GROWING FERNS BY CAPILLARY MEANS

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It may be that many nurserymen regard the production of ferns from spores as a peculiarly specialist activity. It is true, of course, that some specialism is developing in Australian nursery practice and perhaps this is a sign of professional maturity. We have in Australia some specialism in ferns, conifers, palms and claims of specialism in native plants. In this latter field it should be noted that the expertise existing, while it may be considerable, is frequently over a somewhat restricted range of genera and species and, in general terms, may be said to disregard the native ferns, the native grasses and, in some respects, the native palms. Thus the degree of development of nursery specialisation in Australia is not yet great and most of us are still interested in growing a wide range of plants for sale. Were it not for the work of George Sonter and his family it is doubtful if the current interest in and enthusiasm for native ferns would have reached the present pitch. Impetus has been added to this enthusiasm by the publication in 1976 of a book on Australian native ferns which is at once authoritive and informative (1), and a useful addition to other references on fern culture (2,3).

The time for producing ferns could never be more propitious. If we are still in the situation of being general propagators there must be a reason why so few of us include the production of ferns as a significant part of our activities. This paper is prepared on the supposition that lack of fern production is due to lack of production techniques and to offer a simple method which is capable of exploitation to produce viable and saleable ferns in large numbers.

It should be emphasised that I am not insensitive to the future of tissue culture or to the astronomical production number possibilities of this method. However, I base the following on the view that many of us are unlikely to face the considerable demands both in capital and staff for the economic development of these methods particularly in nurseries of moderate size. Further, since spore producing ferns (as distinct from sterile cultivars) have a potential for producing similar numbers, there remains a case for propagation from spores.

My experience leads me to believe that an adequate technique for the production of sporophytes is that which is dependent on watering both the spore beds and the subsequent

juvenile ferns by capillary means. Such a method has the following obvious advantages.

1. It permits the establishment of a microclimate of near sterile conditions.
2. Since necessary moisture is always available it prevents some, at least, of the future intrusion of foreign agents into the microclimate.
3. It permits the treatment of the water external to the microclimate to further reduce the possibility of infection from without.

Let us suppose that we are dealing with a small spore sample (say, one capable of producing several hundred sporophytes). The following method is recommended.

1. Take a standard wine flagon and remove the base. This may be done either with: a) a glass cutter; b) burning a string around the bottle and subsequent immersion; or c) (my own method) turn the flagon in the palm of the left hand over a simple spirit burner. Test heat with the thumb of the left hand and immerse in 2 cm of water (Present record is 36 per hour). When the bottom drops out you will have created the cheapest bell jar on the market.

Now take a pot which is a snug fit in the flagon. I use a standard yoghurt can which is an exact fit. Partially fill the pot with rock wool and add propagation medium. In Western Australia the local sedge peat with the trade name of Compeat is adequate, but various mixtures of imported peat and sand have been used with success.

Sterilise the flagon and its cap. Use of chlorine needs care as the bottle must be thoroughly rinsed. Mild disinfectants such as potassium permangenate seem to work. Sterilise the yoghurt container, the medium and the rock wool with boiling water. Place the flagon with cap intact over the can. Return to the task of sowing spores when the medium is cool (say 1 hr.).

Keep spores in pepper shakers, kitchen herb containers or other like equipment, all of which must have a top seal (the kitchen herb bottle is superior). Sow spores by simply "peppering" the medium. Now place the entire assembly in a water tray, say an ice-cream can container pierced at sensible height to prevent flooding. Add water so that the surface of the medium and the spores are obviously moist. The addition of potassium permanganate will provide additional guard against infection. The water tray used may be of such dimensions as to hold many flagons and should be situated under a greenhouse

bench, in a shade house or in any like situation which will ensure reasonable lighting but no direct sunlight.

Rates of germination will vary from species to species and will be more rapid in summer than in winter or again more rapid in a warm house than in a cool one.

One of the essential strengths of the flagon germinator is that moisture condensing on the glass does not drop on the spores but because of the shape of the bottle it finds its way down the sides and back into the water tray.

When spores germinate they may be left to develop in the original pot. However it should be realised that even with the most careful initial sterilisation some infection may occur. Indeed one may be sowing some fungal spores with those of the fern. Should this occur the uninfected areas of germinating spores or developing prothalli may be "pricked-out" into a peat pot. Normally 20 to 30 mm clumps are lifted with forceps and spaced in the new medium at similar distances. As a general policy the use of such methods will minimise losses both by infection and by sporophytes "choking" each other. Pots may be left until strong sporophytes develop but pricking early is a good rule to prevent losses as a result of the more precocious sporophytes suppressing the less vigorous. I find that individual ferns are best pricked into mist tubes and that smaller tubes give a better result than larger. The tubes should be placed in a suitable tray or container rigged for efficient capillary watering and covered with a polythene hood. As the ferns grow on they may be "hardened off" by the partial raising of the hood and finally its total removal. At this stage the sporophytes may be fed, particularly with nitrogen, and should be ready for potting within a month of their removal from their miniature greenhouses.

A comment on methods of spore collection.

1. Place fertile fronds in paper bags and dry out quickly. Put the resultant dehisced spores through a fine sieve to remove some of the roughage from bursting sporangia.
2. Sow as soon as possible. The viability of fern spores is intensely variable. While spores of *Cyathea* may be stored for several years those of other species lose viability very quickly. Some species have what, in lay language, are called 'green spores'. These must be sown within hours of their extraction. *Todea barbara* is a good example of this.

Finally, by following the simple techniques detailed here I believe that the use of capillary watering in fern production is not particularly difficult, expensive or tedious and that by it's

use fern production may become a very rewarding part of general nursery practice.

REFERENCES

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NURSERY HYGIENE

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Successful propagation involves the integration of many interrelated factors such as the correct time and method of taking cuttings with the right temperature, light and water supply. However what a pointless exercise if, after gaining the knowledge and expertise of taking cuttings, we lose them to diseases and pests. The industry has become more and more specialised with larger quantities of the same plant being grown at any one time. In this way we have created very suitable environments for the disease organisms and pests which can cause such dramatic losses in cuttings and defeat the purpose of our work. We must take great care to prevent the spread of these organisms.

Hygiene is the most important factor we have to contend with. We must be certain our clothes, shoes, hands and even fingernails are clean and sterile in a hygienically controlled propagation system. Everything we use must be clean and free of infection, from the trolleys we use for transport, to the benches where we pot our stock. All tools used in the preparation of cuttings must be sterilized and kept in a spotless condition, whether they be a knife, a pair of secateurs, or whatever we use. If a number of cuttings are to be taken off one plant, it is preferable to disinfect the instruments before going on to the next plant. Of course the sharper the instrument the cleaner the cut, and the less chance the infection has of becoming established. A small bowl of disinfectant should be adjacent to the operator so that he can regularly dip his utensils. By this means disease, if present, is restricted and more easily contained. However, as happens in the best of establishments, an infected cutting can slip through, so that the regular disinfection of fingers, benches and instruments is first priority. How often have we been in the position of working on our cutting propagation