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Propagation For Zoo Exhibits

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A zoo presenting a paper to a plant propagation forum reflects the changes that have occurred in zoos over recent years. The functions of today's zoo exhibit differ markedly from those of the 19th century menagerie. Naturalistic exhibits have become the standard. Whilst propagation techniques used for *plant production in zoo exhibits are for the main part standard, the applica*tions can often be unique. Botanically zoological horticulture is vast with some 1000 species of plants introduced to the Melbourne Zoo collection since the master plan was implemented in 1989. Some 60% of this material has been propagated on site. This paper will provide a background to zoological horticulture and discuss the implications and the associated plant production/propagation challenges and opportunities presented.

MASTER PLAN

The Melbourne Zoo master plan for redevelopment was devised in 1987 and represents a complete restructure of the zoo grounds and animal enclosures into bioclimatic zones. The bioclimatic approach enables animals to be displayed with other coexisting species, and is based on representation of habitats.

HORTICULTURAL IMPLICATIONS/PLANTING CONCEPTS

Many factors need to be considered prior to the planting of naturalistic exhibits. More than 18 months may elapse between the start of plant production/propagation and planting out. Generally, the most important factors determining the type of planting and plant material to be considered, relate to the exhibit theme, the animals displayed and the habitat to be represented. Obviously jungle exhibits will have a very different vegetation to that of a grassland exhibit, which in turn will differ from a desert exhibit. In all cases the aim is to offer vegetation representative of the habitat. Information is gathered through a variety of sources, i.e. regional vegetation surveys, ecological reports, and animal food plant listings.

MELBOURNE ZOO PLANT NURSERY

Most plants encountered, when researching regional vegetation, are not available

through the wholesale nursery industry, or even known to be in cultivation. The plant nursery at Melbourne Zoo is an invaluable resource and provides the capacity to source propagation material and to trial and assess the suitability of such plants. This provides an extraordinary capacity to create unique zoo environments and broadens the range of plant material that can be considered for specific projects.

PLANT PRODUCTION/PROPAGATION REQUIREMENTS

Depending on the project, the majority of the material to be planted would be propagated and produced by the Melbourne Zoo plant nursery, e.g. the pygmy hippopotamus and mandrill exhibit involved some 9000 plants made up of 80 plant species. Sixty-five hundred plants were propagated and produced at Melbourne Zoo, this represented approximately 60 species. No attempt was made to produce advanced plant material for the project, as all advanced and semi-advanced plant material required was purchased from advanced tree nurseries.

CASE STUDIES

The following are some specific examples of plant production and propagation at Melbourne Zoo.

Butterfly House. The butterfly breeding project is the most technically challenging task that the Melbourne Zoo has undertaken. Butterfly life cycles are complex and food plant requirements are demanding, particularly at the larval stage. The project has been in operation for more than 10 years and still the supply of host plants presents many challenges. Up to 6000 food plants are required to meet the requirements of some 35,000 butterflies released into the butterfly house each year. In essence, it is the success of the plant production that determines the overall success of this project. Therefore the development of successful propagation protocols for the various food plants required is essential. *Passiflora cinnabarina* is the host plant for a number of lacewing butterflies including the orange lacewing which forms an important part of the butterfly project. The propagation of this plant has proven difficult. Unlike other *Passiflora* species, seed has proven unreliable with sporadic germination occurring over an 18-month period. Cuttings tend to produce an inferior root system that is short lived due to lack of root vigour. We undertook to explore options and to trial various treatments to improve the results we were obtaining from sexual propagation. It is likely that the dispersal agents for this plant would be a forest bird or bat, and that in the process of dispersal the fleshy pulp containing germination inhibitors would be removed from the seed coat. Simply removing the pulp from the seed coat mechanically did not however improve germination of this plant. Trials with fermenting the seed in its pulp for 4 weeks prior to pulp removal were promising and we have now established that germination is greatly enhanced through this technique. The 18-month, sporadic-germination period can be replaced with uniform germination after a 15- to 21-day period. This year we will be undertaking trials to determine if grafting onto *P. caerulea* stock produces a more vigorous plant.

