SEED PRODUCTION IN CAUCASIAN CLOVER

(*Trifolium ambiguum* Bieb.) CV. MONARO

SHIMIN FU

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ABSTRACT

A number of factors which may affect seed production in Caucasian clover (*Trifolium ambiguum* Bieb.) cv. Monaro were investigated *viz.* root system development and its relationship with seed yield; morphological and reproductive characteristics of different genotypes from within the cultivar; the effects of plant density on seed yield; and, the effects of insect pests on seed yield and quality.

Caucasian clover is a rhizomatous legume pasture plant with a large root system. A sand bed was used to investigate root system development and the relationship between the root system and seed yield. During vegetative growth (September to November) root dry matter (DM) accumulated more rapidly than shoot DM, and the root to shoot ratio was 2.45 by mid November. However as reproductive growth accelerated the rate of root DM accumulation decreased and by early February the root to shoot ratio was 0.65. Plants developed primary, secondary and tertiary crowns in this first growing season, with both primary and secondary crowns producing reproductive shoots. The protracted flowering period (four months) was a result of an initial production of reproductive shoots from primary crowns, and an extended production of reproductive shoots from secondary crowns when primary crown shoot production had ceased. There were therefore two flowering peaks. A single primary crown produced an average seed yield of 3.8 g compared with 0.81 g seed from an average secondary crown. However as there was only one primary crown but 26 secondary crowns per plant, the total seed yield from secondary crowns reached 21.1 g per plant. Root DM was highly correlated (R^2 = 0.80-0.97) with the number of leaves, reproductive shoots and inflorescences, as well as the number of secondary crowns. Seed yield per plant was almost entirely dominated by the number and size of the secondary crowns, which in turn depended on the size of the root system prior to reproductive development.

The seed production potential of three genotypes selected from within cv. Monaro was investigated. The genotypes differed significantly in their morphological and reproductive characteristics, including the number of reproductive stems and inflorescences produced. Genotypes 2 and 12 had seed yields of 3.65 g and 2.99 g per plant respectively, which genotype 9 had a seed yield of only 0.18 g per plant, primarily because it produced very few inflorescences. Poor inflorescence production by some genotypes within a cultivar will limit seed yield and may alter the genotypic composition of the cultivar as seed multiplication progresses.

A radial trial was used to determine the optimal density for seed production of the cultivar. Plant density significantly affected leaf number, reproductive stems, inflorescences number and seed yield per plant in that plants at the highest density (38.2 m^{-2}) produced about 7 times fewer reproductive stems and over 15 times fewer inflorescences per plant compared with those in the lowest density (3.1 m^{-2}). Inflorescence number increased as plant density decreased (R^2 = 0.82-0.89). The lowest density plants had the greatest reproductive growth per plant but were not capable of creating the highest reproductive production per unit area. Cultivar Monaro showed a parabolic relationship for reproductive production per unit area with plant density, both for inflorescence number and seed yield m^{-2}. Plants grown at the density of 10.8 plants m^{-2} produced the highest inflorescence number and seed yield per unit area. The number of inflorescences per plant was the most important seed yield component determining final seed yield in cv. Monaro (R^2 = 0.95). Plant density affected seed yield only through reducing inflorescence number; it had no effect on thousand seed weight, or germination and hard seed percentage. It is probable that plant density affects reproductive development through its effects on root system development in Caucasian clover.

A semi-radial trial was also used to examine the effects of plant density on seed production of twelve genotypes from within cv. Monaro. These genotypes demonstrated significant differences in reproductive capability. Genotypes 1, 2, 4

and 12 represented a high or normal reproductive capability group compared with others and these genotypes produced inflorescences across all five densities. Genotypes 3, 5, 8, 9, 13 represented another group which either failed to produce or produced only a small number of inflorescences even at the lowest density. Genotypes 6, 7 and 10 were intermediate. Seed yield per plant at the 10.8 plants m^{-2} density ranged from 0 g for genotypes 5, 8, 9 and 13 to 0.89 g for genotype 1. Reproductive response to plant density did not differ from that when seeds of the cultivar were sown in the full radial trial.

Insect pests, particularly thrips (Thripidae) may reduce seed yield and quality. The insecticide taufluvalinate (Mavrik) was applied at 150 ml ha^{-1} either once (just prior to peak flowering) or every 14 days until harvest, beginning at first inflorescence appearance. Both adults and larvae of onion thrips (*Thrips tabaci*) and red clover thrips (*Haplothrips niger*) were detected in inflorescences during peak flowering and seed development. The multiple insecticide applications significantly increased seed number per inflorescence and thousand seed weight, therefore increasing seed yield. However the single application had no effect on seed yield or quality.

