



A Publication for Vermont Pesticide Applicators

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Have questions or comments on this newsletter? Please contact Wendy Anderson at (802) 828-3475, or wha@agr.state.vt.us.



News from the Vermont Department of Agriculture, Plant Industry Division



BE ON THE LOOK - OUT FOR APPLICATOR RENEWAL PACKAGES!

Renewal packages for pesticide company licenses and applicator certificates will be sent out the first or second week in December. If you haven't received your paperwork by the first week in January, please call us and we'll send you another package!

FILLING OUT YOUR ANNUAL PESTICIDE USAGE REPORT

When reporting the "total amount of product used", please report only that amount of <u>manufactured product</u> used, not the total amount of the diluted product used in the application. For example, if you apply ½ gallon of "product X" in 10 gallons of water, you would report the use of ½ gallon of product, not 10 gallons, on your usage report. Reporting the total amount of diluted product will lead to an over-reporting of the amount of pesticidal active ingredient used.

NEW: To expedite data entry on our end, please specify "solid" or "liquid" when reporting usage in ounces.

Also, remember that your usage report must list the use of pesticides by all individuals employed by you over the past year, whether or not they are still working for you.

If you have any questions about filling out the usage report, call Cary Giguere at 802-828-6531.

NOTE: Private applicators do <u>not</u> need to submit an annual pesticide usage report, but must keep records of restricted use pesticide usage for a period of 2 years and submit them to the Department if requested.

News From The University of Vermont, Extension Service

IPM FOR NORTHERN AND WESTERN CORN ROOTWORM IN VERMONT

Sid Bosworth Extension and Research Agronomist Plant and Soil Science Department, University of Vermont

The Western corn rootworm (WCRW) was first detected in Vermont in 1991 and has been found in almost every county in the state since. This insect is far more aggressive than the Northern corn rootworm, an insect that has been prevalent in corn for many years in Vermont. Damage first occurs by root-feeding larvae. Pruning of roots causes plants to be more susceptible to dry conditions and reduces water and nutrient uptake. Visual damage is sometimes observed when plants lodge due to a weak root system. However, research in New York found that corn silage yields could be reduced even when there were no above ground visual signs of damage.

There has been some reaction by corn growers to the recent concerns of WCRW by using insecticides applied at planting. According to Vermont Department of Agriculture pesticide use records, we estimate that about 5 percent of the corn acreage was treated with an insecticide for this purpose. Yet, we have very little quantitative data on actual WCRW populations and impact in Vermont. There has been some scouting by private crop consultants using IPM procedures, but this is on limited acreage.

Digging plants and inspecting roots for root feeding is the best way to confirm early season damage. However, scouting for emerged adults just before and during silking is the most practical way to estimate insect populations and make decisions about the next crop year.

The most common scouting procedure for corn rootworms is a visual approach. Fields should be scouted when silking begins and continued on a weekly basis until females start laying eggs (about 3 consecutive weeks). Since larvae feed only on corn roots and no other crop, few problems exist in the first year of corn. Therefore, fields that have been in corn for more than one year are the best candidates for assessment.

A recommended procedure is to walk through the field and randomly assess up to 55 plants across the field. Stealth is a key as you move through the corn crop to detect adults. These insects are easily startled and will literally drop off the plant if disturbed. So move through slowly and quietly. Grasp the ear silks in one hand to confine any beetles feeding in the silk and quickly look over the rest of the plant starting from the top down. Finally, assess the silk for any remaining beetles.



Left - Adult Western Corn Rootworm Right - Adult Northern Corn Rootworm

Record both northern and western adults. Add up the total number of "western corn rootworm equivalents" with every two northern adults equaling one western. Divide this total by the number of plants assessed. You need an average of one adult western corn rootworm beetle per plant (remember that 2 northern adults equals one western) for your populations to be high enough to warrant a management decision. If you have a lot of Northern adults, you can include them in your calculations but 2 Northern adults equals one Western. A modification of the visual approach is called the "Sequential Sampling" method, which allows you to sample fewer plants.

A different method of scouting adults developed at Virginia Tech University is to use sticky traps placed just above the ear. Adults stuck to the trap are counted once a week and a threshold is determined. The number of traps used depends on the size of the field.

In the summer of 2001, several crop consultants across Vermont participated in an IPM program assessing the visual method to a sticky trap method. We thought that perhaps the sticky trap method would be easier and faster to implement. As it turned out, this method took longer because of set up time. Also, it was sometimes difficult to assess traps when they were also loaded with other insects.

Twenty-seven fields located in five counties were monitored in 2001. Only three of the 27 were found to be above an action threshold for making any control decision. The rest were at low populations. We also found that only about 10 percent of the adults monitored were of the Western species. The large majority was Northern.

Rotation is still the best control for these insects. Insecticides are available. They generally cost around \$15 to \$20 per acre. So a two-ton increase in yield could easily offset this cost provided corn rootworm is the real problem.

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News From The University of Vermont, Extension Service

UVM PARTICIPATES IN TRI-STATE EPA GRANT FOR SCHOOL IPM

Ann Hazelrigg Pesticide Safety and Education Program Coordinator Plant and Soil Science Department, University of Vermont

Iniversity of Vermont, along with the Jordan Institute in New Hampshire and the Maine Department of Agriculture, recently received a \$40,000 grant from the EPA Pesticides Environmental Stewardship Program to implement Integrated Pest Management (IPM) in Maine, New Hampshire and Vermont schools.

