The Pesticide Applicator Report

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For Vermont's Pesticide Applicators
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In This Issue:

News from the Agency

Agency Responds to Persistent Herbicides in Compost

As you may be aware, the use of compost that contains residues of persistent herbicides has been causing problems in homeowner gardens in Vermont over the past year or more. Our investigation into this problem has shown the presence of very low levels of certain herbicide active ingredients in finished compost. Some of these ingredients have the ability to harm plants at these very low concentrations, but they only harm broadleaf plants since these products are for broadleaf weed control in pastures, and generally do not harm plants in the grass family. The investigation into the source of these residues was found to be the legal use of these products, possibly both in and outside of Vermont.

In an effort to protect Vermont composters from herbicide residues that may be present in their inputs, and home gardeners from these residues in their compost, the Vermont Agency of Agriculture has designated the herbicides that contain the problematic active ingredients as Class A- state restricted-use products.

Continued →

Questions or comments regarding this newsletter?
Please contact **Matthew Wood** at the Vermont Agency of Agriculture at 802-828-3482 or email matthew.wood@state.vt.us

Product Name	EPA Reg. No.	Active Ingredient	%
Clean Slate	228-491	Clopyralid	40.9
Clopyralid 3	81927-14	Clopyralid	40.9
Cody Herbicide	81927-28	Clopyralid	5.1
Monterey Thistledown	228-491-54705	Clopyralid	40.9
Quali-Pro 2-D Herbicide	62719-92	Clopyralid	12.1
Opensight Specialty Herbicide	62719-597	Clopyralid	62.13
Stinger Herbicide	62719-73	Clopyralid	40.9
Capstone	62719-572	Clopyralid	2.22
ForeFront HL Speciality Herbicide	62719-630	Aminopyralid	8.24
ForeFront R&P Specialty Herbicide	62719-524	Aminopyralid	6.58
Milestone Specialty Herbicide	62719-519	Aminopyralid	40.6
Milestone VM Plus	62719-572	Aminopyralid	2.22
Milestone VM Specialty Herbicide	62719-537	Aminopyralid	40.6
Capstone	62719-572	Aminopyralid	2.22
ForeFront HL Speciality Herbicide	62719-630	Aminopyralid	8.24
ForeFront R&P Specialty Herbicide	62719-524	Aminopyralid	6.58
Milestone Specialty Herbicide	62719-519	Aminopyralid	40.6
Method 50SG Herbicide	352-787	Aminocyclopyrachlor	50
Perspective Herbicide	352-846	Aminocyclopyrachlor	39.5
Streamline Herbicide	352-848	Aminocyclopyrachlor	39.5
Viewpoint Herbicide	352-847	Aminocyclopyrachlor	22.8
Method 240SL Herbicide	352-786	Aminocyclopyrachlor	25

Figure 1. List of products that are now Class A – Restricted-use in Vermont.

In addition to making these products state restricted-use, the following are examples of some of the new label language on these products, and can be used as management recommendations for hay land (and pasture) in Vermont that has already been treated with these herbicides;

- Manure that has been generated by animals grazing on grassland or hay treated with these pyridine herbicides may contain residues. After ingestion by livestock, manure produced can only be used to fertilize rangeland or pasture grasses.
- Once a field is treated, grasses grown for hay from this field can be harvested but may not be sold or otherwise moved off the farm as hay for 18 months following treatment. Once 18 months have passed, hay may then be harvested from the treated field and sold off the farm.
- Livestock owners must ensure that manure, urine or bedding from animals that consume treated hay or grasses is not be used for compost, or distributed for use in home or commercial gardens.
- Do not transfer grazing animals from areas treated with the product to areas where sensitive broadleaf crops occur without first allowing 3 days of grazing on an untreated pasture. Otherwise, urine and manure may contain enough herbicide residual to cause injury to sensitive broadleaf plants.
- Do not use treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed forage or eaten hay harvested from treated areas, in compost, or mulch or mushroom spawn that will be applied to areas where commercially grown mushrooms or susceptible broadleaf plants may be grown.