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TABLE OF CONTENTS

ABSTRACT ..... **I**

ACKNOWLEDGMENTS ..... **IV**

TABLE OF CONTENTS ..... **VI**

LIST OF TABLES ..... **XI**

LIST OF FIGURES ..... **XV**

LIST OF PLATES ..... **XX**

LIST OF APPENDICES ..... **XXII**

CHAPTER 1. GENERAL INTRODUCTION **1**

CHAPTER 2. LITERATURE REVIEW **4**

2.1. CAUCASIAN CLOVER (TRIFOLIUM AMBIGUUM BIEB.) AND ITS AGRICULTURAL VALUE 5

2.1.1 Species description *5*

2.1.2 Origin, distribution and habitat *7*

2.1.3 Growth habit and adaptability *7*

2.1.4 Productivity *8*

2.1.5 Nutrient composition and palatability *10*

2.1.6 Persistence *11*

2.1.7 Pest and disease resistance *12*

2.1.8 Soil conservation and other uses *13*

2.2 CAUCASIAN CLOVER GROWTH AND DEVELOPMENT 14

2.2.1 Establishment *14*

2.2.2 Root system development and nodulation *16*

2.2.3 Vegetative growth, reproductive growth and root/shoot ratio *21*

2.2.4 Seed development *26*

2.3 GENOTYPE (VARIATION WITHIN SPECIES AND CULTIVAR) 29

2.4 PLANT DENSITY 31

2.4.1 Effects of plant density during vegetative and reproductive growth *32*

2.4.2 Effects of plant density on seed yield *33*

2.5 SEED YIELD AND QUALITY AS AFFECTED BY INSECT PESTS 35

2.5.1 Insect pests and their effects on seed quality *35*

2.5.2 Pests in pasture legumes *37*

2.5.3 General pest control *43*

2.6 SEED PRODUCTION AND MANAGEMENT 43

2.6.1 Seed yield and seed yield components *43*

2.6.2 Obstacles to seed production *47*

2.6.3 Management for seed production *48*

CHAPTER 3. ROOT SYSTEM DEVELOPMENT IN CAUCASIAN CLOVER CV. MONARO AND ITS CONTRIBUTION TO AERIAL COMPONENTS 59

3.1 INTRODUCTION 59

3.2 MATERIALS AND METHODS 60

3.2.1 Experimental site and management *60*

3.2.2 Plant measurement and statistical analysis *63*

3.3 RESULTS 65

3.3.1 Structure of Monaro plants *65*

3.3.2 Development of aerial components and dry matter accumulation 68
3.3.3 Flowering pattern 70
3.3.4 Relationship between underground dry matter and other plant components 74
3.3.5 Characteristics of the primary and secondary crowns 74
3.3.6 Characteristics of the inflorescences harvested on different dates 74
3.3.7 Distribution of pods with zero, one or two seeds 79
3.4 DISCUSSION 79
3.4.1 The development of aerial components and the root system 79
3.4.2 Interrelationship between root growth and reproductive growth 84
3.4.3 Flowering behaviour 85
3.4.4 Seed yield and yield components 86

CHAPTER 4. DIFFERENCES IN MORPHOLOGICAL AND REPRODUCTIVE CHARACTERISTICS AMONG INDIVIDUAL PLANTS OF CAUCASIAN CLOVER CV. MONARO 90

4.1 INTRODUCTION 90
4.2 MATERIALS AND METHODS 91
4.2.1 Experimental site, management and treatments 91
4.2.2 Plant measurement and statistical analysis 93
4.3 RESULTS 95
4.3.1 Morphological characters 95
4.3.2 Reproductive characteristics 95
4.3.3 Seed yield and yield components 97
4.4 DISCUSSION 98

CHAPTER 5. EFFECTS OF PLANT DENSITY ON VEGETATIVE AND REPRODUCTIVE DEVELOPMENT AND SEED YIELD OF CAUCASIAN CLOVER CV. MONARO 103

5.1 INTRODUCTION 103
5.2 MATERIALS AND METHODS 105
5.2.1 Experimental site and soil conditions 105
5.2.2. Experimental design and material used 105
5.2.3 Planting, measurement and statistical analysis 108
5.3 RESULTS 116
5.3.1 Vegetative and reproductive development in the seed sown radial trial 116
5.3.2 Relationships between plant density and aerial components 123
5.3.3 Relationship between aerial components as affected by plant density 123
5.3.4 Seed yield and yield components in seed sown radial trial 130
5.3.5 Seed yield and yield components in the seedling transplant (genotype) radial trial 130
5.4 DISCUSSION 139
5.4.1 Vegetative and reproductive development under different plant densities 139
5.4.2 Relationship between vegetative and reproductive development as affected by plant density 144
5.4.3 Seed yield and yield components 145
5.4.4 Genotype effects on reproductive capability 149

