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Purpose
Emerald ash borer (EAB) is of immediate or pending concern in communities throughout the mid-west and Upper Great Lake states. All municipalities with ash trees on public property will be faced with the challenge of managing this devastating pest. Most, even those with urban foresters on-staff, are ill-equipped to stay abreast of the rapidly evolving science, management options, and cost-benefit factors which impact the budget decisions that determine ash management plans.

This Best Management Practices guide provides current information to assist municipalities in developing an EAB management strategy. It can be used by municipalities that are currently infested with EAB, and those not yet infested. If you have ash trees in your community, it is only a matter of time before you need an ash management plan.

This guide will:
• Help municipalities understand current EAB management options
• Help draft & implement a community-appropriate ash management plan
• Assist with estimating costs associated with managing EAB
• Serve as a resource for municipal questions regarding EAB

Scope and Applicability
Large or small, any community in North America possessing a stand of ash will benefit from the information included in this BMP guide.

This guide is designed for
• Municipal foresters
• City managers and other municipal officials who are currently or will be required to make difficult decisions about managing EAB
• Commercial contractors who are partnering or may partner with municipalities to create and implement EAB management plans

The document can also be referenced and used by
• Scientists
• University extension personnel
• State government officials within the Department of Agriculture and Department of Natural Resources
• Green industry groups who provide education, outreach and management recommendations to municipalities
• The general public to become better informed about the use of insecticides for management of municipal trees
• Street tree commissions
• Volunteers who work with public trees
Emerald Ash Borer Background
The Emerald Ash Borer (EAB) has killed tens of millions of ash trees since its discovery in southeastern Michigan in 2002. Native to Asia, EAB is thought to have been introduced into the Detroit, MI area in wood packing material used on cargo ships or airplanes at some point in the early to mid 1990s. Through a combination of natural spread and human-associated spread it is now found in a total of 13 states ranging from New York to as far west as Minnesota (as of March 2010). This pest will continue to spread throughout the country and, unchecked, is expected to destroy all native ash species.

EAB FACTS:
- EAB will attack any ash tree, including Legacy and High Value trees, regardless of size or condition
- The beetle can travel 1/2 mile on its own but can be moved long distances by human activity
- Symptoms can take 2-3 years to become visually apparent
- Untreated trees will die 4-6 years after the initial infestation

For most recent EAB distribution please go to http://www.emeraldashborer.info/
Reasons for Protecting and Preserving Ash Trees
The economic impact to municipalities is significant when you factor in the value that ash trees provide. Trees increase property value, reduce heating and cooling costs, reduce stormwater run-off, increase habitat for wildlife and provide other aesthetic and landscape values. In addition, dead and dying ash trees can pose risks and hazards if left standing. A recent study has shown damage caused by EAB can cost up to $157,000 – $665,000 for every 1,000 Ohio residents (Syndor, et al. 2008).

Reasons to treat ash trees with insecticides may include:
- Preservation of the economic asset that trees provide to your municipality
- Preservation of the environmental and ecological value that the trees provide your municipality
- Reduce, defer, or eliminate premature removal costs
- Maintain urban canopy until replacement trees fill in
- Residents encourage treatment and preservation
STEP ONE:  
Tree Inventory

Conducting a full municipal tree inventory can provide valuable information that will influence the decision making process regarding allocation of municipal resources for EAB management. If you do not have the resources to conduct a complete tree inventory, you can conduct a specific needs inventory.

Specific needs inventories help ascertain details related to smaller populations of trees. You may only be interested in collecting specific data that will help make management decisions on a specific pest such as EAB. Furthermore, specific needs inventories help determine which trees should be removed, considered for treatment with insecticides, and which trees should be left alone. Set the criteria for which trees will be removed, treated, or left alone and ensure that your inventory collects the necessary data to make management decisions for each tree.

Specific needs inventories can be formal (collection of large amount of data and are frequently updated) or informal (general tree size and relative value to the community).

