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Roley SS, Duncan DS, Liang D, Garoutte A, Jackson RD, Tiedje JM, Robertson GP

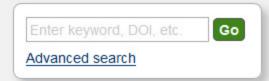
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Description During 2015, net nitrogen mineralization, net nitrification, soil nitrogen fixation,

and root nitrogen fixation was measured in the Switchgrass Nitrogen Rate Experiment, at both Kellogg Biological Station (MI, USA) and Arlington Agricultural Research Station (WI, USA). All replicates of 3 fertilizer treatments (0 kg N/ha/yr, 56 kg N/ha/yr, and 196 kg N/ha/yr) were measured 4 times: pre-fertilizer (May), post-fertilizer (June), at peak biomass (late July) and post-senescence (October). This data file contains the data on root N fixation, measured with 7-day lab incubations with 15N2 and glucose.

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Keywords associative nitrogen fixation, stable isotope, switchgrass

Scientific Names Panicum virgatum

Spatial Coverage US Midwest, Michigan, Wisconsin

Abstract

Associative N fixation (ANF), the process by which dinitrogen gas is converted to ammonia by bacteria in casual association with plants, has not been well-studied in temperate ecosystems. We examined the ANF potential of switchgrass (Panicum virgatum L.), a North American prairie grass whose productivity is often unresponsive to N fertilizer addition, via separate short-term 15N2 incubations of rhizosphere soils and excised roots four times during the growing season. Measurements occurred along N fertilization gradients at two sites with contrasting soil fertility (Wisconsin, USA Mollisols and Michigan, USA Alfisols). In general, we found that ANF potentials declined with long-term N addition, corresponding with increased soil N availability. Although we hypothesized that ANF potential would track plant N demand through the growing season, the highest root fixation rates occurred after plants senesced, suggesting that root diazotrophs exploit carbon (C) released during senescence, as C is translocated from aboveground tissues to roots for wintertime storage. Measured ANF potentials, coupled with mass balance calculations, suggest that ANF appears to be an important source of N to unfertilized switchgrass, and, by extension, to temperate grasslands in general.

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