Universidad de La Laguna

Department of Agricultural and Environment Engineering

# Effect of Wounding and Reduction of Foliar Area of Scions on Cutting-grafting of *Leucospermum* 'Rigoletto' onto *L. patersonii*

*M.C. Vera-Batista, A.M. de León-Hernández, J.C. Martín-Luis, I. Rodríguez-Hernández and J.A. Rodríguez-Pérez*

Universidad de La Laguna

Department of Agricultural and Environment Engineering

# INTRODUCTION

- ***Leucospermum*** **'Rigoletto'** (*L. cordifolium* × *L. glabrum*) is a cultivar selected in South Africa and evaluated on Tenerife in clayey soil with unsatisfactory results.
- Grafting on a rootstock tolerant to clayey soils may allow it to grow in that type of soil.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- On this island many of the soils in areas suitable for cultivation of proteas are clayey or alkaline-clayey.
- We have observed that ***Leucospermum patersonii*** is suited to alkaline soils (Vogts, 1982) and tolerates clayey soils (Rodríguez-Pérez, 2007).

- It therefore appears to be a good rootstock to use in this type 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.

- In the first three methods the scion is grafted onto rooted cuttings, while in the last, scions are grafted on unrooted cuttings of the rootstock.

- These are 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.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- Leaf area reduction of scions has been used to control leaf desiccation.
- Leaf surface area is reduced approximately to about 0.5 cm2 (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.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The basal wounding technique alone or combined with other treatments (IBA) has been used to stimulate root formation in some proteas

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The present study was carried out in order to study the influence of wounding and reduction of foliar area of the scions on cutting-grafting of ***L.*** **'Rigoletto'**on ***L. patersonii***, as no information about it was available.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

# MATERIALS AND METHODS

- The assay was carried out between autumn-winter (October-March) 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 (28º 29´N).

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The experimental design was a completely randomized block with 2 x 2 treatments (10 cuttings per treatment) and 4 replications.
- The total number of cuttings was 160.
- The treatments consisted of reducing the leaves of the scion or not, with or without wounding of cuttings.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The wedge grafting technique was used. Scions 5-7 cm long, with 4 leaves, were prepared from terminal semi-hardwood stems of cultivar '**Rigoletto**'.
- At the basal end, two sloping cuts, 2 cm long, were made to form a wedge.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- Terminal semi-hardwood cuttings of *L. patersonii*, 16 cm long, from the current season´s growth were employed as rootstocks.
- Cuttings were deheaded and several leaves from the base and the top of the cuttings were removed, leaving a few leaves on the central section of the cutting.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- A vertical cut was made at the top of the cutting, 2 cm long, where the scion was inserted.
- The scion was tied in place with 10 cm long parafilm strips.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- 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) or not, according to the treatment.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The basal 2 mm was then dipped into a 4000-ppm solution of IBA for five seconds, followed by a dip in talc containing carbendazime at 5% of active matter concentration, before planting them in the rooting media, in plastic propagating trays.

- At that point, the leaves of the scion were reduced by 2/3.
- The trays were placed on a bed with bottom heat (22 ± 2º C) under a fog system in a glasshouse, with 50% reduction of natural light.
- Day ventilation started when the temperature rose above 20º C.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- Fog started to flow when the relative humidity of the air was less than 70 ± 2 %
- Cutting-grafts were sprayed weekly with the recommended fungicides to control diseases.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- From the sixth week after planting, the percentages of grafted plants were evaluated every two weeks.
- A modified scale designed by Criley and Parvin (1979) was used to score rooting at the same time in order to establish a rooting index (RI): 0 = dead; 1 = without callus; 2 = with callus; 3 = with roots but not transplantable; 4 = transplantable.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- The results corresponding to percentages of grafted plants and RI were subjected to analysis of variance, after arcsine transformation.
- Significant differences in means were separated using Duncan´s multiple comparison test.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

## RESULTS AND DISCUSSION

- At 12 weeks from planting, the combination of scions with unreduced leaves + wounded cuttings produced 52.5% of grafted plants, followed by the combination of scions with unreduced leaves + unwounded cuttings (47.5%).
- There were no significant differences among treatments.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatments | Percentages of grafted plants at 12 weeks from planting |
|---|---|
| UL, UW | 47.5 a |
| RL, UW | 25.0 a |
| UL, W | 52.5 a |
| RL, W | 45.0 a |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

- Ackerman et al. (1997) obtained percentages of grafted plants of ***L.*** **'High Gold'** in 4-8 weeks, using ***L. patersonii*** **'Carmeli'** as a rootstock, which varied from 66 to 85%.
- León-Hernández et al. (2010) obtained 80% of grafted plants of the same cultivar grafted on ***L. patersonii*** in 6 weeks (scion with unreduced leaves and unwounded rootstock).