Formal Tree Inventories
Formal inventories can be conducted by in-house employees or contractors. There are many commercially available software programs which assist with formal inventories yet a simple spreadsheet program can also be an effective tool. Please contact Rainbow if you would like assistance conducting a formal tree inventory.

Recommended Data To Collect:
• Location
• Tree Size
• Species (white ash, green ash, etc)
• Tree condition (subjective rating scale)
• Tree structure (co-dominant or multi-stem tree vs. strong central leader)
• Presence of structural defects and potential for tree to be hazardous
• Site growing characteristics
  o Growing under a power line
  o Site provides enough growing space for tree to reach mature size
• Value of tree to site
Informal Tree Inventories
Many municipalities opt for a quick method for determining which ash trees to consider for treatment. An inventory such as this can be completed rapidly by in-house employees, contractors, or volunteers. Ash trees can be placed into 3 simple categories using the following guidelines:

**Legacy Trees**
Trees that could not be easily replaced and have significant value to the community. These are often substantial in size (larger than 15” DBH) and may provide any of the following:
- Beauty
- Shade
- Backdrop
- Historic value
Trees designated as Legacy should be top candidates for protection.

**High Value Trees**
Trees that carry a high level of value to the community but may not be as large as a Legacy tree. High value trees are often in high visibility locations such as:
- Parks
- City buildings
- Schools
- Golf courses
High Value trees can be removed, yet it may be more fiscally responsible to protect the tree so it may contribute to canopy development.

**Casual Trees**
These are smaller and lower value trees that populate public places throughout any urban area. These trees are often smaller in size and can be removed economically.
Casual trees are often replaced with different species without causing much disruption to landscape function or the visual and emotional impact on residents.

Example tree inventory of a city park.
This survey inventoried:
- 2 Legacy trees
- 3 High Value trees
- 7 Casual trees

Legend:
- Legacy Ash Tree
- High Value Ash Tree
- Casual Ash Tree
- Non-Ash Tree
STEP TWO: Determine Which Trees To Treat

This step should be fairly easy if a tree inventory was conducted, since the inventory helps prioritize candidates for treatment. If the tree inventory was skipped, a quick field assessment of prominent sites in the community and areas with known presence of high-value ash can provide enough information to make initial decisions regarding a treatment program.

The overall percentage of ash in a municipal inventory does not determine management. Currently the more important factor is size distribution of the ash population. Size directly affects cost of removal and potential canopy loss, and cost to treat per inch DBH (diameter at breast height) and expected treatment outcome. Cost of removal varies greatly between communities due to the contracting market and / or in-house skills, equipment, manpower, etc. So, communities which on the surface appear to have similar ash burdens, can quite reasonably reach different management decisions. You have to run your numbers.

Municipalities in heavily infested areas face an intense 3 - 6 year removal interval in order to limit liability related to dead and dying ash. Electing to treat a portion of the ash inventory to defer removal essentially eliminates this otherwise crippling budget impact. In some situations, treatment for the remaining service life of the tree will cost no more than the cost of up-front removals. The budget impact is spread over 25 - 40 years and removals occur as trees age out in the normal course of events. This has appeal to finance committees.

In municipalities that elect to treat for a limited number of years strictly to stage removals, the strategy and intent should be well-communicated to residents. Further, it is recommended that abutting property owners be allowed the option to pay for continued treatment of the city-owned ash trees after the municipal treatment program has ended. For information on homeowner treatment options please see Appendix III.
Factors to Consider When Selecting an Insecticide for EAB Management:

1. Effectiveness of insecticides
2. Cost per inch of DBH (covered in Step Four)
3. Ease of Application (i.e. how long does it take to treat each tree)
   a. Mixing and preparation time
   b. Application time (minutes/inch DBH)
4. Safety to user and the environment
5. Duration of effectiveness or retreatment interval

Effectiveness of Insecticides: There is considerable confusion and misinformation related to the effectiveness of insecticides for protecting ash trees from EAB. Initial university research on many insecticides resulted in inconsistent results due to various factors. However, effective and predictable management strategies have emerged as scientists have continued to refine application techniques and treatment protocols. When insecticides are applied according to these newer protocols results demonstrate that several products can effectively protect ash trees even when subjected to peak EAB populations.

