2,405
flurprimidol	Cutless, Topflor	PGR	Sepro	709-914
fluthiacet-methyl	Cadet	H	FMC	> 5,000
flutolanil	Moncoat, Prostar	F	Bayer, Nichino	> 10,000
flutriafol	Fortix	F	Arysta	1,140
fluvalinate	Apistan, Mavrik	I	Wellmark	260-280
fluxopyroxad	Systiva, Xzemplar	F	BASF	> 2,000
folpet	Fungitrol	F	International Specialty Products	> 10,000
fomesafen	Sinister	H	Helena	1,250-2,000
formic acid	Mite-Away	Mi	Nod Apiary Products	110
fosamine ammonium	Krenite	H	Bayer	10,200
fosetyl-Al	Aliette, various	F	Bayer, various	5,800
furfural	Multiguard Protect	F/N	Agriguard	65
gibberellic acid	GibGro, ProGibb	PGR	various	630
<i>Gliocladium virens</i>	Soil Gard	F	Certis	low toxicity
glufosinate-ammonium	Finale, Ignite, Liberty, Rely, Remove, various	H	Bayer, various	1,620-2,000
glyphosate	Accord, Rodeo, Roundup, various	H	Dow AgroSciences, Monsanto, various	4,050-5,600
halosulfuron-methyl	Sandea, Sedgehammer, various	H	Monsanto, Nufarm, various	1,287
harpin protein	Axiom, various	B, I, F, N, PGR	various	low toxicity
hexaflumuron	Shatter	T, IGR	Dow AgroSciences	> 5,000
hexazinone	Velossa, Velpar	H	DuPont, Helena	1,690
hexythiazox	Hexygon, Onager, Savey	Mi	Gowan	> 5,000
hydramethylnon	Amdro	I	various	1,131-1,300
hydroprene	Gentrol, various	IGR	various	> 34,600
IBA	Hormodin, various	PGR	various	100 (mice)
imazalil	Fungaflor	F	Whitmire	227-343
imazamox	Beyond, Clearcast, Raptor	H/ H(aq)	BASF, Sepro	> 5,000
imazapic	Cadre, Plateau	H	BASF, NuFarm	> 5,000
imazapyr	Arsenal, Chopper, Habitat, various	H	BASF, Sepro, SSI Maxim	> 5,000
imazaquin	Image	H	BASF	> 5,000
imazethapyr	Pursuit	H	BASF	> 5,000
imazosulfuron	Celero, League	H	Valent	> 5,000
imidacloprid	Admire, Advantage, Merit, various	I/A	Bayer, various	450
imiprothrin	see metaflumizone	---	---	---

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹=restricted use)	Trade Names Other Names	Action	Company	Acute LD₅₀ Values for White Rats- Oral (mg/kg) Technical
indaziflam	Alion, Esplanade, Marengo, Specticle	H	Bayer, OHP	> 2,000
indoxacarb	Advion, Avaunt, Steward	I	DuPont	268-1,732
iodosulfuron	Autumn	H	Bayer	2,678
ipconazole	Acceleron, Rancona, Vortex	F	Bayer, Chemtura, Monsanto	> 5,000
iprodione	Eclipse, Rovral, various	F	FMC, Sipcam Agro, various	3,500
isoxaben	Gallery	H	Dow AgroSciences	> 10,000
isoxaflutole	Balance	H	Bayer	> 5,000
kasugamycin	Kasumin	F	Arysta	> 5,000
kinoprene	Enstar	IGR	Wellmark	4,900-5,000
kresoxim-methyl	Sovran	F	BASF	> 5,000
lactofen	Cobra, Phoenix	H	Valent	> 5,000
linuron	Linex, Lorox	H	Tessenderlo Kerley	1,500-4,000
magnesium phosphide ¹	Fumi-Cel, Fumi-Strip, Magtoxin	Fum	Degesch	0.3
malathion	Malathion, various	I	various	1,375-2,800
maleic hydrazide	MH-30, various	H/PGR	various	6,950
mancozeb	Dithane, Fore, Manzate, various	F	various	> 5,000
MCPA	MCPA, various	H	various	700-800
mecoprop	MecoMec, various	H	PBI/Gordon, various	930
mefenoxam	see metalaxyl-M	—	—	—
mefluidide	Embark	H/PGR	PBI/Gordon, various	> 4,000
mepiquat chloride	various	PGR	various	464
mepiquat pentaborate	Pentia	HA/ PGR	BASF	500
mesotrione	Callisto, Tenacity	H	DuPont, Syngenta	> 5,000
metaflumizone	Altrevin, Siesta	I	BASF	1,800
metalaxyl-M (mefenoxam)	Apron, Subdue	F	various	1,040
metaldehyde	Deadline, various	M	various	630
metam-sodium ¹	Vapam, various	Fum	Amvac, various	1,800
metconazole	Caramba, Metlock, Quash, Tourney	F	BASF, Valent	660
methamidophos ¹	Monitor	I	Bayer	17
methiocarb ¹	Mesuroi	I/M/Rep	Gowan	15-35
methomyl ¹	Lannate, Nudrin, various	I/N	DuPont, various	17-24
methoprene	Altosid, various	IGR	Wellmark Intl., various	34,600
methoxyfenozide	Intrepid, Troubadour	I	Dow AgroSciences, Helena	> 5,000
methyl anthranilate	various	Rep	various	> 5,000
methyl bromide ¹	Bromo-O-Gas, Metabrom, Meth-O-Gas	Fum	Great Lakes, various	200 (vapor)
metiram	Polyram	F	Loveland	> 10,000

