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Title: Multi-Location Trial to Establish Maintenance Requirements and Performance of New Bermudagrass Cultivars for Fairway Use

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Objectives: Our global hypothesis is that bermudagrass cultivars maintained under fairway conditions differ overall in terms of shade tolerance, wear tolerance, and drought tolerance. To investigate this hypothesis, we will address the following objectives:

1. Determine relative differences in shade, wear, drought and insect pest tolerance of six fairway-height bermudagrass cultivars.
2. Determine the drought response of six fairway-height bermudagrass cultivars under both a Linear Gradient Irrigation System and through deficit irrigation.
3. Determine the minimum nitrogen fertility requirements to maintain acceptable and evaluate the interaction between nitrogen fertilization rate and drought response of six fairway-height bermudagrass cultivars.

Start Date: 2017
Projects Duration: Three years
Total Funding: $45,000

Background

There are several criteria that need to be considered when selecting a bermudagrass cultivar (*Cynodon dactylon* [L.] Pers.; *C. dactylon* x *C. transvaalensis* [Burtt-Davy]) for use on a golf course. Bermudagrass is the primary turfgrass established on golf course fairways in the southern United States because it provides a very dense, green turf cover that is able to tolerate drought and heat as well as a wide variety of soil types, pH, textures, fertilities, and temperatures (Hanna and Maw, 2007). Arguably the most important factor is its ability to withstand injury and re-grow quickly to maintain a high quality playing surface. Selecting a bermudagrass that is genetically able to withstand high amounts of traffic, reduction in light intensity as a result of shade or low light conditions, and maintain quality under reduced irrigation can give turfgrass managers a competitive advantage from the start.

Turfgrass culture is unique from other production agriculture systems. It exacerbates competition for light by attempting to maximize plant population to increase density. When other required components of turfgrass health (water, adequate temperature, nutrition) are met, light interception is the growth-limiting factor. Factors in the turfgrass market often necessitate that turfgrass be grown under lower light conditions. Trees are used on golf courses to increase difficulty and aesthetics for players, but shade cast by a tree canopy can cause lower light levels. Additionally, coastal regions of the US experience reduced light intensity due to heightened levels of water vapor in the atmosphere.

Various leaf-level traits that function together to maximize carbon fixation under low light is known as shade tolerance (Henry and Aarssen, 1997). It can also be seen from a physiological point as the minimum amount of light needed for plant survival. (Valladares and Niinemets, 2008). Shade avoidance denotes architectural traits exhibiting strong vertical growth (Grime, 1966). The term shade avoidance is used in conjunction with shade tolerance to describe different groups of mechanisms that can occur simultaneously or exclusively within a plant under shade stress. In general, physiological changes are associated with shade tolerance mechanisms, while morphological changes are more related to shade avoidance. As these mechanisms are identified as being activated, an increased understanding on how a plant is reacting to shaded conditions can be achieved.

Water resources have become a critically limiting factor for economic growth, and to feed and support an increasing world population. A growing population, urbanization, domestic and industrial usage, and energy production exacerbate the pressure for water demands. There is an estimated 40 million acres of maintained turfgrass in the United States on home lawns, golf courses, sports fields, parks, playgrounds, cemeteries, and highway rights-of-way. Water availability for irrigating turfgrass is becoming limited even in regions where annual rainfall is abundant and periodic droughts occur. Selecting turfgrasses with superior drought resistance could mitigate the conflict between water demand and supply. Efficient selection depends on understanding turfgrass drought responses and characteristics associated with water use. This proper understanding also clarifies the expectation for turf performance under drought.

Water consumption of turfgrass differs both between and within species, and it is influenced by growth rate, evapotranspiration (ET), length of growing season, and cultural practices such as fertilization rate (Biran et al., 1981).

Research on multiple turfgrass species has shown that cultivar (genotype) directly affects insect abundance and pest damage. Turfgrass cultivars often have different pest insect tolerance and resistance, or ability to harbor predatory insects, which directly affects plant health and management inputs. One that harbors more predators and is less suitable to pests can reduce management costs and increase playability. Thus, screening cultivars to promote predatory insect diversity and reduce pest damage is critical to golf course sustainability, particularly once a cultivar is selected for fairway use.

Research has also demonstrated that ground-dwelling predators of key insect pests are often much less abundant on fairways than roughs due to higher management inputs and different turf characteristics (Smitley et al. 1998). If cultivars can be screened that reduce pest pressure and the need for insecticide use, the system as a whole will benefit.

