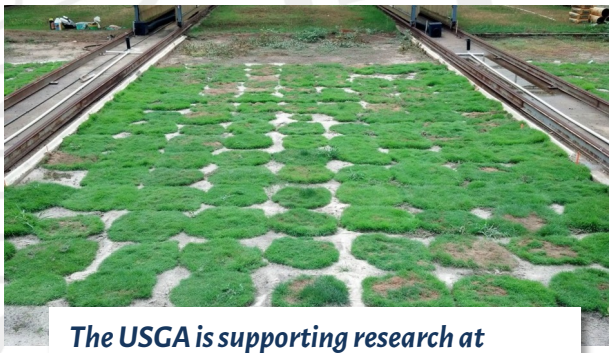
Gene Markers for Creeping Bentgrass Heat and Drought Tolerance

Heat and drought cause the summer decline in the health of creeping bentgrass. Reduced turf quality brought about by these two stresses involves many complex underlying factors. These include a reduction in photosynthesis, damage to cell membranes or increased reactive oxygen production. The heat and drought stress results in turf areas experiencing premature senescence and eventual plant death.

Improved heat and drought tolerance will help maintain quality turf the during the summer months. The USGA is supporting scientists at Rutgers University to identify heat and drought tolerance molecular markers in bentgrass. Promising gene markers include chlorophyll a/b binding protein, heat shock protein-70, and antioxidant gene glutathione-s-transferase. Now researchers are evaluating the relationship between the molecular markers and bentgrass field performance.



The USGA is supporting research at Rutgers University to identify molecular markers that effectively screen for heat and drought tolerance. Rutgers and the University of Georgia are cooperating on field testing the effectiveness the genetic marker to screen creeping bentgrass populations. The photo from the University of Georgia taken on August 6, 2014, shows the variation in summer turf performance among some of the creeping bentgrass lines and commercia cultivars.

Two creeping bentgrass populations established at Rutgers and University of Georgia contained 144 plants. The populations are a diverse collection from breeding programs at the two universities. The test also included 'Penncross', 'Crenshaw', 'Declaration', 'Penn A-4', and 'Luminary'. The goal was to confirm the usefulness of the developed molecular markers.

The research team rates the turf plots for heat tolerance during the summer at both locations. Characteristics evaluated include turf quality, membrane stability, chlorophyll content, and NDVI. Additionally, the scientists digitally analyze turf plot images

for turf color and density.

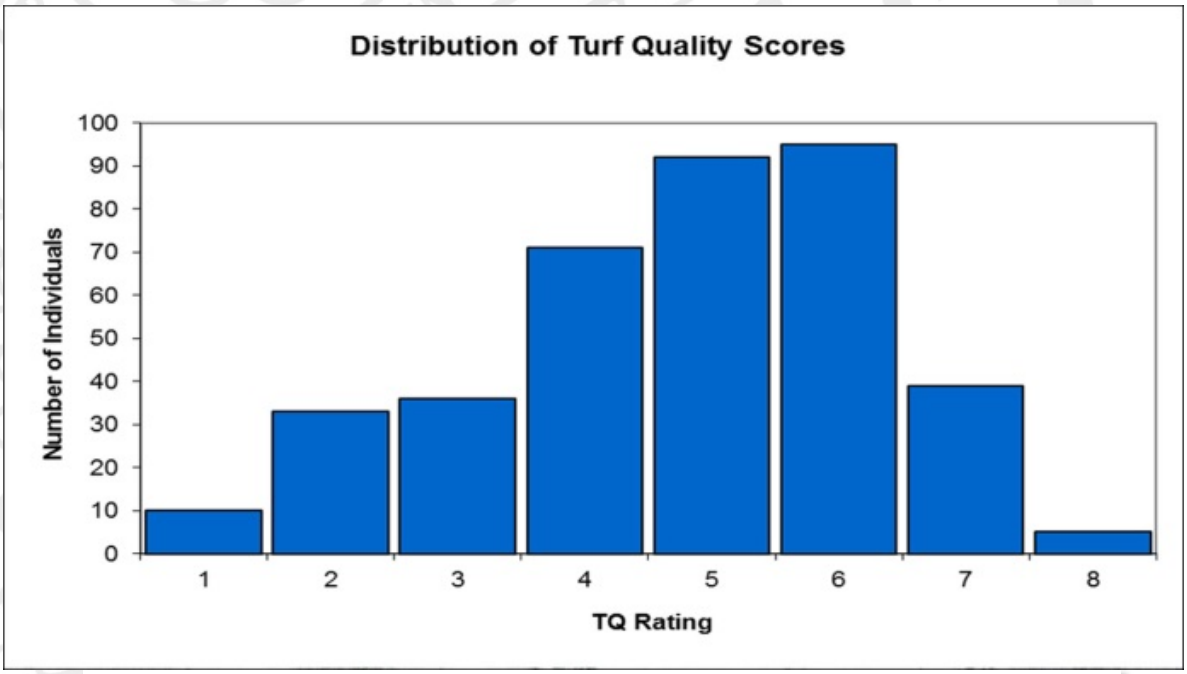
Turf quality ratings ranged from 1.0 to 8.0 during summer 2014 (Figure 1). A third of new lines outperformed the best-performing cultivars examined in this trial. DNA analysis identified similar gene markers associated with heat tolerance traits within the test populations. These results provide some confirmation of the usefulness and stability of molecular markers. The researchers are now evaluating drought tolerance using automated rain-out shelters at both locations. DNA from bentgrasses will be screened to determine the usefulness of the molecular markers for drought tolerance.

Source: Mike Kenna.

Additional Information:

Candidate Gene Markers for the Selection of Heat Tolerant Bentgrass

Identification of Quantitative Trait Loci (QTL) associated with drought and heat tolerance in bentgrass species



The distribution of turf quality (TQ) ratings at Rutgers University during the summer of 2014, showing genetic variation among 144 creeping bentgrasses lines and commercial cultivars for summer turf performance. A third of the new bentgrass lines performed better that the best-performing commercial cultivars in the trial.