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
metolachlor	Cinch, Dual, Pennant , various	H	DuPont, Syngenta, various	2,780
metrafenone	Vivando	F	BASF	> 5,000
metribuzin	Metribuzin, Sencor, Tricor	H	Bayer, various	1,100-2,300
metsulfuron-methyl	Ally, Cimarron, Escort, various	H	Bayer, DuPont, various	> 5,000
mineral oil	Dormant Oil, various	I/Mi	various	low toxicity
MSMA	MSMA, Target	H	Drexel, Luxembourg	1,700
myclobutanil	Eagle, Laredo, various	F	Dow AgroSciences, various	1,600-2,290
NAA	Dip'nGrow, Pomaxa, RootMaster	PGR	Valent, various	1,000
NAD	Amid-Thin, Rootone	PGR	Amvac, Bayer	1,000
naled	Dibrom, Trumpet	I	Amvac	430
naphthalene	"moth balls"	Fum/I /Rep	various	50-500
napropamide	Devrinol	H	United Phosphorus	5,000
neem	see azadirachtin	—	—	—
nicarbazin	Ovocontrol	Av	Innolytics, LLC	10,000
nicosulfuron	Accent	H	DuPont	> 5,000
norflurazon	Solicam	H	Tessenderlo Kerley	> 9,400
<i>Nosema locustae</i>	Nolo Bait	I, M & R	M&R Durango	low toxicity
novaluron	Diamond, Pedestal, Rimon	I	Chemtura, Makhteshim Agan	> 5,000
noviflumuron	Recruit	T, IGR	Dow AgroSciences	> 5,000
oryzalin	Surflan, various	H	United Phosphorus, various	> 10,000
oxadiazon	Ronstar, various	H	Bayer, various	> 8,000
oxamyl ¹	Vydate	I/N	DuPont	5.4
oxydemeton-methyl ¹	MSR	I, Mi	Gowan	65-75
oxyfluorfen	Goal, various	H	Dow AgroSciences, various	> 5,000
oxytetracycline	Mycoject, Mycoshield, Treotech	F	various	low toxicity
paclobutrazol	Bonzi, Cambistat, Piccolo, Profile, Trimmit	PGR	various	5,346
paradichlorobenzene	"moth balls"	I/Rep	various	500-5,000
paraquat ¹	Gramoxone, various	H	Syngenta, various	150
pendimethalin	Pendulum, Prowl, various	H	BASF, Scott's, various	1,250
penoxsulam	Galleon, Sapphire	H/H(aq)	Dow AgroSciences, Sepro	> 5,000
pentachloronitrobenzene	Blocker, Terraclor, Turfcide	F	Amvac	1,650-12,000
penthiopyrad	Fontelis, Velistat, Vertisan	F	DuPont	> 5,000
permethrin ¹	Ambush, Pounce, various	I	Amvac, FMC, various	4,000
phenmedipham	Spin Aid	H	Bayer	> 4,000
phenothrin	Bedlam, various	I	MGK, various	> 5,000
phorate ¹	Thimet	I	Amvac	2-4
phosmet	Imidan	I	Gowan	147-316

