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The Many Benefits of Tall Fescue Extend Belowground

By: Jenny Kao-Kniffin, Ph.D.

Tall fescue has come a long way from its days in the pasture. Traditionally, tall fescue was used for animal forage in the United States, but in more recent times has made its way into lawns, parks, and sports fields. The forage type grass has coarse blades that blend poorly with other turfgrasses, but newer varieties have a finer, turf-type appearance that comes closer to resembling their bluegrass and ryegrass counterparts. The deep green color of the turf-type varieties also help tall fescues blend in well with bluegrass as sod or overseeding on lawns. While much attention is spent above the soil surface, much of what makes tall fescue so beneficial to lawns and playing fields is buried beneath.

Tall fescue roots penetrate deeply into the soil, which helps the grass contend with drought better than other turfgrasses. Deeper roots have greater access to water found further down in the soil profile, but also allow the grass to explore a greater volume of soil for nutrient uptake of phosphorus and nitrogen. Indeed, plant roots play an important role in tall fescue's performance under drought stress, but the millions of bacterial cells and fungal hyphae found in the soil root zone may contribute to tall fescue's response to water deficit.

A lesser known advantage that tall fescue has over other turfgrasses is its partnerships with soil fungi and bacteria. A good example is the prevalence of fungi that are found living inside the roots and blades of the grasses. Some of these endophytic fungi protect the grass from water deficit stress by helping the plant adjust their physiology to promote recovery from drought. The accumulation of sugars, sugar alcohols, and proline in plant leaves and roots are associated with the presence of endophytic fungi in grass leaves. Beyond this, very little is known of how other microorganisms modulate plant responses to drought.

A team of researchers at Cornell University and NYS Integrated Pest Management (Jenny Kao-Kniffin, Ph.D., Kyle Wickings, Ph.D., Marty Petrovic, Ph.D., Frank Rossi, Ph.D., Jennifer Grant, Ph.D., and Joellen Lampman) investigated the additional types of microorganisms found in the

root zone of turf-type tall fescues under drought stress and recovery. Funded by the NYS Turfgrass Association (NYSTA) Turfgrass Environmental Stewardship Fund in 2014, the researchers found that soil bacteria show a drastic shift in their composition when recovering from drought. They grew 116 cultivars of turf-type tall fescues under a retractable rainout shelter, and exposed the grasses to drought for weeks. The novelty of the study shows the changes in the composition and function of the microorganisms during drought or recovery, and the potential role they play in tall fescue responses under these stressful conditions.

The results of the study are significant in probing the role of the hidden half of turfgrasses under a changing climate. As summers become hotter and drier, with more prolonged heat waves, and potentially more restrictions in irrigation usage, it is clear that turfgrass species or cultivars that are drought tolerant will be more sought after. With only one breeding selection in a single year, it is doubtful that plant breeding alone will provide the solutions needed for improving grass varietals in the rapid pace of climate change. Future plans to modify the biota in grass root zones to promote grass density, stress tolerance, and suppress weeds and pests are in development at Cornell, with several commercial applications underway.

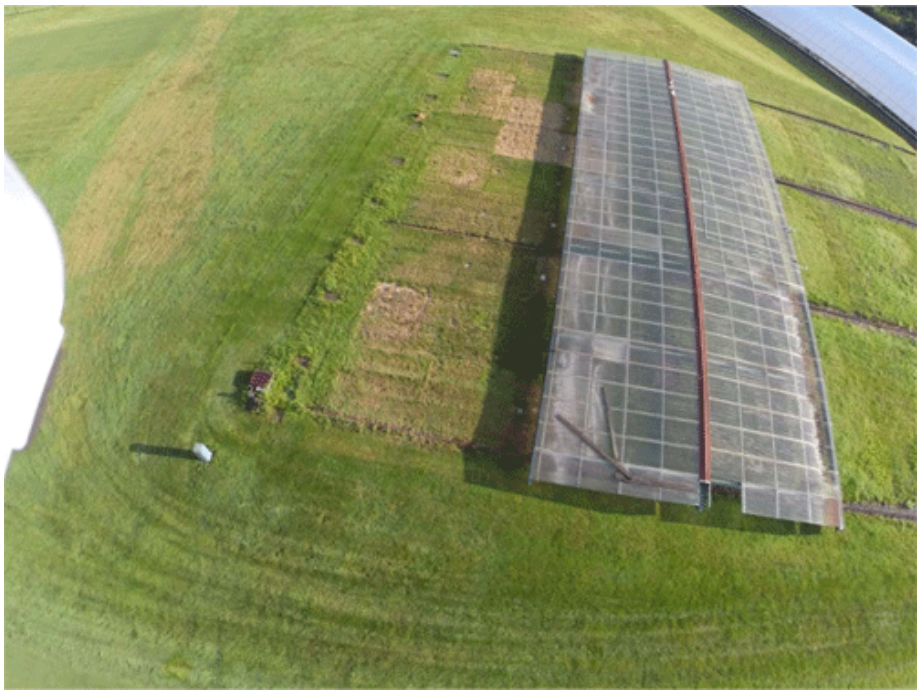

Photo shows the rainout shelter and the 116 cultivars of tall fescue in the 2014 drought tolerance study funded by the NYSTA TESF program. The photo was taken by Mary Thurn using a drone fixed with a camera.

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