CHAPTER 6. THRIPS AND THEIR EFFECTS ON SEED YIELD AND QUALITY OF CAUCASIAN CLOVER CV. MONARO 151

6.1 INTRODUCTION 151

6.2 MATERIALS AND METHODS 152
6.2.1. Experimental site and treatments *152*
6.2.2. Plant measurement and statistical analysis *155*
6.3 RESULTS 159
6.3.1 Insect pests identified *159*
6.3.2 Flowering pattern and pest patterns *159*
6.3.3 Seed yield and quality *163*
6.3.4 Germination and hard seed percentages of normal, brown spotted and shrivelled seeds *167*
6.3.5 Effect of insecticide treatments *167*
6.4 DISCUSSION 167
6.4.1 Thrips and their population in Caucasian clover *167*
6.4.2 Seed yield and quality as affected by thrips *171*
6.4.3 Effect of different treatment times *173*

CHAPTER 7. GENERAL DISCUSSION AND CONCLUSION 175

7.1 PLANT DEVELOPMENT IN RELATION TO SEED PRODUCTION . 175
7.2 SEED YIELD AND YIELD COMPONENTS 176
7.3 SEED YIELD AS AFFECTED BY GENOTYPES IN CV. MONARO .. 179
7.4 SEED YIELD IN RELATION TO PLANT DENSITY 180
7.5 SEED YIELD AS AFFECTED BY INSECT PESTS 181
7.6 GENERAL COMMENTS 182
7.7 CONCLUSION 183

BIBLIOGRAPHY 185

APPENDICES 215

LIST OF TABLES

Table 2-1. Root distribution of Caucasian and white clover 17 months after sowing..... **25**

Table 2-2. Root/rhizome: shoot ratio of Caucasian clover..... **25**

Table 3-1. Development of the root system and aerial components in Caucasian clover cv. Monaro in the 1994-1995 season. Data are per plant..... **69**

Table 3-2. Characteristics of primary and secondary crowns in terms of leaf number, reproductive shoot number, inflorescence number, seed yield and aerial and root dry matter per plant during peak flowering[1]. **78**

Table 3-3. Characteristics of inflorescences harvested in early February or in late March in terms of floret number, seed number per inflorescence, thousand seed weight (TSW), and germination percentage. **78**

Table 3-4. The percentage of pods with zero, one or two seeds harvested in early February and in late March. **81**

Table 3-5. Position of florets within an individual inflorescence[1] bearing zero, one or two seeds (%). **81**

Table 4-1. Comparison of above ground characters (leaf number plant^{-1}, leaf size, stem number plant^{-1}, plant diameter and dry weight) in cv. Monaro genotypes 2, 9 and 12 at seed harvest (7 April 1995). **97**

Table 4-2. Comparison of flowering behaviour in genotypes 2, 9 and 12 of cv. Monaro..... **97**

Table 4-3. Comparison of seed yield and seed yield components (inflorescences plant^{-1}, floret and seed number inflorescence^{-1}, seed yield plant^{-1} and thousand seed weight) in genotypes 2, 9 and 12 of cv. Monaro..... **99**

Table 4-4. Comparison of germination characters among seed from genotypes of cv. Monaro. **99**

Table 5-1. Numerical data for the layout of the radial spacing trials. **107**

Table 5-2. Effects of plant density on seed yield per plant and per square meter in Caucasian clover cv. Monaro for the seed sown radial trial in the 1995-1996 season..... **131**

Table 5-3. Effects of plant density on inflorescence number (Infl. no.) per plant, floret number per inflorescence (infl.$^{-1}$), seed number per inflorescence, thousand seed weight (TSW), seed germination (Germ.) and hard seed (HS) in Caucasian clover cv. Monaro for the seed sown radial trial in the 1995-1996 season..... **131**

Table 5-4. Number of inflorescences per plant (Infl. plant^{-1}) and seed yield per plant (SY g plant^{-1}) for 12 genotypes (G1-G13) in Caucasian clover cv. Monaro at five densities (plants m^{-2}) in the seedling transplant radial trial in the 1995-1996 season. **132**

Table 5-5. Effects of plant density on number of florets per inflorescence in genotypes 1, 2 and 4 of Caucasian clover cv. Monaro..... **137**

Table 5-6. Effects of plant density on number of seeds per inflorescence in genotypes 1, 2 and 4 of Caucasian clover cv. Monaro..... **137**

Table 5-7. Effects of plant density on thousand seed weight (g) in genotypes 1, 2 and 4 of Caucasian clover cv. Monaro..... **138**

Table 5-8. Effects of plant density on germination percentage in genotypes 1, 2 and 4 of Caucasian clover cv. Monaro..... **138**

Table 5-9. Effects of plant density on hard seed percentage in genotypes 1, 2 and 4 of Caucasian clover cv. Monaro. **139**

