

# Propagation by grafting on *Leucospermum patersonii* and *L. 'Spider'* of *Leucospermum* cultivars: 'Anouk', 'Raziya', 'Succession I' and 'Themba'



A.M. de León-Hernández<sup>1,\*</sup>, M.C. Vera-Batista<sup>1</sup>, V. Herrera-González<sup>1</sup>, M. Hernández<sup>1</sup>, I. Rodríguez-Hernández<sup>1</sup> and J.A. Rodríguez-Pérez<sup>1</sup>

<sup>1</sup>Agricultural Engineering Section, Department of Agricultural and Environmental Engineering, Higher Polytechnic School of Engineering, University of La Laguna, 38071 Tenerife, Canary Islands, Spain; <sup>2</sup>Instituto de Productos Naturales y Agrobiología, Consejo Superior de Investigaciones Científicas, Avenida Astrofísico Francisco Sánchez, 3, La Laguna, 38206, Tenerife, Spain.

\*E-mail: amleon@ull.es

## ABSTRACT

*Leucospermum* forms the foundation of protea cultivation in the Canary Islands. Areas potentially suitable for cultivation have clayey or alkaline-clayey soils. The use of tolerant rootstocks to this type of soils, such as *Leucospermum patersonii* or *L. 'Spider'*, could allow plantings in them. This study was carried out to evaluate the propagation by grafting of the *Leucospermum* cultivars 'Anouk', 'Raziya', 'Succession I', and 'Themba' on *L. patersonii* and *L. 'Spider'* rootstocks. Scions were grafted onto one-month-

old rooted cuttings of *L. patersonii* and *L. 'Spider'*, growing in plastic pots, located in a well ventilated greenhouse, with 50% shade. In the former, the wedge graft was used, and in the latter, the splice graft. Twenty-five scions of each cultivar were grafted onto each of the two rootstocks. The total number of grafts of each rootstock was 100. At the end of the trial, when grafting onto *L. patersonii* is considered, 76% of 'Anouk' grafts were successful, which differed significantly from 'Themba' (40%), but not from the other cultivars.

When considering grafting onto *L. 'Spider'*, there were no significant differences between the cultivars, with 'Anouk' and 'Raziya' showing the highest percentages of grafted plants, 44% and 40%, respectively.

Keywords: alkaline soils, clayey soils, cut flowers, proteas, *Proteaceae*

## INTRODUCTION

The development of proteas cultivation in the Canary Islands, has been based in recent years on *Leucospermum* cultivars, such as 'High Gold', 'Tango' and 'Succession I'. The expansion of crops in climatologically suitable areas for growing these plants, presents difficulties due to the presence of clayey soil, although alkaline-clayey soils may also be present. We have observed that *Leucospermum patersonii*, suited to alkaline soils (Vogts, 1982), tolerates clayey soils (Rodríguez-Pérez, 2007), and therefore appears to be a good rootstock to use in alkaline-clayey soils. *L. 'Spider'* (*L. tottum* × *L. formosum*) has been selected in South Africa as rootstock for clayey soils. Malan (2012) reports the existence of a plantation in South Africa of *L. 'High Gold'*, grafted on *L. 'Spider'*, growing in clayey soil. Several interesting cultivars of *Leucospermum* 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'*), selected in South Africa, grafted onto *L. patersonii* or *L. 'Spider'* could then be cultivated in these soil types.

Different grafting methods have been used in the propagation of *Leucospermum*, such as wedge graft, modified chip budding, splice graft and cutting-grafting (Brits, 1990; Malan, 1992 and 2012; Moffatt and Turnbull, 1994; Ackerman et al., 1997; Rodríguez-Pérez, 2007; de León-Hernández et al., 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 establishment of the graft union, thus affording new grafted plants. Leaf area reduction of scions has been used to control leaf desiccation. Leaf surface area is reduced to approximately 0.5 cm<sup>2</sup> (Brits, 1990). Autumn to late winter is probably the best period for grafting (Brits, 1990).

