

PRODUCTIVITY AND ENERGY CONTENT OF NATIVE PERENNIAL GRASSLAND SPECIES

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Native perennial herbaceous grassland species have been identified as a potential feedstock for energy production. Prairie plants are ideal candidates because they are adapted to low-nutrient environments, generate significant biomass, and provide a plethora of ecological services. Much research has been conducted regarding the productivity of perennial prairie polycultures in natural and restored ecosystems, but there is insufficient information available on the energy conversion potential of individual species. When cellulosic ethanol production is evaluated, it is important to consider the type of polysaccharides in the plant material. The energy industry is interested in the hexose (glucose, galactose, and mannose) and pentose (xylose and arabinose) sugars in biomass feedstocks. At this time ethanol-producing microorganisms cannot convert other monosaccharides (rhamnose, fucose, and uronic acid) to ethanol. In our experiment, we evaluated the distribution of these polysaccharides and the theoretical ethanol yield (according to the National Renewable Energy Laboratory calculator) of multiple native perennial prairie species. Grasses, legumes, and nonleguminous forbs were cultivated alone and in mixtures including one, four, eight, 12, and 24 species. Species were planted into 9-m² plots in June 2006 and harvested in fall 2007. We selected *Panicum virgatum*, *Andropogon gerardii*, *Sorghastrum nutans*, *Elymus canadensis*, *Astragalus canadensis*, *Helianthus maximiliani*, and *Ratibida pinnata* for chemical composition analysis. Samples were collected from research plots at Lamberton, Waseca, St. Paul, and Becker, MN, and analyzed separately by location. Results from the establishment phase of this experiment show that the energy content of native perennial prairie species varies according to the maturity at harvest and environment. *Panicum virgatum* cultivated at Lamberton, MN, had the greatest overall potential ethanol yield (3,682 L/ha) and *Helianthus maximiliani* at St. Paul had the lowest ethanol yield (52.13 L/ha). The ethanol yields were influenced primarily by biomass yield as well as the distribution of C₅ and C₆ polysaccharides.

KEY WORDS: perennial polycultures, cellulosic ethanol

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