

# Propagation by cutting-grafting on *Leucospermum patersonii* of *Leucospermum* cultivars: 'Anouk', 'Raziya', 'Succession I' and 'Themba'



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## INTRODUCTION

Commercial cultivation of proteas was introduced in the Canaries in the nineteen eighties. Initially, several species of the genus *Banksia*, *Leucadendron*, *Leucospermum* and *Serruria*, were planted. Currently, *Leucospermum* cultivars are the base of their cultivation. The expansion of crops in areas climatologically suitable for growing these plants, presents difficulties due to the presence of clayey soil, although alkaline-clayey soils may also appear. We have observed that *Leucospermum patersonii*, which is suited to alkaline soils (Vogts, 1982), also tolerates clayey soils (Rodríguez-Pérez, 2007), and therefore appears to be a good rootstock to use in alkaline-clayey soils. Several interesting cultivars of *Leucospermum* selected in South Africa such as 'Anouk' (L. 'Sunrise' × L. 'Tango'), 'Raziya' (L. 'Sunrise' × L. 'Sunrise'), 'Succession I' (L. cordifolium × L. lineare) and 'Themba' (L. 'Caroline' × L. 'High Gold'), could therefore be grafted onto *L. patersonii* cultivated in those kinds of soils.

Different methods have been used in the propagation by grafting of *Leucospermum*, such as wedge grafting, modified chip budding, splice grafting and cutting-grafting (Brits, 1990; Malan, 1992 and 2012; Moffatt

and Turnbull, 1994; Ackerman et al., 1997; Rodríguez-Pérez, 2007; de León-Hernández, 2010). In the first three methods the scion is grafted on rooted cuttings, while in the last, scions are grafted onto unrooted cuttings of the rootstock, then tied to the rootstock and placed in propagating trays with mist, to promote simultaneous rooting of rootstock and graft consolidation, thus affording new grafted plants. Leaf area of scions was reduced to about 0.5 cm<sup>2</sup> to control leaf desiccation (Brits, 1990). Autumn to late winter is probably the best period for grafting (Brits, 1990).

In propagation by cuttings of *Leucospermum*, the standard rooting medium is a mixture of peat moss and polystyrene grains (Jacobs and Steenkamp, 1975; Malan, 1992; Rodríguez-Pérez, 2007). The basal wounding technique alone or combined with other treatments (IBA) has been used to stimulate root formation in some proteas (Rodríguez-Pérez, 1990; Rodríguez-Pérez et al., 1997; Rodríguez-Pérez et al., 2003; Rodríguez-Pérez et al., 2014).

The present study was carried out in order to assess the propagation by cutting-grafting on *L. patersonii* of the *Leucospermum* cultivars cited above, as there was no information available.



Grafting on *L. patersonii* of *L. 'Succession I'*, *L. 'Anouk'*, *L. 'Themba'* y *L. 'Raziya'* scions, respectively (from left to right).

## MATERIAL AND METHODS

The assays were carried out between December 2012 and April 2013 at the Escuela T.S. de Ingeniería Agraria, (currently Higher Polytechnic School of Engineering, Agricultural Engineering Section) University of La Laguna, Tenerife, Canary Islands, Spain (28° 29' N).

The wedge grafting technique was used. Scions, 5-7 cm long, with 4 leaves, were prepared from terminal semi-hardwood stems of cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba'. At the basal end, two sloping cuts, 2 cm long, were made to form a wedge.

Terminal semi-hardwood cuttings of *L. patersonii*, 15-20 cm long, from the current season's growth were employed as rootstocks. Cuttings were deheaded and several leaves from the base and top of the cuttings were removed, leaving a few leaves on the central section of the cutting. A 2 cm-long incision was made vertically at the top of the cutting, where the scion was inserted. The scion was tied in place with 10 cm long parafilm strips. 25 scions of each cultivar were grafted, making a total number of 100 grafts. The scion was considered to have taken when the first shoot was about 2 cm long.

A fresh cut 1 cm long was made at the base of the unrooted cutting-grafts. Then they were wounded (two shallow opposite incisions were

made in the basal bark, penetrating as far as the outer cortex and extending upwards for about 2 cm). The basal 2 mm was dipped into a 4000-ppm solution of IBA for five seconds, followed by a dip in talc containing carbendazim at 5% of active matter concentration, before planting them in the rooting media in plastic propagating trays. The trays were placed on a bed with bottom heat (22 ± 2 °C) under a fog system in a glasshouse, with 50% reduction of natural light. Day ventilation started when the temperature rose above 20°C. The fog system started to operate when the relative humidity of the air was less than 70 ± 2%. Cutting-grafts were sprayed weekly with the recommended fungicides to control diseases.

