

## 2007 MICHIGAN TURFGRASS FOUNDATION

### PROPOSAL TITLE: ORGANIC CONTROL OF BROADLEAF WEEDS

#### **PRINCIPAL INVESTIGATOR:**

Name: Dr. Suzanne Lang  
E-mail: [langsu@msu.edu](mailto:langsu@msu.edu)  
Department of Horticulture Science

#### **TECHNICAL SUPPORT:**

Name: Ms. Tara Valentino  
E-mail: [paranick@msu.edu](mailto:paranick@msu.edu)  
Department of Horticulture Science

#### **COOPERATORS:**

Name: Mr. Ron Calhoun  
E-mail: [calhoun@msu.edu](mailto:calhoun@msu.edu)  
Department of Crop and Soil Science

Name: Dr. John Rogers  
E-mail: [rogersj@msu.edu](mailto:rogersj@msu.edu)  
Department of Crop and Soil Science

#### **JUSTIFICATION:**

Leaf burning was used for disposal of leaf litter and other yard waste across the US until passage of the Clean Air Act in 1970. Municipalities then initiated programs to dispose of leaf litter in public landfills. However, the magnitude of the amount of plant material contributing to solid waste was soon apparent. Prior to 1994, plant waste was estimated to account for ca. 20-25% of Michigan's throw away trash placed in landfills. Plant waste was banned from Michigan landfills with the passage of the Federal Solid Waste Management Act in 1995.

Recycling alternatives were investigated and some municipalities initiated leaf litter collection for redistribution onto agriculturally managed land. Not only did these programs aid communities in the disposal of leaf litter, they significantly improved soil structure, fertility, and moisture holding capacity of the fields to which they were applied. However, the collection and redistribution of leaf litter in many locations became a burdensome expense for taxpayers. The costs of these recycling programs were prohibitive. Although the advantages in applying leaf litter to agricultural lands was obvious, it was clear that alternatives were clearly needed. Leaf litter remained a huge problem for many cities, towns and golf courses. Use of leaf litter as an onsite mulch was then considered.

Due to possible alleopathic properties of some plant tissue, the application of plant residues to newly planted or established lawns and gardens was a concern. Nikolai and Rieke (1999) showed that deciduous leaf-litter could be used as mulch with no apparent deleterious effects to *established* turfgrass canopies as quantified by turfgrass quality ratings, C/N ratio and soil samples. Serendipitously, turfgrass treated with maple mulch had developed fewer weeds than the plots treated with oak leaf mulch or plots that received no leaf mulch (controls). Thus, maple leaf mulch appeared to have potential as an organic herbicide. In 2004 and 2005 additional work (Kowalewski, 2006) investigated use of red maple, silver maple, sugar maple and red oak as leaf mulch applied at particle sizes that ranged from 1.3 to 6.4 cm<sup>2</sup> at rates of 0.5 and 1.5 1.5-kg m<sup>-2</sup>. Results from this work suggest that fall maple tree leaf application can provide 81% control of dandelion. **We submit if the effective broadleaf herbicide activity of maple leaf litter can be enhanced to near 100% control, it could be developed into a product that would have potential use in turfgrass management and many additional markets.**

The success of other organically based turfgrass and garden products, which have limited herbicidal activity, illustrates the potential benefits of using maple leaf litter as an organic broadleaf herbicide. Work at Iowa State University, has shown that processed corn meal (corn gluten meal) exclusively inhibits the formation of monocotyledonous weeds roots at germination (Christians,



dicamba) will be applied to the experimental area 45 and 28 days prior to application of mulch treatments to eliminate established dandelion plants. Sunlight penetration of the turfgrass canopy and open soil surfaces are crucial to weed seed germination. In an effort to facilitate weed seed germination, mowing height will be reduced from 3 in. to 1 in. and plots will be thinned with a vertical flailing knife unit immediately prior to application of dandelion seed (V&J Farms, Woodstock, Ill.). Clippings and thatch will be removed and soil samples will be taken at a depth of 0-4 in. Dandelion seed will be applied to the plots (238 seeds/ft<sup>2</sup>) to establish a population of broadleaf weeds. The timing of sowing dandelion seeds will coincide with autumn soil temperatures between 55-65°F at a 0-2 in. depth. Application of four maple leaf species/cultivar treatments will be applied at rates of 0.5kg m<sup>-1</sup> and 1.5kg m<sup>-1</sup>, and at two particle sizes where medium = particle size resulting from vacuum mulch with Popular Blower/Vac; and fine = vacuum mulched, then re-mulched with Mighty Mac Mulcher [1/2 in screen]. Controls will consist of non-maple leaf mulch applied (Oak, *Quercus*), an inert cellulose mulch (blank newsprint), and no leaves applied. Treatments will be evaluated based on broadleaf weed control (number of broadleaf weeds per plot), and turf quality (turf density, color, leaf reflectance, and surface hardness), C/N ratio, as well as turfgrass foliar and soil samples to quantify nutrient availability and uptake in response to mulch treatments. Field experiments will be replicated over three years with additional maple mulch applications to investigate the effect of single versus sequential applications on broadleaf weed control. Analysis of protein content in leaf litter mulch will be determined to quantify N that may be available from mulch application and therefore influence nutrient management in sustainable turfgrass systems.

