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Interagency Riparian/Wetland Plant Development Project

First Quarter FY 1993 Progress Report

Project Staff

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Introduction

This quarterly report is a continuation of the first quarterly report that was submitted at the September, 1992 wetland tour here at the PMC. It includes updates on what the project has accomplished since October.

Objectives of the Project

The objectives of the Interagency Riparian/Wetland Plant Development Project are seven-fold.

1) Assemble, collect, evaluate, and select performance tested ecotypes of the following species for commercial production; to provide plant materials for advanced testing and for commercial growers.

    Nebraska Sedge, Carex nebrascensis (CANE2)
    Creeping Spikerush, Eleocharis palustris (ELPA3)
    Baltic Rush, Juncus balticus (JUBA)
    Threesquare Bulrush, Scirpus americanus (SCAM2)
    Alkali Bulrush, Scirpus maritimus (SCMA)
    Hardstem Bulrush, Scirpus acutus (SCAC)
    Water Smartweed, Polygonum amphibium (POAM8)

2) Develop design criteria for establishing and maintaining native riparian/wetland plant communities.

3) Develop design criteria for establishing and maintaining wetland plants to maximize their performance in constructed wetlands for water quality improvement.

4) Develop and manage a riparian/wetland plant attribute database.

5) Coordinate input into riparian/wetland restoration/development training courses.

6) Coordinate preparation of videos, slide shows, publications, and other means of information exchange.

7) Develop demonstration sites to show plant materials and techniques for the establishment of constructed wetlands.

Seed Collections

Last summer, we attempted to collect seed from the original sites at the same time as live plants were collected. However, many of the species had already dropped the seed or had not filled because of the drought. Sixteen collections were made: 7-SCAC, 4-SCAM2, 2-SCMA, 1-CANE2, and 2-ELPA3. No JUBA was collected because none of the seeds that were found had filled. POAM8 was very difficult to find at all. Only one population was identified as POAM8. All of the rest of the populations were either POAME or an annual. Nine additional collection sites near the PMC were identified and seed was collected: 3-SCMA, 2-SCAM2, 2-ELPA3, and 2-CANE2. All the seed was cleaned on 12/4/92 at the PMC. These included: 4-SCMA, 3-JUBA and 1-SCAC collection that arrived late in 1991.

A few of the original collections have been dropped from the selection process. One collection site was not a discrete population, and we were unable to locate one site. A total of seven original collections have been dropped or replaced because of poor performance in the greenhouse.

Live Plant Collections

All the live plant collections were made and planted at the PMC by October 2, 1992. All the plants, excluding the POLYG4, had their stems trimmed before they were transported back to the PMC. The POLYG4 plants were not cut because in the greenhouse we found that cutting inhibited growth of the plants and recovery was very difficult. The uncut live plants did not transport well. Mortality of the uncut live POLYG4 plants was about 58% which was one of the highest recorded (Table 2). For POLYG4, propagation by seed rather than live plant transplants may be the best method to use. The plants are very prolific seed producers, so seed is not a problem.

After the first pond evaluation, a problem with SCMA and SCAM2 was noticed. The cut stems were growing very little or not at all, and had few new shoots. A cutting trial is now in progress to determine if cutting the stems is a problem. A submersion trial similar to the SCAC trial will also be done to determine whether or not submersion kills the plants.

Evaluations

Two evaluations of the plants have been completed, one in August and the second in October of 1992. Some plants were only evaluated once due to planting dates. The data from the field copies has been entered into the computer for analysis.

After the second evaluation, mortality was figured for the live collections and seed propagated plants (see Table 1). The live collection mortality for the Scirpus maritimus is 73.2%. The Polygonum also has a high mortality in the live collections. The stems were not cut due to our experience in the greenhouse, so transporting was difficult and may have stressed the plants. Propagation by seed may work the best for the Polygonum species. The mortality for seed propagated plants was high for Scirpus maritimus and Scirpus americanus. These two species were planted late in the growing season, so the figures may change by the end of the 1993 growing season.

