USE OF SYSTEMIC TREATMENTS FOR THE MANAGEMENT OF SPECIFIC INSECT PESTS OF SEED ORCHARD AND PLANTATION TREES

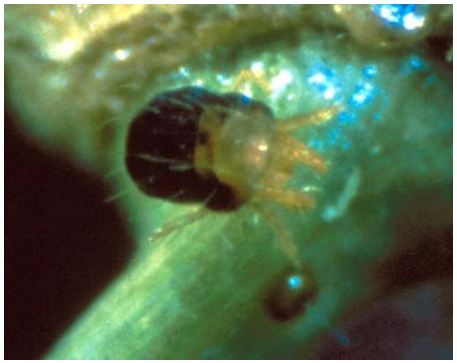
SFTIC 2017

ARBORjet®
Revolutionary Plant Health Solutions

Don Grosman

Thrips

Conifer mite



Seedworm

Bark beetle (5+ spp)

Midge

Seed bug (2 spp)

Coneworm (5+ spp)

Cone beetle (5+ spp)

Hydraulic sprays can only reach to a height of ~30 feet. For larger trees, the need for a bucket truck increase cost considerably.

Even with a light breeze, pesticide can easily drift off target.

Limitations of Bole or Foliar Sprays

- Expensive
- Becoming difficult to find applicators (seed orchards)
- Short treatment duration, e.g. several (2 – 6) treatments required per year
- Worker exposure
- Drift
- Potential for non-target (bees, parasites & predators) mortality

Potential Advantages of Tree Injections

- Full dose administered to tree; reduce pesticide load in treatment area
- No need for bucket trucks to treat large trees; entire tree protected
- No exposure to customer, minimal to applicator
- No drift or non-target effects
- Wide treatment window
- Long treatment duration (2 or more years); no photo- or microbial-degredation of chemical

Registered Systemic Insecticides

- Abamectin (Abicide 2, Greyhound, Vivid)
- Acephate (ACECAP 97, ACE-jet, Dendrex, Lepitect)
- Azadirachtin (AzaSol, TreeAzin)
- Bidrin (Inject-a-cide B*)
- Chlorantraniloprole (Acelopryn)
- Dinotefuran (Safari, Transtect)
- Emamectin benzoate (Arbormectin, Boxer, TREE-äge*,TREE-äge G4)
- Imidacloprid (IMA-jet, Imicide, Pointer, Xytect)

* **Restricted Use Product**

What is Emamectin Benzoate (TREE-äge)?

- It was derived from abamectin and produced by a naturally occurring soil born bacteria called ***Streptomyces avermitilis***.
- Mode of Action – Acts on insect nerves to suppress muscle contraction, resulting in insect paralysis and death.
- Emamectin benzoate is highly active against a range of pests, particularly in the order Lepidoptera.
- After injection into a tree, emamectin benzoate appears to be stored with the tree's sugars and proteins, and released as the tree uses it's stored energy. This results in extended tree protection (2 or more years).

Revolutionary Plant Health Solutions

Systemic Insecticide Injection Studies

Systemic Insecticide Injection Studies 1996 - 2013

Objectives

Evaluate trunk injection of systemic insecticides as alternatives to:

1) aerial sprays for the control of cone and seed insects in pine and hardwood seed orchards.

2) trunk sprays for protection against bark beetles.

