A PRAIRIE LAND'S COMPANION

STEPHEN AUSMUS (D854-1)

Switchgrass—a lean, mean, growing machine that would tap most ceilings if grown indoors—is on the verge of a major comeback.

Until the grass was mentioned in the 2006 State of the Union address for its bioenergy potential, most Americans had never heard of *Panicum virgatum.* Wandlike, as its Latin name implies, the grass was an integral part of the tall-grass prairie that dominated much of America's Midwest until about 150 years ago.

For a while, it looked as if native switchgrass was going the way of the buffalo, routed out by westward expansion. Now, there appears to be a growing effort to bring back this pivotal prairie plant and others like it.

Michael Casler, a plant geneticist who works at the ARS U.S. Dairy Forage Research Center in Madison, Wisconsin, can attest to the recent zeal over native grasses. In fall 2006, he attended an Eastern Native Grass Symposium in Harrisburg, Pennsylvania, that he describes as "growing by leaps and bounds."

"Months later, I still have people contacting me, excited to tell me about native prairies they know of in places as far south as Tennessee and Mississippi," Casler says.

Plant breeders, conservationists, landscaping firms, homeowners—they all see a future that's deeply rooted in lanky, softly flowing grasses. Renewable energy, a desire to "go native," and a longing for easy-to-grow, drought-resistant garden plants are a few of the driving forces.

But the task of reestablishing a plant that's been largely missing from its home range for hundreds of years poses many questions.

Casler, who's been breeding switchgrass plants for the past 10 years, has found at least a few answers. His is the first study to delve into the genetic legacy of this king of grasses.

"Remnant" Plants Versus "Bred"

There are basically two worlds when it comes to switchgrass: grass that grows unhindered on fragments of pristine prairie land and grass that's been cultivated by humans to encourage more positive agricultural traits.

For those wishing to restore prairie lands using native grasses like switchgrass, the general rule of thumb has been to tap local stocks—those from no farther than 50 to 100 miles out. It's believed that these plants are less likely to genetically contaminate other native or restored prairies in the area.

In other words, switchgrass growing in a native prairie in central Ohio isn't thought to be fit for planting in Minnesota. Even if that grass seed were more plentiful, easier to access, and cheaper, the prevailing thought is: Its genes would be too different.

"This kind of 'purist' thinking has often meant that switchgrass cultivars, which tend to be more readily available and less costly, get passed over for restoration projects," says Casler.

Casler, who's mostly focused on switchgrass's value in making biofuel, decided to pursue this offshoot of his research with assistance from ARS plant geneticist Kenneth Vogel of Lincoln, Nebraska. No one had ever before examined the genetic similarity between native switchgrass plants and their contemporary cousins.

Natural Land, Never Farmed

In the summers of 1996 and 1997, Casler and colleagues traveled from western Minnesota to New York and down to Indiana and over to Ohio in search of prairie lands that had never been "under the plow." This was Casler's cue for locating still-living slices of genuine prairie.

They collected more than 75 switchgrass samples from dozens of locations. Since most sites had been set aside by county or state departments of natural resources or were owned by private land-acquisition organizations, they contained essentially preserved grasses left over from the days of the great sprawling prairie.

After cultivating the accessions in his Madison laboratory, Casler extracted their DNA. He then extracted DNA from common current-day cultivars like Blackwell, Cave-in-Rock, Pathfinder, and Shawnee and compared them all for genetic differences and likenesses.

The results were surprising.

Still Rooted to Its Ancestors

Casler's switchgrass subjects had their differences, but hardly any were attributable to broad geographic disparities. Actually, aside from subtle differences owed to variations in soil, climate, and slope, the broad switchgrass pool sitting before Casler was pretty homogeneous.

"Plants from each individual population were as variable as those from geographically distant populations, and the remnant populations were very similar to the cultivars," he says.

Part of this can be explained by the fact that people have been breeding switchgrass for only about 50 years, compared to the thousands of years of domesticating modern wheat or corn.

"In fact, the most advanced cultivars I analyzed are only three to four generations removed from wild switchgrass," says Casler. He adds that these breeding-induced changes are small, since breeders only exploited a small amount of genetic variation already existing in native switchgrasses.

The good news about these findings is that so-called "improved" switchgrass cultivars are, genetically speaking, very similar to populations of plants being used for native restoration. "The difference between native and cultivated switchgrass," says Casler, "is probably due to changes in the frequency of just a few genes that have little overall impact on switchgrass gene pools."

A Grass That Can Make the "Switch"

These findings make switchgrass, which was already enjoying modest agricultural fanfare, especially attractive.

"Our findings show that switchgrass that's grown for biofuel," says Casler, "can also be grown for conservation and other uses without the fear of possible genetic contamination. We need to pay attention to the origin of switchgrass seed populations, but we've learned that seeds can be transferred widely within the hardiness zone in which they originated."

Switchgrass as a source of renewable energy still requires more research before its full potential is realized. Casler says that the plant's biofuel future probably lies in specially designed seed mixtures with supporting role-type plants—including beneficial legumes that fix their own nitrogen.

If Casler's right, fields of soft, willowy switchgrass growing alongside native legumes like pure prairie clover and Illinois bundleflower could someday provide us with a source of green energy as well as a window into our country's verdant past.—By **Erin Peabody,** ARS.

This research is part of Rangeland, Pasture, and Forages, an ARS national program (#205) described on the World Wide Web at www.nps.ars.usda.gov.

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Using DNA markers to characterize differences among switchgrass plants related to geographic variation, technician Nick Baker (left) and geneticist Michael Casler analyze the DNA markers of switchgrass plants using capillary gel electrophoresis.