



Save Georgia's Hemlocks

Instructions for Treating Hemlocks with Imidacloprid

Determining if hemlocks are infested with HWA

1. Look on the underside of the branches. If you see small white, woolly balls about the size of a peppercorn, the hemlock has the HWA infestation.
2. If even one hemlock on your property has the HWA, or if a near neighbor's hemlocks have it, assume that all of yours have it too (or will soon have it) and prepare to treat them. In Georgia, Hemlocks *can* be treated year-round *except* when the ground is saturated or frozen or during a prolonged drought. Having adequate soil moisture is key for good results.

Note: Soil is considered saturated where there is free-standing water on the surface, when water puddles in your footsteps, or when you can squeeze water easily from a handful of soil.



Determining the level of infestation

1. Compare what you observe on your hemlocks with the 3 photos below to estimate the level of infestation.
2. Lightly to moderately infested trees can be treated with a relatively inexpensive product called Imidacloprid.
3. Heavily infested trees require a more aggressive, fast-acting chemical called Safari.



Light



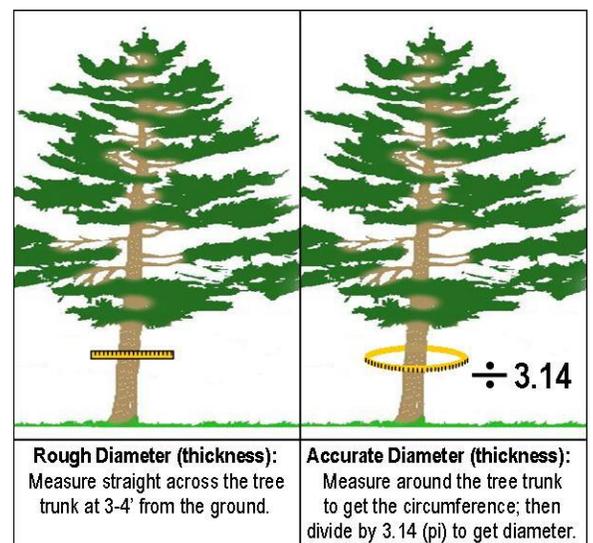
Moderate



Heavy

Measuring the trees to be treated

1. First, you should decide which hemlocks you want to save. Ideally, they should be spaced no closer than 10-15 feet from each other (unless you're using them as a hedge or screen) to give each one enough room to take water, nutrients, and light. Choose as many large trees as you desire, but also choose some medium and small ones to allow for successional growth. Cut out the ones that are not going to be saved. It's not necessary to haul them away, burn, chip, or shred them; when the sap dries up, the feeding insects that are attached will die.
2. Determine the trunk diameter at breast height (dbh) for each tree to be treated. Breast height = 4 ½' above the ground.
 - a. For a rough measurement, stretch a measuring tape straight across the tree trunk to get the diameter at breast height.
 - b. To get an accurate measurement, stretch the measuring tape around the tree trunk to get the circumference and then divide by pi (3.14) to get the diameter at breast height.
 - c. If there are multiple trunks, measure each one and add them together to get the diameter.
3. Once you know the total number of inches to be treated, you can purchase the required amount of chemical.



Obtaining the treatment product

1. The product recommended for treating lightly to moderately infested hemlocks is Imidacloprid 75% WSP or WSB. Use the chart below to estimate how much chemical will be needed, based on the total number of diameter inches to be treated. The minimum quantity that can be purchased is a 4-pack of 1.6 oz packets.

Size of product package	Number of inches treated
One 1.6 oz packet	Approx. 48 inches
One 4-pack containing four 1.6 oz packets – minimum quantity sold	Approx. 192 inches
One case containing four 4-packs – sixteen 1.6 oz packets	Approx. 768 inches

Note: If all or most of your trees are smaller than 11 inches in diameter at breast height, you'll be able to treat more than the averages above. If all or most of your trees are larger, you'll be able to treat less than the averages above.

2. You can find a partial list of vendors on the [Contacts](#) page of the web site. (Note: We have no financial stake in any of them.) Call and compare pricing as it varies among vendors and is subject to frequent change. Imidacloprid is marketed under several different brand names, so specify that you want a **“generic product containing 75% Imidacloprid in 1.6 oz packaging for treating the hemlock woolly adelgid”** and indicate the number of diameter inches you need to treat. Then the store can tell you the appropriate product and amount to buy.

