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Fertilizer N rates to optimize bioenergy feedstock production and water quality in semi-arid environments

Brett Allen, Upendra Sainju, and Jay Jabro

USDA-ARS, Sidney, United States of America (brett.allen@ars.usda.gov)

Renewable bioenergy feedstocks offset the demand for conventional petroleum-based energy resources. Switchgrass (*Panicum virgatum* L.) is a warm-season perennial C4 grass that has been utilized for lingo-cellulosic ethanol production and direct energy via combustion. However, little is known about its potential as a feedstock in the semi-arid northern Great Plains USA, including the impact of N fertilizer application on biomass production and on environmental quality. A field study initiated in 2009 seeded 'Sunburst' switchgrass into 12.2 m by 30.5 m plots. Split plots randomized within each main plot included fertilizer N broadcast each spring at 0, 28, 56, and 84 kg N per ha as urea, with four treatment replicates. Aboveground biomass, allowing a 20 cm stubble height, was harvested, weighed, and dried at 55 deg C each fall beginning in 2011 from four randomly selected 0.25 m sq areas. Soil cores were taken to a depth of 1.2 m in fall 2018, air-dried, and analyzed for soil nitrate. Switchgrass biomass ranged from 1.8 to 12.3 Mg per ha. In most years, N application increased switchgrass biomass, but response to N rates above 28 kg per ha was inconsistent. Biomass from fertilized switchgrass averaged 6.5 Mg per ha compared to 4.4 Mg per ha for the unfertilized control. Soil nitrate levels indicated the potential of (over)fertilization of switchgrass feedstocks to impact water resources in semi-arid environments.