

Evaluation of Ornamental Grasses for Use as Golf Course Plantings

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Introduction

Background of Golf Course Needs

Golf courses often have areas referred to as “out-of-play”. These areas are usually beyond the maintained rough and are to be avoided by the golfer. Developing a strategy for out-of-play areas with regard to the creation, maintenance and definition is an issue every superintendent must face (Connolly, 2006). The attention given to out-of-play areas, often synonymous with “natural areas”, is a result of the increase in environmental awareness and the desire to have fewer acres of maintained turfgrass. Most golf organizations, including the United States Golf Association, are promoting the benefits of establishing naturalized areas (Nelson, 1997). According to Dr. James Beard, Chief Scientist of the International Sports Turf Institute, more than 70% of the golf course is devoted to areas consisting of a naturalized ecosystem.

In Florida, it is considered a Best Management Practice for 50 to 70% of the non-play areas to remain in natural cover (DEP, 2007). The demand for readily available, low maintenance, attractive plants for these natural areas is high. However, little data is compiled about which plant species meet this need. The objective for this research is to rate the grasses for preference by the respondents and create a list of performance proven plant materials that can be grown in the golf course naturalized areas.

Background of Horticultural Terminology

The term ornamental grass is used to include not only true grasses (members of the Gramineae or Poaceae family) but also close relatives such as sedges (Cyperaceae), rushes (Juncaceae), hardy bamboos (particularly the genus *Phyllostachys*), and other grass-like ornamentals, such as *Liriope* spp., *Lomandra* spp., or *Ophiopogon* spp.

(Wilson, 2004). As opposed to a lawn grass, ornamental grass is not mowed and is allowed to grow to its full potential. It is used in the landscape in the same manner as perennials or other woody ornamental plants. Growth habits range from low groundcovers to intermediate shrub-like plants to very tall hedge-like plants. Ornamental grasses are quite dynamic; the size, shape, texture and color of grass will change with each season. They can be used as groundcovers, specimen plants, for erosion control, and as vertical design elements. Grasses are adaptable and can grow in poor soils. Ornamental grasses, once established, are relatively easy to manage in the landscape because of their minimal fertility, irrigation, and pruning needs.

When selecting an ornamental grass there are several characteristics to consider: (1) annual or perennial, (2) evergreen or deciduous, (3) warm season or cool season, (4) growth form (including clumping or creeping habit, and mature shape and height), (5) foliage color, (6) time of flowering, (7) winter characteristics, and (8) invasive potential. A perennial grass will live for many years, while an annual grass will only last one season and will die after flowering, or may be killed when exposed to freezing temperatures. Evergreen grasses remain green through the winter, whereas, deciduous grasses turn brown and require new foliage to grow back from the base of the plant each spring. Many cool season ornamental grasses won't thrive in the hot Florida environment; therefore, the majority of the species considered are warm season grasses.

Clump forming grasses, also called bunch grasses, grow in compact tufts, with the width at the base slowly increasing over time. Creeping grasses are also called running or spreading grasses and spread by above ground stems called stolons or underground stems called rhizomes. Grasses that spread by stolons or rhizomes form roots along these

stems, making many of them difficult to restrict to a specific area. Keeping them from encroaching into turfgrass areas requires constant maintenance. Additionally, objects (such as golf balls) are often hard to locate in these forms of grasses. Therefore, creeping grasses are not considered suitable for golf course planting beds. However, they should be considered for slopes to reduce erosion and dangerous maintenance activity.

Short grasses, those that grow .5 – 2 feet in height, can be used in small groups for a massing effect or in large groups as a living groundcover. Small clumping grasses provide an excellent border between plant beds and walkways, while small spreading grasses make an excellent groundcover that reduces erosion. These plants also make good accent plants among other short annual or perennial species.

Medium height grasses may be used to define areas within the landscape that do not require a solid screen. In the early spring, the plants are only a few inches tall and will not affect the spring and summer breezes. As the plants grow to a height of 2-3 feet by autumn, they provide fall and winter wind protection.

