Phytoremediation of Pesticide Wastes in Soil

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Soils at agrochemical dealer sites often are contaminated with pesticide residues from decades of accidental and incidental spillage. We have determined that prairie grasses native to the Midwestern U.S. are suitable for phytoremediation because they are tolerant of most herbicides and of climatic extremes, such as heat, cold, drought, and flooding. A mixed stand of big bluestem, switch grass, and yellow indiangrass develops a rhizosphere with microflora that can readily detoxify pesticide residues. Specific atrazine-degrading bacteria or the free enzyme atrazine chlorohydrolase also can enhance the rate of biotransformation of atrazine in soil. Metolachlor degradation can be accelerated significantly by the prairie grass/rhizosphere effect. Several grasses used in filter strips have also been evaluated for their pesticide-degradation capabilities. The prairie grasses also have been demonstrated to reduce the rates of leaching of pesticides through intact soil columns, since less water leaches out of vegetated soil columns compared to non-vegetated soil columns. The evaluation of the degree of success of remediation has relied heavily on chemical residue analysis, but recent studies on biological endpoints have shown promise for providing more ecologically relevant indications of the potential exposure of organisms to pesticides in the soil. Earthworm 8-day bioaccumulation assays and root growth assays have shown the value of assessing the bioavailability of the residues. Mass balance experiments have utilized radiolabeled atrazine and metolachlor to ascertain the complete metabolism and binding profile of those two pesticides in phytoremediation studies.

Key words: Phytoremediation, Pesticides, Bioaugmentation