435h Selection of Warm-Season Grass and Other Feedstocks for Biomass Gasification

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The key to sustainable biomass production is maximizing yield with minimal inputs. Feasibility and ease of establishment also affect acceptance of a species. Several plant species have shown potential for use in biomass production in the humid Southeast. This study focused on nine species; four native species [switchgrass (Panicum virgatum ‘Alamo'), big bluestem (Andropogon gerardi), eastern gamagrass (Tripsacum dactyloides ‘Highlander') and indiangrass (Sorghastrum nutans ‘Cheyenne')], two naturalized [sorghum-sudangrass, johnsongrass (Sorghum halapense)] and four exotic species [eulalia and giant miscanthus (Miscanthus sinensis and M. floridulus, respectively) and elephantsgrass (Pennesetum spp)]. Harvest regimes of 5, 3, 2, and 1 harvest per season were superimposed upon these species. Seasonal yield was calculated. Ash percent and caloric value were also estimated. Ash percentage was most closely tied to harvest regime and with early season harvests. Harvest regimes of 5 and 3 times per season were unsustainable under rainfed conditions. Yield was highest for elephantgrass, giant miscanthus and switchgrass. However, elephantgrass is marginally hardy at Starkville, and giant miscanthus must be vegetatively propagated.

Thirteen different types of feedstocks found in Mississippi were evaluated for use for biomass conversion to biofuels. Of all the feedstocks evaluated, rice straw, soybean stalks, cotton stalks, grain sorghum stalks, and cotton gin stalks all had high energy values. The highest of these values was soybean stalks at 9042.2 BTU/lb, while rice straw was the lowest at 6675.5 BTU/lb. Corn stover, switchgrass, and the switchgrass-bermuda grass mixture were in the mid 4000 BTU/lb range. Ash content for all the feedstocks were low except for rice straw. None of the feedstocks had exceedingly high contents of any of the elements tested except for the boron content of the rice straw. All of the feedstocks are crops or crop residue. If one bases a feedstock decision on yield per acre, then switchgrass is the feedstock of choice. If energy per pound is the basis, then soybean stalks are the winner and if ash content is the basis it would seem that soybean or cotton stalks would be the winner. All of three of the above criteria should be used to evaluate the feedstock and thus switchgrass would be the feedstock of choice. However, if the crop residues can be obtained at no cost and can be harvested economically, there would be a strong case for several of those. Chemical analysis data has shown no real problems with any of the feedstocks evaluated.

Conservatively there are 18 to 20 million tons of wood waste per year in the entire state of Mississippi that could be used for biomass conversion to biofuels. Fuel value of the different types of wood chips varies from 7559.8 BTU/lb to 8705.9 BTU/lb and ash content varies from 11.1 % to 4.8% for red oak and pine, respectively. There is approximately 1.2 million tons of chicken litter per year in Mississippi. The fuel value of chicken litter was 6588.7 BTU/lb and the ash content was 21.1%. Chicken litter also had higher amounts when compared to other feedstocks of almost all of the elements that were analyzed.