Arguably the most important factor for the long term success of a turfgrass stand on a golf course is its ability to withstand injury and re-grow quickly to maintain a high quality playing surface. As play increases, injury from traffic and divots can accumulate causing a stand of turf to thin, creating an unfavorable, unsafe, and unattractive playing surface. Historically, selection of traffic tolerant cultivars has not been a large field of study, but is becoming essential as more cultivars are developed each year (Trappe et al., 2008; 2010b; Williams et al., 2010).

Research Methodology

Research plots will be established on fumigated sites at each of three University of Florida locations: West Florida Research and Education Center, Jay, FL; Plant Science Research and Education Unit, Citra, FL; and Ft. Lauderdale Research and Education Center, Ft. Lauderdale, FL during the 2016 growing season and will include six cultivars of bermudagrass; two standard cultivars (Tifway 419 and Celebration) or four novel cultivars (TifGrand, TifTuf, Latitude 36, and Bimini).

Experiment 1: General Assessment of Turfgrass Performance – Ft. Lauderdale, Citra, and Jay

Plots at all locations will be evaluated at least monthly to monitor cultivar response to fertility, drought, shade, and wear treatments. Visual ratings will be done using NTEP rating guidelines where a visual rating of 9 equals perfect grass, a 1 equals dead grass and below 6 = non acceptable turfgrass quality. Data may also be collected using digital image analysis of pictures collected using a light box. Instrument ratings (NDVI, thermal, and chlorophyll) will also be used to augment the visual ratings.

Experiment 2: Drought Response – Ft. Lauderdale and Jay

West Florida Research and Education Center – Jay, FL

Grasses will be established on a pre-existing Linear Gradient Irrigation System (LGIS) as described by Zhang et al., 2013. Whole plots will measure 12' X 80' and will be replicated four times. Irrigation rates range from 0 – 120% ET.

Ft. Lauderdale Research and Education Center – Davie, FL

Grasses will be established on 10 x 30 ft plots with four replications to evaluate cultivar response to deficit irrigation and the interaction between deficit irrigation and nitrogen fertilization rate. Two irrigation treatments will be implemented, 50% ET and 80% ET (may be adjusted if needed to preserve canopy), to represent a severe deficit and a typical irrigation program respectively.

Experiment 3: Fertility Requirements – Jay and Ft. Lauderdale

West Florida Research and Education Center – Jay, FL

Nitrogen fertilization treatments (0, 0.25, 0.5, and 0.75 lbs N/1,000 ft2/growing month) will be applied in strips (3' X 80') across the irrigation gradient to investigate the interaction between fertilization rate and drought response among cultivars.

Ft. Lauderdale Research and Education Center – Ft. Lauderdale, FL

Nitrogen fertilization treatments (0, 0.16, 0.33, and 0.5 lbs N/1,000 ft2/growing month) will be applied sub- plots on the deficit irrigation plots (7.5' x 10').

Experiment 4: Wear Tolerance – Citra, FL

Wear tolerance will be determined using a modified Cady wear machine at the PSREU. Wear will be applied two times a week for a period of six weeks during spring and fall of each year. Digital image analysis will be used to quantify declines in turf quality and percent green cover during wear and increases in both parameters during recovery periods.

Experiment 5 – Shade Tolerance and Divot Recovery – Citra, FL

Grasses will be planted into an existing oak canopy to evaluate shade tolerance. Cultivar performance will be quantified using digital image analysis to track green cover. Divots recovery will be evaluated under shaded conditions. Repair from divots in the shade will be quantified using Digital image analysis methodology described by Williams et al., 2011.

Experiment 6 – Playing Surface Response – Jay, FL

Measurements of golf ball lie will be obtained through digital image analysis as described by Richardson et al., 2010. Digital images will be collected on a monthly basis from LGIS plots receiving 70% and 100% ET at 0.5 and 0.75 lbs N/1,000 ft2/growing month.

Experiment 7 – Insect Diversity and Abundance – Citra, FL

We will survey research plots for ground-dwelling insects using 15 mm diameter plastic pitfall traps inserted flush with the soil surface. We will also collect thatch and soil samples to extract soil-dwelling arthropods. To determine cultivar tolerance to pest insects, we will introduce key pests into 30 cm diameter arenas in field plots and evaluate plant damage and insect reproduction, survival, and development.

Expected Outcomes

• Side-by-side comparisons of the four novel bermudagrass cultivars have not been conducted. We expect the information generated from this research to greatly aid golf course superintendents in their selection and management of these new cultivars.

• Results from the irrigation studies will provide water requirement estimates (% ET) at a given level of nitrogen fertility.

• This project will address and eliminate or highlight concerns for Bimini. Which is unknown for its technical merits, but is increasingly being used in south Florida.

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