Saving Turf, and Water, Too

By Jim Baird, Ph.D., Turfgrass Specialist, University of California, Riverside

More and more, turf is becoming the Rodney Dangerfield of the landscape. It gets "no respect." However, before we begin removing grass for the sake of water savings or perceived environmental benefits, let's be reminded or informed about the many important roles that turf plays in the landscape. It is aesthetically pleasing, increases the value of real estate, and provides a safer, cushioned surface for sports and recreational activities. Turfgrass reduces surface temperature by transpirational cooling. It also lessons glare, noise, soil erosion, and dust, thereby reducing air pollution and allergens. Turfgrass provides habitat for wildlife and reduces wildfire hazard. It has been demonstrated to be an effective bio-filter for applied pesticides and nutrients as well as pharmaceuticals and other xenobiotics in reclaimed water for irrigation. Turfgrass sequesters approximately 2-3 times the amount of carbon from the atmosphere compared to agricultural crops. On an average managed lawn, turfgrass captures about four times the carbon from the air than the carbon output of a typical lawn mower. Last but certainly not least, turfgrass is a multi-billion dollar industry in California and has a direct and significant impact on the state's economy.

On the other side of the coin, turfgrass can demand significant amounts of water, especially C3 or cool-season species like tall fescue (*Festuca arundinacea* Schreb.) that require supplemental irrigation to maintain green color year round in a Mediterranean climate. Tall fescue is currently the most widely used turfgrass species in California. In southern California, maintaining a reasonable visual quality of tall fescue requires replacement of 80% of reference evapotranspiration (ET_o) in coastal climates and 90% to 100% ET_o in transition climates. The Model Ordinance developed by the California Urban Water Conservation Council and supported by a vast majority of water agencies has now been lowered to 70% ET_o. That, coupled with other recently imposed landscape irrigation restrictions, makes it difficult if not impossible to keep cool-season grasses like tall fescue green during the summer months. Thus, turf managers and homeowners alike will be forced to either remove some of their irrigated turf and landscape plants or replace existing vegetation with more drought tolerant plants to achieve a further reduction in landscape water use.

At UC Riverside, we have been developing a cool-season turfgrass with improved stress tolerance. Perennial ryegrass (*Lolium perenne* L.) is widely used because of its rapid germination and establishment, wear tolerance, and dark green color. By intercrossing with meadow fescue (*Festuca pratensis* Huds.) a recurrent selection for drought and heat tolerance, we have developed a population of perennial ryegrass with a marked increase in drought tolerance. This increase was associated with a dramatic increase in the frequency of introgression or insertion of *F. pratensis* chromatin on a specific chromosome, among plants of perennial ryegrass that survived in the field for a year without supplemental irrigation. This specific segment of *F. pratensis* chromatin has already been associated with deep rooting, drought, heat, freezing, and flood tolerance in forage-type interspecific hybrids of fescues and ryegrasses in Europe. We believe that extreme selection applied to our materials favored the specific genome regions from *F. pratensis*. If successful, Californians may be able to enjoy their green grass year round with less water, too.

Although improving drought tolerance of cool-season turfgrasses would be beneficial, warm-season or C4 turfgrasses including bermudagrass, buffalograss, zoysiagrass, seashore Paspalum, St. Augustinegrass, and Kikuyugrass inherently use at least 20% less water compared to cool-season species. This is because they are more efficient at photosynthesis and are able to continue high-level carbohydrate production even when their stomates are partially closed. By contrast, cool-season grasses use a less efficient photosynthetic process and cannot produce enough carbohydrate to maintain growth unless their stomates are nearly wide open. Thus, when water is limited, transpiration rates of cool-season grasses are generally higher than those of warm-season grasses. Given that warm-season turfgrasses use significantly less water, why is their use mainly limited to arid and desert climates within the state? The simple answer is that end users desire green turf year round, and warm-season grasses undergo dormancy or turn brown during the colder winter months. Length and degree of dormancy are affected by temperature that, in turn, is affected by factors such as proximity to the ocean and altitude. Another challenge with maintaining warm-season grasses, especially on treed landscapes, is poor shade tolerance that can be compounded by heavy traffic. Despite there being no perfect turfgrass species for California, warm-season species are the future of landscapes in most of the state if turf is to remain a viable option. Research is ongoing at UC Riverside to determine the best and most efficient method of converting your lawn from a cool-season species like tall fescue to a warm-season turf to save water. Preliminary results indicate that eradication of tall fescue with a non-selective herbicide like glyphosate (e.g., Roundup) is the first critical step to eliminate competition with the warm-season grass. Although re-sodding the lawn would be ideal if money were no object, seeding (if seed is available) or plugging warm-season turfgrass species are less expensive means of obtaining a more drought tolerant lawn. And, if brown turf is not your bag, then consider application(s) of a turf colorant to maintain green color during eradication of cool-season turf or during the winter months when warm-season grasses are dormant.

As water resources continue to diminish, so too will water availability for landscape use. However, don't underestimate the benefits of turfgrass to California's economy and environment. At UC Riverside, our aim is to save turf, and water, too.

Dr. Jim Baird will be a featured panelist on Innovative Water Solutions at the 3rd Annual OC Water Summit.