Notes of the Cultivation of South African Restios©

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BACKGROUND

The common name "restio" refers to members of the family, Restionaceae, a Southern Hemisphere family with its center of diversity in the Western Cape of South Africa where there are probably well over 350 species found, many yet to be recognized. (Expect future taxonomic changes.) Plants have a similar organization to bamboo consisting of a network of subsoil rhizomes giving rise to aerial culms showing varied degrees of branching and a fibrous root system. The rhizomes may be tightly clumping, loosely clumping, to running widely. Several species show annual branch production at the nodes as in *Chusquea* among bamboos. Leaves are reduced to scales and bracts with stems performing the photosynthetic function. The Restionaceae is the most tightly linked with the Cape vegetation type known as Fynbos (pronounced: Fane-Boss) an open, fire-dependent shrubland like California's chaparral but with much greater plant diversity. Still, restios are found over a wide environmental and ecological range.

Germination patterns fall broadly into three groups:

1) Simple, no dormancy (*Elegia capensis*) a pattern common in wetlands.
2) Smoke dependent (response may vary with age of seed) many species in *Thamnochortus*, *Elegia*, etc., commonly in drier areas.
3) Yet to be understood dormancies, the large-seeded, ant-dispersed, nut-seeded clade that includes *Cannomois grandis*.

Plants with seed properties in the first group were the first to enter cultivation both in South Africa and California.

Investigations into the action of smoke on germination by researchers J.H. DeLange (DeLange and Boucher, 1990) and especially Neville Brown (Brown, 1993), as well as horticulturist Hanneke Jamieson (Brown et al., 1998), led to a whole new range of genera and species entering horticulture from the second group in the mid 1990s at Kirstenbosch National Botanic Garden and (a few years later) in California through seed offered primarily by the Botanical Society of South Africa and the company, Silverhill Seeds. A commercial germination promoter containing smoke extract, Smoke Plus, was another result of the Kirstenbosch work. It is designed for general use as the "plus" in the name refers to unlisted ingredients GA_4 and GA_7, the most active forms of GA in promoting seed germination.

Germination rates for the third group, the nut-seeded species, are generally very low and little improved by smoke extract. Typical rates range from 0% to 10% although treatments still under investigation by one of the authors have yielded up to 60% in *C. grandis*.

PROPAGATION

Germination Style. The majority of restio species show epigeal germination, the haustorial cotyledon elongating to raise the endosperm containing seed above the soil, but the nut-seeded clade shows hypogeal germination, the seed remaining in the soil and as deep as 10 cm in the case of *C. grandis*. Emergence here is affected by a coleoptile-like structure. The first culm soon appears from the side of either aerial structure. It is important at this stage that the zone in which secondary culms will appear is at, or below, the level of the medium or establishment may be poor as additional root initials are only produced at the base of additional culms.

Division. Although initial information on this approach from South Africa indicated some difficulties, many genera and species can be divided with excellent results. Certain species, like *E. capensis*, can develop rhizomes that seem as hard as steel and require large division size for quick re-growth. Others, like *Chondropetalum tectorum* and *C. elephantinum*, can be re-established quickly even from very small divisions as one of the authors (Grantham) discovered at University of California Botanical Garden at Berkeley around the same time Jeff Rosendale first tried this approach at his nursery. Attention to the annual growth cycle is advisable in timing division. Most restios begin a massive translocation of nutrient stores down to the rhizome in late summer/early fall, the root systems becoming activated with cool nights. Division after these events is likely to be more successful.

The restio root system is referred to by botanists as having two components, a coarse invasive framework and an incredibly fine weft, presumably for nutrient uptake. The authors find the root system extremely plastic in cultivation, varying greatly in size and conformation with nutrient level. Under typical nursery fertilizer levels (NPK) levels, the root system either does not appear very different from typical fibrous-rooted container plants, or, in nutrient-sensitive species, may appear inhibited, with poor penetration and little or no fine weft. Under low NPK, root systems become extensive with a much greater amount of fine weft. Under trace NPK root systems are inhibited again, but bear scattered sections with a brush of fine weft, resembling very closely the proteoid roots found in Proteaceae. In the Cape, with its low fertility soils, restios are probably very important in soil stabilization.

