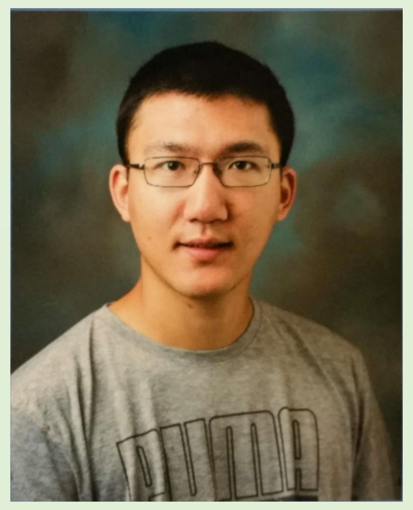

# Carbon Dioxide Flux of Renovated and Established Bermudagrass Fertilized By Slow Release and Soluble Fertilizers


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## Introduction

Bermudagrass is a warm-season turf and is the dominant turfgrass species used on golf course fairways and many other areas in the southern United States (Cole et al. 1997). Carbon dioxide flux of bermudagrass and the resulting sequestration of carbon may play a beneficial role in the ecosystem. A study conducted in Alabama has estimated the $CO_2$ flux of bermudagrass as affected by different N application rates (Hamido et al., 2016). However, the influence of N and seasonal changes in $CO_2$ flux have not been reported on bermudagrass in the subtropical environment of south Florida. Additionally, CO2 flux may differ between soluble and slow release N sources as well as between different soil types.

## Hypothesis

H: Soil types, N sources and N rates will influence the $CO_2$ flux of Tifway bermudagrass (*Cynodon dactylon* (L.) Pers. × *C. transvaalensis* Burtt-Davy).

## Material and Method

**Location:**

UF/IFAS Ft. Lauderdale Research and Education Center

**Time period:**

June 2016 to June 2018

**Grass:**

Tifway bermudagrass

**Soil:**

Hallandale fine sand


About 35 cm of soil was removed and replaced with sand

**Experimental design:**

split-split plot, with 4 replication and 80 sub-sub plots in all

**Treatments:**

(Table 1)

**Fertilizer Application:**

Every two months, started in June 2016

**Data Collection :**

Carbon dioxide flux (Kg $ha^{-1}$ $d^{-1}$), measured every two weeks

**Equipment:**

Licor - 6400XT

**Data analyzation :**

Data was analyzed in SAS using GLIMMIX.

**Table 1. Treatments**

| Whole Plot (10×4m) Soil types | Sub-plot (10×2m) Fertilizer types | Sub-sub-plot (2×2m) N rate (kg $ha^{-1}$ $yr^{-1}$) |
|---|---|---|
| | | 0 |
| Renovated | Urea | 49 |
| | | 147 |
| Established | Polymer coated urea | 245 |
| | | 343 |

**Table 2. ANOVA from June 2016 to May 2017**

| | $CO_2$ Flux |
|---|---|
| Soil | * |
| N source | NS |
| Nrate | *** |
| Soil × N source | NS |
| Soil × N rate | *** |
| N source × N rate | NS |
| Soil × N source × N rate | NS |