- Manure from animals that have grazed forage or eaten hay harvested from treated areas may only be used on pasture grasses, grass grown for seed, wheat or corn.
- Do not plant a broadleaf crop (including soybeans, sunflower, tobacco, vegetables, field beans, peanuts or potatoes) in fields treated with manure from animals that have grazed forage or eaten hay harvested from treated areas until an adequately sensitive field bioassay is conducted to determine that the residual concentration in the soil is at a level that is not injurious to the crop to be planted.
- To promote herbicide decomposition, plant residues should be incorporated evenly into the surface soil, or burned. Breakdown of these herbicides in plant residues or manure is more rapid under warm, moist soil conditions and may be enhanced by supplemental irrigation. Do not rotate to any crop from rangeland, permanent pasture or CRP (Conservation Reserve Program) acres within one year following treatment.

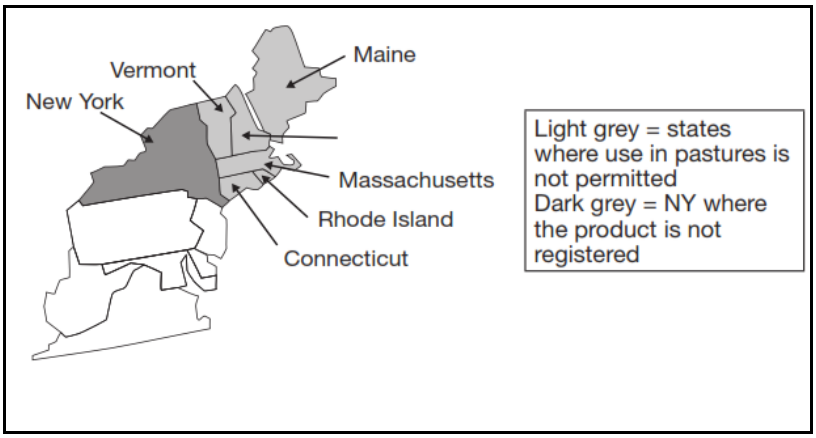

Figure 2. Graphic from Milestone label showing northeastern states where the directions for use have been modified.

Nursery Rule Amendment

The Agency of Agriculture, Food and Markets intends to amend the Vermont Nursery Rule, which was last amended in 1988. Since then, there have been changes in the authorizing law and to Agency structure that are not reflected in the existing rule. Changes to the rule will include the following:
- Removing language relevant to ginseng collection, certification, open season, and ginseng program related material, to be included in a separate 'stand alone' rule;
- Addition of language reflecting the new fee structure enacted by the legislature in 2010;
- Changing the annual licensure period language from January 1 – December 31 to May 1 – April 30; and
- "Housekeeping issues" (e.g. change 'Commissioner' to 'Secretary', change 'department' to 'agency', noting new quarantine rules since 1988 [hemlocks, noxious weeds], section numbering cleanup, etc.).

A copy of the proposed changes may be viewed at our website
http://agriculture.vermont.gov/sites/ag/files/pdf/nurseries/nursery_rule_rewrite_working_copy.pdf
or by contacting the Plant Industry Section directly (802 828-1317).

Please submit comments to the changes in writing (conventional or email) to:

Timothy F. Schmalz, Plant Industry Section Chief / State Plant Pathologist
Vermont Agency of Agriculture, Plant Industry Section
116 State Street, Montpelier, VT 05620 tim.schmalz@state.vt.us

Pesticide Resistance

Article from Chapter 12 of the Cornell Northeast Core Manual, 3rd edition, November 2012, and University of Wisconsin-Extension Pesticide Applicator Training Program. Used with permission.

To survive, pests must adapt to and overcome countless adversities: harsh winters and attack by parasites and predators are just a few. By all accounts, they have succeeded remarkably well. So it shouldn't surprise us that pests can also adapt to any control measures we use against them.

Pesticide ***resistance*** is the inherited ability of a pest to avoid toxic effects when exposed to a particular pesticide. As resistance becomes more frequent in a pest population, the pesticide will become less effective. Its continued use will only accelerate the problem. In time, you may find it impractical or even impossible to get adequate control with the pesticide. From a practical standpoint, this means you will have lost a tool for managing that pest.

Keep in mind that resistance is only one possible explanation for a control failure. In the vast majority of cases, failure to control pests is due to inadequate pest management efforts (e.g., misidentifying the pest, improper choice or placement of pesticide, poor sanitation or exclusion efforts). You should begin to suspect resistance only after all other possibilities for a control failure have been ruled out.

How Resistance Develops

Hundreds of pest species have become resistant to one or more pesticides. While not every population of these pests is resistant (e.g., resistance might appear in one state but not another), each has the potential to become resistant.

