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Culture and Growth of Pickerelweed from Seedlings[1]

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ABSTRACT

Dry weight, and number of plants and flower stalks increased when seedlings of pickerelweed (*Pontederia cordata* var. *lancifolia* (Muhl.) Torrey) were cultured in sand amended with 2.5, 5, 25, or 50 g of the controlled-release fertilizer, Osmocote, which supplied nitrogen, phosphorus, and potassium. Seedlings grown with sand only did not increase in plant number and produced no flower stalks, and only slightly increased in dry weight and plant height. When micronutrients were added, growth increased dramatically for the 25- and 50-g rates of Osmocote but not for the 2.5- and 5-g amounts. Pickerelweed plants planted with Osmocote with micronutrients were taller than those planted with Osmocote without micronutrients treatments. These data suggest pickerelweed biomass equivalent to 4.9 kg per m^2 and a density of 171 plants per m^2 can be achieved within a 16-week culture period when seedlings are cultured with 645 g of Osmocote per m^2 with micronutrients. The use of nursery-grown native aquatic plants will provide weed-free plants and will reduce the need to deplete natural populations for lake restoration and mitigation projects.

Key words: Hydroponics, mitigation, biomass, fertilizers, aquaculture, wetlands, micronutrients.

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INTRODUCTION

In Florida a permit is required by the Florida Department of Natural Resources for collection of up to 25% of the population of a particular species on public lands. Commercial culture of aquatic plants would lessen the demand for removal of aquatic plants from Florida's freshwater systems. Also, the use of proper culture techniques will result in the availability of nursery-grown stock free of contamination by weed seeds and other plants.

Sources of readily available aquatic and wetland plants are needed for lake restoration and wetland mitigation projects. Information on the nutritional requirements of aquatic plants will be of value in developing commercial cultural practices to make native aquatic plants available for use in plantings.

A study was conducted to evaluate the growth of aquatic plant seedlings in sand amended with fertilizer. Pickerelweed (*Pontederia cordata* var. *lancifolia* (Muhl.) Torrey), a common, native aquatic plant found throughout Florida, was chosen for the study because of its benefits for use in lake restoration and wetland mitigation projects.

MATERIALS AND METHODS

Seeds of pickerelweed plants were allowed to germinate on the surface of a saturated muck soil. Seedlings were cultured by placing a single plant in a non-porous plastic pan (dimensions of 30.5 cm in length by 25.4 cm in width by 15.2 cm in depth, equivalent to a surface area of 0.0775 m^2) filled to a depth of 12 cm with coarse builders sand amended with fertilizer. The pans were placed in an outdoor cement tank (dimensions of 6.2 m in length by 3.1 m in width with pond water at a depth of 0.36 m) located at the Fort Lauderdale Research and Education Center. Pond water, from the source described by Steward (2), flowed into the tank on the surface at one end and out the tank from a bottom drain at the other at a rate which allowed for two complete exchanges of water every 24 hr.

Water temperature in the culture tank was monitored with a maximum/minimum thermometer. Readings were recorded between 3:30 and 4:00 P.M. from the thermometer 5 days a week.

To study the influence of fertilizer on growth of pickerelweed seedlings, 2.5, 5, 25, or 50 g of Osmocote plus 0.3 g of Esmigran and 1.8 g of Dolomite[3] (treatments termed "Osmocote with micronutrients") were placed in a layer 5 cm below the surface of the sand. Other pans received only Osmocote (treatments termed "Osmocote without micronutrients"). Control pans were filled with sand only. Nutrient properties of the sand have been described by Langeland *et al.*, (1). A replicate consisted of four pans of sand amended with each treatment amount of fertilizer and one pan of non-amended sand. Four replicates were used in the study. The pans were grouped in the tank in two blocks each of (1) Osmocote with micronutrients and (2) Osmocote without micronutrients, and randomized according to the concentration of Osmocote within a row placed perpendicular to the flow of water.

