

A Blended Learning Program for Golf Course Water Conservation

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Abstract

In collaboration with the Golf Course Superintendents Association of America (GCSAA), a new concept in training golf course superintendents was developed. This program is unique for GCSAA, in that, it was designed as a “blended learning” experience that assists the practitioner in development of a water conservation plan site-specific to their golf course. The University of Georgia turfgrass faculty was responsible for development of sound scientific-based educational resources and the responsibilities of GCSAA were to market the program to its clientele. The first phase of the “blended learning” program was the development and launch of an on-line course, to provide introductory level information on **W**ater and how it is impacted by **A**tmospheric factors, uptake and use by the **T**urfgrass plant, impact of **E**daphic or soil factors, and the **R**elationship of the soil / plant / atmosphere continuum, the title of the course was **W.A.T.E.R.** The second phase of this program was a workshop conducted by Drs. Carrow, Duncan, and Waltz, with hands-on development of a water conservation plan. The superintendents will have instruction and access to templates they can modify and implement to accommodate the nuances of their locale. The program will conclude with a 60-day access to instructors through a GCSAA maintained list-serve for final refinement of individual plans. The deliverables of this program were development of written plans to be followed for water conservation on individual golf courses. Within the first two

weeks of launching the on-line phase, registrants included superintendents from 20 states and 7 counties.

Introduction

A mission of many university systems is to disseminate useful, practical, and scientific-based information to its clientele. As society struggles with issues related to water management and conservation, it is these stakeholders who will look to Cooperative Extension Service and Experiment Station personnel for guidance, recommendations, and solutions. Informational packages must be developed for an increasingly educated, web adept audience with demands for high levels of educational programs. To meet these expectations, novel modes of information delivery and packaging must be employed.

Tenets for the implementation of water conservation practices are to present in-depth informational packages of scientific principles with specific, practical applications to all individuals involved with water management (i.e., elected officials, municipal authorities, regulatory agents, on-site water managers, and the general public). While educating all involved is critical, improving the practitioner's awareness of water conservation practices coupled with implementation on their site are where the most immediate and long-lasting effects can be realized. Site specific practices are developed using a template of BMPs that is holistic, comprehensive, and science based.

Without accounting for the many environmental, ecological, and economic benefits of turfgrass systems, some special interest groups and municipalities have targeted turfgrass and golf courses as initial areas for water restrictions or bans. In an effort to improve water use efficiency and the industry's image, a partnership between The University of Georgia (UGA) Extension and Research faculty, and the Golf Course Superintendents Association of America (GCSAA) was initiated in 2003. The objectives of this collaboration were to generate and disseminate educational packages focused on turfgrass water conservation practices. These packages were marketed to golf course superintendents, who are often well-educated managers who have been placed in charge of a golf facility's water resources.

The Program

Upon completion of this program, it is expected that the participating golf course superintendent and the golf facility's officials go through the process of developing and implementing a set of Best Management Practices (BMPs) for water conservation which is site-specific. These BMPs would be the guiding document for daily water management practices, future planned renovations or new constructions, and general turfgrass management. Furthermore, the development, implementation, and adherence to these BMPs will provide documentation of a course's previous and ongoing stewardship efforts that may be used as proof of existing water conservation measures when resources become limited. This water management approach may allow golf courses to continue to operate without any additional irrigation restrictions when other industries are adjusting to meet water conservation demands.

The “Blended Learning Program for Golf Course Water Conservation” is divided into three modules. The first module of the program was the development of an online course. The specific goal of Module 1 was to provide introductory level information on **W**ater and how it is impacted by **A**tmospheric factors, uptake and use by the **T**urfgrass plant, impact of **E**daphic or soil factors, and the **R**elationship of the soil / plant / atmosphere continuum, the title of the course was **W.A.T.E.R.** Module 2 was an 8-hour interactive workshop titled “BMPs for Turfgrass Water Conservation”. The seminar was conducted by The UGA turfgrass scientist during the GCSAA’s annual conference and show. Lastly, Module 3 was access to a “list serve” hosted by GCSAA where course participants could post questions and interact with colleagues and scientist during the development process of their site-specific water conservation plans. This program “blended” three learning styles, self-study though the on-line course, a class-room lecture style as part of the seminar, and active participation style through the development of a deliverable product, the site-specific water conservation plan, and access to a “list serve” for discussion of ideas and feedback.

Module 1: W.A.T.E.R. for Efficient Water Management (online course)

This is a stand-alone, for fee, on-line course to provide a sound, scientific understanding of turfgrass water relationships. Module learning objectives are listed in Figure 1. The targeted audience was golf course superintendents, assistants, technicians, agronomy and horticulture students, grounds managers, or other turf industry professionals who desire a better understanding of turfgrass water management. While this was written as a stand-alone course which is available to anyone, GCSAA member or non-member, Module 1 integrates into the “Blended Learning” concept by being a prerequisite to continue into Modules 2 and 3.

The development of this course was a joint project between The UGA faculty and GCSAA and is hosted on the GCSAA server, www.gcsaa.org/learn/online/water.asp. It was the responsibility of the turfgrass scientists to write and ensure scientific accuracy of the content while keeping the course focused on turfgrass water use and conservation. Furthermore, submission of content updates and revisions will be the responsibility of The UGA authors. The GCSAA was responsible for preparation of the course format, advertisement to its membership, collection and distribution of fees, and the administration of membership continuing education credits. In addition, graphic artists on staff assisted the authors with design and development of graphical content and interactive activities within the course.

W.A.T.E.R contains five chapters, each featuring a chapter outline, learning objectives, in-depth reading material, interactive reviews, and photos and illustrations. Each chapter is broken down into a number of sections, such that, the student does not have to complete the entire course, or even one chapter, in a sitting. The flexibility of online learning allows the participant the ability to repeat chapters or advance to the next section when the student feels they have mastered the chapter’s concepts.

