DEFICIT IRRIGATION OF TURFGRASS SYSTEMS

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ABSTRACT

An increased demand on limited water supplies has led to a growing interest in landscape irrigation for turfgrasses such as ‘Empire’ zoysiagrass (*Zoysia japonica*). Deficit irrigation, a practice of irrigating in an amount below that of the plant’s maximum water demand, has been utilized to reduce water use in cool and warm seasonal turfgrass species. I conducted an experiment researching the different deficit irrigation amounts on ‘Empire’ zoysiagrass. Twice a week the turf was tested for overall color, quality and stress levels. Results from this project indicate that the decrease in water deficit irrigation effects the overall quality of ‘Empire’ zoysiagrass. In this study, it was shown, the greater acceptability of water deficit strategies to conserve water will occur if little loss in color, quality and stress can be assured, however that shifting from 0% to 25% to 50% to 75% irrigation deficits resulted in a decrease in overall turf quality for all treatments. My results showed that a 0% deficit treatment was most suitable for the overall quality of ‘Empire’ zoysiagrass.

BACKGROUND

Having witnessed first hand, the effects of water shortage in many areas of Australia, I can appreciate the value and need for water conservation. My studies while attending college in the USA are concentrated towards landscape and horticulture practices, and the importance of researching different watering techniques aimed to minimize water use may become beneficial in future years.
Turfgrass water consumption is defined as the total amount of water required for growth plus the amount of water lost through evaportranspiration, where ET is comprised of the sum of soil evaporation and plant transpiration.
Deficit irrigation, a practice of irrigating in an amount below that of the plant’s maximum water demand, has been utilized to reduce water use in cool and warm seasonal turfgrass species. ‘Empire’ zoysiagrass *(Zoysia japonica)* is a very hardy, attractive turfgrass for residential landscapes and offers maintenance advantages. Durable for professional use, ‘Empire’ zoysiagrass is also found on golf courses, theme parks, master planned communities and other commercial areas.
This study was conducted to evaluate the response and survival of ‘Empire’ zoysiagrass *(Zoysia japonica)* under the influence of deficit irrigation conditions.

METHODS

The study was conducted at the University of Florida’s Environment Horticulture Facility. The experiment design included treatment to twenty individual pots being weighed, evaluated and irrigated twice weekly. Pots were then weighed twice weekly (Monday & Thursday) to determine daily watering requirements on a volume basis for irrigation application to other pots. These treatments were continued for three weeks.
The 0% deficit pots were irrigated based on the amount of weight loss (grams) per pot (previous recorded pot weight – current pot weight = total weight loss). The 25%, 50% & 75% deficit treatment pots were irrigated according to the average weight recorded from the eight 0% deficit treatment pots. The change in color, stress and quality of each individual ‘Empire’ zoysiagrass pot was evaluated using the National Turfgrass Evaluation Program (NTEP). NTEP is a leader in evaluation of the quality of turfgrass species in the USA and many parts of the world (*7*). During the experiment these guidelines offered by the NTEP were used to rate the overall color, stress and quality of each turfgrass pot.

METHODS (contd)

RESULTS

Mean daily 0%, 25%, 50% &75% deficit treatment rates used to determine irrigation amounts are presented in Fig 1. The eight controlled ‘Empire’ zoysiagrass pots irrigated at 0% deficit in the three weeks of the experiment exhibited a fast decline in the first five days (350g to 224g), followed by a small incline for the next nine days (224g to 250g). Fourteen days into the experiment, a sharp decline of weight was experienced. The data shows that the average loss of weight in the first fourteen days was 265g, compared to 53g in the final seven days on the experiment. In addition to 0% deficit treatments, the remaining twelve pots were divided into groups of four. Each set of four pots either received a water irrigation of 25%, 50% or 75% deficit. This figure was calculated from the data taken from the 0% deficit treatment pots. The average weight figure loss from these eight pots were used to find the relative 25%, 50% & 75% amounts.

In the average quality and average color findings, it is clear that as time progressed the deficit treatments quality and color ratings decreased. The best turf quality ratings were observed with the the 0% deficit irrigation. See figure 2 and 3.The poorest ratings were observed with the 75% deficit irrigation. The best color ratings were observed with the 0% deficit irrigation. The poorest ratings were observed with the 75% deficit irrigation. It was interesting to note that after nineteen days that all the percentage deficit pots were below an acceptable (NTEP) rating of 6. Pots receiving less water due to the variety of deficit treatments resulted in greater quality and color loss.