Choosing an application method

Soil injection (see below) and soil drench (see page 5) are the recommended application methods for property owner use. Foliar spray (see page 6) is also an option. **It is the user's responsibility to read and follow the instructions on the product label. Never use more product or less product than is called for or use a product in any manner that is inconsistent with the label.**

SOIL INJECTION -- Recommended

Soil injection is appropriate for almost all situations, is the most reliable method, offers the best residual protection period (average of 5 years, sometimes as long as 7 years), and is immediately safe for children and pets.

Borrowing an injector

1. Once you have obtained the treatment product, you can make arrangements to borrow a soil injector. In most counties, injectors are at either the Forestry Commission Office or the County Extension Office. In addition, some neighborhood associations may also have them to lend. Please refer to the list on the [Contacts](#) page of the web site.
2. When you pick up the injector, you will be requested to leave a refundable deposit which will be returned when you bring the injector back. You may also request some brief hands-on training.

Getting ready to work

Before heading into the woods, assemble your gear. Here's what is recommended.

Personal Protective Gear	Tools and Equipment	
Long-sleeved shirt	Soil injector	Hammer and rebar to make holes in the soil
Long pants	Adequate supply of chemical	Hoe or tined tool to make a trench for soil drench
Boots	Wide-mouthed gallon jug for <i>mixing chemicals only*</i>	1-pint measuring cup with ounces and/or grams marked
Rubber or neoprene gloves	Measuring tape and calculator	Scissors for opening packs
Dust mask	Notebook and pen	Vice grip, wrench, screw driver, pliers, needle-nose nippers, and small gimlet for on-site maintenance
Goggles	Spray paint or marking tags	Large light-colored towel in case injector must be disassembled in the woods
Hand sanitizer	Bucket for <i>clean water only</i>	Ziplock baggies to seal up leftover packets of powder
Small hand towel	Machete or loppers	
	Work apron or tool belt	

Checking and preparing injector

1. Visually inspect injector for any damaged or missing parts.
2. Check injector holes to be sure they're free of dirt.
3. Make sure the calibration ring is set to 5 cc to obtain the maximum output per stroke (about .15 ounce). Then test that it is accurately calibrated as follows:
 - a. Using plain water and a measuring cup that shows ounces, load a few ounces of water into barrel of injector.
 - b. Pump the plunger handle with the heel of your hand in rapid motion 6 times and see if you get exactly one ounce.
 - c. Repeat this several times for accuracy.



Mixing the treatment solution

The **recommended formulation of Imidacloprid is 75% WSP or WSB**. A 1.6-ounce packet of 75% Imidacloprid contains 36 grams of active ingredient.

The amount of water you use to mix the solution depends on the level of moisture in the soil – drought condition, dry/normal, or moderate to wet. Determining soil moisture is a judgment call, so if you're in doubt, assume dry/normal soil.

1. Choose open-air environment away from water sources or other sensitive areas and position yourself upwind.
2. Use gloves, goggles and a mask.
3. Use a wide-mouth, one-gallon container with a removable lid and a lip or pouring spout for mixing.
4. Put the water into the container first. Then add the treatment product. Product dissolves better in warm water than in cold. Depending on the soil moisture level, mix in the following proportions. (Default = Dry to Normal)



MIXING		
Amount of Product	Amount of Water for Moderate to Wet	Amount of Water for Dry to Normal Soil
75% WSP/WSB Imidacloprid: Put entire 1.6 oz packet into water; don't open packet.	Use 12 fl oz water. Each fluid ounce of this mixture contains 3 grams of active ingredient.	Use 24 fl oz water. Each fluid ounce of this mixture contains 1.5 grams of active ingredient.
75% wettable powder: .7 teaspoon / inch DBH	25 oz water / inch DBH	.5 oz water / inch DBH
21.4% liquid: .2 fl oz / inch DBH	.2 fl oz water / inch DBH	.4 fl oz water / inch DBH

5. Secure the lid and shake well until all the powder and any packet covering are dissolved.
6. Be ready to load and use the injector immediately.

Loading the treatment solution into injector

1. Insert the injector into the ground at an angle to facilitate the pouring process. Do this under a tree to be treated.
2. Unscrew the cap. Leave the filter in place but pull it out slightly to allow for easier filling. Pour slowly.
3. Remove clogs from the filter as necessary and then push it down firmly before screwing the cap back on.
4. Use towel to wipe off spillage from hands and injector.
5. Begin using injector immediately.



