The Pesticide Applicator Report

Published by
The Vermont Agency of Agriculture, Food & Markets
For Vermont's Pesticide Applicators

Spring 2011

Volume 13 – Issue I

In This Issue:

News from the Vermont Agency of Agriculture, Food & Markets

Attention Pest Control Operators: Pending Changes in the Legal Status of Little Brown Bats in Vermont

Scott Darling, Vermont Fish and Wildlife Department

As most of you may know, the disease White-nose Syndrome (WNS) has dramatically impacted six of Vermont's nine species of bats, all six of which are species that hibernate in caves and mines during the winter. The disease is now fully spread across the state and has, as best as we can tell, infected all of our bat hibernacula. Internationally, the disease ranges from New Brunswick to Ontario and southward to Oklahoma.

While all six cave bat species are affected by WNS, two in particular, the little brown bat (*Myotis lucifugus)* and the northern long-eared bat (*Myotis septentrionalis)*, have been most impacted. What were Vermont's two most common bat species have now declined by a range of 76% to 99%, depending on the survey technique, in just the past three years. Some population models now predict the little brown bat will become extirpated in as soon as the next 15 years.

As a result, the Vermont Fish and Wildlife Department (VFWD) and the Mammals Scientific Advisory Group of the Endangered Species Committee jointly recommended that the two species be listed as state-endangered. Vermont Agency of Natural Resources (VANR) Secretary Deb Markowitz approved moving forward with the proposal, pending a public hearing to be held May 10 in Montpelier. The hope is that an endangered species status will help reduce other non-disease-related mortality factors enough to buy us some time to keep this species alive until an effective treatment for WNS is available.

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

The pending endangered species status for the little brown bat has implications for all Vermonters, including pest control/animal damage professionals. The once common little brown bat is one of two species (the big brown bat being the other) frequently found in people's residences. Activities to address human-bat encounters and conflicts that were once largely unregulated are now subject to the limitations of the Vermont Endangered Species Law. Typically, under state law, any take (e.g., harm, harassment, and killing) of an endangered species first requires one to obtain a State Threatened and Endangered Species Permit from the Secretary of VANR.

The VFWD is actively working to provide the little brown bat with the protections afforded to endangered species while, at the same time, recognizing that specific circumstances may require the take of little brown bats. In response the Secretary of VANR will be establishing an Incidental Take Permit which will allow for citizens to respond to potential exposure to rabid bats. It is likely that any take under these conditions will need to be reported to be authorized under the permit.

The VFWD will also be establishing criteria under which animal damage/pest control professionals can conduct work for homeowners without the need to obtain a Threatened and Endangered Species Permit. The VFWD is currently developing *Best Management Practices for Bat Exclusions* that, once completed, will allow for such practices without obtaining a state permit. The draft document is currently being circulated to a sample of animal damage/pest control professionals for their input.

Lastly, the VFWD is currently designing a user-friendly page on its website for public access to information on WNS, Vermont bats, and the various strategies to address human-bat conflicts.

I am hopeful that a reasonable, collaborative approach to reducing human-caused mortality of bats will help Vermonters work through this challenge. I welcome your assistance and suggestions as we work to maintain bats on the Vermont landscape.

Scott can be reached at scott.darling@state.vt.us

Spray Adjuvants

Article from a Pesticide Safety Fact Sheet published by Penn State Extension. Original text prepared by Winand K. Hock, professor emeritus of plant pathology. Current text updated by Eric S. Lorenz, senior extension associate, Pesticide Education Program.

The agricultural and horticultural industries are being overwhelmed by adjuvant choices. With so many products to choose from, how do you make an informed decision about which adjuvant to use in a particular situation? A good place to start is to examine the characteristics of this diverse group of chemicals.

An adjuvant is a broadly defined as any nonpesticide material added to a pesticide product or pesticide spray mixture to enhance the pesticide's performance and/or the physical properties of the spray mixture.

The right adjuvant may reduce or even eliminate spray application problems, thereby improving overall pesticide efficacy. Because adjuvants themselves have no pesticidal properties, they are not required to be registered by the U.S. Environmental Protection Agency (EPA). Additionally, most states do not regulate the distribution of adjuvants.

Before using any adjuvant, you should consult the pesticide's label. Many EPA-registered pesticide products have very specific recommendations on their labels about using one or more adjuvants. Failure to follow these instructions is a violation of the product label and considered ~~an inappropriate use~~ *(actually, a misuse [matt])* of the pesticide.

