

Switchgrass for Biomass

Introduction

Switchgrass (*Panicum virgatum*) is a tall-growing, warm-season, perennial bunchgrass native to portions of Kentucky. Once a major component of the Midwestern prairies, switchgrass stands have dwindled as natural grasslands have given way to expanding farms and developments.

There has been interest in recent years in re-establishing switchgrass. It is currently most widely recommended for soil and wildlife conservation uses, but switchgrass can also be used to provide mid-summer grazing in pasture systems. In addition, switchgrass is being researched as a potential biomass crop to produce energy.

Biomass is any organic matter that can be converted to electricity or fuel. Organic matter can be transformed to usable energy by direct combustion, liquid fuel production (e.g. ethanol), and the manufacture of synthetic gases. Switchgrass appears to be well-suited for all of these processes; however, much of the current research and testing is focused on co-firing switchgrass with coal to produce electricity, and on the conversion of switchgrass to ethanol.

Direct combustion of biomass is similar to the technology used for burning coal. In fact, small percentages of switchgrass can be co-fired with coal in existing power plant boilers. Burning only 10 percent switchgrass with coal generates electricity with lower emissions (fewer pollutants) than burning coal alone. The



use of higher percentages of switchgrass, however, will require modifications in current burner designs. This has been accomplished at the Maysville, Kentucky Spurlock Power Station, where a relatively new clean coal generating unit has been modified to burn alternative fuels, such as switchgrass.

Switchgrass shows promise as an economical and efficient source of cellulosic ethanol. Unlike corn for ethanol production, switchgrass can be grown on marginal land and would not compete with food crop production. Some researchers have reported that switchgrass can yield five times more energy than it takes to produce it, a substantial improvement over corn's net energy output.

Renewable energy sources like switchgrass have the potential to help reduce our dependency on finite supplies of fossil fuels, although most experts believe it is unlikely that biofuels will totally replace them.



Marketing and Market Outlook

There currently are no existing biomass markets for switchgrass in Kentucky. While this crop holds promise as an alternative energy source, work is still in the research and development phase here. Chariton Valley in Southern Iowa and Gadsden, Alabama, where switchgrass is being used at electricity-generating power plants, are currently the nearest markets.

At present, co-firing with coal appears to offer the most realistic potential use of switchgrass for bioenergy in Kentucky. University of Kentucky (UK) researchers are currently involved in a co-firing project in which switchgrass will be used to supplement coal for electricity production. Twenty growers within 60 miles of the Maysville generating plant are participating in the study. Researchers are examining cropping systems, analyzing plant composition, considering sustainability, determining net energy output, and evaluating the economics of switchgrass production for biomass.

In addition to the co-firing study, UK is conducting research on the potential of switchgrass for ethanol production. The conversion of switchgrass to ethanol is a complicated process requiring a biorefinery. While Kentucky does not have one, several states, including Tennessee and Georgia, are building pilot-scale biorefineries. The possibility of compressing switchgrass into fuel pellets for thermal energy production will also be examined in UK studies.

Production Considerations

Site selection and planting

Switchgrass can be grown on marginal land and is adaptable to a variety of soil types. It is most productive, however, when grown on moderately well to well-drained sites of medium fertility. Freshly harvested seed has a low germination rate and must be treated to break dormancy.

Switchgrass can be seeded into a tilled or no-till field in the late spring. Establishment is

generally slow and difficult, often taking from 2 to 3 years. In some cases reseeding will be necessary to produce a uniformly vigorous stand. However, once established, this perennial grass will continue to yield for 10 or more years. Plants can reach a height of 7 to 10 feet under favorable growing conditions.

Pest management

Switchgrass is a hardy plant that is bothered by few insects and diseases. It does not compete well with other grasses and broadleaf weeds until well-established. Therefore, good pre-plant weed control is essential to the establishment of a good stand.

Harvest

Established switchgrass stands can be harvested either once or twice per year with conventional haying equipment. With some varieties, the total biomass yield is similar whether cutting once or twice. Cutting once has the economic advantage of being cheaper than cutting twice. In addition, cutting once will remove fewer nutrients from the soil; harvest will occur after frost when the nitrogen and some of the potassium have moved back into the root system.

When the crop is harvested after frost, it is cut at a height of 6 inches. The cutting height should be 8 to 10 inches when harvested during the growing season.

Switchgrass can be baled in either round or large rectangular bales; however, the latter are considered easier to handle and transport. Stored bales must be kept dry and off the ground, therefore covered storage is preferred.

Economic Considerations

The Department of Agricultural Economics at the University of Kentucky is in the process of updating their switchgrass budgets. As soon as that information becomes available, basic budget estimates will be added to this profile.

Selected Resources

- Grain and Forage Crop Guide for Kentucky, AGR-18 (University of Kentucky, 2007)
<http://www.ca.uky.edu/agc/pubs/agr/agr18/agr18.pdf>
- Native Warm-Season Perennial Grasses for Forage in Kentucky (University of Kentucky, 2009)
<http://www.ca.uky.edu/agc/pubs/agr/agr145/agr145.pdf>
- Project Examines Switchgrass' Potential to Produce Alternative Fuels (University of Kentucky College of Agriculture news release, 2008)
<http://www.ca.uky.edu/news/?c=n&d=75>
- Agricultural Marketing Resource Center: Switchgrass
<http://www.agmrc.org/agmrc/commodity/biomass/switchgrass/>
- Bioenergy Feedstock Information Network
<http://bioenergy.ornl.gov>
- Chariton Valley Biomass Project (Iowa)
<http://www.iowaswitchgrass.com/index.html>
- Costs of Producing Switchgrass for Biomass in Southern Iowa (Iowa State, 2001)
<http://www.extension.iastate.edu/Publications/PM1866.pdf>
- Estimated Costs for Production, Storage and Transportation of Switchgrass (Iowa State University, 2008)
<http://www.extension.iastate.edu/agdm/crops/pdf/a1-22.pdf>
- Growing and Harvesting Switchgrass for Ethanol Production in Tennessee (University of Tennessee, 2008)
<http://utextension.tennessee.edu/publications/spfiles/SP701-A.pdf>
- Management Guide for the Production of Switchgrass for Biomass Fuel in Southern Iowa (Iowa State University, 2003)
<http://www.extension.iastate.edu/Publications/PM1710.pdf>
- Switchgrass (Iowa State University, 2007)
<http://www.extension.iastate.edu/Publications/AG200.pdf>
- Switchgrass as a Bioenergy Crop (ATTRA, 2006)
<http://attra.ncat.org/attra-pub/switchgrass.html>
- Tennessee Biofuels Initiative (University of Tennessee, 2008)
<http://www.utbioenergy.org/TNBiofuelsInitiative>

*Photos: Seed head courtesy of University of Kentucky
Forage Identification and Use Guide AGR-175;
Switchgrass field by Lynn Betts, courtesy of USDA NRCS.*

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