



NITRATE LEACHING AND NITROUS OXIDE EMISSIONS FROM TURFGRASS IRRIGATED WITH TAILORED WATER

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Background

- Turfgrass maintenance currently relies on nitrogen fertilization and potable irrigation. Turfgrass is the largest irrigated crop in the US (Milesi, n.d.).
- 50-70% of urban water use during the summer is attributed to landscape irrigation (Kjelgren et al., 2000).
- Nitrogen fertilization of crops causes nitrous oxide emissions.

Proposed solution

Tailored water: treated effluent with 15 ppm of nitrate added
Irrigating with tailored water eliminates the need for both potable water and nitrogen fertilizer.

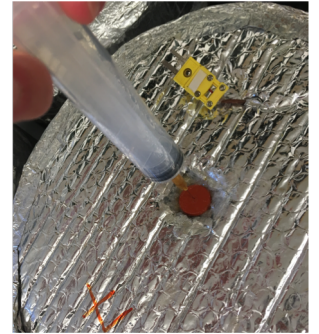
Question

Does tailored water increase nitrous oxide emissions?

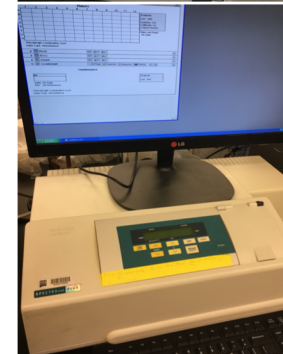
Materials and Methods

Sampling

- Drainage samples
- Biomass (grass clippings)
- Soil
- Gas sampling



Gas chromatograph with an electron capture detector (GC-ECD) for running gas samples for nitrous oxide



SPECTRAMax PLUS (colorimetric method) for running drainage samples for nitrate and nitrite.

Grass pots

- 6 bermudagrass pots
- 6 native soil control pots
- 6 buffalograss pots

Treatments

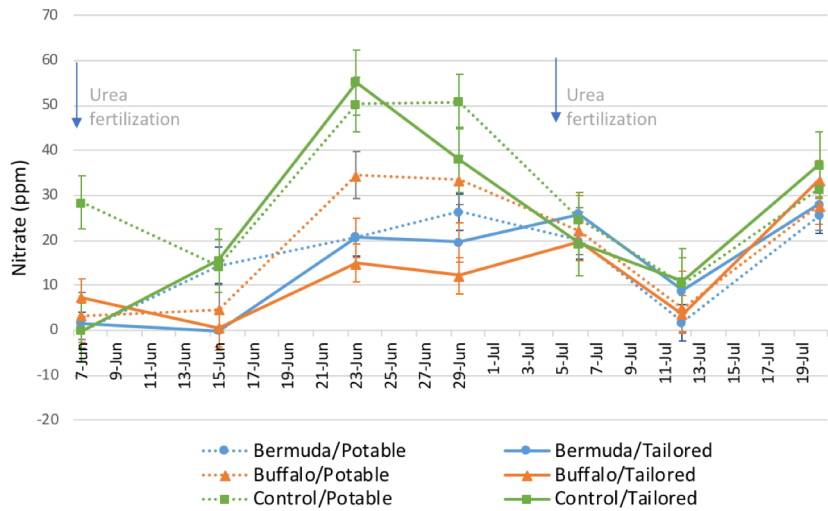
- 3 of each grass pot type watered with tailored water every other day
- 3 of each grass pot type watered with potable water every other day, and fertilized with urea fertilizer once a month
- Each pot receives the same amount of nitrogen fertilization per month



