

north Queensland.

**Rootstock Compatability and Tree Performance** Uniformity in tree growth of the emerging tropical exotics has been compromised due to the "anything and all" approach by nurserymen in regard to access to numbers of rootstocks. Unfortunately, the same approach is often adopted in Asia and thus there are few guides to rootstock selection.

We have witnessed overgrowth of rambutan scions on some rootstock cultivars, incompatibility with some lychee cultivars (particularly Amboina and Kwai May Red) on Tai So seedling rootstocks, and poor performance of Thai longan cultivars grown on Chinese cultivar rootstocks (and vice versa). Whilst some of these problems have been overcome (for example using Wai Chee or Bengal seedling rootstocks for lychee cultivars), obviously many more will arise particularly because there are varying incompatibilities at the cultivar level within species.

**The Future** Whilst there has been little organised and documented "emerging" tree fruit species propagation research in northern Australia, there has been a considerable body of knowledge built up (and is still being developed) by a number of innovative nurserymen.

What is essentially lacking is a coordinated approach to the gleaning of trial and error information right through to the field planting and cropping stage. Of major concern for the various crops is that rootstock (or own roots) choice be such as to achieve and maintain maximum productivity.

Tissue culture research should be pursued for the most promising of the exotics. Success in this area has been largely complicated by contamination and the difficulty in formulating the callus medium. Once achieved we still require field research on long term growth of own-rooted trees.

## **BUDDING OF EUROPEAN (SPANISH) CHESTNUT (*CASTANEA SATIVA* MILL.)**

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The European (Spanish) chestnut is a relatively new tree fruit crop in Australia, especially for production in commercial orchards. The trees are grown for the shiny brown nuts which are produced in prickly seed cases or burrs. The starchy,

edible nuts are very popular in parts of Europe and it is from these connections that a substantial market has developed in Australia. Chestnuts (*Castanea*), oak (*Quercus*) and beech (*Fagus*) are all genera in the family FAGACEAE — the cup-bearing trees. Chestnut burrs are vegetative structures with a similar function to the cups which carry oak acorns.

Thirteen species of chestnut are now listed and the most important one in Australia at the present time is the European or Spanish chestnut, *C. sativa* Mill. The name indicates that this species is a native of southern Europe and it is also widely distributed in the Asia Minor countries. The European or Spanish chestnut is similar to the American chestnut, *C. dentata* (Marsh.) Borkh. with both species having long leaves with coarsely toothed margins. However, the leaves of the American chestnut are wedge-shaped at the base and do not have hairs on the undersurface. Shoot growth of the European or Spanish chestnut is stouter and the buds are larger than other chestnut species.

Little has been done with the selection and development of chestnut cultivars and, at present, nurserymen select propagation materials from the better strains from within their own areas. In northeastern Victoria there are probably some 12 different strains. The best ones have the following characteristics:

- large, dark brown, shiny nuts.
- easy release of nuts from the burr.
- moderate to heavy and regular (annual) cropping.
- burrs full of nuts. (Some strains develop only one nut out of a possible three.)

All non-cultivated chestnut trees have developed from seed and, therefore, there is a tremendous amount of variability. Care must be taken from the very start with the commercial production of chestnut trees. I have not read any research findings on the subject but, in my experience, less incompatibility occurs when chestnut wood is grafted onto seedlings produced from the same tree. This may not be totally desirable, of course, since the rootstocks may need to be selected for characteristics which are different from those of the scion, e.g. tolerance to root diseases, vigour, etc. The same incompatibility has not been experienced with chip-budded stocks so this method of chestnut propagation seems to allow the normal range of stock and scion selection criteria to be used.