The most current information on EAB insecticide research has been summarized by the leading EAB researchers from five states in a document entitled *Insecticide Options for Protecting Ash Trees from Emerald Ash Borer* (Herms et al., 2009). This document clearly concludes that ash trees can be effectively protected from emerald ash borer when specific management protocols are implemented. Numerous insecticide products are listed as options in the multi-state bulletin and are available for in-house use by municipalities and/or for use by professionals who contract with municipalities. Products labeled for EAB that are not included in the multi-state bulletin should not be considered as they lack sufficient data to support their use against EAB.


This entire publication is available by going to:

http://www.emeraldashborer.info/files/Multistate_EAB_Insecticide_Fact_Sheet.pdf
Product Options
Rainbow recommends that municipalities consider the use of the following products for management of EAB. These products are widely used by professionals within the green industry for EAB and are currently the products of choice for EAB management by numerous municipalities. See Appendix I for detailed application protocols for each product.

Table 1: Products for EAB Treatments

<table>
<thead>
<tr>
<th>Product Trade Name</th>
<th>Active Ingredient</th>
<th>Application Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xytect</td>
<td>imidaclorpid</td>
<td>soil injection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>soil drench</td>
</tr>
<tr>
<td>TREE-äge</td>
<td>emamectin benzoate</td>
<td>tree injection</td>
</tr>
<tr>
<td>Transtect</td>
<td>dinotefuran</td>
<td>soil injection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>soil drench</td>
</tr>
<tr>
<td></td>
<td></td>
<td>systemic bark spray</td>
</tr>
</tbody>
</table>

Insecticide applications can be performed in-house by municipal staff or by commercial application contractors. When considering who will apply insecticide treatments for your municipality the following factors are important:

1. Cost of treatment per inch DBH (costs will be addressed in Step Four)
2. Ease of application method
3. Flexibility of application timing
4. Duration of effectiveness or retreatment interval
5. Safety for user and environment
6. If hiring a contractor, ensure the contractor is licensed, insured, and an ISA Certified Arborist. For more information on hiring a Certified Arborist, please go to http://www.treesaregood.org/

Table 2: Details of Treatments

<table>
<thead>
<tr>
<th>Product</th>
<th>Application Method</th>
<th>Average Time to Treat a Legacy Tree</th>
<th>Application Timing</th>
<th>Retreatment Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xytect</td>
<td>soil injection, soil drench</td>
<td>4 minutes</td>
<td>Spring or Fall</td>
<td>Annually</td>
</tr>
<tr>
<td>TREE-äge</td>
<td>tree injection</td>
<td>20 minutes</td>
<td>Growing Season</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>Transtect</td>
<td>soil injection, soil drench, systemic bark spray</td>
<td>4 minutes, 3 minutes</td>
<td>Spring, Spring</td>
<td>Annually</td>
</tr>
</tbody>
</table>
Application Methods
The three active ingredients recommended for EAB treatments differ in their method of application to the tree. It is important that applicators receive application training for the products and application methods that your municipality chooses to use.

**Xytect** Soil drench or soil injection treatments with Xytect should be applied in April/May in the spring for same year protection or in late summer/early fall until soils freeze for protection the following year. The leaves DO NOT have to be on the tree to make applications in the fall. Xytect remains bound to soil throughout the winter months and will be taken up the following spring to provide season long protection. Xytect must be re-applied annually. Do not apply to trees growing directly in water or to areas where surface water is present.

**TREE-äge** TREE-äge can be applied by micro-infusion whenever the tree is actively transpiring during the growing season. TREE-äge is currently labeled for 2 years of control for Emerald Ash Borer. TREE-äge is a Restricted Use Pesticide that can only be applied by professionals or by municipal staff who are licensed to apply Restricted Use Pesticides. Requirements for applying TREE-age vary by state. Check with your state’s department of agriculture to determine requirements for contract applicators and in-house applicators.

