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Project Title: *Evaluation of the Potential of Big Bluestem for Biofuel Production*

Dr. Donghai Wang

PI: Dr. Donghai Wang
Kansas State University
Biological &Agricultural Engineering

Co-PIs:
Dr. Wenqiao Yuan
Kansas State University
Biological & Agricultural Engineering

Dr. Richard Nelson
Kansas State University
Chemical Engineering

Dr. Loretta Johnson
Kansas State University
Biology

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Project Goal

The goal of this research was to develop a comprehensive understanding of the effects of ecotype and planting location on biofuel production potential from big bluestem. The specific objectives were:

1) Characterize the chemical and elemental compositions of big bluestem and study the effects of ecotype and planting location on chemical and elemental compositions of big bluestem along the Great Plains precipitation gradient.
2) Evaluate what are the patterns of thermal properties of big bluestem across the ecotype and climate gradient.
3) Determine the optimum acid pretreatment conditions and investigate glucan yield variation from enzymatic hydrolysis in diverse big bluestem accessions and also assess the adaptive potential of different genotypes as potential bio-energy crops.

Project Outcomes

- Three big bluestem ecotypes from central Kansas (Cedar Bluffs and Webster populations), eastern Kansas (Konza and Top of the World populations), and Illinois (12Mile and Fults populations), as well as the Kaw cultivar, were harvested and evaluated for their chemical and elemental compositions.
- All populations revealed a large variation in cellulose (31.8–36.5%), hemicellulose (24.96–29.74%), lignin (14.4–18.0%), C (47.3–51.3%), &N (4.91–6.44%)
- Planting location had significant effects on both chemical and elemental compositions of big bluestem. Ecotype had significant effects on glucan, xylan, lignin, and ash contents as well as on C, O2, & H elemental fractions.
- The total sugar content of the big bluestem (regardless of ecotype) increased as the Great Plains precipitation gradient increased from west to east. Annual precipitation, growing degree days and potential evapotranspiration in 2010 explained up to 97%, 88% & 80% of the variation in compositions, respectively.
- The populations varied widely in specific heat (2.35–2.62 kJ/kg/K), thermal conductivity (77.85–99.06 ×10-3 W/m/K), thermogravimetric property as weight loss during the heating process (71–73%), and high heating value (17.64–18.67 MJ/kg).
- Glucan percentage in solid dropped from 98.4 to 77.3% with an increase in acid concentration. Glucan loss increased as acid concentration increased from 0.1 to 5.2%, whereas glucan content in liquid increased from 1.6 to 17.6%.
- EEH (enzymatic hydrolysis efficiency) increased from 79.7 to 90.0% after 72 hours hydrolysis as acid concentration increased from 1.0 to 2.0%, which was significantly higher than control samples pretreated with water (18.1%).
- All the populations revealed a large variation in mass recovery (52.0–59.7%) and glucan recovery (79.0–87.50%) after acid treatment, EEH (84.6–88.9%), and glucan mass yield (20.8–29.3%).