A modified scale designed by Criley and Parvin (1979) was used to score rooting in order to provide a rooting index (RI): 0 = dead; 1 = without callus; 2 = callus; 3 = poorly rooted (3-6 roots); 4 = fairly rooted (6-12 roots); and 5 = transplantable (>12 roots).

Chi square tests for independence were performed on data of grafted plants at 10, 12 and 14 weeks from grafting. Analysis of variance was performed on rooting data after arcsine transformation using SPSS 14.0 software. Significant differences in means were separated using Duncan's multiple comparison test.



Fog-system detail.

Cutting-grafting in propagation trays



Rooted cuttings of 'Anouk', 'Raziya', 'Succession I' and 'Themba' cultivars of *Leucospermum* (two of each, from left to right).

## RESULTS

The percentages of grafted plants obtained from the different cultivars at 10, 12 and 14 weeks from the beginning of the trial can be seen in Table 1.

At 12 weeks the percentage of plants grafted from the cultivar 'Anouk' (56%) was significantly different from the other cultivars ( $P < 0.05$ ), among which there were no significant differences. This behaviour was maintained until the end of the trial, at 14 weeks, when Anouk yielded 64% grafted plants, while the other cultivars showed values below 25%.

Table 1. Percentages of grafted plants obtained from cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba' of *Leucospermum* using *L. patersonii* as rootstock at 10, 12, and 14 weeks from the beginning of the trial.

Cultivar	10 weeks	Grafted plants (%) 12 weeks	14 weeks
'Anouk'	32 <sup>a</sup>	56 <sup>a</sup>	64 <sup>a</sup>
'Raziya'	4 <sup>b</sup>	24 <sup>b</sup>	24 <sup>b</sup>
'Succession I'	16 <sup>b</sup>	20 <sup>b</sup>	20 <sup>b</sup>
'Themba'	0 <sup>c</sup>	24 <sup>b</sup>	24 <sup>b</sup>

Within the same column values that show the same letter are not significantly different ( $P > 0.05$  to 5%).

The rooting indices of the different cultivars at 10, 12 and 14 weeks from the beginning of the trial can be seen in Table 2.

At 6 weeks there were no differences among cultivars.

However, at 10 weeks, 'Anouk' gave an index of 2.84, significantly different from that for 'Raziya' ( $P < 0.05$ ), but not from the other cultivars. This behaviour was maintained until the end of the trial, at 14 weeks.

Table 2. Rooting index of cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba' of *Leucospermum* using *L. patersonii* as rootstock at 6, 10 and 14 weeks from the beginning of the trial.

Cultivar	Rooting index		
	6 weeks	10 weeks	14 weeks
'Anouk'	2.36 <sup>a</sup>	2.84 <sup>a</sup>	2.92 <sup>a</sup>
'Raziya'	1.80 <sup>a</sup>	1.72 <sup>a</sup>	1.64 <sup>a</sup>
'Succession I'	1.64 <sup>a</sup>	1.84 <sup>a</sup>	1.88 <sup>a</sup>
'Themba'	1.68 <sup>a</sup>	2.00 <sup>a</sup>	1.88 <sup>a</sup>

Within the same column values that show the same letter are not significantly different ( $P > 0.05$  to 5%).



Grafted plants of *L. 'Succession I'*, *L. 'Anouk'*, *L. 'Themba'* y *L. 'Raziya'* (from left to right)



*Leucospermum* 'Succession I'

*Leucospermum* 'Anouk'

*Leucospermum* 'Themba'

*Leucospermum* 'Raziya'

## DISCUSION

Cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba' of *Leucospermum* can be propagated by cutting-grafting using the wedge grafting technique, but the percentage of grafted plants was low, not exceeding 24%, with the exception of 'Anouk' which gave 64% of grafted plants and an acceptable rooting index.

León-Hernández et al. (2010) obtained in 6 weeks 80% of grafted plants of *Leucospermum* 'High Gold' onto *L. patersonii*. Ackerman et al. (1997) grafted 6 cultivars of *Leucospermum* on the lime-tolerant rootstocks *L. 'Nemastrong'* and *'Carmel'*, using the cutting-grafting method, observing that the grafting and rooting success rates were affected by the rootstock, cultivar and season. In this work, the different genetic composition of the cultivars may have influenced the results.

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## CONCLUSIONS

- Under the conditions of this experiment, it is advisable to use the *L. patersonii* rootstock for propagation of the cultivar 'Anouk' by cutting-grafting.

- The percentages of grafted plants obtained from the other cultivars were low from the commercial point of view, so this propagation method is not recommended under the assayed conditions.