Seed Orchard and Plantation Trials

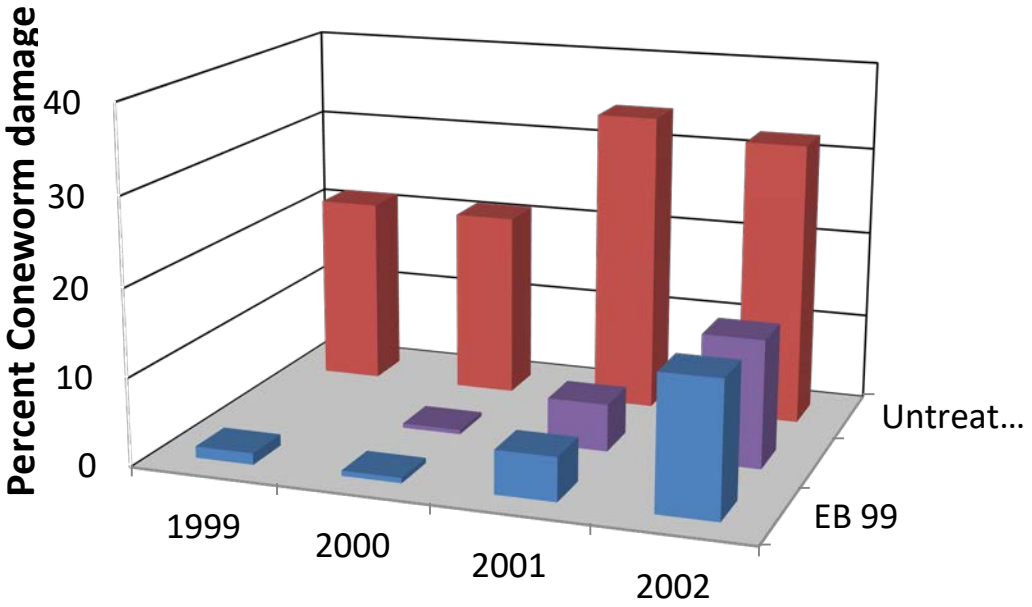
- Coneworm (18: 1996 – 2012, 2017)
- Seed bugs (18: 1996 – 2012, 2017)
- Seedworm (3: 1998 - 2004)
- Pales weevil (1: 2003)
- Bark beetles (27: 2004 – 2017)
- Acorn weevil (3: 2004 - 2006)
- Pine needle scale (1: 2005)
- Slash pine flower thrips (1: 2005 – 2006)
- Cone beetle (1: 2011 – 2012)
- Pine wood nematode (3: 2012 – 2014)
- Ambrosia beetles (6: 2012 – 2017)
- Conifer mite (3: 2013 – 2015)

EB Control of Pine Coneworm

Study
Texas Forest Service

Treatments
20 trees injected with EB 1999 and 10 of these injected again in 2000

Evaluation
Cones were collected & assessed for coneworm damage in 1999 - 2002



Shows 2+ years of control against Pine Coneworm

TREE-äge Results
Significantly less damage in single treatments from 1999 and for annual treatments 1999 & 2000.

Donald M. Grosman et. al, 2002

Systemic Insecticide Injections for Control of Cone and Seed Insects in Loblolly Pine Seed Orchards—2 Year Results

Donald M. Grosman, William W. Upton
Ronald F. Billings, *Texas Forest Servic*
P.O. Box 310, Lufkin, Texas 75902-0

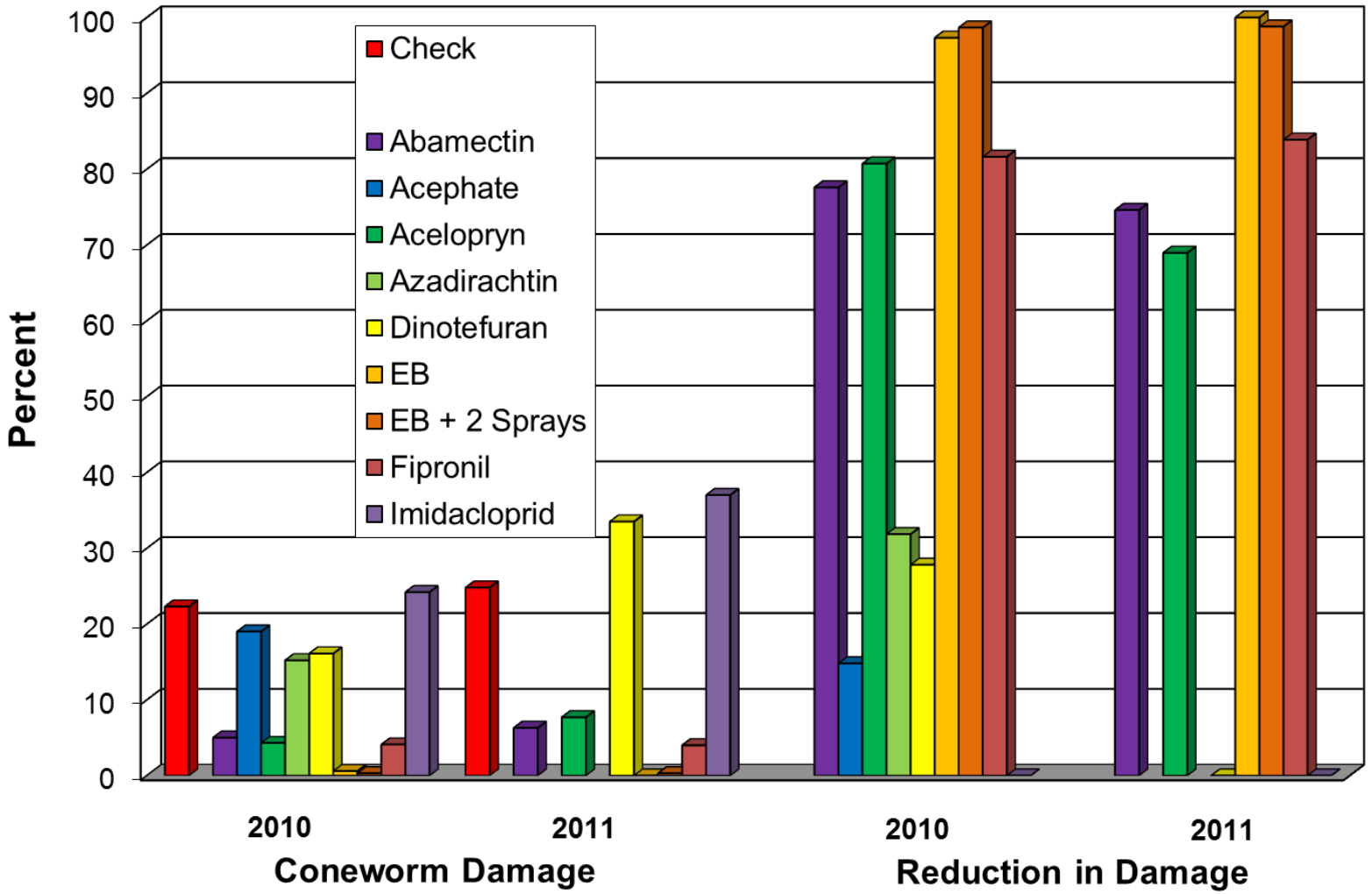
ABSTRACT: *Three systemic insecticide combination of emamectin benzoate and taeda L., during a 2 yr period in a emamectin benzoate reduced cone injection after 1 yr did not imp 1999, but not in 2000. Sig* **Leptoglossus corculus** *Hei imidacloprid and thiamethoxa of imidacloprid or thiamethoxam treatment, two injections of emamec by 86%. South. J. Appl. For. 26(3):14*

