



**DECLARATION**

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.



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**Signature**

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**Date**

## SUMMARY

The occurrence of both pre- and postharvest leaf blackening in certain *Protea* species and cultivars is a problem that severely limits their marketability, vase life and transport options. This research focuses on : (I) The distribution of carbohydrates in inflorescence bearing stems of certain *Protea* cultivars from harvest, following pulsing with a 10 g.L<sup>-1</sup> glucose solution until four weeks postharvest. Stems were held under a variety of postharvest conditions, and (II) The suppression of *Protea* postharvest leaf blackening with specific focus on the cultivar 'Sylvia' (*P. eximia* x *P. susannae*).

High levels of polygalatol occurred in all shoots and shoot parts of 'Sylvia' before and following the pulsing treatment. Concentrations of polygalatol remained fairly constant in all shoot parts over time and therefore it can be concluded that this carbohydrate does not contribute to the carbohydrate metabolic pool and is unavailable for metabolism. It appears that stems contain significant amounts of reserve carbohydrates in the form of glucose, fructose and sucrose but very little starch and can function as a storage area for carbohydrate reserves. Leaves contain significant amounts of reserve carbohydrates in the form of glucose, sucrose, fructose and starch. Glucose appears to be rapidly converted to starch in the leaves of certain *Protea* but this does not occur in the stems. The inflorescences, stems and leaves of *Proteas* have all been shown to contain carbohydrates that can function as reserve metabolites. The metabolically active carbohydrate pool therefore consists of sugars that occur in the inflorescences, leaves and stems as well as starch from the leaves.

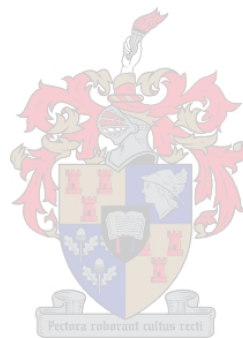
Directly following the pulsing most of the glucose was located in the stems. This implies that the stems act as an important reservoir of glucose when shoots are pulsed. The decrease in the glucose concentration in the stems after pulsing indicates that slow transport of the glucose to other shoot parts took place during storage. An increase in the starch concentration occurred in the leaves of 'Sylvia' directly after the glucose pulsing treatment. It appears, therefore, that glucose is rapidly converted into starch in the leaves but not in the stems of 'Sylvia'. This occurrence seems to be cultivar specific. The concentrations of both glucose and sucrose decrease most rapidly in glucose pulsed 'Sylvia' shoots and they are therefore the main reserve carbohydrates present. Reserve carbohydrates decrease at a slower rate in 'Sylvia' shoots stored at lower temperatures than in those shoots held at higher temperatures.

The relationship between reserve carbohydrates, particularly glucose, and postharvest leaf blackening is now well established.

Prohexadione-calcium had no effect in delaying or preventing postharvest leaf blackening when applied to 'Sylvia' *Protea* plants. Paclobutrazol significantly inhibited the elongation of shoots of 'Sylvia' when applied as a soil drench. Levels of cumulative

postharvest leaf blackening were significantly lower on shoots harvested from plants treated with Paclobutrazol when compared to control shoots. However, the removal of the spring growth flush had no significant influence on the level of postharvest leaf blackening when compared to the control. This indicates that Paclobutrazol does not inhibit postharvest leaf blackening through the suppression of stem elongation but it appears that blackening is possibly enhanced by high levels of gibberellins present in the plants or shoot removal occurred too late to have an effect.

The rate and severity of postharvest leaf blackening on 'Sylvia' inflorescence bearing shoots increased dramatically during the spring and early summer months in the Western Cape Province of South Africa. It was shown that following an excessively warm period of weather, preharvest leaf blackening symptoms (of a similar nature to postharvest symptoms) began to appear on inflorescence bearing shoots. Symptoms appeared first and were most severe on those shoots that subtended inflorescences that were nearing commercial maturity.



## OPSOMMING

Die voorkoms van beide voor en na-oes blaarverswaring in sekere *Protea* soorte en kultivars is ñ probleem wat bemerking, vaaslewe en vervoeropsies kwaai beperk. Hierdie navorsing fokus op: (I) die verspreiding van koolhidrate in blom draende stamme van sekere *Protea* kultivars vanaf oestyd en dan gedoop in ñ oplossing van  $10 \text{ g.L}^{-1}$  glukose oor ñ periode van vier weke na oestyd. Lote is onder verskeie na-oes toestande behandel. (II) Die beheer van *Protea* na-oes swart blaarvlek, met spesifieke verwysing na die kultivar 'Sylvia' (*P. eximia* x *P. susannae*).