**Transtect** Transtect can be applied as a soil application in the same manner as Xytect, however, Transtect should be applied in late spring/early summer. Transtect should not be applied late summer/fall.

Transtect can also be applied to ash trees as a systemic bark spray. Bark sprays should be applied in spring or early summer by wetting the trunk up to 5 feet off the ground. Care should be taken to minimize drift.

If you need assistance, Rainbow will work with you determine which product option best fits your specific situation and operational need.
**STEP FOUR: Cost Calculations***

**Identify Removal and Replacement Cost vs. Treatment Cost**

Municipal budgets and finances will vary from location to location, so cost effectiveness is relative to a community's specific situation. State and Federal dollars for tree removal and replacement continue to decrease leaving local governments to pay for ash management. Therefore comparing the treatment costs against what a municipality will be required to pay for removal and replacement is an essential part of the decision making process.

Removal and replacement costs will vary depending on local market conditions and whether or not the work is being contracted or done in-house, but on average a municipality will pay a contractor(s) $400 - $1000 to remove a 20 inch DBH ash tree and replace the tree with a new tree.

<table>
<thead>
<tr>
<th>Product Trade Name</th>
<th>In-house Treatment Cost</th>
<th>Removal Costs without Stump Removal</th>
<th>Removal Costs with Stump Removal</th>
<th>Average Replacement and Replanting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xytect</td>
<td>$20.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREE-äge</td>
<td>$62.40**</td>
<td>$420</td>
<td>$495</td>
<td>$200</td>
</tr>
<tr>
<td>Transect</td>
<td>$35.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Product costs in this document are based on 2010 market prices. Contact Rainbow for the most recent prices. Removal costs based on average bid prices for removing boulevard trees in upper Midwest municipalities. **TREE-äge is applied every two years.

The net annual cost for municipal in-house treatment of a mature 20-inch ash would be approximately $20.00, or $1.00 / inch DBH. Contracted application typically falls in the range of 3 - 5X in-house costs. Compare these numbers to cost of removal / replacement and many communities will find that a favorable economic model exists for protection of some portion of the ash inventory, preserving functional assets as part of the green infrastructure and aesthetic benefits as well.

**Using the approximate figures above, a 20 inch ash tree could be treated annually with Xytect for 24 years before it becomes more cost effective to have it removed in year one.** In many cases, this would be the service life of a municipal tree. Certainly, more sophisticated analysis can be done, however, this provides an indication that treatment can be cost effective when compared to the price of removal.
Cost Comparison Calculators which compare the cost of treatment to the cost of removal and project these costs into future years are important tools that can be used to help guide a municipality’s decision on whether or not to treat or how many trees to treat.

Purdue University has created an online cost calculator that can be useful for comparing different management scenarios (see Additional Resources at the end of this document). The cost to treat or remove is not the only consideration that municipalities should use for determining to treat or not to treat with insecticides. Ecological and environmental benefits that mature trees provide are significant and municipalities now have urban tree assessment tools to help quantify these eco-system benefits as well. Failure to include these benefits in most treatment/removal economical models has been a shortcoming that should be remedied going forward.

<table>
<thead>
<tr>
<th>Costs vs. Benefits of Treating or Removing Ash Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost for treating a 20” DBH ash tree over 22 years:</strong></td>
</tr>
<tr>
<td>In-house treatment with Xytect cost for 20” tree per year: $20 per year x 22 years = $440</td>
</tr>
</tbody>
</table>

| **Cost for removing and replacing a 20” ash tree over 22 years:** |
| Average removal, disposal, and stump grinding of 20” DBH ash tree: $495 |
| Replacement, replanting: $200 |
| Over 22 years: $695 |

**Comparison of time over 22 years:**
It takes roughly 22 years for a newly planted tree to reach Legacy size and begin providing the maximum benefits to the urban forest.

