



Sweet On Switchgrass

Widely acclaimed for its grazing, haying and wildlife habitat potential, interest in switchgrass is also sprouting for its use as a renewable biofuel resource. Here are factors to consider for establishing and growing this warm-season native grass.

by *Kindra Gordon*

Among conservation circles, switchgrass — a grass species that occurs naturally in every state in the continental United States except Oregon, Washington and California — has always been well-liked as a forage for livestock grazing, haying, wildlife habitat and even prairie restoration efforts. It's also earned a nice reputation as an ornamental plant in landscaping projects.

Its fame skyrocketed after it was mentioned in President Bush's 2006 State of the Union address. Bush referenced that additional research was being funded to evaluate the use of cellulosic materials — such as wood chips, stalks and switchgrass — for the ethanol process. Specifically, the President's goal is for fuel made from natural materials, like switchgrass, to provide 30% of America's transportation fuels by the year 2030.

While experts suggest the practical use of switchgrass in the ethanol milling process is still several years away, interest in the plant itself has soared.

Dwight Tober, a plant materials specialist with the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) in Bismarck, N.D., reports that he frequently receives calls from landowners seeking more information about switchgrass. Tober says many producers are interested in establishing switchgrass stands for seed production in anticipation of increasing demand for the forage should its potential as a renewable biofuel resource become reality.

To assist with providing information about switchgrass, Tober and his colleagues

Switchgrass not for horses or sheep

Researchers have found that switchgrass is reported to be toxic to horses, sheep and goats when grazing pure stands, but no problems have been noted for cattle.

at the Bismarck USDA Plant Materials Center have recently compiled a report detailing switchgrass biomass trials in the Dakotas and Minnesota. The 18-page report evaluates the performance of 10 different varieties of switchgrass for biomass yield and stand density at six sites in the three-state area based on six years of data collection. The report also provides establishment and management recommendations for switchgrass stands. Here, Tober shares some of the findings.

Consider variety

Switchgrass can be grown from Texas to Canada and from New York to Nevada. But Tober emphasizes that the variety origin is a critical consideration when deciding to plant switchgrass. Specifically, landowners will want a variety that is suitable to their region's climate. Additionally, if the goal is to produce switchgrass for ethanol production, a variety

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with a higher biomass performance should be selected.

In the biomass trials evaluated by Tober, 10 varieties with origins from Oklahoma, Kansas, Nebraska, Illinois, North Carolina and the Dakotas were evaluated. To illustrate the importance of origin of the variety, Tober reports that northern seed sources that were moved more than 200 miles south from their origin generally performed poorly, and biomass was significantly less than local or more southern origin sources.

From the research, Tober reports:

- **Sunburst switchgrass**, which originated near Yankton in southeastern South Dakota, was among the top biomass producers and has become one of the most recommended varieties. It has a broad area of adaptation, has a large seed size and showed no signs of winter injury. However, because it is a popular variety, Tober says seed availability is limited, and the price for Sunburst seed has spiked.
- **Summer switchgrass**, which has origins in southeast Nebraska, also ranked near the top for biomass production in the three-state trial. It has a smaller seed size than other switchgrass varieties, however, making establishment and harvest for seed production slightly more challenging.

► **Forestburg switchgrass**, which originated in east-central South Dakota, also performed well in the trials. Tober reports this variety had good stem counts and good biomass. This variety is characterized by early maturity, persistence, forage yield and quality, winter hardiness, and seed production.

► **Dacotah**, a variety that originated in south-central North Dakota, ranked lowest in the five-year average biomass yield at all six sites in this study. It was the northernmost origin of switchgrass in the trials and is noted for its short stature and early maturity.

In determining which switchgrass variety is best-suited to your region, Tober suggests working with your local NRCS office. Switchgrass performs best on moderate- to fine-textured, deep soils in areas with greater than 14 inches (in.) of average annual precipitation. Western and northern varieties are adapted to drier conditions.

Additionally, Tober emphasizes the importance of working with the highest-quality seed available to ensure a reputable stand of switchgrass. He recommends seeding only foundation or certified seed.

Establishment, management

Switchgrass seed can be pricey at \$5 to \$10 per pound (lb.) depending on the variety

and quality of the seed, and availability can be limited. So it's an investment worthy of some extra effort to ensure proper stand establishment. Tober provides these recommendations:

Seeding. Switchgrass is a small, smooth seed with approximately 390,000 seeds per pound. Seeding rates vary across the U.S., generally increasing from west to east. The recommended drilled seeding rate is 3.5 lb. pure live seed (PLS) per acre in western North and South Dakota and 4.5 lb. PLS per acre in the eastern part of the Dakotas. The recommended seeding rate is 10 lb. PLS per acre in the southeastern U.S. The recommended broadcast seeding rate is two times the recommended drill rates.