IPM is simply a process for achieving long term, low risk pest suppression through the use of a wide variety of practices. A good school IPM program uses routine scouting for pests, building or procedural modifications that prevent pest build up, and selecting the least hazardous and most effective pesticide for a targeted pest after all other strategies have been implemented.

Use of Integrated Pest Management (IPM) principles and practices in the school environment is a growing trend in communities throughout the United States, leading to regulations in several states across the US. Federal regulations requiring the adoption of IPM in all schools, while not adopted this year, passed by majority vote in the Senate in 2002. With this level of support, future bills are likely to be brought before Congress again. In Vermont, there are no regulations requiring school IPM to be used, but in July 2000, the state did pass Act 125, an act relating to toxic materials and indoor air quality in Vermont Public Schools aimed at reducing pesticide exposure and other air quality risks to school children. (More information on ACT 125 can be found in the *Pesticide Applicator Report* from November 2001.)

The objectives of the Tri-State grant are 3 fold. The first is to provide training for K-12 school staff and administrators for organizing, implementing and evaluating IPM programs in Vermont, Maine and New Hampshire schools. To aid the people from different agencies and organizations in Vermont and New Hampshire who provide services and education to schools, we are offering a "Train-the-Trainer" meeting on November 7, in White River Junction. The featured speaker will be Dr. Bobby Corrigan, an engaging, experienced and effective educator and problem-solver specializing in pest management. He is chair of the Integrated Pest Management in Schools Committee of the National Pest Management Association and serves as a consultant for school communities. Dr. Corrigan will also lead the group through a local elementary school for some hands-on experience addressing IPM issues in schools.

Once Vermont and New Hampshire trainers have been "trained", they can then educate and train school administrators, custodial staff and others involved with local schools in their states. UVM is currently developing a School IPM website that can be accessed by Vermont school administrators, staff and parents to learn more about IPM and information needed to implement a program in their school.

The second objective of the grant is to implement a pilot demonstration program in a few schools in the 3 states that will serve as a model and foundation for the expansion of school IPM programs for the tri-state region.

The final objective outlined in the grant is the development of a School IPM Tool Kit. Training materials such as fact sheets, checklists, guidelines, reference materials, slide presentations, resource lists and tabletop displays are an important component of IPM education, training and promotion. The development of the kit will be led by Maine, but will be adapted for use in New Hampshire and Vermont. The kit will provide a useful tool for IPM supporters and school IPM users for training and implementation of school IPM.

UVM APPLE TEAM RESEARCHING AN ORGANIC PEST MANAGEMENT OPTION



rs. Lorraine Berkett and Elena Garcia are investigating an organic alternative. kaolin, that was developed to replace certain insecticides that manage key apple insect pests. Kaolin is a clay that has been previously used as an inert additive in the food industry. When sprayed onto the tree, kaolin forms a white, physical barrier on the surface of the leaves and fruit (i.e., the tree turns white) which repels insect pests or makes the feeding, egg-laving, or colonization site unrecognizable and/or unsuitable. However, it appears that kaolin may have other effects on the tree; the white barrier may reflect infrared radiation in the canopy causing a reduction in canopy temperature. This could be beneficial in warmer climates and reduce heat stress, but may impact maturation of apples grown in cooler environments. Since thorough coverage of the tree with kaolin is critical to obtain the desired effects on insect pests, does the white film on the tree impact tree vigor, fruit quality and yield when used over multiple seasons in cooler orchard environments? Also, will the white film make the fruit unrecognizable or unsuitable for bird feeding which can be a serious problem in orchards? These are some of the questions the research aims to answer.

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News from the Vermont Department of Agriculture, Plant Industry Division

APPLYING MOSQUITO LARVICIDES? YOU MAY NEED A PERMIT!

hile the winter months bring a welcome break from the nuisance of mosquitoes, spring will be here soon enough, along with the need to resume mosquito management activities. Be aware that if you intend to apply a larvicide to any waterbody, not only do you need to be certified in category 7b (Mosquito and Biting Fly), but you must also obtain a Mosquito Larvicide Permit from the Vermont Department of Agriculture, Food and Markets. [Note: A number of homeowner larvicide products have been exempted from the need for a permit. These include products that come in packages of less than 3 pounds or any ready-to-use toss-in or dunk products that contain Bacillus thuringiensis israelensis. Examples of exempted products include, but are not limited to: Mosquito Bits (EPA Reg. # 6218-73); Mosquito Dunks (EPA Reg. # 6218-47); and, B.t.i. Briquets (EPA Reg. # 6218-47).

In the past, mosquito larvicide permits, which fell under the category of "Aquatic Nuisance Control Permits", were reviewed and approved by the Vermont Department of Environmental Conservation, Water Quality Division. However, during the 2002 State Legislative session, authority for the review and issuance of mosquito larvicide permits was transferred to the Vermont Department of Agriculture, Food and Markets. Please call (802) 828-2431 for a copy of the Mosquito Larvicide Permit Application form.

Remember - the elimination of mosquito breeding habitats is an essential component to any successful mosquito control program. Educating your customers about ways to eliminate standing water on their property can be an extremely valuable addition to the services offered by your company.