In human years, this is the same amount of time it takes a newly born child to graduate college.
Cost Calculation Formula
In-house Applications

There are many ways to calculate the cost of treatment for a municipality. As product costs, labor costs, and number of trees treated are variables that must be accounted for, the formula below can be helpful when attempting to find the true cost of any product or treatment method.

This formula can be used to estimate the costs associated with treating trees in your municipality by plugging in values for product cost, tree size, hourly labor cost, and your operational efficiency.

Please note this formula does not account for factors such as public pre-notification costs, equipment purchase cost, equipment maintenance costs, windshield time, setup time, clean-up, and other potential costs but it can be helpful to determine general expected treatment costs.

\[
\left( \frac{\text{Product Cost per DBH Inch} \times \text{Tree Size in DBH Inches}}{\text{Labor Costs per Hour}} \right) + \left( \frac{\text{Labor Costs per Hour}}{\text{Trees Treated per Hour}} \right) = \text{Cost of Treatment per Tree}
\]

See Appendix II: Table 10
See Appendix II: Table 11

Worksheet
Used for estimating in-house treatment costs

\[
\left( \frac{\text{Product Cost per DBH Inch} \times \text{Tree Size in DBH Inches}}{\text{Labor Costs per Hour}} \right) + \left( \frac{\text{Labor Costs per Hour}}{\text{Trees Treated per Hour}} \right) = \text{Cost of Treatment per Tree}
\]
Using an outsourced, or contract, applicator can be a cost effective manner of treatment, especially for municipalities that lack qualified staff to apply treatments. Treatment contracts can be open to competitive bidding or simply awarded to application companies already doing business with the municipality depending on local laws. It is important that the city create clear bid specifications to ensure the correct product and application protocol is quoted by each contractor.

Most contract applicators will bid treatment work as a function of tree size, mostly as a fixed cost per inch of DBH. Below is a simple formula that can be useful when determining the cost of contractor applications for EAB treatments.

\[
\text{Cost of Treatment per Tree} = \left( \frac{\text{Treatment Cost per DBH Inch}}{\text{Tree Size in DBH Inches}} \right) 
\]

Price per inch bid by contactors

**Worksheet**

*Used for estimating contractor treatment costs*

\[
\left( \frac{\text{Treatment Cost per DBH Inch}}{\text{Tree Size in DBH Inches}} \right) \times = \text{Cost of Treatment per Tree}
\]
Appendix I, Section 1:
Xytect Soil Application EAB Management Protocol

Summary:
High value trees at risk of EAB infestation should be treated preventively with Xytect. Soil applications of Xytect either as a basal soil drench or basal soil injection are a quick and easy method and can be done by in-house staff or contract applicators. Xytect is absorbed by the tree’s root system and is transported up into the trunk and leaves protecting trees from EAB. Movement of Xytect into the trunk and canopy of your tree can take 3 to 6 weeks.

Applying the correct dosage rate with Xytect is important. As trees grow, more active ingredient is required to protect the trunk and leaves of larger trees. Trees larger than 15 inches that are within a quarantine area or within 15 miles of a quarantine area should be treated at the highest labeled dosage rates. The highest dosage rates for Xytect 2F and Xytect 75 WSP allow applicators to apply enough imidacloprid in a single application in the spring or fall to protect large trees. Most other soil applied imidacloprid products (Merit, Zenith, Bandit, Quali-Pro) must be applied twice each growing season to achieve similar control on large trees.

"Xytect soil treatments are labeled for application at a higher maximum rate than other imidacloprid formulations, and we recommend that trees larger than 15-inch DBH be treated using the highest labeled rate."


Table 4: Xytect Products *

<table>
<thead>
<tr>
<th>Product Trade Name</th>
<th>Active Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xytect 2F</td>
<td>imidacloprid 21.4%</td>
</tr>
<tr>
<td>Xytect 75WSP</td>
<td>imidacloprid 75%</td>
</tr>
</tbody>
</table>

* Both formulations of Xytect provide the same amount of active ingredient and proven level of protection.

