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

A Thesis Presented in Partial Fulfilment of
the Requirements for the Degree of
Doctor of Philosophy at
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by

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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 vi
List of Figures vii
List of Plates x
List of Appendices xv

1 INTRODUCTION 1

2 CHAPTER I 5
   INTRODUCTION 5
   LITERATURE REVIEW 6
   MATERIALS AND METHODS 17
   RESULTS 25
   DISCUSSION 53
   CONCLUSION 67

3 CHAPTER II 69
   INTRODUCTION 69
   MATERIALS AND METHODS 70
   A. EMBRYOLOGY 78
      Literature Review 78
      Results 88
      Discussion 97
   B. CELL STRUCTURE CHANGES IN THE SEED COAT DURING SEED DEVELOPMENT 101
      Literature Review 101
      Results 111
      Discussion 121
   C. STRUCTURE OF VARIOUS REGIONS OF THE SEED COAT AND THEIR ROLE IN AFFECTING SEED PERMEABILITY OR IMPERMEABILITY 126
      (a) Structure of special regions of the seed coat 126
      Literature Review 126
      Results 132
      Discussion 143
      (b) Seed coat structure and its relation to impermeability 146
      Literature Review 146
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><strong>CHAPTER III</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INTRODUCTION</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>LITERATURE REVIEW</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td>MATERIALS AND METHODS</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>RESULTS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. SEED GERMINATION AND VIABILITY UNDER FIELD CONDITIONS</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td>B. LABORATORY ASSESSMENT OF THE CHARACTERISTICS OF SEED RECOVERED FROM</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>THE SOIL AND SEED STORED IN THE LABORATORY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. MICROCLIMATIC CONDITIONS AT SEED BURIAL SITES AND IN THE LABORATORY</td>
<td>204</td>
</tr>
<tr>
<td></td>
<td>D. FIELD EMERGENCE TRIAL</td>
<td>208</td>
</tr>
<tr>
<td></td>
<td>DISCUSSION</td>
<td>212</td>
</tr>
<tr>
<td></td>
<td>CONCLUSION</td>
<td>224</td>
</tr>
<tr>
<td>5</td>
<td><strong>GENERAL CONCLUSION</strong></td>
<td>226</td>
</tr>
<tr>
<td>6</td>
<td><strong>BIBLIOGRAPHY</strong></td>
<td>231</td>
</tr>
<tr>
<td>7</td>
<td><strong>APPENDICES</strong></td>
<td></td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flowering sequence in a flower head</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Mean number of seeds per flower head and per 100 florets in an individual head</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>Differences in moisture content of seeds with the same maturity harvested at different dates</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>Laboratory germination and <em>in situ</em> germination in the soil after 2 weeks burial</td>
<td>190</td>
</tr>
<tr>
<td>5</td>
<td>Percentage means of seed recovered from the soil at different intervals of seed removal</td>
<td>192</td>
</tr>
<tr>
<td>6</td>
<td>Percentage means of seed recovered from the soil for samples of different seed maturities</td>
<td>193</td>
</tr>
<tr>
<td>7</td>
<td>Percentage germination recorded at different intervals of removal</td>
<td>195</td>
</tr>
<tr>
<td>8</td>
<td>Percentage germination of seeds of different maturities following seed removal</td>
<td>196</td>
</tr>
<tr>
<td>9</td>
<td>Daily lowest and highest levels of minimum-maximum ambient temperatures (°C) recorded in the field and in the laboratory</td>
<td>206</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Experimental site for seed development study</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>Frequency histograms showing the numbers of internodes on 50 random stems at the time of floral initiation and peak flowering in both autumn and spring sown crops</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>Mean number of fully flowering heads and totally withered heads present in five random plots</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>Bumble bee populations observed at different temperatures during the flowering period in 1976</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>Bumble bee populations observed at different percentages of relative humidity during the flowering period in 1976</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Mean percentage of seeds produced and mean number of seeds per 100 florets present in different portions of individual flower heads</td>
<td>35</td>
</tr>
<tr>
<td>7</td>
<td>Percentages of different seed colour categories occurring during seed development</td>
<td>37</td>
</tr>
<tr>
<td>8</td>
<td>Fresh weight, dry weight, absolute moisture and percentage moisture changes during seed development</td>
<td>40</td>
</tr>
<tr>
<td>9</td>
<td>Percentages of normal seedlings, abnormal seedlings, fresh ungerminated seeds, viable seeds and hard seeds in samples harvested at different developmental stages</td>
<td>44</td>
</tr>
<tr>
<td>10</td>
<td>Percentage of total viability of freshly harvested seeds taken from different positions in flower heads harvested 30 days after pollination</td>
<td>47</td>
</tr>
<tr>
<td>11</td>
<td>Percentage of total viability of freshly harvested seed samples after prechilling at 5°C for different periods</td>
<td>48</td>
</tr>
</tbody>
</table>
12 Percentage of total viability of freshly harvested seed samples following different intensities of seed coat injury 50

