GEORGIA FORESTRY COMMISSION

Hemlock Woolly Adelgid: Control Options

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The hemlock woolly adelgid is a very destructive pest of eastern and Carolina hemlock trees. Once the adelgid is found in your area, it is time to think about control options. Treatments should begin once adelgids have infested your trees. Trees can be treated systemically (using insecticides that are transported in the sap) or with foliar sprays. The following describes available options for controlling the hemlock woolly adelgid.

Note: Be sure to read and follow all label instructions with any pesticide treatment. The use of trade names in this publication is solely for the purpose of providing specific information and does not constitute an endorsement, nor is criticism of unnamed products implied.

Soil Treatments: In this systemic treatment, an approved insecticide is applied within the surface organic soil layer around the base of the tree and is taken up by the root system. Products containing the active ingredient imidacloprid, and the product Safari 20 SG® which contains the active ingredient dinotefuran, can be used as a soil treatment (see Addendum for their comparison). The soil application is made by placing tablets into the soil or by mixing the chemical with water and pouring or injecting it into the soil around the base of the tree. Avoid applications to excessively dry, frozen or waterlogged soil. The following describes three soil application techniques.

A. Soil drenching: This technique applies the chemical solution to the soil surface or in a shallow trench near the base of the tree (Fig. 1). Follow the label regarding how much water to use. One approach is to make a shallow trench around the tree with your boot heel, pour the insecticide mixture into the trench, and then replace leaf litter, soil, and mulch after application. The trench method places active ingredient below the surface, close to the fine roots. A hose end sprayer is a convenient device to drench insecticides where trees are close together or where access to the trunk is difficult, such as hedges.

Figure 1: Insecticide applied as a soil drench.

B. Soil injection: This technique involves injecting a concentrated insecticide suspension at 2 to 5 inches depth around the base of the tree using a low volume soil injector (Fig. 2). A tool of this type can be purchased for around $300. Deep root feeding probes commonly used by arborists are inappropriate for this application because deep injection places insecticides below the root zone. Inject the product six to twelve inches from the tree's base. This treatment can be used for trees near stream banks; provided you have good soil conditions and you treat the side of the tree away from the stream. Do not apply if surface water is present around the tree. (See Addendum for details regarding soil injection)

Figure 2: Insecticide can be injected into the soil around hemlock trees.

C. Tablet placement: Imidacloprid is available as a tablet (CoreTect®). Tablets (2-3 per inch DBH; use the lower dosage for smaller trees) should be placed within the surface layer of organic soil beneath hemlock trees. Tablets may be pushed individually into the soil, spaced similar to soil injection, or can be placed in a shallow trench like the soil drench. For either method, the tablets should then be covered by soil and leaf litter.

Figure 3: Foliar applications can be effective for controlling adelgids. *Photograph by the Great Smokey Mountains National Park Resource Management Archives.*

Foliar Treatments: This refers to treatments that kill adelgids by spraying a product on the adelgid, foliage and stem of the tree. Imidacloprid products, bifenthrin products, Safari 20 SG®, insecticidal soaps and horticultural oils can be used. Although bifenthrin products and other pyrethroids can be very effective, their use will also kill beneficial predatory insects and mites. Horticultural oil is often chosen because it is complementary to the systemic treatments: oil will suppress mite pests not affected by systemics, but may leave a remnant population of adelgids. Foliar sprays work best on small trees or hemlock hedges. Insecticidal soaps and dormant oils can be used with very little risk to the applicator, children, pets, and adelgid predators. The key to success with soaps and oils is to coat the adelgid. Foliar applications are best made in late spring or from July through October when the insect is not covered by protective wool. A backpack sprayer (Fig. 3) or a garden hose end sprayer (Fig. 4) can effectively apply the product to trees less than 15 feet tall. Be sure to direct spray upward to thoroughly wet the underside of the branches.

Figure 4: Garden hose end sprayers have a dial that allows you to control the concentration of the solution. No mixing is required. *Unknown photograph*.

Trunk spray: In this systemic treatment, Safari 20 SG® is mixed with water and sprayed on the trunk. The product is applied at a rate of 3 to 12 grams per inch DBH, with larger diameter tree receiving the higher rates (See Table 1). Mix the product in enough water to apply 1.5 fluid ounces of spray solution per inch DBH. Evenly spray the tree trunk from 0 to 4.5 feet above the soil line. The addition of a surfactant to improve penetration is not necessary. This treatment is useful for minimizing contamination of soil with insecticides (a consideration for rocky sites) and for quickly treating large numbers of trees where competing undergrowth does not interfere with spraying. A backpack wand sprayer equipped with a pressure regulating control flow valve can be calibrated by measuring the amount of time to spray 1.5 fl. oz., which is then known to be the time required to spray each inch of tree diameter. A vertically oriented flat fan nozzle is useful for targeting small diameter trees.

*DBH in inches	Grams of product per inch
1 - 15	3
16 – 19	4
20 – 23	5
24 – 27	6
28 – 31	7
32 – 35	8
36 – 39	9
40 – 43	10
44 – 47	11
48 or greater	12

* DBH - Tree diameter at 4.5 feet above the ground
Conversion: grams / 28.375 = ounces

Table 1: Trunk Spray - Amount of Safari 20SG to apply based on tree DBH

Stem injections: In this systemic treatment, imidacloprid is injected into the trunk of the tree. This application is normally recommended for trees growing in poor soil conditions trees on stream banks or cliffs, and very rocky areas. Stem injection treatments should be made by a professional arborist. Specialized equipment is needed (Fig. 5). Soil treatments or trunk sprays should be favored when possible because stem injections can wound the tree, cost more and be less effective.