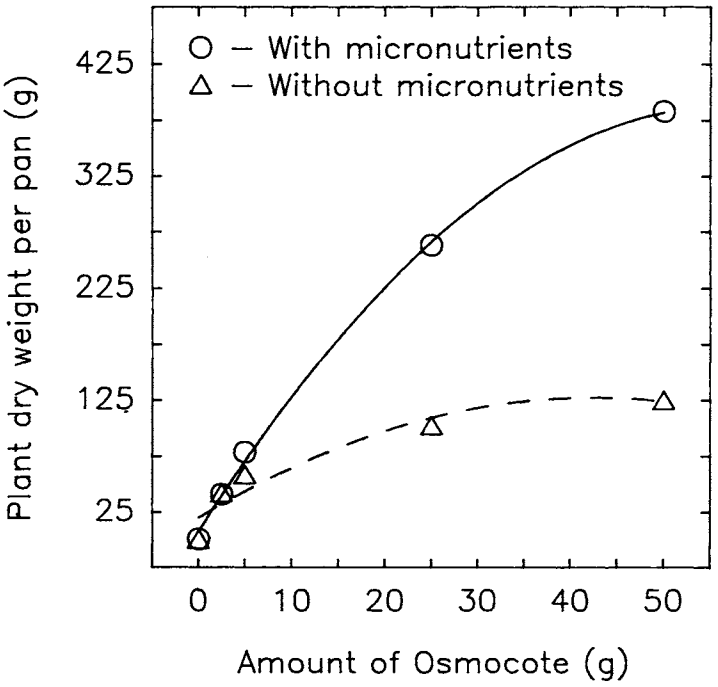

Figure 1. Dry weight of pickerelweed plants cultured outdoors for 16 weeks in sand amended with fertilizers. Each value is the mean total dry weight of plants grown from a single seedling in each of four pans.

Seedlings which averaged 14 cm (s.d. = 3) in length were planted July 21, 1989 and allowed to grow for 16 weeks. Every 2 weeks the tallest leaf in each culture pan was measured and the number of flower stalks counted. At the end of the 16-week culture period the plants were removed from the pans, washed with pond water, and counted before they were dried at 60 C to a constant weight.

Values for plant dry weight, number of plants, length of tallest leaves, and number of flower stalks were statistically analyzed using the General Linear Models (GLM) procedures developed by the Statistical Analyses System (SAS)[4] for use on a Personal Computer.

RESULTS AND DISCUSSION

Water temperature during the 16-week culture period averaged 30 C with a high of 40 C and a low of 18 C.

Dry weight of pickerelweed seedlings similar to those planted initially weighed an average of 0.21 g (s.d. = 0.24). After 16 weeks of growth, those plants in the non-amended sand weighed an average of 0.56 g per pan, indicating very poor growth in the absence of fertilizer. The pickerelweed plants after 16 weeks of growth in the non-amended sand treatment averaged 14 cm more than their initial length. No increase in plant number or production of flower stalks occurred for the seedlings planted in the non-amended sand treatment.

[3]Osmocote (18-6-12) with an 8- to 9-month release time is manufactured by Sierra Chemical Company, Milpitas, CA 95035; Esmigran by Mallinckrodt, Inc., St. Louis, MO 63147; and dolomite (Soil Doctor) by Soil Doctor, Inc., Crystal River, FL 32629. Mention of a trademark or a proprietary product does not constitute a guarantee or warranty of the product by the University of Florida and does not imply its approval to the exclusion of other products that also may be suitable.

[4]SAS Institute Inc., Cary, NC 27512-8000.

