

Introduction to Treating Hemlocks

Determining the level of infestation

1. Look on the underside of the branches. If you see small white, woolly balls about the size of a peppercorn, the hemlock has an infestation of Hemlock Woolly Adelgid (HWA).
2. If HWA is present in your county or an adjacent county, you should prepare to treat them as soon as possible, whether you can see adelgids on your own trees or not.
3. If you do see adelgids on any of your hemlocks, compare what you observe with the 3 photos below to estimate the level of infestation.
4. Lightly to moderately infested trees can be treated with a relatively inexpensive, long lasting product containing the active ingredient Imidacloprid.
5. Heavily infested trees or very large infested trees (>20" dbh) are best treated with a faster-acting chemical containing the active ingredient Dinotefuran.



Light



Moderate



Heavy

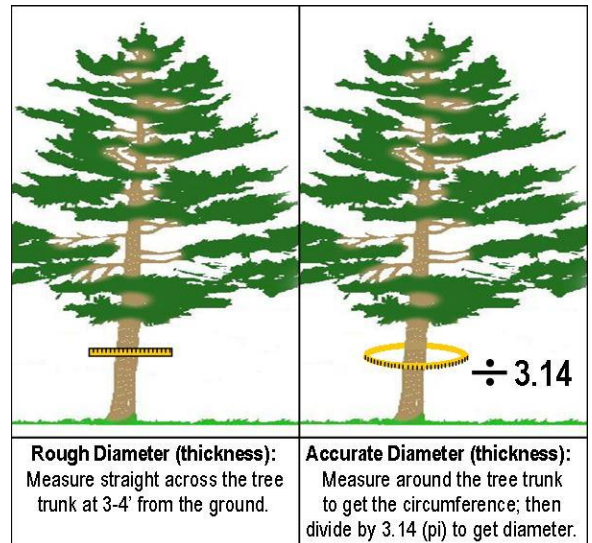
Choosing the trees to be treated

You should decide which hemlocks you want to save. If you can't save them all, choose as many large ones as you can since they're the cone-makers, 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 tree is cut, the sap will dry up and the feeding insects that are attached will die.

Measuring the trees

1. Determine the trunk diameter at breast height (dbh) for each tree to be treated. Breast height = 4 1/2' 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 π (3.14) to get the diameter at breast height. Or you can use a diameter tape that converts circumference to diameter for you.
 - c. If the tree is growing on a **slope**, stand on the upside to take the measurement.
 - d. If there are multiple trunks that split **at or below** breast height, measure each one and add them up to get a total. If the trunk splits above breast height, ignore the multiple stems and just measure at breast height.
2. Once you know the total diameter inches for all the trees to be treated, you can determine the amount of chemical to purchase.



Choosing the treatment product

The chemical recommended for treating **lightly to moderately infested** hemlocks is **Imidacloprid**. The most commonly used formulations are 75% water soluble powder (WSP), 22.6% or 21.4% liquid (2F or 2L), and tablets (sold as Coretect). Imidacloprid products have been found to travel in the soil only 6 - 12 inches from each injection point and can be used safely within a few feet of waterways or other sensitive areas when applied to normal soil with good organic content, clay or loam. Imidacloprid is mobilized by the tree somewhat slowly, usually gaining control of an infestation in 6 – 12 months, but provides protection for an average of 5 – 6 years.

The chemical recommended for treating **heavily infested or very large (>20") infested** hemlocks is **Dinotefuran**. The most commonly used formulation is 20% soluble granules, sold as Safari 20 SG. (In some parts of the country Dinotefuran is also sold under the name Transtect 70 WSP but not the southeast). Dinotefuran is more soluble than Imidacloprid and therefore can travel somewhat farther in the soil. While the product label contains no required setback from waterways or other sensitive areas, SGH recommends choosing the appropriate application method based on proximity to such areas (see below). Dinotefuran is fast acting, usually gaining control over an infestation within 3 – 8 weeks, but provides protection for only 1 – 2 years. At that point it is usually possible to change over to using Imidacloprid every 5 years.

In the South, hemlocks can be treated with Imidacloprid year-round *except* when the ground is saturated or frozen or during a prolonged drought. Having adequate soil moisture is key for good results. The manufacturer of Safari recommends that it be used from spring through fall rather than in the deepest part of winter.

Acquiring the treatment product

The following chart can help you estimate how much product you'll need. Be sure that any product you choose is labeled for treating adelgids on trees using one of the application methods specified in this document. Note that the "average" inches treated is just that – an average – because smaller trees need less of the chemical than larger trees. For a more accurate estimate of the amount and cost of product needed, use the Chemical Calculator on the Facilitators page of the web site.