Tall grasses, growing 3-7 feet in height, provide a strong vertical element in the landscape. Evergreen grasses can be used to divide the garden into sections, direct and control traffic flow, or as a transitional plant between a tall hedge and shorter shrubs or perennials. Early in the season, deciduous plants do not dominate the planting area because of their short stature. However, as the season progresses into the hot summer, they grow and become a more dominant element, which also serves as a windbreak.

Directing air movement on a golf course is an important consideration for the movement of the ball, irrigation management of turfgrass areas, and the environmental comfort level experienced by the golfers and spectators. Particular placement of

ornamental grasses with the most suitable growth height and habit can significantly aid in the management of wind conditions.

In residential landscapes, ornamental grasses are popular because they can provide year-round aesthetic appeal without costly maintenance. However, golf courses have been slow to adopt their use, possibly due to limited information available regarding the adaptability of these plants to these particular sites. My proposed project established a field trial of twenty-two different ornamental grasses on a one acre simulated golf course. Each was evaluated annually for performance and aesthetics by this specific clientele over a three year period. At the conclusion, the top three species selections will be presented as recommendations for future marketing to golf course superintendents. Additionally, Extension educators will gain the knowledge necessary to develop and deliver programming that addresses environmental landscape design for golf courses.

Problem

The adoption of ornamental grasses as golf course plantings may result from the endorsement of grounds managers through field trial evaluation. There are several environmental and economic advantages to utilizing ornamental grasses in this setting. However, aesthetics is perhaps the most popular reason for golf course personnel to choose the plants. The problem is finding a venue in which this particular audience would have the opportunity to observe a large selection of plant material. Additionally, the ornamental grasses must be established and maintained under the same conditions experienced on a typical golf course to ensure survival in such an environment.

Research Design

The Gulf Coast Turfgrass Expo held at the West Florida Research and Education Center – Jay Station each year in June provided an ideal site. A one acre putting green and sculptured turfgrass area was constructed according to golf course infrastructure design principles on the site in 2004. Approximately 16,000 sq. ft. of plant beds was added to the perimeter of the course in 2005. Twenty-two different ornamental grasses, including 10 genus and 3 native species were chosen for the golf course project (Table 1). A total of 900 plants were purchased as 1 inch liners in January 2006. Each was transplanted into 1 gallon nursery containers and allowed to establish a root system under nursery production conditions at the University of Florida –Milton campus. In March 2006, 828 plants were installed in five planting beds at the West Florida Research and Education Center (WFREC) located in Jay, FL. The grasses installed were exposed to the same conditions and maintenance practices performed on a full size golf course, including full sun exposure, frequent irrigation, and chemical applications. The surrounding turfgrass received direct pesticide and fertilizer applications; whereas the ornamental grasses only received runoff from the treatments. During the Gulf Coast Turfgrass Expo, participants on the golf educational track were asked to place colored flags next to their first (blue), second (red) and third (white) preferences, a grading technique commonly used for anonymous field trial ranking. The procedure was utilized each June from 2006 to 2013. Additionally, I evaluated the aesthetics of the ornamental grasses once each season using a grading system previously established from other research field trials.

Table 1. Ornamental Grasses Installed at WFREC, 2006.

