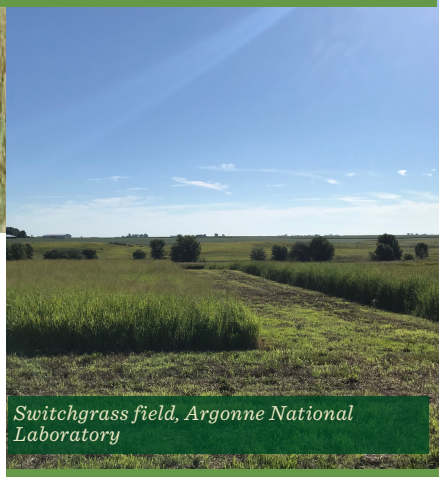
PERENNIAL BIOENERGY GROWING GUIDE

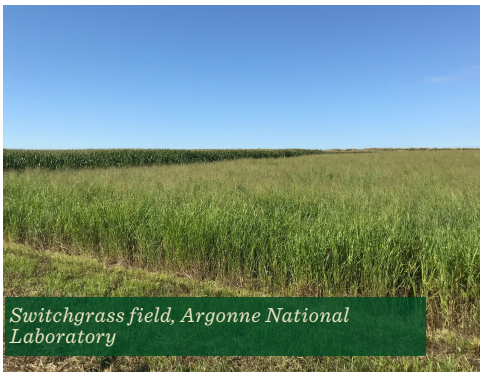
SWITCHGRASS



Switchgrass field, Argonne National Laboratory

Introduction

Farmers motivated to increase biodiversity and build soil health on their farm may do so by adopting a native perennial grass for bioenergy feedstock production. Switchgrass offers unparalleled ecosystem services to the agricultural landscape in the Midwest because it is a native prairie grass. Large scale implementation of this crop offers a suite of environmental benefits as well as end use options that may boost overall farm resilience and profitability.



Switchgrass field, Argonne National Laboratory

Switchgrass produces biomass and additional benefits, such as increasing soil carbon, fixing atmospheric nitrogen, and providing high biofuel yield per land unit. It can be grown on low quality, marginal land and has low input requirements. This crop can provide additional economic advantages for a farm operation.

The ecosystem services switchgrass offers can improve soil health function and allow farmers to adjust their nutrient management strategy and reduce overall inputs. This minimizes costs associated with production, which may increase overall profitability.

Growing Considerations

There are many different varieties of switchgrass that are divided into two broad categories: lowland varieties and upland varieties. Lowland varieties have higher yields per hectare compared to upland varieties. Among the upland varieties, Cave-N-Rock is well suited for cultivation in the Midwest because it is cold tolerant. Its life span is about 10 years but could be longer with decreasing biomass yields over time. While this variety is preferred for biomass production, Cave-N-Rock is susceptible to a fungal smut disease that has the potential to reduce plant vigor and yield.

Other switchgrass varieties that are recommended for lowland regions are Alamo and Kanlow. These varieties may be higher yielding compared to Cave-in-Rock but have a higher risk of winterkill in northern Illinois, Iowa, and other northern States.

Switchgrass Optimal Growing Conditions

Soil & Field Conditions

- Well-draining
- Silt & clay loams
- Flat to slightly rolling terrain with 0-12% slope
- Highly erodible land
- Sediment & nutrient runoff
- Low crop productivity

Equipment Needs

- Seed drill
- Rotary head mower
- Hay cutter & baler

Nutrient Management

- 50lb/acre Nitrogen

Switchgrass Drawing, Bioenergy Technologies Office (BETO)

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Seeding

Switchgrass can have a high percent of dormant seed. Seed that has been stored for at least one year and is stratified can improve stand establishment. Stratification improves overall germination by breaking or softening the hard outer seed coat. The recommend seeding rate for Cave-in-Rock switchgrass is 5 to 6 pounds of pure live seed (PLS) per acre.

