SWITCHGRASS AS A BIOENERGY CROP: BIOMASS PRODUCTION AND SOIL CARBON SEQUESTRATION IN RESPONSE TO NITROGEN FERTILIZATION

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Switchgrass (Panicum virgatum L.) is a warm-season, perennial grass native to the prairie region of the central U.S. Recent attention has focused on the development of switchgrass as a biomass crop for the production of cellulosic ethanol and other advanced biofuels and bioproducts. Since switchgrass possesses a deep, fibrous root system, it can also offer environmental benefits, including enhanced soil carbon sequestration. Presently, information regarding the management of switchgrass as a low-carbon energy crop is incomplete. Because nitrogen (N) is generally the most limiting resource for crop production, field experiments were conducted to evaluate the effects of N fertilization on biomass production and soil carbon sequestration by switchgrass. In 2006-2007, switchgrass plots were treated with 0, 65, 140, or 220 kg N ha-1 in the spring and harvested following frost in the Fall. Additionally, in Fall 2005 and 2007, soil samples were collected to a depth of 100 cm using a hydraulic probe and soil organic carbon (SOC) content was determined using combustion analysis and pressure calcimetery. Biomass yield demonstrated a quadratic response to N, with optimal yield of 13 ± 0.6 (mean ± se) Mg ha-1 at 140 kg N ha-1. Nitrogen fertilization also had pronounced effects on SOC content. Over the two-year experimental period, significant gains in SOC were detected at input rates of 65 and 140 kg N ha-1, but SOC remained unchanged at rates of 0 and 220 kg N ha-1. Therefore, similar to biomass yield, SOC also exhibited an optimal response to N inputs. These results indicate that both biomass production and carbon sequestration by switchgrass can be managed using N fertilizers, and that over the short-term both are optimized with input rates in the range of 140 kg ha-1.