THE USE OF PACLOBUTRAZOL IN CONTROLLING TREE GROWTH

by

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DECLARATION

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been ackowledged in this thesis

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ABSTRACT

Paclobutrazol (PAC), is a synthetic compound which inhibits the gibberellin biosynthesis pathway. A range of studies were conducted investigating PAC's reactivity, detection, movement, effects and, introduction into trees.

PAC was subjected to a range of experiments to detect its presence either *in vitro* or *in vivo*. PAC is a relatively inert compound and neither chemical reactivity nor optical recognition could be used to identify it *in vitro*. *In vivo*, PAC could be detected using a linear displacement technique, ^{14}C-PAC tracer studies and bioassays. The relative success of each detection method was related to its complexity, with radioactive tracer studies proving most effective in identifying PAC *in vivo*.

Field trials using PAC were established in Armidale, New South Wales, Australia. Three street tree species which posed a potential threat to overhead powerlines were chosen for study. *Liquidambar styraciflua* responded favourably to PAC showing sustained shoot growth inhibition for up to 18 months. *Pistachia chinensis* responded to PAC, but its inhibitory effects were not as well sustained over the trial period. *Eucalyptus nicholii* responded poorly to PAC in comparison to the other test species. The level of response of a tree species to the inhibitory effects of PAC is discussed, and is dependent on anatomical, physiological and environmental factors.

PAC was believed to be exclusively xylem mobile in plants. This thesis presents evidence using HPLC detection and radiolabelled ^{14}C-PAC that the compound is also phloem mobile in *Ricinus communis*.

The main method of introduction of PAC into trees is through the use of pressurised trunk injection. This practice can potentially damage the tree if high pressure is applied to force material into the xylem. A new method presented in this thesis, uses a negative suction to extract emboli from the xylem and provide a contiguous interface between the xylem sap and solution to be introduced.

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ABBREVIATIONS

a.i.	active ingredient
AUFS	absorbance unit full scale
cm	centimetre
°C	(temperature in) degrees Celsius
HPLC	high pressure liquid chromatography
h	hour/s
µm	micrometre
l	litre (used instead of the SI unit of dm^3)
mg	milligrams
min	minute/s
MPa	megapascals
nm	nanometre
PAC	paclobutrazol
ppm	parts per million
s	second/s
TLC	thin layer chromatography
TZ	tetrazolium chloride
UV	ultraviolet
y	year/s