Applying the treatment

Please keep a record of the number of trees you treat and amount of chemical you use – you may be asked to report this information when you return the injector.

1. Before injecting the soil, cut away all dangerous or unwanted limbs and rake back any heavy ground cover or litter layer under the tree.
2. Insert injector into the soil 2-5 inches above the spray holes (not the injector tip) to deliver treatment solution into the feeder root mass within 12-18 inches of base of tree. However, if necessary, soil injections can be effective when placed within the drip line of the tree; this can be useful for protecting trees that are located next to a stream.
 - a. NEVER put your foot on the metal baffle to push the injector tip into the ground because it will break. It is a gauge used to control the injection depth.
 - b. NEVER force the injector into the ground. Avoid rocks and large roots when inserting the injector. Find a place where the tip will go in easily or, if the soil is too difficult, either moisten the soil to soften it or use a hammer and rebar to make a hole.
 - c. If roots are close to surface, insert injector more shallowly so treatment solution is delivered at or above root level.
3. Make one injection hole for each inch of trunk diameter. Space injections evenly in four quadrants (or like a clock face) around the tree. Use a minimum of 4 evenly spaced injection holes to dispense the required amount of solution.
4. Depending on the soil moisture level and trunk diameter, use one of the charts below to determine how many times to pump the handle to dispense the correct amount of solution into each injection hole. Be sure to **choose the Dosing Chart with the same moisture level** as you used for the Mixing Chart. The Dosing Charts also show the amount of active ingredient dispensed for each diameter range and the average cost per inch for the do-it-yourself option.



DOSING FOR MODERATE TO WET SOIL

1.6 oz packet of 75% WSP/WSB = 36 grams active ingredient. In 12 oz of water each fluid ounce contains 3 grams AI.

Inches DBH	Pumps of the Injector Handle per Injection Hole	Amount of Solution Dispensed per Inch DBH	Grams of Active Ingredient per Inch DBH	Cost per Inch DBH for Do-It-Yourself Option
1-11	1	.165 oz	.5 g	17 cents
12-18	1.5*	.25 oz	.75 g	26 cents
19-22	2	.33 oz	1 g	35 cents
>22 Trees of this size should be treated two consecutive yrs	3	.5 oz	1.5 g x 2 years	52 cents x 2 years

*To get the equivalent of 1.5 pumps per hole, do 1 pump in half the holes and 2 pumps in the other half and try to distribute these two levels evenly around the tree.

DOSING FOR DRY TO NORMAL SOIL

1.6 oz packet of 75% WSP/WSB = 36 grams active ingredient. In 24 oz of water each fluid ounce contains 1.5 grams AI.

Inches DBH	Pumps of the Injector Handle per Injection Hole	Amount of Solution Dispensed per Inch DBH	Grams of Active Ingredient per Inch DBH	Cost per Inch DBH for Do-It-Yourself Option
1-11	2	.33 oz	.5 g	17 cents
12-18	3	.5 oz	.75 g	26 cents
19-22	4	.67 oz	1 g	35 cents
>22 Trees of this size should be treated two consecutive yrs	6	1 oz	1.5 g x 2 years	52 cents x 2 years

Imidacloprid mix and application rates provided by Mark Dalusky, UGA researcher. Do not apply more than 182 grams of active ingredient per acre.

5. Mark each tree with a small dot of spray paint or a tag as treatment is completed. Devise your own method for keeping track of the large trees that need two consecutive years of treatment.
6. Rake heavy ground cover or litter layer that was removed back into place around the tree.
7. If there is solution in the tank, do not pause using the injector for more than 10 minutes because the powder begins to fall out of suspension and can clog the spray holes. If you need to pause for 10 minutes or more, pour unused solution into a sealed water-tight container away from sunlight. Then triple-rinse the injector with clean water under a hemlock tree until the discharge runs clear to prevent clogs from sedimentation in lower parts of the injector.
8. Periodically, after all the solution in the tank is used up, correlate the number of oz dispensed with the number of dbh inches measured to check accuracy of calibration and adjust as necessary. Also, check to see that all bolts and screws are tight and calibration ring is still set on 5 cc.
9. If injector has to be disassembled in woods, do so over a light-colored towel to avoid losing springs and bearings.