COMPARATIVE STUDY OF INSECT REPELLENTS IDENTIFIES DEET AS THE WINNER



he increased occurrence of arthropod-transmitted diseases, such as West Nile Virus encephalitis, underscores the need for effective insect repellents. Multiple chemical, botanical, and "alternative" repellent products are marketed to consumers. A recent study was designed to determine which products available in the United States provide reliable and prolonged

involved 15 volunteers to test the relative efficacy of seven botanical insect repellents; four products containing N,N-diethyl-3-methylbenzamide (DEET); a repellent containing IR3535 (ethylbutylacetylaminopropionate); three repellent- impregnated wristbands; and a moisturizer with citronella that is commonly claimed to have repellent effects. These products were tested in a controlled laboratory environment in which the species of the mosquitoes, their age, their degree of hunger, the humidity, the temperature, and the light-dark cycle were all kept constant.

Results: DEET-based products provided complete protection for the longest duration. Higher concentrations of DEET provided longer-lasting protection. A formulation containing 23.8 percent DEET had a mean

complete-protection time of 301.5 minutes. A soybean-oil-based repellent protected against mosquito bites for an average of 94.6 minutes. The IR3535-based repellent protected for an average of 22.9 minutes. All other botanical repellents tested provided protection for a mean duration of less than 20 minutes. Repellent-impregnated wristbands offered no protection.

In summary, currently available non-DEET repellents do not provide protection for durations similar to those of DEET-based repellents and cannot be relied on to provide prolonged protection in environments where mosquito-borne diseases are a substantial threat.

(Source: New England Journal of Medicine, 347(1):13-18, July 4, 2002.)

NEW TERMITE CONTROL CATEGORY PROPOSED



ermites? In Vermont? Other than an isolated

■ colony in Hardwick, and some termite activity along the Connecticut River from Windsor south to the Massachusetts border, Vermonters have been left relatively untouched by the damaging effects of the Eastern Subterranean Termite. However, with the discovery of a termite colony in Williston this past summer by our State Entomologist, Jon Turmel, we may be entering the ranks of states that need to pay serious attention to the threat termites pose to our real estate.

To make sure Vermont pest control operators are ready to meet the challenge of termite management, the Department has proposed the creation of a new

Category 7f - Termite Pest Management. The proposed category is part of an overall proposed revision to the *Vermont Regulations for the Control of Pesticides* currently being drafted. The proposed revisions to the regulations can be viewed on the Department's web site at <u>www.state.vt.us/agric/.</u>

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News from the Vermont Department of Agriculture, Plant Industry Division

This change will require you to be certified in Category 7f in order to perform termite management services. We will keep you informed of the status of the proposed regulatory changes. If you have comments regarding the creation of a termite category - we urge you to review the proposed revisions and provide comments to the Department.

MORE HELPFUL PEST MANAGEMENT WEB SITES ON THE INTERNET

Several web sites are available to help you and your customers to identify pests and obtain more detailed information about them. As we become aware of new sites, we will continue to share them with you.

✓ Clemson University Pesticide Information Program: http://entweb.clemson.edu/pesticid/saftyed/pstident.html (includes weeds, insects, and diseases)

✓ Guide to New England Household Pests, Harvard University: <u>http://www.massinsects.com/</u>

IPM Problem Solvers at Penn State:

http://paipm.cas.psu.edu/problemSolv.html

This is a vast listing of on-line resources for information and recommendations for pest management and related problems in both crop and non-crop situations. To date these resources are primarily from Penn State, but as the site expands, other materials from outside Pennsylvania will be added.

News from the University of Vermont, Extension Service (cont'd. from page 3)

Organic Pest Management Option for Apples, cont'd.

During the 2002 growing season data were collected on fruit weight, size, skin color, flesh firmness, soluble solids, starch-index ratings, russetting, water core, internal breakdown or browning, bitter pit and other harvest disorders as well as overall attractiveness using standard criteria. As measurements of tree productivity, data were collected on flower density, fruit set, and yield efficiency. In addition, incidence of disease and insect damage on fruit and foliage, along with incidence of bird damage, were recorded for the various treatments that compared kaolin to a standard pest management program. Currently, the very large volume of data are being summarized and analyzed.

Vermont apple growers are interested in this research and are being kept up-to-date on the project's progress. A project description with its research objectives were part of a feature article in the Vermont Apple Newsletter whose subscribers include commercial apple growers, pest management consultants, and agricultural industry personnel, and was posted on the University of Vermont Apple Extension and Research Program website, UVM Apple Orchard (http://orchard.uvm.edu), which is accessed by apple growers across the country and around the world. A local television news program reported on the research. In addition, presentations were made at the 2002 Vermont Tree Fruit Growers Association Annual Conference (attended by approximately 150 growers and ag-industry personnel), the 2002 New England, New York, Canadian Fruit Pest Management Workshop (attended by 55 apple extension, researchers, and IPM consultants), and research progress will be presented at the 2003 New England Fruit School which is the major conference for the apple industry in the region.



MASTER GARDENER COURSE NOW ENROLLING STUDENTS

It is time to register for the Master Gardener Basic Course for 2003! Participants in the course receive 14 weeks of research-based instruction in all areas of home horticulture taught by

UVM Extension faculty, Vermont Department of Agriculture, and other garden experts. Students will learn about soils and soil fertility, plant pests and diseases and their control, fruit and vegetable production, turf management, annual and perennial flower growing, caring for shrubs and ornamentals, and integrated garden management. The training is adapted to local needs and the Vermont environment. The course is offered evenings at Vermont Interactive Television sites around This first class is Monday, February 3. the state. Thereafter, classes are Tuesday evenings from February 11 through May 6. The price for this year's course is \$225.00 which includes an extensive guide. If you would like to have brochures advertising the course for your place of business, or for more information on registering for the course, check out the Master Gardener website at http://pss.uvm.edu/mg/mg/ or contact the Master Gardener office at 1-802-656-9562, or e-mail master.gardener@uvm.edu.