Questions about the specific properties of an adjuvant or pesticide product should be referred to the manufacturer before you attempt to use the product. Manufacturers can provide labels, technical data sheets, material safety data sheets (MSDS), supplemental labeling, and promotional literature about their products.

The two types of adjuvants are distinguished by how they are combined with the pesticide. A *formulation adjuvant* is already included in the pesticide product by the manufacturer. A *spray adjuvant* is a separate product that is added to the spray tank by the applicator. Since applicators have no control over formulation adjuvants, this publication focuses on spray adjuvants.

Adjuvants and Spray Application

Some research indicates that up to 70 percent of the effectiveness of a pesticide depends on the spray application. However, spray application is perhaps the weakest link in the pesticide development process. Therefore, the ability to use adjuvants to minimize or eliminate many spray application problems will help boost the pesticide's effectiveness.

Adjuvants are designed to perform specific functions, including buffering, dispersing, emulsifying, spreading, sticking, and wetting. Adjuvants also can reduce evaporation, foaming, spray drift, and volatilization. No single adjuvant can perform all these functions, but different compatible adjuvants often can be combined to perform multiple functions simultaneously.

Spray adjuvants can be categorized into two groups: activator adjuvants and special-purpose or utility adjuvants.

Activator adjuvants - The primary purpose of activator adjuvants is to enhance the "activity" of the pesticide product. These enhancements—both physical and chemical—generally lead to improved absorption and, as a result, a more efficient use of the pesticide. Activator adjuvants include surfactants, oils, and nitrogen-based fertilizers.

Surfactants - (*surf*ace *act*ing *a*ge*nts*), also called wetting agents and spreaders, physically alter the surface tension of a spray droplet. For a pesticide to perform its function properly on a plant, the spray droplet must be able to wet the foliage and spread out evenly. Surfactants enlarge the area of pesticide coverage, thereby increasing the pest's exposure to the chemical. Surfactants are particularly important when applying a pesticide to a plant with waxy or hairy leaves. Without proper wetting and spreading, spray droplets often run off or fail to adequately cover these surfaces. Too much surfactant, however, can cause excessive runoff or deposit loss, in turn reducing pesticide efficacy. Surfactants are classified by the way they ionize, or split apart, into electrically charged atoms or molecules called ions. A surfactant with a negative charge is anionic, one with a positive charge is cationic, and one with no electrical charge is nonionic. Pesticidal activity in the presence of a nonionic surfactant can be quite different from activity in the presence of a cationic or anionic surfactant.

Selecting the wrong surfactant can reduce the efficacy of a pesticide product and increase the risk of plant injury. Anionic surfactants are most effective when used with contact pesticides. Cationic surfactants should never be used as stand-alone surfactants because they usually are phytotoxic (poisonous to plants). Nonionic surfactants are often used with systemic pesticides and help pesticide sprays penetrate plant cuticles. Furthermore, nonionic surfactants are compatible with most pesticides, and most EPA-registered pesticides that require a surfactant recommend a nonionic type.

Organo-silicone surfactants are a newer group of surfactants that are taking the place of the more traditional nonionic surfactants. They have the ability to reduce surface tension, increase spreading ability and improve rainfastness (the amount of time between a pesticide application and rainfall). Rainfastness can be improved, or shortened, when pesticide absorption into the plant is increased.

Oils - Oils are being used to control grassy weeds. The three types of oil-based adjuvants include crop oils, crop oil concentrates, and vegetable oil concentrates.

Crop oil is generally 95 to 98 percent paraffin or naptha-based petroleum oil with 1 to 2 percent surfactant/emulsifier. Crop oils promote the penetration of a pesticide spray either through a plant's waxy cuticle or through an insect's tough, chitinous shell. Traditional crop oils are more commonly used for insect and disease control and rarely with herbicides.

Crop oil concentrates (COC) consist of 80 to 85 percent emulsifiable petroleum-based oil and 15 to 20 percent nonionic surfactant. Crop oil concentrates provide the penetration properties of oil and the spreading properties of a surfactant. COC's are often used with postemergence herbicides.

Vegetable oil concentrates (VOC) consist of 80 to 85 percent crop derived seed oil (usually cotton, linseed, soybean, or sunflower oil) and 15 to 20 percent nonionic surfactant. To improve their performance, many VOC's have undergone a process called esterification, which increases the oil-loving characteristics of the seed oil and results in methylated seed oil (MSO). MSO's are comparable in performance to traditional crop oil concentrates in that they increase penetration of the pesticide into the target pest.