Product		Diameter Inches Treated	
Imidacloprid	One bottle of 250 Coretect tablets	83" – 250"	avg 166"
	One 4-pack of Imidacloprid 75 WSP containing four 1.6 oz packets	90" – 272"	avg 181"
	One case of Imidacloprid 75 WSP containing sixteen 1.6 oz packets	362" – 1088"	avg 725"
	One 4-pack of Imidacloprid 75 WSP containing four 2.25 oz packets	128" – 382"	avg 255"
	One case of Imidacloprid 75 WSP containing sixteen 2.25 oz packets	512" – 1528"	avg 1020"
	One gallon of Imidacloprid 2F or 2L containing 2 lbs active ingredient	604" – 1813"	avg 1208"
Dinotefuran	12-ounce container of Safari 20 SG	28" – 113"	avg 70"
	3-pound container of Safari 20 SG	113" – 453"	avg 283"
	Cannister of Transtect 70 WSP containing 20 0.6 oz packets	99" – 396"	avg. 247"

You can find a partial list of vendors on the [Contacts](#) page of the web site. (Note: SGH has no financial stake in any of them.) Call first to verify availability and compare pricing as it varies among vendors and is subject to frequent change.

Estimating the cost

If you'll be using Imidacloprid, be aware that Bayer's Merit 75 is the original brand name product and costs about \$92 per four-pack, but there are several generics that are chemically equivalent, equally effective, and much less expensive; so we recommend you specify that you want a *generic* product for treating the hemlock woolly adelgid. The most commonly available generic Imidacloprid products are listed in a document called "Chemicals, Contacts & Sources" on the [Resources](#) page of the web site. There are currently no generics for Dinotefuran products.

The actual treatment cost is based primarily on the treatment material used, whether it's a brand name or a generic, size of the trees, and whether the property owner does the treatment or hires a professional.

- DIY using Imidacloprid 2F/2L – \$0.05 to \$0.16 per diameter inch, based on retail cost of a gallon \$97
- DIY using Imidacloprid 75WSP – \$0.12 to \$0.36 per diameter inch, based on retail cost of a 4-pack \$33
- DIY using Safari 20 SG – \$0.82 to \$2.72 per diameter inch, based on retail cost of a 3-lb jug \$370 or 12-oz bottle \$120

- Professional treatment using Imidacloprid 75 WSP or 2F/2L – \$0.60 to \$4.00 per diameter inch
- Professional treatment using Safari 20 SG – \$1.50 to \$9.00 per diameter inch

Allowing your hemlocks to die could cost \$300 - \$1500 to take down and haul away the large ones and may reduce your property value by 7 – 10%.

Choosing the application method

There are four commonly used methods for applying the treatment, and the choice of method depends on several factors.

Soil injection – This is the most recommended application method. It is appropriate for most situations as it places the treatment material directly into the root zone and avoids both drift and surface exposure. Soil injection can be used with either Imidacloprid or Dinotefuran. It can be used year-round in the South except when the soil is saturated or frozen or during a prolonged drought.

Soil drench – This is the second most recommended application method and is a good alternative to soil injection if an injector is not available. It is best used on level to sloping ground; if used on steep terrain, apply a bit more of the total dose to the soil above the tree than below it. Soil drench can be used with either Imidacloprid or Dinotefuran. Like soil injection, it can be used year-round in the South except when the soil is saturated or frozen or during a prolonged drought.

Basal trunk spray – This method is a good choice for treating trees in sites where soil application is not possible or would not be desired (such as for trees located immediately next to a waterway, growing out of boulders, or having a compromised or inaccessible root zone); however, it can be used only with Dinotefuran. The material is absorbed through the bark and is thought to enter the vascular system of the tree slightly more quickly than when applied to the soil. It is important to avoid drift when doing basal trunk spray.

Foliar spray – In general, SGH does *not* recommend applying hemlock treatment by foliar spray because:

- the concentration is very dilute and the level of protection is low,
- the residual protection period is very short and treatment must be repeated frequently,
- the cost on a per-inch-per-year basis is high, and
- much of the spray may miss its target and drift onto non-target plants or beneficial insects.

However, there are two cases in which foliar spray may be advisable:

- It can be used on very small hemlocks such as a “nursery” of saplings or on short hedges where it is possible to reach the entire plant.
- It can also be used as a supplemental treatment on the lower branches of moderately to heavily infested hemlocks being treated by soil application to give them some relief sooner than later. This method gives locally systemic protection (i.e., it works on the areas that the spray reaches).