13 Germination percentage of unscarified and mechanically scarified 'Pawera' red clover seed scarified for different durations and at different pressures (following three months' storage) 52

14 Experimental layout for seed burial trial (Clayey soil) 184

15 Experimental layout for seed burial trial (Sandy soil) 185

16 Percentage of hard seed recovered from the soil at different times of removal 194

17 Seed losses in the soil during the burial period of 18 months and the germinability of seeds recovered from the 15 cm depth 197

18 Seed losses in the soil during the burial period of 18 months and the germinability of seeds recovered from the 15 cm depth 198

19 Percentage of hard seed remaining after normal laboratory germination tests immediately following each time of seed removal 200

20 Percentage of hard seed, germination, dead seed and abnormal seedlings of seed samples stored under laboratory conditions 202

21 Percentage moisture content of seed samples stored in the laboratory and in the soil 203

22 Monthly average ambient maximum and minimum temperature (°C) in the laboratory and at the outdoor burial sites 205

23 Monthly average soil temperature (°C) recorded at two depths in two soil types 207
24 Monthly average soil moisture percentage measured at two depths in two soil types

25 Percentage field emergence at different times of the year with various burial dates
<table>
<thead>
<tr>
<th>Plate</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&quot;Grasslands Pawera&quot; tetraploid red clover plant at the flowering stage</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Cages used for controlled pollination</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>A long-tongued bumble bee (<em>Bombus hortorum</em>) collecting nectar through the mouth of the corolla tube of a floret of 'Pawera' red clover</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>A long-tongued bumble bee visiting a flower head of 'Pawera' red clover</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>Partially dissected flower head of 'Pawera' red clover showing arrangement and length of florets and corolla tubes</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>A short-tongued bumble bee (<em>Bombus terrestris</em>) robbing nectar from the side of a corolla tube</td>
<td>33</td>
</tr>
<tr>
<td>7</td>
<td>Changes in seed size occurring during seed development in freshly harvested samples</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td>Changes in seed size and appearance occurring during seed development in samples following 3 months' storage</td>
<td>38</td>
</tr>
<tr>
<td>9</td>
<td>Two ovules in the ovary of a floret just before pollination</td>
<td>89</td>
</tr>
<tr>
<td>10</td>
<td>Section A of Plate 9</td>
<td>89</td>
</tr>
<tr>
<td>11</td>
<td>Two days after pollination - an ovule within the ovary</td>
<td>90</td>
</tr>
<tr>
<td>12</td>
<td>Four days after pollination - an early globular embryo</td>
<td>90</td>
</tr>
</tbody>
</table>
13 Six days after pollination - globular embryo

14 Six days after pollination - globular embryo, just before the initiation of cotyledonary outgrowths

15 Six days after pollination - an ovule showing embryo and endosperm development and degeneration of the inner integument

16 Eight days after pollination - oblique section through a heart-shaped embryo which is surrounded by cellular endosperm

17 Eight days after pollination - torpedo-shaped embryo enveloped by a tube of cellular endosperm

18 Ten days after pollination - cellular endosperm proliferating ahead of a torpedo-shaped embryo towards the chalazal end of the embryo sac