Systemic Insecticide Injections: New, Effective Option for Protecting Pine Seed Orcha Crops from Insect Pests

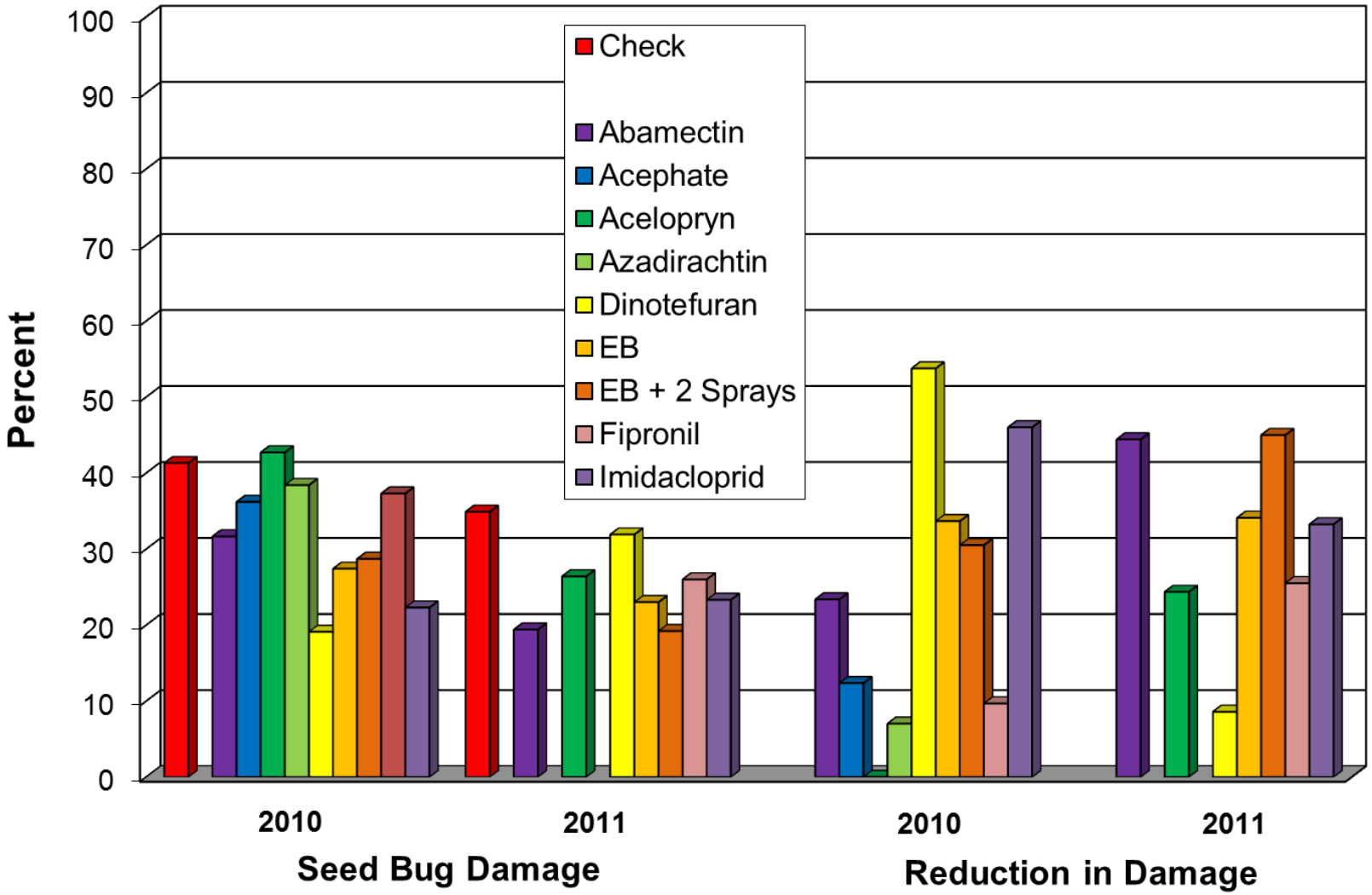
D. Grosman[1], W. Upton[1], A. Mangini[2], C. Rosier[3], T. Slichter[4], J. Tule[5], and J. Watkins[6]