Application Timing:
Apply Xytect 75 WSP or Xytect 2F in Mid-fall or mid to late spring.
Table 5: Xytect Dosage Rates

<table>
<thead>
<tr>
<th>Tree Size</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Xytect 75WSP</strong></td>
<td></td>
</tr>
<tr>
<td>Trees Smaller than 15”</td>
<td>1 packet (1.6oz) per 24 inches of DBH</td>
</tr>
<tr>
<td>Trees Larger than 15”</td>
<td>1 packet (1.6oz) per 12 inches of DBH</td>
</tr>
<tr>
<td><strong>Xytect 2F</strong></td>
<td></td>
</tr>
<tr>
<td>Trees Smaller than 15”</td>
<td>6 ml per inch of DBH</td>
</tr>
<tr>
<td>Trees Larger than 15”</td>
<td>12 ml per inch of DBH</td>
</tr>
</tbody>
</table>

**Treatment Interval:**
Apply Xytect 75 WSP or Xytect 2F annually each Spring or Fall.

**Application Method:**
Xytect 75 WSP and Xytect 2F can be applied at the base of the tree, either by pouring a basal drench solution around the tree or by using soil injection equipment. Xytect should be applied to the mineral soil. Landscape mulch, landscape plastic or other barrier should be pulled back or removed to ensure the Xytect reaches the root zone. During times of drought or low soil moisture, supplemental water will help the tree absorb and translocate the Xytect throughout the tree.

If using soil injection, there are a number of different systems that can be used. Systems are categorized as either a high volume or low volume system. High volume systems typically deliver solution at a low concentration whereas low volume systems deliver low volumes of solution at high concentration. Rainbow’s guidelines for water dilution are to apply 1 quart of mixed solution per inch DBH. This is only a guideline; water dilution rates will vary based on the equipment and operational situation. Xytect can be applied effectively with a variety of water dilution rates.

Xytect can be applied by homeowners for use on their own trees and is available in a retail version for residents of your community. Go to www.xytect.com to find a retailer near you.
Appendix I, Section 2: TREE-äge Trunk Injection EAB Management Protocol

Summary:
Tree injection of TREE-äge delivers chemical directly into the tree’s vascular system by drilling holes into the root flares. There are a number of tree injection devices and products being sold for EAB management, however, Rainbow recommends the use of TREE-äge (emamectin benzoate) for use against EAB because research has shown that a single application can predictably provide multiple seasons of control in research trials.

TREE-äge is the only product available that provides more than one year of protection against EAB. TREE-äge can be used preventively and has also performed well as a rescue treatment on trees that are suspected of being infested or on trees that display low levels of visible symptoms. While all tree injection systems do wound trees, the use of TREE-äge minimizes the impact of wounding the tree annually, as occurs with other tree injection products for EAB.

Tree injection of TREE-äge reduces the lag time between treatment and full protection, reduces applicator exposure and can be used in environmentally sensitive areas and areas where there is no access to soil. TREE-äge is a Restricted Use Pesticide that can only be applied by professionals or appropriately municipal staff. This product cannot be applied by homeowners for management of EAB.

Table 6: TREE-äge Product

<table>
<thead>
<tr>
<th>Product Trade Name</th>
<th>Active Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREE-äge</td>
<td>emamectin benzoate 4%</td>
</tr>
</tbody>
</table>

Dose:
The current label for TREE-äge is broken into 4 different dosage categories: Low, Medium, Medium/High and High. The amount of TREE-äge increases in each rate category as the diameter of the tree increases. Researchers are still conducting trials to better determine the optimal TREE-äge dosage rates to apply, however, it appears that even the Low and Medium rates will provide at least two years of control. The current TREE-äge label is for two years of control. Rainbow recommends the following dosage rates:
Table 7: TREE-äge Dosage Rates

<table>
<thead>
<tr>
<th>Tree Size</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 - 19” DBH</td>
<td>Low Rate</td>
</tr>
<tr>
<td>20 - 39” DBH</td>
<td>Medium Rate</td>
</tr>
<tr>
<td>Trees Greater than 40” DBH</td>
<td>Medium/High Rate</td>
</tr>
</tbody>
</table>

**Application Timing:**
Early May to Mid-June is optimal timing for TREE-äge to ensure control and protection during the year of treatment. However, TREE-äge is most efficiently applied throughout the growing season when the ash trees are in full leaf and actively transpiring.