Gahnia sieberiana. This plant is the larval food plant for the sword grass brown butterfly. It is hoped that we can introduce this butterfly into the program but a reliable supply of *Gahnia sieberiana* needs to be established before undertaking a breeding program. As with many other Cyperaceae the germination of seed can be

difficult. We have stumbled onto a technique that works for this species and possibly has application for many other species. A trial undertaken to soak the seed, as we do with many rainforest species, resulted in the seed being moistened and placed into a snap-locked plastic bag. The intention was to leave the seed in the bag for about 2 weeks and sow directly. The seed bag was placed in the bottom of a drawer and forgotten. It stayed there in the dark for about 6 to 8 weeks and when rediscovered was left on a tabletop in the light. Within a week the seed was actually germinating in the plastic bag. We repeated the process with *Elegia capensis* seed, again a notoriously difficult plant to propagate, with the same results. The seed was given anaerobic conditions and darkness for an extended period, the same conditions as if the seed was inundated by a seasonal flood or period of extreme waterlogging.

Heath Mouse/Smoky Mouse. The native mammal section at Melbourne Zoo has undertaken a program to develop the husbandry procedures necessary to breed these threatened species in captivity. As the wild populations of both these species are declining, a formal breeding program may soon be essential. Included in our current research is the provision of elements of their wild diet in captivity. Once the Melbourne Zoo has established self-sustaining captive colonies, release into the wild will be undertaken. To condition the animals prior to release the Melbourne Zoo has established a large outdoor heath land enclosure in which the animals can learn to forage for food and to make nests. In Victoria, the heath mouse is found only in the south west, and prefers heathland habitats which have regenerated after fire. Heath mice feed exclusively on the berries, seeds, and flowers of various epacrids. The horticultural section has the task of providing the plant species of their wild diet in the outdoor heath land exhibit and the establishment of fodder plantations for harvesting. This requires an understanding of the floristic structure of their heathland habitat, and the capacity to propagate and grow the important food plant species. To date we have successfully established representative flora in the outdoor enclosure with the support of a number of specialist indigenous plant growers. There are still a number of challenges in the development of propagation protocols for many of the epacrids required for the long-term success of this program. The heath mouse and smoky mouse projects can only occur in organisations such as zoos. Zoos today are attempting to manage their collections mindful of the complex interactions and interdependencies of natural ecosystems.

Eidothea zyzoelocarya. We received an unusual request from the Melbourne Botanic Gardens in 1995 to explore the possibility of passing the seed of a particular native rainforest Proteaceae through the gullet of our resident Cassowaries. The species in question was the recently described *E. zyzoelocarya*. Indications are that the dispersal agent for this plant is a large bird, possibly a cassowary. The large rounded fruit is amongst the hardest of any plant in the rainforests of northern Australia. It is also possible that once the fruit is consumed by the cassowary it remains in the gullet of the bird, as a gullet stone, to aid in the digestion of other rainforest fruits. Whilst it remains in the gullet of the cassowary the seed is scarified, and over an extended period the endocarp is worn down or softened to allow germination to occur when finally passed. The seed may remain in the gullet for several years.

The propagation of this plant would represent a major botanical initiative. A quantity of seed was sourced by the Melbourne Botanic Gardens, and in the

interests of covering all possible propagation angles, the Melbourne Zoo was approached to feed some of the seed to our resident cassowaries. The progress at our end of this co-operative project is that the cassowaries are still with nut. Through more conventional means the Melbourne Botanic Gardens have germinated two plants to date. This was achieved by the scarification of the seed coat to the endosperm with a file. The seed took 6 months to germinate and plants have maintained a steady growth rate. Werribee Zoo has recently undertaken a similar project with the rare *Eremophila desertii*. They fed the fruit to their emus and then collected the subsequent dung. The seed was then separated from the dung, counted, and sown by conventional methods.

SUMMARY

The Melbourne Zoo Plant Nursery and its staff have demonstrated that it is possible for a zoo to be involved in a variety of plant production activities. Increasingly the nursery is being viewed as a significant "resource" by the Zoo board. With developments at Werribee Zoo in grassland plant conservation; at Healesville Sanctuary, with its ongoing revegetation project; and a seemingly never-ending list of potential projects at Melbourne Zoo; it is obvious that the challenges faced in propagation for zoo exhibits will continue for sometime.