Master Gardener Helpline Winter Hours

The Master Gardener Helpline will still be staffed by Master Gardener volunteers to answer questions throughout the winter. There may not be a volunteer available in the office when you call, but all calls and messages will be answered within a couple of days. Call the **Helpline at 1-800-639-2230** for help with your plant and home gardening questions!

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Pesticide Applicator Report

News from the Vermont Department of Agriculture, Plant Industry Division

2002 PESTICIDE ENFORCEMENT REVIEW

John Stein Agrichemical Compliance Officer

his past year the Department conducted 455 inspections of pesticide operations, including dealers, private applicators, commercial applicators, retail outlets and pesticide producers. The following table summarizes the investigations conducted and the enforcement actions taken.

Investigation Type	Investigations	Cease and Desist Order	Letter of Warning	Administr ative Penalty	TOTAL
Pesticide Outlets	259	15	0	3	18
Dealers	97	0	0	0	0
Ag Use	24	0	1	3	4
Non-Ag Use 45		2	4	0	6
Worker 30 Protection (Ag)		0	0	1	1
TOTAL 455		17	5	7	29

Administrative penalties ranged from \$4,250 to \$100, with the average penalty amount being \$1,540. All penalties were settled prior to conducting a formal hearing. The vast majority of the penalties resulted in the drafting of an Assurance of Discontinuance (AOD). An AOD allows the Commissioner to settle the case without a hearing and gain compliance with the regulations.

This past year the Department continued to note a lack of compliance with the use of Personal Protective Equipment (PPE) as required by the product label (primarily eye protection and appropriate chemical resistant gloves.) PPE is listed on the label to help protect the applicator. Please use it. The proper use of PPE may also help send a message to the public - that you are a trained professional and take your responsibilities seriously. The Department may take formal actions in situations were required PPE is not used.





The importance of public relations when it come to pesticide applications can not be stressed enough. The Department receives calls from the public every year with concerns regarding pesticide applications. If you find yourself in a situation where a member of the public is questioning what you are doing, take a few minutes to explain the application and the products being applied. Not all of the people will listen to you and may express an ill feeling toward the application, but in the long run, it is time well spent. An investigation from the department may take much longer than the ten minute conservation with a concerned citizen.

As a final note, the Department is available and ready to answer your questions and help you comply with the law. Our goal is compliance, not penalties.

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Pest Profile Bed Bugs - They're Back!!

Bare often associated with unsanitary conditions, there are occasions when the problem may be found even in clean homes, hotels, or other buildings.

Our primary concern is with the bed bug species, *Cimex lectularius*, a cosmopolitan species that attacks man and is most frequently found in northern temperate climates of North America, Europe and Central Asia. According to pest control experts, increased tourism has contributed to the problem because bed bugs are transported in luggage from overseas. Interestingly enough, a change in pest control techniques involving the targeted use of less toxic insect baits and hormonal growth regulators may have also aided in the insect's comeback.



Mature bed bug before (left) and after (right) a blood meal.

BED BUG BASICS

□ Adults are about the size of a small lady bug - flat oval and wingless. The upper body surface has a flimsy, crinkled appearance.

They are chestnut brown, unless engorged with a blood meal. After feeding, they appear swollen and dull red.

□ Adults feed once a week on average, but can live up to 2 months or more without feeding.

□ Adults feed on the blood of a host by using a piercing mouthpart - like mosquitoes. When biting they introduce a fluid into the skin that assists in obtaining blood. This salivary secretion causes swelling, itching and burning which may persist for a week or more.

After a blood meal, the bed bug crawls away to a hiding place to digest its meal.

□ In the warmth of a house, bed bugs can continue to breed throughout the year.

□ Females lay from 200 to 500 eggs, in batches of 10 to 50, on rough surfaces such as wood or paper in their hiding places. After hatching, the egg shells frequently remain attached to the substrate. Eggs are white, oval in shape and about 1 mm (1/32 inch) long.

Bed bugs undergo incomplete metamorphosis, passing through five nymphal instars that resemble the adult organism. Each nymph must have a blood meal to be able to molt to the next instar.

CONTROL MEASURES

Step #1 - Locate their Hiding Places

The first step in managing a bed bug infestation is to locate all of their hiding places!!

Signs of bed bug infestation to look for include: dark spots of fecal material; bloody spots on sheets or pillowcases; cast skins (as the nymphs molt and pass on to the next instar); eggs; eggshells; and, an offensive, sickeningly sweet odor.

Places to look:

□ Furniture, especially in the bedroom, must be inspected carefully, even to the point of dismantling the bed for easier inspection and possible treatment.

□ Check under and behind other pieces of furniture, such as chairs, couches, dressers, etc. It may be necessary to remove the dust covers on the undersides of chairs and couches. Pull drawers out of dressers, inspect them carefully and examine the interior of the dresser.



□ Remove and inspect objects such as pictures, mirrors, curtains (pay careful attention to seams and hems), etc., that are hung or mounted on the walls.

Check obvious cracks and crevices along baseboards.

Check under carpets, behind torn or loose wallpaper and decorative borders.

Check clothing and other items stored in areas where bed bugs have been found.

□ If your client has traveled in the last few months, inspect luggage as well as the closet/storage area.

