Kika de la Garza Plant Materials Center

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SALT-MARSH BULRUSH: TWO GERMINATION STUDIES

ABSTRACT

For the first study, seed from salt-marsh bulrush (S*cirpus robustus*) was stored for a period of eighteen months using two different methods of seed storage. Sample A of the salt-marsh bulrush seed was stored dry in a humidity controlled storage cooler at approximately 50º f, while Sample B was stored submerged in de-ionized water in a standard refrigerator at approximately 35ºf. After 18 months, both samples were removed from storage. For each test, fifty seeds from each sample were then placed on separate sets of pre-moistened germination blotter that was set into separate plastic trays with lids. Each test was replicated four times. The trays were placed in a germination chamber that had been set at 25ºc for 10 hours dark and 35ºc for 14 hours of light. They remained in the chamber for 28 days. Sample B, the soaked seed, had significantly more germination than Sample A. No Sample A seeds germinated during this study; whereas Sample B seed averaged 50% germination. The purpose of this study was to compare the effects of the two storage methods on seed germination.

The second study used freshly harvested seed from two accessions of salt-marsh bulrush growing at the wetlands facility at Kika de la Garza PMC. Fifty seeds of each accession were collected and immediately placed in plastic containers with water and sand from the wet tank that the parent plants were growing in. The plastic containers were placed adjacent to the original wet tanks where the parent plants were growing. Air temperature, water temperature, container salinity, and germination were monitored daily for 28 days. Seeds were exposed to approximately fourteen hours of daylight and ten hours of darkness. Air temperatures ranged from 71ºF to 102ºF, water temperatures from 76ºF to 105º, and water salinity levels ranged from 0 to 5 parts per thousand. Accession #9076934 (Jackson Cty., TX) showed 100% germination, while accession # 9076931 (Aransas Cty., TX) showed 32% germination during this twenty-eight day study. The purpose of this study was to test earlier seed dormancy of salt-marsh bulrush.

INTRODUCTION

Salt-marsh bulrush (*Scirpus robustus*), also known as (*Scirpus maritimus,* var. machrostachyus), is a member of the cyperaceae or sedge family (Hatch, Gandhi, & Brown, 1990). It is a native, rhizomatous perennial, with extensive culms tufted along the rhizome. Often there are tuber-like structures located basally (Correll & Johnston, 1996). Salt-marsh bulrush is frequently found in colonies in wet, brackish soils and in the shallow waters of ponds, lakes, and marshes (Jones, 1982). It can be found in the coastal marshes of southeast Texas and the Rio Grande Plains (Correll & Johnston, 1996). Salt-marsh bulrush is tolerant of alkalinity and has been known to grow in sandy or clay soils, and in fresh or brackish water. It should be noted; however, that the site salinity may be inversely correlated with both seed production and germination (Keyes & Lloyd-Reilley, 1999). It can be used as a wetland restoration plant for south Texas. It also provides habitat for waterfowl and other wetland wildlife and its seeds are an excellent food source for ducks (Martin & Uhler, 1939). Salt-marsh bulrush may be propagated from rootstocks, division of rhizomes, or seed.

Two germination studies were conducted by the staff at Kika de la Garza Plant Materials Center in Kingsville, Texas with the seed of salt-marsh bulrush. The objective of the first study was to evaluate the effects of two different storage treatments on the germination of salt-marsh bulrush seed. The purpose of the second study was to evaluate whether seed from salt-marsh bulrush requires a period of seed dormancy prior to germination. This study originated because a PMC staff member noticed that some freshly matured salt-marsh bulrush seed had fallen into the wet tank water and was beginning to germinate in a matter of days. Previous literature on germination of *Scirpus spp*. seed has indicated that a natural seed dormancy period was evident prior to germination (Keyes & Lloyd-Reilley, 1999) Much of the literature on propagation of salt-marsh bulrush by seed has focused on breaking the seed dormancy (Dietert & Shontz, 1978; George, 1977; O'Neill, 1972; Palmisano & Newsom, 1967; Prevost & Gresham, 1981). Various methods of mechanical scarification (Dietart & Shontz, 1978), chemical scarification (George, 1977; O'Neill, 1972), cold stratification (Dietart & Shontz, 1978), and hot stratification (George, 1977; O'Neill, 1972) have been evaluated as tools to help break seed dormancy and enhance germination.

MATERIALS AND METHODS

Seed Storage Study

For the first study, seed from accession #9076931 salt-marsh bulrush was collected and cleaned by hand in December of 1997 by staff at the Kika de la Garza Plant Materials Center in Kingsville, Texas. The plants from which the seed was harvested were located in Block O, the wetland plant evaluation area, at the PMC. Some of the seed was placed in a seed collection envelope (Sample A) and stored in a temperature and humidity controlled cooler at the

center. The cooler is kept at approximately 50ºf and 50% humidity. The remainder of the seed was placed in fine netting, along with a net pouch containing small rocks, and submerged in a plastic container of de-ionized water (Sample B). The rock pouch was used to add enough weight to keep the seeds completely submerged. The plastic container was then placed in a regular refrigerator, which is kept at approximately 35ºf. Both samples were stored for a period of eighteen months because plants of the genera scirpus are known to have a period of seed dormancy.