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- This faster production of grafted plants could be due to the fact that ***L. patersonii*** is one of the parents of ***L.*** **'High Gold'**, and therefore with greater genetic proximity.

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- In the following weeks, the percentage of grafted plants progressively increased.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatments | Percentages of grafted plants at 16 weeks from planting |
|---|---|
| UL, UW | 57.5 a |
| RL, UW | 35.0 a |
| UL, W | 62.5 a |
| RL, W | 57.5 a |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- At the end of the assay, at 20 weeks, treatments with unreduced leaves showed grafted plant percentages higher than 70%.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatments | Percentages of grafted plants at 20 weeks from planting |
|---|---|
| UL, UW | 77.5 a |
| RL, UW | 37.5 b |
| UL, W | 72.5 a |
| RL, W | 65.0 a |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- At that stage, the combination of scions with unreduced leaves + unwounded cuttings gave 77.5% of grafted plants, followed by the combination of scions with unreduced leaves + wounded cuttings (72.5%).

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatments | Percentages of grafted plants at 20 weeks from planting |
|---|---|
| UL, UW | 77.5 a |
| RL, UW | 37.5 b |
| UL, W | 72.5 a |
| RL, W | 65.0 a |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- There were no significant differences among treatments except for the scions with reduced leaves + unwounded cuttings, which only showed 37.5% of grafted plants.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatments | Percentages of grafted plants at 20 weeks from planting |
|---|---|
| UL, UW | 77.5 a |
| RL, UW | 37.5 b |
| UL, W | 72.5 a |
| RL, W | 65.0 a |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- Scion leaf reduction had a significant negative effect on the success of grafting.
- Wounding and leaf state × wounding interaction were not significant.

| Treatment | | Grafted plants (%) |
|---|---|---|
| ***Leaf state*** | | |
| | **Unreduced** | **47.8** |
| | **Reduced** | **23.3** |
| ***Wounding*** | | |
| | **Unwounded** | **36.0** |
| | **Wounded** | **49.6** |
| ***Significance*** | | |
| **Leaf state** | **P<0.05** | |
| **Wounding** | **n.s.[1]** | |
| **Leaf state × wounding** | **n.s.** | |

n.s.[1] : not significant

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- At 12 weeks, the combination of scions with unreduced leaves + wounded cuttings gave a RI of 3.08, significantly greater than the 2.45 obtained with reduced leaves + wounded cuttings ($P<0.05$) treatment, but not from the others.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatment | Rooting Index | | |
|---|---|---|---|
| | 12 weeks | 16 weeks | 20 weeks |
| UL, UW | $2.68^{ab}$ | $3.15^{ab}$ | $3.50^{a}$ |
| RL, UW | $2.45^{b}$ | $2.83^{b}$ | $2.95^{b}$ |
| UL, W | $3.08^{a}$ | $3.33^{a}$ | $3.50^{a}$ |
| RL, W | $2.88^{ab}$ | $3.35^{a}$ | $3.48^{a}$ |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

Universidad de La Laguna

Department of Agricultural and Environment Engineering

- This behaviour was maintained until the end of the trial, at 20 weeks.

**Treatments that show the same letter are not significantly different at the 5% level.**

| Treatment | Rooting Index | | |
|---|---|---|---|
| | 12 weeks | 16 weeks | 20 weeks |
| UL, UW | 2.68$^{ab}$ | 3.15$^{ab}$ | 3.50$^{a}$ |
| RL, UW | 2.45$^{b}$ | 2.83$^{b}$ | 2.95$^{b}$ |
| UL, W | 3.08$^{a}$ | 3.33$^{a}$ | 3.50$^{a}$ |
| RL, W | 2.88$^{ab}$ | 3.35$^{a}$ | 3.48$^{a}$ |

***Treatments notation: UL = unreduced leafs; RL = reduced leafs; UW = unwounded; W = wounded***

- At that final stage, leaf state, wounding, and leaf state × wounding significantly influenced the rooting index.