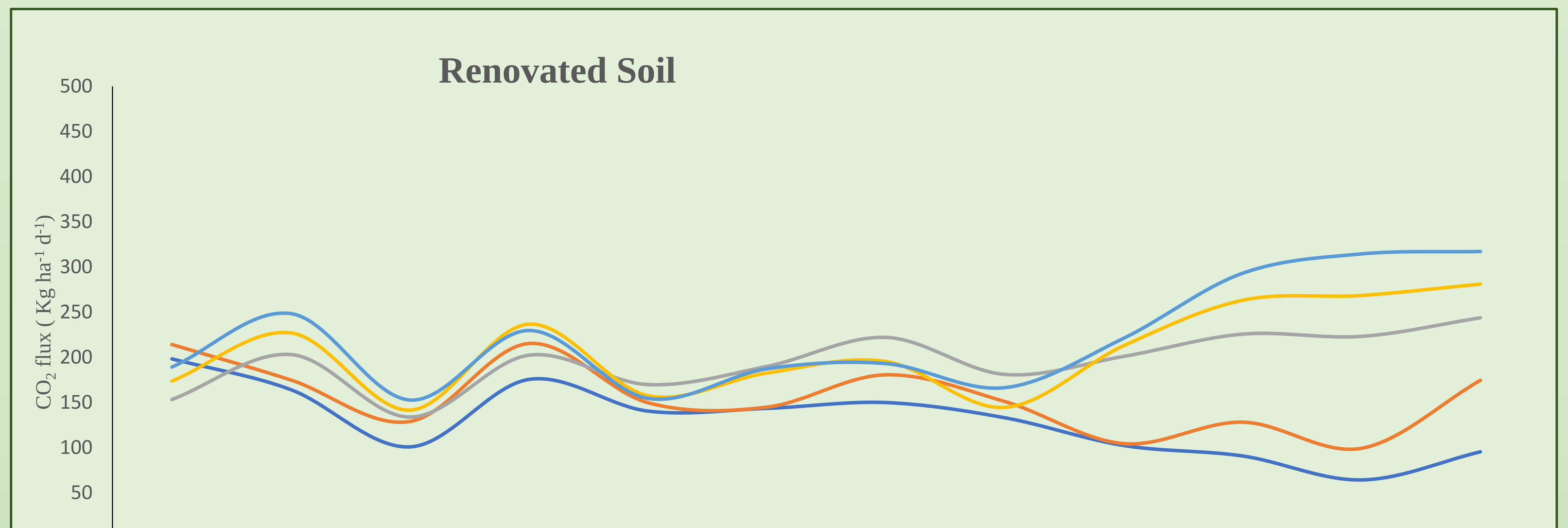
* Significance at P ≤ 0.05

*** Significance at P ≤ 0.001

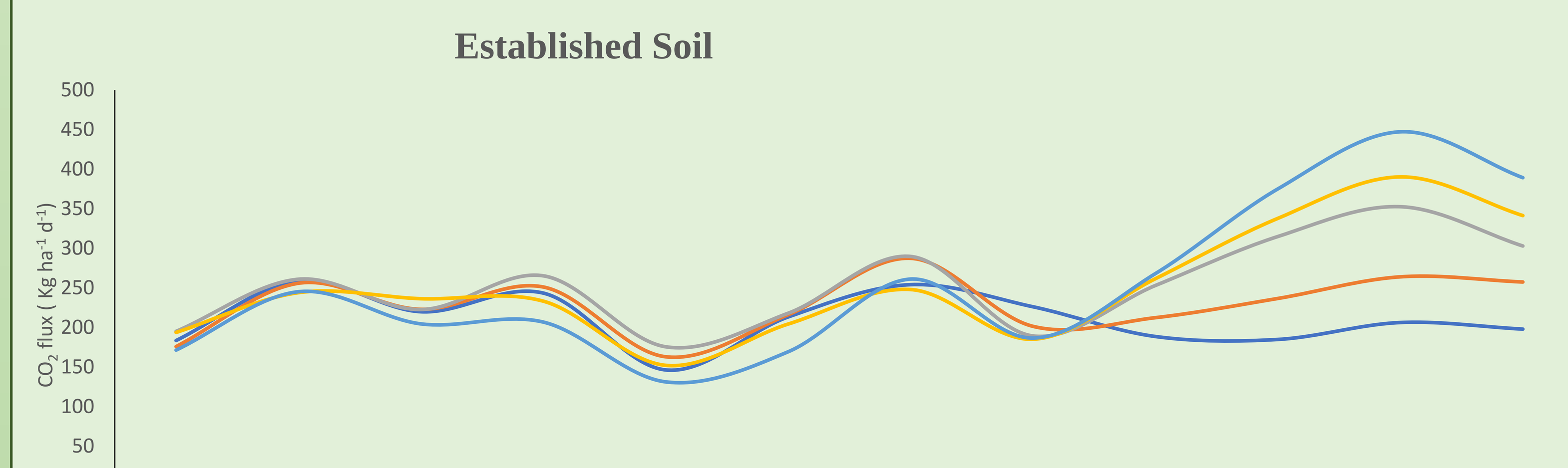
**Table 3. Soil N analysis**

| | $NO_3$-N† (mg/kg) | $NH_4$-N † (mg/kg) | Total N‡ (%) |
|---|---|---|---|
| Renovated | 0.16 | 8.47 | 0.01 |
| Established | 2.79 | 8.10 | 0.47 |

