

# YELLOWSTONE NATIONAL PARK CONTAINERIZED PLANT PRODUCTION

Aberdeen Plant Materials Center  
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## Introduction

In 2007 the Natural Resources Conservation Service (NRCS), Plant Materials Center (PMC), Aberdeen, Idaho entered into an interagency agreement with the National Park Service (NPS), Yellowstone National Park (YNP) to propagate and deliver approximately 35,000 plants in 10 cubic inch containers. Delivery is to take place over a three year period (approximately 12,000 plants per year) beginning in the fall of 2009. Species to be grown include *Carex aquatilis*, *C. microptera*, *C. rostrata*, *C. utriculata*, *Juncus ensifolius*, and *Deschampsia caespitosa*. A preliminary literature search indicated that *C. utriculata* and *C. rostrata* are currently considered synonymous by taxonomists and will hereafter be treated as *C. utriculata*.

Table 1. Species desired for propagation

Scientific name	Common name
<i>Carex aquatilis</i>	Water sedge
<i>Carex microptera</i>	Smallwing sedge
<i>Carex rostrata</i>	Beaked sedge
<i>Carex utriculata</i> = <i>C. rostrata</i>	Beaked sedge
<i>Juncus ensifolius</i>	Swordleaf rush
<i>Deschampsia caespitosa</i>	Tufted hairgrass

Due to limited availability of information regarding the propagation of the desired species, it was agreed that the PMC would conduct propagation research studies on available seed during 2008. Seed used for these studies came from YNP collections being stored at the Bridger, Montana, PMC. Table 2 lists accession numbers, species and other relevant information as received from Bridger PMC.

Seed received from Bridger PMC was in good condition, but some accessions required additional cleaning prior to planting. *Carex* species required the removal of perigynia before they could be planted. Two accessions, 9087451 and 9087464, appeared to be misidentified. 9087451 is clearly a *Juncus* sp. and 9087464 is a *Carex* sp., most likely *C. utriculata*. Other species determinations may change as plants being tested begin to flower and are more readily identifiable. Of the accessions identified to species, there was a total of 430g *C. utriculata*, 9g *C. aquatilis*, and 7g of *D. caespitosa*. No accessions received were identified as *C. microptera* or *J. ensifolius*.

Table 2. Species received

Accession	Species	Age (yrs)	Bulk (g)
9081715	<i>Carex aquatilis</i>	1	6
9087692	<i>Carex aquatilis</i>	2	3
9087763	<i>Carex cusickii</i>	1	54
9087693	<i>Carex gynocrates</i>	2	74
9087450	<i>Carex</i> sp.	4	43
9087451	<i>Carex</i> sp.	4	56
9087452	<i>Carex</i> sp.	4	70
9087582	<i>Carex</i> sp.	3	73
9087691	<i>Carex</i> sp.	2	15
9087584	<i>Carex utriculata</i>	3	304
9087584	<i>Carex utriculata</i>	1	70
9087694	<i>Carex utriculata</i>	2	56
9087455	<i>Deschampsia caespitosa</i>	1	7
9087766	<i>Juncus mertensianus</i>	1	7
9087463	<i>Juncus</i> sp.	4	11
9087464	<i>Juncus</i> sp.	4	130

## Materials and Methods

Propagation studies were conducted on seed from identified species. *Carex* seed was stratified by placing seed in bags made from coffee filters and submerging the seed bags in an 8 oz ointment jar with 8.0g green moss and filled with water. Stratification treatments lasted 30 days at 4° C.

*Juncus* species typically do not require special stratification treatment, so these were planted with no pre-treatment.

A literature review indicated that *Deschampsia* seed may or not require stratification depending on the population the seed was collected from. However, experience gained from previous work completed at the PMC indicated *Deschampsia* germinates readily with no pre-treatment, and it was decided that stratification of the seed in the initial testing was not necessary.

Two irrigation regimes were tested. The first technique was overhead irrigation with sprinklers programmed to water 2 minutes per hour from 8:00am to 3:00pm, plus a 60 minute weekly deep soak to flush accumulated salts. The second technique was subsurface irrigation by placing the containers in 4x8x1' tanks filled with 4 to 8 inches of water.

Seed from unidentified species was planted into 12x18" greenhouse flats to allow plants to grow to a point where they can be properly identified. If these are determined to be of the desired species the seed can be used for future propagation.

*Juncus* species were planted on April 25, 2008. *Deschampsia* was seeded on April 30. *Carex* seed was stratified from May 5 to June 9. *Deschampsia* and *Carex* were seeded

with 5 to 20 seeds per cone. Seed of all species was sprinkled on the soil surface and pressed by hand. *Deschampsia* seed was additionally covered with a thin later of soil. Soil used was a 1:1:1 mixture of peat, sand and perlite with the addition of 18g 11-15-11 fertilizer and 16ml Redimil fungicide per cubic foot.