Nitrogen-based fertilizers - Enhanced herbicide activity has been shown by adding ammonium sulfate or urea-ammonium nitrate to the spray mixture. Nitrogen fertilizers may replace some adjuvants but are usually added in addition to a surfactant and a crop oil concentrate for use with systemic pesticide products. Many fertilizer-based adjuvants are available in liquid forms, which are easier to mix and provide more consistent results. Fertilizers should only be used with herbicides when indicated on the label.

Special purpose/utility adjuvants - Special purpose adjuvants correct specific conditions that can adversely affect the spray solution or the actual application of the pesticide. By controlling these factors, you can maximize the efficient use of the pesticide. The following adjuvants modify the physical characteristics of the spray solution and include compatibility agents, buffering and conditioning agents, defoaming agents, deposition agents, and drift control agents and thickeners. Carefully follow product label directions before adding any adjuvant to a spray mix.

Compatibility agents - Pesticides are commonly combined with liquid fertilizers or other pesticides. However, some combinations can be physically or chemically incompatible, causing clumps and uneven distribution in the spray tank. Occasionally, the incompatible mixture will clog the pump and distribution lines, resulting in expensive cleanup and repairs. Using a compatibility agent may eliminate these problems. A "jar test" can help determine the stability of the mixture.

Buffering and conditioning agents - Most pesticide solutions or suspensions are stable between pH 5.5 and pH 7.0 (slightly acidic to neutral). Pesticide solutions above pH 7.0 are at greater risk of degrading or breaking down by alkaline hydrolysis. Acidifiers are adjuvants that lower the pH of the water in the spray tank, although they do not necessarily maintain a constant pH level. Buffers tend to stabilize the pH at a relatively constant level.

Conditioning or water-softening agents reduce problems associated with hard water. Hard water minerals, especially calcium and magnesium ions, bind with active ingredients of some pesticides, which results in decreased pesticide performance. Before using a buffer or conditioning agent, consider the specific pesticide requirements and conduct a water analysis for pH and hardness.

Defoaming agents - Some pesticide formulations create foam or a frothy head in some spray tanks. This is often the result of the type of surfactant used in the formulation and the type of spray tank agitation system. The foam usually can be reduced or eliminated by adding a small amount of foam inhibitor.

Deposition agents - These adjuvants, which are often referred to as "stickers," increase the adhesion of solid particles to the target surface. These adjuvants can decrease the amount of pesticide that washes off during irrigation or rain. Deposition agents can also reduce evaporation of the pesticide and some can slow degradation of pesticides by ultraviolet rays. Many deposition agents also include a wetting agent to make a general purpose product that both spreads and adheres to the target surface.

Drift control agents and thickeners - Drift is a function of droplet size, wind speed, and height of the spray boom. Spray droplets with diameters of 100 microns or less tend to drift away from targeted areas. Drift retardants or deposition aids improve on-target placement of the pesticide spray by increasing the average droplet size. Drift reduction is a priority near sensitive sites, and using a spray drift agent may be well worth the small reduction in efficacy that can result from the change in droplet size. Thickeners, as the name suggests, increase the viscosity of spray mixtures. These adjuvants are used to control drift or slow evaporation after the spray has been deposited on the target area. Slowing evaporation is important when using systemic pesticides because they can penetrate the plant cuticle only as long as they remain in solution. Once the water has evaporated, any unabsorbed pesticide will remain on the leaf surface and can only be taken up by the plant if it resolubilizes.

How to Choose the Right Adjuvant

Many factors must be considered when choosing an adjuvant for use in a pest management program. The following are some guidelines:

- First and foremost, *read the pesticide label*.
- Use only adjuvants manufactured and marketed for agricultural or horticultural uses. Do not use industrial products or household detergents with pesticides because they may interfere with pesticide performance.
- Pesticide labels seldom mention specific brands of adjuvants, but rather the general type of adjuvant, such as nonionic surfactant, crop oil, or defoaming agent. However, if the pesticide label lists a specific brand of adjuvant, that brand should be used.
- Miracle adjuvants do not exist. Ignore claims such as “keeps spray equipment clean,” or “causes better root penetration.” Always buy recognizable, name-brand products from a reputable dealer.
- Adjuvant recommendations may change due to changes in pesticide formulations, newly labeled tank mixes and premixes, and changes in application technology and procedures. Always read the label *every time* a pesticide product is used.
- Using an adjuvant is not always necessary. Knowing when *not* to use an adjuvant is just as important as knowing when to use one. If the pesticide label does not mention an adjuvant, the manufacturer’s research probably has shown no benefits—or even adverse effects—from adjuvant use.