Abstract: The efficacies of systemic insecticides emamectin benzoate and fipronil were evaluated in four southeastern pine seed orchards for preventing damage and mortality to cones by cone and seed insects. Single injections of emamectin benzoate consistently reduced cone damage and mortality (70 – 95%) by coneworms in slash pine and loblolly pine orchards for two years compared to untreated checks. Fipronil performed nearly as well on most sites reducing coneworm damage by 66 – 92%. Both chemicals were moderately effective against pine seed bugs during the first year after injection; reducing damage by 3 – 37% compared to checks. No significant treatment effect was observed against seed bugs during the second year. Emamectin benzoate demonstrated some activity against slash pine flower thrips in Alabama.

Percent coneworm (*Dioryctria* spp.) damage and reduction in damage compared to check, Woodville, TX 2010 & 2011.



Percent seed bug (*Leptoglossus* and *Tetyra* sp.) damage to second year cones, Woodville, TX 2010 & 2011



New Formulations of TREE-äge for Control of Pine Coneworm

Study Site
Geneva State Forest, AL

Treatments
10 trees each injected in early April with:

1) TREE-äge (4% RUP, 8.6ml/pt) 1:1 with water via TREE IV F-Series)

2) TREE-äge G4 (4% GUP, 8.6ml/pt via Quikjet Air)

3) TREE-äge R9 (9.5% RUP, 3.6ml/pt via Quikjet Air)

Evaluation
Cones will be collected & assessed for coneworm damage in 2017 and 2018

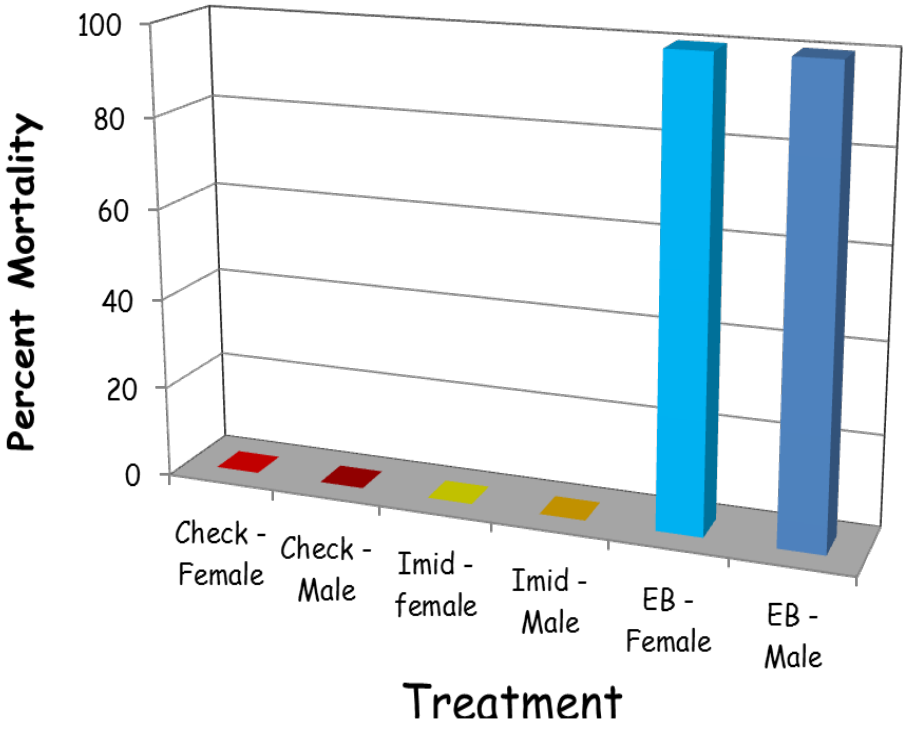
Null Hypothesis
All EB treatments will significantly reduce coneworm damage to similar levels compared to untreated checks.