**Treatment Interval:**
Multiple research trials suggest that at least three years of control can be achieved with TREE-äge, however, the current EPA approved label states that TREE-äge can be used to control EAB for 2 growing seasons.

**Application Method:**
TREE-äge can be applied using three different Arborjet application systems. The Quik-Jet, TREE IV and Air Hydraulic system can be used.

Placement of injection sites should be at the base of the tree into the stem within 12” of the soil, into the trunk flare, or into tree roots, exposed by shallow excavation. Make applications into intact, healthy sapwood. Avoid injured areas or areas with decay. Select injection sites associated with stem growth.
Appendix I, Section 3:
Transtect Soil Application and Systemic Bark Spray EAB Management Strategy

Summary:
Transtect can be applied either as soil application or as a systemic bark spray. Transtect soil applications will be absorbed and translocated into the tree faster than Xytect soil applications, so the lag time between treatment and control is reduced.

Transtect systemic bark sprays will translocate into the tree more quickly than soil applications of Transtect. Transtect soil applications and systemic bark sprays are an operationally efficient option that will maximize the rate of tree uptake and provide rapid control of EAB.

With Transtect, ash trees can be quickly controlled without having to drill into a tree or rely on conditions favorable for uptake of TREE-äge. Soil applications of Transtect either as a basal soil drench or basal soil injection are a quick and easy method and can be done by in-house staff or contract applicators. Transtect is absorbed by the tree’s root system and is transported up into the trunk and leaves protecting trees from EAB. Transtect soil treatments are translocated into the trunk and canopy of the tree in as little as 2 to 3 weeks.

<table>
<thead>
<tr>
<th>Table 8: Transtect Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Trade Name</strong></td>
</tr>
<tr>
<td>Transect</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 9: Transtect Dosage Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application Method</strong></td>
</tr>
<tr>
<td>Soil Application</td>
</tr>
</tbody>
</table>
| Systemic Bark Spray           | Add 6 packets (3.6 oz) of Transect per gallon of spray solution.  
                                        1 gallon spray solution will treat 50-80 DBH inches depending on the bark thickness of the trees being treated. |
Application Timing:
Soil Application/Systemic Bark Sprays
Transtect can be applied throughout the growing season. Soil applications should be applied in late spring/early summer for control the year of treatment. Transtect cannot be applied in late summer/early fall to provide control the following year. Transtect can be applied whenever soils are not frozen and can effectively be applied later in the growing season. For example if an infested tree is discovered in late June/Early July a Transtect soil application can still provide a benefit that year.

Treatment Interval:
Apply Transtect soil and systemic bark sprays annually each year.

Application Method:
Soil Application
Transtect can be applied at the base of the tree, either by pouring a basal drench solution around the tree or by using soil injection equipment. Transtect should be applied to the mineral soil. Landscape mulch, landscape plastic or other barrier should be pulled back or removed to ensure the Transtect reaches the root zone. During times of drought or low soil moisture, supplemental water will help the tree absorb and translocate the Transtect throughout the tree.

If using soil injection, there are a number of different systems that can be used. Systems are categorized as either a high volume or low volume system. High volume systems typically deliver solution at a low concentration whereas low volume systems deliver low volumes of solution at high concentration.