| Treatment | | Rooting index |
|---|---|---|
| ***Leaf state*** | | |
| | **Unreduced** | **3.50** |
| | **Reduced** | **3.21** |
| ***Wounding*** | | |
| | **Unwounded** | **3.22** |
| | **Wounded** | **3.49** |
| ***Significance*** | | |
| **Leaf state** | **P<0.05** | |
| **Wounding** | **P<0.05** | |
| **Leaf state × wounding** | **P<0.05** | |

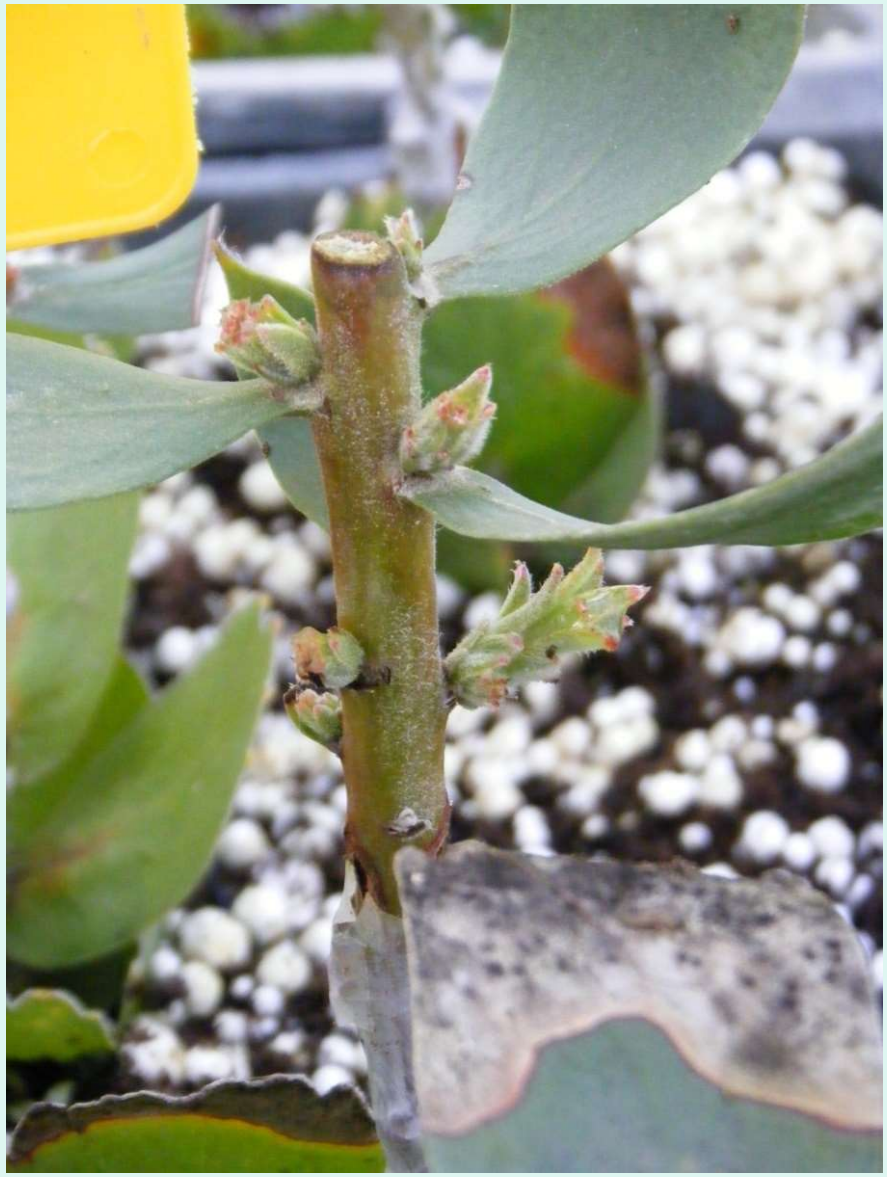
Universidad de La Laguna

Department of Agricultural and Environment Engineering

# CONCLUSIONS

- In summary, it can be concluded that under conditions similar to those in which this assay was performed, it appears to be recommendable to use the combination of unreduced leaves + unwounded or wounded cuttings to obtain satisfactory grafting percentages and rooting indices of ***Leucospermum*** **'Rigoletto'** plants grafted on ***L. patersonii***.

# Grafted plants of ***L.*** **'Rigoletto'** onto ***L. patersonii***



Grafted plants of ***L.*** **'Rigoletto'** onto ***L. patersonii***

# THANK YOU FOR YOUR ATTENTION