Botanical Name	Cultivar	Common Name	Number of Plants
<i>Carex glauca</i>	'Blue Zinger'	Blue Sedge	35
<i>Carex tenuiculmis</i>	'Cappuccino'	Chocolate Sedge	50*
<i>Cortaderia selloana</i>	'Pumila'	Dwarf Pampas Grass	21
<i>Dianella caerulea</i>	'Becca'		34
<i>Eragrostis elliottii</i>	'Blue Wisp'	Blue Love Grass	50
<i>Eragrostis spectabilis</i> +		Purple Love Grass	50
<i>Lomandra longifolia</i>	'Breeze'		36
<i>Miscanthus sinensis</i>	'Bluetenwunder'	Blue Maiden Grass	36
<i>Miscanthus sinensis</i>	'Gracillimus'	Maiden Grass	36
<i>Miscanthus sinensis</i>	'Little Zebra'	Dwarf Zebra Grass	36
<i>Miscanthus sinensis</i>	'Rigoletto'	Compact Japanese Silver Grass	36
<i>Miscanthus sinensis</i>	'Super Stripe'	Super Stripe Silver Grass	36
<i>Muhlenbergia capillaris</i> +		Gulf (Purple) Muhly Grass	36*
<i>Muhlenbergia dumosa</i>		Bamboo Muhly Grass	36*
<i>Panicum virgatum</i>	'Heavy Metal'	Heavy Metal Switch Grass	16
<i>Panicum virgatum</i>	'Rotstrahlbusch'	Red Switch Grass	68*
<i>Pennisetum alopecuroides</i>		Fountain Grass	36
<i>Pennisetum alopecuroides</i>	'Hameln'	Dwarf Fountain Grass	36
<i>Pennisetum alopecuroides</i>	'Nafray'		36
<i>Pennisetum alopecuroides</i>	'Viridescens'	Black Flowering Fountain Grass	36
<i>Pennisetum messiacum</i>	'Red Buttons'	Red Button Fountain Grass	36
<i>Schizachyrium scoparium</i> +		Little Bluestem	36
Total		22	828

+Native

*Installed in more than one planting bed.

Results

During the container establishment at the UF Milton campus, seventy-two plants failed to survive, principally due to improper upgrading procedures for the liners. Those root-bound plants that had not been loosened up prior to repotting didn't form new roots. Instead, they became hydrophobic plugs in larger pots. This information was shared with University and Extension personnel doing research and education on nursery container production.

The first criteria for determining which ornamental grass would be the most suitable choice for a given golf course planting is survivability. Of the 22 different plant selections installed at the WFREC-Jay site, only 11 species remained in the landscape by 2009 (245 of the original 828 plants). Additionally, due to building construction on the site, one of the planting areas needed to be relocated. Several grasses were transplanted, but many of them didn't survive the move. None of the *Eragrotis elliottii* 'Blue Wisp' nor any of the *Carex*, *Panicum*, *Pennisetum* or *Schizachyrium* species remained in the landscape. The preference ranking of the surviving ornamental grass species continued, with notation made of the species that were not reliable perennial grasses (Table 2). Since, I was unable to submit this final project that year, I continued the personal evaluations and preference grading at the Gulf Coast Turfgrass Expo each year through December 2013.

Table 2. Rating of Ornamental Grasses Surviving, 2009.

Botanical Name	Cultivar	Number of Plants	Rating
<i>Carex glauca</i>	'Blue Zinger'		
<i>Carex tenuiculmis</i>	'Cappuccino'		
<i>Cortaderia selloana</i>	'Pumila'	21	
<i>Dianella caerulea</i>	'Becca'	4	
<i>Eragrostis elliottii</i>	'Blue Wisp'		
<i>Eragrostis spectabilis</i>		38	
<i>Lomandra longifolia</i>	'Breeze'	33	First Choice
<i>Miscanthus sinensis</i>	'Bluetenwunder'	17	
<i>Miscanthus sinensis</i>	'Gracillimus'	36	Third Choice
<i>Miscanthus sinensis</i>	'Little Zebra'	17	
<i>Miscanthus sinensis</i>	'Rigoletto'	28	
<i>Miscanthus sinensis</i>	'Super Stripe'	20	
<i>Muhlenbergia capillaris</i>		30	Second Choice
<i>Muhlenbergia dumosa</i>		1	
<i>Panicum virgatum</i>	'Heavy Metal'		
<i>Panicum virgatum</i>	'Rotstrahlbusch'		
<i>Pennisetum alopecuroides</i>			
<i>Pennisetum alopecuroides</i>	'Hameln'		
<i>Pennisetum alopecuroides</i>	'Nafray'		
<i>Pennisetum alopecuroides</i>	'Viridescens'		
<i>Pennisetum messiacum</i>	'Red Buttons'		
<i>Schizachyrium scoparium</i>			
Total	11	245	

The ornamental grass trial installed and evaluated at the West Florida Research and Education Center at Jay golf course demonstration site identified the preferences of 486 individuals employed in the golf industry. Among the participants were seven superintendents and managers of five Certified Audubon International Signature Sanctuaries located in the Florida Panhandle. These eco-friendly courses meet required standards for protecting water quality, conserving natural resources, and providing wildlife habitats.

