PROPAGATION OF

REDHEAD GRASS

(*Potamogeton perfoliatus* L.)

TRANSPLANTS FOR RESTORATION PROJECTS

Jennifer Kujawski and Randy Thompson

Redhead grass (*Potamogeton perfoliatus* L. [Potamogetonaceae]) is a perennial submerged aquatic monocot, commonly found in fresh to brackish water up to 20 parts per thousand salinity (Orth and others 1992) throughout eastern North America, from Canada west to Ohio and south to Florida and Louisiana. It is generally found on muddy or sandy soil and can tolerate only mild currents. Several publications cite the plant's affinity for alkaline conditions (Stodola 1967; Hurley 1990; Thunhorst 1993).

Abstract

Redhead grass (*Potamogeton perfoliatus* L. [Potamogetonaceae]) is a perennial submerged aquatic plant targeted for restoration plantings in Chesapeake Bay. We have not been successful using seed to generate transplant material for restoration projects, but stem cuttings are easily started in the greenhouse. Cuttings root in a 1:1 soil:sand mix in about 2 wk, and transplants from stem cuttings can be field planted about 12 wk after rooting. Our simple protocol for rooting and growing cuttings can be used for mass production of plants.

KEYWORDS: submerged aquatic vegetation, Potamogetonaceae, asexual propagation, restoration, seed germination

NOMENCLATURE: USDA NRCS (1999)

The plant is characterized by broad, oval leaves that clasp branching stems. As the plant grows, new roots and stems arise from the nodes where leaves are attached. Both roots and rhizomes hold the plant in the ground. During summer, clusters of tiny flowers appear on stalks that rise above the water surface, and are wind pollinated. As temperatures drop later in the fall, the aboveground parts of the plant die back, and thickened portions of the rhizome remain in the soil for spring regeneration.

Seeds, stems, and rhizomes are valuable sources of food for waterfowl, in particular Redhead, Mallard, Ring-necked Duck, Black Duck, Canada Goose, and Tundra Swan (Thunhorst 1993). The plant also provides habitat for fish and numerous other aquatic organisms.

Redhead grass is one of several species of submerged aquatic vegetation (SAV) targeted for restoration in Chesapeake Bay and its tidal tributaries. Restoration groups in the Bay region attempting large-scale transplants need starter plant material of local origin, and would like to obtain this material without digging plants from existing natural stands. These groups are also beginning to work with citizen volunteer growers and need methods that are easy to use in a home growing system. Simple propagation methods are also useful to aquatic garden growers who want to grow native materials.

Seed Propagation

Our initial intent was to develop simple seed propagation methods for redhead grass. Seed propagation seemed appropriate because we wanted to maintain some amount of genetic diversity in the offspring, and we had earlier success with starting another SAV species, wild celery (*Vallisneria americana* L. [Hydrocharitaceae]), from seeds (Kujawski 1997; Kujawski and Norman 1998). Seeds of other *Potamogeton* species generally germinate well (> 50%) after a long period of cold, wet storage, up to a year in some cases (Meunscher 1936); however after 11 mo of cold water storage and various scarification treatments, our redhead grass seeds had a maximum germination rate of 14%, and more commonly < 2%. Such poor results are impractical for volunteer groups needing reliable techniques. While we continue to investigate seed ripening and germination requirements, we have turned to vegetative propagation by stem cuttings as a simple, effective technique for volunteer restoration groups.

Photo by Jennifer Kujowski

Figure 1 • Cuttings are about 15 cm (6 in) long and can be cut from any section along the stem.

Vegetative Propagation

Most of our SAV material is grown in a 5130-l (1350-gal) freshwater tank in our greenhouse at the USDA-NRCS National Plant Materials Center in Beltsville, Maryland. Tank water is about 0.45 m (18 in) deep and its temperature fluctuates with the surrounding air temperature between 20 °C (68 °F) in winter and 25 °C (77 °F) in summer. Water is continuously flushed through a 2-sponge filter. Natural day length is augmented during winter months by 5 h of light supplied by four 1000-watt sodium lamps suspended along the center line of the tank, 2.6 m (8.5 ft) apart and 1.8 m (6 ft) above the water surface.

With many people wanting to get involved in volunteer SAV projects, it is often necessary to maximize the number of new plants generated from small amounts of plant material. We take cuttings from any part of redhead grass stems (main stems, side shoots, vegetative stems, flowering stems, stem tips, stem midsections), often generating several cuttings along the length of a single stem. In a comparison of root and shoot production between 7.5-cm (3-in) cuttings and 2.5-cm (1-in) cuttings, we found the longer cuttings formed new roots and shoots more quickly. After 2 wk in 800-ml (25.6-oz) jars of tap water, 90% of the 7.5-cm (3-in) cuttings had new roots and shoots, while only 30% of the 2.5-

TABLE 1

Growth of redhead grass cuttings after 7 wk in 5 cm (2 in) wide x 10 cm (4 in) deep pots. All mixes were equal volumes of each component. A 6-mm (0.25 in) layer of sand was placed over each medium to reduce algal growth. Fertilizer treatment was 1.2 g (4.8 kg/m^3 [8.3 lb/yd^3]) of a slow release formulation (Nutricote Total 18N:6P_2O_5:8K_2O; 180 d release rate at 25 °C [77 °F]) applied under the sand. Each pot was planted with one 7.5-cm-long (3-in) cutting. Means and standard errors ($s_{\bar{x}}$) are given for 10 replicates.