GROWTH AND PRODUCTION NEEDS

Soils/pH/Fertilization. The vast majority of South African restios is from nutrient-poor, acidic soils with low organic content and perform best in acidic soil mixes with caution in fertilization. Phosphate intolerance can occur at mid-range soil levels and may be responsible for contracted, densely branched culm form, yellowing of both new and old growth, burned tips, and death. Very similar yellowing, but without contracted growth, can be the result of periodic over drying.

Limestone derived and other alkaline soil types are present in South Africa and there are a number of restio species that can tolerate them, such as *Thamnochortus insignis*.

All restios the authors have grown respond well in production to an acid soil mix and a low strength, no or low phosphate, fertilizer such as fish emulsion or Doctor Greens Chelated Iron, a product sold by E.B. Stone & Son, Inc.

Ideally, new species with horticultural potential should be tested for soil adaptability because tolerances in cultivation may be broader than natural range would indicate.

The following species have been soil adaptable/tolerant of mid-range soil phosphate levels: *Askidiosperma paniculatum, C. elephantinum, C. tectorum, Ischyrolepis subverticillata, Rhodocoma arida, R. capensis, T. insignis.*

Water. The majority of South African restios introduced so far have relatively high water requirements for best appearance. Among the five Mediterranean world regions, South Africa's is the least stringent with about 2 more months of rain than California and many areas both near the coast and in the mountains that receive sporadic rain throughout summer. Those areas with more water tend to be the best explored botanically. The species apt to deal best with California's more stringent summer drought are to be expected in the hot, dry, north aspects of mountains where hiking trails are scarce and knowledge of the flora poor. There are mountains rising out of succulent karoo desert that support fynbos near their summits and restios from transition zones here should be particularly drought tolerant as is the case with *R. arida* found in just such situations. The authors have found both *A. paniculatum* and *R. arida* particularly drought tolerant.

Exposure. Growing in open shrublands, most restios require high light intensity and brisk air movement, but species that are found in forest margins such as *I. subverticillata* and *R. foliosa* tolerate shade.

Pests and Pathogens. As with all exotics early in their cultivation, restios have left their natural pests and pathogens behind in South Africa. These include a variety of bud-gall-forming organisms and stem-eating lepidoptera. As the bud galls look like oddly placed inflorescences, care should be taken to avoid them when collecting seed in the field. Under cultivation in California, restios are exceptionally pest and pathogen free. New growth is vulnerable to aphids when plants are grown under glass. Long root-bound plants under wet conditions may succumb to fungal root rots.

INVASIVENESS

Because with few exceptions restios are dioecious with separate male and female plants, chances of invasive establishment by seed are greatly reduced. Seed dormancies and the lack of soil adaptability in many species would greatly limit invasive potential as well. In South Africa *T. insignis* has shown signs of invasiveness by seed when used as an ornamental outside its natural range where fire or other disturbance is present. It should be noted that a certain small percentage of seed in this and a few other species regarded as requiring smoke treatment will germinate without such treatment and, if this is a heritable trait, it is possible over time for seed dormancy to be lost.

Vegetative invasion by rhizome fragmentation is a possibility for species with a running habit. All South African species in the nursery industry so far are of the tightly to loosely clumping habit, but there are quite a few attractive running species that should not be introduced carelessly.

COLD HARDINESS

As these plants are grown outside their native range, limits of cold tolerance are being tested and observed. The suddenness of onset of frost/low temperature is often significant. Some species are reported to withstand 15 °F without damage. Others recover from these temperatures with new growth in the spring.

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