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Pesticide Applicator Report

Pest Profile Bed Bugs - They're Back!!

🖙 Step #2 - Management

Control of bed bugs can be difficult, especially in homes that have many cracks and crevices, loose wallpaper, etc. After conducting a thorough investigation of potential hiding places, the following management steps should be taken.

1. Perform a thorough vacuum cleaning job. Vacuuming may remove particles from cracks and crevices to encourage greater insecticide penetration, and may actually remove many of the bed bugs and eggs. Remember to discard the vacuum bag in a sealed plastic bag when finished.

2. Use a space spray to penetrate infested areas. Close all outside doors, windows, etc., as tightly as possible. Inside, open or spread out items to allow fumes to penetrate. For example: open all inside doors; take mattresses off box springs; open dresser drawers and spread clothes or contents; remove or space items in clothes closets; take scatter rugs off the floor or carpeting; and, remove cushions from couches or chairs. Be sure to remove pets or fish. After this has been done, one-timerelease aerosol insecticide bombs can be used for fumigation. Follow the instructions on the can exactly making sure that the cubic feet requirements of the space to be treated are met. People must stay out of the treated areas for at least four hours, or as long as the label directs.

3. After space spraying, use a light application of an approved aerosol spray on mattresses, stuffed chairs, etc. to kill surviving bed bugs. People should not sleep directly on treated mattresses. Mattress must be dried, aired out, and a sheet put on before use.

4. Apply residual insecticides to cracks and crevices. Surface treatments should be kept to a minimum if they are used at all - bed bugs are most likely to get lethal doses in cracks and crevices.

Repeat pesticide treatments may be necessary if you see signs of bed bugs again after two weeks. As always, follow label directions carefully and exactly when making applications.

Is that bite from a flea or bed bug? When bitten by a bed bug, a colorless wheal or lump develops at the bite location. In contrast, flea bites have reddish centers. (Sources for "Bed Bugs - They're Back":

University of Maine Cooperative Extension, Insect and Plant Disease Diagnostic Fact Sheet: <u>http://pmo.umext.maine.edu/factsht/bedbugs.htm.</u>

University of California, UC Pest Management Guidelines, Bed Bugs, 5/98: <u>http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7454.html</u>.

Penn State Entomology Department Fact Sheets - Bed Bugs: http://www.ento.psu.edu/extension/factsheets/bed_bugs.htm

North Caroline Cooperative Extension Service, Residential, Structural and Community Pests; ENTT/rsc-31: http://www.ces.ncsu.edu/depts/ent/notes/Urban/bedbug.htm.

Colorado State University Cooperative Extension, Fact Sheet no. 5.574: <u>http://www.ext.colostate.edu/pubs/insect/05574.html.</u>)

UPCOMING TRAINING EVENTS

 Private Applicator Training for Field and Forage February 10, 2003 - The Abbey in Sheldon
February 11, 2003 - American Legion in Middlebury
February 12, 2003 - Holiday Inn Express in Springfield
February 13, 2003 - Comfort Inn in St. Johnsbury

Commercial Applicator Meeting for Field and Forage

- Commercial Categories 1a and 10 January 23, 2003 Vermont Technical College 9:00 to 4:00

Initial Applicator Certification Training April 3, 2003

This course is offered over Vermont Interactive Television at the following sites: Brattleboro; Bennington; Colchester; Middlebury; Randolph; St. Albans; Springfield; Newport. This course reviews information covered in the Pesticide Applicator Core Manual, and helps to prepare individuals to take the commercial and private core exams.

Brochures with specific meeting times and agendas will be sent out in advance of the meetings. For additional information, contact Ann Hazelrigg at 802-656-0493 or Wendy Anderson at 802-828-3475, or visit the Department of Agriculture web site at <u>http://www.state.vt.us/agric/pestcredits.htm</u> for a complete list of approved training events.



Factors Affecting Groundwater Contamination with Pesticides

pproximately seventy percent (70%) of all Vermonters get their drinking water from groundwater sources. Groundwater is primarily stored in aguifers - geologic formations of permeable rock, sand and gravel that contain enough water to yield usable amounts to wells and springs. Groundwater may come to



the surface naturally at a spring or marsh, or it may be drawn to the surface from a well. Aquifers are recharged - or groundwater is replaced - by rainfall or snow melt slowly seeping, or leaching, through the ground, or by surface waters with which they are interconnected.

Once contaminated with pesticides or other potential pollutants, groundwater is difficult or impossible to clean. Because groundwater moves slowly, contaminants do not spread or mix quickly. Contaminants remain concentrated in slow-moving masses of water (plumes)

and are typically present for many years. Additionally, contaminated groundwater may lead to the contamination of surface water since they are hydrologically linked.

The factors that affect the likelihood of groundwater becoming contamination with pesticides are discussed below.

CHEMICAL PROPERTIES OF PESTICIDES

Solubility: As water seeps through the soil, it carries with it water-soluble chemicals. This process is called leaching. The more water soluble a chemical is, the more likely it is to leach.

Table 1 lists the relative mobility - or potential for leaching - of certain pesticides in soil. Pesticides with low or very low mobility in soil tend to remain close to where they were originally placed. They may pose a threat to sensitive crops planted in the area, but are not generally a threat to groundwater. Pesticides with moderate to high movement in soil (high solubility) are of greatest concern and all efforts must be taken to keep them out of groundwater.

