

# TURFGRASS RESEARCH 2020



## Water Requirements of ‘Meyer’ Zoysiagrass for Survival and Recovery After Prolonged Drought

*Mu Hong, Dale Bremer, and Steve Keeley*

### Summary

Water restrictions on irrigation are generally not science-based and may cause irreversible damage to turfgrass or inadvertently waste water. The objectives of our study were to evaluate effects of minimum water applications to ‘Meyer’ zoysiagrass (*Zoysia japonica* Steud.) on 1) turfgrass performance during prolonged dry downs; and 2) survival and recovery thereafter. Zoysiagrass was watered with 0, 5, 10, 15, 20, 25, and 30% reference evapotranspiration (ET) replacement for two months in two consecutive summers under an automated rainout shelter (excluded all rainfall) near Manhattan, KS. Results indicated that irrigation at 20 to 30% ET slowed the decline in zoysiagrass performance compared with no water inputs. Irrigation at 30% ET maintained zoysiagrass at >75 percentage green cover (PGC) in the first year, and even with no water inputs (0% ET) or irrigation at only 5% ET replacement, zoysiagrass recovered after full irrigation resumed. In the second year, irrigation at 30% ET maintained zoysiagrass at >25 PGC throughout the dry down and it recovered thereafter, but plots with no water inputs (0% ET) or irrigated with 5% ET replacement only recovered to 30–42 PGC after 50 days of full irrigation. Water restrictions during severe droughts may conserve more water and reduce turfgrass damage by limiting irrigation of zoysiagrass to 20–30% ET than by using traditional standards such as allowing irrigation for only one day per week.

### Rationale

During prolonged droughts, water for turfgrass may be restricted or stopped, which may cause dormancy or even death of turfgrass. The loss of turfgrass during severe droughts may result in unsatisfactory visual appearance and significant reestablishment and human labor costs. Previous studies have indicated that limited water



JULY 2020

**K-STATE**  
Research and Extension

Kansas State University  
Agricultural Experiment Station  
and Cooperative Extension Service

K-State Research and Extension is an equal  
opportunity provider and employer.

View all turfgrass research reports online at: <http://newprairiepress.org/kaesrr>



applications during droughts may mitigate the severity of drought stress and improve the ability of turfgrass to recover upon rewatering (Fu et al., 2004; Hejl et al., 2016; Wherley et al., 2014). This indicates the possibility to achieve a balance between water conservation and turfgrass survival through droughty periods. Nevertheless, there has been little research on irrigation thresholds (water amounts) for preserving turfgrass survival during severe drought.

## Objectives

To evaluate in Meyer zoysia turfgrass: 1) the effects of minimum irrigation amounts on soil moisture and canopy performance during prolonged dry down periods; and 2) survival and recovery thereafter.

## Study Description

The study was conducted under an automatic rainout shelter that excluded all rainfall in 2017 and 2018 at the Rocky Ford Turfgrass Research Center near Manhattan, KS. The soil was a silty clay loam. In 2017, a 59-day dry down period (June 7 to August 5) was followed by a 40-day well-watered (recovery) phase. In 2018, a 60-day dry down period (June 4 to August 3) was followed by a 40-day well-watered (recovery) phase. Soil moisture, normalized difference vegetation index (NDVI), PGC, and visual quality (VQ: 1 = dead turf; 9 = uniform, green and dense turf; and 6 = minimally acceptable turf for use in home lawns) were measured weekly. The Meyer zoysia turfgrass had been sodded several years earlier on June 4, 2013. Zoysia plots were mowed at a 2-inch height. Six weekly irrigation treatments included: 0, 5, 10, 15, 20, 25, and 30% ET replacement using data from an on-site weather station (<http://mesonet.k-state.edu/>).