Spray adjuvants can contribute substantially to safe and effective pest control when used at the recommended rate on the label. Although a single adjuvant may perform more than one function, no single product can solve every problem. As a result, many spray adjuvants are available, each formulated to solve problems associated with a particular type of application. Read the pesticide label.

The correct use of adjuvants does require some knowledge of the site you plan to spray, the target pest, your equipment, and, of course, the pesticide you plan to use. By knowing the particular needs and limitations of the products you intend to use, adjuvants can prove to be a positive addition to the spray tank.

See the quiz on page 9 for a credit.

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Reminder to all Applicators

When submitting training attendance forms to the VT Agency of Agriculture for recertification credits, especially those from states other than Vermont, *be sure to include your CLEARLY PRINTED NAME, signature and VT certification number.* Lately I have received a number of forms from out-of-state trainings with no name on them whatsoever, so I have had to add them to my growing pile of un-issued credits ☹

If you use email and can supply me with a fairly reliable address, it would be useful as I am starting to use it more for communicating with applicators. For example, I just sent out a friendly reminder to those applicators that have not renewed for 2011! Also, let me know if you would like to receive this newsletter via email ***instead of a paper copy***, by emailing your request to matthew.wood@state.vt.us. Thanks! - ꟿ

News from UVM Extension

Plant Diseases 101

Ann Hazelrigg, Pesticide Safety Education Program

As long as crops have been grown, plant diseases have caused famines, death and suffering and were feared as much as war and human diseases. Diseases in plants have been described in ancient texts and in the Old Testament, where mildews, blast, pestilences and bights were used as threats for punishments for individuals not behaving properly. Plant disease controls have also been mentioned in ancient texts including a reference by Homer for using sulfur to control a disease in 1000BC. Olive grounds were identified in 470 BC as a control for plant diseases.

The definition of a plant disease is the impairment of health or function in a plant. A plant pathogen is the agent that causes plant disease. Plant diseases can be caused by both abiotic (non-living) problems and biotic (living) problems. Winter injury, fertilizer burn, lightening damage, overwatering, drought injury and chemical injuries are all examples of abiotic or non-living agents causing plant diseases. Most of what comes into the Plant Diagnostic Clinic at UVM is caused by these abiotic problems. Since abiotic problems are not infectious and don't spread, they are controlled by avoiding or correcting the problem that caused the disorder in the first place. This may mean choosing more winter hardy plants, making sure your blueberries are planted in soils with a pH of 4.5-5.0 or by calibrating your fertilizer spreader or backpack sprayer so you don't add more chemicals than are necessary.

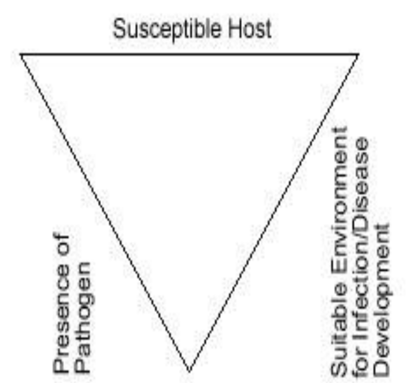

Figure 1. The Disease Triangle

To figure out whether your plant's or crop's problem is abiotic, look for a pattern of injury. If all one age of leaf on the plant shows damage, or if only one side of the plant is affected, suspect an abiotic problem. If the damage seems to occur overnight, or over the course of the winter, this is a clue that it is an abiotic problem. (Infectious diseases don't infect when it is cold out!) Finally, if there seems to be a gradient of damage, like what we are seeing with all the browned pines near I-89, and how the plants nearer the cause of the damage (i.e. salt from the highway) look worse and as you move away, the plants look better, consider an abiotic problem as the culprit.

Biotic, or infectious diseases, are caused by a variety of pathogens including bacteria, fungi, viruses and nematodes. Unlike abiotic problems, these pathogens cause diseases that can spread from plant to plant and are more random in occurrence. When discussing infectious plant diseases, plant pathologists use the concept of the "plant disease triangle" (see figure 1.) to explain the relationship among the pathogen, the environment and the host and how it affects the probability of disease.

