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RESEARCH ARTICLE

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Suitability of the Medicinal Plant, *Acorus calamus* L., for Wetland Restoration

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ABSTRACT: Socio-economically important plant species that are used in wetland restoration projects can act as economic incentives for conservation and restoration. We examined the suitability of a medicinal plant, *Acorus calamus* L. (sweetflag, Acoraceae), for use in wetland restoration. We subjected rhizomes of *A. calamus* to different levels of light (full light and shade), moisture (400 ml and 200 ml water biweekly), and nitrogen (10 µg ml-1 and 4 µg ml-1 nitrogen biweekly) in a greenhouse study mimicking different stages of wetland restoration. At the end of the experiment, the biomass and length of each rhizome, and number of mature buds, leaves, and roots, were recorded. Multivariate analysis of variance indicated that light (λ = 0.762), nitrogen (λ = 0.449), and moisture (λ = 0.508) had significant effects on rhizome growth. Our results indicate that *A. calamus* displays a high degree of morphological plasticity in biomass allocation patterns in response to environmental parameters. Furthermore, most of its biomass is sequestered in roots and rhizomes, which are economically important. The rhizome of *A. calamus* can persist in nitrogen-limited soil though it fares better in soils with greater nitrogen content. It is also adapted to grow in both light and moderate shade and can grow in both flooded and drawdown areas. These characteristics make *A. calamus* suitable for planting at both the beginning and later stages of wetland restoration. *Acorus calamus* can be harvested as a low input crop from both nitrogen-poor and nitrogen-rich wetlands to help local communities benefit from wetland restoration.

Index terms: Acorus calamus, biomass allocation, medicinal plant, rhizome, wetland restoration

INTRODUCTION

Species selection for planting in a wetland restoration project is often based on local availability, life history characteristics, and adaptations to site conditions (Hammer 1992). Sometimes, additional qualities such as suitability for phytoremediation (Weis and Weis 2004), production of biomass fuel (Singhal and Rai 2003; Ciria et al. 2005), or sequestration of nitrogen runoff (Hey 2002) can enhance the suitability of a species for wetland restoration. Many wetland species, such as paddy rice (*Oryza* spp.), sago palm (*Metroxylon sagu* Rottb.), bull thatch (*Sabal* spp.), willow (*Salix* spp.), and reeds (*Phragmites* spp.), are also a source of income and food security to rural communities (Maltby 1986). However, few wetland restoration projects have considered socio-economically important species that could benefit local communities.

Acorus calamus L. (sweetflag, Acoraceae), a medicinal plant, is considered as a species suitable for wetland restoration use in North America (Mitsch and Gosselink 2000). The species' ubiquitous presence in Asia, North America, Europe, and South Africa is attributed to both natural occurrence and intentional human introduction along ancient trade routes (Motley 1994). The rhizome of *A. calamus* is popular in several ethnopharmacoepia and is widely used in the pharmaceutical, perfume, and vermouth industries (Motley 1994; Van Wyke et al. 1997; Kumar et al. 2000). *A. calamus* was used by several Native American groups including the Abnaki, Algonquin, Blackfoot, Cherokee, Iroquois, and Dakota (Moerman 1998). The species was used mainly as a stomachic, hunger suppressant, and hallucinogen. Early North American settlers planted *A. calamus* near settlements and Native Americans distributed it along hunting trails (Gilmore 1930).

Several characteristics make *A. calamus* an apt choice for planting in North American wetland restoration projects. Acorus calamus populations occur in a wide variety of wetland areas throughout the northeastern United States, often visible as large monotypic stands during early summer (Pai and McCarthy 2005). Van der Valk and Bliss (1971) observed the species in open, early successional stages of North American wetlands, disappearing from more shaded, later stages. The species has exceptionally high anoxia tolerance, persisting through prolonged submergence (Joly and Brandle 1995) during uncertain flooding regimes. *Acorus calamus* reproduces both sexually (by seeds) and vegetatively (by rhizomes) allowing for different planting strategies. It is also readily available through horticultural outlets (Winterrowd 1990). Recent reports indicate that North American *A. calamus* is commercially desirable as it has less β-asarone (a probable carcinogen) content compared to Asian and European varieties of the species (Hanson et al. 2005). Despite its local availability and promise