Effects of EB and Imidacloprid on Pales Weevil After Feeding on White Pine - 2003

Study
Texas Forest Service & Virginia Tech

Treatments
One white pine tree each injected with emamectin benzoate or imidacloprid in 2003

Evaluation
Twigs collected from trees & presented to male and female pales weevil in petri dishes; measured level of feeding and mortality



Results
All weevils (male and female) died after feeding on EB-treated twigs.

Conifer Bark Beetles of Economic Importance

Small southern pine engraver

Ips avulsus

Southern Pine Beetle

Dendroctonus frontalis

Mountain Pine Beetle

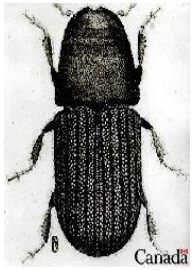
Dendroctonus ponderosae

Eastern five-spined Ips

Ips grandicollis

Pine engraver

Ips pini



Western Pine Beetle

Dendroctonus brevicomis

Six-spined engraver beetle

Ips calligraphus

Black Turpentine Beetle

Dendroctonus terebrans

Spruce Beetle

Dendroctonus rufipennis

Effects of emamectin benzoate on *Ips* engraver beetle colonization of loblolly pine logs 1 month after injection - 2004

Check

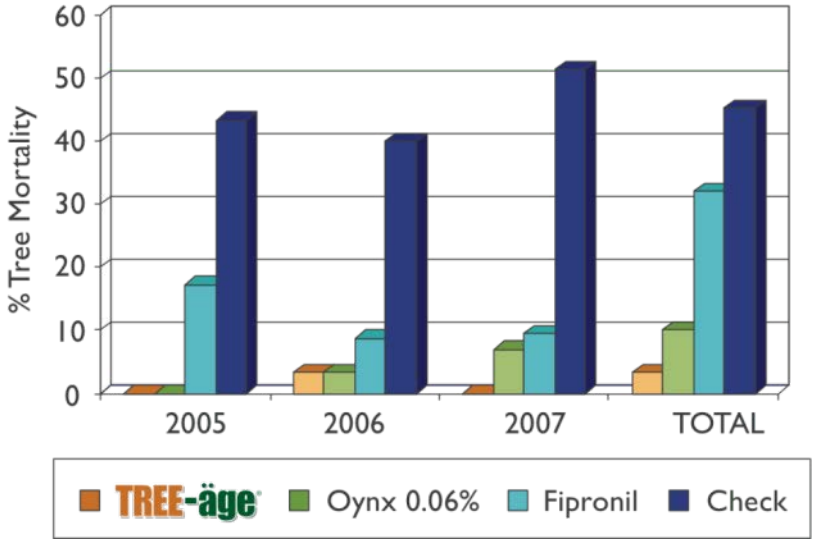
EB @ 1 month

TREE-äge® control of Western Pine Beetle on Ponderosa Pine- CA

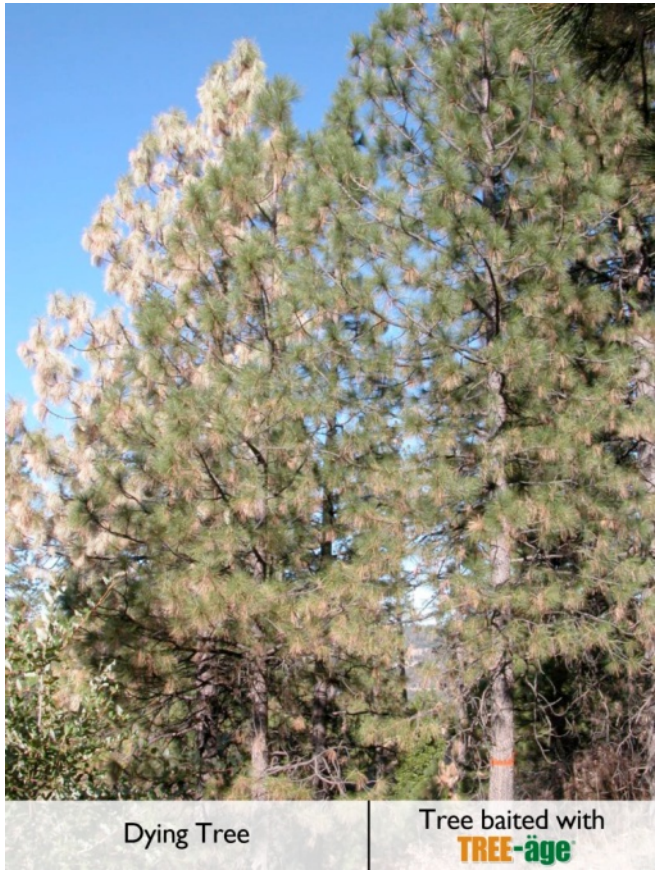
2005 Treatment – 2005, 2006 & 2007 assessments