Throughout the world where European or Spanish chestnuts are grown for nut production most nursery stock is grafted. In northeastern Victoria I have found chip budding to be just as successful as nursery grafting and quite a lot better



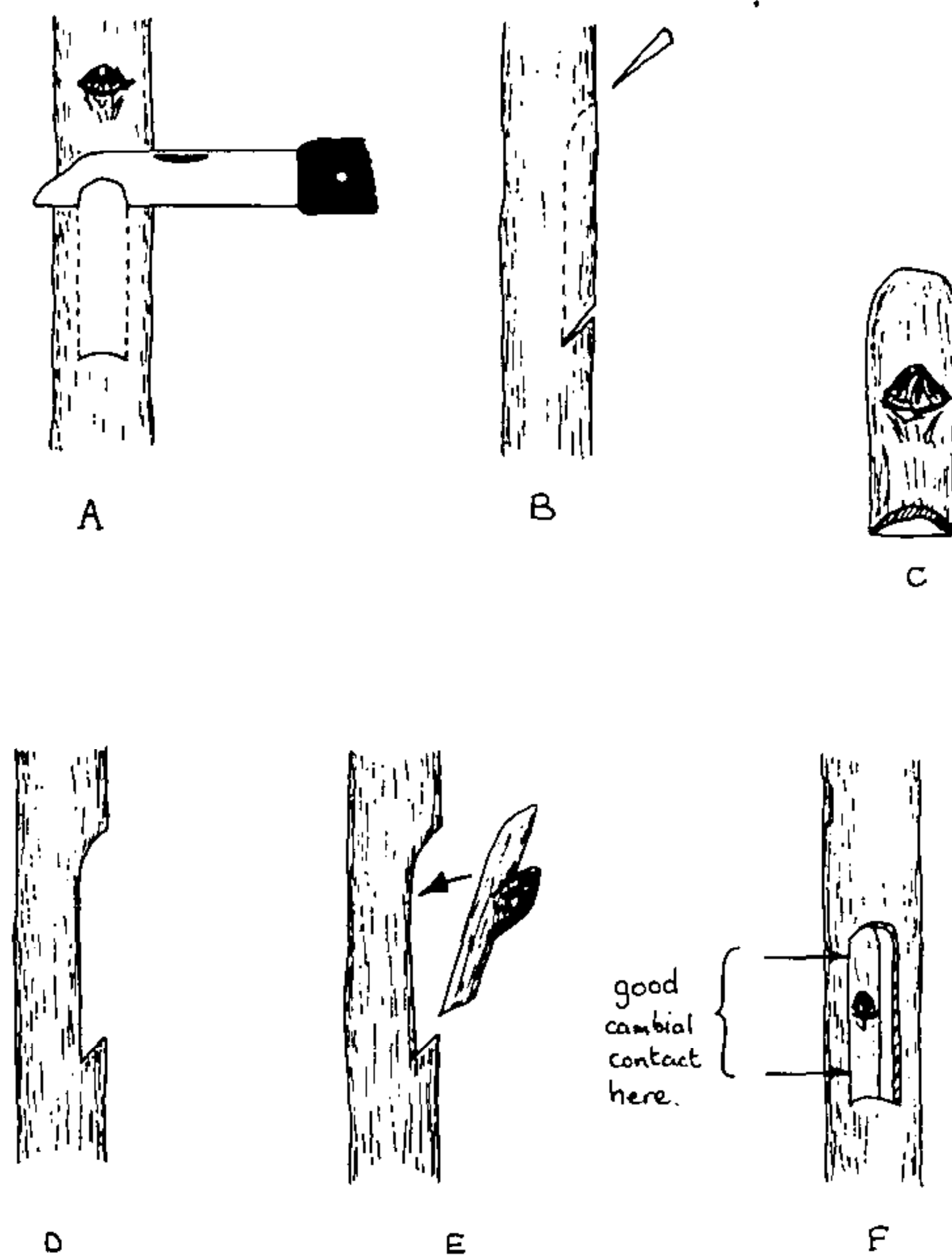
than T-budding. It is thought that budding of chestnuts is not widely practised because the wood is fluted, or grooved, and the cambial layers of the bud and stock do not join uniformly.

