Grafting in the Cultivation of *Kunzea pomifera*©

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***Kunzea pomifera* is an Australian native food species that has a potential place in the fresh berry market. Cultivation of the species could ensure a consistent, high quality, and reliable supply in this market. A potentially useful modification of *K. pomifera* for commercial production is graftage on to a rootstock such as *K. ambigua*. Such grafting could possibly extend its geographical range, increase resistance to root disease, and improve the cultivated form. Wild-collected *K. pomifera* was grafted on to *K. ambigua* rootstock using the side-veneer technique (Garner, 1988; Hartmann, 1997). In this trial a union rate of 50% was achieved which was encouraging, considering that the scion material was collected directly from the wild and the rootstock was pot-bound and the pots were intermittently dried out in the fog house.**

INTRODUCTION

Kunzea pomifera, a coastal and dryland species of south-eastern South Australia and western Victoria, produces a berry having commercial food potential (Graham and Hart, 1997; Beal, pers. comm. 1999; Robins, pers. comm. 2000). The wild fruit has considerable acceptance as a fresh product, particularly as it can be consumed whole without processing. Field observations and industry consultation reveal that there is considerable phenotypic diversity within the species for a number of traits, including desirable canopy structure for ease of harvest and attractive fruit characteristics such as colour size and taste. Although the natural range of the species is contracting, it is not endangered because populations of considerable size still exist in the wild. Accessing these populations is relatively easy, as many occur in close proximity to the coast and road networks of South Australia and western Victoria.

Current commercial interest in the species is based on the fruit, known as muntries or munthari, which is approximately 8 mm in diameter and is typically described as a succulent berry (Wrigley, 1993; Elliot, 1996) with a spicy apple-type flavour. Propagation of *K. pomifera* by seed and cuttings can be undertaken with relative ease (Lethbridge, 1997; Harding, 1999). Current commercial production of muntries is very small, geographically dispersed, and based primarily on harvesting of wild populations. Such an industry, is described by Graham and Hart(1997) as having unknown viability, supply, and market potential. Wild-harvested muntries can be expected to satisfy a restricted market because of its high price and variable quality. Domestication of *K. pomifera* may improve its cultivation potential and offer a consistent supply of uniform quality fruit to the market.

Selection, breeding, and crop management are important components of the domestication process. Domesticating muntries will involve altering potentially important characters such as yield, disease resistance, and fruit quality through objective breeding, selection, and cultivation management (Pickersgill, 1986), which has the potential to transform its status to one of commercial significance. Grafting, an important component of production management, can be used to unite

a horticulturally desirable plant (as a scion) with a related species (as rootstock) adaptable to a broad environmental range. The present study repeats investigations of grafting *K. pomifera* on to *K. ambigua* (Beal, pers. comm., 1999; King, pers. comm., 1999; Dawson pers. comm., 2000) as a probable means of improving the commercial performance of *K. pomifera*.

There are few documented instances of grafting *Kunzea pomifera*. Dawson (1996b) reported that *K. pomifera* grafted on to *K. ambigua* had been undertaken at the Australian National Botanic Gardens (ANBG) and like similar trials (Beal, pers. comm., 1999; King, pers. comm., 1999) details of these grafts are undocumented and unpublished. Two plants at ANBG were grafted in 1973-74 and still survive today (Dawson pers. comm., 2000) indicating the two species may be graft compatible over the long term. A major objective for grafting *K. pomifera* is to raise the prostrate nature for the benefit of crop maintenance. By raising the plant to "working height", activities like pruning and harvesting can become more efficient. Root system improvements may be made by grafting onto selections exhibiting tolerance to root diseases and a wide range of soils. Literature descriptions suggest *K. ambigua* and *K. ericoides* are two related species that exhibit a tall (3 to 4 m) erect morphology, which as a rootstock for *K. pomifera* offer potential for improving commercial production (Kirschbaum and Williams, 1991; Wrigley, 1993; Elliot, 1996; Singer and Burgman, 1999). The current study concentrated on *K. ambigua* because of the previous report of successful grafts with *K. pomifera* (Dawson, 1996b).

MATERIALS AND METHODS

The initial grafting trial was undertaken by side-veneer grafting (Fig. 1.) of *K. pomifera* on to *K. ambigua*. The side-veneer graft was used, as it is easy to apply to the thin wood (<5mm dia.) of the *K. ambigua* rootstock (Garner, 1988). The *K. ambigua* specimens were grown from seed sourced from Nindethana Seeds (W.A) and were approximately 1 m in height at the time of the grafting.

