Characterization of Reactive Nitrogen Emissions from Turgrass

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INTRODUCTION

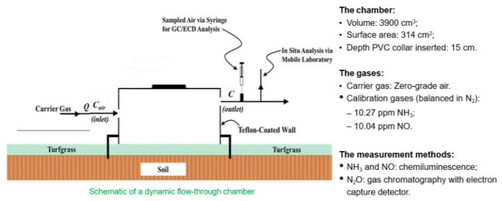
Turfgrass management is a multibillion-dollar industry that has been regarded as an important part of urban and suburban landscape practices[1].

This study is aimed at characterizing seasonal emissions of three reactive nitrogen (Nr) species, *i.e.*, ammonia (NH_3), nitric oxide (NO), and nitrous oxide (N_2O), from turfgrass over the course of a year.

EXPERIMENTAL DESIGN

Soil emissions, conducted at the Lake Wheeler Turfgrass Field Laboratory, Raleigh, NC, USA, were measured using the dynamic chamber interfaced to an environmentally controlled mobile laboratory[2]. NH_3, NO, and N_2O flux were measured over the tall fescue surface, following a randomized complete block design with 10 replicates of three N-fertilizer (2.3% ammoniacal N, 22.7% urea N) treatments (0, 36.5, and 73 kg N ha^{-1} yr^{-1}).

Measurement of Nr from turfgrass



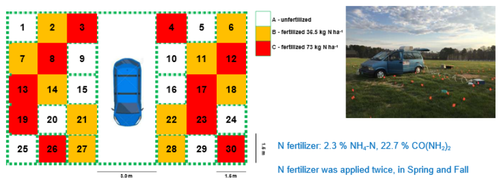
Schematic of a dynamic flow-through chamber

The chamber:
- Volume: 3900 cm^3;
- Surface area: 314 cm^2;
- Depth PVC collar inserted: 15 cm.

The gases:
- Carrier gas: Zero-grade air.
- Calibration gases (balanced in N_2):
  - 10.27 ppm NH_3;
  - 10.04 ppm NO.

The measurement methods:
- NH_3 and NO: chemiluminescence;
- N_2O: gas chromatography with electron capture detector.

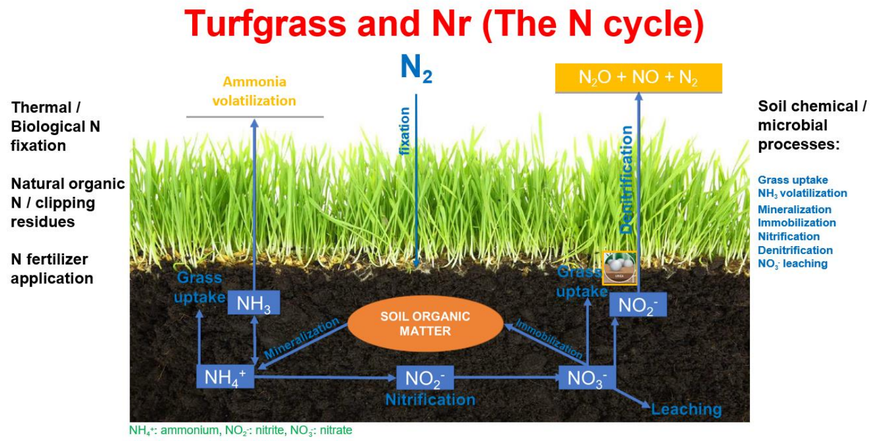
Experimental design



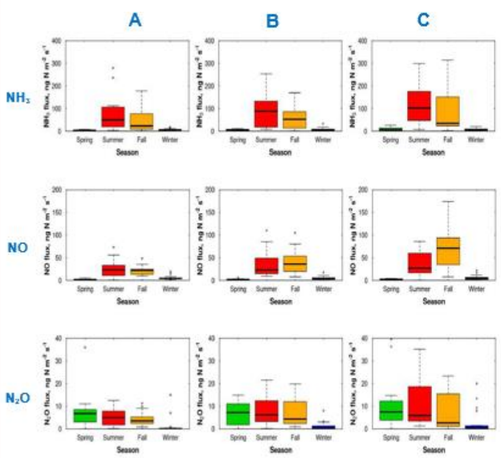
N fertilizer: 2.3 % NH_4-N, 22.7 % $CO(NH_2)_2$

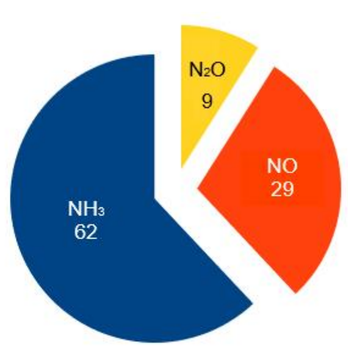
N fertilizer was applied twice, in Spring and Fall

NITROGEN CYCLE IN TURFGRASS



RESULTS

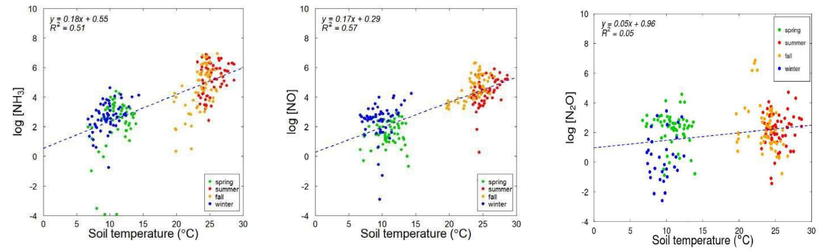




% of reactive nitrogen (NH_3, NO, and N_2O) from turfgrass

Reactive nitrogen seasonal emission flux

Log [Nr] Versus Soil Temperature



NH_3 NO N_2O

CONCLUSIONS

- **Seasonal Nr emissions from turfgrass were measured using dynamic flow-through chamber technique;**
- **Meteorological, soil physical and chemical parameters relevant to analysis;**
- **Different patterns shown by Nr species in response to N-fertilizer, soil temperature and moisture;**
- **Nr emission factors from turfgrass with respect to N-fertilization treatment;**
- **Estimated Nr emissions during the four predominant seasons.**

REFERENCES

1. Spence, P.L., Walker, J.T., Robarge, W.P., Preston, B. and Osmond, D.L., 2015. Comparing nitrous oxide losses from three residential landscapes under different management schemes following natural rainfall events. Urban Ecosystems, 18(4), 1227-1243.
2. Aneja, V.P., Chauhan, J.P., Walker, J.T., 2000. Characterization of atmospheric ammonia emissions from swine waste storage and treatment lagoons, Journal of Geophysical Research, 105, 11535-11545.

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