

APPENDIX G

ANNUAL REPORT: TURFGRASS APPROPRIATION 2003-2004

Center for Turfgrass Environmental Research and Education
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The turfgrass industry is one of the most important economic sectors in North Carolina. Based on 1999 data, an economic survey by the North Carolina Department of Agriculture and Consumer Services estimated the economic impact to be 4.7 billion dollars. Turfgrass acreage in the state is increasing 4.3 percent annually, so the economic value in 2004 would be considerably higher.

Despite its economic success, the turfgrass industry is facing major problems. Turf species are not native vegetation in the southeastern U.S. Without continuous management, it is not possible to maintain turfgrass systems and prevent intrusion of natural vegetative succession. Historically, maintenance of turfgrass systems has relied upon significant inputs of fertilizers and pesticides. There is widespread public concern that turfgrass management is adversely affecting human health and water quality.

In 2001, the General Assembly of North Carolina established a yearly appropriation of \$600,000 for turfgrass research. The purpose of the research is: 1) to develop new, environmentally sound management approaches for turfgrass systems that will allow the industry to grow and remain economically sound, and 2) to develop and implement advanced outreach programs to inform the turfgrass industry and the public about research results and new management strategies.

The current, continuing appropriations are an extension of support for turfgrass research by the N.C. Legislature. Special appropriations, targeted at resolving specific environmental issues, have been passed on a yearly basis since 1998. And in 2004, the U.S. Congress established an annual appropriation of \$100,000 to supplement funding by the State. The financial support from government sources reflects the growing economic importance of the industry and recognition that management of turfgrasses in home lawns and recreational areas impacts virtually every citizen.

The turfgrass research appropriations are administered by the Center for Turfgrass Environmental Research and Education. The Center establishes research guidelines and solicits proposals from faculty at N.C. State and North Carolina Agricultural and Technical State University. The proposals are reviewed by a Board of Advisors made up of representatives from six major sectors in the turfgrass industry and from N.C. State and N.C. A&T.

For the 2003-2004 budgetary year, the state appropriation was reduced to \$540,000 because of budget cuts. Fifteen proposals were approved for funding. A brief overview of funding allocations to specific research areas and some highlights are included below.

Additional proposals were accepted in the spring of 2004 for funding during the 2004-2005 fiscal year. The proposals were peer reviewed by scientists at other research universities and

by the Board of Advisors. A research symposium was held in May 2004 on N.C. State Centennial Campus to allow individual research faculty to present their proposed work and answer questions raised by other faculty and the Board. Soon afterward, it was decided by the Board that 13 research projects and two outreach proposals would be funded. Those funding allocations and research progress will be detailed in next year's report.

Project Areas and Funding for 2003-2004:

Alternative strategies for pest control. \$132,000. Numerous pesticides currently used in turfgrass management are suspected of being problematic for human health and the environment, and are being phased out by EPA regulation. Several turfgrass research projects are focused on developing alternative methods of insect and disease control that reduce or eliminate chemical applications.

Research on insect control is investigating the use of biological agents, with a focus on the efficacy of different pathogen strains. New information regarding the impact of soil and air temperature, pheromone and light trap catches, and soil moisture on pest forecasting have allowed development of newer, more environmentally sound pesticide programs. Research has also shown that cultural practices influence insect populations and can render them more susceptible to alternate control strategies.

A new, exciting project is developing an internet-based system for prediction of turfgrass disease development based on observed and forecasted weather data. The system will lead to lower pesticide applications by targeting fungicide applications during times when conditions favor disease infestations. The interdisciplinary group of scientists includes faculty from the Departments of Plant Pathology and the Marine, Earth, and Atmospheric Sciences. Considerable progress has been made in the past year and a prediction model is being tested.

The Turfgrass Pathology program is working to describe a new fungal disease, which has caused widespread problems in recreational turfgrass across the Southeastern United States since 2002. Through a combination of laboratory and field research, effective methods for diagnosis and control of this disease have been developed. Research is ongoing to identify the source of the pathogen and develop integrated, cost-effective programs for prevention that have minimal chemical inputs.

Fate of Nitrogen and Pesticides in the Environment. \$171,000. Water quality continues to be a major concern in North Carolina. The purpose of these research projects is to determine the extent of surface and groundwater pollution associated with turfgrass systems, and if pollution is occurring, design management approaches to minimize the problem. Studies of nutrient and pesticide fate in turfgrass systems are in place throughout the state.

The initial phases of the nutrient research examined the fate of nitrogen applied to golf courses and sod farms in different regions of North Carolina. Special attention was given to the Neuse and Cape Fear River basins, where persistent water quality problems have occurred. Using exacting methodologies, interdisciplinary research groups have found solid evidence that well-managed turfgrass systems on golf courses do not lead to contamination of water supplies in the eastern part of the state. The experiments with sod farms are underway and results will be available in the next year.