Growing medium	Mean number of new shoots	Mean maximum length (cm [a]) of new: shoots	roots	rhizomes
Sand	2.1 (0.3)	7.0 (1.5)	22.5 (1.8)	5.9 (1.2)
Sand + shell	2.3 (0.3)	3.6 (0.5)	24.0 (1.7)	6.9 (1.3)
Soil	3.6 (0.6)	15.9 (1.4)	22.9 (2.1)	16.5 (1.9)
Soil + sand	4.0 (0.4)	10.9 (0.8)	19.9 (1.1)	15.3 (1.7)
Soil + shell	3.5 (0.3)	12.7 (1.3)	25.2 (1.4)	13.2 (1.3)
Soil + sand + shell	3.0 (0.2)	14.9 (1.1)	25.5 (1.5)	8.7 (1.1)
Soil + sand + shell (fertilized)	6.5 (1.0)	41.0 (5.6)	10.6 (1.3)	25.8 (4.4)

[a] One cm = 0.4 in.

cm (1-in) cuttings had new roots and 80% had new shoots. After 4 wk, all of the cuttings had new shoots; all of the 7.5 cm (3 in) cuttings and 80% of the 2.5 cm (1 in) cuttings had new roots.

Volunteer planting sessions cannot always be arranged at the same time plant material is gathered, and cuttings may need to be taken ahead of time in preparation for distribution to volunteer growers. Maintaining cut plant material is not difficult. Cuttings in clear glass containers of tap water, without any added nutrients, at room temperature, and under natural light will stay green for well over a month and will actually grow new shoots and roots. While many terrestrial plant cuttings benefit from application of a rooting hormone, redhead grass stem sections root readily without added hormone, usually within 2 wk of cutting and placement in 800-ml (25.6-oz) containers of water, or in trays of soil under 45 cm (18 in) of water. It takes about 12 wk to go from rooted cuttings to transplant-ready material in our tanks.

In developing a propagation method for wild celery, we found differences in plant growth depending on what growing medium was used. We tested some of the same mixtures used for wild celery seedlings on redhead grass cuttings. In an attempt to simulate a Bay-floor growing medium for redhead grass plants, we also tested crushed-oyster-shell mixtures similar to those used by Ailstock and others (1991) for another *Potamogeton* species, sago pondweed (*P. pectinatus* L. [Potamogetonaceae]). Addition of a slow-release fertilizer to one of the test mixtures appeared to have more effect on growth of stems, roots, and rhizomes than any of the mixtures themselves (Table 1). In fact, layering the fertilizer near the top of the planting containers kept root growth in the upper portion of the containers; roots in the other, less nutrient-rich media treatments extended out through holes in container bottoms. Since we did not see a noticeable effect of adding crushed oyster shells, we are using a 1:1 (v:v) top soil (Pioneer Southern, Suffolk, Virginia) and screened, washed play sand (Quikrete Companies, Atlanta, Georgia) mixture for propagation. Controlled-release fertilizer (Nutricote Total 18N:6P_2O_5:8K_2O; 180 d release rate at 25 °C [77 °F]) at a rate of 4.8 kg/m^3 (8.3 lb/yd^3) works well for growing stock plants and generating a lot of cutting material. Currently we lack data on survival of fertilized or unfertilized redhead grass transplants returned to restoration sites, but survival of wild celery transplants grown with fertilizer versus material transplanted from natural stands to restoration sites appears similar at the end of 1 growing season (Weldon and Kujawski unpublished data).

Photo by Jennifer Kujawski

Figure 2 • New shoots and roots arise from nodes along the stem.

Continuing Work

We are currently looking at the effect of water salinity on redhead grass propagation. Redhead grass cuttings from 4 Chesapeake Bay locations with different salinities were obtained. We are comparing the cuttings' survival and growth in fresh water and 2 brackish water tanks in order to determine what acclimation procedures, if any, may be necessary before restoring transplants to a brackish water site. After maintaining thousands of plants in the greenhouse for several months, we want to make sure they have every chance of success when planted back into a natural setting. We plan to further develop and refine our production techniques with volunteers from local restoration groups.

Figure 3 • Redhead plant generated from a cutting started in a 1:1:1 soil:sand:shell medium amended with controlled-release fertilizer, ready for transplanting 3 mo after cutting was stuck.

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