Data Analysis

All the data that has been entered into the computer has been sorted for entry into MSTATC. The preliminary results from the Analysis of Variance and Duncan's Range tests show that the data for height, width, and rhizomes are significant with the probabilities less that 0.05 (Table 3).

Greenhouse Stratification and Germination Studies

Stratification

One priority of this wetland project is to determine stratification methods which will result in successful seed germination. The first stratification studies generated some preliminary data that are being used to further define stratification tests.

For Scirpus acutus, Scirpus maritimus, Scirpus americanus, Eleocharis palustris, and Polygonum species, cold temperature versus alternating temperature conditions were tested by one set of samples being placed at 3°C and maintained for the duration of stratification, and another set of samples placed on a four week rotating period of 3°C and 37°C for the alternating temperature condition. On December 23rd, the above stratification trials ended. The data are now being analyzed.

From our experiences with these tests, we have concluded that the pond water and distilled water can be dropped from further studies because they did not enhance germination. Accessions will now be placed in wet and moist conditions, stratified for 4 weeks at 3°C, and planted directly into warm moist soil.

Additional studies with moist and wet conditions in alternating temperatures will be done to determine optimal stratification conditions and time periods.

Seed Drying

All the seeds from the wet and moist cold stratification trials are still in stratification cups in the cooler. We want to be able to dry this seed and use it later. Viability is unknown after extensive soaking and then drying the seed.

Stratification Test

Drying wetland plant seeds after storing them in water may affect germination. In addition, stratification may have to be repeated before planting the dried seeds. To test these theories, the following trials will be initiated. Three accessions each of SCAC, SCAM2, and ELPA3 will be tested under 3 different treatments. All trials will consist of 100 seeds taken from the stratification cups that have been stratifying in cold pond water (wet and moist stratifications) since May 1992. Trials 1 and 2 will be dried, restratified, and then planted. Trials 3 and 4 will be dried, and then planted. Trials 5 and 6 will be planted directly from the present stratification cups. This test was initiated on November 17, 1992, so no results are yet available.

Germination

The germination data indicates that moist stratification was more successful than wet stratification for the Scirpus acutus and Scirpus americanus species. The Polygonum seeds did not germinate under wet stratification, but once transferred to moist soil conditions they germinated as successfully as the seeds stratified in moist conditions. The Scirpus maritimus experienced equal germination between wet and moist stratifications, but the plants from the moist stratification, established and grew more rapidly after planting. The Eleocharis palustris seeds in wet stratification had a higher percentage of germination, but if the seeds had germinated in the stratification cups, survival after transplanting was lower due to apparent cotyledon damage during the planting process.

Greenhouse Temperature and Lighting

The greenhouse temperatures are kept between 30°C and 37°C. During the summer months when the greenhouse boilers were turned off, the temperatures occasionally reached 40°C (in August) and occasionally dropped to 20°C (in September). In October, the boiler broke down several times and caused the temperatures to drop as low as 7°C. To remedy the problem, we have installed a new thermostat and plastic on the west side windows.

The greenhouse is equipped with mercury vapor lights over each tank. These lights are on 8 hours a day. As of 12/10/92, the lights were turned on for 16 hours a day to stimulate the plants to set seed.

Special Tests

Thermistors

Thermistors and an Ohm meter are being used to monitor the temperatures while the seeds are in cold and warm stratification. This will allow better adjustments in our germination environment. It may also help us determine why germination is higher in the stratification cups.

1967 Germination Test

In 1967, the PMC researched SCMA for potential release. During a routine seed inventory, seed from the old study was found in storage. The potential to establish viability of older seed was immediately evident, so we decided to stratify it and plant it. In September, the seed was placed in wet and moist stratification conditions at alternating temperatures.