This study was carried out to evaluate the propagation of the *Leucospermum* cultivars cited above, by means of grafting onto *L. patersonii* and *L. 'Spider'* rootstocks, as there was no information available for these specific scion and rootstock combinations.



*Leucospermum patersonii*

*Leucospermum 'Spider'*

## MATERIAL AND METHODS

### General aspects

The assays were carried out between February and May 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).

Rooted one-month-old cuttings of *L. patersonii* and *L. 'Spider'* grown in plastic pots of 14 cm in diameter, containing a substrate composed of a mixture of peat moss/ volcanic ashes (1: 3 in volume), located in a well-ventilated greenhouse, with 50% shade, were grafted with scions from the cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba'. Twenty-five scions of each cultivar were grafted onto each of the two rootstocks. The total number of grafts onto each rootstock was 100. The graft was considered successful when the first shoot of about 2cm long was produced by the scion.

Chi square tests for independence were performed at 10, 12 and 14 weeks from grafting on data of grafted plants.

### Grafting on *L. patersonii*

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

Rooted cuttings were deheaded and several leaves from the top were removed. A 2 cm vertical cut was made at the top of the cutting, where the scion was inserted. The scion was tied in place with parafilm® (Bemis Company, Inc., Neenah, WI, USA) strips. Scions were covered with a small white polyethylene bag to reduce desiccation.

### Grafting on *L. 'Spider'*

The splice grafting method was used. Scions, 5-7 cm long, with 4 leaves, were prepared from terminal semi-hardwood stems of the cultivars 'Anouk',

'Raziya', 'Succession I' and 'Themba'.

As with *L. patersonii*, rooted cuttings were deheaded and several leaves from the top were removed. At the apex of the rooted *L. 'Spider'* cutting and at the basal end of the scion, a sloping cut was made with the same angle. The cut surface of the scion was matched to the cut surface of the rootstock and tied with parafilm® strips.

## RESULTS AND DISCUSSION

### Grafting on *L. patersonii*

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

At 10 weeks the percentage of plants grafted of the cultivar 'Anouk' (84%) was significantly different from the cultivar 'Themba' (52%), but not from the other cultivars ( $P < 0.05$ ). This behavior of the cultivars is maintained during the experiment until its completion at 14 weeks. At that moment, 'Anouk' gave the highest grafted plants percentage (76%) followed by 'Raziya' (56%). In general, the percentage of grafted plants obtained was greater than 50%. Ackerman et al. (1997) grafted six cultivars of *Leucospermum* onto lime-tolerant rootstocks *L. 'Nemastrong'* and *L. 'Carmeli'*, observing that the grafting and rooting success rates were affected by the rootstock, the cultivar and the season. In this study, the different genetic composition of the rootstocks and cultivars and the grafting methods may have also influenced the results.

Table 1. Percentages of grafted plants obtained of 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.

Rootstock	Scion	Grafted plants (%)		
		10 weeks	12 weeks	14 weeks
<i>L. patersonii</i>	'Anouk'	84 <sup>a</sup>	76 <sup>a</sup>	76 <sup>a</sup>
	'Raziya'	72 <sup>a</sup>	64 <sup>a</sup>	56 <sup>a</sup>
	'Succession I'	56 <sup>a</sup>	52 <sup>a</sup>	52 <sup>a</sup>
	'Themba'	52 <sup>a</sup>	40 <sup>b</sup>	40 <sup>b</sup>

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

### Grafting on *L. 'Spider'*

Table 2 shows the results corresponding to the percentages of grafted plants obtained of the different cultivars, at 10, 12 and 14 weeks from the beginning of the trial.

At 10 weeks the cultivar 'Raziya' showed the highest percentage of grafted plants (48%), followed by 'Anouk' and 'Succession I' (44% each). There were no significant differences between the cultivars, behavior that is maintained until the end of the trial, at 14 weeks. At that time, the cultivar 'Anouk' gave the highest percentage of grafted plants (44%), followed by 'Raziya' (40%). The grafted plants percentages obtained were low, less than 45%.