Germination counts of cones with established plants were taken on July 28, 2008.

## Results

### *Identification of unknown collections*

Poor to excellent germination was achieved in the unknown species plots (figure 1). All seed identified as *Juncus* (including accession 9087766 previously identified as *J. mertensianus*) appears to be *J. ensifolius* with small amounts of *J. acuminatus*. As of July 31, none of the *Carex* plants have flowered so positive identification is not possible, but educated guesses can be made in some instances by comparing vegetative characters to those of identified accessions. Table 3 lists accessions of unknown species, probable determination (if possible) and comments on general establishment.



Figure 1. Unidentified species grown out in 12x18" flats.

Table 3. Identification of unknown species.

Accession	Species	Comments
9087450	<i>Carex aquatilis</i>	Excellent germination
9087451	<i>Juncus ensifolius</i>	Excellent germination
9087452	<i>Carex</i> sp.	Small statured sedge; good germ
9087582	<i>Carex cusickii?</i>	Poor stand
9087691	<i>Carex</i> sp.	Excellent germination
9087463	<i>J. ensifolius</i>	Good germ; some <i>J. acuminatus</i>
9087464	<i>Carex</i> sp.	Probably same as 9087691; poor germination
9087766	<i>J. ensifolius</i>	Excellent germ; some <i>J. acuminatus</i>

### *Germination of known species*

Germination results from the initial establishment trial were encouraging (table 4). All accessions produced seedlings with some having 100% of seeded cones filled. This study was not replicated so no statistical analysis was conducted.

*Carex aquatilis* appears to be easily propagated with 100% germination coming from all accessions under both irrigation regimes.

*Carex cusickii*, though not on the list of species to be propagated, was tested with the thought that YNP may want some plants propagated if seed for other species is limited. *C. cusickii* had fair germination with 14 to 57 percent of cones being filled depending on accession and watering schedule. Because one accession had better germination with overhead water and one had better germination with subsurface water, there was no detectable preference in watering regime.

Two accessions of *Carex utriculata* were tested with one accession, 9087584, having collections from 2005 and 2007. *C. utriculata* had high germination rates in all accessions ranging from 71 to 100% of cones being filled. In two of three cases germination was slightly higher in the overhead irrigated cones.



Figure 2. *Carex* species grown in 10 cubic inch containers under overhead irrigation.

Table 4. Germination of known species with overhead or subsurface irrigation.

Accession	Species	Overhead irr.	Subsurface irr.
		% cones with seedlings	% cones with seedlings
9087692	<i>C. aquatilis</i>	100	100
9087450	<i>C. aquatilis</i>	100	100
9081715	<i>C. aquatilis</i>	100	100
9087582	<i>C. cusickii</i>	14	57
9087763	<i>C. cusickii</i>	50	33
9087584 (05)	<i>C. utriculata</i>	97	100
9087584 (07)	<i>C. utriculata</i>	86	71
9087694	<i>C. utriculata</i>	93	76
9087455	<i>Deschampsia caespitosa</i>	100	100

### *State of seedlings*

On July 25 plants from the overhead irrigation table were compared with those in the subsurface irrigation tanks. Plants grown with subsurface irrigation appear to be larger and have better root development (figure 3). The applied irrigation schedule of 2 minutes each hour did a good job germinating seed, but needs to be changed to longer, less frequent watering as the plants (seedlings) grow to promote root elongation.

*Deschampsia* seedlings grown in the subsurface irrigation tanks had excellent root growth and were developed enough for transplanting after 90-100 days. This rate of root growth should also be achievable with overhead irrigation if an adjusted schedule is implemented.



Figure 3. *Deschampsia caespitosa* seedlings grown under subsurface irrigation (top) and overhead irrigation (bottom) after 90 days.

## **Discussion**

Initial establishment tests show that the species desired to be propagated are germinable at satisfactory amounts using standard propagation protocols. *J. ensifolius* and *D. caespitosa* are easily propagated without stratification. *Carex* species require the removal of the perigynia to germinate and also require a 30 day stratification period. Although no *C. microptera* was tested, it is likely that this species will perform similarly to other *Carex* species examined.

In order to meet the 35,000 desired plants, Aberdeen PMC will require additional seed collections from YNP. Because seed will have to be processed, cleaned and stratified in the case of *Carex* species, the first installment of seed should be delivered to the PMC beginning early fall 2008. Seed can then be cleaned to be ready for planting in early spring. Under this schedule, the first year's seedlings should be ready for delivery in July 2009.