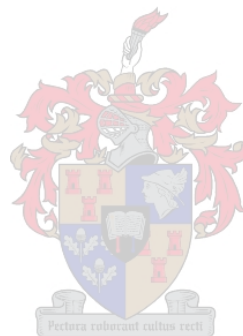
Hoë vlakke van polygalatol het in al die lote en spruite van 'Sylvia' voorgekom voor en na die doop behandeling. Konsentrasies van polygalatol het redelik konstant gebly in al die lootkomponente. Dit kan dus aangeneem word dat hierdie koolhidraat nie bydra tot die metaboliese pool koolhidraat nie en is derhalwe nie beskikbaar vir metabolisme nie. Dit wil voorkom asof die steel aansienlike hoeveelhede reserwes koolhidrate bevat in die vorm van glukose, sukrose, frukose en stysel. Dit wil voorkom asof glukose vinnig omskep word in stysel in die blare van sekere *Protea* soorte, maar dit vind nie plaas in die stele nie. Die blomkoppe, stele en blare van *Proteas* het getoon dat hulle koolhidrate bevat wat as reserwe metabolites kan funksioneer. Die metaboliese aktiewe koolhidraatpool bestaan dus uit suikers in die blomkoppe, blare en stele, sowel as stysel in die blare.

Direk na die pulseringsproses het die meeste glukose in die stele voorgekom. Dit lyk asof die stele optree as 'n belangrike stoorplek vir glukose na pulsering. Die afname in die glukose konsentrasie in die stamme na die dopery verklaar dat die stadige vervoer van die glukose na ander lootdele geskied. ñ Verhoging in die stysel konsentrasie het in die blare van 'Sylvia' plaasgevind direk na die glukose behandeling. Dit wil dus voorkom dat glukose omgesit word in stysel in die blare maar nie in die stele van 'Sylvia' nie. Hierdie voorkoms skyn kultivar gebonde te wees. Die konsentrasies van beide glukose en sukrose neem die vinnigste af in glukosebehandelde 'Sylvia' stele en hulle is dus die hoof reserwe koolhidrate wat teenwoordig is. Reserwe koolhidrate neem in 'Sylvia' lote af teen 'n stadiger tempo as hulle teen laer temperature geberg word in vergelyking met stamme wat teen hoër temperature gestoor word. Die verhouding tussen reserwe koolhidrate en veral glukose, en na-oes swartblaar ontwikkeling is nou vasgestel.

Prohexadione-kalsium het geen invloed gehad in die vermindering of voorkoming van na-oes swartblaar ontwikkeling toe dit op 'Sylvia' plante gespuit was nie. Na-oes swartblaar ontwikkeling was aansienlik laer op lote geoes van plante wat met Paclobutrazol as 'n grondtoediening behandel was in vergelyking met die kontrole lote. Die verwydering van die lentegroei het nie blaarswartwording voorkom nie. Dit wys dat Paclobutrazol nie na-oes swartvlek op blare verhinder deur

onderdrukking van lootverlenging nie. Dit wil voorkom asof die swartword verhoog word deur hoë vlakke van gibberelliene teenwoordig in die plante.

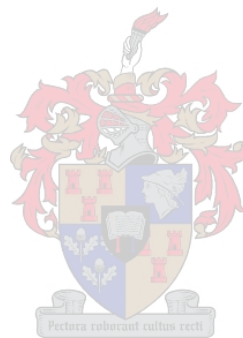
Blaarverswaring van 'Sylvia' is 'n groter probleem in die lente as in ander tye van die jaar. Dit is bewys dat na ñ uiters warm weer voor-oes swartvlek simptome (ooreenkomstig met na-oes swartvlek simptome) hulle verskyning op blom draende lote gemaak het. Simptome het veral voorgekom op lote met blomme wat kommersiële volwassenheid bereik het.



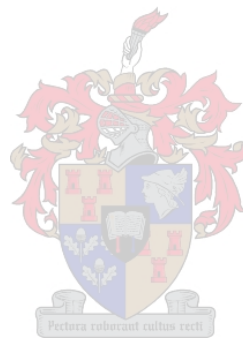
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**DEDICATED TO MY MOTHER AND FATHER AND IN REMEMBRANCE  
OF MY BROTHER**





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