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹=restricted use)	Trade Names Other Names	Action	Company	Acute LD₅₀ Values for White Rats- Oral (mg/kg) Technical
phosphine gas ¹ (hydrogen phosphide)	Eco ₂ Fume, VAPORPH ₃ OS	I/Mi, Fum	Cytec Ind.	0.3
phostebupirim ¹	Aztec ¹ (w/cyfluthrin)	I	Bayer	2.9-3.6
picaridin	Cutter, Off, various	Rep	S.C. Johnson, various	4,743
picloram ¹	Tordon K, various	H	Dow AgroSciences, various	8,200
picoxystrobin	Approach	F	DuPont	> 5,000
pinoxaden	Axial	H	Syngenta	> 5,000
piperalin	Pipron	F	Sepro	2,500
piperonyl butoxide	(used as a synergist)	I	various	> 7,500
polybutene	Hot Foot, various	Rep	various	low toxicity
polyoxin D	Affirm, Endorse, Ph-D, Veranda	F	Arysta	> 5,000
potassium bicarbonate	Armicarb, Kaligreen, Milstop	F	various	500-5,000
primisulfuron-methyl	Beacon	H	Syngenta	5,050
prodiamine	Barricade, various	H	Syngenta, various	> 5,000
prohexadione calcium	Anuew, Apogee, Kudos	PGR	BASF, Cleary, Fine	> 5,000
prometon	Pramitol, various	H	various	2,980
prometryn	Caparol, CottonPro	H	Syngenta, Makhteshim Agan	5,235
pronamide ¹ (propyzamide) ¹	Kerb	H	Dow AgroSciences	5,620-8,350
propamocarb hydrochloride	Banol, Previcur, Proplant	F	Bayer, Lesco, Sipcam	8,600
propargite	Omite	Mi	Chemtura	2,200
propiconazole	Alamo, Banner, Tilt, various	F	Syngenta, various	1,517
propoxur	Invader, various	I/Mi	FMC, various	95-104
propyzamide ¹	see pronamide	—	—	—
prosulfuron	Peak	H	Syngenta	4,360
prothioconazole	Proline	F	Bayer	> 6,200
pymetrozine	Endeavor, Fulfill	I/Mi	Syngenta	5,820
pyraclostrobin	Cabrio, Headline, Insignia	F	BASF	> 5,000
pyraflufen-ethyl	Edict, Venue	H, HA	Nichino	> 5,000
pyrethrum	Pyrethrins	I	various	584-900
pyridaben	Nexter, Sanmite	I/Mi	Gowan	820-1,350
pyridalyl	Overture	I	Valent	> 5,000
pyrimethanil	Scala	F	Bayer	4,149
pyriproxyfen	Distance	IGR	Valent	4,733
pyrithiobac-sodium	Pyrimax, Pysonex, Staple	H	Agsurf, DuPont, Makhteshim Agan	4,000
pyroxasulfone	Zidua	H	BASF	> 2,000
pyroxsulam	GR1, PowerFlex	H	Dow AgroSciences, DuPont	> 2,000
quinclorac	Facet, various	H	BASF, various	> 2,610
quinoxifen	Quintec	F	Dow AgroSciences	> 5,000

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
quizalofop-p-ethyl	Assure II, Targa	H	DuPont, Gowan	1,182-1,210
resmethrin ¹	Scourge	I	Bayer, various	> 2,500
rimsulfuron	Matrix, various	H	DuPont, various	> 5,000
rotenone ¹	CFT Legumine, Prenfish, Prentox	V	Central Garden & Pet Co.	132-1,500
saflufenacil	Detail, Integrity, Sharpen, Treevix	H	BASF	> 2,000
sethoxydim	Poast, Rezult, various	H	BASF, various	2,676-3,200
siduron	Tupersan, various	H	various	> 7,500
silica/silicon dioxide	various	I	various	3,160
simazine	Princep, various	H	Syngenta, various	> 5,000
sodium bentazon	Basagran, Rezult B, various	H	Arysta, BASF, various	1,100-2,063
sodium chlorate	Defol, various	H	Drexel, various	1,200
sodium chloride	TABLE SALT	---	Morton, various	3,320
sodium cyanide ¹	M-44	V	USDA-APHIS-WS	6.4
sodium fluoroacetate ¹	1080	V	USDA-APHIS-WS	0.22
spinetoram	Delegate, Radiant	I	Dow AgroSciences	> 5,000
spinosad	SpinTor, Tracer, various	I/Mi	Dow AgroSciences, various	> 5,000
spiromesafen	Forbid, Judo, Oberon	I/Mi	Bayer, OHP	> 2,500
spirotriamat	Kontos, Movento	I	Bayer, OHP	> 2,000
starlicide ¹	Compound DRC-1339, Starlicide Complete	Av	USDA-APHIS-WS, Vlrbac AH	1,770
streptomycin sulfate	Agri-Mycin, various	F	various	> 10,000
sulfentrazone	Authority, Spartan, various	H	FMC, various	2,855
sulfometuron-methyl	Oust, various	H	Bayer, various	> 5,000
sulfosulfuron	Certainty, Outrider	H	Monsanto	> 5,000
sulfoxaflor	Closer, Transform	I	Dow AgroSciences	1,000
sulfur	Thiolux, various	F, I/Mi	various	low toxicity
sulfuryl fluoride ¹	Profume, Vikane, Zythor	Fum	Dow AgroSciences, Ensystem II	100
tebuconazole	various	F	various	4,000
tebufenozide	Confirm, Mimic	I	Gowan, Valent	> 5,000
tebupirionfos ¹	see phostebupirim ¹	—	—	—
tebuthiuron	Spike, various	H	Dow AgroSciences, various	579
tefluthrin ¹	Force, Precept	I/Mi	Monsanto, Syngenta	20-35
tembotrione	Laudis	H	Bayer	> 2,000
temephos	Abate	I	Clarke	8,600-13,000
terbacil	Sinbar	H	Tessenderlo Kerley	> 5,000
terbufos ¹	Counter	I	Amvac	1.6
tetrachlorvinphos	Rabon	I/Mi	Bayer, various	4,000-5,000
tetraconazole	Domark, Mazinga	F	Isagro, Sipcam Agro	1,248
tetramethrin	various	I	various	4,640