Cleaning the equipment and disposal of packaging / unused chemical

1. During continuous use, if you notice a difference in the injector pump action or the amount of solution being dispensed, check the spray holes and clean them with a gimlet or other sharp-pointed tool if necessary.
2. When finished using injector, pour any unused solution around treated hemlocks or into a sealed water-tight container with a screw top and store in a place that is away from sunlight and not subject to freezing temperatures. **DO NOT** pour unused solution into a stream or down a drain.
3. Triple-rinse the injector with clean water under a hemlock tree until discharge runs clear. **DO NOT** flush the injector or pour the rinse water into a stream or down a drain.
4. Remove any debris from tip area, and rinse outside of injector to remove chemical residue and dirt.
5. Use towel to be sure entire injector is clean and dry.
6. Mixing containers should be triple rinsed and dried.
7. Used packaging should be placed in garbage bag for disposal.
8. Place any unopened packets of powder back into the original pack envelope, seal it in a zip-lock bag, and store in a cool, dry place away from sunlight.
9. Unopened packets of powder can be shared with neighbors, saved for future use, or donated to Save Georgia's Hemlocks for a tax deduction receipt. Keep the product label instructions with the product.

Returning the injector

1. As there is sometimes a waiting list to borrow injectors, please return the injector by the agreed upon date. Be sure the injector and any accompanying equipment (such as mixing jugs) are returned clean and dry.
2. Your deposit (if any) will be returned at that time.
3. Be prepared to report the number of trees you treated and the amount of chemical you used, if you are asked.
4. And if any defect was observed or damage occurred to the injector while you were using it, please report it to the office from which you borrowed it.

SOIL DRENCH

Soil drench is appropriate where the ground is level but not soggy due to standing water or where the ground is sloping but not too thin or rocky; location should not be subject to immediate flooding. Some property owners consider this method of delivering Imidacloprid to be a bit faster and easier than soil injection, and recent research suggests the uptake is a bit faster.

Getting ready to work – Same as for soil injection regarding protective gear; recommended tools/equipment include measuring tape, notebook and pen, spray paint or marking tags, measuring cup and mixing jug, hammer and rebar or tined tool for making holes or trench in soil, and bucket or other container for pouring solution into soil.

Mixing the treatment solution – Same as for soil injection and then add more water. For trees up to 12" in diameter, use a minimum of one gallon of water. Add one pint of water for every inch over 12.

Applying the treatment

1. Rake back any heavy ground cover or litter layer from around the base of the tree.
2. Prepare the soil surface to receive the treatment solution. One way is to use a hoe or small shovel to dig a shallow trench around the tree 3-5 inches deep and 3-4 inches wide within 12-18 inches of the trunk. Another way is to use iron rebar and a hammer to make holes in the ground 3-5 inches deep – one hole for each inch of trunk diameter – evenly spaced around the tree within 12-18 inches of the trunk.
3. Use the mixing jug to pour the solution slowly and evenly onto the soil around the base of the tree. On a slope, pour more slowly to prevent run-off and allow the treatment product to soak into the soil.
4. Rake dirt back into the trench (if you made one). Replace ground cover or litter layer around the base of the tree.
5. Give the treatment product time to dry before children or pets are allowed in the area.

Cleaning the equipment and disposal of packaging / unused chemical – Cleaning of mixing containers and buckets is same as for soil injection. Disposal is same as for soil injection.

Helpful Hints for Soil Application

1. For soil that is very dry and hard, watering the ground around the tree before and after soil application will help the treatment solution soak in and be absorbed by the tree. If you water before, allow time for the water to soak in before you treat. After treatment, wait at least 6 hours before watering to give the product some “residency” time to bind in the root mat and avoid washing the material out of the feeder root zone.
2. If the soil is very wet, wait a few days until it dries out a bit.
3. NEVER use the mixing jug to dip water from a water source such as a lake, stream, or well; use a CLEAN bucket only.

Foliar Spray

Foliar spray is appropriate for very small hemlocks or hedges where you can reach the entire plant; it is also appropriate as a supplemental treatment on the lower branches of badly infested hemlocks being treated by soil application. This method gives locally systemic protection (i.e., it works on the areas that the spray reaches) and give the lower branches some relief sooner than later.

Getting ready to work – Same as for soil injection regarding protective gear; recommended tools/equipment include measuring tape, notebook and pen, spray paint or marking tags, measuring spoons and mixing jug, and sprayer for applying solution.