The greenhouse provides a controlled environment

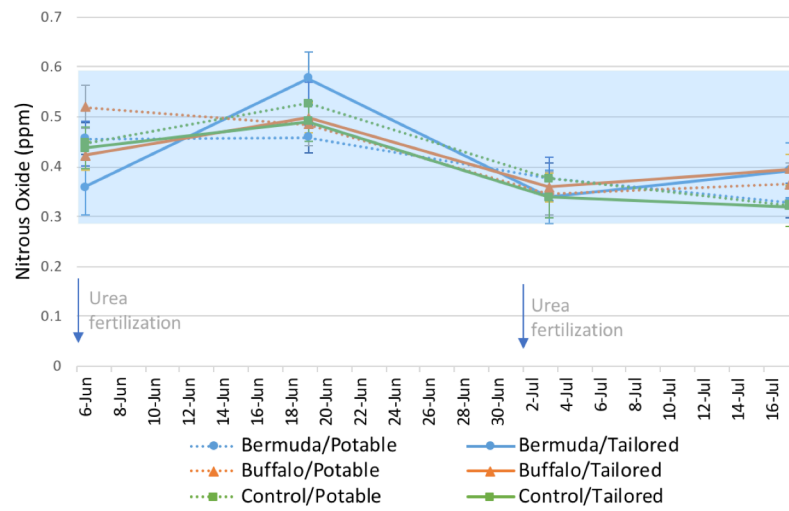
Results

Nitrate in drainage



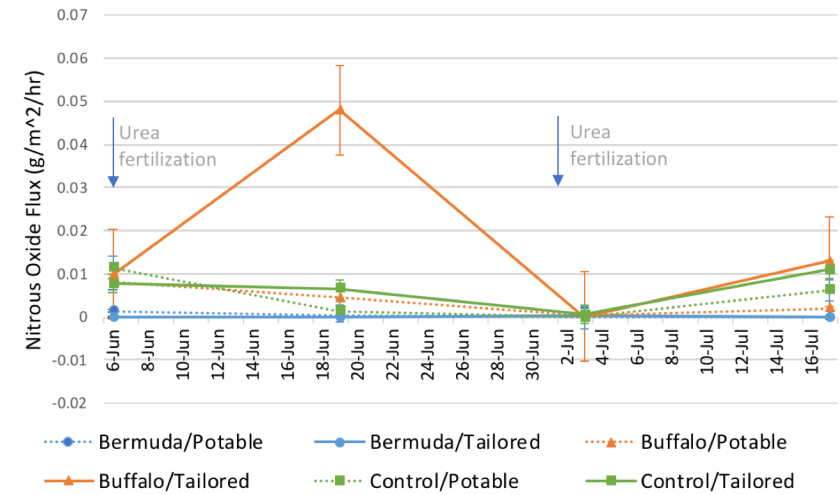
Based on ANOVA, only grass type makes a difference with regards to average nitrate in drainage ($p = 0.0058$). The control pots have more nitrate in drainage likely due to the lack of uptake by the plants.

Nitrous oxide emissions



The blue area represents the range in which ambient nitrous oxide concentrations are measured. ANOVA testing indicates neither irrigation type nor grass type makes a difference in N_2O emissions ($0.0853 < p\text{-values} < 0.709$).

Nitrous oxide flux



Nitrous oxide flux is calculated with the model $f_0 = \frac{(C_1 - C_0)^2}{t_1(2C_1 - C_2 - C_0)} \ln\left(\frac{C_1 - C_0}{C_2 - C_1}\right)$. Based on ANOVA testing, neither grass type nor irrigation type are have significantly different average nitrous oxide fluxes.

Conclusions

- Tailored water is a suitable replacement of urea fertilizer/watering.
- Tailored water doesn't exacerbate nitrous oxide emissions or nitrate in drainage.

References

- Kjelgren, R., L. Rupp, and D. Kjelgren. (2000). Water conservation in urban landscapes. *HortScience* 35:1037–1040.
- Longworth, J., Valdez, J., Magnuson, M., & Richard, K. (2010). New Mexico Water Use by Categories 2010. *New Mexico Office of the State Technical Report 54*.
- Milesi, C., Elvidge, C., Dietz, J., Tuttle, B., Nemani, R., & Running, S. (n.d.). A Strategy For Mapping and Modeling the Ecological Effects of US Lawns. *ISPRS*. Retrieved from <http://www.isprs.org/proceedings/XXXVI/8-W27/milesi.pdf>
- Parkin, T., & Venterea, R. (2010). Chamber-Based Trace Gas Flux Measurements. In *USDA-ARS GRACEnet Project Protocols* (pp. 3-1-3-39).