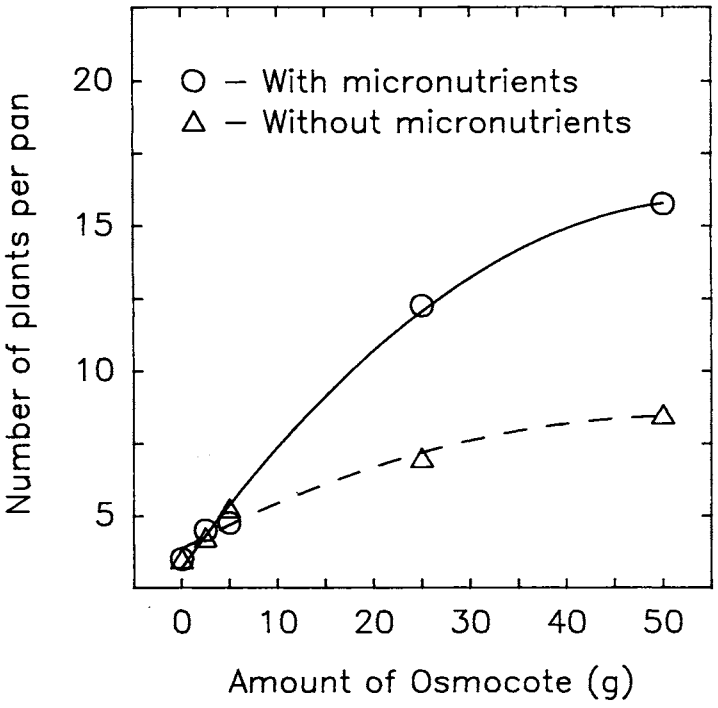

Figure 2. Numbers of pickerelweed plants produced outdoors after 16 weeks of growth in sand amended with fertilizers. Each value is the mean number of plants produced from a single seedling in each of four pans.

Dry weight of pickerelweed seedlings increased significantly with the increased amounts of Osmocote fertilizer added to the sand (Figure 1). Plants in the 25- and 50-g rate of Osmocote averaged 102 and 125 g per pan, respectively; furthermore, the addition of micronutrients resulted in an additional 2.5- and 3-fold increase in dry weight for these rates. For the 2.5- and 5.0-g rate of Osmocote, there was no difference in dry weight between the Osmocote treatments with or without micronutrients.

Numbers of plants per pan in both the 25- and 50-g treatments of Osmocote with micronutrients were 2.2 times as great as compared to the same concentration of Osmocote without micronutrients (Figure 2). Again, no differences in plant number were noted for the 2.5- and 5-g rate of Osmocote with or without micronutrients.

In general, pickerelweed plants were much greener in color in the pans containing Osmocote with micronutrients than those plants in the pans containing Osmocote without micronutrients. Pickerelweed plants planted with Osmocote with micronutrients were taller than those planted with Osmocote without micronutrients (Figure 3).

The number of flower stalks was greater in the pans with 50 g of Osmocote with micronutrients than in the pans with Osmocote alone (Figure 4). Although the results for the other Osmocote treatments are not shown, fewer flower stalks were counted at lower rates of Osmocote, and no differences were observed for pans with or without micronutrients.

The results of this study demonstrate that pickerelweed seedlings can easily be cultured in sand amended with controlled-release fertilizers with micronutrients and indicate plant biomass equivalent to 4.9 kg per m^2 and a density of 171 plants per m^2 can be achieved within a 16-week culture

