# BIOLOGY AND PROPAGATION OF AUSTRALIAN RUSHES AND SEDGES

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## INTRODUCTION

Australian Cyperaceae (sedges) and Restionaceae (rushes) are important components of the Western Australian cutflower industry. They are used fresh, dry, and dyed as greens or as fillers in dry floral arrangements. One species, *Ecdeiocolea monostachya* (Ecdeiocoleaceae) is also being examined for fibre extraction. Most plant product is collected from the wild or from semi-managed wild stands usually on private land. The total Western Australian production of these plants for local consumption and export is 3 to 4 million stems annually and is set to increase.

Twenty species (representing 2% of the 391 species of rushes and sedges native to Western Australia) have been utilised with 12 species used intensively. The main eastern Australian species used are: *Caustis blakeii* and *Restio tetraphyllus*, and important Western Australian taxa are *Caustis dioica* (and morphs), *Leptocarpus scariosus*, *Evandra* spp., *Mesomelaena* spp. and *Restio ustulatus*. A number of other taxa show equal promise as horticultural subjects but are rare, of restricted distribution, or grow in inaccessible locations, e.g. *Reedia* sp., and *Restio* spp. and are thus not commercially viable at present.

The development of commercial horticulture of reeds and rushes depends on the availability of mass propagated greenstock. Except for *Cyathochaeta*, most rush and sedge species of commercial value are difficult to propagate by seed or vegetative division. This paper will outline recent developments for propagation of Australian rush and sedge species which have potential for commercial row cropping of some species.

## DISTRIBUTION AND GROWTH FORMS

Rushes and sedges are widespread and common in all vegetation types in Western Australia. Commercially significant species occur in the Mediterranean-type climatic zone in the southwest of the state with picking concentrating on the south coast region from Esperance to Augusta. Most rush and sedge species grow in dryland sites favouring free-draining nutrient deficient soils Some of the significant commercial species grow in seasonally inundated swamps and wetlands.

All species possess a subsurface rhizome which serves as a repository for dormant buds and/or nutrient storage. The rhizome extends on a seasonal cycle of activity often in concert with production of new photosynthetic parts. Roots produced on the rhizome may be fibrous or thick and fleshy. In some species terminal fleshy swellings on some roots act as nutrient/moisture reserves.

The vegetative spread of a clone is via the rhizome. Species are tuft forming (< 10mm long internodes along rhizome) or possess creeping clones (with 1 to 40cm long internodes). Some tuft-forming species (e.g. *Tetraria capillaris* and *Lepidosperma tenue*) produce daughter plants at the end of 10 to 20 cm long rhizomes.

Above ground shoots or culms are more or less leafless in the Restionaceae while the Cyperaceae produce annually a basal tuft of ephemeral leaves. In both families new culms are produced annually, old culms senescing after 2 to 3 years. New shoots and rhizome segments are produced from late March until early September (autumn to early spring). New roots are produced concomitant with shoot production, and flowering occurs in autumn or spring following culm maturation. Some Restionaceae produce attractive culm branchlets that are very fine and hair-like as in the eastern koala fern (*Restio tetraphyllus*) and some western Restio species.

Restionaceae are mostly dioecious while Cyperaceae are monoecious. The flowers of all rushes and sedges are generally insignificant and in most species are produced in aerial spikelets or clusters. Scarious bracts which subtend the flowers in many species are often attractive, coloured brown or deep maroon and are persistent (e.g. *Leptocarpus* species).

## SEED PRODUCTION AND VIABILITY

Seed matures in 6 to 18 months depending on the species, and seed germination occurs in nature in moist soil from late autumn to spring. Most dryland rush and sedge species studied produce small quantities of seed (0.2 seed/culm for *Loxocarya cinerea* and *Mesomelaena pseudostygia*), with low viability. Low viability of seed is often expressed as failure of the seed to produce an embryo. One third of the decline in seed number in the Cyperaceae compared to Restionaceae species is attributable to seed embryo abortion. In wild situations Cyperaceae and Restionaceae produce 0.1 to 17.0 (mean: 5.3) and 0.9 to 960 (mean: 136.2) viable seeds per clone per annum, respectively. In the event of whole clone death or displacement many rush and sedge species are therefore unlikely to have the reproductive potential to reproduce the clone in natural habitat. However, in both families germination of seeds is only 5% except for the sedge *Cyathochaeta* which produces large quantities of germinable seed (greater than 96% germination under laboratory conditions). For all species examined to date excised embryos (cultured in vitro) germinate more readily than intact whole seed, indicating non-embryo derived seed dormancy factors may operate.

Nutrient and moisture supplements applied to in-site field-grown plants of four species of rush and sedge failed to ameliorate factor(s) causing low seed production and viability.

## PROPAGATION

Australian reeds, rushes, and sedges have not been as horticulturally important as many other Australian plants. For example there are no records of rush and sedge species being grown amongst 600 species of Australian plants cultivated in English greenhouses in the 1860's.

The reluctance of nurseries to utilize rushes and sedges may be a result of the recalcitrance of many of these plants to propagate readily and in commercial quantities. Until now traditional propagation by seed or rhizome division has met with little or no success. Even in mine rehabilitation areas though, rush and sedge species account for about 8400 plants/ha in some premined vegetation; less than 1.3% or 107 plants/ha regenerate from freshly replaced top soil containing seed.

## VEGETATIVE PROPAGATION

Some success has been achieved with whole plant transplants of swamp rush species and rhizome divisions of the eastern Australian koala grass (*Restio tetraphyllus*) (G. Lamont, pers. comm).

Transplant studies into irrigated or non-irrigated field sites containing at least 3 year-old segments of wild-sourced plants show that for both rushes and sedges:

- survival improved if transplant culms are cut near ground level.
- most species transplant better if vegetative divisions are taken in mid-winter (using wild, unirrigated plants as the source of transplants)
- irrigated rather than non-irrigated plants survive transplanting better. However some species, e.g. *Lepidosperma gracile* and *Tetraria capillaris* decline if kept wet following transplanting.

In general there is 80 to 90% survival of transplants of *Cyathochaeta, Restio, Loxocarya,* and *Lepidosperma.*

Undisturbed clones of most species produce actively growing roots only from new or the immediate past season's rhizome segments. However, in some species rhizome segments up to two years old may retain active roots and produce lateral roots which penetrate soil to 30cm deep. Disruption of this deep-seated root system during transplanting could account for the high mortality of transplants recorded for species like the little semaphore sedge, *Mesomelaena pseudostygia.*

## MICROPROPAGATION

Plants have been cultured from seed embryos in 15 out of 19 rush and sedge species examined, using half strength Murashige and Skoog minerals supplemented with growth factors. Five of these species have shoot multiplication rates greater than ten-fold. In addition 11 of the 15 species have rooted in vitro and 7 species are growing vigorously out-of-flask in a peat:perlite mix under greenhouse conditions.

## CONCLUSIONS

For the rush and sedge species studied to date, vegetative propagation and in vitro micropropagation are the most successful means for plant multiplication. Studies are continuing in Kings Park and Botanic Garden to define media for optimal shoot multiplication rates and for use of parent plant vegetative material as explant sources. However, the cost effectiveness and practicality of these propagation practises for commercial row cropping of these groups is yet to be assessed.