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Herbicide stress and flatheaded borer attacks in red maple cultivars

Red maple is a popular ornamental shade tree well known for its stunning autumn color and fast growth rate. It is also one of the most often grown deciduous trees in residential and commercial landscapes, parks, and public places in the United States and accounts for more than 34% of trees grown in US nurseries. The use of herbicide to control weeds or other undesirable vegetation is common practice in landscapes and nurseries. However, incidental spray drift or residual contamination make non-target plants vulnerable to different insect pests. Herbicide damage on the ornamental trees can be detrimental to their growth and development. The effects on the plants can be seen from the morphological to the molecular level when they are exposed to stress. They can act by inhibiting cell division, reducing photosynthetic activity, and causing oxidation of cell membranes by reactive oxygen species (ROS) resulting in poor growth and development. A preliminary study demonstrated that flatheaded borer attacks were induced by herbicide stress on 'Brandywine' red maple trees. Flatheaded borer is considered the most damaging insect pest in red maple production. Borer infestations are most common on stressed and recently transplanted trees during production. Plants respond to herbicide stress in several ways that include accumulation of antioxidant activity to scavenge ROS, stomatal closure to minimize transpiration, changes in the molecular level, and several other means. The morphological, physiological, and biochemical changes that plants make in response to chemical stress either reduce their exposure to stress, limit damage, or aid in the recovery of damaged systems. In this study, we measured different biochemical attributes, including photosynthetic pigments, polyphenols, and enzyme activity, to determine how different cultivars respond to herbicide stress. We also attempt to correlate cultivar characteristics with borer resistance in field conditions. Four different maple cultivars were treated with herbicides on one side of the canopy, and leaf samples were collected for analysis of these biochemical attributes. From our study, we found that red maple cultivars showed different responses to herbicide stress in terms of different biochemical attributes. However, no correlations between red maple cultivar and borer attacks were observed in the first year of an associated herbicide field study.