CONTRACTILE GROWTH OF THE HYPOCOTYL IN WHITE CLOVER SEEDLINGS (*Trifolium repens* L.)

Carla Anne Maine

1998

A thesis presented in partial fulfilment of the

requirements for the degree of

Master of Science

at

Massey University,

Palmerston North, New Zealand

ABSTRACT

White clover (*Trifolium repens* L.), like many epigeal emerging legumes, displays a phenomenon known as contractile growth. This process occurs in the weeks following seedling emergence and involves the longitudinal shortening and radial expansion of tissues in the hypocotyl and upper primary root. During routine trials at AgResearch Grasslands, Palmerston North, it was noted that some seedlings of cv. Grasslands Huia displayed an aberrant growth form characterized by a failure to display normal contractile growth. These seedlings were intermated for one to two generations to form the 'non-contractile' populations used in this thesis. The 'contractile' populations used were formed through the random selection and intermating of plants which showed normal contraction. The non-contractile phenotype was found to occur naturally in populations of white clover at a frequency of 2-22%. When compared to tissue from normal contractile seedlings, hypocotyl tissue from non-contractile seedlings showed reduced radial expansion which in turn led to decreased contraction.

Since the plant hormone ethylene has been implicated in the promotion of radial expansion in many plant tissues and systems (Abeles 1973 b), the effects of applying silver thiosulphate and the ethylene-releasing compound Ethrel, were examined in contractile and non-contractile seedlings. Endogenous ethylene production by contractile and non-contractile seedlings was also examined. Seedlings from the contractile line showed an overall higher production of ethylene during early seedling growth than did seedlings from the non-contractile line. When treated with silver thiosulphate (which blocks ethylene perception), hypocotyls from seedlings of the contractile line failed to display contractile growth and hypocotyls from seedlings of the non-contractile line displayed non-contractile growth to a greater degree. When treated with Ethrel hypocotyls from seedlings of the non-contractile line displayed contractile growth but hypocotyls from seedlings of the contractile line failed to display contractile growth. These results indicate that ethylene is required for normal contractile growth of the hypocotyl in white clover seedlings, and that non-contractile growth of the hypocotyl is caused by a decreased production of, rather than a decreased sensitivity to, the plant hormone ethylene.

ACKNOWLEDGEMENTS

I would like to thank:

- my supervisors Paula Jameson (Massey University) and Derek Woodfield (AgResearch Grasslands) – for their help, advice, and never-ending patience.
- AgResearch Grasslands – as this research was partially supported by AgResearch through Foundation for Research Science and Technology Grant C 10 640
- Derek Woodfield - for kindly providing the plant material for this project
- John Caradus – for his advice and encouragement during the initial stages of this work
- every single person working at AgResearch Grasslands – as much for their overall friendliness as for the practical help, advice and resources I received, and
- my family, friends and flatmates – for their love and support over the past four years.

CONTENTS

LIST OF FIGURES

LIST OF TABLES