

Improving Take Rates in Grafting Macadamias®

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BACKGROUND

Macadamia nuts are the success story for the Australian bush food industry, but with a twist. Macadamias were discovered in Australia, but nuts were originally taken to Hawaii, U.S.A. where they were grown and bred. It took some enterprising Australians to bring them back to the NSW north coast to establish an industry now worth tens of millions of dollars.

There are two species that have been used for nut production, *Macadamia integrifolia* and *M. tetraphylla*. While the flavour of *M. tetraphylla* is considered superior, *M. integrifolia* cultivars are the most widely planted for nut production.

Macadamia trees are generally grafted onto seedlings, with the selection 'Hinde' (syn. H2) being the most widely used rootstock. This is a *M. integrifolia* selection and is said to grow a vigorous seedling due to the large size nut. There has been some work on rootstock evaluation, but this has been limited.

The grafting technique is different from that of other plants because the macadamia wood is decidedly hard. The method is to create a whip on both the scion and rootstock, the union made and tightly wrapped with PVC strips. A common practice is to then seal the graft scion with a bituminous (black) or PVC (white) paint to seal in moisture.

Macadamias are noted as not being a tree that stores significant starch in its limbs, this being a trait of most of the family Proteaceae. To enable the scion wood to survive while the graft union heals, the limb of the scion tree is cinctured (ring barked) some 4 weeks prior to grafting. This forces the build up of starch in the cinctured limb as the sugars produced in the leaves are prevented from flowing back to the root system.

Advantage Plant Production was asked in late 2005 to produce macadamia trees for regional orchardists because there was a severe shortage of planting material at that time.

Fresh seeds were purchased and germinated according to usual industry practice. Following germination they were potted into a pine bark potting medium in 5.5-L polybags and grown in the full sun. Advantage Plant Production seeks to be as water efficient as possible and so opted for an individual dripper system rather than the usual overhead sprinkler system.

Another difference is that the nutritional requirements of the plant are primarily met using a liquid feed system as distinct from controlled-release fertilizers commonly applied in other macadamia nurseries. Plants grew well and were ready for grafting earlier than expected.

THE PROBLEM

Grafting started in mid-2006, using wood cinctured and starch tested. The results were disappointing, with take rates below 70%. Some graft scions were alive for 2 months but failed to grow out.

We felt confident that the graft “carpentry” was adequate. Our main grafter has some 25 years of experience. We had tested the scion wood to ensure that there was sufficient starch, so that was ruled out also. It was obviously something different to the normal that was inhibiting graft grow out.

A back to basics approach was taken. We had to find out what was happening. We tried to rule out as many variables as possible to try and find the reason for the failures.

We knew that scion material will build starch and hold this for some months. So grafting wood was cinctured and left for more than 6 weeks to be sure that starch was definitely present.

In examination of the graft failure, a difference was noted between the takes that were grafted straight after scion material was taken from the tree and 2 days later. We had good records of what and when we had done things so this was possible. We then ensured grafting material was collected at dawn on the day of grafting and not held longer than 2 days. Wood was also held in a refrigerator or under a wet cloth to keep it cool and moist.

After-graft care was also examined. We thought that the rootstocks could have been slightly dry, so the newly grafted plants were watered before being taken back to the field, and the watering regime of the plants was increased.

Grafting success increased; however, the aim of 90% plus was not achieved. We went back to the drawing board to try and find if there was something else that was not right.

The consensus of thought was that the main difference between the Advantage Plant Production system and others is our lack of overhead watering. A thought was that our post-graft environment was too dry, even though plants were placed under shade structures.

We decided on a trial of watering. Our regular system was to water once a day to a little beyond field capacity. A thought was that “it may make a difference if we broke the watering into four cycles a day.” Our irrigation computer control system made this change relatively easy. The irrigations were rescheduled so that the plants were watered throughout the daylight hours and kept at or near field capacity.

We also decided to leave the trees in the shade for a longer period if necessary to reduce stress from sunlight.

Conversations with other growers showed that some were experimenting with a different approach to scion sealing. We had been using the white PVC paint, but were not entirely happy with the result. We felt that some scions were drying out before the scion had a chance to grow out. We tried both Parafilm® white tape and clear Parafilm budding tape that we had also used for citrus budding.

THE RESULTS

Success. The take rates hit the magic 90%-plus target for over 2,000 trees. Plants grew out much quicker than before, and shoots were much larger.

On reflection the thing that made the most difference I believe was the watering — that is, after grafting in macadamias it is important to maintain your pot medium at, or near, field capacity to have grafts grow out effectively. Because macadamias are rainforest trees, this stands to be logical.

Advantage now follows a strict process for grafting macadamias. Here are a couple of points that we felt to be important for others wanting to increase graft success.

- Grow rootstocks vigorously and maintain good plant health and nutrition.
- Select scion material from young trees that have not reached full bearing.
- Cincture wood some 6 to 8 weeks before grafting to ensure adequate starch levels.
- Collect scion wood early in the morning and store scion wood in a cool and wet condition.
- Do not use scion wood more than 2 days after collection.
- Wrap the entire scion with a Parafilm layer to prevent drying out.
- Post-graft, water as soon possible.
- Maintain the trees at, or close to, field capacity until grow out stage.