Figure 5: Insecticide can be injected into the tree to control adelgids. *Photograph by the Great Smokey Mountains National Park Resource Management Archives.*

Longterm Solution? The goal of the treatments described above is to keep our hemlocks healthy until predators become established. Forest Health professionals are actively involved in finding a biological control for the hemlock woolly adelgid (http://www.invasive.org/hwa/). Several labs are rearing predator beetles that will hopefully save the eastern and Carolina hemlock species. These beetles are currently being released in hopes that they can bring the adelgid population down to levels that the trees can tolerate.

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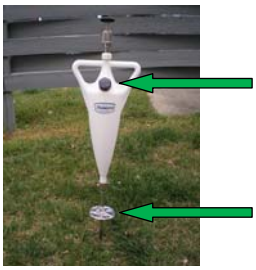
Addendum
Soil Injection: How to Mix and Apply Insecticides for Hemlock Woolly Adelgid

1. Always follow the label when mixing the product. Mix product thoroughly before pouring into injector. The initial mixing is best done in a wide mouth container with a lid. *Always leave the screen in place when pouring the product into the injector. Pulling the screen out slightly will allow for an easier fill.* Stick injector into the ground at an angle to facilitate the pouring process. **See mixing and application instructions below.**
2. Products are mixed and applications are made per inch of tree diameter at breast height (DBH). DBH is measured at 4.5 feet above the ground which is chest high on most adults. Just a reminder that diameter is the distance through the tree not the distance around the tree. A handy conversion formula is (distance around tree/ 3.14 = diameter).
3. The injector can be adjusted to apply different amounts of solution per pump. The numbers on the dial are for cc's. The maximum output per stroke is 5 cc. Roughly 6 pumps on the injector at maximum output will apply 1 ounce of solution. Leave the setting at the maximum output to minimize the number of pumps needed to treat a tree. The plunger should be struck with the heal of the hand in a rapid motion. *It is recommended that you calibrate the injector each day using 10 ounces of water in the injector and counting how many pumps it takes to empty it. Divide the number of pumps by 10 to determine the number of pumps per ounce. Make sure water is coming out of all 4 holes during this process*.
4. Evenly space one injection site per inch DBH, within 1 foot of the tree's base. Inject the solution in the upper 2 to 5 inches of soil where feeder roots are located. Clear needles, leaves and twigs from injection area if necessary. Avoid rocks and large roots when inserting injector into the ground. *Don't use the depth gauge for foot leverage.*
5. After using, triple rinse with clean water and inject around treated tree. Don't allow chemical to stand in injector over night.



Fill cap. Pour solution in here. Always pour the solution through the screen to prevent clogging.

Do not place foot pressure on disk, as it will break. This is a gauge used to control injection depth.

Mixing & Application Instructions for Imidacloprid 75 WSB/WSP

This product comes in a convenient to use 1.6 ounce (45.4 grams) packet. The amount of water used to deliver the product depends on soil moisture. Determining soil moisture is a judgment call. If in doubt, use the recommendation for drier soil.

Moist soil
Mix 1.6 ounce packet in 12 ounces of water.. Apply at the following rate.

DBH* in inches	Pumps per inch
1-11	1
12-18	**1.5
19-22	2
*23 or greater	3

* Trees 23" DBH or greater should be treated 2 consecutive years
** For 1.5 pumps per inch, alternate 1 pump and 2 pumps in the injection holes around entire circumference.

Drier soil (avoid application during drought)
Mix 1.6 ounce packet in 24 ounces of water (1.5 grams active ingredient per ounce). Apply at the following rate.

DBH* in inches	Pumps per inch
1-11	2
12-18	3
19-22	4
*23 or greater	6

*Trees 23" DBH or greater should be treated 2 consecutive years

Note: Do not apply more than 8.6 ounces of imidacloprid 75 per acre per year.

Apply imidacloprid any time of year (don't apply during extremely dry periods). Imidacloprid is slower to take effect but offers a longer period of control. Adelgid control will begin 6 months to 1 year after treatment. Peak amounts of imidacloprid are found at the growing tips two years after treatment. Imidacloprid residues are found in plant tissue 5 years after treatment. Retreat at the first sign of adelgids. A period of 5+ of years between treatments could be expected.

Mixing & Application Instructions for Safari ®20SG

Safari 20SG comes in a 3 pound (1362 grams) container.

Mix 10.2 ounces (288 grams) of product with 96 fluid ounces (3 quarts) of water. Use the plastic measuring device that comes with *Safari* 20 SG to measure required amount of product. The numbers printed on measuring device refer to weight of *Safari* 20 SG in ounces, **NOT** fluid ounces. Apply at the following rate.

DBH* in inches	Pumps per inch
1 - 15	6
16 – 19	8
20 – 23	10
24 – 27	12
28 – 31	14
32 – 35	16
36 – 39	18
40 – 43	20
44 – 47	22
48 or greater	24

Note: Do not apply more than 2.7 lbs. of Safari 20SG per acre per year.

Apply Safari® 20SG from February 1 to November 15 (don't apply during extremely dry periods).Safari® 20SG is very fast to act but offers a shorter span of control. Adelgid control will begin 6 weeks or less after treatment. Trials detected dinotefuron in the tree as long as 8 months after treatment. Retreat once HWA populations begin to build. A period of 2+ of years between treatments could be expected.