Water and Salinity Stress Impact on Tall Fescue Growth: An Evaluation of the ENVIRO-GRO Model

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INTRODUCTION

Turf is the largest irrigated crop in the United States. Minimizing water use and using recycled water are some of the practices that will help sustain the turf industry. Predictive models have the potential to help growers make management decisions related to water quality and deficit irrigation. This research tested Tall Fescue performance and water use under various drought and salinity conditions in columns in a greenhouse. The measured experimental data were then compared to simulated results from the ENVIRO-GRO model (Pang and Letey, 1998). The tested model has the potential to be a very useful resource for irrigation management and water conservation.

PROJECT OBJECTIVES

1. Evaluate the usefulness of the ENVIRO-GRO model in predicting relative yield, especially in the context of management of turf growth and performance as a result of applied water and salinity stress

2. Observe water and salinity stress effects on clipping yield and overall turf quality

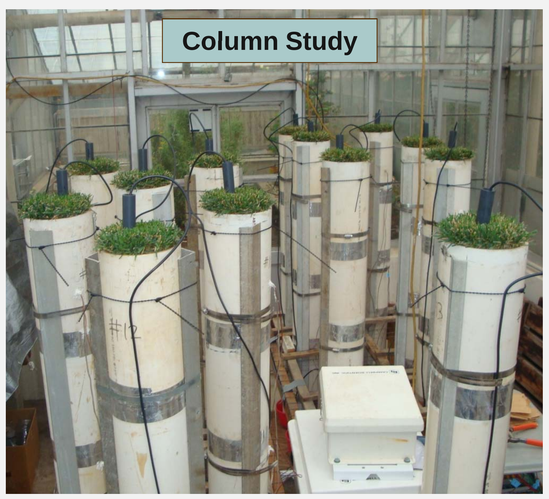
MATERIALS AND METHODS

Column Study:

Eigteen PVC columns (15.25 cm diameter, 1.5 m height) were constructed and packed with a sandy loam soil (68% sand, 20% silt, 12% clay) to a bulk density of 1.53 g cm^{-3}. Tall Fescue (Schedonorus phoenix (Scop.) Holub) was then planted in the column from sod and was given a 20-week establishment period, after which treatments of different irrigation application rates and irrigation water salinities were introduced to the columns (see Table 1). The turf was cut weekly to a standard height of 6.5 cm, and the clippings were collected, dried, weighed. Bi-weekly the turf was rated for overall visual quality and color using a scale 1 to 9 with 5=minimal acceptance. Since the treatments were not replicated, a scaling factor was used to reduce the effects of location on the data in order to show only the treatment effects.

Table 1

Trtmt #	EC_{iw} (ds/m)	I/ET_o
1	0.6	0.7
2	0.6	0.8
3	0.6	0.9
4	0.6	1.0
5	0.6	1.05
6	0.6	1.1
7	0.6	1.2
8	2.0	0.8
9	2.0	0.9
10	2.0	1.0
11	2.0	1.05
12	2.0	1.1
13	4.0	0.9
14	4.0	1.1
15	4.0	1.3
16	6.0	0.9
17	6.0	1.1
18	6.0	1.3



Model Evaluation:

ENVIRO-GRO uses water flow, plant uptake, and salt transport coefficients to calculate water content, salt movement, and thus relative yield. Model parameters including, soil hydraulic properties, plant root distribution, etc. were measured in the laboratory or estimated from information in the literature. Simulations were run and comparisons made between model simulated data and measured results.

RESULTS AND DISCUSION

Model Evaluation of Relative Yield:

- A linear relationship exists between model-simulated relative yield and measured relative yield (Figure 1).
- Deviation in plotted data can be attributed to experimental variability

Figure 1

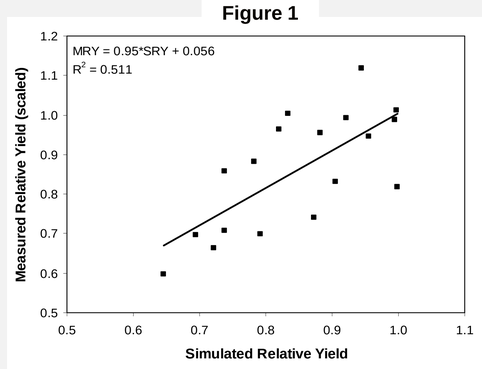
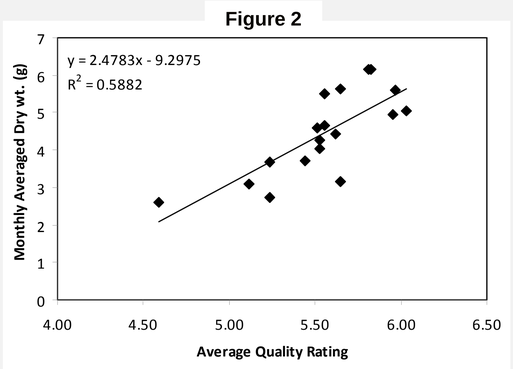


Figure 2



Observations Related to Yield:

- Yield decreases as ECiw increases, however, the decrease was not dramatically great
- The best I/ET for this experiment is 1.1, the higher water application rate resulted in a yield reduction, most likely due to aeration issues

Quality and Yield:

- Turf quality is linearly related to unscaled yield (see Figure 2).
- Because of this linear relationship, it is possible to estimate a "scaled" quality rating using scaled yield data (Figure 3).

Figure 3

CONCLUSION

- Yield reduction due to water and salinity stresses can be predicted by ENVIRO-GRO. The model shows promise as a predictive tool to assist turf growers in making management decisions related to irrigation water application rates and quality.

- In this experiment, high water application rates resulted in a yield reduction, most likely caused aeration issues and possibly nutrient leaching. For this column study the best I/ETo was 1.1.

- Turf Quality in this study can be correlated to total clipping weight

KEY REFERENCES

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