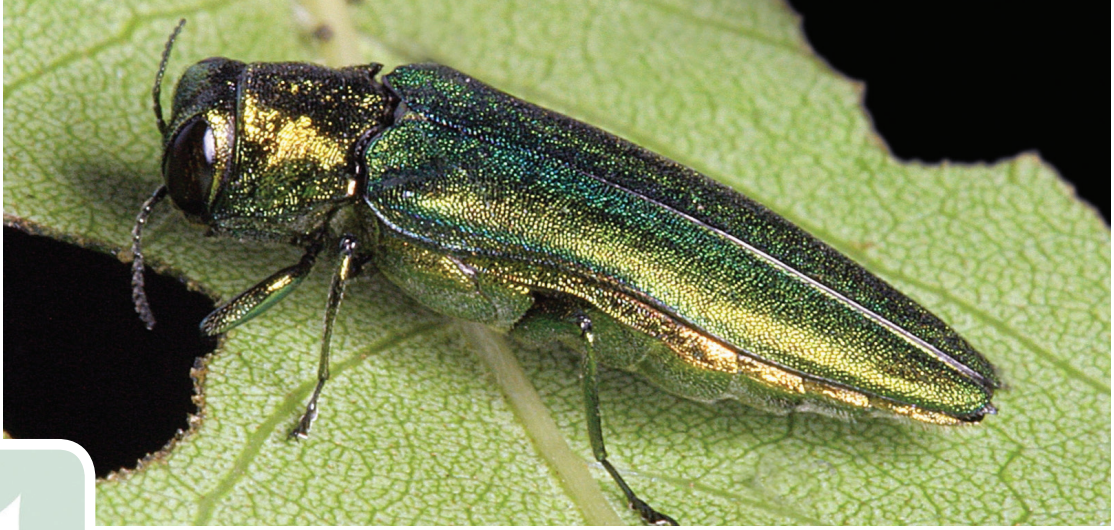

Emerald Ash Borer Management Options

The emerald ash borer (EAB) is an exotic insect that is destructive to ash trees (*Fraxinus* species). It is considered to be one of the most destructive tree pests ever seen in North America. Although the adult beetle causes minor feeding damage on ash foliage, the larval stage feeds beneath the bark and disrupts water and nutrient flow within the tree, which leads to tree death. Larvae actively feed from early summer through fall.

The insecticide products listed in this publication work best as **preventive** treatments for **healthy** ash trees planted along streets or in yards or parks. Healthy trees have full crowns, elongating branches, and bark held tightly to the trunk/branches. It is not practical or cost effective to treat woodlot trees where timber production is the primary goal.

Properly applied systemic insecticides provide effective and consistent protection from EAB. Unprotected ash trees will die from the borer's feeding. Before using an insecticide, several factors must be considered:

- Identify the tree as ash. For an identification aid, see ***www.extension.iastate.edu/forestry/iowa_trees/tree_id.html***
- Determine if your ash tree has EAB signs and symptoms: ***https://store.extension.iastate.edu/Product/1482***
- Estimate the tree's value in the community (see Table 1). Some benefits of urban trees include helping clean the air, slow stormwater runoff, raise property values, sequester carbon, and reduce energy costs.

Table 1. Estimated annual economic benefit of ash trees for a single family residence in Des Moines, Iowa*

Trunk Diameter (in)	Black Ash	Green Ash	White Ash
5	$35	$33	$32
10	$86	$86	$95
15	$141	$147	$177
20	$181	$197	$266
25	$215	$259	$359
30	$209	$300	$478
35	$191	$346	$488

* Based on National Tree Benefit Calculator (***www.treebenefits.com***).

PM 2084 Revised December 2016

IOWA STATE UNIVERSITY
Extension and Outreach

- Evaluate tree health. If the tree is declining, storm damaged, or growing in a limited site, has loose bark, or if the cost of treatment will exceed the landscape value, replace the tree with an alternate species rather than treat:
  - ***www.extension.iastate.edu/psep/Publications/EAB/AshAlternateShadetrees2013.pdf*** or
  - ***www.extension.iastate.edu/psep/Publications/EAB/AshAlternateSmall-staturetrees2013.pdf***
- Site and environmental factors can influence a tree's ability to uptake systemic insecticides, and determine how effective the treatment will be. Before treating, evaluate the soil moisture, soil compaction, and other site factors.
- Systemic insecticides are the products of choice when treating for the emerald ash borer. These chemicals are transported within the vascular system of the tree from the roots and trunk to the branches and leaves. Systemic insecticides reduce hazard such as drift of pesticides to nontarget sites or applicator exposure, and have less impact on beneficial organisms.
- Most of the insecticide products listed in this publication must be used each year for several years. The active ingredient emamectin benzoate protects ash trees for two years following treatment. Azadirachtin is effective for two years when EAB populations are low, but must be injected yearly when EAB populations are high.
- Ash trees within 15 miles of a confirmed EAB site are at risk of attack. Preventive treatments are suggested within this risk zone, but may be premature if outside this area. Continued monitoring of ash trees is valuable outside the immediate risk area. Known infestations are given at ***www.emeraldashborer.info***.