Foliar spray can be used with either Imidacloprid or Dinotefuran but must be done carefully to avoid drift. The best seasons for foliar spray are spring through fall.

Obtaining application equipment

For **soil injection**, several types of injectors can be used. Kioritz soil injectors are no longer available for purchase; however, in many counties they can be borrowed from either the Forestry Commission Office or the County Extension Office. Some Forestry Commission Offices also have the Nu-Arbor backpack style injector to lend. And a few neighborhood associations have injectors that may be available to borrow.

When you borrow an injector, you will be requested to leave a refundable deposit which will be returned when you bring the injector back. The

[Contacts](#) page of our web site list locations where Kioritz and/or Nu-Arbor

soil injectors can be borrowed as well as links to sources from which Nu-Arbor soil injectors can be purchased.

There is a newer hand-held device called the EZ-Ject Lite that can be purchased but to our knowledge is not yet available for borrowing, call the Hemlock Help Line for information on this device.



For **soil drench**, you'll need a mixing container, a separate pouring container, and a thin piece of rebar to make the holes in the soil around the base of the tree. For **foliar or trunk spray**, any type of hand-pump sprayer or back-pack sprayer can be used. These are generally not available for public borrowing but can be purchased at most hardware stores, big box stores such as Lowe's or Home Depot or Walmart, and equipment suppliers such as John Deere or Tractor Supply. These vendor names are provided for information only and do not constitute an endorsement.

Basic safety recommendations

- 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 on the label or use a product in any manner that is inconsistent with the label.
- Before beginning a treatment project and periodically during a project, inspect your equipment to be sure it’s working properly and in safe condition.
- Don’t use equipment or containers that have ever been used with herbicides.
- Use separately marked containers for clean water and for mixing chemicals.
- If spraying, avoid drift.
- After applying treatment by any method **other than** soil injection, allow time for material to dry before allowing children or pets into the area. With soil injection, re-entry into the area can be immediate.
- Clean equipment and containers immediately after each use, but DON’T do it in a stream or waterway or allow rinsate to flow into surface water or go down a drain. If possible, pour rinsate under a hemlock tree.

Getting ready to work

Before heading into the woods, assemble everything you’ll need. Here’s what is recommended.

Personal Protective Gear	Equipment & Supplies	Other Items
Long-sleeved shirt Long pants Sturdy shoes/boots and socks Hat or safety helmet Rubber, nitrile, or neoprene gloves Dust mask or respirator if spraying Goggles if spraying Hand sanitizer Small hand towel	Application device – soil injector, sprayer, or pouring container and piece of rebar Chemical in original packaging Wide-mouth screw-top container for mixing chemicals only Separate container for clean water only Special measuring cup if using Safari Regular measuring cup to check calibration and measure non-Safari ingredients	Printed mixing and dosing instructions Work apron with pockets or tool belt Diameter tape and calculator Small notebook and pen Funnel and paper paint filters for loading chemical Baggie for used funnel, filters, gloves Spray paint or tags, nails and hammer to mark treated trees

Mixing the treatment material

Treating hemlocks is not difficult or complicated but must be done precisely and according to the specific needs of hemlock trees. Here are the general guidelines:

1. Choose open-air environment away from water sources or other sensitive areas and position yourself upwind. Wear gloves. If mixing a powdered or granular product, goggles and a mask are also recommended.
2. For mixing chemical, use a 1-gallon container with a wide mouth, screw top, and pouring spout.
3. If you’re using Imidacloprid, the mixing ratio of product and water depends on the level of moisture in the soil – dry to normal or moderate to wet. Determining soil moisture is a judgment call, but default to the dry/normal column of instructions if (a) you’re using powdered product in a Kioritz soil injector, or (b) you’re unsure of the moisture level.
4. Whenever you’re mixing any treatment product with water, always put the correct amount of water into the container first, and then add the treatment product. Product dissolves better in **warm water** than in cold.
5. Secure the lid and shake well until all the material is dissolved and no particles can be seen. Be ready to load and use the applicator immediately.

For specific mixing instructions, be aware that the usage instructions printed on the product labels tend to be “one-size-fits-all” and can be somewhat confusing. Therefore, SGH recommends using the **hemlock-specific instructions** on the [Resources](#) page of our web site. They are completely consistent with the product labels but are more precise, easier to follow, and reflect the scientific guidelines that smaller trees need less active ingredient per diameter inch and larger trees need more per inch.

To select the right instruction, scroll to the product you plan to use and then the instruction for your chosen application method.

