Fruit Tree Propagation

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INTRODUCTION

Nurserymen growing fruit trees generally need to become masters of a wide range of propagation methods and cloning techniques. The larger the range of plant types grown, the greater the number of propagation methods needed. Proficiency must be achieved in the following plant propagation methods used throughout the nursery industry: seedling, cuttings, marcotting (aerial layering), grafting, budding and to a lesser extent micropropagation (tissue culture).

For any fruit tree nursery to maintain commercial viability in today's competitive market place, an estimated 70% propagation success rate is required to break even, with the additional 30% providing the profit. In fact, success rates over 90% must be consistently achieved for long-term profitability and survival.

Seedling production is generally limited to rootstock production for future grafting although some*Carica* and*Passiflora* species. are field planted as seedlings. Polyembryonic *Mangifera* and *Garcinia* species. produce true-to-type nucellar seedlings.

Vegetative clonal propagation of selected cultivars is mandatory and constitutes over 95% to 100% of most fruit tree output. This is generally achieved by either grafting/budding onto genetically variable seedling rootstocks or using cuttings/marcotts from established parent orchard trees. Micropropagation is carried out by specialist laboratories producing *Musa*, *Carica,* and *Vaccinium* species.

ACHIEVING RELIABLE SUCCESSFUL FRUIT TREE PROPAGATION

All plant propagators have some level of natural ability that usually determines what type of plant they end up propagating. Traditionally, most plant propagators with grafting and/or budding ability usually end up in the fruit tree industry due to the high level of application of those skills in that field. For this reason, the following discussion will be limited to budding and grafting, although many of the general principles discussed can be used with propagation by seedling, cutting or marcotting.

Keep Good Records. To consistently achieve high success rates year after year, it is essential that accurate records be kept as follows:

- Plant genus and species
- Time of year and specific date
- Rootstock condition, maturity, and variety
- Rootstock sap flow
- Scion material condition, maturity, and variety
- Weather conditions—daily and seasonal temperature maximum and minimum.

- Daily humidity
- Daily rainfall
- Number of plants propagated
- Grafting tape and source
- Grafting tools used in operation
- Time of side shoot removal
- After care of plant post grafting
- Success rate of results
- Pest and disease influence

Accurate records enable us to learn from our failures. Remember, if only 1% success is achieved, the potential is there next time to attain 100% success.

Scion Selection and Time for Grafting. Understanding the physiology of your plant in relation to seasonal growth cycles is an essential part of scion selection. Generally, most fruit trees require some rest period to accumulate starches and store food reserves prior to flowering and fruiting. This occurs towards the end of winter for most sub-tropical and temperate fruits that are semi-deciduous or deciduous. The ideal time to graft is just prior to or at the beginning of sap flow in spring. There usually is a period of 10 to 30 days, depending on species and variety, when best results will be achieved. Often in cooler climates budding is carried out in late summer/ early autumn as sap flow slows down. Buds are allowed to remain dormant and rootstocks are cut back in spring to produce strong bud growth.

Rootstock Production. The results of grafting will be good only if rootstocks are healthy and with strong straight roots. Particular attention must be given to vegetative and root pathogens including viruses and nematodes with species such as *Persea*, *Citrus*, *Passiflora*, *Malus*, *Prunus,* and *Macadamia*.

With tropical plants, the rest period occurs during the dry season or between vegetative growth flushes although these may be short in the true wet tropics. Scion material is best collected towards the end of the rest period just before growth commences. This principle also applies to deciduous trees when summer greenstick grafting. Best budding or grafting results are achieved when scion material is selected at the end of the spring/early summer growth flush just prior to commencement of the mid-summer/summer growth period.

Stock/Scion Maturity. Where possible, closely match the maturity of rootstock and scion. Young rootstock in a green condition will readily accept either young or mature scion material. Mature hardwood rootstocks will accept mature scions only. Always avoid grafting young scion material onto old woody rootstocks. Remember "you can graft old or young into young but not young into old".

Do not Propagate Wet Plants. Accurate records over a 12-year period have shown over 99% of major losses have been attributed to budding or grafting during wet weather. Complete losses have been experienced when scion material was collected under wet conditions. When collecting and cutting scion material, be sure to abide by the following rules:

1) Never cut fully turgid scion material during wet weather or early in the morning when laden with dew. Best time to collect material is 10:00 a.m. to 4:00 p.m. or 24 h after the last rainy day. Be sure to quickly remove leaves if scion material is collected during hot dry conditions so as to prevent desiccation.

2) Never graft/bud wet rootstocks.

Bad failures can often be attributed to one of the above, especially (1), when also applied to cuttings and marcotting. There are two main reasons:

1) Fully turgid tissue collected during wet conditions is bruised 5 to 10 cells into the cambium during the grafting operation. This discourages the growth of healthy callus tissue and encourages the development of bacterial soft rots within the graft union.

2) Scion material cut during the wet weather/early morning when fully turgid has stomata and stem lenticels in fully open positions. This encourages the material to lose moisture and desiccate during the healing period following grafting.

Grafting Operation. This is important and must be carried out precisely and correctly. If scion/rootstock maturity is similar, bark/cambium/cortex thickness will be the same and good results will be achieved.