† KCl extractable
‡ Total N by combustion




| N rate (kg $ha^{-1}$ $yr^{-1}$) | June | July | August | September | October | November | December | January | February | March | April | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 198.28 A | 164.19 A | 100.93 A | 175.53 A | 140.56 A | 143.5 A | 149.95 A | 133.19 A | 102.46 B | 90.87 E | 64.35 E | 95.45 E |
| 49 | 214.11 A | 174.85 A | 128.9 A | 215.24 A | 149.79 A | 144.77 A | 180.6 A | 151.09 A | 104.43 B | 128.18 D | 99.26 D | 174.52 D |
| 147 | 153.24 A | 203.1 A | 133.81 A | 202.34 A | 169.81 A | 189.89 A | 222.1 A | 181.09 A | 201.02 A | 225.71 C | 223.25 C | 243.83 C |
| 245 | 173.75 A | 226.93 A | 141.61 A | 236.61 A | 157.63 A | 182.55 A | 195.48 A | 144.64 A | 212.73 A | 263.02 B | 268.33 B | 280.91 B |
| 343 | 189.15 A | 248.37 A | 152.67 A | 229.7 A | 154.52 A | 187.18 A | 193.03 A | 166.34 A | 221 A | 293 A | 314.48 A | 317.18 A |




| N rate (kg $ha^{-1}$ $yr^{-1}$) | June | July | August | September | October | November | December | January | February | March | April | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 183.4 A | 258.9 A | 219.74 A | 243.28 A | 146.26 A | 213.18 A | 253.96 A | 226 A | 188.45 B | 184.75 E | 206.14 E | 197.8 E |
| 49 | 175.71 A | 255.75 A | 222.8 A | 250.96 A | 162.8 A | 215.99 A | 287.22 A | 201.22 A | 212.23 B | 236.51 D | 263.85 D | 257.31 D |
| 147 | 194.96 A | 260.81 A | 222.48 A | 265.1 A | 175.43 A | 217.9 A | 289.56 A | 189.11 A | 252.96 A | 314.82 C | 352.43 C | 302.79 C |
| 245 | 193.64 A | 243.88 A | 236.23 A | 233.1 A | 152.06 A | 204.26 A | 247.83 A | 185.08 A | 261.58 A | 337.77 B | 390.06 B | 341.22 B |
| 343 | 171.32 A | 245.11 A | 204.46 A | 206.74 A | 131.19 A | 169.28 A | 261.09 A | 186.57 A | 268.11 A | 375.1 A | 447.18 A | 389.19 A |

Figure 1. $CO_2$ Flux as Influenced by Soil Types.

