

## Getting Grafts to Take...or Why Grafts Don't Take... or 1000 Excuses for a Poor Result!®

**Greg McPhee**

Horticultural Communications Pty. Ltd., PO Box 339, Lismore NSW 2480 Australia

Email: greg.mcphee@www.hort.com.au

### INTRODUCTION

I have been involved “hands on” in grafting for some 30 years. During this time I have experienced monumental success and failure — sometimes both within a few weeks.

Nobody likes a poor take rate. Obviously there is more to grafting success than how an individual holds their knife, but sometimes it's easier for a nursery manager to blame the grafter than look closer at their production processes.

Simple things can make a big difference. Since my livelihood is dependent on grafting success, I have observed what can go wrong with grafting as a way to assist growers in getting the best result. I am happy to share these clues.

### BOTANY BASICS

My talk will use the term grafting, but I am also including budding in the discussion. Grafting entails matching stems of the rootstock with stems of the scion (shoot system)—which have more than one bud. Budding is typically the transfer of a single bud with a small portion of the scion stem. But let's keep it simple.

Generally, grafting is done with dicotyledonous plants. These plants have a vascular system arranged in a circle that grows outwards toward the periphery of the stem as they grow larger. Don't even try to graft grasses, palms, bulbs, etc. It is not going to work!

Grafting success declines as you increase the genetic differences between the rootstock and scion. A plant has the greatest success rate when grafted back on itself (autograft). There is a slight chance of failure when grafting different clones of the same species. Failure levels increase with different species within the same genus, while the failure rates are very high when grafting between different genera within the same family. Interestingly, with some genera there is high grafting success between some species and low success with others.

Grafting *Diospyros kaki* (sweet persimmon) onto *D. kaki* rootstocks is easy, but a low take occurs when working *D. kaki* onto *D. virginiana* seedlings. *Eucalyptus* species are particularly fussy, as are *Grevillea* — when grafting between species that are found in tropical and temperate regions.

Few grafts will take if the scion wood is put on upside down (reversed polarity). Hence, the correct polarity is important for all but the easiest-to-graft plants. Sometimes the grafts grow out in a weird way (just to embarrass the grafter!) before they finally succumb.

You get best results with healthy rootstocks and scions. I cannot emphasise strongly enough the need to have both rootstocks and scions in good condition before the graft takes places.

A cursory glance at the *Combined Proceedings of the International Plant Propagators' Society* will lead you to conclude that cuttings of young, actively growing parent plants have a higher rooting success. The same holds true with grafting

material. Select scionwood that has round, uniform sections and vertical growth with evenly spaced internodes that are pest-free.

Rootstocks also need to be in a juvenile growth form, with upright, even growth. Fertilizing rootstocks has been an issue. Regular liquid-feeding programs are not a problem, nor are low levels of controlled-release fertilizer. You would be cautious if the leachate from pots shows high levels of nitrate-nitrogen (greater than 50 ppm N) and a high electrical conductivity. Avoid applying fertilizer to plants about to be grafted.

In the days prior to grafting, make sure the rootstocks are well watered. You should avoid water stress as much as possible. Stressed rootstocks yield poor results. Stress will result in plants shutting down growth and focusing on survival; this will lead to poor grafting success, particularly since grafting or budding also entails the additional stress of attaching a “foreign body” to a rootstock just trying to survive.

## SCIONWOOD

Scionwood collection has its own little quirks. Most deciduous plant material can be collected at the start of winter and stored well into spring when wrapped in moist bags and held in a cool room. Not so with many tropical and subtropical species. *Annona reticulata* (custard apple) will die very quickly in cool temperatures and should be held at room temperature with the base placed in water. It is disastrous if vine tips of *Passiflora edulis* (passion fruit) are allowed to wilt prior to grafting. Holding macadamia wood for more than 2 days is problematic, and the budwood needs prior cincturing or girdling for a few weeks to ensure starch is built in the wood at all.