## Results

### *Dry Down*

Not surprisingly, canopy performance (NDVI, VQ, and PGC) generally declined among ET treatments as the dry downs progressed in each year (Figure 1 and 2). However, as a drought-resistant warm-season grass, Meyer zoysiagrass remained partially green, even without water inputs during a two-month dry down in the first year (Figure 1). In the second year, all zoysiagrass survived although some of the drier plots went dormant during the two-month dry down (Figure 2). Zoysiagrass irrigated at 30% ET maintained PGC above 75% and 25% during the drought periods in 2017 and 2018, respectively, while zoysiagrass at 0% ET declined towards 30% and 0% PGC by the end of each respective drought. In all, soil moisture and all canopy measurements in 30% ET plots averaged higher than those of 0% ET plots during drought in both years (data not shown). This indicates that zoysiagrass receiving as little as 30% ET from irrigation or rainfall could maintain partial green coverage during droughty periods. The overall performance of zoysiagrass declined faster in 2018 than 2017. This is probably because the carbohydrate reservoir of

**K-STATE**  
Research and Extension

Kansas State University  
Agricultural Experiment Station  
and Cooperative Extension Service





zoysiagrass had been largely depleted during the dry down in 2017 and may have not fully recovered by the beginning of 2018.

### *Recovery*

In both years, zoysiagrass generally recovered from the dry downs although the recovery was substantially weaker in the second year (Figure 1 and 2). For example, PGC, VQ, and NDVI increased to statistically similar levels among all irrigation treatments by 4 and 8 days after resuming full irrigation in 2017 and 2018, respectively. However, PGC, VQ, and NDVI rebounded faster and remained higher throughout the recovery of 2017 compared with 2018. Surprisingly, zoysiagrass with 0% and 5% ET recovered to ~60 PGC after only 4 days of full irrigation in 2017, but only recovered to 30–42 PGC after 50 days of full irrigation in 2018. Plots irrigated with 30% ET recovered to averages of both PGC > 60 and VQ > 6 in 4 days and 36 days in 2017 and 2018, respectively. The slower recovery of zoysiagrass in 2018 was likely a result of its reduced drought resistance during the dry down in 2018 than in 2017, as discussed earlier. This resulted in more plots of zoysiagrass that were dormant at the end of the dry down in 2018 than in 2017, which likely slowed the recovery afterwards. The recovery of zoysiagrass generally trended higher among plots that received more irrigation during the drought periods, especially in the second year, although differences were usually insignificant among treatments during the recovery in both years.

### *Conclusion*

Policy makers may conserve more water during prolonged droughts by restricting irrigation of zoysiagrass to 20–30% ET rather than imposing traditional restrictions such as allowing irrigation on only one day per week. Furthermore, irrigation at 20–30% ET could also improve zoysiagrass performance during drought, enhance survival and recovery, and ultimately reduce turfgrass damage compared with no irrigation at all.

### *References*

- Fu, J., J. Fry, and B. Huang. 2004. Minimum water requirements of four turfgrasses in the transition zone. *HortScience* 39:1740–1744. Retrieved from <https://doi.org/10.21273/HORTSCI.39.7.1740>.
- Hejl, R. W., B.G. Wherley, R.H White, J.C. Thomas, and C.H. Fontanier. 2016. Deficit irrigation and simulated traffic on ‘Tifway’ bermudagrass summer performance and autumn recovery. *Crop Sci.* 56:809-817. doi:10.2135/cropsci2015.03.0197.
- Wherley, B., J. Heitholt, A. Chandra, and P. Skulkaew. 2014. Supplemental irrigation requirements of zoysiagrass and bermudagrass cultivars. *Crop Sci.* 54:1823-1831. doi:10.2135/cropsci2013.11.0753.