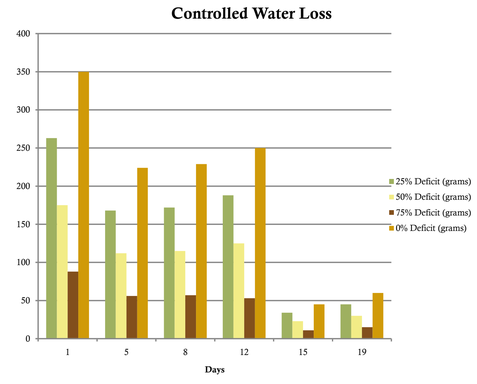


Fig 1: Deficit Irrigation Loss

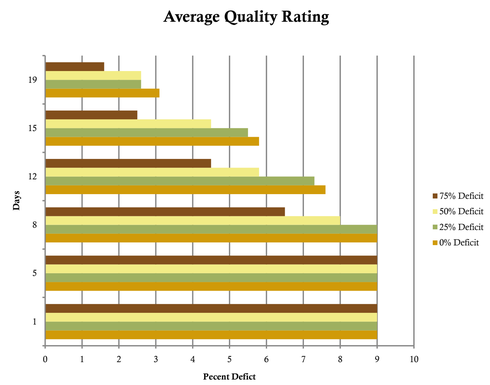


Fig 2: Average Quality

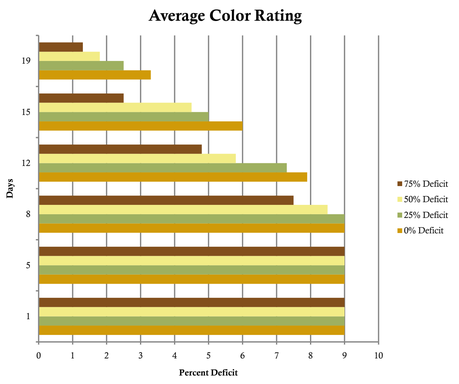


Fig 3: Average Color

0% Deficit – Day 12

25% Deficit – Day 12

50% Deficit – Day 12

75% Deficit – Day 12

RESULTS (contd)

The change of stress to each individual pot increased as time progressed in the experiment. This is shown in Fig 4. The highest stress levels in the ‘Empire’ zoysiagrass was shown in the 75% deficit treatment pots. The lowest stress levels in the ‘Empire’ zoysiagrass was shown by the 0% deficit treatment pots.

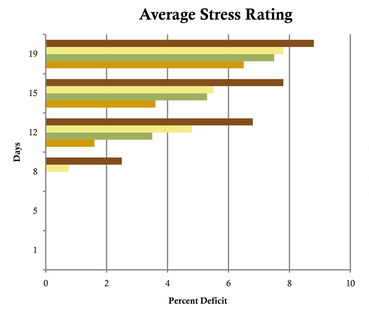
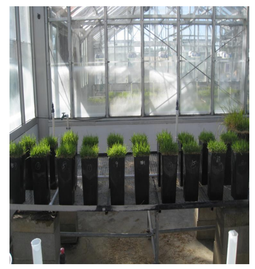


Fig 4: Average Stress



20 ‘Empire’ Zoysiagrass Pots

CONCLUSIONS

In all twenty pots color, quality and stress levels were well below acceptable standards. Based on this experiment, such a strategy of deficit treatment could only be partially beneficial if 100% of the ET lost was replaced with the appropriate irrigation amount. Reducing the deficit amount was shown to significantly affect the overall appearance of ‘Empire’ zoysiagrass in the experiment. However according to Jon F. Sass research, the results indicate that a 80% replacement of ET was sufficient to maintain ‘Empire’ zoysiagrass (*8*). Jon F. Sass’s results also agreed with the findings of DaCosta and Hang, who reported that zoysiagrass during the summer months could be irrigated on a three times per week frequency with as little as 80% if actual ET and maintain acceptable turf quality (*4*). Therefore, these two experiments show that irrigation deficit had great potential to conserve water resources and maintain quality grass. My results did not support these other research findings. Reasons why my results supported a 0% deficit treatment and not an 80% deficit was possibly due to the time of year of the experiment was conducted and the location of the experiment. The research from Jon F. Sass, DaCosta and Hang was conducted during the summer season and turf was grown outside. My research which was conducted during the late fall season and was also conducted in a controlled greenhouse facility, which created no interaction with natural environmental. It was clear that to maintain a high quality turf appearance, all deficits amounts except for 0% would cause a decrease in quality. As a future landscaper, this project has informed me of the importance of implementing an irrigation system, that is able to irrigate ‘Empire’ zoysiagrass at different deficit treatment amounts.

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