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Abstract. Trees are subjected to mechanical loading during their life span or face premature mortality. The strain resulting from loads intercepted by the canopy and transferred throughout the tree is of significant importance, not only for the survival of the tree, but for the safety and well-being of the human population found in close proximity. To test the function of tree orientation to an applied load, static load tests were conducted on 15 mature pin oak trees (*Quercus palustris* Muenchh.). We applied the static load tests to tilt the trees 0.1° from natural position. We used a digital image correlation system to map strain in the leeward, windward, and tangential roots in the root-stem transition zone. Results indicate that mean maximum strain magnitudes are similar in the leeward and windward orientations and lower on the tangential orientation. The leeward orientation experienced compressive strain, the windward orientation experienced tensile strain, and the tangential orientation had both tensile and compressive strain. This information provides the arboricultural and plant science sectors with a better understanding of how loading force moves through trees and will further enhance tree risk assessment and root zone management protocols.

Keywords. Bending Moment; Digital Image Correlation; Static Load Test; Strain; Tree Stability.

Abstract. The protection of high-value trees against bark beetles and the development of alternatives to bole sprays is a priority for the tree manager. The objective of this study was to evaluate stem-injected TREE-äge® (emamectin benzoate [EB]) as a protective treatment for western white pines (*Pinus monticola* Dougl. ex D. Don) against mountain pine beetle (MPB, *Dendroctonus ponderosae* Hopkins). Treatment efficacy was based solely on tree mortality as per Shea protocols (i.e., ≥ 60% check vs. ≤ 20% treated tree mortality). Our first experiment was installed in 2007 and included trees stem-injected with TREE-äge and untreated controls. Bole application of S-(-)-verbenone and green leaf volatile (GLV) blend was included for observational comparison. Pressure from MPB was heavy, as indicated by the number and timing of control tree mortality (90%). Strip attacks by MPB in TREE-äge trees indicated that the impacts of EB, and by inference its distribution, were inconsistent. In 2009, the injection protocol was revised to improve EB distribution in the phloem via closer injection points. In the 2009 TREE-äge-treated trees, adult beetle mining stopped when they contacted phloem and was insufficient to cause tree death by girdling. Blue-stain fungi colonized the sapwood of trees in both studies. Isolates from autopsied trees treated with TREE-äge alone were subsequently identified as *Grosmannia clavigera* and *Leptographium longiclavatum* (Ophiostomatales: Ascomycota), species that can incite tree mortality. In 2013, we revised our protocol to include GLV plus verbenone or propiconazole with TREE-äge, wherein these treatments proved effective in protecting trees against MPB and their associated pathogenic fungi.

Keywords. Bark Beetles; Blue-Stain Fungi; *Grosmannia clavigera*; *Leptographium longiclavatum*; Propiconazole; Tree Injection; Verbenone.

Abstract. Emerald ash borer (EAB, *Agrilus planipennis*) is an invasive phloem feeder from East Asia that has killed millions of ash trees in North America. Currently, effective options for individual tree protection are limited to systemic insecticides, in particular neonicotinoids, which have come under increased scrutiny for their nontarget effects. In this study, green ash (*Fraxinus pennsylvanica*) trees were treated with two neonicotinoid insecticides, imidacloprid and dinotefuran, at full and half label rates based on trunk diameter to evaluate residues and

efficacy. Analyzing the leaf, stem, and root tissues, there was no difference in insecticide residues between application rates within each tissue type. However, there were significantly higher residues of imidacloprid in root tissue compared to other plant tissues, and dinotefuran applied at the full label rate resulted in lower residues in stem phloem tissue. Additionally, insecticide-treated stems were artificially infested with EAB eggs to measure larval success (survival and growth). EAB larvae consumed less phloem in treated trees compared to untreated controls. These findings suggest that, in small-diameter ash, lower than label-recommended doses may be a viable component of an integrated management plan for EAB.

Keywords. *Agrilus planipennis*; Dinotefuran; *Fraxinus*; Imidacloprid.

Abstract. Apple and pear scab are foliar diseases of ornamental and fruiting apple and pear trees. Unmanaged, yield and aesthetic losses can be severe. Overreliance on synthetic fungicides means novel means of disease management are required. Field trials were conducted using apple (*Malus* cv. Crown Gold) and pear (*Pyrus communis* 'Williams Bon Chrétien') to assess the efficacy of a range of commercially available inducing resistance (IR) agents (harpin protein, potassium phosphite, salicylic acid derivative, and chitosan) as root drenches against both scab diseases. A synthetic fungicide (penconazole) spray program used within the UK for apple and pear scab control was included for comparison. Each IR agent was applied four times, (i) before the visible appearance of scab (April through June, i.e., preventatively) or (ii) after symptoms of scab were visibly observed (June through August, i.e., curatively). Limited efficacy as scab protectants was demonstrated when IR agents were applied curatively. Likewise, limited efficacy was recorded when IR agents were applied once or twice as a preventative measure. However, when IR agents were applied as root drenches greater or equal to three times, efficacy as scab protectants was confirmed (increased leaf chlorophyll content, increased fruit yield, reduced leaf and fruit scab severity). A synthetic fungicide penconazole spray program provided the greatest protection against apple and pear scab in all trials when sprayed preventatively rather than curatively. Results suggest application of at least three root drenches from April through June with an appropriate IR agent provides a useful addition to existing methods of apple and pear scab management under field conditions.

Keywords. Fungicides; Integrated Disease Management; Orchard Management; Pathogen Control; Plant Health Care; Urban Landscapes; *Venturia inaequalis*; *Venturia pirina*.

Abstract. As urban areas expand, there are a greater number of urban trees; however, development often leads to a reduction in urban trees in many areas. A reduction in the canopy volume of trees results in a reduction in the number of benefits. Additionally, urban trees can have additional stressors and must be more actively managed to maintain those services. Selecting tree species for the right site can lead to greater benefits and longer-lived trees. Increasing diversity of urban trees can help to mitigate some of the threats facing urban forests, such as invasive pests and climate change. We surveyed Tree City USA designated cities across Oregon and Washington to explore how they are selecting tree species for their municipalities. Responses were recorded for 79 out of 151 municipalities for a 52.3% response rate. Both open-ended questions and descriptive statistics were used to triangulate how managers are selecting tree species. Emergent themes in open-ended responses indicate a variety of justifications for tree species selection and the challenges of balancing those criteria. There is evidence to suggest that these municipalities are actively diversifying the urban forest; however, there are still 10 municipalities that reported ash (*Fraxinus* spp.) in their top 5 most frequently planted species in 2016. Many municipalities are still planting large quantities of maple (*Acer* spp.). Overplanting certain genera and species can lead to an increase in susceptibility to pests and pathogens. We recommend an increase in consideration for the diversification of tree species in urban areas.

Keywords. Emerald Ash Borer; Tree Species Diversity; Tree Species Selection; Urban Forest Managers.