U.S. Department of Agriculture **Work Unit Description AD-416** **U.S. Dept. of Agriculture, State Agricultural Experiment Stations and Other Institutions**				Date (Month/Day/Year) 07/09/2012
1. Accession No.	Agency Identifiers		5. Work Unit/Project No.	6. Status
	2. NIFA	3. LA.B	LAB94153	A = New Project
7. Title **Varietal Development, Cultural Management, and Aerial Planting of Coastal Restoration Plants**				
8. Performing Organization 8190 - 2010 Rice Research Station Agricultural Experiment Sta, Louisiana State Univ			9. Cooperating Departments within State Performing Institution a. School of Plant, Environmental, and Soil Sciences b. Burden Research Center	
10. Multistate Project No.			11. Cooperating States	
12. Investigator Name(s) Last Name and Intitials) 1. Utomo, H.				sent via BITNET/INTERNET electronic mail systems Date: 7/10/12
13. Project Contact Last Name and Intitials: Utomo, H.			Phone: 337-788-7531 Fax: 337-788-7553	POSTED
E-Mail: hutomo@agcenter.lsu.edu URL:				
14. Project Type Hatch	15. Contract/Grant/Agreement No.		16. Amount	17. FY

18. Award Date (Month/Day/Year)	19. Start Date (Month/Day/Year)	20. Termination Date (Month/Day/Year)
	07/01/2012	06/30/2016

Goals/Objectives/Expected Outputs

The goals and objectives of this project include 1) Genetic improvement and development of seed-based smooth cordgrass (Spartina alterniflora) varieties; 2) Establishment and enhancement of cultural practices and seed production system, specific seed properties to increase success rate of seedling establishment rates and aerial planting precision, and long-term seed storage methodology for smooth cordgrass; 3) Development of aerial seeding method for large scale coastal restoration efforts; 4)Genetic improvement and development of salt-tolerant and superior California bulrush (Schoenoplectus californicus); and 5) Establishment of distribution protocols for smooth cordgrass certified seed and certified clones of California bulrush. Expected outputs include 1) New germplasm and varieties, 2) Conducting and analyzing experiments and assessments; and 3) Conducting demonstration sites, field days, and symposia.

Methods

Conventional breeding protocols will be used to develop polycross of smooth cordgrass. Most promising lines selected will be used to generate a polycross that contains certain sets of parental lines (4, 5, and 6 parents). Yield potential of these polycross sets were evaluated in replicated trials of three replications at the Rice Research Station. Two most promising sets were further evaluated in two natural marsh environments (Lake Pontchartrain and Rockefeller sites) together with their progeny. More tests will be conducted in two different sites (Belle Chase and Marsh Island sites). Phenotypic performance measured by vigor, spread, height, biomass, and seed production. In addition to applied field testing, basic research will also be conducted. Standard diallel crosses will be carried out to estimate general and specific combining ability. Various polycross combinations based on seed production potential, superior phenotypic performance measured by vigor, spread, height, biomass, and seed yield, and their relative genetic distance (determined based on 20 microsatellites and 120 AFLP markers) will be evaluated. Cellular manipulation protocols developed earlier for S. californicus will be employed. Cellular selections will be conducted through progressive exposures to elevated salt concentrations of 12, 14 and 18 ppt for at least three cycles. The surviving calli will be regenerated. Greenhouse verification tests will be carried out by exposing the plants to a 18 ppt salinity level continuously for four months. Lines that perform consistently in the greenhouse tests will be tested in the brackish natural environments in Rockefeller and Lake Pontchartrain sites. Aerial seeding studies will be conducted in a newly constructed marsh (dredged sediment) free of smooth cordgrass in Raccoon Island. A randomized complete block design will be used to accommodate the treatments effectively, including blocking based on high and low tidal wave actions. Several days prior to aerial seeding, the aerial seeding contractor will calibrate the applicator. Data collection will include seed density and distribution, seed germination, stand establishment, seedling vigor, plant vigor, stem density, stem height, stem diameter, seed production, and total biomass. Priming, GA3 treatments, and presoaking/pre-emergence will be conducted to improve physio properties of the seed. Seed pelleting studies include incorporation of water attracting materials, oxygen provider, tackifier, and chitosan. An Analysis of Variance or General Linear Model procedure of SAS (SAS Institute, Cary, NC) will be carried out on all data collected. Results of analyses will be used to develop specifications for pelleting smooth cordgrass seed. Pelleted seed from aerial seeding will be done commercially based on the specifications developed. Distribution of superior smooth cordgrass seed and clones of California bulrush developed from this program will require certification. Varietal certification will be established though collaborations with the Louisiana Department of Agriculture and Forestry (LDAF).

23. Non-Technical Summary

Reducing the rates of coastal marshland loss in Louisiana and preserving the most productive estuarine ecosystem are not only crucial to the economy of the state but also to the life and culture of many people who depend on this environment. Between 1932 and 2000, coastal Louisiana lost over 1,875 square miles of land. Without intervention, it is predicted that an additional 513 square miles will be lost by 2050, with an estimated loss of more than $37 billion in public resources and services. A current practice in coastal erosion control and habitat restoration involves the use native coastal plants, including smooth cordgrass (Spartina alterniflora, Loisel.) and California bulrush (Schoenoplectus californicus, C.A. May). These plants are commonly used in marsh revegetation and restorations. Revegetation technology is an important component to help reduce the erosion rates. Development of genetically diverse and superior coastal plant varieties is critical to improve the efficiency of coastal restoration. Genetic improvement of coastal plants in the past has been focused on vegetative cultivars for use specifically in hand-transplanting. To allow for a larger scale of coastal restoration to be conducted, it is necessary to develop seed-based varieties. Development of seed cultivars of smooth cordgrass is crucial since seed can be flown and aerially planted. It takes less than 8 seconds to aerially plant an acre of land. Aerial seeding will provide an economical means to rapidly secure newly constructed marshes, conduct large-scale planting for erosion control, reclaim the eroding land, rejuvenate distress habitat following the destruction from natural disasters, such as hurricanes, reestablish habitats that are lost due to massive die-back or brown marsh, and prevent irreversible land loss due to the prolonged absence of vegetation. Genetic improvement and development of seed-based smooth cordgrass varieties and salt-tolerant California bulrush will be conducted to provide significant contributions in erosion control and habitat restoration efforts. This project will also address other research areas, include enhancement of specific seed properties of smooth cordgrass to increase success rates of stand establishment rates and aerial planting precision. In addition, basic research to develop long-term seed storage methodology for smooth cordgrass is also needed. This research will include cellular and breeding selection to develop salt- tolerant California bulrush. To ensure a variety's genetic identity, purity, and its performance characteristics, protocols for smooth cordgrass seed certification will be developed. Effective delivery of these products to the end users requires research to establish cultural practices and an efficient seed production system. Seed certification will help establish a mechanism to obtain high quality coastal plant materials that can lead to highly efficient coastal restoration that will benefit all parties involved in the program. The expected outcomes/impacts include the adoption of aerial planting of smooth cordgrass seed as a rapid coastal marsh revegetation technology.

24. Keywords

smooth cordgrass; Spartina alterniflora; Schoenoplectus californicus; California bulrush; coastal grass; erosion control ; aerial seeding; salt tolerance; seed cultivar; marsh; coastal loss; breeding; biotechnology; DNA markers; habitat restoration; rapid revegetation; seed coating; pelleting; crop duster

****** The Original signed document is on file at this institution. ******

Signature	Title	Date
Dept: Admin: [signature]	*Associate Director*	7/9/12