

Pendimethalin phytotoxicity and leaching in container media and field soil

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Weed management in container nursery production relies primarily on hand weeding and preemergence herbicide application. Dinitroaniline herbicides are commonly-applied to container-grown plants for preemergence weed control. Previous research has shown these herbicides can affect root development of container-grown nursery crops.

Container trials were conducted to determine the importance of leaf versus root uptake of pendimethalin by azalea. The emulsifiable concentrate form of pendimethalin was applied at 3.34 kg ai/ha to 'Tradition' azalea shoots, the growing medium (pine bark), or shoots plus the growing medium. Initial plant height and root volume were recorded. Plant height was recorded 2, 4 and 8 weeks after treatment (WAT). Azalea root and shoot growth was evaluated at 4 and 8 WAT. After 4 WAT, azalea height in shoot-only and shoot plus growing medium exposure treatments increased by 17% and 25%, respectively, while height in growing-medium only exposure and in the untreated control increased by 34%. All treatments reduced azalea shoot fresh weight when compared to the untreated control. At 4 WAT, azalea root development in the shoot only exposure was similar to that seen in the untreated plants, while root growth was reduced in the growing medium and growing medium plus shoot exposures.

Experiments were conducted to evaluate depth of pendimethalin movement in container media and field soil at two different irrigation volumes, as indicated by a large crabgrass bioassay. Soil columns were constructed from polyvinyl chloride pipe, with a 5 cm internal diameter and a 35 cm length. A Tetotum silt loam soil was compared to 100% pine bark. An emulsifiable concentrate form of pendimethalin was applied at 3.4 kg ai/ha. Media in the soil columns were separated into 0 to 3 cm, 3 to 6 cm, 6 to 9 cm, 9 to 12 cm, 12 to 18, and 18 to 24 cm depths after completion of the simulated irrigation events and seeded with large crabgrass. Large crabgrass root weight and root length were recorded 2 weeks later. After 18 cm of irrigation, pendimethalin leached into the 6 to 9 cm depth in pine bark, while the silt loam field soil displayed no detectable herbicide movement past the 0 to 3 cm depth. Doubling the irrigation volume did not increase the depth to which pendimethalin leached in pine bark or field soil. Large crabgrass root weights significantly increased as pine bark depth increased from the 0 to 3 cm, 3 to 6 cm, 6 to 9 cm and 9 to 12 cm depths, indicating most of the herbicide remained near the medium surface. There was no significant difference in large crabgrass root weights among the 9 to 12 cm, 12 to 18 cm and 18 to 24 cm depths in pine bark. By mass, approximately one half of the particle size of pine bark was 2 mm or greater, while none of the field soil particles were 2 mm or greater. Pine bark had a drastically greater volume of air space (41%) compared to the silt loam soil (4%). The bulk density of pine bark was much less than that of field soil, while water percolation rates were much higher for pine bark than field soil.

Sprayed applications of pendimethalin can directly reduce azalea shoot growth, while exposure of root systems to pendimethalin results in reduced root growth. Root suppression is due to pendimethalin leaching into the 6 to 9 cm zone below the pine bark surface. Pendimethalin moves downward in pine bark much more readily than in field soil as

pendimethalin did not leach below 3 cm in field soil.. The differences in physical properties between pine bark and field soil may account for the greater leaching depth in a soil-less growing medium. The greater leaching in pine bark is probably due to the higher percolation rate and higher amount of air space in this growing medium compared to field soil. Growers need to ensure adequate root development prior to application of a dinitroaniline herbicide to containers.