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Biomass production on farms in the eastern United States

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Key words : Switchgrass , biomass , cellulosic ethanol , renewable energy

Introduction Native warm season grasses are an important component of bio-energy research in the USA for production of ethanol , biomass for generating electricity , biogas production , and fuel pellets . These perennial grass species have the potential to provide renewable sources for energy on land that is not suitable for annual crop production . Previous research has shown that there is a range in biomass yields across varieties and species (Fike et . al . , 2006) .

Although there is tremendous on farm interest in biomass production , most producers do not have experience growing dedicated biofuel crops and there is no current market for these crops . Therefore , the University of Kentucky , in partnership with the Kentucky Forage and Grassland Council , recently received funding from the KY Agricultural Development Board to 1) determine the potential for producers in Northeastern KY to grow biomass crops sustainably and economically , and 2) develop viable markets for biomass .

Materials and methods This project will coordinate the establishment , maintenance , and harvest of 2 ha fields of switchgrass (*Panicum virgatum* L.) on 20 farms in Northeastern Kentucky within a 100 km radius of Maysville, KY from 2007-2010 . Maysville was chosen because it is the site of an East KY Power electrical production facility that recently upgraded one line to a fluidized bed delivery system that can handle bulky biomass products . The University of Kentucky is managing the project with county extension agents as the local coordinators . Eight fields were established in 2007 and the remaining fields (12) will be established in 2008 . Requirements for field locations include : accessible at all times , producer must supply equipment for harvesting and baling , must not contain rock outcroppings , livestock must be excluded , and a 2.5 m buffer strip should surround the field . East KY Power will conduct a series of trial burns in combination with coal when the first single cut harvests take place following frost in late 2008 .

Concurrent small plot experiments include a range of switchgrass varieties and other warm season grass genera including *Miscanthus* . These experiments are being harvested for biomass yield and various fuel quality attributes . Compositional analyses (mineral content , lignin , ash , cellulose , and hemicellulose) following the protocols developed by NREL will be used to evaluate each feedstock produced . After compositional analysis , laboratory screening tests will be performed to evaluate the ethanol production potential from each feedstock . Initial tests will be performed using 125 ml shake flasks and approximately 4 g of biomass . Samples will be pretreated with alkaline or acid pretreatments followed by simultaneous saccharification and fermentation (Duguid et al . 2007) . This will allow a comparison of the suitability of the various feedstocks for ethanol production . The ethanol and residual sugar concentration will be measured and the ethanol yield per acre calculated .

Results and discussion A survey of the producers currently enrolled shows strong support for this project . In fact , there are many more that would like to enroll than there are available spots . The producers are responsible for fertilizer , chemical applications , harvesting , and transport , but since funding provides generous land rental payments there is little or no financial risk to be part of the project . These payments have been essential to the success of the project since there is currently no viable market for perennial grass biomass in Kentucky .

Ethanol conversion rates from switchgrass varieties in the small plot experiment showed a small range of ethanol conversion efficiencies . Biomass yields combined with compositional analysis show that some varieties are better suited for biomass production under a one cut system than others .

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