FY2005 MDA Horticulture Fund Final Report
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Phytoremediation of Nursery Runoff Water Using Ornamental Plants

R.T. Fernandez, B.M Cregg, D.B. Rowe, Department of Horticulture, MSU

Eighteen small nursery beds (10 ft x 20 ft) were developed using 6 mil plastic covered with a woven landscape fabric as the production surface. The beds were oriented east to west on the long axis. The beds were graded to drain to the center of the beds and toward the western end. This allowed collection of runoff water from

Graduate student Aaron Warsaw and undergraduate assistant Nicole Haut take water samples to determine effectiveness of metalaxyl phytoremediation

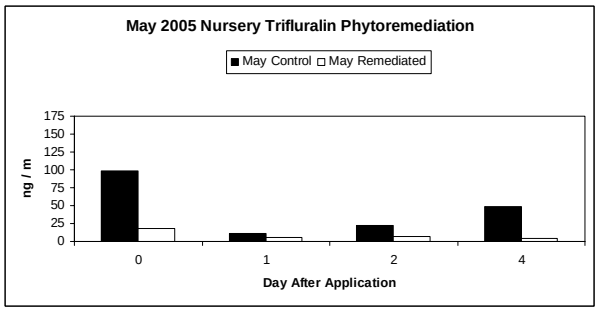
each bed at this point. Immediately after the western end of the beds, an aquatic plant production area was

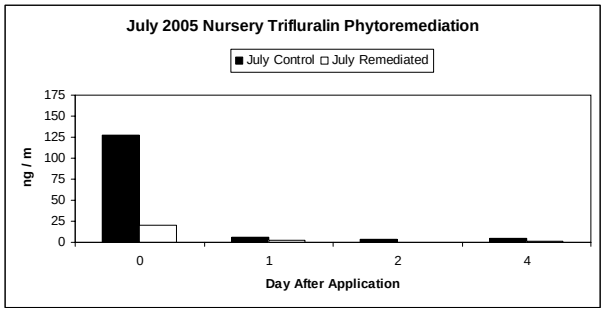
established as a runoff remediation area. Runoff water from the beds was channeled through the aquatic plant production area. Four replicates of 20 plants or a control with no plants were used in remediation area. Plants used were *Salix alba* ‘Britzensis’ and *Sambucus nigra* ‘Aurea’ in 3 gallon containers with an 85% pine bark, 15% peat moss potting substrate. Plants used in the remediation area should be suitable for sale after use as filters. A mixture of plants in 2, 3 and 5 gallon pots were in the nursery beds with the same number and size of each plant in each bed so that all beds were similar. Plants were spaced 1 foot apart on center in the beds.

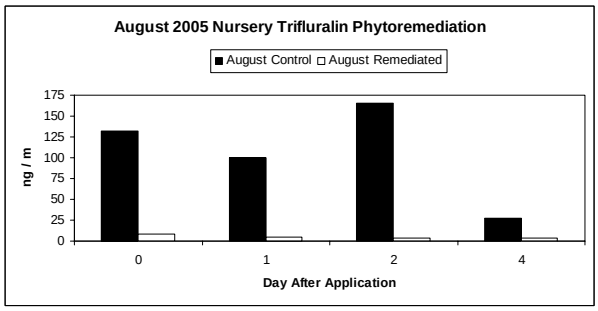
Snapshot TG was applied in late May, mid July and late August 2005, plants were fertilized with a controlled release fertilizer at the beginning of May 2005. Approximately 1 hour after herbicide application, irrigation was applied for 40 minutes to provide 1 inch. Runoff water was sampled from the ends of the beds and from the reservoirs and volume of flow determined. Samples were taken on the day of application, one, two and four days after application (0, 1, 2, and 4DAA). Water samples were analyzed by high performance liquid chromatography. Runoff water concentrations of trifluralin (from Snapshot) and

nitrate (from controlled release fertilizer) are shown below.

The black bars in the Trifluralin Phytoremediation graphs represent trifluralin concentration (ng ml^{-1}) in runoff water leaving the nursery beds, the white bars represent trifluralin concentration in runoff water leaving the remediation beds.



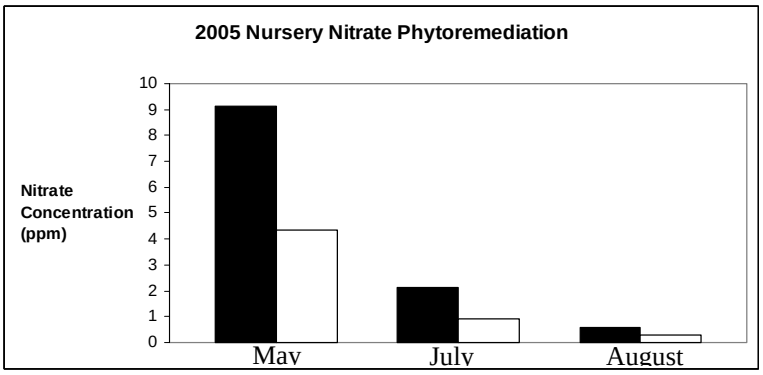




Trifluralin concentration was reduced by 82%, 85% and 94% in runoff water by the remediation beds on the day of application for the May, July and August runs, respectively. Additionally, trifluralin was lower in runoff water leaving the remediation beds compared to the water leaving the nursery beds for most days measured in all three months measurements were taken.

Nitrate was determined from water samples from one day of each period that herbicide was analyzed. Nitrates were

reduced by more than 50% as water moved through the remediation beds for all dates analyzed. The black bars on the graph below represent nitrate concentrations of runoff water leaving the beds, the white bars are nitrate concentrations in runoff leaving the remediation reservoirs.



Continuing funding was received for this project from MDA for analysis of metalaxyl and nitrate for FY2006. The first water samples for metalaxyl were collected the week of July 10, 2006. The second replication of metalaxyl samples are being collected this week (July 31, 2006) and a third replication will be taken toward the end of August, 2006. Concentration and quantity of metalaxyl and nitrate will be determined from the water samples.

Several factors probably contributed to the reduction of the herbicides as they moved through the reservoirs. Initially the water in the reservoirs had no herbicide, so part of the effect was dilution. The reservoirs also slowed down the movement of runoff water and allowed time for phytolysis (break down by light), hydrolysis (break down by

water) and volatilization (conversion of herbicide to gas). Plants in the reservoir were in an organic substrate, 85% pine bark, 15% peat, and organic matter strongly binds most herbicides. Plants are known to absorb herbicides. The reservoirs had been established for approximately 1 month before treatment and microorganisms were present. All of these mechanisms could have contributed to the reductions found in the herbicides and nitrates as the water moved through the reservoirs. Research next year will be conducted to determine remediation effectiveness for metalaxyl, a very soluble fungicide that has been found in high concentrations in runoff water.