19 Ten days after pollination - curved torpedo-shaped embryo showing the suspensor at the micropylar end.

20 Ten days after pollination - early cotyledonary stage embryo

21 Eight days after pollination - pointed caps of malpighian cells and loose sclerenchyma cells at the strophiole

22 Fourteen days after pollination - wide malpighian cells with thickened walls and cell lumen

23 Twenty six days after pollination - spindle shaped malpighian cells over lying the sclerenchyma cells
24 Eighteen days after pollination

25 Eighteen days after pollination - scanning electron micrograph

26 Thirty two days after pollination - hilar region

27 Ten days after pollination - lateral wall of the seed coat

28 Eighteen days after pollination - hilar and radicular regions

29 Scanning electron micrograph showing the morphological appearance of a portion of the seed coat on the cotyledonary lobe

30 Scanning electron micrograph showing the morphological appearance of an area near the hilum of the seed coat

31 Scanning electron micrograph showing the arrangement of the cells at the strophiolar region

32 Eighteen days after pollination - hilar region

33 Eighteen days after pollination - hilar region

34 Thirty six days after pollination - hilar region

35 Surface view of the hilum

36 Surface view of the hilum

37 Hilar groove as seen in cross section at the hilum

38 Hilar fissure cut at a lower plane at the hilum than in Plate 37
39 Micropylar pore immediately outside the hilum rim

40 Surface view of the outer end of the micropylar canal immediately outside the hilum rim

41 The outer end of the micropylar canal at the hilar region

42 Malpighian cell elongation at the strophiolar region two days after pollination

43 Eighteen days after pollination - transmedian section showing the unique structure of the cells at the strophiolar region

44 Forty days after pollination - cell structure at the strophiolar region of a mature seed

45 Ten days after pollination - hilar structure with vascular bundle and trachoid bar

46 A cross section showing the vascular arrangement at the area between the hilum and chalazal end

47 Plates showing the initial site of water entry at the strophiole and the pattern of subsequent staining in ferrous (0.003 M Fe++) solution.

48 Black stains on the seed coat show the affected areas due to scarification

49 Eighteen days after pollination - the arrangement of the malpighian and other accompanying cells at the strophiolar region

50 A transverse section of a mature seed coat showing the intercellular spaces around the seed except at the strophilar region
51 Anatomical features at the strophiolar region of a mature seed

52 A fracture at the strophiole showing the general appearance of the surface of the strophiolar region

53 Staining at various sites of the seed coat

54 Surface view of the chalazal region of a seed showing an area where the arrangement of the cells appear to meet together

55 Section 'B' of Plate 54 showing the meeting point of the surface cells

56 Experimental layout for seed burial trial (clay soil site)

57 Experimental layout for seed burial trial (sandy soil site)
LIST OF APPENDICES

1 Frequency distribution of number of internodes on 50 random stems at the time of floral initiation and peak flowering in both autumn and spring sown crops.

2 Mean number of fully flowering heads and totally withered heads in 5 random plots.

3 Bumble bee population visiting the crop at different times of the day during the flowering period.

4 Number of seeds per flower head and number of seeds per 100 florets of an individual flower head harvested at six different random times.

5 Mean numbers and percentages of seeds and florets in different parts of individual flower heads.

6 Weight of seed samples with different maturities and different seed colour categories after 3 months' storage.

7 Colour standards and colour nomenclature.

8 Fresh weight, dry weight and moisture content of freshly harvested seeds at different developmental stages (1976).

9 Fresh weight, dry weight, and moisture content of freshly harvested seeds at different developmental stages (1977).

10 Fresh weight, dry weight and moisture content of freshly harvested seeds of different flower head tagging dates (1974 autumn sown crop).

11 Fresh weight, dry weight and moisture content of freshly harvested seeds of different flower head tagging dates (1974 spring sown crop).

12 Fresh weight, dry weight and moisture content of freshly harvested seeds at different dates after peak flowering (1974 autumn sown crop).
Climatic conditions during seed developmental period.