A total of 50 grafts were carried out using semihardwood cuttings approximately 5 mm in diameter at heights of 60 to 80 cm. The cuts were made using a No. 10 disposable scalpel blade, and unions were bound using a flexible self-adhesive bandage "Stericrepe". The main leader of the rootstock was cut and 20% of the foliage below the graft was removed. The plants were then placed in a glasshouse with a compressed air-driven fog system which maintained relative humidity at approximately 90%. The removal of 50% of the remaining leaves on the rootstock was undertaken at scion bud burst, and the remaining leaf material was removed once the scion exhibited vigorous growth.

The successful grafts were then potted into 125-mm pots and placed in an unheated polytunnel to harden off for 4 weeks, before being placed outdoors at the Burnley Nursery. The scions were tip-pruned to thicken growth and all shoots arising from the rootstock were removed during the growing season. Six months after removal from the glasshouse, 12 of the grafted plants were planted in the field for on going assessment.

RESULTS

Grafts that formed callus at the union of the rootstock and scion and exhibit vigorous growth of scions were recorded as successful. Of the 50 grafts taken, 25

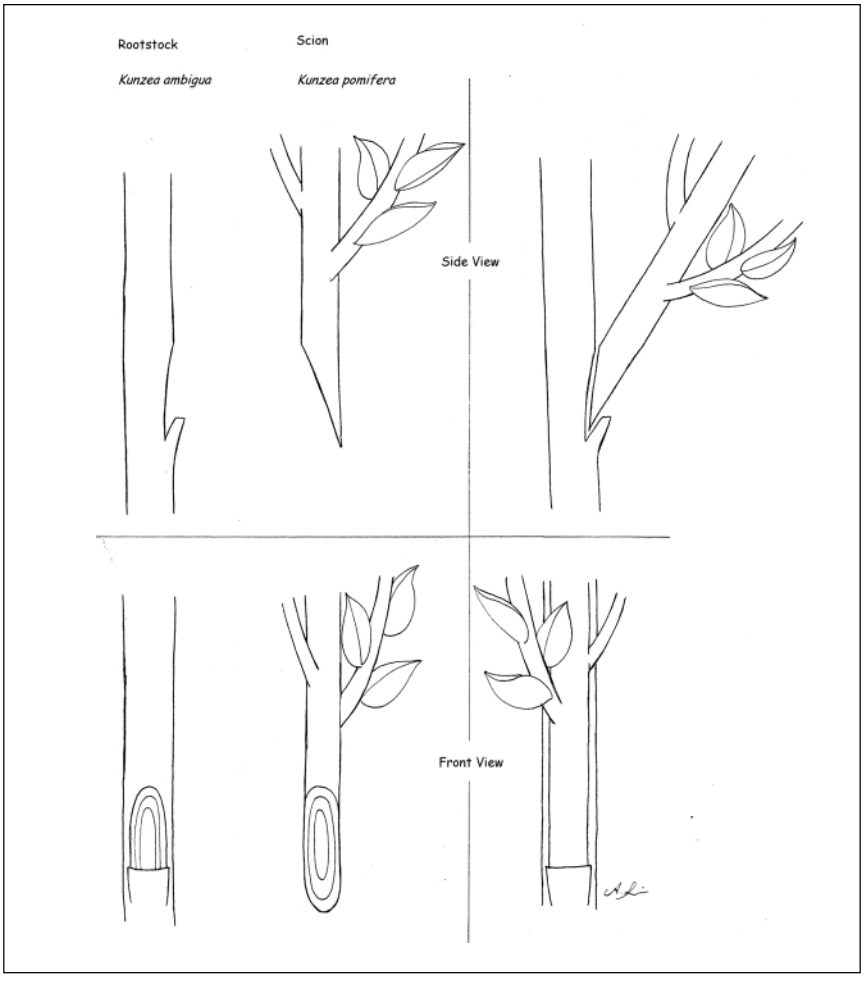

Figure 1. Side veneer graft of *Kunzea pomifera* on to *K. ambigua*.

were successful, giving a success rate of 50%. Of the successful grafts 3 died 5 months after the grafting, but this was due to experimental error rather than graft incompatibility. The remaining 44% (22 plants) survived in pots over 6 months to the present.

DISCUSSION

Particular limitations confronted the current grafting experiment not usually encountered in most grafting studies (Burke, 1983; Crossen, 1990; Hodge, 1990; Hartmann et al., 1997). Firstly the scion material was collected from wild sources and stored at 4^{o}C for 10 days before grafting. Secondly it was collected and grafted during a period of reduced growth in winter. Thirdly the rootstock plants of *K. ambigua* were glasshouse grown in small pots which somewhat restricted their

Table 1. Species proposed as possible sources of rootstocks for grafting with *Kunzea pomifera* (Adapted from Dawson, 1996b).