Adsorption: Many chemicals do not leach because they are adsorbed, or tightly held, by soil particles. Adsorption depends not only on the chemical properties of the pesticide, but also on the soil type and the amount of organic matter and clay present.

* Degradation: Pesticides are degraded, or broken down, by heat, sunlight, microorganisms, and a variety of physical and chemical properties. Most pesticide degradation takes place within the top few inches of soil. Pesticides that take a relatively long time to degrade are said to be persistent. The longer the compound persists in the soil, the longer it is available to leach into groundwater.

Volatility: Compounds that vaporize readily are said to be volatile. If a chemical is highly volatile and not very water soluble, it is likely to be lost to the atmosphere, and less likely to leach into groundwater. Highly volatile compounds may become groundwater contaminants, however, if they are also highly soluble in water. Of course, pesticides with high vapor pressure tend to move off site easily and must be used under the appropriate environmental conditions.

SOIL PROPERTIES

Soil texture: The relative proportions of sand, silt, and clay determine the texture of a soil. Texture affects movement of water through soil, and thus also movement

of dissolved chemicals such as pesticides. The coarser the soil (i.e., gravel), the faster the movement of percolating water, and the less opportunity for adsorption or evaporation. Soils with higher clay or organic matter content tend to hold water and dissolved chemicals longer. These soils also have more surface



area onto which pesticides can be adsorbed.

Soil permeability: Soils that allow water to move downward very quickly are highly permeable and include sandy soils and loose, porous soils. Dissolved chemicals are carried along with the water and thus more likely to reach groundwater in soils that are highly permeable.

Organic matter content: The amount of organic matter in a soil affects the adsorption capacity of a soil and the amount of water the soil can hold. Soils with a high organic matter content tend to hold the water and dissolved chemicals in the root zone where they will be available to plants and to eventual degradation.

Where can you get information on what type of soil vou have? Your local Conservation District maintains soil maps and soil interpretations for all soils and their locations within each county. Contact your local district office for availability of information. Some maps may actually be available on line. Visit the districts' website at www.vacd.org for contacts and phone numbers. If you do not have internet access, check in the telephone book under "USDA Service Center".

Factors Affecting Groundwater Contamination with Pesticides

SITE CONDITIONS

Depth to groundwater: The shallower the depth to groundwater, the less soil there is to act as a filter, and the fewer opportunities there are for degradation and adsorption of chemicals.

Rainfall: If rainfall is high and soils are permeable, water carrying dissolved chemicals may take only a few days to percolate downward to the groundwater. In all cases, special care must always be taken to avoid applying pesticides right before a rain event.

★ Geologic conditions: The permeability of the geologic layers between the soil and groundwater also affects the probability of contamination. Highly permeable materials, such as gravel deposits and fractured bedrock, allow water and dissolved compounds to freely percolate down to groundwater. When coupled with shallow soils, these geologic conditions can easily lead to groundwater contamination. Layers of clay are much less permeable and thus inhibit the movement of water and chemicals.

SUMMARY

The following is a quick "cheat sheet" on the combination of factors which would indicate the greatest vulnerability of groundwater to contamination with pesticides.

A pesticide of:

high solubility low adsorption persistence

* applied to a soil that is:

sandy

low in organic matter

in an area with:

shallow depth to groundwater permeable layers heavy rainfall



THE EARTH'S WATER CYCLE: NATURE'S OLDEST RECYCLING PROGRAM

Oceans contain 97 percent of the world's water supply. The remaining three percent is fresh water, of which approximately 70 percent is stored as ice in glaciers. Nearly all of the unfrozen fresh water on the planet occurs in aquifers below ground; only one percent is stored in lakes, streams and rivers.

Water drawn from rivers and extracted from aquifers has been continuously recycled between land and the atmosphere for thousands of years through the intricate processes of *evaporation*, *transpiration*, *precipitation*, *overland runoff*, and *infiltration* (or leaching). Together these processes are linked as the hydrologic (water) cycle.



The sun energizes the hydrologic cycle. Solar

energy converts surface water to atmospheric water vapor through evaporation. Plants absorb water from the soil and can release it into the atmosphere by *transpiring* (giving off) water vapor from leaves. Water vapor rises, then condenses in the cooler atmosphere to form clouds; water stored in clouds is eventually returned as *precipitation* in the form of rain, hail, sleet or snow which can fall directly into rivers, streams, lakes, ponds, and wetlands. Water can also move into these bodies by *overland runoff* or *percolation* (infiltration/leaching) below ground. Water entering the soil can infiltrate deeper to reach ground water which, in turn, can discharge to surface water or arrive back at the surface through wells, marshes and springs. Once on the surface, water is again energized by the sun to repeat the hydrologic cycle.

Table 1. Movement of Pesticides in Soils-Listed as Active Ingredient Common Names

Very Low or No Movement	Moderate Movement		
Ametryn Benefin Bifenthrin Cyfluthrin DCPA Diquat DSMA Glyphosate Isopropalin MSMA Oryzalin Paraquat Permethrin Prometryn Propazine Simazine Trifluralin	Alachlor Bromacil Carbofuran Chloramben Chlorfenvinphos Chlorsulfuron EPTC Ethoprop Fenamiphos MCPA MCPB Metolachlor Monocrotophos Terbacil 2,4-D		
Low Movement	High Movement		
Azinphosmethyl Butylate Chlorpropham Dichlobenil Disulfoton Diuron Linuron Prometon Siduron Vernolate	Aldicarb Asulam Atrazine Dalapon Dicamba Hexazinone Methomyl Metribuzin Picloram TCA Tebuthiuron		

Protecting Groundwater from Contamination with Pesticides

Using pesticides effectively while protecting and maintaining groundwater quality presents an important challenge to pesticide applicators. A limited amount of leaching may actually be essential to move a pesticide to its target, as is the case with surfaceapplied pre-emergence herbicides and some soil insecticides. However, when pesticides move beyond their intended target, they become pollutants and pose a threat to our water resources, and the environment as a whole. Pesticide users, from commercial operators treating large acreages to homeowners treating their lawns, can take the protective measures discussed below to prevent contamination of our water resources.