For any biotic disease to occur you need three things to be present; a susceptible host, the proper environment and the right pathogen. If you can eliminate one of those three sides of the triangle, you can eliminate or avoid the plant disease. For example, if you are growing phlox and don't want to spray a fungicide for powdery mildew all summer, you can choose a resistant variety. Even if the pathogen is present and environment is conducive for disease, there is no susceptible host, so no disease! You can manipulate the environment (most pathogens like high humidity or wet foliage) by using good spacing in vegetable fields and staking plants to promote rapid drying of leaves. This will eliminate the type of environment the pathogen prefers, so you will see less disease. To manage or lessen pathogens, we rotate our fields and crops to prevent the buildup of pathogens in soil. Encouraging homeowners to rake and destroy infected diseased leaves in the fall will also decrease the amount of overwintering spores that can infect in the spring.

Try using this disease triangle concept to think about and manage plant diseases in the future. This simple concept can be applied to plant disease management in the garden, landscape and in large fields.

See the quiz on page 11 for a credit.

Identifying and Managing White Grubs in Turf

Sid Bosworth, Extension Agronomist, UVM

White grubs are the larval stage of several scarab beetle species that feed on grass roots causing wide variation in damage. Last fall, we saw an abundance of white grub damage around Vermont, so it is likely, that we will see more damage this spring and summer. However, grub damage can vary significantly from year to year and we know that turf that receives adequate water and has a healthy root system can tolerate high numbers of grubs without showing signs of damage. Research in upstate New York has shown that insecticide treatments are only needed about twenty percent of the time on both home lawns and golf course fairways; therefore, the consistent use of a season long preventative insecticide is unnecessary in a majority of cases.

Grub Identification - It is important to be able to identify which species is causing a problem since control methods may only be affective for certain species. Last year, I met a homeowner in Burlington who had been trying for a few years to control his grub problem with milky spore disease. In spite of the fact that this biological control has not been shown to be very affective due to our cold soils in Vermont, it certainly will not work if the grub is not Japanese beetle (commercial products of milky spore are specific to Japanese beetle). As it turned out, the major grub species that this homeowner had was Oriental beetle which is not controlled by commercial milky spore.

In the Northeast, we have at least eight different species of insects classified as white grubs. Four species are native (black turfgrass ataenius, green June beetle, May or June beetles, northern masked chafer) and four are exotic or introduced (Asiatic garden beetle, European chafer, Japanese beetle, Oriental beetle).

A good time to identify grubs is in May or June when most grub species are in the 3rd instar and large enough to ID with a good hand lens or a 10 x magnifying glass. Late August and September are also good times to look. You can usually ID grubs by observing their raster (anal hair) patterns. A couple factsheets that help in identifying grubs can be found on the web at: ohioline.osu.edu/hyg-fact/2000/2510.html and www.umassturf.org/publications/fact_sheets/insects/white_grub_ID.pdf. You can also collect grubs and send them to the UVM Diagnostic Lab for Identification. If you place the grubs in moist soil in a plastic bag with pin holes, they will keep for a while. Download the Plant Diagnostic Clinic Specimen Form (http://pss.uvm.edu/pd/pdc/), complete it as much as possible and mail it in with the grub sample.

Cultural Practices for Managing Grubs - Grub management should include cultural practices but can also include biological and chemical control strategies. Unfortunately, there are no known turfgrass species or cultivars resistant to white grubs; however, the spreading growth habit of Kentucky bluegrass and creeping bentgrass can be beneficial for filling in thin spots caused by grub damage. Although not resistant per se, drought tolerant grasses such as fine fescues and endophyte-enhanced tall fescue and perennial ryegrass may recover more quickly from grub damage. Good cultural practices such as adequate irrigation and fertilization can also help offset grub damage. Actively growing turf with healthy roots have been shown to tolerate populations up to 50% higher than recommended thresholds without showing damage. Fall fertilization can help with recovery of grub damage; however, high nitrogen applications in the spring will usually encourage shoot growth at the expense of root development which can make the turf more susceptible to spring and summer grub damage.

Chemical Control - For chemical control, there are two basic approaches for managing grubs: 1) a preventative application of a slow-acting and long lasting insecticide such as chlorantraniliprole or imidacloprid applied in the summer to prevent subsequent infestations, or 2) a reactive or curative application in autumn based on the actual presence of grubs at a action threshold population using fast acting chemicals such as trichlorfon.