The results of the golf course project revealed that the top three ornamental grass species choices were: 1) 'Breeze' Lomandra (*Lomandra longifolia*), 2) Gulf Muhly Grass (*Muhlenbergia capillaris*) and 3) Dwarf Pampas Grass (*Cortaderia selloana*) (Table 3). While "Red Buttons" Fountain Grass was vigorously growing, it was the preferred ornamental grass. However, its survivability was limited to two years. 'Gracillimus' Maidengrass (*Miscanthus sinensis*) rated as preferred as Gulf Muhly Grass. However, due to fungal infestations that occurred late each summer and discolored the foliage severely, its aesthetic rating decreased in the fall and winter.

Table 3. Rating of Ornamental Grasses 2006 - 2013.

Botanical Name	Cultivar	Preference Rating							
		2006	2007	2008	2009	2010	2011	2012	2013
<i>Cortaderia selloana</i>	'Pumila'					3	3	3	1
<i>Dianella caerulea</i>	'Becca'	3		2					
<i>Eragrostis elliottii</i>	'Blue Wisp'	2							
<i>Lomandra longifolia</i>	'Breeze'		2		1	1	1	1	
<i>Miscanthus sinensis</i>	'Gracillimus'			1	3		2		2
<i>Miscanthus sinensis</i>	'Super Stripe'							2	3
<i>Muhlenbergia capillaris</i>			3	3	2	2			
<i>Pennisetum messiacum</i>	'Red Buttons'	1	1						
Total	8								

Golf course superintendents are responsible for creating and maintaining a play field with unique characteristics on a constrained budget and by demonstrating sustainable land use. Ornamental grasses can be the low budget solution if course managers are provided with information on the most suitable species choices. Superior ornamental grass selections are relatively trouble-free and require minimal maintenance, especially when compared to herbaceous perennials. This research study has revealed three desirable ornamental grasses that can enhance the golf course environment and conserve natural resources. The information would also be useful to plant developers,

nursery growers and horticulture marketing agencies, as they are the suppliers of the plant material acquired by golf courses.

Implications and Discussion

Project Plant Selection

Ornamental grasses chosen for this project were selected from species that have been previously trialed for survivability and/or are new to the market. University of Florida and independent researchers have evaluated a few of them for survivability, growth height and width, and inflorescent qualities including height and color. Research projects involving grass trials that were completed in the Florida Panhandle served as preliminary information for this project.

A three-year ornamental grass study (2000-2002) completed by Jeff Norcini and James Aldrich from the North Florida Research and Education Center (NFREC) narrowed the numbers of top performing native grasses to one choice, Gulf Muhly Grass (*Muhlenbergia capillaris*). Six different native grasses were installed in trial gardens located at the West Florida Research and Education Center in Jay, FL and the Leon County Extension Office Demonstration Garden in Tallahassee, FL. Each was evaluated for long-term survival and performance. All but the Muhly grass failed to consistently attain high ratings due to failure to recover from winter damage, lodging (foliage that falls over rather than growing upright) or poor re-growth following pruning. Since Gulf Muhly is a low-input ornamental grass that is readily available, it was included in the golf course grass research project.

A second study conducted by Gary Knox involving 65 individual plants of *Muhlenbergia capillaris* installed at NFREC in Quincy, FL established the evaluation

criteria for appearance. The grasses were planted in randomized blocks and given minimal care that included only weed control and occasional watering. Over the 2005-2007 growing seasons, Master Gardener volunteers collected data on the quality of the grasses including: measurements of foliage height and width, measurements of the culm and complete inflorescence, and an overall attractiveness rating. As recognized trained observers, Master Gardeners were utilized as the data gatherers in order to avoid bias. Additionally, for such a labor-intensive procedure, significant personnel time is required and there were several willing volunteers available in the area.

