

Growing the Future: Switchgrass Management for Ethanol

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Switchgrass is a native perennial grass that has been selected as a model lignocellulosic feedstock for biofuel production. This fact sheet is intended to provide Michigan growers with information on establishing and maintaining a switchgrass stand in a sustainable manner.

Selecting a cultivar and purchasing seed

Few switchgrass cultivars are currently available, but it is hoped that improved breeding efforts will develop higher yielding cultivars for specific agro-ecological regions. Growers need to select an upland cultivar that is high-yielding and has long-term yield stability. Switchgrass reaches peak biomass by flowering time, so a cultivar that flowers late in the season will accumulate more biomass than one that flowers earlier. However, the plant must enter reproductive growth in time to undergo its programmed senescence, during which carbohydrates and nutrients are translocated to the root system. Otherwise, winter hardiness and stand longevity will suffer. Upland cultivars are best suited for Michigan. Currently the cultivar 'Cave-in-Rock' is being used in research efforts in Michigan, and 'Shawnee' shows promise as a high-yielding variety. Purchase non-dormant seed with few to no weed seeds and with a high germination rate. Switchgrass variety performance trials are ongoing at Michigan State University. Contact your local MSU Extension office to obtain up-to-date information on switchgrass variety performance.

Establishment

It has been suggested that wide rows (30 inches vs. 7.5 inches) lead to higher biomass production (Ma et al., 2001), but a good stand can be achieved with existing seeding equipment, including a conventional or no-till seed drill or Brillion forage seeder. Recommended seeding rates vary, but our research shows that cali-



Switchgrass seedlings at the 3-4 leaf stage in the establishment year.



Harvesting senesced switchgrass with a modified Hesston forage harvester.

brating your equipment for 8 pounds of pure live seed (PLS) per acre provides a good population. Seeding depth should be 0.25 to 0.5 inches.

A stand frequency of 40 percent or greater is needed in the first year to ensure adequate yields in the future (Schmer et al., 2006). A frequency grid developed by Vogel and Masters (2001) will be useful in determining if you are above the threshold. Cut a piece of wire mesh used to reinforce concrete into a five-cell by five-cell grid. Each cell is 6 inches by 6 inches. Place the grid in the field, and record whether each cell has or does not have a switchgrass plant in it (present or absent). The grid is then flipped over four times until 100 cells have been viewed and recorded per sampling area. This should be done multiple times to try to get a representative stand frequency for the field.

Fertilizer, Herbicides and Pesticides

Switchgrass performs best on moderately well to well-drained soils with a pH in the range of 5.5 to 7. Recouping establishment costs and growing the crop in a cost-effective manner means maximizing yield over a long period of time. It is recommended that a soil test be conducted before establishment to check for pH and macronutrient levels, particularly potassium and phosphorus. Most Michigan soils will be in the 5.5 - 7 pH range; liming may be necessary in acidic or sandy soils. Establishing adequate P and K levels that will remain sustainable with multiple harvests could prove to be a good investment in the long run. No nitrogen fertilizer is used in the first year because switchgrass is a warm-season grass and slow to establish. Nitrogen

applied in the first year of establishment will only benefit weed species that could outcompete switchgrass and result in a poor stand. Switchgrass has no significant insect or disease pests that cause economic losses in Michigan at this time, so insecticides and fungicides are not likely to be cost effective.

No herbicides are registered for use in switchgrass in Michigan. Researchers at Michigan State University are working to identify herbicides and weed control programs for producing switchgrass as a biomass feedstock. One option is to clip weeds to a height of 4 to 5 inches whenever they reach a height of 6 to 10 inches. This may be one or more times during the first growing season. When generating a weed control program, it is important to have a good idea of what weeds may be problematic to your area or particular field, the cultural weed control options available and the method of establishment that will be used.

If you're using a no-till system, a fall burndown application to target biennial, perennial and winter annual weeds may be necessary. Cool-season grasses and broadleaf weeds that emerge in early spring can be knocked back with effective tillage or with a preplant herbicide burndown application. Using a preemergence herbicide that is effective in killing both grass and broadleaf weeds with good residual effect is key to effective switchgrass stand establishment. Grasses that might emerge after a tillage event and around the same time as switchgrass also pose a threat to establishment. Large crabgrass, the foxtails and fall panicum are good examples. Once the stand is established, herbicides may not be needed, but monitoring weed species and populations is recommended.

Postestablishment Fertility Management

Nitrogen (N) is needed to maximize switchgrass yield in Michigan. The amount required is still unknown, but research efforts are under way to determine the amount of nitrogen needed to optimize yield and feedstock quality. A nitrogen fertilizer rate of 70 lb N/acre is the current recommendation for Michigan. This may change if research shows that higher yields can be realized in a cost-effective manner with minimal environmental impact.

Harvest

Harvest management is one of the most important considerations in producing switchgrass because it is an important determinant in yield, biomass quality and stand longevity. Switchgrass should be harvested in the late fall after a killing frost to optimize feedstock quality and ensure nutrient translocation back to the

root system. A 6- to 8-inch stubble height is recommended for reducing tire injury and for trapping snow and improving winter survival. It can stand overwinter, but substantial yield losses of up to 40 percent can occur. Switchgrass can be baled (round or large rectangles) or cut high-moisture and ensiled with conventional hay-making equipment. The needs of future bioconversion facilities will determine desired harvest methods and biomass storage practices.

Conclusion

Switchgrass is an efficient, low-cost crop with potential as an energy crop. It takes 2 to 3 years to establish a mature stand, but patience and proper management can lead to a successful crop that can be harvested for 10 to 12 years. The Biomass Crop Assistance Program offered by the Farm Service Agency through the Farm Bill provides assistance for farmers wanting to establish a new crop of switchgrass. Contact your local Farm Service Agency office for details. Additional information, including sources of seed, can be found in MSU Extension bulletin E-2987, "Switchgrass as a Biofuel for Michigan."

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