Table 2. Percentages of grafted plants obtained of cultivars 'Anouk', 'Raziya', 'Succession I' and 'Themba' of *Leucospermum* using *L. 'Spider'* as rootstock at 10, 12, and 14 weeks from the beginning of the trial.

Rootstock	Scion	Grafted plants (%)		
		10 weeks	12 weeks	14 weeks
<i>L. 'Spider'</i>	'Anouk'	44 <sup>a</sup>	44 <sup>a</sup>	44 <sup>a</sup>
	'Raziya'	48 <sup>a</sup>	40 <sup>a</sup>	40 <sup>a</sup>
	'Succession I'	44 <sup>a</sup>	36 <sup>a</sup>	32 <sup>a</sup>
	'Themba'	32 <sup>a</sup>	28 <sup>a</sup>	24 <sup>a</sup>

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

## CONCLUSIONS

The following conclusions can be drawn from the study

- Both *L. patersonii* and *L. 'Spider'* can be used for the propagation of 'Anouk', 'Raziya', 'Succession I' and 'Themba' cultivars by grafting.
- In the case of the *L. patersonii* rootstock, using the wedge grafting technique, all cultivars, except the cultivar 'Succession I', gave percentages of grafted plants higher than 50%.
- Regarding the *L. 'Spider'* rootstock, in which the splice grafting method was used, all cultivars showed percentages of grafted plants lower than 45%, so it would be convenient to repeat the test using the wedge grafting method to observe if, with that method, better results can be achieved.

## Literature cited

Ackerman, A., Gilad, S., Mechnik, B., Shohri, Y., and Ben-Jaacov, J. (1997). "Cuttings-grafts" for *Leucospermum* and *Leucadendron*. A Method for Quick Propagation by Simultaneous Rooting and Grafting. *Acta Hort.* 453, 15-27. <http://dx.doi.org/10.17660/ActaHortic.1997.453.1>

Brits, G.J. (1990). Rootstock production research in *Leucospermum* and *Protea*. I. Techniques. *Acta Hort.* 264, 9-25. <http://dx.doi.org/10.17660/ActaHortic.1990.264.1>

De León-Hernández, A.M. (2010). Effect of Wounding, Rooting Media, and Reduction of Foliar Area of the Scions on Cutting Grafting of *Leucospermum 'High Gold'* on *L. patersonii*. *Acta Hort.* 869, 109-112. <http://dx.doi.org/10.17660/ActaHortic.2010.869.12>

Malan, D.G. (1992). Propagation of *Proteaceae*. *Acta Hort.* 316, 27-34. <http://dx.doi.org/10.17660/ActaHortic.1992.316.5>

Malan, D.G. (2012). *Protea* Cultivation. From Concept to Carton. (Sun Media, Stellenbosch, South Africa), pp.298.

Moffatt, J. and Turnbull, L. (1994). Grafting proteas. (Nanju Protea Nursery, Toowoomba, Australia), pp.47.

Rodríguez Pérez, J.A. (2007). El cultivo de las proteas sudfricanas y su desarrollo en Canarias. (Turquesa Ediciones, Santa Cruz de Tenerife, Spain), pp.123.

Vogts, M. (1982). South Africa's Proteaceae. Know them and Grow them. (C.Struik, Cape Town, South Africa), pp.240.



Rootstocks rooting of *L. patersonii* and *L. 'Spider'* on a bed with bottom heat (22 ± 2°C)



Cutting of *Leucospermum 'Spider'* prepared for rooting



Plants of *Leucospermum patersonii* and *L. 'Spider'* in plastic pots



Rootstocks ready for grafting: vertical cut in *L. patersonii* and a sloping cut in *L. 'Spider'*



Grafts of *L. 'Spider'* of *L. 'Succession I'*, *L. 'Anouk'*, *L. 'Themba'* and *L. 'Raziya'*



Grafts placed in a well-ventilated greenhouse, with 50% of reduction of natural light. Scions were covered with a small white polyethylene bag to reduce its desiccation.