

mended rate (0.6 Kg/M³). For the final potting we use 1.4 Kg/M³. These rates give excellent growth on capillary beds.

Eucalyptus roots. Eucalyptus have a rapid growing tap root system. The plants are very sensitive to root damage and are intolerant of any root restriction. A nurseryman's natural inclination is to pot on a small seedling into a 10-12 cm pot. However a 17 cm holds twice as much compost as a 12 cm pot. When we place this size container on a capillary bed not only do we not get any rooting through but the adequate supply of water seems to retard the development of a coarse and fangy root system.

For subsequent establishment, a young vigorous root system is preferable to a coarse root. For these reasons we find that 17 cm container is ideal for the production of quality plants provided watering is by automatic capillary beds.

Worldwide research indicates that young plants not more than 4 months old and 45 cm tall give best establishment. Our production system offers a good compromise between what is the ideal plant and planting time for eucalyptus and popular prejudices favoring traditional tree planting practices.

LITERATURE CITED

1. Mitchell, A., private communication.
2. Official Yearbook of the Commonwealth of Australia, 1973.
3. Australian Forests and Forest Industries, Forestry and Timber Bureau, Canberra A.C.T., 1966.
4. Barnard, R.M., R.H.S. Journal, 1963.
5. Batchellor, O.M., I.P.P.S. Proceedings 1973, pp.195-201.
6. Raising Eucalyptus Seedlings. Commonwealth of Australia, Forestry and Timber Bureau.

SOME OBSERVATIONS OF THE NURSERY INDUSTRY IN AUSTRALIA

R.F. MARTYR

*Pershire College of Horticulture
Pershire, Worcs.*

The initiative for my six months visit to Australia came from the Queensland Nurserymen's Association; the reason was their concern about the absence of adequate training facilities for the nursery industry and the opportunity was provided by a temporary vacancy at the Queensland Agricultural College. The objective was to encourage and advise on setting up courses — particularly technical and technological courses — directed towards the needs of the nursery industry. Horticulture has a very low status in Australia — and the ornamental section is quite

unrecognized as a potential career by educationists or school leavers.

Australia is a very large country, about the size of the U.S. but with only 13 million people. It is easy, therefore, for us over here to get the impression of a thinly spread rural community. Nothing is further from the truth. It is an overwhelmingly urban and suburban population. Brisbane, alone of the state capitals, has less than 50% of the whole population of its own State. As land is not the limiting factor that it is in Europe the homesteads are generous and the potential for plant consumption is enormous. There has been tremendous property development in the past two decades and the market for plants has been extensive. Thanks to the generosity of the Q.N.A. and other organizations I had the opportunity of visits to Sydney, Canberra and Melbourne (twice) speaking at meetings and conferences and visiting nurseries and educational establishments.

Statistics of the nursery industry are somewhat misleading. In most States anyone who sells any plants must register as a nurseryman, so one gets a large number of inactive, or purely amateur, part-time and substandard enterprises as well as the *bona fide* nursery businesses and garden centres. This arrangement no doubt has its advantages but I do feel that it is one of the causes of the low status that the industry undeservedly has in most quarters. The industry has evolved a long way from its back garden ancestry but I found most Australians quite unaware of the sophistication of modern plant production and certainly completely unaware of its possibilities as a career for young people.

Each State has its own Nurserymen's Association and their membership lists give a better idea of the size and strength of the industry in Australia. Until a year or two ago these State Associations were loosely joined into an all-Australian Federation but now an Australian Nurserymen's Association has been formed which is active in the political field and can speak with an authoritative voice. It has recently started its own publication — "The Australian Nurseryman". The A.N.A. can also sponsor schemes such as the Green Survival campaign, Plant of the Month scheme, and it is currently working hard for the establishment of a Plant Variety Rights scheme. There is a tremendous demand for information. Conferences organized by the A.N.A. or other responsible bodies are eagerly attended from all over the country. Hence, of course; the very rapid and successful development of the I.P.P.S. Australian Region.

The Development of the Nursery Industry. If a date has to be given for the start of the present vigorous buoyant Nursery Industry in Australia it would have to be 1960 — and the event, the arrival of Dr. Kenneth Baker from the University of Califor-

nia to the Waite Agricultural Research unit at Adelaide on a Fulbright scholarship. He brought not only his expertise on the U.C. composts and plant nutrition but developed the aerated steaming techniques of soils. Every large established grower to whom I spoke agreed that this was a turning point if not indeed the turning point of large scale nursery development in Australia. The same principles apply today though the mechanics have changed — viz. by mixing 6-1/2 lbs air to 1 lb of steam at 212°F you get aerated steam at 140°F which provides effective pasteurization, without problems of re-infection, always a serious problem under their conditions, when a biological vacuum is caused by raising the temperature to 212°F. Furthermore there is less toxicity and less cost. Much of their seed is treated in this way before sowing also. This breakthrough in sanitation made their modern nursery production possible. In the U.K. we have no conception of the dominating importance of disease control in those warmer climates. Ruin is the inevitable result of a failure to control *Phytophthora*.

