Switchgrass (Panicum virgatum L) Stand Establishment: Key Factors for Success

Table of Contents

- Why Establishment is Important
- Is Switchgrass Feasible for the Area?
- Soil Conditions & Planting Dates for Switchgrass
- Use a High-Quality Certified Seed
- Develop a Good Seedbed
- Planting Methods
- Manage Weeds ASAP
- Determining a Successful Stand
- For Additional Information
- Contributors to this Article

Successful establishment is critical to the long-term economic viability of a switchgrass stand. But it is not difficult if these key management practices are followed: development of a good seedbed, certified seed planted at the correct time, with proper seeding depth and rates, and weed control.

While money spent on good-quality seed and weed control will likely result in a higher *per acre* cost for establishment, the reward is rapid establishment of a productive stand with lower costs *per ton* of harvest.

Why Establishment is Important

Switchgrass is not difficult to establish given good management practices. Successful stand establishment, is critical to economic viability over the life of the switchgrass stand, expected to be at least ten years. Growers in regions with good soils should be able to harvest in the planting year. (In areas with poor or marginal soils, a first-year harvest is likely to produce lower yields and to reduce stand quality and persistence. Delayed harvest until the third year after

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

establishment to achieve expected yields on these soils.)

While money spent on good-quality seed and weed control will likely result in a higher per acre cost for establishment, the reward is a more productive stand and lower costs per ton of harvest.

Is Switchgrass Feasible for the Area?

First, determine if it is feasible to grow switchgrass in your area. A good rule of thumb is that switchgrass will be productive in an area that is suitable for dryland corn. Switchgrass is a warm-season grass native to most of North America except Washington, Oregon, and California.

Next, determine which cultivars are best adapted to your area. Switchgrass is broadly adapted, and regionally specific cultivars are available for most of the United States. Lowland cultivars, such as Alamo and Kanlow, are best adapted to the southern and mid-latitude regions of the United States, while upland cultivars, such as Shawnee and Sunburst, grow best in the mid- and northern latitudes. High-yielding bioenergy cultivars are under development for some regions that result in 20 to 30 percent increases in yield compared with forage-type cultivars. Check with your local Extension office to determine which cultivars work best in your area.

With good management, switchgrass can be grown on land that is marginally productive for most crops, but avoid poorly drained soils in the northern United States, where frost heaving can be a problem. West of the 100th meridian, switchgrass can be grown with irrigation.

Soil Conditions and Planting Dates for Switchgrass

Switchgrass establishes and grows best in warm conditions, requiring a soil temperature of 60 degrees F or warmer for germination. Optimal dates for planting vary across the United States and depend on the region, soil temperature, and moisture. A general guideline is to plant switchgrass two to three weeks before or after the optimum corn planting date for your location; ranging from late March in the Southeast to late June in the northern Great Plains. Planting should be conducted with a grassland drill to place a specific amount of seed at an exact depth to promote rapid and low-cost establishment and reduce risks of seeding failure.

Take a soil test in the fall before planting to determine fertility needs. Do not apply nitrogen (N) fertilizer or manure to switchgrass in the seeding year. Excessive N will encourage weeds that compete with the new seedlings, and increase the cost of establishment. A soil test will indicate whether to apply phosphorus and potassium before

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

seeding for better root growth. Switchgrass can tolerate moderately acidic soils, but optimum seed germination occurs when soil pH is between 6 and 8.

Use a High-Quality Certified Seed

Switchgrass seeds are small and often have 250,000 to 400,000 seeds per pound. Choose high-quality, certified switchgrass seed from an adapted cultivar. Base your seeding rate on Pure Live Seed (PLS, or the percent germination of the seed multiplied by the percent of pure seed of the actual seed in the switchgrass variety), not pounds of seed per acre. A seeding rate of 30 PLS per square foot is recommended.

Switchgrass seed can have high levels of dormancy, so select seed lots that have high germination, high purity, and low dormancy, which results in seed lots with a high percentage of PLS. Switchgrass seed lots can vary widely in germination rates and number of seeds per pound. (See *Understanding Seeding Rates, Recommended Planting Rates, and Pure Live Seed (PLS)*
https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/lapmctn9045.pdf

To make sure the seeding rate is accurate, first determine the percent PLS in the seed lot to be planted. Multiply the total germination rate by the seed purity (both of which are found on the seed tag), then divide by 100. That will give you the percent of PLS in the seed lot. Remember, avoid seed lots with high dormancy. Multiply the desired seeding rate by 100 and divide by the percent PLS to find the actual seeding rate at which you must plant. For instance, if your goal is a seeding rate of 6 pounds per acre and the seed is 60% PLS, you must plant 10 pounds of seed per acre.

Develop a Good Seedbed

The first requirement for establishment is to develop a seedbed that promotes good seed-to-soil contact, especially important because switchgrass seeds are small. Grassland drills with depth bands will place seeds at a consistent depth. No-till seeding may be the most successful method, if the weeds and crop residue are managed before planting. Plant into stubble with a no-till drill with small seed boxes, followed by press wheels. When planting switchgrass after a crop that leaves a heavy residue, such as corn or soybeans, reduce residue by grazing, shredding, or baling it.