BEFORE APPLICATION

Identify the vulnerability of the site. Refer to the article on "Factors Affecting Groundwater Contamination with Pesticides" to identify factors that contribute to groundwater vulnerability.

Evaluate the need for a pesticide. Use an Integrated Pest Management (IPM) approach, combing a variety of non-chemical control strategies with monitoring of pest populations. As part of an IPM program, use pesticides only when necessary and according to label directions.

Choose a pesticide that is least likely to leach. Check the pesticide label for warnings about potential to leach and cause groundwater contamination.

The "Environmental Hazards" section of the label may contain specific directions to prevent the occurrence of the pesticide in groundwater. A product already on the market becomes subject to restrictions and advisories when it is detected in groundwater. These restrictions are based on the chemical and physical properties of the compound (mobility, persistence, environmental fate) and levels of concern for human health, as well as plant and aquatic health. If a product has been found in groundwater, the product will bear a statement such as: "This chemical is known to leach through soil into groundwater under certain conditions as a result of agricultural use. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination."

A new pesticide product undergoing the registration process must include specific precautionary statements if the pesticide has been identified as a potential leacher. For example, "This chemical demonstrates the properties and characteristics associated with chemicals detected in groundwater. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination." Evaluate your method and frequency of pesticide application. Applying pesticides at the lowest labelled concentration and frequency that will control the pest decreases the likelihood of groundwater contamination.

Check the well system. Properly seal new wells, and inspect old wells and check valves to ensure that seals are adequate. This will help to keep accidentally contaminated water from entering the well and, eventually,



groundwater. Data collected under the Vermont Pesticide and Groundwater Monitoring Program has indicated that of the tested wells that have detections of bacteria, fertilizers, manure or herbicides, the most common cause of these water quality problems is that of poor well construction.

Product labels will often bear the statement - "This product may not be mixed, loaded, or used within 50 feet of all wells, including abandoned wells, drainage wells and sink holes."

DURING APPLICATION

Read and follow label directions. Many pesticide labels list use instructions or precautions designed to avoid groundwater contamination.

Apply the pesticide at the right time. Fewer applications are required if they are carefully timed in relation to the pest's life cycle. Pest monitoring and knowledge of the pest's biology are essential to the proper timing of pesticide applications.

♦ Use the correct rate. Do not use more than the labelled rate. Increasing the dosage increases the cost of pest control, contributes to the potential for resistence development by the pest, increases the chances for environmental contamination, and is illegal!

Mix only the amount needed for the job. This will eliminate the need to store or dispose of unused pesticide mixture. Mixing only what you need will also eliminate the temptation to over-apply the mixture to the treatment site.

Calibrate and maintain equipment. Calibrating application equipment regularly reduces the chances of overor under-applying product. Check equipment frequently for leaks and malfunctions.

Avoid back-siphoning and spills. Be especially careful next to wells or other water sources. Most

Protecting Groundwater from Contamination with Pesticides

contamination incidents are thought to have occurred from carelessness at the mixing/loading site. Mixing/loading and equipment washing sites should be located downgradient and at least 100 feet away from wells, springs and surface water sources. If possible, mixing and loading should take place on curbed, impervious pads, or the mixing/loading site should be changed on a regular basis (i.e., mix at different sites in the field).

Prevent back-siphoning by keeping the end of the hose above the water level in the spray tank. Install a back-flow prevention device (air gap or check valve) on the filling pipe. If a spill does occur, use every precaution to protect water sources. (For more information on spill management, refer to the July 2002 issue of the *Pesticide Applicator Report*.)

Remember! According to the Vermont Pesticide Regulations, if using a pesticide that provides pest control within the soil profile, you must maintain a buffer of 50 feet around existing private wells.

Avoid drift. Drift of pesticide off-target and over water sources can contribute to contamination. There are a number of things you can do to reduce the potential for pesticide drift:

- Do not make applications during windy conditions (winds greater than 5mph) or during temperature inversions;
- Select nozzles to increase droplet size;
- Use lower spray pressures;
- Use lower spray boom heights;
- Use drift control agents in the spray tank; and,
- Use spray shields.

Avoid application to areas where there is exposed bedrock or shallow permeable soils over fractured bedrock. These conditions provide a very easy route for pesticides to enter groundwater.

Use excess spray according to label directions. The practice of disposing of leftover spray mix by repeatedly spraying it out at the mixing area or other site can contribute significantly to soil and groundwater contamination. Instead, excess spray mixture must be applied only on a labeled site in accordance with all label directions.

✤ Store pesticide safely. Pesticides should be stored in their original containers in a cool, well-ventilated, locked location away from pumps and water sources. (For more information on pesticide storage, refer to the November 2001 issue of the *Pesticide Applicator Report*.)

