**N2O emissions during establishment phase of various bioenergy cropping systems**

Nitrous oxide (N2O) is a potent greenhouse gas and a substantial proportion of the total carbon footprint associated with feedstock production, and as bioenergy cropping systems continue to be considered, their greenhouse gas emissions will be a key component of sustainability evaluation. N2O emitted from soils is primarily the result of microbially-driven nitrification and denitrification, processes which are influenced by various environmental factors including temperature, oxygen availability, and microbial activity, among others, and the effect of each of these factors differs among cropping systems. Researchers in the DOE’s Great Lakes Bioenergy Research Center compared the establishment phase N2O emissions of annual monocultures of continuous corn and corn-soy bean-canola rotations; perennial monocultures of switchgrass, miscanthus, and hybrid poplar; and perennial polycultures of early successional species, native grasses, and native prairie species. These measurements were done over the 2- to 4-year period following planting over which several perennial crops attain “full capacity” production of biomass. Their results indicate that emissions ranged from 3.1-19.1 kgN2O-N/ha yr for annuals (continuous corn > corn-soybean-canola) and 1.1-6.3 kgN2O-N/ha yr for perennials, with N2O peak fluxes being associated with periods of rain following fertilizer application. Additionally, they found that during establishment phase, perennial bioenergy crops emit less N2O than annual crops, especially when not fertilized. And finally, their results show that models trained on single systems performed well in most monocultures but worse in polycultures, which means simulation models including N2O emissions should be parameterized specifically for particular plant systems.

**References:** Oates, L. G., Duncan, D. S., Gelfand, I., Millar, N., Robertson, G. P. and Jackson, R. D. (2015), Nitrous oxide emissions during establishment of eight alternative cellulosic bioenergy cropping systems in the North Central United States. GCB Bioenergy. doi: 10.1111/gcbb.12268

 **Contact**: Dr. N. Kent Peters, SC-23.2, (301) 903-5549