Scion	Rootstock	Years since graft	Reference
K. affinis	*K. ambigua*	2	McKenzie, 1984
K. affinis	*K. ericoides*	2	McKenzie, 1984
K. baxteri	*K. ambigua*	23	Dawson, 1996b.
K. baxteri	*K. ambigua*	2	McKenzie, 1984
K. baxteri	*K. ericoides*	2	McKenzie, 1984
K. pomifera	*K. ambigua*	23	Dawson, 1996b.
K. pulchella	*K. ericoides*	2	McKenzie, 1984
Kunzea sp.	*K. ambigua*	-	Burke, 1983
Kunzea sp.	*Callistemon citrinus*	-	Burke, 1983

vigour. However a mean graft success of approximately 50% suggests that they unite easily.

Stem strength of the rootstock was inadequate to support the weight of the growing scion, and the bending stems required staking to keep them upright. Although the high planting density and root-bound nature of the rootstock would not have helped, the spindly stems were mainly due to the stem strength of the rootstock selection. The rootstocks were of a commercial source and may have been selected on the basis of ornamental or revegetation features. Selections for these purposes are unlikely to include tall single-stemmed woody characteristics that are important in a production situation. Other cultivated selections of *K. ambigua* exhibit much stronger and woodier stems than the stock used in the present study. A collection program of *K. ambigua* types from natural populations may be required to provide desirable forms having a strong central leader with minimal branching and post-graft sucker shoots as a more suitable stock source for grafting with *K. pomifera.*

Interactions between stock and scion in intra- or inter-specific grafts can potentially alter horticulturally significant traits of the scion such as plant size, habit, vigour, disease resistance, productivity, and fruit characteristics (Garner, 1988). In apples, grafting the same cultivar on to different rootstocks can produce trees varying in vigour from dwarf to tall in stature. Garner (1988) proposed that the rootstock influence over the scion is greater than “vice-versa”, and in relation to fruit, the rootstock can alter traits such as size, yield, quality, and timing of fruit set (Hartmann et al., 1997). The effect of graft interactions on *K. pomifera* scions is largely anecdotal. King (pers. comm. 1999) suggested that 75% of the *K. pomifera / ambigua* grafts exhibited fruiting in the early stages of the trial.

CONCLUSION AND RECOMMENDATIONS

The present study revealed quite a high level of graft compatibilty between *K. pomifera* and *K. ambigua*. The trial did not employ a wide range of plant morpho-

logical variation in *K. ambigua* for use as stock for grafting with *K. pomifera*. The species *K. affinis* and *K. baxteri* have been successfully grafted to both *K. ambigua* and *K. ericoides* (Table 1), which shows a potential for *K. ericoides* to be used as a *K. pomifera* rootstock. Broadening the genetic resource base with *K. ericoides* may lead to environment-specific rootstocks. Published morphological descriptions of *K. ambigua* and *K. ericoides* suggest they have the potential to meet the stem and height requirements (Elliot and Jones, 1996; Kirschbaum and Williams, 1991; Singer and Burgman, 1999; Wrigley and Fagg, 1993), but the selections screened, to date, exhibit a bushy habit with thin flexible stems. Potential rootstocks for *K. pomifera* that exhibit a strong-stemmed upright habit, could be sought through systematic selection from wild populations.

Further grafts will be undertaken using top-wedge, whip, and side veneer grafts. This will help assess the most successful grafts in terms of easiest technique, greatest number of unions, and strongest union. To determine feasibility of grafting in the field, semipermeable plastic bags may be used to maintain humidity (Garner, 1988). To ensure the highest union rate, stock plants will need to be well watered, fertilised, and actively growing during the "grafting season" (Crossen, 1990; Hodge, 1990).

Formative pruning and training of the rootstock might be required to encourage a strong erect central leader. Although a standard form has been favoured for commercial production, other forms like "multiple-branch grafting" could be an option. The results from this encourage further investigations of grafting *K. pomifera* as a scion, encompassing different rootstocks, graft techniques, canopy management, compatibility, and interaction observations.

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Nursery Exports©

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ANALYSING EXPORT ACTIVITY

The Nursery Industry Association of Australia, Australian Horticultural Corporation, and the Horticultural Research and Development Corporation commissioned a project in 1999 to analyse nursery exports. The project considered:

- Extent of exports
- Products and markets
- Pitfalls and successes
- Development and production of a *Beginners Guide for Nursery Export*
- Recommendations for further development

AUSTRALIAN PLANT EXPORTS (ORNAMENTALS)

Less than 5% of plants produced in Australia are exported. Gross value of production of the Australian nursery industry is estimated at $650M.

EXTENT OF EXPORTING?

Approximately 100 nursery businesses, individuals, agencies [Australian Quarantine and Inspection Services (AQIS), Austrade, Environment Australia, etc.] were surveyed. The exporters were identified.

Focus groups, face-to-face interviews, surveys of recent, and established exporters were conducted by questionnaire around Australia.

WHERE TO?

Exports were mostly to Japan, Singapore, USA, Netherlands, and New Zealand.