What follows is a set of instructions that describe how to actually do the treatment. There’s a section for each of the four application methods. Please proceed to the one you plan to use.

- How to do soil injection page 5
- How to do soil drench page 6
- How to do basal trunk spray page 6
- How to do foliar spray page 7

How to do soil injection with Kioritz soil injector

A. Checking and preparing the injector

1. Visually inspect injector for any damaged or missing parts.
2. For a Kioritz soil injector, be sure the calibration ring is set on 5, the plastic collar above the tank is tight, and the metal depth gauge plate is in the lowest position.
3. Load a cup of plain water into the injector and pump the handle several times to be sure water squirts out 4 – 6 feet in all four directions. If emitter holes are clogged, clean them carefully with a gimlet, ice pick, or metal paperclip.
4. To test the calibration, place the injector tip into a sturdy Pyrex measuring cup and pump the handle smartly. For a Kioritz injector, 12 pumps should yield exactly two ounces. If the injector puts out less than the correct amount, it will be necessary to adjust the mixing ratio of chemical to water (see “Testing & Adjusting Kioritz Soil Injector Calibration” on the [Resources](#) page of the web site).



B. Loading the treatment into injector

1. Insert the injector into the ground at a 45-degree angle so the tank opening faces straight up. 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. If the filter is missing, use a funnel and medium-grid paint filter. 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.



C. Applying the treatment

1. Before injecting the soil, cut away all dangerous or unwanted limbs. Rake back any heavy ground cover, leaf litter or needle duff under the tree to expose the bare soil.
2. Use the injector tip to make one injection hole in the soil for each inch of trunk diameter. Space holes evenly in all four quadrants (or like a clock face) around the tree. For trees smaller than 4 inches in diameter, use a minimum of 4 evenly spaced injection holes to dispense the required amount of solution.
3. Insert injector into the soil up to the metal baffle (or 2-4 inches deep) to deliver treatment solution into the feeder root mass within 12 inches of base of tree. However, if a tree is located within 1 or 2 feet of a stream, soil injections can be effective when placed in a double ring close to the trunk on the side away from the stream.
 - a. NEVER use the metal baffle for foot pressure because it will break. It is only a gauge 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 narrow spike to make a hole.
 - c. If roots are close to surface or the tree is very small, insert injector more shallowly so the treatment is delivered **at or above** the root zone.
4. Follow the Dosing chart in the treatment instructions to determine the number of times to pump the injector handle into each hole. If applying Imidacloprid, be sure to use the same moisture level column for dosing as you used for mixing.
5. Mark each treated tree with a small dot of spray paint or a tag as treatment is completed. If using tags and nails, be sure to use only aluminum nails. Attach tags with nail head angled slightly down with about an inch of nail exposed to allow tag to drop as tree grows. Devise your own method for keeping track of the large trees (>22 inches dbh) that need two consecutive years of treatment.
6. Rake the ground cover or litter layer that was removed back into place around the tree.



Special note: If there is solution in the tank, keep the injector moving continuously and do not pause using it for more than 10 minutes because the carrier material will fall out of suspension and can clog the internal parts of the injector. If you need to pause for 10 minutes or more, pour unused solution into a well sealed container and keep it out of the sunlight. Then follow the cleaning instructions below.

D. Cleaning the injector and other equipment

1. During continuous use, if you notice a difference in the injector pump action or the amount of fluid being dispensed, check the emitter holes and clean them with a gimlet or other sharp-pointed metal tool if necessary.

2. When finished using injector, pour any unused solution around hemlocks as the mixed material doesn't keep well.
3. **Triple-rinse** the injector with clean water, pumping it through the unit until the discharge runs clear; do this under a hemlock tree, not into a stream or down a drain.
4. Remove any debris from tip area, and use a towel to be sure entire injector is clean and dry.
5. Mixing containers should be triple rinsed and dried when finished.

E. 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 is returned clean and dry. Your deposit (if any) will be returned at that time.
2. If you observed any defect or damage occurred to the injector while you were using it, please report it to the office from which you borrowed it.

How to do soil drench (**NOT trench!**)

Soil drench is similar to soil injection in most respects. The differences are explained below.