Tree Mortality

- 40 to 50% of the check trees died each year
- **TREE-äge: Only 1 tree died within 2 years!**



(Dead/Total) TREE-äge: (1/30) Check: (43/95)



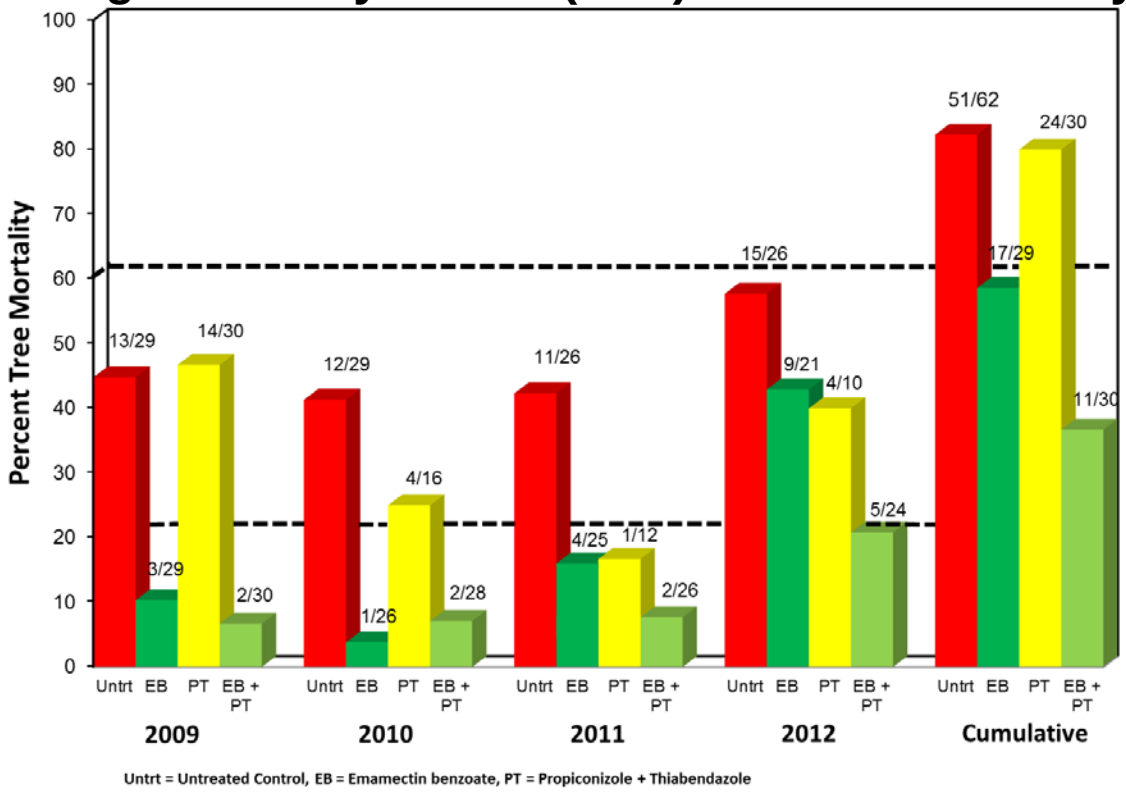
Donald M. Grosman et. al, 2010

TREE-äge® control of SPB on Loblolly Pine - AL

2009 Treatment – 2009 – 2012 assessments

Tree Mortality

- 41 to 58% of the check trees died each year
- **TREE-äge: Only 4 trees (13%) died within first 2 years!**
- **TREE-äge + fungicide: Only 6 trees (20%) died within first 3 years!**



Untrt = Untreated Control, EB = Emamectin benzoate, PT = Propiconizole + Thiabendazole


Efficacy of Two Systemic Insecticides Injected Into Loblolly Pine for Protection Against Southern Pine Bark Beetles (Coleoptera: Curculionidae)

FOREST ENTOMOLOGY

DONALD M. GROSMAN,[1,2] STEPHEN R. CLARKE,[3] AND WILLIAM W. UPTON[1]