Aesthetics were rated on a scale of 0-5, zero representing a dead plant, one being poor and five being outstanding appearance. The rating included all factors such as: size, form, habit, texture, and color. Evaluations were completed year-round so that aesthetic ratings could be gathered through all seasonal foliage and inflorescence changes. The data gatherers also commented on their personal preference for the grasses as the season progressed and the plants changed. Their comments can be correlated to consumer purchasing indicators.

Aesthetics and Maintenance

Aesthetic values in landscape design include seasonal color and textural changes, diverse foliage, fruit and flower performance, healthy plants, year-round visual interest and wildlife viewing opportunities. Ornamental grasses offer all these qualities and yet have very few maintenance requirements. Upon initial planting, irrigation or frequent rainfall is required to establish a stable root system. Following that stage, supplemental water is not necessary. However, it is well tolerated, enabling the grasses to absorb excess runoff from the turfgrass applications.

During the fall months, when little else is flowering, grasses can take center stage. The inflorescence is the flowering portion of the plant, including the culm (stalk supporting the blooming portion of a grass), bracts (modified leaves), flowers and seeds above the last stem leaves. Grass seed heads and foliage add a significant vertical presence to the winter landscape and are commonly left standing until spring. The mature flowers of grasses may remain intact through the winter or they may shatter. Regardless, these dead, dry features add tremendous interest to the winter garden when contrasted with evergreen plants or structures such as walls or fences.

The dried foliage of deciduous grasses creates sound as it expands and contracts in response to changes in temperature or moisture while interaction with wind creates movement in the garden. For this reason, pruning of the dead foliage and inflorescences is not recommended until growth resumes in the early spring. Routine recommended pruning of ornamental grasses is performed by reducing the height to less than one foot at the conclusion of winter. The new growth point is located just above the soil surface and should not be damaged. However, by removing aged and/or mature leaves using this cutting technique, juvenile foliage is initiated.

As with many exotic plants, the potential to become an invasive pest must be considered when selecting ornamental grasses. There is already some concern in other areas of the United States. Pampas grass (*Cortaderia selloana*), although not considered a problem species in Florida, is considered a pest in California. Similarly, volunteer seedlings of Japanese Silvergrass (*Miscanthus* sp.) have been reported in several northern states. Bloodgrass (*Imperata cylindrica*) has been banned in the state of Florida and is among the world's worst weeds (Thetford, 2012).

Environmental Benefits

There are many environmental benefits to enhancing natural areas on golf courses. Vegetative cover reduces soil erosion and provides dust stabilization. Grassland ecosystems typically contain high levels of soil organic matter, making them an excellent carbon storage site. These areas serve as groundwater recharge and chemical degradation sites. Following a rainfall or irrigation event, water is entrapped in dense grass plantings, which reduces runoff and helps with flood control. Diverse populations of soil microflora and micro-fauna located in the soil covering the root systems of grasses create an active biological system capable of filtering out and breaking down nutrients and pesticides, thereby functioning in the protection of groundwater quality. Dense plants provide enhanced heat dissipation and a reduction in noise and reflective glare. The evaporative cooling potential of ornamental grasses could buffer the heat stress effects on humans, namely Florida summer golfers. Additionally, the dense mass planting can serve as a wind and sound barrier. One study found that high grasses along a road reduced the noise level by 40% at a distance of seventy feet (Cook et al.,1971).

