

but most grafts are made between October and March. I feel sure that the economics of grafting far outweigh a continual re-planting program of stock bushes for cuttings. Grafted plants commands a much better price than plants on their own roots. Grafted plants are more vigorous, flower better and live longer.

VIC LEVY: We have found 'Apple Blossom' hibiscus to be most susceptible to phytophthora.

ALEX SCOTT: That surprises me and is not our experience. I will check into that.

## COMMERCIAL PROPAGATION OF MACADAMIAS

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Macadamia trees were regarded as impossible to graft up to the 1920's. Around this time a high school student in Hawaii successfully grafted two macadamias. However, it was probably not until the late 1940's that any large scale commercial grafting of macadamias took place in Hawaii.

In Queensland grafting of macadamias was still generally an unsolved mystery by 1960 with one or two notable exceptions. One man in particular, Mr. Norman Greber of Beerwah, had mastered the art and attempted to teach others his relatively simple, very successful grafting technique. Mr. Greber could not understand the failures of others to copy his method. This continued failure at propagation was the major stumbling block to the establishment of a macadamia industry around this time.

Mr. Greber's graft is a modified side wedge which allows almost any sized scion and stock to be united. Success rates were generally high with rootstock sizes ranging from small seedlings to limbs on topworked trees 6 to 10 inches in diameter. This method was adopted by one or two nurserymen and also by CSR for commercial propagation for several years. This graft relies on a small wood plane to achieve a flat surface on the scion. Propagator skill is required to produce a matching cut on the rootstock with a knife. Propagation rate is a maximum of 130 per day with a success rate from 60% to 90% depending on scion cultivar. This technique also requires an in-

tensive maintenance programme for one or two years to establish an upright tree. Other methods of propagation were sought to reduce costs and to make greater use of limited supplies of scionwood.

A series of trials to test all manner of propagation techniques commenced in the mid 1960's. Among those attempted were:- Splice grafts, wedge and inverted wedge grafts, seed grafts, patch budding, chip budding, and cuttings.

Cuttings gave us limited success and a very slow growing plant. The N.S.W. Department of Agriculture had developed the seed graft. This is a method of inserting a small leafy scion into the cotyledons of a germinated seed. Initially in commercial practice this gave very variable results but this was offset by the rapidity of grafting. However, the small plants do not grow as rapidly as grafted seedlings although growth is faster than from cuttings.

Limited success was achieved with all the propagation methods tested. However, some were very demanding on a particular type of scion wood or were slow while others were dangerous for the operator. Patch budding was slow, dangerous, and takes were not high but this method appeared to have "something" other methods lacked. The advantages were that available scionwood could be used to propagate 3 or 4 times as many seedlings as for Greber grafting. Patch budding led to the idea of "punch budding" which Mr. Stan Henry went on to develop into a commercial technique.

Approach grafting is still used by one Queensland nurseryman but this is very laborious for large numbers of trees. Mr. Edward Tonks in Rhodesia has developed a leafy scion technique for small rootstocks. The grafting rate is 30 per day for a skilled operator. Obviously this method is not suited to a high wages country.

The mystery in macadamia grafting was partially removed by cincturing of limbs several weeks prior to grafting. Success rate still fluctuated. Earlier use of a simple colour test for starch accumulation in cinctured wood could have saved much time and effort. The test consists of dipping a cut end of a scion stick into a super saturated solution of potassium iodide and observing the degree of darkening on the end of the stick. The deeper the purple colour the greater the starch accumulation and the better the chance of success.

Throughout the series of propagation tests rootstock and scion vigor appeared to be correlated with success. Shade appeared to either be detrimental, or at best no improvement over full sunlight for all non-leafy scion grafting. It is now fully established that consistent high success rates may be achieved if

the rootstock and scion material are in excellent growing condition. This also enables the tree to continue to grow rapidly when planted into the field.

Vigor is probably the key which caused many failures in Australian macadamia propagation. CSR required medium sized seedlings to graft and efforts were made to grow trees 2 to 4 feet high in 8 to 12 months to reduce nursery costs. This growth rate has been achieved and bettered with trees grown in full sunlight and such healthy trees have improved the propagation success rate for grafts or buds. Such seedlings produce grafted trees 4 to 6 feet high which is suitable for orchard planting but is difficult for nurserymen to pack for consignment to customers. Thus other commercial nurserymen attempt to grow small but healthy trees but this is difficult to achieve with a tree which grows very rapidly when conditions are good. This conflict of nursery requirements with tree growth habits is responsible for the widely varied methods in the commercial propagation of macadamia.

## **PUNCH BUDDING OF MACADAMIA**

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Australia has many beautiful and useful native plants but macadamia is the only one under cultivation to produce food for man.

Grafting of macadamias is not as easy, as fast, or as sure as most orchard species. This is demonstrated by the early difficulties experienced with grafting macadamia and the numerous propagation methods which have been developed.

In 1969 scionwood supplies of desired cultivars was in short supply. We offset our scionwood shortage by going onto patch budding instead of grafting. Results and propagation rate were similar to grafting. (Propagation rate was approx. 100 / man / day.) It was while doing this laborious patch budding that the idea of punch budding occurred to me.

On 15th January, 1970 two 0.303 bullet shells were used to prove that macadamia buds could be punched. Our first punch-budded trees resulted from this and tens of thousands of trees produced since then have proved the benefits of punch-budded trees for CSR Limited requirements.