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CONTENTS

Abstract. Background: Emerald ash borer (EAB), *Agrilus planipennis*, is an invasive wood-boring beetle that threatens ash trees (*Fraxinus* spp.) in the urban forest. Methods: We compared the efficacy at which 3 different injection systems deliver emamectin benzoate (EB) to the leaf canopy and protect trees. Two of the systems, Arborjet Tree I.V.™ and Rainbow Ecoscience Q-Connect™, used sixteen ports/m of trunk circumference, whereas the third system, Brandt enTREE® EB, used eight. Results: The two systems with more injection ports provided more uniform delivery of insecticide to the leaf canopy. Although all 3 injection systems provided excellent control for the first 2 years, only the 16-port injection systems provided protection for up to 3 years. The number of injection ports affected insecticide delivery because the sectorial structure of the ash vascular system limited lateral product diffusion. Additionally, over the course of an 8-year study, we found trunk injections of EB made in the spring provided better control of EAB than fall injections. Protection afforded by a 2013 application in our study failed by 2016 as EAB populations reached their peak. A second application in 2016 extended protection past the peak of EAB abundance through 2019. Conclusions: We conclude that when the same dose of EB is delivered, efficacy of the application is influenced by the number of injection ports used in the injection system, time of application, and the status of the local EAB population. Arborists need to be aware of these factors when planning their EAB management program.

Keywords. *Agrilus planipennis*; Control Persistence; *Fraxinus americana*; Invasive Species; Large Trees.

Abstract. Studies assessing the effects of biochar used as a soil amendment in agriculture and forestry have indicated variable results, from significant improvements in growth and health to no effect at all. Research into biochar use for trees within the urban landscape is extremely limited. This review is aimed at arboricultural practitioners and professionals involved in urban tree landscape management and provides a critical analysis of the use of biochar to support tree health and establishment. Biochar, specifically wood biomass-based biochar, has the potential to enhance tree establishment and survival. However, considerable variability in the physical and chemical properties of biochar currently limits universal application. Therefore, practitioners should aim to use biochar types suitable for the desired function, such as transplant establishment, remediation of declining mature trees, and pest/disease management. Biochar also represents a promising complementary amendment to more established soil management techniques such as mulching and fertilization, but further long-term studies in a range of conditions typical of urban environments are required to fully understand the effects of specific biochar types on urban trees.

Keywords. Biomass; Root Growth; Soil Amendment; Soil Compaction; Tree Survival.

Abstract. Background: Urban tree growth may be reduced due to poor urban soil conditions. Soil management to alleviate poor urban soil conditions often includes organic amendments, fertilization, and/or tillage. A 3-year experiment was conducted in an urban landscape in Bolingbrook, Illinois, USA, to test whether an arboriculture treatment with biochar, fertilization, and tillage could improve soil quality and tree growth. Methods: The urban landscape included 75 street trees (*Gleditsia triacanthos*, *Ulmus parvifolia*, and *Acer rubrum*) growing in compacted, fine-textured soils. Results: The results of this experiment suggest that the arboricultural treatment of biochar, fertilization, and tillage (BFT) may improve soil quality and urban tree growth. Relative height growth was significantly greater ($P \leq 0.05$) for *Acer rubrum* trees with BFT treatment (+ 28.9%) compared to tillage alone (+ 13.3%). Total soil organic matter (SOM), particulate soil organic matter (POM), and a soil quality index (SQI) were significantly ($P \leq 0.05$) greater in the BFT treatment (total SOM = 6.00%, POM = 9.73%, and SQI = 70.2) compared to the tillage treatment (total SOM = 5.29%, POM = 7.23%, and SQI = 60.8). The SOM responses to the BFT treatment appear to be relatively short-lived but correlated with measures of tree growth. Conclusion: This arboricultural treatment of biochar, fertilization, and tillage has potential to be used to improve soil quality and promote growth for trees growing in compacted, fine-textured soils in suburban street tree landscapes.

Keywords. Soil Amendment; Soil Compaction; Soil Quality; Urban Soil.