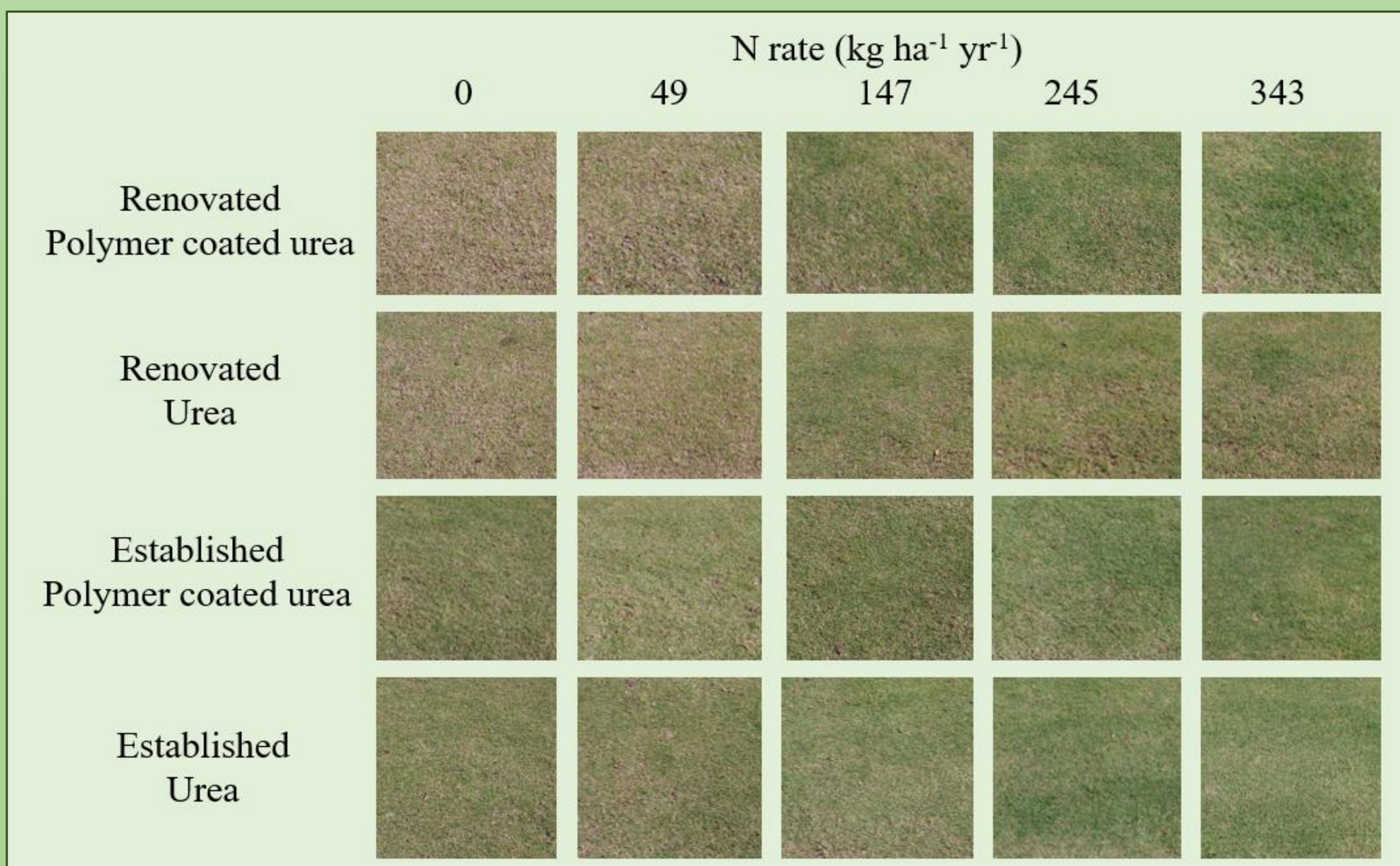



Figure2. March 23, 2017 plot pictures.

## Discussion

Carbon dioxide flux was not influenced by N sources but was influenced by the Soil × N rate interaction (Table 2). From June 2016 to January 2017, N rate did not influence $CO_2$ flux in either the renovated or established soil (Fig. 1). This was unexpected since the established soil contained greater quantities of N than the renovated soil (Table 3). However, beginning in February, 2017, began to be observed among N rates in both soils. The increasing $CO_2$ flux as influenced by N rate followed the order 343 > 245 > 147 > 49 > 0 kg N $ha^{-1}$ $yr^{-1}$ for both soils. From February through April, 2017, turfgrasses $CO_2$ flux responded differently from the 0 and 49 kg N $ha^{-1}$ $yr^{-1}$ treatments. On the established soil, the 0 and 49 kg N $ha^{-1}$ $yr^{-1}$ treatments resulted in an increase in $CO_2$ flux, whereas on the renovated soil both treatments resulted in a decrease in $CO_2$ flux. The $CO_2$ flux reduction on the renovated soil is likely due to a reduction in soil nutrients. Although all plots received N as well as a uniform application of phosphorus, potassium, and micronutrients, the existing nutrients in the established soil likely enhanced turfgrass health as evidenced by the increase in $CO_2$ flux in the established soil from February to April on the 0 kg N $ha^{-1}$ $yr^{-1}$ treated plots. Variations in $CO_2$ flux were observed throughout the year. However, no seasonal trend has been observed as previous investigations may indicate. South Florida's subtropical climate allows bermudagrass to grow year-round, thus, a season influence on turfgrass growth would be minimal compared to studies conducted in cooler climates.

## Conclusion

We reject the $H_o$: N rates and soil types do not influence $CO_2$ flux of bermudagrass and conclude that both soil and N rates do influence $CO_2$ flux. Although the first seven months did not result in differences, differences occurring after February will likely continue since the 0 kg N $ha^{-1}$ $yr^{-1}$ plots will likely continue to decline in quality in the absence of N. We fail to reject the $H_o$: N sources influence $CO_2$ flux of bermudagrass. To date, N sources have resulted in similar $CO_2$ flux.

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