1. Make a master batch of treatment solution according to the Mixing chart in the treatment instructions.
2. Then treatment is done on an individual tree basis. Figure the amount of treatment solution each tree needs by multiplying its trunk diameter times the fractional number of ounces indicated in the Dosing chart in the treatment instructions. Be sure to use the same moisture level column for dosing as you used for mixing. Measure exactly that amount into a pouring container that will hold at least a gallon, and add more water as indicated in the treatment instructions.
3. After exposing bare soil, use a piece of rebar to make one hole in the soil for each inch of trunk diameter, spacing holes evenly in four quadrants (or like a clock face) around the tree. Holes should be within 12 inches of the base and no deeper than 2-4 inches. For trees that are smaller than 4 inches in diameter, use a minimum of 4 evenly spaced holes to dispense the required amount of treatment solution. If you hit a rock or root, move over a bit and try again.
4. Pour the treatment solution into the holes and all around the base of the tree **slowly** to avoid runoff. Be sure to use the entire measured dose of treatment on the intended tree.
5. Mark each tree after treatment and rake the ground cover or litter layer back into place.
6. Mixing containers should be triple rinsed and dried when finished.
7. Keep pets and children away until material is dry (usually 2 or 3 hours).



Helpful hints for soil application (injection or drench)

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 to the organic matter in the root mat and avoid washing the material out of the root zone.
2. If the soil is very wet, wait a few days before treating to allow it to dry out a bit.

How to do basal trunk spray (with Dinotefuran products only)

1. Make a master batch of treatment solution according to the Mixing chart in the treatment instructions. Be sure to use the special measuring device that comes with your purchase of Safari to measure the amount of product, and use a regular measuring cup to measure the amount of water.
2. Then treatment is done on an individual tree basis. Figure the amount of treatment solution each tree needs by multiplying its trunk diameter times the fractional number of ounces indicated in the Dosing chart in the treatment instructions. Use a regular measuring cup to measure out exactly the required amount of solution for the tree and pour it into the sprayer.
3. Set the sprayer for low pressure (10-15 psi) and adjust the nozzle so it makes a spray a couple inches wide, not a mist and not a stream. With the nozzle positioned 2 inches from the trunk, spray very slowly from 5 ½ feet above the ground to 6 inches above the ground, taking care to avoid back-splash and allowing the treatment material to be absorbed into the bark. If you're doing trunk spray where soil application is undesirable, try not to let the material drip down onto the ground.
4. Spray until the sprayer is empty so you use the entire measured dose of treatment on the intended tree.



5. Mark each tree after treatment.
6. The sprayer and mixing containers should be triple-rinsed and dried when finished.
7. Keep pets and children away until material is dry (usually 2 or 3 hours).

Helpful hints for basal trunk spray

1. Even though the package directions may advise using a surfactant to help the treatment adhere to the bark, it is not necessary to do so; the material adheres just fine without one.
2. It may help initiate the wicking action to slightly dampen the bark with a light fine mist of water before spraying, but do not spray when the bark is actually wet or rain is expected within the next 12 hours.
3. If you find that the solution is too foamy coming out of the sprayer, you can add extra water into the sprayer. The important thing is to use the correct amount of product per inch; the water is just a carrier.

How to do foliar spray

1. Choose a dead-calm day without wind to avoid drift onto flowering plants, beneficial insects, and yourself. Apply in the early morning or late evening to avoid sun-scorch of the needles or harm to beneficial insects that are present during the day.
2. Spray thoroughly on all parts of tree – stems and undersides of branches as well as top sides – to cover the entire plant with the treatment.
3. The sprayer and mixing containers should be triple-rinsed and dried when finished.
4. Keep pets and children away until material is dry (usually 2 or 3 hours).

Disposal and storage

1. Used paper packaging should be placed in a garbage bag for disposal. Empty product jugs that contained liquid product must be triple rinsed and punctured on the bottom and all four sides to prevent re-use and then placed in a garbage bag.
2. 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 that is away from sunlight and not subject to freezing temperatures. Unused/unmixed quantities of liquid or granular product can be stored in a cool, dry place that is away from sunlight and not subject to freezing temperatures.
3. Alternatively, unused product 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.

What to expect from treatment

- Improvement on infested hemlocks means a lessening of the infestation, no (or very few) new bright white egg sacs the following spring, improved foliage color and density, and new growth on the branch tips.

Timeframe for Control			
Imidacloprid:	trees 1-12”	trees 13-18”	trees 19” +
	6 months	12 months	18 months
Dinotefuran:	usually within 3 – 8 weeks		
Timeframe to SEE Results			
Imidacloprid:	usually by the following spring but for larger trees could be the second spring		
Dinotefuran:	usually within 3 – 6 months		

- Since the lower limbs are the last part to receive the benefit of treatment, they are usually the last to show improvement and the first ones to become reinfested when chemical potency declines. Limbs that are severely impacted at time of treatment may die even with successful treatment.
- Mite and scale infestations that are already present can become more severe with Imidacloprid treatment, 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.