ing knives of the highest quality kept as sharp as possible at all times. Whenever a knife is felt to "drag" or leave marks on the cut surface it should be re-sharpened. I find the most useful grafting knives are the ones with slightly curved edges.

With most types of deciduous weeping trees I use the "whip and tongue" graft. The length of the flat sloping cut is made approximately six times the thickness of the scion. The cambium layers of at least one side of the graft should be perfectly aligned. The grafting tape is left on the graft until the scion has shoots 5 to 8 cm long. This will usually be two to three weeks after bud burst.

Plants grafted in outdoor situations are usually staked with a small stake tied to both stock and scion to provide protection from wind.

Many interesting plants can be produced by grafting and the current work being carried out in the production of weeping grevilleas illustrates this.

TRANSFERRING TISSUE-CULTURED PLANTS — IN PARTICULAR GREVILLEAS — TO THE NURSERY ENVIRONMENT

ADRIAN BOWDEN

Adrian's Nursery
62 Thomas Street, Jandaket
Perth, Western Australia

When plants propagated by tissue culture are transplanted from the sterile high humidity conditions of the tube or jar to the nursery environment, the results are often very disappointing. When evaluating these results we should not look at transplanting as a single process, but rather as a chain of events with conditioning of plants for transplanting; the actual transplanting; the media; temperature/humidity; and hygiene, all being links in this chain. If we then learn to understand each link and understand how it fits into the chain, results will improve.

It should be pointed out that tissue-cultured plants differ physically from similar sized plants grown conventionally, e.g. under mist from cuttings. When first removed from sterile culture their leaves are thinner, they have less cuticle and are less waxy. They are less functional, as their stomates do not respond as efficiently to stressful conditions. Often instead of closing rapidly they remain open. These factors cause the

young plant to dehydrate more quickly than would be normally expected.

Roots are often not as functional as they appear, and sometimes are not connected in the normal way, thus greatly reducing their effectiveness. After 7 to 10 days new leaves and roots have been produced and from that time on the task becomes a lot easier as the plants begin to function normally.

Let me now make the point that the following plants produced by tissue culture have proved easy to transplant for us: Most house plants, including gloxinia; *Nephrolepis; Syngonium; Spathiphyllum; Saintpaulia; Anthurium, Ficus; Davallia; Dionaea; Cephalotus; Begonia*, and *Cordyline*. In fact, losses in any of these can generally be put down to causes such as insect or fungal attack, or overwatering.

When one starts to transplant perennial and woody plant material, however, it becomes a whole new learning experience. Gerberas and roses, for example, have not proved very difficult to transplant providing the material is in good condition at the time of transplanting. Results in excess of 90% have been achieved.

Gypsophila has proved difficult unless exactly the correct type of material is used for planting out.

Grevilleas, of which we grow several cultivars, have proved to be one of the most difficult, but we have achieved results of 80 to 90% by using the following methods:

Pre-conditioning: Plants in the laboratory are generally subjected to low light, even though this may not appear to be so. It is usually about 1000 lux. These plants are then exposed to higher light — 3000 to 10,000 lux — for up to two weeks before planting out, to prepare them for the harsher conditions in the glasshouse. When the plants are placed in the glasshouse they are put in a shaded area, in light conditions similar to those used for growing ferns.

Temperature/Humidity. Over a period of approximately three years we carried out a comprehensive study of temperature and humidity using a thermohygrograph. This information was correlated with plant survival and losses. During this period the outside conditions varied greatly. In winter the humidity averaged between 50 and 70% and the temperature between 10°C and 20°C. In summer the humidity averaged between 10 and 30% and the temperature between 15°C and 30°C.

From the above trial we were able to conclude that for the successful transplanting of grevilleas, the humidity needs to be 85% plus, while the temperature is held between 15°C and 25°C inside the house for the first three to four weeks.

How high humidity is achieved will vary from place to place. In some operations plastic sheeting is placed directly over the plants for seven to ten days. Others use plastic cling film (Gladwrap®). Others, in areas where outside humidity is low and temperatures are high, use mist or tents with mist inside them.

We use as a guide the following — if you can take a photograph inside your transplanting area, without the lens fogging up, the humidity is too low.

Media. Over the same three-year period trials were also carried out to select the ideal medium. Mixtures of sand, peat, foam, perlite and crushed rock were used.

One of the best was found to be a coarse sand with about 25% air space. There was a direct link between air space in the medium and plant growth. Generally the plants which had proved to be the most difficult to transplant in our conventional medium of peat, foam, and perlite (used for hardwood cuttings) grow much better in coarse sand. This produces some problems, however, when these plants are being freighted out by air.

Controllers. We have preferred to use mist timers rather than sensitive leaf controllers. Whatever controller is used it is wise to have a back up controller on hand as well as spare solenoid valves. When tissue-cultured hardwood plants are first put out you can be sure that everything that can go wrong will go wrong.

Fungal Attack. Fungal attack can be prevented by using steam sterilized media, clean containers, and by spraying immediately after planting out with a fungicide. We use Previcur (70% propamocarb) at the rate of 15 mls/10 l product, with a follow-up application 10 to 14 days later of Rovral (iprodione 50%) at 1 g/l wettable powder.

The Stage Plants Have Reached at Transplanting. This is of major importance and has a large bearing on the number of transplants that become saleable plants later on.

Our approach has been to mostly plant out unrooted material that has callused and is just starting to root. The reasons for this are faster planting speeds and a resultant higher percentage of successful plants. If rooted plants are transplanted a lot of roots are broken off if worthwhile planting speeds are maintained.

In conclusion, if proper care and attention is given to all the aspects of conditioning and transplanting of woody tissue-cultured plant material, the results can be commercially successful.