Seeding switchgrass should take place from mid-November to early April, and is most effective following a soybean rotation. While tillage is not a recommended agricultural practice, it is beneficial to till before the one time planting of switchgrass because it will ensure good establishment for the crop's lifespan. After seeds have been drilled in, a packing device is needed to ensure good seed-to-soil contact. Weed control can be achieved by mowing 1 to 3 times during the first growing season whenever weeds reach 6 to 10 inches tall.

Conventional or no-till drills should include:

Small seed boxes suitable for accurately metering switchgrass;	Seed placement depth adjusted to plant seed no deeper than ¼ inch to ½ inch; and	An effective press wheel. A soil-firming device such as a cultipacker or roller can be used if a press wheel is not available.

It is important to note that it takes approximately two to three years to establish switchgrass that produces enough biomass for a profitable harvest. Good establishment in the first year is key. During this time, the switchgrass crop is growing an extensive root system that provides numerous ecosystem services that boost soil health function on the farm. The underground biomass of switchgrass increases soil stabilization and prevents erosion of sediment and nutrients. After the initial harvest, annual harvests may take place for maximized use of this crop.

Harvesting & Storage

Switchgrass growth typically occurs during the warm summer months of June to August. In the fall, switchgrass undergoes senescence and moves nutrients from the above-ground plant canopy to the roots. Delaying harvest until after senescence reduces the need for nutrient application in the subsequent year, reduces drying time, and improves the quality of the biomass. However, waiting to harvest until after senescence can decrease yield by 15-20%. This different in biomass growth also affects harvest logistics and storage time. These factors influence overall cost of production.

Switchgrass Resource Directory

Scan Here

Switchgrass can be harvested and baled with commercially available haying equipment in most cases. Options are available for packaging switchgrass for storage and transportation, but large round bales or rectangular bales are the most readily available. Large round bales tend to have less storage losses than large rectangular bales when stored outside, but rectangular bales tend to be easier to handle and load a truck for transport without road width restrictions.

Summary

While there are many end use opportunities for perennial bioenergy feedstock, it important to choose an end use option best suited for farm operations and maximize profitability potential. The breakeven prices for profitable production of switchgrass and other perennial bioenergy crops are calculated from estimates of the costs of inputs, machinery, and quality of farmland. According to the University of Illinois, switchgrass can be produced for as low as $72-$102 per ton dried material (DM) in Iowa and Illinois if marginal quality land is used compared to $117-$151 per ton DM if average quality land is used.

Switchgrass field, Argonne National Laboratory

Selling harvested biomass to an off taker may be the most profitable option to a majority of producers. If storage, transportation distance, and other logistics are significant barriers to adoption, on-farm processing and use to provide heat and power may be a more feasible end use for harvested biomass. Farmers who have livestock operations in addition to a switchgrass crop are ideal candidates for the implementation of an anaerobic digestion (AD) system to capture biogas to meet energy needs on the farm. Livestock manure provides wet feedstock that can be combined with harvest biomass from bioenergy crops to be processed in an AD. Other on-farm use options may include a pyrolysis kiln to produce biochar and biogas to supplement grid energy.

END USES FOR BIOENERGY CROPS

Switchgrass feedstock can be used on- and off-farm to produce renewable energy & sustainable fuels.

On Farm Uses			Sell to Processer		
Biomass Furnace	Anerobic Digester	Pyrolysis (Biochar) Kiln	Bio Refineries	Municipal Digester	Other markets
Heating & power	Biogas	Biogas & biochar	Renewable energy & transportation fuels	Biogas	Sustainable products
Investments directed towards energy independence can increase farm profitability and resilience.			Market opportunities depend on local availability of existing infrastructure and farm operation capacity to store and transport feedstocks		

Sources

Teel, Alan, and Stephen Barnhart. "Switchgrass Seeding Recommendations for the Production of Biomass Fuel in Southern Iowa." Iowa State University Extension, 2003.

Mitchell, Robert B. and Schmer, Marty R., "Switchgrass Harvest and Storage" (2012). Agronomy & Horticulture -- Faculty Publications. 548.

For more information on this project or to discuss bioenergy cropping systems please contact Marlee Giacometti, AFT Midwest Program Associate, mgiacometti@farmland.org, 815-267-1326

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