When I work most plants, we keep the budwood in beer coolers. This keeps the wood at an even temperature, keeps them clean, and maintains high humidity. We wrap citrus budsticks in paper — all aligned in the same direction. You can get an idea of how the wood is holding up by the ease with which the petiole stubs fall from the wood. If they are dropping off fast, then the wood is no longer in prime condition.

## CARPENTRY

This part is firmly in the grafter's domain. It takes skill and practice to undertake the cuts for grafting at a consistent level for days on end. I have had the privilege to teach many people the carpentry of grafting, but witnessed very few who have been able to maintain the speed needed for long-term success.

Interestingly, grafting success does not require perfect alignment between scion and rootstock. In my hurry to get numbers done, I have been guilty of some fairly poor matches that were still quite successful grafts. If you are able to have 50% matching surfaces this will usually be sufficient, particularly if this is the middle of the graft.

A smooth cut is essential, as is completing the graft or bud quickly. You have only 60 sec to join the pieces, since surfaces dry quickly, especially in hot weather.

There are a few pointers of hygiene in the carpentry of grafting. You are undertaking a significant operation on the plant, so having clean equipment is important. It is easy to spread bacterial and fungal infection with a knife that has been in contact with dirty water or sap buildup. I try to regularly clean my equipment — at least at each break with 50% alcohol, followed by a thorough clean-up at the end of the day. I also try to never place a knife or grafting tape on a bench when grafting.

I prefer the whip-and-tongue graft and an inverted T-bud. It is a personal choice, based on the best interest of the plant and the need for completing the job quickly. I find a whip-and-tongue is strong and holds the scion well, gives greater union contact and grows out well. For macadamia, I use a block plane since the wood is very hard — so these are only whip-grafted. The union is usually painted with a PVC paint to seal the wound and reflect heat. This has recently been replaced with parafilm tape, which seals the scion better and is not phytotoxic.

Budding is quickest using T-budding. I invert the shield-bud of the T-bud, as I bud on a bench. An assistant then ties parafilm strips over the bud to hold them in place. We do around 1,000 per 8-h day, when things are going well. If the bark does not slip easily, I will chip bud, which takes longer to do and has lower takes.

### POST-GRAFT MAINTENANCE

Once completed, the grafts are usually placed back in the growing areas. Water newly grafted trees as quickly as possible. Moving plants can be stressful, and I have seen instances where the newly grafted plants have been left for hours in the hot sun where they are at their most vulnerable. If you are experiencing variable grafting success during the day, then this may be the cause.

I have had great success placing polyethylene bags over delicate grafts. They will maintain the humidity around the union, keep temperatures warm, and also help to insulate the union. I would certainly recommend this for avocado (*Persea*), persimmon, and delicate micrografts of *Banksia* and *Rhododendron* (azalea). I have used white and clear polybags and found that with clear poly, one can better see the scions growing out.

Unions heal better under low light levels, while strong sunlight can dry out grafts quickly. I would recommend placing newly grafted trees under shade until they start to grow. However, I have also found that for citrus budding, there is little difference if they are shaded or not.

Watering during post-grafting needs to be carefully monitored. I would suggest maintaining plants at field capacity for the first 2 weeks. This keeps sap flow high and removes the chance of water stress, which can cause scion death.

Avoid fertilizing until grafts have grown out, preferably until the first flush has hardened.

### SOME FINAL COMMENTS

You hardly ever get a 100% take. I have rarely experienced the magic of a 100% take, so do not expect all grafts to take — 90% is good and 80% take is respectable. However, I would be concerned if graft takes were lower, without having a good idea of the reason.

There are many ways to graft, and all have their place. Most professional grafters have a favoured style, but one needs to be flexible.

Go back to the basics if you are having a poor graft success rate. Do not consider faulty carpentry as the problem until you have ruled out if good pre- and post-grafting procedures were followed. Keep good records and an open mind and pay attention to detail!