A new project is evaluating factors controlling the maximum rate of sewage effluent that can be applied to turfgrass and maintain efficient pollutant filtering. New environmental policies

by EPA and the DENR are requiring that increases in effluent generated by waste treatment facilities are applied to the landscape. Recreational turf (parks, athletic fields, golf courses) is where most irrigated acreage can be found. Compacted soil, soil texture, seasonal dormancy cycles, and potential evaporation all limit the capacity of turfgrass systems for hydraulic loading, and all influence the ability of turf to 'filter' the pollutants nitrogen and phosphorus. Basic research is underway that will result in models that be used by professionals in the field to manage effluent dispersal in an environmentally sound manner.

Additional experiments being conducted by research faculty from Crop Science, Soil Science and Toxicology are examining pesticide run-off and downward movement in soil profiles using radio-isotope tracer and advanced residue detection techniques. The results indicate that pesticide breakdown during summer months is more rapid beneath established turfgrasses than in agronomic conditions, evidently due to extremely high microbial activity in the root zone. The results also show that pesticide residues can be more persistent in winter months, an observation leading to important modifications in pesticide application recommendations. Current research projects are examining microbial ecology, factors governing rates of reactions, and interactions with climate variables.

Adapted Varieties. \$120,000. It has been recognized for many years that development of improved, adapted varieties of turfgrass is a key strategy to increase stress and disease tolerance and to reduce the need for pesticides and nutrients. A large, comprehensive field project is underway in this important area. Turfgrass faculty at N.C. State are part of the 'National Turfgrass Evaluation Program' (NTEP) in which the performance of turf species and varieties are assessed in different regions of the U.S. In addition to the NTEP Program, evaluations of different cool and warm season grass varieties are being made in large-scale plots throughout the state. New varieties generated by plant breeders are continually added to the evaluation programs each year. The evaluations are done monthly and include stress tolerance and sensitivity to insects and diseases. Results are combined in local and national data-bases to allow up to date recommendations.

A second approach in the development of adapted varieties uses molecular biology and breeding techniques. Several projects are moving forward: 1) the development of strong, constitutive gene promoters and transformation techniques. Transformation of grasses is difficult but substantial progress is being made. 2) Insertion of disease resistant genes into cool and warm season grasses. An initial focus is on engineering of tall fescue for brown patch and gray leaf spot resistance. 3) Development of cold tolerant and finer textured St. Augustine grass. This species can become a more important turfgrass for the southern and eastern parts of the state, if the improvements can be successfully implemented.

Outreach. \$91,000. State of the art, electronic communication systems are being developed for disseminating educational material on best management practices and the latest research results on environmentally sound management strategies. Through interactive programs, industry professionals and the public will have real-time access to information on grassy and broadleaf weed identification as well as cultivar selection for particular sites, identification of turfgrass diseases, insects, and weeds, along with appropriate pest management solutions. A decision aid model will allow cost comparisons within environmentally acceptable management options.

Extension faculty from N.C. State and N.C. A&T have assembled a new turfgrass management training manual and accompanying set of PowerPoint presentations that describe best management practices. The material is being distributed to extension agents and master gardener programs throughout the state. This educational tool was created so that extension agents could

train people in their home county to make environmentally responsible management decisions and to become certified turfgrass professionals.

New Environmental Research Site. \$26,000. On location, field experiments are required for understanding large-scale turfgrass/environment interactions. Many important questions, however, can only be answered in more controlled settings, where defined management treatments are sustained over many years and permanent sampling equipment can be utilized. A new turfgrass field laboratory is being established at N.C. State University for long-term environmental studies. Over the next several years, a portion of the appropriated funds will be used for construction of experimental plots with specialized instrumentation that will provide a state of the art research infrastructure.

Research projects at the turfgrass field site include key studies on nutrient and pesticide leaching and pesticide degradation patterns. In-ground lysimeters are being installed for direct, continuous sampling of soil solution at various profile depths. A computer controlled irrigation system will allow establishment of drought treatments, and an extensive network of soil moisture probes will allow monitoring of plant water availability during periods of soil drying, and assessment of water uptake efficiencies in different soil zones by different turfgrass species. Such information is essential for identifying grasses that can withstand the drought conditions currently plaguing the South.

The new research field laboratory will be an important part of the turfgrass teaching and outreach programs. Graduate student projects will be located there, and the laboratory will allow undergraduate students to be exposed to advanced turfgrass research projects. As the primary site for field days and workshops, the laboratory also will showcase research projects to the turfgrass industry and the public.