A STUDY OF SEED DEVELOPMENT, SEED COAT STRUCTURE AND SEED LONGEVITY IN "GRASSLANDS PAWERA" RED CLOVER (*TRIFOLIUM PRATENSE* L.)

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ABSTRACT

'Grasslands Pawera' tetraploid red clover is an important agricultural legume through its agronomic roles in soil enrichment by nitrogen fixation and the production of high yields of quality herbage. Since this cultivar was only recently released in New Zealand, many of its agronomic aspects, and particularly those relating to seed production are still not fully understood. The present study was conducted to investigate the pattern of seed development, attainment of seed quality components, time of harvesting, cell structure in the seed coat, hardseededness and related problems, and the longevity and germination characteristics of seeds buried in the soil.

Peak flowering date varies with time of sowing and climatic conditions, a sufficiently large number of effective bee pollinators (*Bombus* species) being essential during the flowering period for successful seed production.

The pattern of seed development in 'Pawera' red clover is similar to that of its diploid counterparts and may be divided into three distinct stages. The first stage lasts for 10 days after pollination. The second stage occupies a period of 16 days, and the third stage takes a further 10-14 days. Seed dry weight is maximal 26 days after pollination (physiological maturity). Maximum seed viability is attained 22 to 26 days after pollination. Therefore if seed is harvested during the third or ripening stage, seed quality components such as viability, seedling vigour, seed weight, and storage life will not be adversely affected. The correct time of harvesting can be decided by using seed coat colour and seed moisture content as seed maturity indices.

Generally the sequences of both embryo and endosperm development in 'Pawera' red clover show close similarity to some other *Trifolium* species. The processes of cell degeneration and differentiation occur throughout the seed developmental period. Cell structure in the seed coat is also similar to corresponding structures in the testa of other small-seeded legumes. The present investigation highlights the relationship between individual seed coat structures and their respective role in affecting seedcoat permeability and impermeability mechanisms. The results fail to implicate the micropyle or hilum as permeable sites on the seed coat. In originally permeable seeds, water conduction occurs at random sites on the seed coat. However, when a hard seed is softened by mechanical impaction or under natural environmental conditions, the strophiole is the only initial permeable site on the testa. Observations in the present study have clearly implicated the cell structure of the strophiolar region as a unique and most sensitive area of the seed coat.

The findings of the present study suggest that the rate of breakdown of hardseededness varies inversely with the depth of seed burial. Seed samples containing mature seeds maintain their viability in the soil longer than immature seeds. The rapid depletion of seed numbers in the soil is mainly due to germination *in situ*. Certain proportions of the seed population persist in the soil for extended periods due to the influence of different types of dormancy mechanisms. Of these, enforced dormancy plays a most important role in maintaining the viability of buried seeds, especially with increased burial depth. 'Pawera' red clover seeds show a distinct periodicity of germination at different times of the year. This is an effective genetically controlled and environmentally modified seed survival mechanism.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES