**Objectives:**

1. The main goals include evaluating the effects of irrigation on N$_2$O emissions and CO$_2$ fluxes over two years.
2. Cumulative N$_2$O emissions among treatments will be estimated over the entire study to determine how much emissions can be reduced under various irrigation levels.
3. The effects of irrigation on turfgrass quality and survivability will also be evaluated. Fluxes of CO$_2$ will be investigated with emphasis given to rates of photosynthesis (CO$_2$ intake) compared with respiration (CO$_2$ emissions) to determine the irrigation level(s) with the greatest likelihood of sequestering more carbon.

Nitrous oxide (N$_2$O) and carbon dioxide (CO$_2$) are important greenhouse gases that have been implicated in global climate change. Furthermore, N$_2$O is the most important ozone-depleting substance in the atmosphere. Turfgrass systems are typically fertilized with nitrogen (N) and irrigated, which may result in significant N$_2$O emissions; emissions of N$_2$O also represent a loss of N fertilizer. Turfgrass also has the capacity to sequester or emit CO$_2$ from/into the atmosphere via photosynthesis and respiration. Because turfgrass covers ~ 50 million acres in the USA, turfgrass may have significant impacts on global atmospheric N$_2$O and CO$_2$ inventories. The development of management practices that reduce N$_2$O emissions from turfgrass and enhance carbon sequestration in turf soils may help to mitigate climate change and atmospheric ozone destruction. The use of slow-release N fertilizer may mitigate N$_2$O emissions from turf by reducing ammonium and nitrate levels in the soil immediately after fertilization. Deficit irrigation may mitigate N$_2$O emissions by reducing denitrification in turfgrass soils, although deficit irrigation may also affect carbon (C) sequestration by influencing photosynthesis and respiration (i.e., CO$_2$ fluxes).

The primary goals of this study are to quantify the magnitude and patterns of N$_2$O emissions in turfgrass and to determine how irrigation and N fertilization may be managed to reduce N$_2$O fluxes and enhance carbon sequestration. Carbon sequestration and N$_2$O fluxes will be...
measured in ‘Meyer’ zoysiagrass (Z. japonica) managed under deficit irrigation and fertilized with urea or slow-release N. Zoysiagrass is a warm-season turfgrass species that provides an excellent golfing surface that is commonly used for tees, fairways, and roughs in the transition zone. Fewer inputs are required in zoysiagrass, which may minimize its impacts on the environment compared to other turfgrasses. The study is being conducted under a large rainout shelter near Manhattan, Kansas. By shielding rainfall from the turfgrass, researchers can control the amount of water applied to plots. Zoysiagrass plots were sodded on June 4, 2013 and allowed to establish during the summer of 2013. Starting in 2014, two irrigation treatments will include medium (80% evapotranspiration [ET] replacement) and medium–low (60% ET replacement). Three N–fertilization treatments will include urea and polymer–coated N, both at 2 lb/1000 ft², and a control with no N applied. In each treatment, N₂O emissions will be measured periodically with static chambers placed over the turfgrass surface and using gas chromatography.

Carbon sequestration in the upper soil profile (0 to 12 inches) will be measured by sampling soil C at the beginning and end of the 3–year study. Initial soil C was measured on Aug 22, 2013. Ancillary measurements will include visual quality, percent green cover, soil moisture, temperature, and nitrate and ammonium.

**Summary**

- Zoysiagrass was sodded into plots in June 2013 under a large rainout shelter located in the transition zone.
- Carbon sequestration and emissions of N₂O will be measured from plots receiving two irrigation and three N fertilization treatments.
- Results are expected to provide golf course superintendents with information on specific irrigation levels and N types that could reduce N₂O emissions and enhance carbon sequestration in zoysiagrass fairways and roughs.

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**Meyer zoysiagrass in the plot area of a large rainout shelter near Manhattan, Kansas. October 21, 2013.**