- Infested trees with less than 30 percent dieback of the crown due to EAB feeding may recover following treatment. Prune to remove dead branches.
- Broadcast applications (soil drench, soil injection, granular application, or basal trunk sprays) should not be made where there are roots of flowering plants (annuals, perennials, or shrubs) planted within the drip line since these ash trees are visited by bees and other pollinators. For more information on the effect of neonicotinoid insecticides on pollinators see: ***https://store.extension.iastate.edu/Product/14047***.
- Soil-applied and basally applied insecticides have annual per acre use limits. Refer to product labels and the following publication for more information: ***www.mda.state.mn.us/plants/pestmanagement/~/media/Files/chemicals/pesticides/eablabelguide.ashx.***
- Canopy sprays are not recommended because of limited effectiveness, the need for special equipment, spray drift, and possible adverse effects to nontarget organisms.

In addition to proper selection of ash trees for treatment, the susceptibility of EAB's life stages will determine the effectiveness of systemic insecticides. Table 2 shows the toxicity of the active ingredients to the egg, larval, and adult stages.

Table 2. Toxicity of systemic insecticides to emerald ash borer life stages*

Insecticide	Eggs	Larval stage				Adults
		L1	L2	L3	L4	
Imidacloprid	No	Yes	Yes	No	No	Sustained feeding
Dinotefuran	No	Yes	Yes	No	No	A few bites
Emamectin benzoate	No	Yes	Yes	Yes	Yes	One or two bites
Azadirachtin	No	Yes	Yes	Yes	Yes	Not toxic. Reduces fecundity

* Source: Cliff Sadof, Purdue University.

Table 3. Products for homeowners. Carefully follow label directions[1]			
Type of Application	**Active Ingredient**	**Tree Size – trunk circumference (diameter at 4.5 ft [dbh])**	**Time of Application[2]**
Soil drench[3]	Imidacloprid (1.47%)[4]	Up to 60" (20" dbh)	Mid-April to mid-May **OR** early August to mid-Sept.
Soil drench[3]	Imidacloprid (2.94%)[5]	Up to 60" (20" dbh)	Mid-April to mid-May **OR** early August to mid-Sept.
Soil drench[3]	Imidacloprid (21.4%)[6]	Up to 60" (20" dbh)	Early August to mid-Sept.
Soil drench[3]	Imidacloprid (0.74%) + Clothianidin (0.37%)[7]	Up to 60" (20" dbh)	Mid-April to mid-May **OR** early August to mid-Sept.
Granular[8]	Dinotefuran (2%)[9]	Up to 36" (12" dbh)	Mid-April to mid-May
Granular[8]	Imidacloprid (0.55%) + Clothianidin (0.275%)[10]	Up to 36" (12" dbh)	Mid-April to mid-May
Granular[8]	Imidacloprid (2.5%)[11]	Up to 36" (12" dbh)	Mid-April to mid-May

1 The amount of insecticide required depends on the tree's circumference in inches; see product label directions.

2 If the product label lists spring and fall as possible treatment times, homeowners can treat only ONCE per year. Research has shown spring applications are more effective than fall applications at the same rate. Fall applications do not affect overwintering larvae or pupae, but kill the next year's adults and first instar larvae.

3 Before applying a soil drench, pull back any mulch or dead leaves 12" from the base of the tree. Replace any mulch over the treated area after the mixture has been absorbed into the soil. For trees larger than 60" circumference, enlist the services of a commercial pesticide applicator. Do not make soil applications when soil is saturated or frozen.

4 Examples of products include: Bayer Advanced 12 month Tree & Shrub Protect & Feed Concentrate, Bonide Annual Tree & Shrub Insect Control with Systemaxx, Compare N Save Systemic Tree & Shrub Insect Drench, Ferti-Lome Tree & Shrub Systemic Insect Drench, Ortho Bug B Gon Year-Long Shrub Insect Control Concentrate, and Spectracide Tree & Shrub Insect Control Concentrate.

5 An example of product is Bayer Advanced 12 Month Tree & Shrub Insect Control Super Concentrate.

6 An example of product is Optrol Insecticide.

7 An example of product is Bayer Advanced 12 month Tree & Shrub Protect & Feed Concentrate II.

8 Spread granules evenly on the soil around the base of the plant within 18" of the trunk. Irrigate after application with enough water to dissolve granules and move product into root zone.

9 Examples of products include: Emerald Ash Borer Killer, Green Light Tree & Shrub Insect Control with Safari 2G, and Ortho Tree & Shrub Insect Control Granules.

10 An example of product is Bayer Advanced 12 month Tree & Shrub Protect & Feed RTU Granules II.

11 An example of product is Ferti-Lome Tree & Shrub Systemic Insect Granules, and Ortho Tree & Shrub Insect Control RTU Granules.