Where does such pesticide resistance come from? The answer lies in the natural genetic diversity within a pest species. When an organism reproduces, the offspring receive copies of the "parent" genetic material. However, the copies are not always perfect. Mistakes, somewhat like misspelled or missing words, may appear; we call these mistakes mutations. Because the parent was already well adapted to its environment, most mutations are either harmful or of no consequence. (Imagine the result if you changed one word in your favorite book or one note in your favorite song.)

Sometimes, though, a mutation benefits an organism. An example is resistance to a particular pesticide, which research shows can result from a single mutation. Because pest populations are so large, there will likely be a small number of individuals that carry such a mutation.

These resistant individuals survive when we apply the particular pesticide, and at least some of their offspring will inherit their resistance. Most of the other individuals die, so resistant pests now make up a larger percentage of the pest population than they did before. With each use of the pesticide, this percentage increases and eventually most of the population will be resistant. This shift has been seen after just 6 to 10 applications of herbicides having the same mode of action.

In most cases, pests that become resistant to one pesticide also become resistant to other, chemically related pesticides. This is called cross-resistance. It happens because closely related pesticides have the same mode of action (e.g., all organophosphate insecticides kill by inhibiting the nerve enzyme cholinesterase); if a pest can resist the toxic action of one pesticide, it can often resist other pesticides that act in the same way.

Mechanisms of Resistance

The change(s) in a pest population that results in resistance is called the mechanism of resistance. One or more of the following mechanisms may be at work in a population:

- **Reduced uptake.** To be effective, some pesticides must penetrate or be absorbed by a pest (e.g., through an insect's exoskeleton or a weed leaf's waxy cuticle). A pest that can reduce the amount of absorption or penetration will have an advantage over others.
- **Metabolic resistance.** This is an increase in pests' ability to metabolize a pesticide rapidly enough so that it does not harm them.
- **Target site insensitivity.** A target site is the specific organ or system a pesticide attacks in a

pest. A pest with a modified organ or system can make it less susceptible to the pesticide.

- **Behavioral change.** A pest that behaves in a way that makes them avoid contact with a pesticide, such as a bait, is more likely to survive a treatment. There are no management options known to overcome this mechanism.

Factors in Resistance Development

Given that pesticide resistance is an ever-present threat, you need to understand what influences its development. You can then work to prevent or delay its onset. At the very least, you should have an idea as to how likely it would be for resistance to become a problem in your operation.

Pest Factors

The proportion of resistant individuals in the current pest population. Resistance to a pesticide may be entirely absent from a pest population, or it may be present in a few or in many individuals. Obviously, no resistance is best.

The proportion of the population exposed to the pesticide. The higher the proportion, the faster resistance is likely to become a problem. You usually apply an insecticide when most of the insects are at the same susceptible growth stage. As a result, most of the susceptible insects will be killed and resistant individuals will comprise a much larger proportion of the survivors and, therefore, of the next generation. (Other insects that migrate from untreated areas will effectively reduce this proportion.) In contrast, many weed seeds are dormant in the soil; therefore, many susceptible individuals will survive a herbicide application. As a result, the proportion of resistant individuals may build up more slowly in weeds than in insects.

The length of the pest's life cycle. Pesticide resistance will increase more rapidly in pests that have shorter life cycles—that is, produce more generations in a given time period. This largely explains why insect and fungal populations become resistant faster than weed populations.

Pesticide Factors

The diversity of pesticides you use. If you always use the same pesticide or family of pesticides, you won't be killing pests that are resistant to that pesticide's (or family's) mode of action. The proportion of such individuals in the pest population will increase with every application.

The mode of action. Pest populations are more likely to build up resistance to pesticides that have a very specific mode of action. If a pesticide attacks one enzyme, a single mutation could produce a resistant pest individual. However, multiple mutations would be needed for an individual to become resistant to a pesticide that attacks several enzymes or processes.

The pesticide's persistence and frequency of use. Resistance is more likely to develop against pesticides that have greater persistence and that you apply often to the same site (especially if the pesticide has a very specific mode of action).

Resistance Management

In the past, we responded to pesticide resistance simply by switching products. This was possible because new products were continually available. Unfortunately, we have used up the "easy" pesticide chemistry. Today's new pesticides are more complex, difficult to make, and more expensive to develop and use. And even these products may become ineffective because of pesticide resistance. Obviously, switching products is no longer enough.

In developing a pest management program, you should probably assume that the pests can develop resistance to any pesticide you use against them; in other words, play it safe. This means that you must place greater emphasis on resistance management. It may seem like more work in the short run, but losing a pesticide because of resistance could be more of a problem in the long run.