Systemic Bark Spray Application
Transtect systemic bark spray applications may be applied using many different types of low pressure sprayers. Spray solution onto the tree trunk from 4” to 60” above the soil surface. Adjust sprayer nozzle to uniformly distribute spray solution on bark, covering the entire circumference of the tree trunk. Wet the bark just to the point of saturation and run-off to the soil surface. Use a low pressure sprayer operated at 10 to 20 psi to reduce spray drift or splash back on non-target plants.
**Appendix II:**

**Cost Calculation Tables**

**Table 10: Calculating product costs per DBH**

<table>
<thead>
<tr>
<th><strong>Xytect 75WSP Soil Applications</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>22 - 1.6 oz packet PowderKeg Units</td>
</tr>
<tr>
<td>4 Units per case</td>
</tr>
</tbody>
</table>

Formula for Calculating Product Cost per DBH Inch

**For Trees Under 15” DBH**

\[
\left( \frac{\text{Cost for 22-packet Unit}}{528} \right) = \text{Product Cost per DBH Inch}
\]

**For Trees Over 15” DBH**

\[
\left( \frac{\text{Cost for 22-packet Unit}}{264} \right) = \text{Product Cost per DBH Inch}
\]

<table>
<thead>
<tr>
<th><strong>TREE-äge Tree Injection Applications</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 liter (1000 ml)</td>
</tr>
<tr>
<td>8 Units per case</td>
</tr>
</tbody>
</table>

Formula for Calculating Product Cost per DBH Inch

\[
\left( \frac{\text{Cost for Liter}}{1000} \right) \times \text{rate from TREE-äge label (ml)} = \text{Product Cost per DBH Inch}
\]

* **TREE-äge** is dosed on a logarithmic scale where larger trees require a larger dosage of product.
### Transect 70 WSP Systemic Bark Spray Applications

- **20 - 17.4 gram packets**
- **4 Units per case**

#### Formula for Calculating Product Cost per DBH Inch

$$\left(\frac{\text{Cost for 20-packet Unit}}{\text{Packets per unit}}\right) \times \text{Packets per gallon} = \frac{65}{\text{(DBH Inches Treated per Gallon)}}$$

#### Table 11: Trees treated per man-hour

<table>
<thead>
<tr>
<th>Xytect 75WSP</th>
<th>TREE-äge</th>
<th>Transect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applied by Soil Injection</strong></td>
<td><strong>Applied by TREE IV Injection</strong></td>
<td><strong>Applied by Bark Spray</strong></td>
</tr>
<tr>
<td>Relative Application Speed</td>
<td>Relative Application Speed</td>
<td>Relative Application Speed</td>
</tr>
<tr>
<td>Trees Treated per Hour</td>
<td>Trees Treated per Hour</td>
<td>Trees Treated per Hour</td>
</tr>
<tr>
<td>Slow</td>
<td>6</td>
<td>Slow</td>
</tr>
<tr>
<td>Medium</td>
<td>10</td>
<td>Medium</td>
</tr>
<tr>
<td>Fast</td>
<td>20</td>
<td>Fast</td>
</tr>
</tbody>
</table>

### APPENDIX III:

**Management Options for Homeowners**

Homeowners are encouraged to treat ash trees on their own properties and some municipalities are encouraging homeowners to treat city owned trees. In municipalities where the management strategy is to treat trees temporarily to defer removal costs, it is recommended the residents be allowed the option to pay for continued treatment of the city owned ash trees after the municipal treatment program has ended.

Homeowners can purchase Xytect for treating privately or publically owned trees. Please go to [www.xytect.com](http://www.xytect.com) for a list of local retailers.
ADDITIONAL RESOURCES FOR EMERALD ASH BORER INFORMATION

EAB General Info
http://www.emeraldashborer.info/

USDA Forest Service
http://www.na.fs.fed.us/fhp/eab/

EAB Insecticide Multi-state Bulletin
http://www.emeraldashborer.info/files/Multistate_EAB_Insecticide_Fact_Sheet.pdf

EAB Cost Calculator
http://extension.entm.purdue.edu/treecomputer/index.php

EAB Treatment Product Info
http://www.treecarescience.com/arborceuticals

EAB Homeowner Treatment Info
http://www.xytect.com

for more information:
Rainbow Treecare Scientific Advancements
877-272-6747
info@treecarescience.com

www.treecarescience.com