Environmental and economic issues are at the forefront of golf course concerns. In the mid-1990's the Center for Resource Management brought together a diverse group of individuals from golf and environmental organizations and developed a manual titled, "Environmental Principles for Golf Courses in the United States". The following are the basic precepts of the manual: (1) to support ongoing research to scientifically establish new and better ways to develop and manage golf courses in harmony with the environment, and (2) to document outstanding development and management practices to promote more widespread implementation of environmentally sound golf courses (DEP,

2007). Environmental values that were identified as requiring attention include reduced or efficient pesticide, fertilizer and water use, as well as, the enhancement of habitat value and biodiversity. Interest in economic issues that address cost savings from sustainable design including reduced overall maintenance, labor costs and resource use were outlined.

Florida, as well as many other popular golf course states, is facing an increased difficulty in providing adequate quantities of clean water for domestic use. According to the United States Golf Association (USGA), approximately 80 acres of the average 18-hole golf course's 100 acres of maintained turfgrass are irrigated (Lyman, 2012.). This requires approximately 2,820 inches of water with every irrigation event. Traditional golf course landscape plant selection frequently requires large volumes of water to remain attractive. Florida golf courses average 158 acres, with 114 acres (72%) of maintained turf (DEP, 2007). The remaining acres can be planted with plant material that doesn't require supplemental irrigation in an effort to conserve water. Alternative designs include plants most suited to local environmental conditions and require less water, which includes ornamental grasses.

Wildlife Impacts

The integration of nature and man-made landscape has become an increasing concern. Wildlife habitat fragmentation has been an undesired result of land development. The aesthetics of the natural landscape has demanded more focus and attention due to the intense pressure on the land for human use and the decrease in the natural environment and natural habitat. This interrelationship requires thoughtful and knowledgeable design techniques.

Golfers want attractive recreational green spaces, while wildlife and the general public require that golf courses be environmentally responsible. Sustainable approaches to golf course landscape design allow golf course managers to have attractive and functional golf courses that are environmentally friendly. The resulting benefits can include enhanced aesthetics, lower maintenance costs, more effective use of water and chemical resources, enhanced open space, amenity value and heightened wildlife habitat value.

Sustainable design goes a step beyond traditional design principles to focus on maximizing ecological structure and function within a landscape, while maintaining or enhancing local biodiversity of plants and animals. This approach allows the creation of landscapes and outdoor spaces that effectively blend aesthetics, function and maintenance considerations with existing site and environmental considerations. It has been shown that most golf courses are capable of providing significant, high-quality habitat to a large, diverse population of birds, mammals and other wildlife (DEP, 2007). Ornamental grasses serve as shelter and food for many different species. They are tough plants that are not likely to be browsed, but recover quickly if nibbled on. More often, the plants provide a space for insects that become the food for birds and small mammals. Adding ornamental grasses to golf course plantings has been shown to increase animal populations and diversity.

Wildlife and habitat management is one of the environmental practices required for Audubon International certification. Numerous case studies have noted increases in species diversity coupled with substantial savings of water and man-power. In 2012, one southeastern U.S., 36-hole, resort golf course began a project to convert all of their plant

beds from annual bedding plants to native and xeric plants. Not only did they save over one million gallons of water and 2,500 man-hours in labor, they documented 16 different butterfly species on-site. Another southern U.S., 18-hole, public golf course reduced the course's chemical use and budget from \$39,000 to \$8,000 annually by converting 40 acres of the course to naturalized areas, which also provided nesting areas for 45 bird species.

Relevance to Extension

Specific Audience Needs

There are more than 1,500 golf courses in Florida, with more being designed and built every year. In 2000, golf and golf-related travel and tourism provided a \$9.2 billion boost to Florida's economy and provided 216,000 jobs (DEP, 2007.). Many supporters of golf, including the United States Golf Association (USGA), the Golf Course Superintendents Association of America (GCSAA), and the American Society of Golf Course Architects, are actively promoting environmentally-friendly golf course design and management (DEP, 2007.).

New golf courses frequently incorporate natural areas in the design for environmental, and/or economic reasons. From an economic standpoint, fewer acres of maintained turfgrass can result in reductions in water use, fertilizer, labor and pesticides. On the environmental side, these areas increase wildlife habitat and protect natural resources. There is a tendency for golf courses not to be recognized for their valuable contribution in preserving a naturalized ecosystem in and near urban areas. But, through programs such as the Audubon Cooperative Sanctuary Program for Golf Courses

(ACSP), created in 1991 by Audubon International, acknowledgement of their ecological role has resulted in changes of perception.