Resistance management attempts to prevent, delay, or reverse the development of resistance. It is a complex task that involves more than just pesticides:

- **Use an integrated pest management program.** Alternative control methods will take care of pests that survived a pesticide application and will also reduce the number of pesticide applications needed. This will slow the development of a resistant population.
- **Use pesticides only when needed.** A pest population will develop resistance to a pesticide only when you use that pesticide against it. If you use the pesticide when you don't need to, you may unnecessarily increase the proportion of resistant individuals.
  Likewise, poor timing of a pesticide application can increase the risk of resistance. If you apply fungicides after spore masses are visible, you will expose a much greater number of individuals to the pesticide; thus, there is a greater chance that at least some will be resistant.
- **Apply pesticides at the labeled rate.** Some fungi develop resistance more rapidly to fungicides that are applied below labeled rates. On the other hand, an overdose of pesticide only kills more susceptible pests, meaning that resistant pests will make up an even larger proportion of the survivors. Follow label directions and calibrate equipment carefully.
- **Rotate pesticides with different modes of action.** Remember, a pest that develops resistance to a pesticide will likely be resistant to other pesticides that have the same mode of action (i.e., same way of killing the pest). If you repeatedly apply pesticides with the same mode of action to the same site, resistant individuals will continue to survive and reproduce.
  Therefore, whether you apply pesticides against a pest at a particular location once or several times a year, rotate to a pesticide with a different mode of action than the one you used in the previous application. This way, pests resistant to the first pesticide will be killed by the second.

Resisitance Management on the Pesticde Label
The EPA has requested manufacturers to provide information on pesticide labels that will help you prevent resistance development in pest populations. This information includes resistance group numbers and general resistance management statements.

Resistance Group Numbers
Several pesticide industry and academic groups have developed classification systems that group insecticide, herbicide, and fungicide active ingredients by mode of action. Active ingredients that work by the same mode of action are assigned the same group number. The EPA has requested that pesticide manufacturers include the group number on the front panel of pesticide labels in the format shown below.

Resistance group indicated on front panel of pesticide label.

With the group number on the label, you can easily select a pesticide which has a different mode of action the next time you treat a given site. If a pesticide product contains more than one active ingredient, the group number for each would be represented on the label.

If a label lacks a resistance group number, you can find the resistance group for the product's active ingredient at one of the following web sites:
For herbicides, go to
www.wssa.net/Weeds/Resistance/index.htm
For insecticides, go to
www.irac-online.org/teams/mode-of-action/
For fungicides, go to www.frac.info

Resistance Management Statements

If present on the pesticide label, resistance management statements will most likely be found segregated (perhaps in a box) under the heading "Resistance Management" in the "General Information" portion of the "Directions for Use" section. While not mandatory, these statements suggest actions that have been shown to delay or prevent pesticide resistance; follow these suggestions as appropriate.

See the quiz on page 9 for a credit…

Worker Protection Standard (WPS) in Forests

The Worker Protection Standard (WPS) is a federal regulation administered by the U.S. Environmental Protection Agency (US EPA). The WPS takes effect when a pesticide is used in the production of agricultural plants, including forested lands if the land is managed for the production of timber (an agricultural commodity). *These pesticide applications include the use of herbicides to control invasive plants on timber producing land.*

WPS applies to all agricultural employers, pesticide handlers and agricultural workers that enter the treated area during the Restricted Entry Interval (REI) or for the next 30 days after it has expired. These workers would include any logger, forester or anyone else that may enter the treated area to perform tasks related to the production of timber in the forest, with some exceptions. If people are entering your property for other reasons they are not considered agricultural workers and the restrictions do not apply.

Timing of entry into the treated area for workers is dictated by the REI. This is the period of time after application of a pesticide during which entry into the treated area is only allowed by trained handlers involved in the application. This information is listed in the "Agricultural Use Requirements" box on the herbicide label.

