a significant decline from the average concentrations observed for the high N rate from 2000 through 2003. This research indicates that leaching potential from continually fertilized turfgrass sites changes due to the age of turfgrass and nitrogen rate. In addition to Michigan Turfgrass Foundation funding, this research has been funded by the United States Golf Association since 1998.

North Central Region Creeping Bentgrass Evaluation

Dr. Kevin W. Frank, Jeff Bryan, and Aaron Hathaway

Ten universities from the North Central Region initiated a creeping bentgrass putting green and fairway evaluation trial in the autumn of 2008. The research objectives were to 1) Determine the susceptibility of creeping bentgrass cultivars to dollar spot; 2) Determine the suitability of creeping bentgrass cultivars under putting green and fairway conditions when fungicide applications are scheduled based on threshold level of dollar spot incidence. Each cultivar was seeded in Sept. 2008 at 1 lb./1000 $ft.^2$. The site was fertilized at 1 lb P/1000 $ft.^2$ at the time of seeding using a 1-2-1 fertilizer. Each site received 0.5 lb N/1000 $ft.^2$ biweekly during the remaining growing season in 2008. Beginning in the spring of 2009, the turfgrasses received different fungicide treatments. The fungicide treatments are an untreated control and a fungicide program consisting of Emerald (0.18 oz product/1,000 $ft.^2$) + Daconil Ultrex (3.2 oz product/1000 $ft.^2$). The fungicide mix is applied preventively in May or June at first sign of dollar spot infection centers in all replications of application susceptible cultivar, Crenshaw. Thereafter dollar spot suppression will be conducted curatively when Crenshaw plots have ≥ 20% of dollar spot on the putting green.

Long-term Management of Japanese Beetle Grubs on Golf Courses and Home Lawns

Dr. David Smitley and Terry Davis

Recent research by Smitley that was supported by MTF and Project GREEEN led to the release of a pathogen which helps to suppress populations of Japanese beetles. A protozoan (*Ovavesicula popilliae*) known to infect Japanese beetles and no other insects or animals was found to be present in Connecticut and absent from Michigan. The protozoan pathogen was introduced into research plots at three golf courses in Southern Michigan. Six years after introduction of *Ovavesicula*, we documented a 55% reduction in Japanese grubs along with a significant reduction in egg production. Overall impact provides an average population reduction of 64% per year due to *Ovavesicula*. The natural spread of the protozoan is slow, so to speed up the process Smitley has held Biocontrol field days where golf course superintendents and Michigan residents can pick-up Japanese beetles infected with the protozoan to take back to their own course or lawn. Long-term research (from 1999 to 2008) supported by MTF documented the spread of the introduced pathogen and declines of Japanese beetle where it became established.

Objectives:
(1) Hold biocontrol field days at three locations in Michigan to facilitate distribution of the pathogen throughout Michigan, wherever Japanese beetle has been found.

Pesticide Application Risk Reduction Technology for Golf Course and Athletic Field Turfgrass Using Treated Sand Topdressing Technology

Dr. J.M. Vargas, Jr., Ron Detweiler, and Nancy Dykema

Research at M.S.U. suggests that it may be possible to combine the routine golf course maintenance operations of sand topdressing and pesticide application into one efficient operation, using a combination sprayer/topdresser machine. This novel technology should reduce the cost, play disruption, and the environmental impact (fuel use, CO2 emissions) of these maintenance operations by reducing the number of trips over the turf, especially greens and tees. The potential for operator and bystander exposure to spray drift and volatilization should also be reduced, since the sprays will be applied to the sand in a wind-protected environment on the topdresser, prior to expulsion of the sand to the turf. "Proof of concept" research is underway for the control of turfgrass diseases such as dollar spot and anthracnose, and to expand the utility of this technology beyond fungicides, to fertilizers and other sprayable turfgrass maintenance products

Optimizing the Efficacy and Environmental Fitness of a Commercial *Pseudomonas* Bacterial Biocontrol Product for the Control of Turfgrass Disease

Liewei Yan and Dr. J. M. Vargas Jr.

Dollar spot caused by *Rutstroemia floccosum syn. Sclerotinia homoeocarpa* F. T. Bennet, is the most costly disease on golf courses. This pathogen is becoming resistant to many different fungicide chemical classes thus increasing the need for development of a sound biocontrol alternative to chemical fungicides. A fungicide/antibiotic-producing bacterial strain of *Pseudomonas aureofaciens* Tx-1 (Tx-1) has been commercialized for golf course use with some success in recent years. To achieve adequate control it must be applied daily. This may be partially explained by UV susceptibility of Tx-1, which is a common limitation of biocontrol agents. Results from various wavelengths of ultraviolet radiation (A, B, C) exposure tests showed a significant drop in Tx-1 survivors following increased dosage. Protection with a promising sunscreen was demonstrated in all UV exposure tests. Addition of this sunscreen to Tx-1 cultures provided statistically significant improvement in UV-B tolerance compared to Tx-1 alone. In an attempt to identify the most UV-resistant individual cells, Tx-1 was exposed to intensive UV light (UV-C) for various lengths of time (*in vitro*). Cells (10TC30) with significantly improved survival rate after 7 J/m^2 UV-C irradiation was found followed by 10 cycles of 30 seconds of UVC exposure. Results from bioassays against *R. floccosum* showed the production of antibiotics efficacious did not change after UV exposures. Field data of dollar spot studies