Budding in northeastern Victoria is carried out in late summer (first 2 weeks of February) when, in a normal growing season with rainfall supplemented by irrigation, the rootstocks should be in ideal condition. The highest summer temperatures should have abated, daylight hours shortened, and humidity increased as a result of "dewy" nights starting to occur. Budding in early February allows sufficient time for callusing to take place before temperatures fall further and growth ceases. Once callusing has occurred it is possible to remove the bud ties before winter.

**Selection of bud sticks.** This is of great importance due to the nature of the wood. The current season's growth should be selected and should be firm, mature, and bearing healthy buds. With chestnut many of the basal buds on the current season's growth tend to be missing and this should be taken into account when deciding how much budwood to collect. The diameter of the bud sticks should be similar to or slightly less than that of the stock.

**Preparing bud sticks.** All leaves should be removed as soon as the bud sticks are cut from the parent tree. For chip budding the leaf petiole should be cut as close to the bud as possible. Once the leaves have been removed it is essential to prevent the bud sticks from drying out by wrapping them in a damp towel or some other material. Remember the importance of labelling all material, especially when bud sticks are collected from more than one source.

**The budding operation.** Remove leaves from the rootstock up to a height of 300 mm from the ground. The first cut is made downwards into the side of the stock at an angle of about 20°. Ensure that the knife is held horizontally to leave the base of the cut level (Fig 1A). A second cut is then made downwards to meet the first (Fig 1B). The piece of stock is removed and thrown away. A similar operation is performed on the bud stick to produce a chip bud (C) which fits into the prepared stock. The bud conveniently sits on the downward-sloping bottom cut until it can be tied in place (D). Chip budding is easier if the rootstock and bud stick are the same thickness so that a perfect match can be made (E). Chip buds which are slightly smaller than the prepared cut should be placed centrally. Sometimes budwood may be in such short supply that very thin material must be used. Chip buds from this material are small and must be placed on one side of the cut to ensure good cambial contact (F).



**Figure 1.** The chip budding operation.

It is then important to tie the chip firmly in place with plastic tape. The whole bud is covered over to prevent any drying out or insect damage. Within 14 days the tape can be removed to allow inspection of the bud. Should the bud have not taken then, providing the conditions are still suitable, another attempt can be made. The stock should not be cut back until the following spring when growth recommences.

Comparing chip budding with traditional T-budding, my results have shown that the chip budding method for chestnut produces a consistent 96% "take", whereas T-budding is much less reliable with takes ranging from 50 to 85%. I believe the single most important factor in the success of chip budding for chestnuts is a relatively large area of direct cambial contact. Chip budding also succeeds under conditions which are not quite perfect due to the fact that callus growth does not have to be as prolific as with T-budding.

The results of budding chestnuts in Australia are better than those observed in North America or Europe. Possible reasons for this are:

- more days of consistent warmer temperatures, enhancing callus growth.
- variation between night and day temperatures are not as great.

- during February (Southern Hemisphere) we have more sunlight hours than are usually recorded in August in the Northern Hemisphere.

Chip budding chestnuts onto selected seedling rootstocks allows growers to produce uniform, desirable trees. Orchards, or groves, of such trees should provide the grower with early, substantial yields of high quality nuts.

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## **1984 — A YEAR OF PROBLEMS FOR TREE FERNS — SOME GENERAL OBSERVATIONS**

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Our nursery has been producing the tree fern, *Sphaeropteris cooperi* [syn. *Cyathea cooperii*], from spores for more than ten years.

Quite suddenly in 1984, although the spores germinated as usual, the prothalli degenerated and production dropped to almost zero. The same phenomenon occurred simultaneously in nurseries in Perth and Sydney.

About the same time, enquiries began to flood in from tree fern growers around Australia whose production from spores had failed. Within a period of two months growers had contacted us from Darwin, Cairns, Brisbane, Adelaide, Melbourne, and a host of other areas all around Australia, all with the same story — their spore production had failed. Buyers informed us there was an Australia-wide shortage of tree ferns.

Over the next four months we increased our spore sowing tenfold and for the next three months I spent my time trying to solve the production problems.

The following things were tried:

1. Spores were collected from many remote areas around Australia from natural tree fern populations — from Bedford