When greenstick micro-grafting or when standard grafting or budding any tree during active growth, retain as much leaf as possible on the rootstock below the graft/bud union. This is important so that the newly developing root system is fed until the developing graft/bud commences growing and produces sufficient leaf to sustain rootstock growth.

Most fruit tree nurseries commonly bud using 'T' or chip buds. Whip (splice), cleft, bark or side grafts are commonly also used. A top-side, half-cleft graft is gaining in popularity in many fruit tree nurseries. This graft is used extensively in Asia and Central America. It enables small scion material to be grafted to rootstocks 2 to 4 times thicker, as shown in Fig. 1.

Many fruit tree nurseries obtain rootstock seed and scion material sources through schemes where parent trees are tested for freedom from plant pathogens.

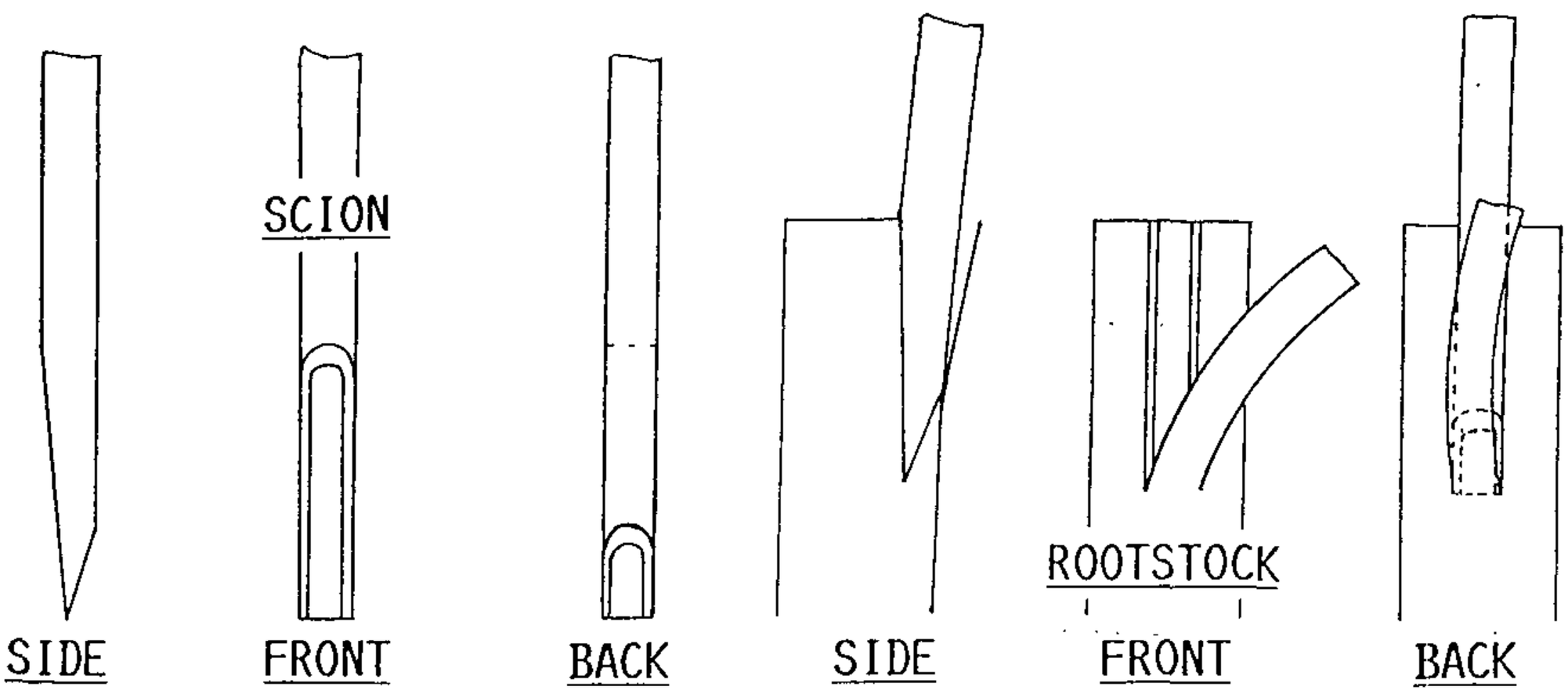

Figure 1. Top side cleft graft.

Also nursery clean-schemes where plants are container bench grown in steam pasteurized potting media and irrigated with chlorinated water ensures freedom from soil-borne pathogens and nematodes.

After Care Following Grafting. Protect newly grafted grafts/buds from:

- Free moisture for at least 2 to 14 days after propagation depending on grafting method used, irrigation system and climate.
- From heat in excess of 35°C by reducing light intensity by at least 30% of previous light intensity used for 10 to 21 days.
- Excessively low humidity—use opaque white plastic bags over grafts or put plant in plastic igloo to maintain optimum humidity levels depending on plant species and propagation technique used.

SUMMARY

In summary, the importance of each step in the production of a grafted/budded plant is as follows:

Operation	Importance (%)
Scion selection/time of grafting	50
Grafting operation/technique	20
After care	15
Rootstock production	15

Naturally, if any one of these steps is incorrect, failures will result. Selection of scion material for grafting or budding is the critical factor of success. The best grafter in the world will achieve poor results when using poorly selected scion material, regardless of his ability to graft.

REMEMBER

Trial + Error = Experience + Success

Be prepared to experiment and through accurate records turn failure into success.