**POTENTIAL IMPACT ON TURFGRASS INDUSTRIES:** Public awareness of chemical applications to turfgrass has increased in recent years. This has led to the perception of excessive application of synthetic chemicals in managed turfgrass systems. This research can identify the potential use of a natural, organic herbicide for the control of broadleaf weeds. The clear benefits of this research to linkages involving better environmental stewardship and sustainability will enhance potential intramural grant awards from national funding sources after patents can be secured. Sales of this organic herbicide would have the potential to reach a national market. Thus, once application protocols for maple leaf mulch can be established and verified; subsequent research funding would be sought from Federal competitive grants to identify the chemical structure of the active compound responsible for herbicide activity.

The proposed research could provide the information for use of maple leaf litter as an effective organic herbicide. National distribution and sales of this product could provide economic return for sugar maple orchards, municipalities that have abundant sources of maple litter within the state of Michigan and turfgrass managers who have maple leaf litter that could be mulched.

#### **TIME LINE:**

##### **YEAR ONE (2007) EXPERIMENTS**

- April Turfgrass prepared at Hancock Turfgrass Research Center for planting;
- May – August Field experiments – Year 1
- September – October Post-emergence Experiments;  
Greenhouse-based Whole Plant Growth
- November – December Data Analysis.

## **YEAR TWO (2008) EXPERIMENTS**

- January Project GREEN funding sought;
- May – October Replication of Controlled Environment and Field Experiments
- November - December Data Analysis; Patent Investigation

## **YEAR THREE (2009) EXPERIMENTS**

- January Continuing Project GREEN funding sought;
- May – October Replication of Field Experiments
- November - December Data Analysis; Patent application process initiated; Extramural funding sought.

## **FUNDING HISTORY:**

MSU Office of Intellectual Properties - \$20,000 FY-03

Michigan Turfgrass Foundation - \$10,000 FY-04

## **LITERATURE CITED:**

Beard, J.B. 1973. *Turfgrass: Science and Culture*. Prentice-Hall, Inc. Englewood Cliffs, N.J.

Christians, N. 1993. A natural product for the control of annual weeds. *Golf Course Management*. Oct. pg 74-76.

Hardebeck, G. and Z. Reicher. 2000. Mulching tree leaves: an alternative to disposal. *Grounds Maintenance*. August. 35:C18, C20, C22.

Kowalewski, A.R. 2006 Organically Derived Weed Control Methods. MS Thesis, MSU. (*in press*)

Nikolai, T.A. and P.E. Rieke. 1999. The role of turfgrass in leaf litter disposal. *Crop Science*. 91:132.

Rice, E.L. 1995. *Biological Control of Weeds and Plant Diseases: Advances in Applied Allelopathy*. University of Oklahoma Press: Norman and London.

## PROJECT BUDGET

**Project Title: Organic Control of Broadleaf Weeds**

**Project Principal Investigator: Suzanne Lang**

### MTF Funds Requested

Budget Item	FY-07	FY-08	FY-09	Non-MTF funds*
<b>A. Personnel Wages</b>				
A1. Research associates & post-docs	5,000	5,000	5,000	
A2. Other professionals				
A3. Secretarial & clerical				
A4. Technical, shop & other				
<b>B. Fringe. Fringe Benefits (Must be charged as direct costs.) See below** (Calculated as 51.8%)</b>	2,590	2,590	2,590	
A5. Undergraduate students – no fringes	500	1,000	1,000	
A6. Graduate students – including associated fringes	0	0	0	20,000 MSU-OIP(2003) 24,453 GREENEEN - Basic Research (2006)
<b>C. Total Personnel Costs (A+B=C)</b>	8,090	8,590		
<b>D. Nonexpendable equipment (Attach explanation if any item exceeds \$5,000.)</b>	0	0	0	
<b>E. Materials &amp; Supplies</b>	1,000	500	500	
<b>F. Travel</b>	500	500	500	
<b>G. Publication</b>	410	410	410	
<b>H. Other Direct</b>	0	0	0	
<b>TOTAL</b>	10,000	10,000	10,000	

\* Identify both sources and amounts of non-MTF funds.

\*\* Fringe rate for MAES and MSUE personnel use fringe rates from MSU Contracts and Grants website.