Today's landscape consumers, including golf course superintendents, are making choices in an environment with instant global access to information and the products themselves. Their initial interest in a particular landscape plant is as likely to come from trade magazines or the Internet as it is from sound research or field trials. The resulting exposure to the newest trends or the best media pieces introduces consumers to what is new and different – more colorful or a different color, taller, shorter, longer flowering – sometimes regardless of the appropriateness of the plant for the specific condition. Then, retailers must anticipate or create these trends, market the appeal of new or different plants to their clientele, and pre-order from producers. To further complicate matters, creating, predicting and meeting demand must take into consideration the time required for production, which can take seasons or years, despite advances in production techniques and landscape production “assembly lines.”

Missing a trend by either over-anticipating or under-anticipating demand may mean the difference between a successful adoption of the use of ornamental grasses in out-play-areas and continuing to utilize traditional high-water use plants because they are readily available. And the unpredictability of working with living things, which may not perform as expected at any point in the process, is coupled with increasing expectations by consumers for the immediate gratification provided by great-looking plants available year-round in multiple sizes.

Major marketing strategists for large producers of landscape ornamentals have invested huge resources in an attempt to predict and influence the behavior of nursery

plant purchasers. If consumer preferences for specific qualities of the plants themselves can be identified, breeders and producers may be able to target their research toward selecting or breeding such traits into plants. Consumers attracted to the plants for reasons such as color or form can then be taught about the other values of the plants, and retailers can use the combination of consumer preferences and education to promote them. Identifying consumer preferences for particular characteristics of ornamental grasses may help promote their use.

Educational Role

Extension serves as an unbiased resource of reliable information and education. By utilizing the research performed by this and other field trials, Extension agents can address the questions and conduct the trainings necessary to inform both the producers and the consumers. Being able to demonstrate which ornamental grasses are of interest to golf course personnel, producers can focus on development and marketing of those species. Simultaneously, Extension educators can teach golf course superintendents and maintenance employees the design use of these plants, as well as, the maintenance techniques and requirements. The focus of Extension education is driven by the needs of its audience and the demands of environmental and economic requirements placed on them. In the case of golf courses, designers, developers, and landscape architects are a part of the clientele that will benefit from training in the area of ornamental grass use. This project has enabled Commercial Horticulture agents, including myself, to better serve this specific clientele with recommendations of ornamental grasses species that may lead to behavior changes in plant selection. In turn, the adoption of their use will contribute to natural resource conservation and reduce non-point source pollution to

essential water bodies. Most golf courses are located in close proximity to Atlantic or Gulf waters, as well as, numerous natural and man-made lakes.

In conclusion, of the 22 different ornamental grass species trialed in this study, three were chosen as the best performers and having the most desired appearance. *Lomandra longifolia* 'Breeze' is a short, evergreen, clumping grass. It could be used to line a walk or golf cart path and define a plant bed end. *Muhlenbergia capillaris* is a medium height, evergreen, clumping native grass. It has a showy fall inflorescence and recovers quickly from late winter pruning. Mass planting can be used in un-mowed rough areas to create naturally appearing prairies that will serve as wildlife habitat. *Cortaderia selloana* is a tall, evergreen, clumping grass. The decorative plumes form in the summer and persist all winter, adding color, sound and movement to the landscape year-round. As it matures it will require pruning and/or dividing to avoid the loss of the interior of the plant. But, the dwarf cultivar used in this study thrived for seven years without showing any symptoms of decline. This species could be used to screen one golf hole from another, to hide or direct views, direct traffic or separate landscape areas. All of the preferred ornamental grasses have an upright, arching growth habit. This structure allows easy access for grounds maintenance workers and makes golf balls easy to locate for patrons.

References

Audubon Cooperative Sanctuary Program for Golf Courses.