J. Econ. Entomol. 102(3): 1062–1069 (2009)

ABSTRACT We evaluated the efficacy of systemic insecticides

Efficacy of Systemic Insecticides for Protection of Loblolly Pine Against Southern Pine Engraver Beetles (Coleoptera: Curculionidae: Scolytinae) and Wood Borers (Coleoptera: Cerambycidae)

DONALD M. GROSMAN AND WILLIAM W. UPTON

Texas Forest Service, Forest Pest Management, P.O. B

J. Econ. Entomol. 99(1):

ABSTRACT We evaluated the efficacy of the sys

KEY WORDS southern pine


Effectiveness of Two Systemic Insecticides for Protecting Western Conifers from Mortality Due to Bark Beetle Attack

Donald M. Grosman, Christopher J. Fettig, Carl L. Jorgensen, and A. Steven Munson

ABSTRACT

Bark beetles (Coleoptera: Curculionidae, Scolytinae) are important tree mortality agents in western coniferous forests. Protection of individual trees from bark beetle attack has historically involved applications of liquid formulations of contact insecticides to the tree bole using hydraulic sprayers. More recently, researchers looking for more portable and environmentally

Keywords:

Research Article

Evaluations of emamectin benzoate and propiconazole for protecting individual Pinus contorta from mortality attributed to colonization by Dendroctonus ponderosae and associated fungi

Christopher J Fettig, Parshall B Bush

Abstract

JES 16-34

FETTIG ET AL.: Emamectin Benzoate Protects Engelmann Spruce

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NOTE

Injections of Emamectin Benzoate Protect Engelmann Spruce from Mortality Attributed to Spruce Beetle (Coleoptera: Curculionidae) for Two Years[1]

Christopher J. Fettig,[2] Darren C. Blackford,[3] Donald M. Grosman,[4] and A. Steven Munson[3]

TREE-äge™ Pest Targets

- Pine Wood Nematode

- Lepidoptera
- Pine Coneworm
- Western Spruce Budworm
- Winter Moth
- Bagworm
- Fall Webworm
- Gypsy Moth
- Tent Caterpillars
- Clearwing Borers
- Leaf Miners
- Oakworm Caterpillar
- Tussuck Moth

- Hymenoptera
- Erythrina Gall Wasp
- Sawfly

- Coleoptera
- Emerald Ash Borer
- Bronze Birch Borer
- Two Lined Chestnut Borer
- Longhorn Borers
- Bark Beetles (Scolytids)
- White Pine Weevil

- Mites
- Mites – Eur., Spruce, 2 spotted
- Eryiophid Mites

Evaluated ability of injection systems to inject two volumes of TREE-äge into pine and treatment efficacy over time.

Portle

Tree IV

M3

Sidewinder

Mauget

Quick-jet

Other systems available, but none have pressure capable of pushing product into conifers.

Macroinjection

Pine Infuser

Chemjet

Tree Tech

Ecoject

Arborjet's Tree I.V. Micro Infusion System

Tree I.V. System with Larger Trees

- **First you measure the DBH of the tree**
- **Then you put the exact amount of chemical in the bottle and pressurize the bottle**
- **Next you drill and plug the tree**
- **Attach IV lines and open the bottle and let it push into the tree**

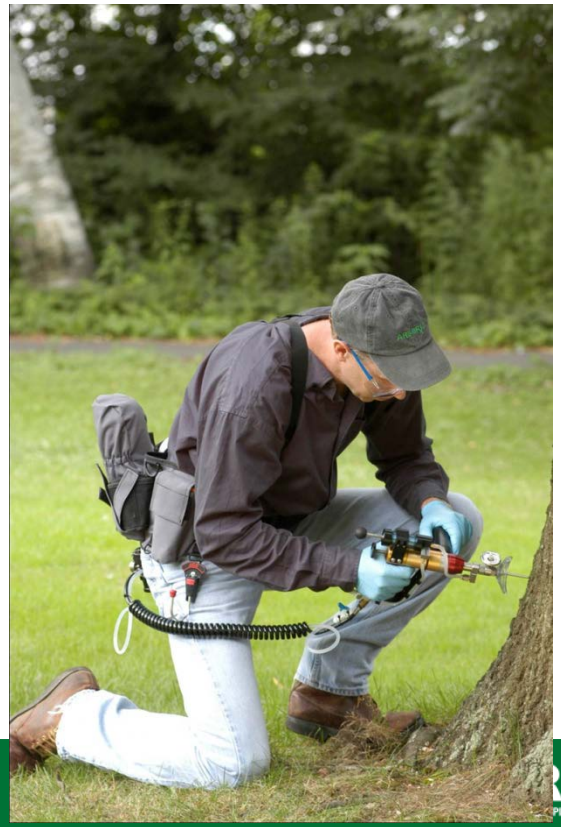
Leap Frog with Multiple Trees Increases Productivity

Original TREE I.V.