As agricultural employers, landowners are required to continue to comply with the WPS for 30 days following the expiration of the REI. We recommend restricting the entry of all agricultural workers for 30 days following the expiration of the REI. By doing this, landowners can avoid having to provide all of the WPS requirements listed below to their agricultural workers. If agricultural workers are entering the site within 30 days following the expiration of REI, the workers need to be trained in Worker Protection and the agricultural employer (landowner) is responsible for providing the following to the agricultural workers:

- a central location for pesticide application information, safety instructions, emergency contact information
- pesticide safety training for ag workers before they enter the treated area
- a decontamination site for all workers
- emergency assistance to all agricultural workers
- notification about applications to ag workers, either orally or by posting
- personal protective equipment (PPE) for agricultural workers and pesticide handlers as dictated by the label

A newly developed poster that summarizes the Worker Protection Standard requirements for Forests is available through the Vermont Agency of Agriculture. If you are interested in copies of this poster or have any questions regarding WPS, please contact Annie Macmillan at the Vermont Agency of Agriculture at 802-828-3479 or anne.macmillan@state.vt.us

News from UVM Extension

Ann Hazelrigg, UVM Pesticide Safety and Education Program

Applying Pesticides in Hot Weather

Article from Chapter 9 of the Cornell Northeast Core Manual, 3rd edition, November 2012, and University of Wisconsin-Extension Pesticide Applicator Training Program. Used with permission.

It wouldn't be summer in Vermont without a few uncomfortable weeks of high temperatures. Applying pesticides during hot weather is no fun, and can lead to heat stress.

Heat stress is the buildup of heat in the body generated by muscles during work and by a warm or hot work environment. ***Heat illness*** results when the body is subjected to more heat than it can cope with. It is important to understand and recognize heat stress since protective clothing worn during pesticide applications can increase your risk of heat stress and the symptoms of heat illness can be confused with the symptoms of acute pesticide poisoning.

When your body becomes overheated, less blood goes to the active muscles, the brain and other organs. You may feel weaker, more tired, less alert and less able to use good judgment and perform work tasks. As the strain from heat becomes more

severe, your heart rate may rise and your body temperature can increase. This can occur quickly and is not accompanied by any pain. With an increase in 2 degrees F, your ability to reason is impaired. An increase of 5 degrees F can be life threatening and lead to heat stroke, which is fatal in 20% of cases.

Symptoms of heat illness can range from dizziness and blister-like red spots on the skin to cramps, muscle spasms, nausea, increased pulse and breathing rate. Symptoms of heat illness can be similar to those caused by pesticide poisoning. Both heat illness and organophosphate/carbamate poisoning can cause sweating, nausea, headache, fatigue, loss of coordination, and confusion. Some differences include; heat illness causes dry membranes (dry mouth, no tears) as opposed to organophosphate/carbamate poisoning causing moist membranes (lots of salivation, tears). Heat illness can cause increased pulse rather than a decreased pulse in the case of the pesticide poisoning example. In some cases, both pesticide poisoning and heat illness can occur together.

Be aware of the circumstances that can increase your risk for heat stress. If you supervise pesticide applicators, be sure to hold a safety training to go over the dangers of heat stress. Factors affecting heat stress include:

- **Heat factors-** As temperatures, humidity and/or amount of sunlight increases, so does the likelihood of heat stress. Wind will help to keep you cooler. Spray in the morning to avoid the hot temperatures in the afternoon.
- **Work load**-With hard work, the body produces heat. Heat stress is more likely to develop if you are carrying heavy loads like a backpack sprayer, or working on foot, rather than on a tractor. Working without breaks can contribute to heat stress.
- **Personal Protective Equipment (PPE)-**Extra layers of clothing and chemical-resistant gear protects you from pesticide exposure but can interfere with the natural body cooling that occurs when sweat evaporates.
- **Hydration**-Although your body cools itself through sweating and evaporation, if you don't drink enough water to replace what you are losing, your temperature will rise and can lead to heat stress.

There are helpful steps you can take to avoid heat stress. **Always stop work if you experience symptoms of heat illness.**

- Manage your workload by working in the heat for short periods (about 2 hours) each day until your body adjusts.
- Take frequent breaks to allow your body to cool down.
- Drink lots of fluids before, during and after work. Do **not** wait until you are thirsty! Drink enough water each day to replace any water lost through sweating.
- Schedule tasks/spraying during the coolest time in the day. Using a cooling vest that holds ice or frozen-gel inserts can help to keep your body cool.

Select the proper PPE and do not wear more than is necessary. Check the pesticide label for the minimum PPE you must wear. Hot, sweaty skin will absorb pesticides more rapidly than cool, dry skin, so do not ignore the PPE requirements even when you are hot. Use a wide-brimmed hat in the sun.

