GEORGIA FORESTRY COMMISSION

Hemlock Woolly Adelgid: Control Options

Scott Griffin, Forest Health Specialist

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.

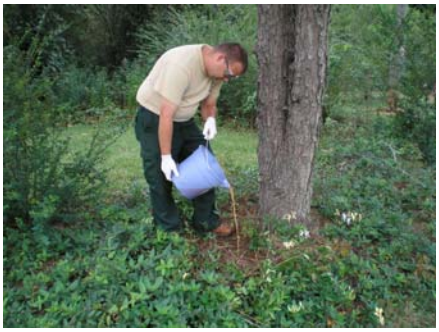

Figure 1: Insecticide applied as a soil drench.

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)

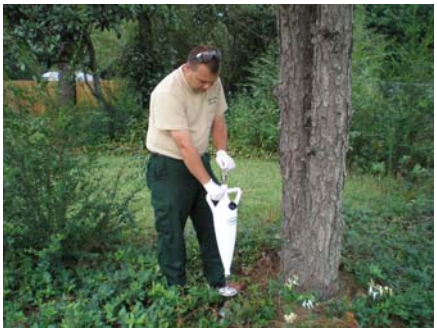

Figure 2: Insecticide can be injected into the soil around hemlock trees.

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. Up to 12 grams of product per inch DBH are permitted, but 3 grams of product per inch DBH is sufficient for most trees. 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.

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.

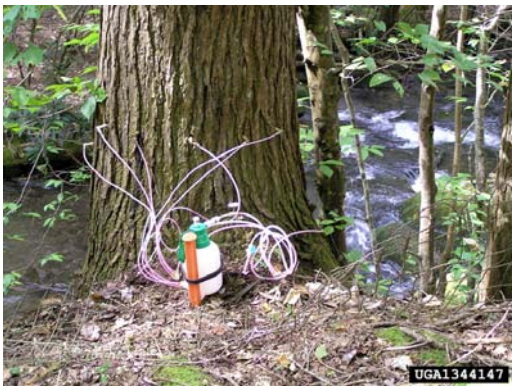

Figure 5: Insecticide can be injected into the tree to control adelgids. *Photograph by the Great Smokey Mountains National Park Resource Management Archives.*

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.

Thanks to Dr. Richard S. Cowles, Connecticut Agricultural Exp. Station, for contributing information to this article.

Comparison of insecticides used to control the Hemlock Woolly Adelgid

<table>
<tr><th></th><th>Imidacloprid 75 WSP or WSB</th><th>Safari® 20SG (active ingredient –Dinotefuran)</th></tr>
<tr><td>Mixing & application (Soil Injection)

The charts to the right are accurate when using a Kioritz soil injector calibrated to deliver 5 ml per pump.

*DBH - tree diameter measured at 4.5 feet above the ground line

<u>Soil injection:</u> 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.</td><td>A 1.6 ounce packet of 75% imidacloprid contains 36 grams of active ingredient. The amount of water you use to deliver the active ingredient depends on soil moisture. Determining soil moisture is a judgement call. If in doubt, use the recommendation for drier soil.

Moist soil
Mix 1.6 ounce packet in <u>12 ounces of water</u> (3 grams active ingredient per ounce). Apply at the following rate.

<table>
<tr><th>DBH* in inches</th><th>Pumps per inch</th><th>Grams of active ingredient/inch</th></tr>
<tr><td>1-11</td><td>1</td><td>.5</td></tr>
<tr><td>12-18</td><td>1.5</td><td>.75</td></tr>
<tr><td>19-22</td><td>2</td><td>1</td></tr>
<tr><td>23 or greater</td><td>3</td><td>1.5</td></tr>
</table>
(Trees 28" 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 <u>24 ounces of water</u> (1.5 grams active ingredient per ounce). Apply at the following rate.

<table>
<tr><th>DBH* in inches</th><th>Pumps per inch</th><th>Grams of active ingredient/inch</th></tr>
<tr><td>1-11</td><td>2</td><td>.5</td></tr>
<tr><td>12-18</td><td>3</td><td>.75</td></tr>
<tr><td>19-22</td><td>4</td><td>1</td></tr>
<tr><td>23 or greater</td><td>6</td><td>1.5</td></tr>
</table>
(Trees 28" DBH or greater should be treated 2 consecutive years)

Note: Do not apply more than 182 grams of active ingredient per acre.</td><td>Safari® 20SG comes in a 3 pound container and contains 272.7 grams of active ingredient.

Mix 10.5 ounces of product with 96 fluid ounces (3 quarts) of water. Use the plastic measuring device that is sold with Safari® 20SG to measure required amount of product. The numbers printed on measuring device refer to weight of Safari® 20SG in ounces, and NOT the volume of water in fl oz. Apply at the following rate.

<table>
<tr><th>DBH* in inches</th><th>Pumps per inch</th><th>Grams of active ingredient per inch</th></tr>
<tr><td>1-15</td><td>6</td><td>.6</td></tr>
<tr><td>16 – 19</td><td>8</td><td>.8</td></tr>
<tr><td>20 – 23</td><td>10</td><td>1</td></tr>
<tr><td>24 – 27</td><td>12</td><td>1.2</td></tr>
<tr><td>28 – 31</td><td>14</td><td>1.4</td></tr>
<tr><td>32 – 35</td><td>16</td><td>1.6</td></tr>
<tr><td>36 – 39</td><td>18</td><td>1.8</td></tr>
<tr><td>40 – 43</td><td>20</td><td>2</td></tr>
<tr><td>44 – 47</td><td>22</td><td>2.2</td></tr>
<tr><td>48 inches or greater</td><td>24</td><td>2.4</td></tr>
</table>
Note: Do not apply more than 2.7 lbs. (245.4 grams active ingredient) per acre per year.</td></tr>
<tr><td>Application timing</td><td>Any time of year (don't apply during extremely dry periods).</td><td>Apply from February 1 to November 15 (don't apply during extremely dry periods).</td></tr>
<tr><td>Duration of control</td><td>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.</td><td>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. Because dinotefuran works so quick it is not necessary to treat at the first sign of adelgid return. Retreat once populations begin to build. A period of 2+ of years between treatments could be expected.</td></tr>
</table>

Note: If you are treating heavily infested trees consider a plan to use both chemicals. Start out with Safari® for a quick kill and at the first sign of HWA's return begin using imidacloprid for its long term control. ***Be sure to read and follow all label instructions with any pesticide treatment. Imidacloprid mix and application rates provided by Mark Dalusky, UGA researcher. Safari® mix and application rates provided by the Valent Company.***