With the preventative method, applications are made too early to utilize scouting information. Although these insecticides have a low mammalian toxicity and are applied at a low rate, they do have a longer window of exposure which can negatively impact natural predators and other non-target fauna. Therefore, this approach should only be warranted in areas that consistently have damaging grub populations or in high risk situations with high value turf. With the second approach, scouting can be used to assess threshold populations and spot treatments can be applied just on affected areas. Unfortunately, the insecticides for this approach are relatively high in mammalian toxicity and are applied at a high rate of active ingredient; therefore, caution and appropriate applications are even more critical.

Spring treatments are not recommended. Usually, the grubs are large enough to be tolerant of insecticides. Also, the grass is usually growing at a fast enough rate to compensate for grub damage. According to Cornell's IPM recommendations, regardless of insecticidal approach, best IPM should have attributes that include reliability, reduced-risk, late-season efficacy, narrow spectrum of activity, fast-action and low cost.

Biological Control of Grubs - There are at least three biological control agents commercially available for white grubs in turf: entomopathogenic nematodes, entomopathogenic fungi, and the milky spore disease bacteria. Although effective in laboratory studies, these alternatives have relatively poor or inconsistent results in the field. Some of the reasons may include unsuitable environmental conditions such as cold or droughty soils, insufficient water at time of application, improper storage and handling of the organisms and incorrect species (particularly a problem with the nematodes). However, there may be situations where a turf manager wants to try a biological due to insecticide restrictions. When purchasing these products it is important to be assured that they were handled in an appropriate manner to assure viability of the organisms and that you carefully follow all the directions during and after application.
The above approaches to biological control are classified as inundative since you are directly applying organisms to the host pest. A more "classical" method of biological control is the general release of predators that have a narrow host range for that particular pest. In the early 1930's, USDA entomologists imported a predatory wasp, *Tiphia vernalis* Rohwer (Hymenoptera Tiphiidae), from Korea for the biological control of the Japanese beetle. Numerous releases were made throughout the Northeast. Recent work at the University of Connecticut has focused on this insect and its ability to parasitize Japanese and Oriental beetle grubs. One area of their research is to find ways to conserve this predator wasp in the landscape in order to enhance their survival, spread and efficiency in attacking grubs. One interesting approach is to plant peonies which apparently are excellent nectar sources for the wasp. A study in Kentucky had shown that peonies increased wasp populations and parasitism of Japanese Beetles. So, researchers in Connecticut are evaluating different peony varieties to test their efficacy in wasp population improvement.

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Home Study Quiz 1 – Spray Adjuvants

The following questions refer to the article on pages 2-5. 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 definition of an adjuvant?

2. Are adjuvants required to be registered with the US Environmental Protection Agency? Why or why not?

3. Who is the best source of information about the use of adjuvants?

4. What is the difference between a *formulation* adjuvant and a *spray* adjuvant?

5. What particular conditions would warrant the use of a surfactant?

6. What could happen if the wrong surfactant is used when you are treating desirable plants?

7. At or above what pH are pesticide solutions at greater risk of degrading or breaking down by alkaline hydrolysis?

    A. pH 8.5
    B. pH 8.0
    C. pH 7.0
    D. pH 5.5
    E. pH D

8. What can be added to the spray tank to reduce or eliminate the foam that develops?

    A. Soap
    B. Rub your finger next to your nose and stick it in
    C. A defoaming agent
    D. Don’t add anything, just agitate more

9. How do drift control agents reduce spray drift?

<u>The following information is required.</u> 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:**
OPTIONAL: Please include your E-MAIL ADDRESS if you haven't already given it to me.		

Mail to:

Vermont Agency of Agriculture, Food & Markets
Attn: Matthew Wood
116 State Street
Montpelier, VT 05620-2901

Home Study Quiz 2 – Plant Diseases 101

The following questions refer to the article on page 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.**

1. What is the definition of plant disease?

2. What is a plant pathogen?

3. What are the two types of plant diseases?

4. Over fertilization, herbicide injury, salt damage, hail injury and winter damage are what kind of plant disease?

5. Name three biotic pathogen types.

6. Explain how the disease triangle works.

7. Give a disease scenario that you may face in your work and tell how you would apply the concepts of the plant disease triangle to manage it.

8. Why do we rotate crops (what are we manipulating in terms of the disease triangle)?

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Vermont Agency of Agriculture, Food & Markets
Agriculture Resource Management Division
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OPTIONAL: Please include your E-MAIL ADDRESS if you haven't already given it to me.		