Mean fresh weight, dry weight and moisture content of seeds taken from different parts of flowerheads harvested 8, 10, 18 and 30 days after pollination.

Percentages of germination and viability of freshly harvested seeds at different developmental stages (1976).

Percentages of germination and viability of freshly harvested seeds at different developmental stages (1977).

Percentages of germination and viability of freshly harvested seeds at different developmental stages (1977).

Daily maximum and minimum temperature °C recorded in the laboratory.

Daily maximum and minimum relative humidity percentage recorded in the laboratory.

The effect of seed storage for 3 months on the percentage and viability of seed samples harvested at different developmental stages (1977).

Percentages of germination and viability of freshly harvested seeds at different flower head tagging dates (1974 autumn sown crop).

Percentages of germination and viability of freshly harvested seeds at different dates after peak flowering (1974 autumn sown crop).

Percentages of germination and viability of freshly harvested seeds at different flower head tagging dates (1974 spring sown crop).

Tetrazolium test results on freshly harvested seeds at different developmental stages.

Percentages of germination and viability of freshly harvested seeds taken from different positions in flower head harvested 30 days after pollination.
25 Percentages of germination and viability of freshly harvested seed samples with different maturities prechilled at 5°C for different periods (1976).

26 Percentages of germination and viability of freshly harvested seed samples prechilled at 5°C for different periods (1977).

27 Percentages of germination and viability of freshly harvested seed samples treated with gibberellic acid.

28 Percentages of germination and viability of freshly harvested seed samples germinated in an oxygen enriched atmosphere.

29 Percentages of germination and viability of freshly harvested seed samples receiving different intensities of seed coat injury.

30 Percentages of germination and viability of mature seed samples with different seed colours.

31 Germination percentages of unscarified and mechanically scarified 'Pawera' red clover seed following 3 months' storage.

32 Buried seed population in the soil.

33 Long life-span of seeds of different species in the soil.

34 Seed burial trial: Analysis of variance for seed recovered from clay soil site.

35 Seed burial trial: Analysis of variance for hard seed from clay soil site.

36 Seed burial trial: Analysis of variance for laboratory germination from seeds buried in clay soil site.

37 Seed burial trial: Analysis of variance for seed recovered from sandy soil site.

38 Seed burial trial: Analysis of variance for hard seed from sandy soil site.
Seed burial trial: Analysis of variance for laboratory germination from seeds buried in sandy soil site.

Seed burial trial: Percentage germination \textit{in situ} of seed buried in clay and sandy soil.

Percentage of seed recovered, laboratory germination of recovered seed and seeds remaining hard after laboratory germination recorded at different intervals of seed removal.

Percentage of seed recovered, laboratory germination of recovered seeds and seed remaining hard after laboratory germination tests recorded for different maturities of seed samples.

Seed burial and laboratory storage trial: Percentage hard seed means for different storage conditions.

Seed burial trial: Analysis of variance for hard seed from seed samples stored in the laboratory.

Seed burial trial: Analysis of variance for laboratory germination from seed samples stored in the laboratory.

Seed burial trial: Analysis of variance for dead seeds from seed samples stored in the laboratory.

Seed burial trial: Percentage moisture content of seed samples stored in the laboratory or buried in the soil.

Seed burial trial: Monthly average maximum and minimum ambient temperatures and relative humidities recorded at two burial sites and in the laboratory.

Seed burial trial: Monthly average soil temperatures recorded at different depths in two soil types.

Seed burial trial: Monthly average soil moisture percentage measured at two depths in two soil types.
51 Field emergence trial: Percentages of seedlings from seed samples buried at 1/2 cm depth in two different soil types (July burial).

52 Field emergence trial: Percentage of seedlings from seed samples buried at 1/2 cm depth in two different soil types (August burial).

53 Field emergence trial: Percentage of seedlings from seed samples buried at 1/2 cm depth in two different soil types (September burial).

54 Field emergence trial: Percentage of seedlings from seed samples buried at 1/2 cm depth in two different soil types (October burial).