Mixing the treatment solution – The labels on various Imidacloprid products indicate using 100 – 300 gallons of water for mixing a foliar application. Since most people don't have sprayer tanks that large, the charts below may be useful in determining the amounts of water and treatment product to use for smaller tanks. **Be sure to choose the correct chart for the particular product concentration/formulation you have.** Also be sure the sprayer has never been used to apply herbicides as some residue may remain and harm the trees.

Imidacloprid 75% Water Soluble Powder		
The label indicates using one 1.6-ounce packet of product with 300 gallons of water.		
For smaller tanks, mix as follows:		
Water	Imidacloprid by ounces	Imidacloprid by level measure
200 gal.	1 ounce (2/3 packet)	4 tablespoons
100 gal.	.5 ounce (1/3 packet)	2 tablespoons
50 gal.	.27 ounce	1 tablespoon
25 gal.	.13 ounce	1 ½ teaspoons
10 gal.	.065 ounce	½ teaspoon
5 gal.	.037 ounce	¼ teaspoon

For a sprayer that holds less than 8 gallons of water, use ½ teaspoon of product with whatever amount of water the sprayer tank holds.

Imidacloprid 75% Wettable Powder

The label indicates using three tablespoons plus one teaspoon of product with 100 gallons of water.

For smaller tanks, mix as follows:

Water	Imidacloprid by ounces	Imidacloprid by level measure
50 gal.	.835 ounce	5 teaspoons
25 gal.	.417 ounce	2 ½ teaspoons
10 gal.	.167 ounce	1 teaspoon
5 gal	.083 ounce	½ teaspoon
2.5 gal.	.04 ounce	¼ teaspoon

For a sprayer that holds less than 2.5 gallons of water, use ¼ teaspoon of product with whatever amount of water the sprayer tank holds.

Imidacloprid 21.4% Liquid

The label indicates using one 1.5 fluid ounces (3 tablespoons) of product with 100 gallons of water.

For smaller tanks, mix as follows:

Water	Imidacloprid by ounces	Imidacloprid by liquid volume
50 gal.	.75 fl. ounce	1 tablespoon + 1 ½ teaspoon
25 gal	.375 fl. ounce	2 ¼ teaspoons
10 gal	.15 fl. ounce	1 teaspoon
5 gal	.075 fl.ounce	½ teaspoon
2.5 gal	.037 fl. Ounce	¼ teaspoon

For a sprayer that holds less than 2.5 gallons of water, use ¼ teaspoon of product with whatever amount of water the sprayer tank holds.

Applying to foliage – The best seasons for foliar spray are spring through fall. Use in early morning or evening to avoid sun-scorch of the needles or harm to beneficial insects during the day. Also choose a calm day to avoid wind drift.

Spray thoroughly on all parts of tree – stems and undersides of branches as well as top sides. Wear goggles and a mask while spraying. Give the treatment product time to dry before children or pets are allowed in the area.

Cleaning the equipment and disposal of packaging / unused chemical – Cleaning of mixing containers and disposal are same as for soil injection. Be sure to rinse the sprayer equipment thoroughly after use in the same manner as for soil injection.

What to expect from Imidacloprid treatment

- Imidacloprid can take from 6 weeks to 12 months or longer to become effective, and it might take several years to achieve complete control and show new growth, particularly in large diameter trees.
- Improvement on infested hemlocks means a lessening of the infestation, very little reinfestation in the following egg-laying season, and finally new growth with no reinfestation. Small trees treated with Imidacloprid by soil application take up the solution and disperse it throughout the entire tree in a matter of months, and normally show improvement between 6 and 12 months. This process takes longer for larger trees, sometimes as long as 12 - 18 months.
- Since the lower limbs are the last part to receive the benefit of treatment, they are usually the last ones to show improvement. Limbs that are severely impacted at time of treatment may die even with successful treatment. To give badly infested lower limbs some extra help, you can apply foliar spray to them at the same time you do soil application.
- Residual efficacy in the South can be as long as 3-5 years; in the North reported residual is as long as 7-8 years. Hemlocks should be examined for presence of HWA prior to retreatment as reinfestation might take several years.
- Mite and scale infestations can occur, particularly with over-dosing of hemlocks. These usually self-resolve but not always.

NOTE: The information provided here is based on product labels and advice from experts, including various public land managers, product representatives, and the University of Georgia. It is the user's responsibility to read and follow the label instructions when using pesticides.

For more information, please call the Hemlock Help LineSM 706-429-8010 or visit www.savegeorgiashemlocks.org.