In June of 1999, both seed samples were removed from their storage locations so that germination testing could be conducted. . For each test, fifty seeds from each sample were then placed on separate sets of pre-moistened germination blotter that was set into separate plastic trays with lids. Each test was replicated four times. The trays were placed in a germination chamber that had been set at 25ºc for 10 hours dark and 35ºc for 14 hours of light. They remained in the chamber for 28 days. Trays were checked for germination on a daily basis. Seeds were considered germinated when the root and the shoot exceeded the length of the seed.

Seed Dormancy Study

For the second study, seed from accessions #9076931 (Aransas Cty., TX) and #9076934 (Jackson Cty., TX) salt-marsh bulrush was collected and cleaned by hand in July of 1999 by a staff member at the Kika de la Garza Plant Materials Center in Kingsville, Texas. The plants from which the seed was harvested were located in wet tanks in Block A (#9076934) and Block O (#9076931) of the wetland plant evaluation area, at the PMC. Fifty seeds were harvested from plants in each location and placed into separate plastic containers filled with water and sand taken from the wet tanks where original plants were growing. Additional water from the tanks was added as needed throughout the study to replace water lost to evaporation.

The containers were placed in locations adjacent to the Block A and Block O wet tanks containing the salt-marsh bulrush plants, so that the conditions in the containers would mimic the temperature and light conditions in the respective wet tanks. Morning and evening air temperatures and water temperatures were monitored, as well as water salinity for each container. Germination was monitored daily for 28 days beginning July 15, 1999, or until 100% germination was recorded. Seeds were considered germinated when the root and the shoot exceeded the length of the seed.

RESULTS AND DISCUSSION

Seed Storage Study

Statistical analysis for the first study was conducted using SPSS 9.0 for Windows. A one-way analysis of variance (ANOVA) was run using treatment as the factor. A second one-way ANOVA was run using replication as the factor. Germination percentage was the dependent variable used for both factors.

No Sample A seed germinated throughout the study. Sample B seed began germinating three days after the trays were placed in the germination chamber and continued until day nineteen. The average seed germination for Sample B seed was 49% (Table 1).

Sample B seed, the wet-stored seed, was found to have a significantly higher percentage of germination than the Sample A or dry-stored seed based on the results of the one-way ANOVA (Table 2). No significant differences in germination percentages were found between replications.

Based on the results of this study, it appears that storing salt-marsh bulrush seed in water significantly increases the germination potential of the seed. Future studies will experiment with the amount of time that the seed needs to be stored in water to increase germination and with storage temperatures.

Seed Dormancy Study

During the second study, seeds were exposed to approximately fourteen hours of daylight and ten hours of darkness. Air temperatures ranged from a low of 71ºF to a high of 102ºF. Water temperatures for the Block A container ranged from 77ºF to 100ºF, and Block O container had water temperatures from 76ºF to 105ºF. Water salinity levels ranged from 0 to 5 parts per thousand for Block A and Block O.

Seeds from both accessions began to germinate eight days into the study. By the sixteenth day, 100 percent of the seeds from accession #9076934 (Block A) had germinated, and no further data was taken on the Block A portion of the study. The Block O accession, #9076931, finished germinating by the eighteenth day. Thirty-two percent germination was achieved for this accession.

The results of this study differed from published reports on the seed dormancy period for *Scirpus robustus*. Dietart and Shontz's 1978 study found no germination less than one month after harvest, but got germination with mechanically scarified and cold stratified seed after one month. George (1977) got germination with dry-stored seed that was at least five years old using different scarification and stratification techniques. The seed dormancy period may be induced by storage conditions after harvest. Some previous studies (including Geoerge, 1977) have used seed that had been harvested and stored

dry. As was documented in the seed storage study at Kika de la Garza PMC, wet-stored seed had significantly better germination than dry-stored seed eighteen months after harvest. Wet- storage tends to mimic the natural conditions, as seed generally falls into water, or at least wet soil. It appears that storing seed in water immediately after harvest significantly improves germination. In addition, it appears that under the right set of temperature and light conditions, if the seed is placed in water following harvest, no seed dormancy period is required. Wet-stored seed must be stored at cool temperatures to prevent germination and increase long-term storage potential. Wet-storing seed at warmer temperatures may cause the seed to germinate.

George (1977) stated that some sources of salt-marsh bulrush seed tend to be consistent germinators, while others are more prone to dormancy. So, what is found to be true with seed from one source may not apply to seed from a different source. The results of the second study tend to support George's (1977) finding. Breaking of seed dormancy may not need to be the main focus of future studies. Finding a fertile accession that is adapted to a particular region may be more valuable. Accession #9076934 may be that accession for south Texas. Further studies will be conducted to better evaluate its potential.

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Table 1.

Germination Percentages for Two Seed Storage Treatments

Rep	Sample A (Dry-Stored Seed)	Sample B (Wet-Stored Seed)
1	0	54
2	0	36
3	0	44
4	0	62
Total	0	49

Table 2.

ANOVA Table For Germination With Storage Treatment As Factor

	Sum of Sq.	df	Mean Sq.	F	Prob. Sig.
Between Groups	4802.000	1	4802.000	74.258	.000
Within Groups	388.000	6	64.667	-	-
Total	5190.000	7	-	-	-