Large-scale Production Promising For Louisiana Smooth Cordgrass

Highly fertile lines might be appropriate for a broad range of brackish environments

By Herry S. Utomo, Michael D. Materne, Steve A. Harrison and Ida Wenefrida

Native to salt marshes along the eastern U.S. seaboard and the Gulf coast, smooth cordgrass (*Spartina alterniflora* Loisel.) can also be found in the estuarine around Europe, Australia, New Zealand and Asia. Because it is the predominant plant species in coastal salt marshes, a current practice in coastal erosion control and habitat restoration involves the use of *S. alterniflora*. *Spartina alterniflora* possesses an extensive root system and can tolerate fluctuating water levels and grows well across a large range of soil types, from sandy to clay with pH ranging from 3.7 to 7.9. In addition to tolerating fluctuating water depths, it grows well in salinities ranging from 0 to 35 parts per thousand salinity (Fig. 1). *Spartina alterniflora* is an effective wave and tidal energy buffer, trapping suspended sediments and providing shoreline protection from erosion.

Louisiana coastal marshes are being rapidly converted into open water at rates estimated at 65 square kilometers (km^2) to 91 km^2 annually (Bourne, 2000). Coastal marsh loss in Louisiana represents 80 percent of the coastal wetland loss nationally. Wetland loss is generally attributed to a combination of natural and human causes, including subsidence, sea level rise, hydrologic modification, ditching, dredging and herbivory (Day et al., 2001). If loss persists at the current rate, it will have devastating effects because the coastal marshes play a pivotal role in the ecology and economic well being of Louisiana. Because *S. alterniflora* is the predominant plant species in Louisiana's intertidal saline marshes, it plays a major role in determining estuarine structural and ecological function in these regions (Proffitt et al., 2003). Consequently, wetland restoration planners and practitioners rely heavily on *S. alterniflora* to offset Louisiana's coastal wetland losses.

A number of sediment enhancement techniques — such as beneficial-use dredge sediments and bay bottom terraces — are promising, and the technology for large-scale marsh creation is accelerating (Reed, 2004), resulting in significantly large acreage of wetland restoration. Major limitations, such as inaccessibility to many of these interior marsh sites and the significantly high per-unit cost associated with clonal plantings, will continue to limit the use of plant materials on large restoration projects. Developing rapid and successful vegetative restoration technology is critical to the acceptance of vegetation as part of large-scale restoration projects and for the large areas of degrading wetlands.

Challenges

The released cultivar *Vermilion* is the only available commercial variety of *S. alterniflora* in Louisiana. It has demonstrated superior growth characteristics, has performed well on newly created, enhanced or in highly disturbed salt marsh, and is often specified as the species of choice by many federal and state conservation agencies when issuing vegetative restoration contracts. However, it has a low seed set (20.6 percent) and low germination (35 percent). Current clonal planting practices in restoration projects are both labor-intensive and costly. Labor requirements for planting sprigs, plugs or container plants range from 25 hours per acre to 125 hours per acre. Manual digging and separating of the plants require 25 hours per acre to 65 hours per acre. Mechanized digging, such as using adapted small agricultural tractors for separating and planting, requires about half the time. Estimated direct and indirect costs of replanting salt marshes could easily reach $3,500 per acre, depending on location. The seed-based propagation technique will only require a fraction of the cost. Hundreds of acres potentially can be planted in a day with aerial seeding.

Seed-based propagation

A seed-based *S. alterniflora* propagation method can expedite the establishment of vegetation over a large area quickly and economically. An aerial seeding can reach marsh interior marshes most affected by erosion not only to restore coastal marshes but also maintain the entire salt marsh systems. Through aerial seeding, hundreds of acres can be planted in a day at a fraction of the cost of current planting practices. A large production of *S. alterniflora* seed under a managed environment will provide a steady supply of *S. alterniflora* seed.

A total of 13 genetically diverse, superior and high seed-producing lines were developed by the Louisiana State University AgCenter. These lines — VRES-1, VRES-2, VRES-3, VRES-4, VRES-5, VRES-6, VRES-7, VRES-8, VRES-9, VRES-10, VRES-11, VRES-12 and VRES-13 — were space planted randomly to produce synthetic or blend seed. *Spartina alterniflora* seed does not mature at the same time. Once it matures, the seed shatters. Seed was hand harvested around mid-November by cutting the panicles before the seed shatters. To obtain maximum harvest, the panicles were stored under room temperature in plastic bags to provide 100 percent humidity for one month to allow all seed to mature and shatter. Specialized harvesters, such as the Flail-Vac harvester, may be used to mechanically harvest the seed as it matures. The average seed set of the blend population was 56.5 percent with an average germination rate of 82.2 percent. Cold stratification at 2 degrees Celsius (2 C) in 100 percent humidity for one month was applied to break seed dormancy. Seed was stored in air-tight sealed containers in a wet condition with a temperature set to 2 C (1 degree variability). Vitavax solution (5 milligrams per liter) was applied to minimize fungus contamination during storage.

Stratified, non-dormant seed produced visible shoots after 10 hours at 27 C. Initial root germination was visible at least 15 hours later. Time for 50 percent visible shoot germination was 20 hours to 25 hours at three temperature regimes of 27 C, 32 C, and 37 C. Time for 50 percent visible root germination was 30 hours at 27 C and 32 C but was not observed until after 80 hours at 37 C. After approximately one month of cold stratification, seed started to germinate in the cold storage (2 C). Seedling viability of blend seed remains highly viable in a six-month period. However, its viability becomes rapidly deteriorated thereafter.

The average yield of *S. alterniflora* synthetic population was 347.2 pounds per acre, which is equivalent to approximately 16.9 million viable seeds.

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PHOTO 1

***Spartina alterniflora* cultivated under a freshwater environment at the LSU AgCenter Rice Research Station, Crowley, La.**

PHOTO 2

Germination of S. alterniflora seed from cv. Vermilion (left) and a polycross/blend population of 13 highly fertile breeding lines (right).

PHOTO 3

A total of 13 genetically diverse, superior and high seed-producing lines were developed by the Louisiana State University AgCenter.

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As comparison, a total of 106.3 million seed is produced from an acre of rice (5,800 pounds per acre). Rice seed produced in an acre can be used to plant 48.3 acres (at a seeding rate of 2.2 million seeds per acre). Using an equivalent seeding rate, *S. alterniflora* seed produced from an acre can be used to plant 7.7 acres. Therefore, relative efficiency of seed production in *S. alterniflora* was a little less than one sixth of the rice.

Potential cultivation

Spartina alterniflora could be an alternative in some areas. This plant has the ability to tolerate a range of salinities, from sea strength to freshwater. Populations of *S. alterniflora* have been cultivated and maintained under freshwater conditions at several research institutions for years and have performed consistently well.

Since *S. alterniflora* can be cultivated in a broad range of salinity environments, large-scale commercial seed production is highly probable and could be an adjunct to aquatic crops, such as rice, with little modification to existing equipment or land. Due to increasing salt contamination of inland groundwater, many areas historically used for rice production have been abandoned, thus providing opportunity for *S. alterniflora* production as an alternative crop.

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