We also wanted to know if we could plant the seeds right out of the cooler and have the same germination success as occurred in the stratification cups. This would eliminate the chance of damaging the young cotyledon during planting. Four hundred seeds were counted out and divided up, 100 to a cup, two stratification cups for the wet and two stratification cups for the moist. They were stratified at 3°C for 28 days starting on 9/4/92. After 28 days, the stratification cups were moved to the greenhouse. Then, a group of 200 seeds were planted, 100 from the wet and 100 from the moist. The remaining 200 seeds were left in their wet and moist stratification cups as the control group. On 10/13/92, 36 seeds from the wet and 23 seeds from the moist had germinated from the control group. Conversely, only 1 seed had germinated in the planted group. Total germination was:

21% moist (planted)	55% moist (cups)
8% wet (planted)	55% wet (cups)

One possible explanation for the difference between the 2 treatments is that when the 21°C water was drained to control algae, it was replaced with 11.5°C water. This decreased the soil temperature for a period of time. This fluctuating soil temperature may have been detrimental to seed germination.

We will be replicating this type of test with younger seed in the future.

Scirpus acutus Submersion Test

This test was initiated to determine whether SCAC would die if the tops were cut and the plants submerged. This is a common control practice for controlling wetland plant populations.

Our preliminary results show that the plant does not die when submerged, but growth is slowed significantly. We plan to replicate this test in the Spring, 1993.

Water Quality Constructed Wetland Systems

A Constructed Wetland System is a relatively inexpensive way to improve the water quality of agricultural irrigation waste water before it returns to ground water, aquifer, river, stream, lake, or reservoir. It can remove or significantly reduce levels of attached and soluble nutrients, especially soluble phosphorous, nitrogen, sediment, fecal bacteria, and organic matter from runoff. The system is composed of 5 components; 1) sediment pond, 2) primary grass filter, 3) wetland, 4) deep water pond, and 5) final grass polishing filter. Each component is an integral and necessary part of the system for it to remove or reduce contamination as the waste water moves toward the return point.

Poulson CWS Demonstration Site

A Water Quality Constructed Wetland System Demonstration Site on the Neil Poulson farm, American Falls, is in the planning stage. Funds are being solicited for its construction. To date a topographic survey of the site has been done by the Soil Conservation Service Area III Engineering Staff. Preliminary designs for each component have been completed and a copy of the conceptual design sent to all of you for review. Upon confirmation of construction monies, a final design will be completed by the SCS State Office Engineering staff. Construction of the CWS is planned for early spring (depending on funding, the bid process, and contractor negotiation). The components will be planted with the Project's wetland plants as soon as possible after construction. The first year will be strictly plant establishment and component testing. Actual water quality testing may not take place until the start of the irrigation season of the second or third year depending on plant establishment and spread.

Bear Lake RC&D CWS Demonstration Site

On November 18, I met with the Bear Lake RC&D Council to request funding for a CWS Demonstration Site in northern Utah or southern Idaho. The council was interested in the presentation and appeared to have some potential sites in mind. Availability of funding for a potential Demonstration Site was unclear. Further contacts have not produced new information. Future funding is still hoped for.

Constructed Wetland Ponds

PMC Pond Irrigation

Two methods of adding water to the ponds were used in 1992 (the 6th year of the drought), ditch irrigation and a portable 1200 gallon tank. Water from the ditch was distributed in the ponds by a 50 ft long, 1" pipe with holes drilled every 3-4 inches. The pipe was laid diagonally across the bottom of the pond. Ditch irrigation was used from 6/5/92 to 8/23/92 and from 9/15/92 to

10/15/92. This split in irrigation water delivery was caused by the fact that the Aberdeen-Springfield Canal Co. ran short of water. The Canal Co. directors decided to shut off the water to the system from 8/24/92 to 9/14/92 to have enough water for potato harvest.

In a normal situation, the ponds would be irrigated from April to mid-October. To more accurately reflect a normal irrigation year and to keep the plants alive during the establishment period, water was transported to the ponds in the 1200 gallon tank.

Each pond had water added to keep the soil moist or wet depending on the species in the pond, and the ability of the pond to hold water (Table 2). Table 2 also shows monthly totals of precipitation and evaporation. Transpiration is considered negligible at this time because of the low percentage of vegetation cover within the ponds.