But Baker's visit did more than introduce a valuable new technique. It broke an isolation and provided the catalyst for further co-operation and development. Without the support at that time from Government Research Stations or Universities, the expanding industry learned the importance of self reliance and found its own sources of information and developed its own technology.

This inventive skill and highly developed ingenuity throughout their production must be my most vivid impression in all my contacts with the horticultural industry in Australia. Two examples of this: Firstly their attitude to plant tissue culture, which is more positive than is the case in the U.K. Growers are seeking training in the techniques and they see a wide use of the methods in the future; perhaps under their conditions and with important families, such as the palms, it will have a deeper impact upon the Australian nursery production than will be the case over here. Certainly they are preparing for such a contingency.

It is difficult to choose from the several ingenious examples of mechanical adaptation for the second example but I was particularly impressed by their use of suction pressure and a template to sow seeds in boxes (or beds). One nursery (and indeed perhaps more) have mechanized the whole operation of boxfilling, seed sowing and spacing out.

Containerized Production. The industry is almost entirely based on containerized plants, hence the importance of mastering hygiene and the value of the U.C. experience. Bare-root production is virtually unknown for ornamentals and found only in raising citrus and some other fruit stocks.

There are no real supplies of peat in Australia — and such as there is does not approximate the standard we know. It has been imported mainly from Germany but its cost (more than 3 times the cost here) is pricing it out of the market. Sawdust and shredded bark are both used as substitutes and the Scoresby Horticultural Station in Victoria is evaluating different materials and treatments. Sawdust is rather more variable than supplies which are available in the U.S.A. and care is needed. I saw variable results and some disasters — in one case a saprophytic fungus causing a brick-hard layer mid-way down the pots (I notice that this was also reported in N.S.W. in the 1975 I.P.P.S. Proceedings.) Eucalyptus sawdust (hard wood) is said to contain resin and decays very slowly — it remains in excellent physical condition after 18 months in containers. It is also acid and needs careful adjustment both to pH and nitrogen to stabilize the correct C/N ratio. Many growers seem to use it without composting and, when used alone, this can cause overheating. Also I think that ammonium release causes damage with seedlings and cuttings. The reluctance to compost is due to problems of space and stock piling as well as the labour it would entail but I would not like to take such a risk. Recommendations for the detailed treatment of sawdust with water and urea from the N.S.W. Research Station at Gosford are given in the 1976 I.P.P.S. Proceedings. Their recommendation also is to mix sawdust and medium sand in equal quantities.

The more I see of the problems of using peat substitutes the more I hope that peat of the quality and uniformity we get in the U.K. does not price itself out of the grower's market.

The good natural growing conditions in Australia are exploited to the full, and unnecessary operations are cut out ruthlessly. Hence the tendency to strike cuttings individually in containers. Space is used to the fullest economy.

Australians use the term "greenhouse" and, wisely so, for in Queensland, at least "glasshouses" are comparatively rare and need protection from hail which comes with a severity and frequency quite unknown in Western Europe. Wire netting is an essential outer protection.

Standing grounds. Usually shading is an essential requirement. Shade houses of saran cloth or lath are used but it was interesting to see how the natural shade canopy of the Gum trees is sometimes used. Standing grounds may be graded out of the natural forest. The base must be capable of complete insulation from *Phytophthora* — black plastic may be the cheapest but infection can spread rapidly from plant to plant as the drainage water flows. The only satisfactory standing medium is a deep enough layer of gravel so that the seepage from infected plants runs vertically through.

The tremendous potential of Australian plants. This is my second vivid impression of my stay in Australia. Imagine the feelings of Joseph Banks in 1770 on landing at Botany Bay — faced by an entirely new and different flora — a new world! An extraordinary rich flora of some 850 general and perhaps 15,000 species — about 3,000 brought into cultivation and it is estimated that some 6 to 8,000 are worthy of horticultural development. What a fantastically challenging and inspiring state of affairs! But the tasks of clonal selection, improved forms and hybridization has hardly begun. There is a reason for this in that the demand for native plants has grown so rapidly that the nurseryman has been hard put to propagate sufficient material of what is easily available let alone spend his time in further selection.

Incidentally this is probably one of the reasons why the Australian buyer is less critical about quality than his European or American counterpart. Some of the material which found a ready market would not be saleable elsewhere.

The introduction of many of the Australian native plants into commercial production is fraught with difficulty, for their requirements can be remarkably specific and they are often disappointingly short lived. Nevertheless the development of more reliable and better species and cultivars is a task which will face the propagator for many years.