Web page: <http://www.auduboninternational.org/acspgolf>.

Beard, James B., and Robert L. Green. 1993. Turfgrass and Golf Course Benefits – A Scientific Assessment. United States Golf Association, Green Section Record.

Brede, Doug. Turfgrass Maintenance Reduction Handbook: Sports, Lawns, and Golf

Cameron, Art. 2000. Ornamental Grasses: High Visibility, Low Maintenance, Grounds Maintenance. Web page:

http://www.grounds-mag.com/mag/grounds_maintenance_ornamental_grasses_high/index.html.

Connolly, Jim. 2006. Out of Play, Not Out of Mind. Superintendent Magazine.

Cook, D. I., and D. F. VanHaverbeke. 1971. Trees and Shrubs for Noise Abatement. University of Nebraska Agricultural Experimental Station, Bulletin 246.

Darke, Rick. 1999. The Color Encyclopedia of Ornamental Grasses, Sedges, Rushes, Restios, Cat-tails, and Selected Bamboos. Timber Press, Portland, Oregon.

Ellis, Susan. 2002. The Volunteer Recruitment Book. Energize Inc., Philadelphia, PA.

Fech, John C., and Steven N. Rodie. 1999. Sustainable Design in Golf Course Landscapes, Golf Course Management. Web page:

<http://www.gcsaa.org/gcm/1999/jan99/01sustainable.html>.

Florida Department of Environmental Protection. 2007. Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses.

Greenlee, John, and Derek Fell. 1992. Encyclopedia of Ornamental Grasses. Michael Friedman Publishing Group, Emmaus, PA.

Hawke, Richard G.. 1992. Plant Evaluation Notes. Chicago Horticultural Society.

Lyman, Gregory T.. 2012. How Much Water Does Golf Use and Where Does It Come From?. United States Golf Association. Web page: <http://www.usga.org>.

Manske, Llewellyn L., and Jerry C. Larson. 2002. Xeriscape Ornamental Perennial Grass Trial for Low Water Use Landscaping.

Web page: <http://www.ag.ndsu.nodak.edu/dickinso/research/2002/hort02a.htm>.

Moore, James Francis. 2012. Building and Maintaining the Truly Affordable Golf Course. United States Golf Association. Web page: <http://www.usga.org>.

Norcini, Jeffery G., and James H. Aldrich. 2000-2002. Ornamental Grass Evaluation. North Florida Research and Education Center Newsletter.
Web page: [http://nfrec.ifas.ufl.edu/Newsletters/Archive2000 and 2001](http://nfrec.ifas.ufl.edu/Newsletters/Archive2000%20and%202001).

Rossi, Peter H., Howard E. Freeman, and Mark W. Lipsey. 1999. Evaluation: A Systemic Approach. Sage Publications, Thousand Oaks, CA.

Sadlon, Nancy. 2010. Ornamentals: Grasses Gone Wild. Golf Course Industry.
Web page: <http://www.golfcourseindustry.com/gci-0510-ornamentals-grasses=gone-wild.aspx>.

Snow, James T.. 2012. Water Conservation on Golf Courses. United States Golf Association, Green Section. Web page: <http://www.usga.org>.

Thetford, Mack. 2012. Considerations for Selection and Use of Ornamental Grasses. University of Florida, Publication ENH976.

Todd, Kim. 2008. Ornamental Grass Preference Trial - The Grass is Always Greener: Consumer Preferences for Ornamental Grasses. University of Nebraska – Lincoln.
Web page: <http://unlgardens.unl.edu/aganfhortgardens/grasstrial.html>.

Voight, Tom. 2004. Ornamental Grasses. Golf Course Maintenance.

Wilson, C.R.. 2004. Ornamental Grasses. Colorado State Extension, Publication #7.232.
Web page: <http://www.ext.colostate.edu>.

Wolfe, June, and J.M. Zajicek. 1998. Are Ornamental Grasses Acceptable Alternatives for Low Maintenance Landscapes?. Journal of Environmental Horticulture