Dispose of pesticides and containers safely. Triple rinse pesticide containers and return the rinsate to the spray tank. Puncture the container so it cannot be reused, and dispose of it in a licensed sanitary landfill. Never burn or bury pesticide containers! Follow the label for proper disposal of leftover pesticide.

Maintain records of pesticide use. According to the Vermont Regulations for the Control of Pesticides, pesticide applicators need to keep records of the pesticide product name, EPA Registration Number, amount used, date of application, location of application, and the pest treated for. Records must be kept for a period of 2 years. Private applicators only need to record this information for any restricted use pesticides used; commercial and noncommercial applicators need to keep records of all pesticides used. For outdoor applications, it is also a good idea to record the weather conditions at the time of application. Complete and accurate records are your best defense in the event you are accused of making a misapplication.



 Use care with irrigation after pesticide applications.
Because many pesticides leach through the soil with the movement of water, it is best to

avoid irrigation immediately after application, unless the label directions require it. Avoiding runoff will reduce soil erosion and pesticide entry into water.

Pesticides are an important, but often controversial, component of today's integrated pest management systems. Their continued availability depends on our thoughtful choices and careful handling of these products. It is the job of every pesticide user to understand the consequences of his or her pesticide-related activities and to minimize impacts on human health and the environment. Think before you act, and seek assistance if you have questions or problems.

Sources for "Factors Affecting Groundwater Contamination with Pesticides" and "Protecting Groundwater from Contamination with Pesticides":

Factors Affecting Groundwater Contamination, Pesticide Information Leaflet No. 8, University of Maryland Cooperative Extension, July 1989.

Pesticides and Water Quality: Principles, Policies and Programs, PPP-35, Purdue University Cooperative Extension, September 1995.

✤ Protecting Groundwater from Pesticides, Pesticide Information Leaflet No. 9, University of Maryland Cooperative Extension, 1994.

The Fate of Pesticides in the Environment, Agrichemical Fact Sheet #8, Penn State Cooperative Extension, 1990.

The Standard Pesticide User's Guide, Bert L. Bohmont, 6th Edition, Pearson Education, Inc., 2003



Home Study Quiz - I. Factors Affecting Groundwater Contamination with Pesticides

The following set of questions pertains to the *Factors Affecting Groundwater Contamination with Pesticides* article on Pages 9 - 10. Fill out the information on the back of the quiz and mail the completed quiz to the Vermont Department of Agriculture to receive **one pesticide recertification credit**. You can include extra sheets of paper for answers.

1. What does it mean when a pesticide "leaches" through the soil profile?

- 2. What factors affect the ability of a pesticide to be adsorbed to soil particles?
- 3. Which three (3) soil components determine the texture of soil?
- 4. How does soil texture affect the movement of pesticides through the soil profile?
- 5. What type of soils are said to be "highly permeable"?

True or False (check one)

6TF		It is a good idea to apply pesticides to frozen ground.
7TF		Highly volatile chemicals never become groundwater contaminants.
8. <u> </u> T <u> </u> F		You need to control weeds in an area with permeable soils and shallow depth to groundwater. Products containing the active ingredient Hexazinone would be a good choice to prevent groundwater contamination.
9TF		It is not necessary to take special care to prevent pesticide leaching to groundwater because it is very easy to clean groundwater resources that have become contaminated.
10. <u> </u>	6.4	Using glyphosate in an area with soils high in organic matter would pose a significant threat to groundwater.

Fill out the following information and mail the completed quiz to the Vermont Department of Agriculture to receive <u>one pesticide recertification credit.</u>

Name:			
Certificate #:			
Address:			_
Company/Farm:	- 1 -	 	

Mail to:

Vermont Department of Agriculture 116 State Street, Drawer 20 Montpelier, Vermont 05620-2901

Attn: Wendy Anderson



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Pesticide Applicator Report

Home Study Quiz - II. Protecting Groundwater from Contamination with Pesticides

The following set of questions pertains to the *Protecting Groundwater from Contamination with Pesticides* article on Pages 11 - 12. Fill out the information on the back of the quiz and mail the completed quiz to the Vermont Department of Agriculture to receive **one pesticide recertification credit**. You can include extra sheets of paper for answers.

1. When is the leaching of a pesticide desirable?

- 2. When does a pesticide become a pollutant?
- 3. How can the use of an IPM approach to pest control help to protect groundwater resources?
- 4. Why is it important to apply a pesticide at the appropriate time in a pest's life cycle?

5. What is an acceptable way to use up leftover pesticide spray mixture?

6. Where, on a pesticide label, would you find information relating to the ability of a pesticide to lead to groundwater contamination?

7. List two ways you can prevent the back-siphoning of pesticide into a water source.

True or False

8. <u> </u> T <u> </u> F	Poorly constructed wells and old wells with faulty seals can provide a direct route for pesticides to enter groundwater.
9TF	It is always best to use an application rate greater than that stated on the label in order to achieve maximum pest control.
10 T E	New Address of the Ad

10. ___T ___F In Vermont, it is legal to burn pesticide containers or bury them in your backyard.

Pesticide Applicator Report November 2002

Vermont Department of Agriculture, Food and Markets Plant Industry Division 116 State Street, Drawer 20 Montpelier, Vermont 05620 NONPROFIT U.S. POSTAGE PAID MONTPELIER, VT 05620-2901 PERMIT No.74



Fill out the following information and mail the completed quiz to the Vermont Department of Agriculture to receive <u>one pesticide recertification credit</u>.

Name:	 	
Certificate #:		
Address:		
Company/Farm:		