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The Effects of Fertilizer Sources and Site Location on the Mitigation of Greenhouse Gas Emissions from Creeping Bentgrass Putting Greens and Kentucky Bluegrass Roughs

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Understanding greenhouse gas (GHG) emissions from turfgrass, the largest managed agronomic crop in the United States, allows managers to make cultural management decisions that reduce GHG emissions. The objective of this project was to conduct a two-year field study evaluating fertilizer source [Urea (URE), Polymer Encapsulated Urea (POL), and Milorganite (MIL)] and site location (varying soil moisture) on GHG [carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)] emissions. GHG data, soil temperature, soil moisture, canopy greenness, and turfgrass quality were collected. High soil temperature and moisture were correlated with soil CO_2 and N_2O flux ($p<0.0001$). The wet rough fluxed significantly more CH_4 across the 2-year study ($p<0.05$). The POL fluxed the highest amount of soil CO_2; while POL and MIL fluxed the largest amount of soil N_2O on the wet rough ($p<0.05$). MIL and POL increased canopy greenness in both roughs during the spring ($p<0.05$). On the green, URE produced greater canopy greenness in the spring and fall. MIL, POL, and URE improved canopy greenness during the summer. Our results indicate when soil moisture and temperature are high, turfgrass managers should employ methods of reducing soil temperatures that do not increase soil moisture to reduce GHG emissions. Under warm and wet conditions, gaseous losses of GHGs are accelerated with slow-release fertilizers. Residual nitrogen from slow-release fertilizers can also result in greater GHG losses, especially in areas that experience low soil moisture levels in the previous season.