New F-SeriesTREE I.V.

Arborjet's VIPER Air Hydraulic Device

For Larger Commercial Projects & City Treatments



Arborjet's QUIK-jet Micro Injection System

ARBORjet
Revolutionary Plant Health Solutions

QUIK-jet Air

New System Trials established in 2017

Coneworm/Seed Bug – AL

Gypsy Moth – Cape Cod, MA

Banyan Stem Gall Wasp – Oahu, HI

Polyphagous Shot Hole Borer – CA

Injection time for average 15” DBH = 3.2 minutes

Suggestions for Improving Trunk Injection

- Make applications when trees are actively transpiring (Apr - Nov)
- Fall is the best season for uptake; to provide enough time for trees to circulate product
- Spring is second best
- For most trees, early morning and evenings are best
- Drill deep to take advantage of thick active tissue layer in pines
- Avoid heat of day, when stomata are likely to close
- During summer, treat just after a ½"+ rain event or during drought periods, irrigate trees prior to and after treatment.
- Closer distances between injection points (4" or less) ensure good protection against BTB.

Acknowledgements

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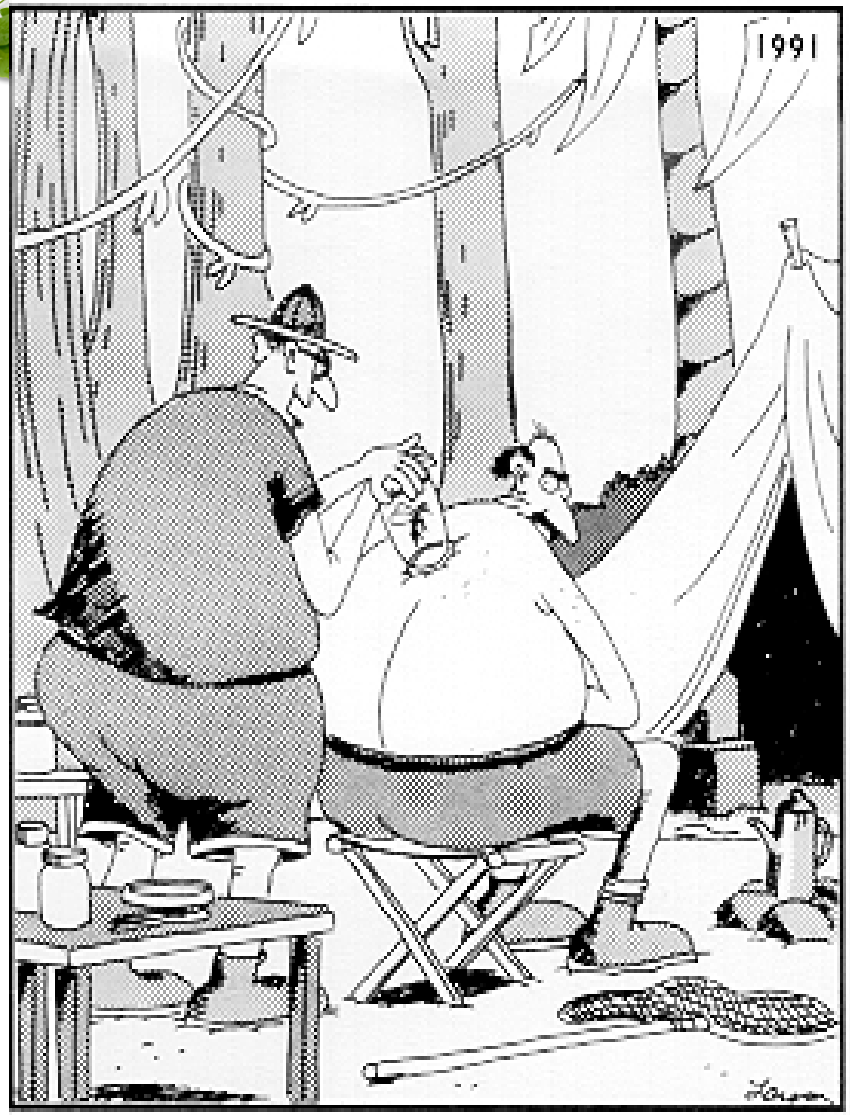

"Got him, Byron! It's something in the *Vespula* genus, all right—and oooooweeeee does he look mad!"

Thank you for your attention!

Questions?