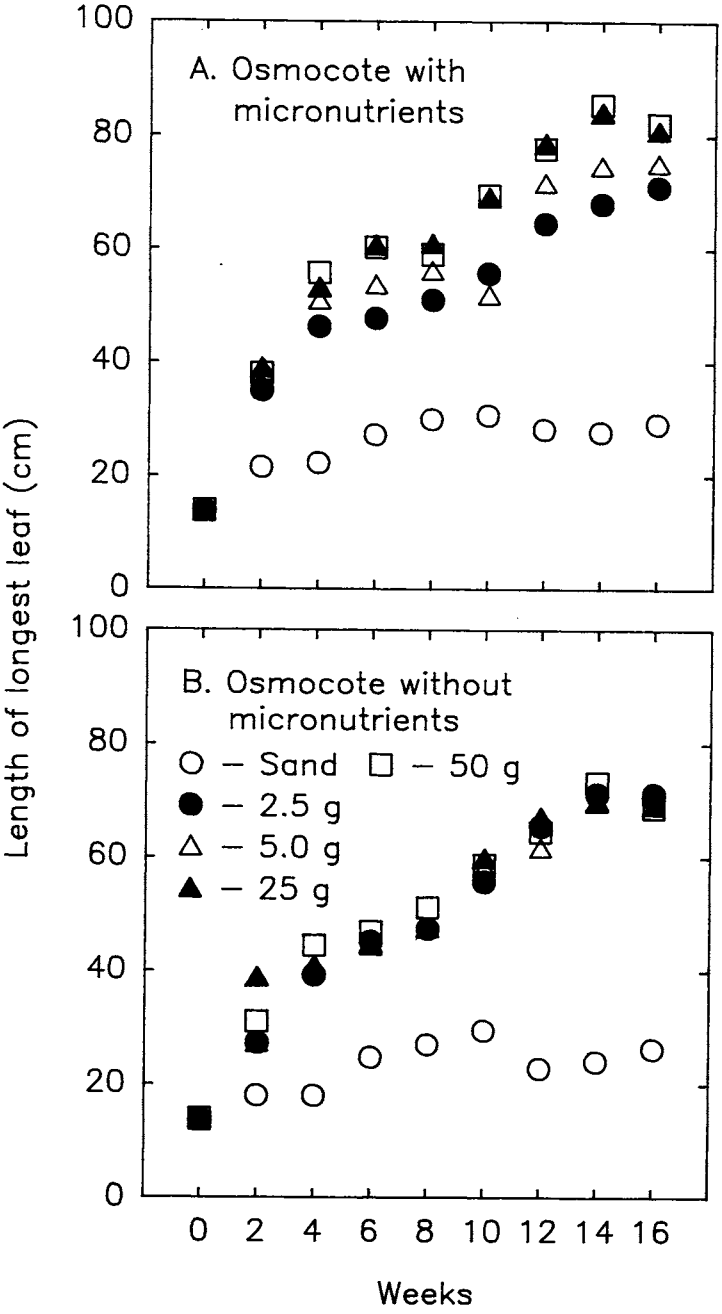

Figure 3. Measurements for length of the tallest pickerelweed leaf of plants cultured outdoors in sand amended with: A. Osmocote with micronutrients, and B. Osmocote without micronutrients. Each value is the mean of measurements of a single leaf in each of four pans.

period with 645 g of Osmocote with micronutrients per m^2. These data also indicate that pickerelweed plants cultured under conditions of low concentrations of the macronutrients nitrogen, phosphorus, and potassium may obtain sufficient amounts of micronutrients from the water or other sources for growth, but when high amounts of the macronutrients are available, then additions of micronutrients are necessary in order to achieve high growth rates of these plants. Furthermore, these data suggest that pickerelweed plants may be an inappropriate choice for restoration and mitigation sites with sediments low in fertility.

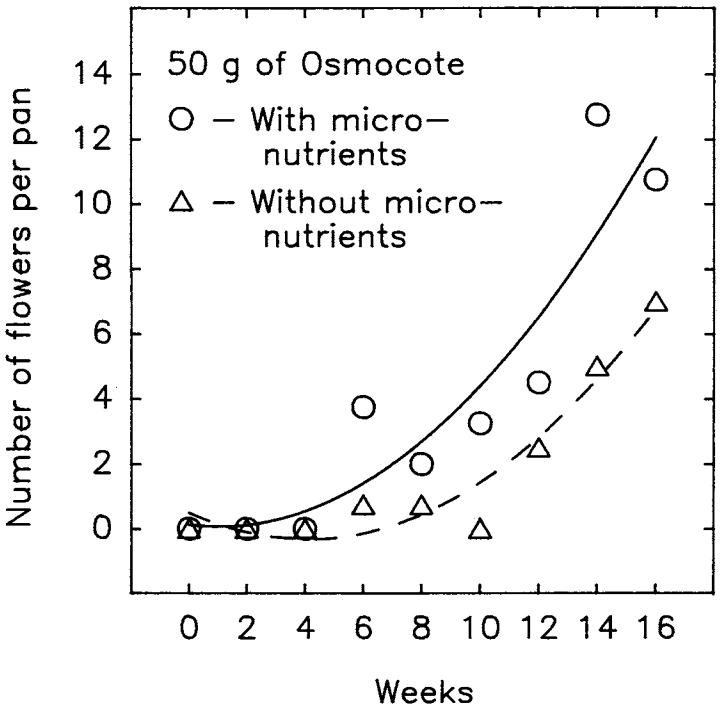

Figure 4. Numbers of flower stalks on pickerelweed plants cultured outdoors for 16 weeks in sand amended with fertilizers. Each value is the mean of the total number of flower stalks counted in each of four pans.

Additional studies are needed to evaluate growth of pickerelweed plants with other fertilizers and different culture techniques. Information also is needed on the variability of growth which would be expected when pickerelweed plants are cultured in other areas of Florida or other parts of the country and at different times of the year.

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