If the soil is clean-tilled, harrow the field and pack firmly with a culti-packer to leave only a faint footprint when stepped on. If a prepared seedbed is rained on, harrow and culti-pack it again before planting. A seedbed as prepared for alfalfa is an excellent seedbed for switchgrass.

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

Figure 1. No-till planting switchgrass. Photo: University of Tennessee

Planting Methods

Using a properly calibrated grassland drill, plant at a seeding rate of 30 PLS per foot. Plant one-quarter to one-half inch deep, but no deeper, because switchgrass seeds are small and will have trouble emerging if planted too deep. Rows should be spaced six to 10 inches apart.

Manage Weeds ASAP!

The main reason that switchgrass stands fail is because of competition from weeds; therefore weed control is essential. Don't delay. Apply pre-emergent herbicides immediately after planting.

Determining a Successful Stand

Check the stand six to 10 weeks after planting, using a frequency grid. A stand is considered successfully established if seedling frequency of occurrence is greater than 40 percent, or three to six plants per square feet.

A stand that can be harvested in the planting year is essential to an economically viable switchgrass stand. Recent research in Nebraska found that the total costs of growing switchgrass were nearly $30 per ton higher during a five-year period, if a switchgrass stand failed to be harvestable in the year it was seeded. (See Farm-Scale Production Cost of Switchgrass for Biomass.
http://www.springerlink.com/content/f85977006m871205/fulltext.pdf

Harvest

Be sure to harvest only after a killing frost in the establishment year so the stand is not

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

damaged, and leave at least a 6-inch stubble. A crop equal to about half of the stand's potential production can be harvested after frost at the end of the planting year if there is proper weed control and favorable precipitation. Then, the first year after planting, expect 75 to 100 percent of full production.

For Additional Information

CenUSA Project Resources

CenUSA Bioenergy research-based information on the opportunities and challenges in developing a sustainable system for the thermochemical production of biofuels from perennial grasses grown on land marginal for row crop production is available at www.cenusa.iastate.edu

- CenUSA Bioenergy Fact Sheet: Control Weeds in Switchgrass (Panicum Virgatum L.) Grown for Biomass. Robert Mitchell. 2014. https://cenusa.iastate.edu/files/cenusa_2019_009.pdf
- Farm-scale Production Cost of Switchgrass for Biomass, Richard Perrin, Kenneth Vogel, Marty Schmer & Rob Mitchell, Bioenergy Research (2008) 1:91-97. http://www.springerlink.com/content/f85977006m871205/fulltext.pdf
- Switchgrass Biomass Production in the Midwest USA: Harvest and Nitrogen Management Kenneth P. Vogel,* John J. Brejda, Daniel T. Walters & Dwayne R. Buxton, 2002. https://naldc.nal.usda.gov/download/11394/PDF
- Management Guide for the Production of Switchgrass for Biomass Fuel in Southern Iowa, Iowa State University. https://store.extension.iastate.edu/Default
- CenUSA Bioenergy Webinar Switchgrass Cost of Production, Marty Schmer. https://www.youtube.com/watch?v=AsrWGhjr4_Y
- Planting and Managing Switchgrass as a Biomass Energy Crop, USDA-NRCS, Plant Materials Program. (Includes chart of cultivars and their adaptation areas). https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042293.pdf
- CenUSA Bioenergy Instructional Video: Drill Calibration Walk Through https://www.youtube.com/watch?v=izBHivo5xfw https://utextension.tennessee.edu/publications/Documents/SP701-A.pdf
- Growing and Harvesting Switchgrass for Ethanol Production in Tennessee. University of Tennessee AgResearch and Extension. https://utextension.tennessee.edu/publications/Documents/SP701-A.pdf
- Switchgrass Variety Type, Oklahoma State University. http://switchgrass.okstate.edu/variety-choice

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

- CenUSA Bioenergy Video Switchgrass Planting Practices for Stand Establishment. Rob Mitchell, USDA-ARS. (2013). (5:17). https://www.youtube.com/watch?v=vwBQ3aYpfmM

Contributors to This Article

- **Rob Mitchell** http://www.ars.usda.gov/pandp/people/people.htm?personid=31809 USDA-ARS Grain, Forage, and Bioenergy Research Unit, Lincoln, NE http://www.ars.usda.gov/main/site_main.htm?modecode=54-40-20-00
- **Susan J. Harlow**, Freelance Journalist

Peer Reviewers

- **Chad Martin**, Renewable Energy Extension Specialist, Purdue University https://engineering.purdue.edu/Engr/People/ptProfile?resource_id=46662, Purdue University Agricultural and Biological Engineering https://engineering.purdue.edu/ABE
- **Jeff Skousen**, Land Reclamation Specialist and Professor of Soil Science, West Virginia University, https://extension.wvu.edu/natural-resources

. . . and justice for all

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Many materials can be made available in alternative formats for ADA clients. To file a complaint of discrimination, write USDA, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964.

Iowa State University Extension programs are available to all without regard to race, color, age, religion, national origin, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Compliance, 3280 Beardshear Hall, (515) 294-7612. Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.

USDA This project is supported by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the National Institute of Food and Agriculture.

www.cenusa.iastate.edu