Amongst the best examples of nursery improvement are the callistemons of which fine named cultivars are now available. The importance of perfecting techniques to propagate the eucalyptus vegetatively soon becomes evident when one sees the range of form and flower colour available in seed grown plants. To me one of the most fascinating was *Eucalyptus ficifolia* with every shade of pink, red, orange or maroon flowers — furthermore, of course, eucalyptus hybridize readily and it is becoming more and more difficult to ensure true seed.

When the early colonists went to Australia the desire was to make it as much like home as possible — hence the introduction of as many of their European garden plants as would stand the changed conditions and even now some suburban gardens around Melbourne look remarkably like their counterparts in Britain. It is not surprising however that a reaction has set in and that to the members of the Australian society for growing native plants the term 'exotic' is almost a dirty word.

Sometimes their case is stated with vehemence. At a Conference I attended at Canberra tempers got quite frayed until someone quietly reminded the assembly that everyone in the room (save only a single delegate from Papua - New Guinea)

was an exotic and that it was therefore obviously a problem which demanded reason and compromise.

Rich though the Australian flora is it has added no major food plant to human knowledge — the nearest being the macadamia or Queensland nut (*Macadamia ternifolia*) and I believe that production is now greater in Hawaii than in Australia. Sadly it is too expensive for the European market for I considered it outstandingly the best flavoured nut.

Status of the Amenity Horticulturist. Some of the prestigious Botanic Gardens — Canberra, in particular, are superb and the large cities have creditable parks but, generally speaking, the status of the amenity horticulturist is abysmally low. It has hardly any claim to professional status. There are few horticulturally trained people and higher supervision in the Parks service is normally in the hands of the City or Shire Engineer or Surveyor whose horticultural knowledge was low and his interest sometimes non-existent.

In Queensland, apart from the main cities, the misuse of plants in roads and public places made one despair. Shrub pruning frequently meant hacking down to ground level irrespective of horticultural habit and the time was decided by the availability of (unskilled) labour without reference to the needs of the plant. Along the highways every Authority seemed to have the right to hack, remove or burn the trees at will; electricity authorities, telephone and road engineers left behind them a trail of vandalism, mutilation without compunction and, more regretfully without any apparent expression of public indignation. It was the accepted norm. Doubtless this was not true of all districts but I saw enough to appreciate the extent of the problem.

All this, of course, has had a disastrous effect on the status of the horticulturist in the amenity field — and into recruitment into horticulture generally. No one in the careers advisory field would consider ornamental horticulture as being able to provide worthwhile careers at all and there will be an uphill battle to change public opinion. This degree-oriented society has neglected to train the technician. There are certainly no shortages of training courses for the landscape architect — but an acute problem exists to turn their plans into fact and to provide the skilled maintenance once a scheme has been planted up.

An Australian Institute of Horticulture has been formed comprising graduate membership of all those interested in horticulture and it numbers amongst its aims that of improving the status of the professional horticulturist. It merits the active support of every such person in Australia.

Need for technical staff. The limiting factor in the extension of many nurseries must be the need for technical staff. Many enterprises have grown as large as the family can supervise and manage themselves. Any increase in production must be sufficiently large to pay for the necessary injection of additional managerial and/or technical staff — of which, of course, there is an acute shortage. The Federal Government tends to consider all horticultural jobs as being suitable for the unemployed.

Horticultural education. The opportunities for horticultural education have reflected the generally low status of the profession and industry in Australia and at all levels from degree to apprenticeship they have been less than is available in any other developed country. In a degree-oriented economy, horticulture has suffered by having no degree except a final year elective and this is no way to attract the plantsman. The nurserymen or Parks Superintendent has as yet no flow of people trained technically at OND or NCH level. Day release or short courses at technical colleges such as Ryde and Canberra give training roughly comparable to City and Guilds Stage I and II. But there are large areas where even this was unavailable. I thought the practical facilities much too basic.

However, things are beginning to change and the needs are well recognized by the leaders of the nursery industry. They will be seeking to fill the monstrous gap in technological and higher technical training for they have outstripped the educational and training facilities available to them. Australia's most famous horticultural college, Burnley in Melbourne has entry requirements and course content roughly equivalent to an HND in this country (without, however, the "sandwich" content). Without disrespect to that college — for it has a famous and honoured history — yet I felt that in this present day the Burnley student was tending to fall between two stools. In the graduate-oriented world he found himself he was not qualified to compete for the higher professional posts; however his training was not sufficiently orientated to industrial needs to enable him to fall into jobs of responsibility on the nursery. Labour costs are high and no grower can be expected to pay "fancy college wages," as he calls them, and teach the practical and supervisory skills himself. Hopefully, this is a gap which the Queensland Agricultural College is seeking to fill.

Lest any Australian who chances to read this and feels that these personal observations are too critical particularly in view of such a limited experience of this vast country, let me conclude by emphasizing that my strongest impression was that of a dynamic and effective industry with a potential which must make anyone in the U.K. envious.