Dike Failure

In August, 1992, lined ponds 1 and 2 were being filled with water when the dike between pond 1 and 2 collapsed and the water from pond 1 rushed into pond 2 which collapsed the dike between 2 and 3. The water from 1 and 2 was caught and held in pond 3. Subsequent investigation by the SCS engineer indicates that a series of problems contributed to the failures. Further investigations are in progress, including cost estimates of the damage repair. Negotiations with the contractor are scheduled to be completed by early spring so repairs can be completed before the irrigation season begins.

Natural Wetland Areas for Plant Testing

Sterling WMA

On the Sterling WMA (Idaho Fish and Game) just east of the Aberdeen PMC Fish and Game Farm, we have installed water depth gauges to monitor the water level above and below the ground surface. This area will be the future location for wetland plant test site. The site will be used to test our wetland plants in a natural wetland area versus a constructed wetland site with no wetland soils. Plants that do not grow well in a constructed wetland pond, may perform very well in a natural wetland revegetation project and visa versa. We are continuing to monitor the water levels.

In 1993, the natural plant communities will be mapped in relation to the established water depth gauges. This is to establish a relationship between water levels and the natural plant community boundaries. All of this information will be used as baseline data for future testing.

Table 1

Live Collections
Transplant Survival

Species	Number Planted	Number Alive	% Mortality
CANE2	340	325	4.4
JUBA	280	266	5.0
ELPA3	280	205	26.8
SCAC	460	307	33.2
SCMA	160	43	73.2
SCAM2	220	157	28.6
POLYG4	160	68	57.5**

** plants were not clipped

Seed Propagated
Tansplant Survival

Species	Number Planted	Number Alive	% Mortality
CANE2	280	259	7.5
JUBA	280	280	0.0
ELPA3	220	220	0.0*
SCAC	440	399	9.4
SCMA	160	78	51.2*
SCAM2	160	108	32.0*
POLYG4	120	118	1.7

* planted late in the summer, mortality figures may change by the end of the 1993 growing season.

Table 2

Evaporation and Precipitation for
6/5/92 to 10/11/92

Date	Evaporation (inches)	Precipitation (inches)	Avg. Monthly High Temp.
June	8.38	0.99	79°C
July	10.94	0.59	82°C
August	11.92	0.00	90°C
September	7.75	0.08	75°C
October	1.73	0.63	66°C

Irrigating Ponds

Pond*	Watering schedule (hrs. per week)	Water level (inches)
#3	8-12	1-3#
#4	8-16	4-6
#5	4	1-3#
#6	4-8	3-4

* The amount of irrigation needed for each pond varied due to the species and leaking through or around the liner.

Only 1/3-1/2 of the pond had standing water.

Pond #3 - Live collections of CANE2, JUBA, and, ELPA3 (moist conditions).
Pond #4 - Live collections of SCAC, SCMA, SCAM2, and POLYG4 (wet conditions).
Pond #5 - Seed propagated plants of CANE2, JUBA, ELPA3 and POLYG4 (moist conditions).
Pond #6 - Seed propagated plants of SCAC, SCMA, and SCAM2 (wet conditions).

Table 3

Outstanding Accessions from Pond Evaluations

Listed below are accessions that were significantly better in height, width, and rhizome spread according to Duncan's Range Tests.

Land Resource Regions (LRR)*

B	D	E
	JUBA	
9057583 (ID) 9057617 (ID)	9057613 (CA) 9057632 (NV) 9057589 (UT)	9057591 (UT)
	ELPA3	
9057585 (ID) 9067386 (ID)	9057604 (OR) 9067387 (NV)	9057601 (ID)
	CANE2	
9057619 (ID) 9057599 (ID) 9067371 (ID) 9067407 (ID)	9057612 (CA)	9057623 (ID) 9057652 (UT) 9057650 (UT)
	SCAC	
9057616 (ID) 9057597 (ID)	9057614 (CA) 9067393 (UT) 9057634 (ID)	None collected
	SCMA	
None collected	9067379 (UT) 9067381 (UT) 9067376 (NV)	9067374 (UT) 9067380 (ID)
	SCAM2	
9057578(ID) 9057596(ID) 9057644(ID)	9057654(UT) 9057610(OR) 9057615(CA) 9057635(NV)	None collected

* Land Resource Regions in our service area include B, D, and E.(see Figure 1)