Prairie cordgrass: Highly underrated

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When D.K. Lee and Lane Rayburn, faculty members in the crop sciences department at the University of Illinois, talk about prairie cordgrass (*Spartina pectinata*) they have difficulty containing their enthusiasm. They are among the very few people doing research on this grass as a potential energy crop.

According to Lee, switchgrass has been studied extensively as a forage crop and a dedicated energy crop. Recently this research has been extended to big bluestem, indiangrass, and other native grasses. Prairie cordgrass has received comparatively little attention because, unlike the others, it is not a good forage crop. "The cow has a preference; this grass is coarse and not good for grazing," Lee said.

However, as interest in energy crops and in feedstock production for cellulosic biofuels increases, prairie cordgrass is receiving more attention because it grows well on marginal land. "It likes environments that are too wet for row crop production." Lee explained.

He and his colleagues in the Energy Biosciences Institute, of which the U of I is a partner, are giving prairie cordgrass this increased attention as a biofuel source plant.

Many conservationists are also interested in the grass. "One of the characteristics of this grass is that it has a strong rhizome and root system," explained Lee. Thus, it is good for erosion control and conservation, particularly in riparian areas because it is a species that likes water.

Another important characteristic of *Spartina pectinata* is salt tolerance. Lee planted prairie cordgrass in west Texas in fields that could no longer be used for crop production because they had been irrigated with salty ground water. "It actually grew pretty well; the farmer was shocked," he said. Soil salinity is a problem in much of the marginal land throughout the world.

It also has good cold tolerance. Although it is a warm-season grass, it starts growing in mid-March like a cool-season grass. Its growing season is longer than that of corn, allowing it to accumulate high biomass.

Rayburn said that what makes it perfect as a biomass grass is that it is a native species with no invasiveness issues associated with it. "If I'm going to work with an energy crop, I want to bring something in that, environmentally and ecologically, I don't have to worry about," he said.

"It's a great plant," added Rayburn. "We know how to control it, it gives good biomass, and it grows on marginal land."

Lee and Rayburn wanted to know where the grass grows and whether it was all the same. Lee traveled over 10,000 miles around the country collecting more than 130 natural populations. He and his group then looked at the DNA and the ploidy level, which is the number of sets of chromosomes.

They found many differences. For example, the prairie cordgrass in South Dakota was mostly octoploid (eight sets of chromosomes) while the Illinois grass tended to be tetraploid (four sets). Then, to their surprise, they found a mixed-ploidy population comprising tetraploids and (previously unknown) hexaploids (six sets of chromosomes) at a single location in Illinois.

Lee said that, for biomass production, this newly discovered hexaploid is

in the top five of his collection. "A lot of people want to have access to this thing, but I'm still keeping it in my house," he said. The Energy Biosciences Institute is hoping to patent the variety. Lee's 'Savoy' cultivar has recently been patented.

Rayburn said that finding the hexaploid "was like catching a snapshot of evolution." The area where the hexaploid was found is a piece of Conservation Reserve Program (CRP) land that has not been farmed for 20 years, meaning that the polyploidy event occurred quite recently.

Rayburn and Lee describe their collaboration as "a perfect combination." Lee is focusing on developing a better cultivar with good agronomic traits. Rayburn is interested in how the hexaploid evolved. "What he does helps me in my studies of how the plant evolved; what I do helps him in his studies on improving it," said Rayburn, "and he's fun to work with."

More information: The research is described in more detail in the following articles:

Kim, S.M., A.L. Rayburn, and D.K. Lee. 2010. "Genome Size and Chromosome Analysis in Prairie Cordgrass (Spartina pectinata L.)." Crop Science 50:2277-2282.

Kim, S.M., A.L. Rayburn, A. Parrish, and D.K. Lee. 2012. "Cytogeographic Distribution and Genome Size Variation in Prairie Cordgrass (Spartina pectinata Bosc ex Link)." Plant Molecular Biology Reporter (in press, online first).

Kim, S.M., A.L. Rayburn, A. Boe, and D.K. Lee. 2012. "Neopolyploidy in Spartina pectinata Link: 1. Morphological Analysis of Tetraploid and Hexaploid Plants in a Mixed Natural Population." Plant Systematic and Evolution (in press, online first).

Kim, S.M., A.L. Rayburn, T. Voigt, A. Parrish and D.K. Lee. 2012. "Salinity effects on germination and plant growth of prairie cordgrass and switchgrass." Bioenergy Research 5: 225-235.