Spring or fall dormant seeding dates are recommended for switchgrass. As a rule of thumb, Tober suggests a spring planting at the same time as corn and soybeans. Fall dormant seeding should be after Oct. 15 in North Dakota.

Because of the small seed size, a shallow seeding depth of ¼ in. in a firm seedbed is essential. Tober reports that studies have shown when switchgrass is planted 1 in. deep, an average germination of only 65% is achieved. Planting 2 in. deep has resulted in zero germination.

Managing the stand. Once the switchgrass stand is established, biomass

Corn-based ethanol not enough to meet energy requirements

The promise of switchgrass and other cellulosic materials to help produce ethanol will be essential to help meet the future energy needs of the United States — because corn can't handle it all, according to a U.S. Department of Agriculture (USDA) energy expert.

Roger Conway, with the USDA Office of Energy Policy, says a combination of renewable energy sources, including grain, cellulosic ethanol, biodiesel, and solid waste hold the key to our energy future.

The U.S. currently has 111 ethanol plants in operation, with 75 more under construction and eight expanding capacity. Another 60 plants are in planning stages.

Annual production has increased from 1.6 billion gallons (gal.) a year in 2000 to more than 5 billion gal. in 2005, with expectations of reaching 9 billion gal. by 2008 or 2009.

But replacing a big chunk of the 58% of the crude oil the United States currently imports requires more than corn ethanol can deliver. "Corn stocks are increasingly tight; the price is high and that means more risk for ethanol plants," Conway says.

He says corn ethanol will "play a role in energy security, but more as an additive than an extender. Corn ethanol alone cannot reduce significantly our dependence on imported crude oil. Cellulosic ethanol is our best renewable energy alternative."

Conway says ethanol production must exist within the context of providing for the domestic livestock industry and export markets. He says some have suggested removing land from the Conservation Reserve Program (CRP) as a means to increase corn production.

Only a small percentage of those acres, however, could produce corn or soybeans on a sustainable level, he says.

However, those acres may be suitable for growing a native grass such as switchgrass, which could then be harvested annually for ethanol processing.

Meanwhile, Agricultural Research Service (ARS) scientists continue to study how this warm-season, perennial plant could be harnessed as an ethanol resource.

Presently, fragments of genetic material from switchgrass called messenger RNA (mRNA) are being studied to determine the genes that regulate the production and deposition of lignin, the cementing agent that holds plant cell walls together.

Bioenergy producers are keen on loosening the grip of lignin so that more of the sugars locked within the cells of switchgrass can be fermented into ethanol. One possible approach is to conventionally breed or genetically engineer new varieties of the grass with a diminished capacity to produce lignin.

Additionally, Ohio State University researchers are evaluating switchgrass production in Ohio for potential biofuels production. Three years of preliminary switchgrass research suggest production is feasible in the state, they say. But it will be at least another year before the crop is harvested and data is generated to evaluate its production and economic efficiencies.

It is believed switchgrass can produce 8-10 tons per acre of biomass, potentially producing 1,000 gal. of ethanol per acre, compared to 400 gal. per acre for corn.



► Tober suggests contacting your local NRCS office if you are interested in switchgrass.

quality, yield, and seed production can be improved with a nitrogen application. A soil test should be used to determine the proper fertilization rate. Switchgrass also benefits from prescribed burning of plant residues prior to initiation of spring growth. Tober reports that in some trials this has increased long-term seed yields.

Palatability and digestibility of switchgrass for grazing or haying is best when harvested in the early boot stage. However, Tober notes that switchgrass has a high growing point and should not be grazed below a stubble height of eight in. in early summer or 12 in. in late summer to maintain the stand. Likewise, the stand should not be mowed shorter than 6 in.

Researchers recommend delaying harvesting switchgrass until late summer or early fall for stand longevity and stable long-term biomass production.

Because many weed seeds, especially foxtails, are similar in size and shape to switchgrass and can be difficult to remove during the cleaning process, weed control is important in switchgrass stands being grown for seed production. Either mowing or herbicide applications have been effective, but Tober notes herbicides tend to be most effective on annual grasses like foxtail.

Harvesting for seed. Maturity dates vary for switchgrass varieties from mid-August to mid-October. Tober notes that seed shattering can be a problem if the crop is harvested too late in the season. A conventional combine can be used to harvest switchgrass seed with some proper adjustments, Tober says. Special facilities are

necessary to clean the seed. Tober says some local elevators offer that service, but many do not. He adds that clean seed yields in excess of 500 lb. per acre are not uncommon for switchgrass.



Editor's Note: To request the full research report titled "Switchgrass Biomass Trials in North Dakota, South Dakota, and Minnesota," contact an NRCS office in North Dakota, South Dakota or Minnesota; or call the Bismarck Plant Materials Center at 701-250-4330. The publication is also available online at <http://plant-materials.nrcs.usda.gov/ndpmc/pubs/SwitchgrassBiomassTrials.pdf>.