Since pesticide poisoning and heat illness symptoms may be similar, you may not be able to tell what is causing the person to feel sick on the job. Do not waste time trying to determine the cause; if a person exhibits any illness when working with pesticides or in areas treated by pesticides, assume it is due to pesticide exposure and seek medical attention immediately.

If you know heat illness is the cause, get the victim to a shaded or cooler area, remove PPE or clothing that is contributing to the stress and cool the victim as quickly as possible using cool water. Have the victim drink as much cool water as possible. NEVER give anything by mouth to an unconscious person.

See the quiz on page 11 for a credit…

Home Study Quiz 1- Pesticide Resisitance

The following questions refer to the article on pages 4-6. Fill out the information on the back of this completed quiz and mail it to the Vermont Agency of Agriculture to receive **(1) one pesticide recertification credit.**

Circle the single, best answer:

1. Pesticide resistance is
   A. the ability of a pest to avoid doing what it is supposed to do.
   B. the inherited ability of a pest to avoid toxic effects when exposed to a particular pesticide.
   C. the only possible reason for a pest control failure.

2. Most genetic mutations in a pest population
   A. are harmful or of no consequence to the population.
   B. lead directly to the development of resistance in the population.
   C. are due to pesticide use.

3. A shift in the percentage of resistant individuals in a population can be seen in as few as how many pesticide applications having the same mode of action?
   A. 1-2
   B. 3-5
   C. 6-10

4. Cross resistance happens because
   A. closely related pesticides have the same mode of action.
   B. the modes of action are very different.
   C. a pest can resist the toxic action of only one pesticide.

5. What might be a reason for resistance building up more slowly in weeds than in insects?
   A. Weeds are not killed by insecticides.
   B. Insects eat the weeds and kill the resistant individuals in a population.
   C. Weed seeds may be dormant in the soil, allowing some susceptible individuals to survive treatment.

6. If you always use the same pesticide or family of pesticides, you won't be killing pests that are resistant to that pesticide's (or family's)
   A. mode of action.
   B. life cycle.
   C. resistance management.

7. How does Integrated Pest Management (IPM) help to manage pesticide resistance?
   A. It increases the number of resistant individuals in a population.
   B. Alternative control methods will take care of pests that survived the pesticide application.
   C. The pest monitoring will identify resistant individuals in a pest population.

8. Using the resistance group number on the pesticide label, how can you avoid using a pesticide with the same mode of action repeatedly?
   A. Rotate to a product with the same resistance group number.
   B. Use the same product over and over.
   C. Rotate to a product with a different resistance group number.

The following information is required. Mail the completed quiz to the Vermont Agency of Agriculture to receive one (1) pesticide recertification credit.

Name:		
Certificate #:		Please check: ☐Commercial ☐ Non-Commercial ☐Government ☐Private
Street Address:		
City/State/Zip		
Company/Farm:		
Signature:	Date:	
Email address (optional):		

Please mail the quizzes in an envelope to: Vermont Agency of Agriculture, Food & Markets
Attn: Matthew Wood
116 State Street
Montpelier, VT 05620-2901

Home Study Quiz 2 – Applying Pesticides in Hot Weather

The following questions refer to the article on pages 7 and 8. Fill out the information on the back of this completed quiz and mail it to the Vermont Agency of Agriculture to receive **(1) one pesticide recertification credit.**

1. What is the difference between heat stress and heat illness?

2. Which is more likely with heat stress-increased pulse or decreased pulse?

3. Why is it important to drink a lot of water during hot weather work?

4. List 4 symptoms of heat illness.

5. How does PPE contribute to heat stress while spraying during hot weather?

6. With a 2 degree increase in body temperature what happens? What happens with a 5 degree increase?

7. List 5 steps you can take to avoid your risk of heat stress.

8. What action(s) should you take if your worker is feeling sick after working in a treated orchard in the middle of an August day.

9. Which absorbs pesticides more rapidly; hot, sweaty skin or cool dry skin?

10. List 5 symptoms that can be common to both organophosphate/carbamate poisoning and heat illness?

Pesticide Applicator Report
Spring 2013

Vermont Agency of Agriculture, Food & Markets
Agriculture Resource Management Division
116 State Street
Montpelier, VT 05620-2901

The following information is required. Mail the completed quiz to the Vermont Agency of Agriculture to receive one (1) pesticide recertification credit.

Name:		
Certificate #:		Please check: ☐Commercial ☐ Non-Commercial ☐Government ☐Private
Street Address:		
City/State/Zip		
Company/Farm:		
Signature:	Date:	
Email address (optional):		