**K-STATE**  
Research and Extension

Kansas State University  
Agricultural Experiment Station  
and Cooperative Extension Service





Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

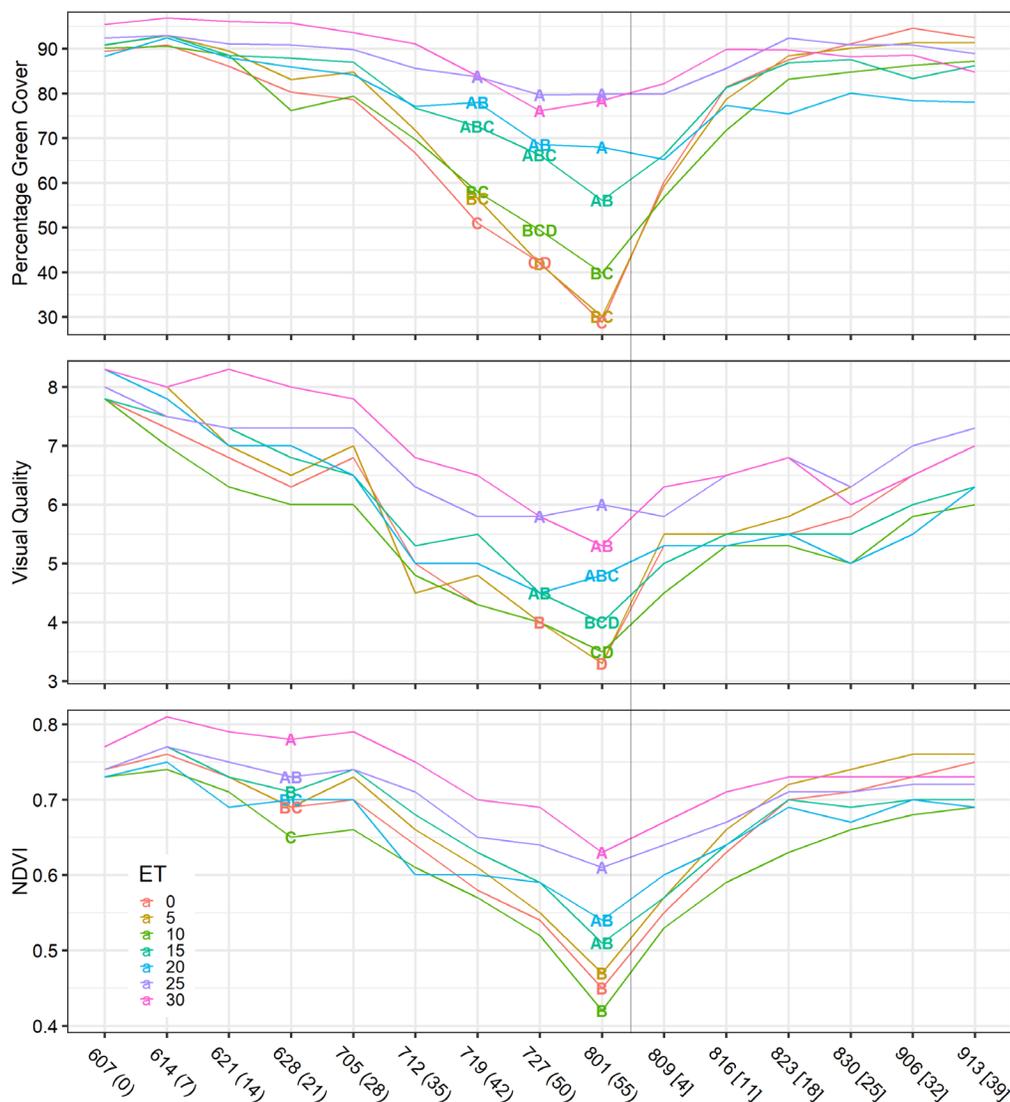
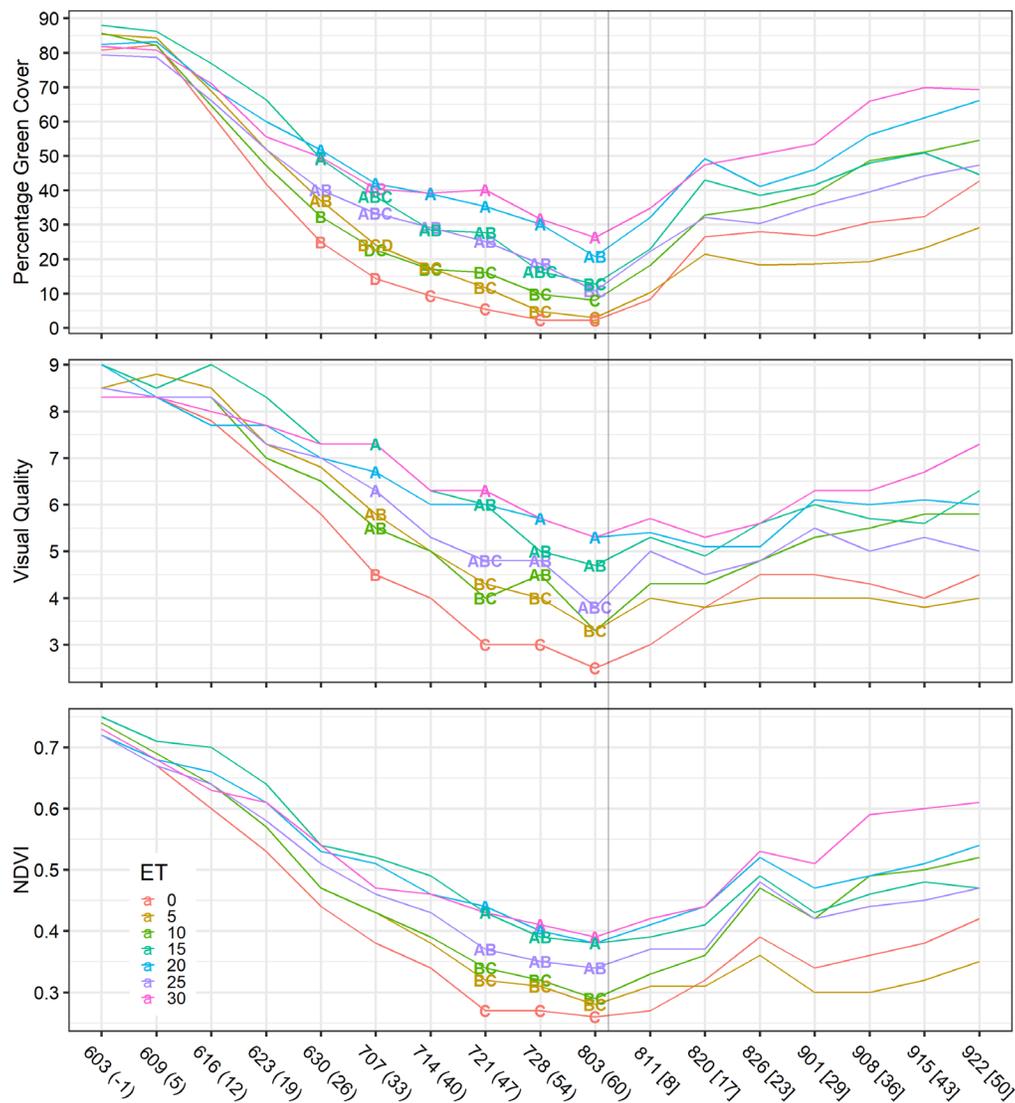


Figure 1. Percentage green cover, visual quality, and normalized difference vegetation index (NDVI) of zoysiagrass irrigated at 0 to 30% evapotranspiration (ET) replacement treatments in 2017. Numbers in parentheses on the x-axis denote days after the beginning of the dry down. Numbers in square brackets denote days after full irrigation was resumed (denoted by vertical line). Means with no letter in common within a measurement and day are significantly different ( $P < 0.05$ ).



Kansas State University  
Agricultural Experiment Station  
and Cooperative Extension Service





**Figure 2.** Percentage green cover, visual quality, and normalized difference vegetation index (NDVI) of zoysiagrass irrigated at 0 to 30% evapotranspiration (ET) replacement treatments in 2018. Numbers in parentheses on the x-axis denote days before (negative) or after (positive) the beginning of the dry down. Numbers in square brackets denote days after full irrigation was resumed (denoted by vertical line). Means with no letter in common within a measurement and day are significantly different ( $P < 0.05$ ). Note the adjusted scales on y-axes of all variables compared with Figure 1.