Table 4. Products for Commercial Pesticide Applicators			
Product (Formulation)	**Active Ingredient**	**Application Method**	**Time of Application[1]**
Arbormectin™	Emamectin benzoate	Trunk injection	**Full canopy:** Early spring to late-Aug.
IMA-Jet™	Imidacloprid	Trunk injection	**Spring:** Full canopy
Imicide®	Imidacloprid	Trunk injection	**Spring:** Full canopy
Merit® (75WP, 75WSP, 2F)	Imidacloprid	Soil injection or drench (1.4 g a.i./inch dbh)	**Spring:** Early April to mid-May
Merit® (75WP, 75WSP, 2F)	Imidacloprid	Soil injection or drench (2.8 g a.i./inch dbh)	**Fall:** Early Aug to mid-Sept.
Merit® Tree Injection	Imidacloprid	Trunk injection	**Full canopy:** Post bloom
Safari® (20SG)	Dinotefuran	Soil injection or drench	**Spring:** Late-April to late-May
Safari® (20SG)	Dinotefuran	Basal bark spray	**Spring:** Mid-May to mid-June
Transtect™ (70WSP)	Dinotefuran	Basal bark spray	**Spring:** Mid-May to mid-June
Transtect™ (70WSP)	Dinotefuran	Soil injection or drench	**Spring:** Late-April to late-May
Tree-Age®	Emamectin benzoate	Trunk injection	**Full canopy:** Early spring to late-Aug
TreeAzin™	Azadirachtin	Trunk injection	**Spring:** Early May to mid-June
Xytect™ (75WSP, 2F)	Imidacloprid	Soil injection or drench (1.4 g a.i./inch dbh)	**Spring:** Mid-April to mid-May
Xytect™ (75WSP, 2F)	Imidacloprid	Soil injection or drench (2.8 g a.i./inch dbh)	**Spring:** Mid-April to mid-May
Xytect™ (75WSP, 2F)	Imidacloprid	Soil injection or drench (2.8 g a.i./inch dbh)	**Fall:** Early Aug to mid-Sept.
Zylam Liquid Systemic	Dinotefuran	Soil injection or drench	**Spring:** Late-April to late-May
Zylam Liquid Systemic	Dinotefuran	Basal bark spray	**Spring:** Mid-May to mid-June

[1] Applications should be made after the ash tree has bloomed to adhere to pollinator protection statements on product labels.

Notes

- Trunk injections are absorbed and distributed throughout the tree more quickly (1-4 weeks) than soil applications (4-8 weeks), and are useful where soil treatments are not practical (excessively wet soils, compacted sites, or restricted surface areas). Research has shown that tree injections are tolerated in healthy green ash trees, especially if treatments are applied once every two years, small volumes of product are injected, and injection holes are small and shallow. If possible, rotate annual trunk injections with other management options to decrease the possibility of long-term damage.
- Before applying a soil drench, pull back any mulch or dead leaves 12" from the base of the tree. Replace any mulch over the treated area after the mixture has been absorbed into the soil. Do not make soil applications when soil is saturated or frozen.
- Soil injections should be made within 12 to18 inches of the trunk, and the solution placed 2 to 4 inches beneath the soil surface.
- Basal trunk sprays are applied to the tree trunk from the root flares at the soil surface to 4 to 5 feet above the soil surface. Surfactants/bark penetrants may be recommended on product label. Best results for trees up to 18" DBH.
- Good soil moisture is very important to move the systemic insecticides throughout the tree. Some products state to soil moist for at least 7 days following treatment.
- Emamectin benzoate has been shown to protect ash trees for 2 years from one application.
- Azadirachtin has been shown to protect ash trees for 2 years from one application when EAB populations are low; trunk injections must be made every year when EAB populations are high.

For more information:

Contact your Iowa State University Extension and Outreach office or see the following website for additional information: ***www.extension.iastate.edu/psep/EmeraldAshBorer.html***.

Prepared by Mark Shour, entomology program specialist; Laura Jesse, director and extension plant pathologist with the Plant and Insect Diagnostic Clinic; Donald Lewis, professor and extension entomologist; Jeff Iles, professor and extension specialist in horticulture; and Jesse Randall, assistant professor and extension forester, Iowa State University. Revised by Lina Rodriguez Salamanca, extension plant pathologist and diagnostician with the Plant and Insect Diagnostic Clinic.

Iowa State University Extension and Outreach does not discriminate on the basis of age, disability, ethnicity, gender identity, genetic information, marital status, national origin, pregnancy, race, religion, sex, sexual orientation, socioeconomic status, or status as a U.S. veteran. (Not all prohibited bases apply to all programs.) Inquiries regarding non-discrimination policies may be directed to Ross Wilburn, Diversity Officer, 2150 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, 515-294-1482, wilburn@iastate.edu.