Table 1.15 - Chemical Information Chart (cont.)

Common Name or Designation (¹ =restricted use)	Trade Names Other Names	Action	Company	Acute LD ₅₀ Values for White Rats- Oral (mg/kg) Technical
thiabendazole	Mertect	F	Syngenta	3,810
thiacloprid	Calypso	I	Bayer	621
thiamethoxam	Actara, various	I/Mi	Syngenta, various	1,563
thiencarbazone-methyl	no stand-alone products	H	Bayer	> 2,000
thidiazuron	Ginstar, various	HA	Bayer, various	> 5,000
thifensulfuron-methyl	Harmony, various	H	DuPont, various	> 5,000
thiophanate methyl	3336, Spectro, Topsin	F	Cleary, various	7,500
thiram	Spotrete, various	F/Rep	Cleary, various	780
tolclofos-methyl	Rizolex	F	Valent	5,000
tolfenpyrad	Apta, Hachi-Hachi, Torac	I	Nichino, Sepro	260-386
topramezone	Armezon, Frequency, Impact, Pylex	H	Amvac, BASF	> 2,000
triadimefon	Bayleton, various	F	Bayer, various	317-568
triadimenol	Baytan	F	Bayer	700-1,200
tribenuron-methyl	Express	H	DuPont	> 5,000
tribuphos (tribufos)	DFT 6, Folex 6, Vestage	HA	Amvac, Loveland, Red Eagle	250
trichlorfon	Dylox	I	Bayer	560-630
<i>Trichoderma harzianum</i>	Rootshield, Turfshield	F	Bioworks	low toxicity
triclopyr	Garlon, various	H	Dow AgroSciences, various	713
trifloxystrobin	Compass, Flint, Gem	F	Bayer, OHP	> 4,000
trifloxysulfuron-sodium	Envoke, Monument	H	Syngenta	> 5,000
triflumizole	Procure, Terraguard, Viticure	F	Chemtura	2,230
trifluralin	Preen, Treflan, various	H	Dow AgroSciences, various	> 10,000
trinexapac-ethyl	Primo, various	PGR	Syngenta, various	> 5,000
triticonazole	Trinity	F	BASF	> 5,000
uniconazole	Concise, Sumagic	PGR	Fine, Valent	2,020
vinclozolin	Curalan, Touche	F	BASF	> 10,000
warfarin	Rodex	R	Bell, Hacco, various	186
zinc phosphide ¹	various	R	Bell, Hacco, various	45.7
ziram	Ziram	F	United Phosphorus, Taminco	1,400
zoxamide	Gavel, Zing, Zoxium	F	Gowan	> 5,000

Protecting Honey Bees

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Honey bees are a valuable service to apiculture and agriculture not only because of 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.

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

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

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

³Some formulations of Sevin XLR are rated as moderately toxic to 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, Floramate (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) ²
Banol (carbanolate)	Ciodrin (crotoxyphos)	Elgetol (dinitrocresol)	Metasystox R (oxydemeton- methyl)	Spirotetramet (Movento)	Thionex (endosulfan)
Bolstar (sulprofos)	Coumaphos ¹ (Agridip, Asunthol)	endrin	Mocap (ethoprop)		Trithion, Thiodan (carbophenothion)
	Counter (terbufos)	Esteem (pyriproxyfen)			Vydate (oxamyl)

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

²Thimet 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) ¹	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)	
Birlane (chlorfenvinphos)	Dylox (trichlorfon)	Kanemite (acequinocyl)	Pentac (dienochlor)	Sucroicide (sucrose octano- ate esters)	
	Endeavor (Pymetrozine)	Kelthane (dicofol)	Plictran [mitacid] (cyhexatin)	Surround (kaolin)	
		Mach 2	Pynamin		

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

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Fungicides

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

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

¹ May increase the toxicity of neonicotinoid pesticides to honey bees if used together.

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

¹ Slightly toxic to honey bees