The course was launched in December 2004 and has been well received. W.A.T.E.R. had the best first month registration and use of any GCSAA's online courses, 43 participants (Table 1). Through February 2004 the course had 71 students, representing 26 US states and 10 counties. California had the greatest number of individuals to complete the course (8), followed by New York (6) and Florida (5). The remaining 23 states with participants, ranging from Main to Hawaii, had four or fewer students. Internationally, Canada had four participants, while Australia, Barbados, France, Germany, Portugal, and Spain had one each. The diversity of participants in this course certainly demonstrates a universal interest among golf course superintendents in water conservation.

Not surprisingly, initial registration was greatest in December and January. This is likely due to several factors, 1) GCSAA's aggressive promotion, 2) appropriate timing for golf course superintendents, many have time for self study during winter months when there is little activity on the golf course, and 3) need to complete the course as a prerequisite for Modules 2 and 3. Although there are times of the year where increased activity is expected, because this is an online course it is offered year-round.

Table 1. Distribution of participants of W.A.T.E.R. online course.

Month and Year	Number of Participants		
	United States	International	Total
December '03	33	10	43
January '04	20	-	20
February '04	8	-	8
Total	61	10	71

Fig. 1 –Learning Objectives for Module 1: Online W.A.T.E.R Course

Chapter I. An Overview of Water

1. Understand the importance of water to biological systems.
2. Identify the structure of the water molecule and explain how structure affects other physical characteristics of water.
3. Relate the chemical properties of the water molecule to plants, soil, and other compounds.

Chapter II. Atmospheric Factors Influencing Water Management

1. Understand the hydrological cycle and its relevance in water conservation.
2. Relate the influence of climatic factors to evapotranspirational losses from the turfgrass plant.
3. Explain the influence of individual microclimates on turfgrass growth and water conservation.

4. Devise a basic irrigation guidance program using the “Checkbook Method” of irrigation.

Chapter III. Turfgrass Characteristics and Water Management

1. Describe how water is taken-up by the plant and the factors that influence water movement.
2. Understand the root and shoot morphological characteristics of turfgrass that influence water uptake, translocation, and transpiration.
3. Relate established crop coefficients to irrigation guidance programs.

Chapter IV. Edaphic Factors Influencing Water Management

1. Correlate soil physical characteristics to soil/water interactions.
2. Explain the movement of water through soils and the importance of basic soil characteristics which are incorporated into established guidelines.
3. Learn methods and instruments for measuring soil water and the application of knowing soil water contents for irrigation guidance.

Chapter V. The System: Soil – Plant – Atmosphere – Continuum

1. Integrate the concepts of the previous chapters into an overall water management program with primary focus of water conservation through improved irrigation application.
2. Communicate the basic principles of soil/plant/atmospheric interactions and relevance of water to a comprehensive water management program.

Module 2: BMPs for Turfgrass Water Conservation (workshop)

The second phase of this program was a full-day (six-hour) workshop during the national GCSAA meeting in February 2004. The focus of this workshop was to assist golf course superintendents in the development of site-specific BMPs for water conservation in a manner that would be acceptable for submission to their facility’s decision makers, elected officials, municipal authorities, regulatory agents, on-site water managers, and the general public.

During the initial four hours of the workshop, a science-based and holistic, systems approach for developing BMPs for water conservation was presented through a lecture format. Also, the major categories of water conservation strategies were presented along with options within each strategy so that a superintendent could select appropriate options for their site-specific situations.

During the next two hours, instructors facilitated discussion among the participants and initiated the development of individual plans. In the development of their water conservation plan, participants were instructed to include various options and the practical implications of specific practices on water use and turfgrass management. Furthermore, the participants were encouraged to include the scientific reasons and justifications for these options.

To aid in the writing of site-specific plans, the superintendents were provided with a 97 page workbook, “Best Management Practices for Turfgrass Water Conservation” in a hard- and electronic-copy format (Figure 2). The workbook detailed specific water conservation practices with scientific documentation of the practices. By use of the electronic copy, participants were allowed to integrate the workbooks contents into their plans.

**Fig. 2 – Best Management Practices for Turfgrass Water Conservation:
Chapter Titles**

Chapter 1 Components of a Golf Course Water Conservation Program

Chapter 2 Initial Planning and Site Assessment for a Water Conservation Plan

Chapter 3 Alternative Irrigation Water Sources

Chapter 4 Irrigation System: Design, Installation, and Maintenance

Chapter 5 Irrigation Scheduling for Water Conservation

Chapter 6 Selection of Turfgrasses

Chapter 7 Golf Course Design for Water Conservation

Chapter 8 Management Practices for Water Conservation

Chapter 9 Additional Water Conservation Strategies

Chapter 10 Benefits and Costs

Module 3: List-serve and Conference Call (follow-up)

For 60-days following the workshop, the instructors were available via a voluntary list-serve to assist the participants in development of their water conservation BMPs document. The instructors offered technical and scientific assistance through the list-serve, while GCSAA maintained and hosted the service.

At the conclusion of the 90-day period there was a voluntary conference call between participants, instructors, and GCSAA Education Department personnel. The purpose of the conference call was to obtain industry input for improvement of future offerings; participants provided specific feedback for improvement of all the learning modules.

Conclusion

The purpose of this blended learning program was to use various learning styles to increase the level of understanding of water conservation, educate participants on methods of improving and implementing water conservation practices, and, ultimately, the development of a site-specific plan to be employed on individual golf courses. This program was initiated in 2004 and thus far, participant reviews have been positive. The instructors will integrate suggestions for improvement and offer the entire course again at the 2005 GCSAA conference and show.