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Abstract. Three types of indirect watering devices were compared to evaluate their performance and to determine their benefits to newly transplanted river birch (*Betula nigra*) trees grown in containers with well drained compost in a controlled greenhouse experiment. Two examples of each device type were used to water trees in this study: upright bags, ring bags, and open tubs. Watering device characteristics, including purchase cost, weight, capacity, and drainage times, were measured prior to installing the devices around the trees. Tree stem heights and calipers, along with leaf coverage and leaf water potential, were measured to determine any growth or water stress differences associated with watering treatments. There was substantial variation in costs and drainage times among watering devices, with ring bags being the least expensive and draining water completely during the drainage test. However, there was no evidence that watering devices benefited tree growth, leaf rating, or water stress in comparison with direct watering, with the possible exception of Treegator ring bags, which may have reduced water stress marginally. Although water release from some of the indirect watering devices was much slower than direct watering, water release from all of the devices was completed within ten hours, which is too rapid to reduce the frequency of watering in our experiment. The major benefits of these devices are slower release of water to the soil, with reduced operator time required, and more infiltration into the soil and root zone, which avoids the surface runoff caused by quick hose (direct) watering.

Key Words. *Betula nigra*; Greenhouse; Indirect Watering Device; Leaf Water Potential; River Birch; Slow-Release Watering Device; Transplanting; Tree Growth; Urban Landscape; Water Stress.

Abstract. Failure of a tree can be caused by a stem breakage, tree uprooting, or branch failure. While the pulling test is used for assessing the first two cases, there is no device-supported method to assess branch failure. A combination of the optical technique, pulling test, and deflection curve analysis could provide a device-supported tool for this kind of assessment. The aim of the work was to perform a structural analysis of branch response to static mechanical loading. The analyses were carried out by finite element simulations in ANSYS using beam tapered elements of elliptical cross-sections. The numerical analyses were verified by the pulling test combined with a sophisticated optical assessment of deflection evaluation. The Probabilistic Design System was used to find the parameters that influence branch mechanical response to loading considering the use of cantilever beam deflection for stability analysis. The difference in the branch's deflection between the simulation and the experiment is 0.5% to 26%. The high variability may be explained by the variable modulus of the elasticity of branches. The finite element (FE) sensitivity analysis showed a higher significance of geometry parameters (diameter, length, tapering, elliptical cross-section) than material properties (elastic moduli). The anchorage rotation was found to be significant, implying that this parameter may affect the outcome in mechanical analysis of branch behavior. The branch anchorage can influence the deflection of the whole branch, which should be considered in stability assessment.

Key Words. Arboriculture; Deflection Curve; Digital Image Correlation; Finite Element Analysis; Pulling Test.

Abstract. Street- and park-planted ash (*Fraxinus* spp.) trees infested with emerald ash borer (*Agrilus planipennis* Fairmaire) ranging in size from 30 to 55 cm (11.8 to 21.7 in) dbh and 10 to 20 m (32.8 to 65.6 feet) in height were measured over two sites. The first group was treated with an emamectin benzoate stem injection at 10 ml/2.54 cm dbh (0.4 g ai) in June 2014, and the second group was left as an untreated control. Chlorophyll concentration and fluorescence was measured to assess plant fitness and vitality over three summers. Trees treated with emamectin benzoate showed improvements in chlorophyll concentration and plant fitness and vitality over the course of the study with peak improvement occurring in the second year. The

untreated control trees showed continued signs of decline in each year of the study. This work demonstrates the utility of chlorophyll fluorescence for detecting plant stress related to forest health threats and could potentially inform managers on both short-term and long-term management options.

Key Words. *Agrilus planipennis*; Ash; Emerald Ash Borer; Chemical Control; Chlorophyll Fluorescence; Plant Fitness; Plant Vitality.

Abstract. Trees growing in the urban environment are often subject to a variety of edaphic stressors that can lead to premature decline. As a result, soil restoration methods are required. The scoop and dump (S&D) technique of soil remediation is the practice of incorporating large volumes of organic matter (33% v/v) into the soil profile. A controlled greenhouse experiment was conducted to determine if S&D soils affected growth of Weeping Fig (*Ficus benjamina* 'Evergreen') trees during establishment (fourteen weeks) and gas exchange during a twenty-six-day water deficit period. S&D soils displayed decreased mean bulk density, increased accumulative gravimetric water holding capacity, and increased mean organic matter compared to unamended soils. In the remediated soils, *Ficus benjamina* 'Evergreen' showed a significant increase in the growth of roots, shoots, and leaf area. The increased leaf area of trees in the S&D soils caused greater transpiration on a whole-plant basis. As a result, the increased water-holding capacity in S&D soils were utilized at a statistically equal rate as the trees in unamended soils. Trees growing in both soil treatments displayed statistically equal reductions in gas exchange during the water deficit period. This study finds that urban soils treated with the S&D technique significantly reduces root-limiting compaction and increases tree biomass growth.

Key Words. Bulk Density; Drought Stress; Evergreen Weeping Fig; Scoop & Dump; Soil Profile Rebuilding.