Table 6-1. Effect of insecticide application on seed yield and yield components of Caucasian clover cv. Monaro in the 1997-1998 season. **164**

Table 6-2. Effect of insecticide application on the percentage (%) of normal, brown spotted and shriveled seeds harvested in Caucasian clover cv. Monaro. **164**

Table 6-3. Effect of insecticide application on the thousand seed weight of normal, brown spotted and shriveled seeds in Caucasian clover cv. Monaro. **166**

Table 6-4. Effect of insecticide application on the germination capacity of seeds in Caucasian clover cv. Monaro..... **166**

Table 6-5. Differences in germination percentage (%) of normal, brown spotted and shriveled seeds in Caucasian clover cv. Monaro..... **168**

Table 6-6. Differences in hard seed percentage (%) of normal, brown spotted and shriveled seeds in Caucasian clover cv. Monaro..... **168**

Table 7-1. Factors affecting seed yield components of Caucasian clover cv. Monaro..... **178**

LIST OF FIGURES

Figure 2-1. Caucasian clover (*Trifolium ambiguum* Bieb.)..... **6**

Figure 2-2. Red clover thrips (*Haplothrips niger* Osborn). Figure 1.--Adult, 2.--Egg, 3.--Larva I, 4.--Larva II., 5.--Prepupa., 6.--Pupa I..... **41**

Figure 2-3. Diagram showing seasonal history of red clover thrips (*H. niger* Osborn)..... **41**

Figure 3-1. Production of rhizome initials from primary (RHIPT) and secondary taproot (RHIST) systems of Caucasian clover cv. Monaro in the first growing season (1994-1995)..... **71**

Figure 3-2. Leaf production on primary (PC) and secondary crowns (SC) of single plants of Caucasian clover cv. Monaro in the first season (1994-1995). **71**

Figure 3-3. Development of reproductive shoots on primary (PC) and secondary crowns (SC) and number of secondary crowns in Caucasian clover cv. Monaro plants in the first season (1994-1995). **72**

Figure 3-4. Production of inflorescences from primary (PC) and secondary crowns (SC) of Caucasian clover cv. Monaro in the first growing season (1994-1995). **72**

Figure 3-5. Status of aerial and underground dry matter of primary crown (ADMPC, UDMPC) and secondary crowns (ADMSC, UDMSC) of Caucasian clover cv. Monaro in the first growing season in 1994-1995..... **73**

Figure 3-6. Flowering pattern of Caucasian clover cv. Monaro in the 1994-1995 season. Vertical bars represent standard errors. **73**

Figure 3-7. Relationship between underground dry matter and leaf number in cv. Monaro. **75**

Figure 3-8. Relationship between underground dry matter and reproductive shoot number in cv. Monaro. **75**

Figure 3-9. Relationship between underground dry matter and inflorescence number in cv. Monaro. **76**

Figure 3-10. Relationship between underground dry matter and secondary crown number in cv. Monaro. **76**

Figure 3-11. Relationship between underground dry matter and number of rhizome initials in cv. Monaro. **77**

Figure 5-1. The layout of the Nelder radial spacing design (Type Ia). **106**

Figure 5-2. Arrangement of twelve genotypes (G1-G13) in a semi-circle radial trial. **112**

Figure 5-3. Effect of plant density on (a) leaf number plant^{-1} and (b) metre^{-2} in Caucasian clover cv. Monaro during the 1995-1996 season **117**

Figure 5-4. Effects of plant density on leaf area plant^{-1} (a) and leaf area index (b) in Caucasian clover cv. Monaro during vegetative and reproductive development in the 1995-1996 season. **118**

Figure 5-5. Effect of plant density on dry matter plant^{-1} in Caucasian clover cv. Monaro during the 1995-1996 season. **119**

Figure 5-6. Effect of plant density on plant height in Caucasian clover cv. Monaro during the 1995-1996 season. **119**

Figure 5-7. Effect of plant density on reproductive stem number plant^{-1} in Caucasian clover cv. Monaro during the 1995-1996 season **121**

Figure 5-8. Effect of plant destiny on inflorescence number plant^{-1} in Caucasian clover cv. Monaro during the 1995-1996 season. **121**

Figure 5-9. Relationship between plant density and inflorescence number plant^{-1} (a) and m^{-2} (b) in Caucasian clover cv. Monaro in the 1995-1996 season. ... **122**

Figure 5-10. Relationship between plant density and seed yield plant^{-1} (a) and m^{-2} (b) in Caucasian clover cv. Monaro in the 1995-1996 season. **124**

Figure 5-11. Relationship between plant density and leaf number plant^{-1} in Caucasian clover cv. Monaro during reproductive development in the 1995-1996 season **125**

Figure 5-12. Relationship between plant density and leaf area plant^{-1} in Caucasian clover cv. Monaro during reproductive development in the 1995-1996 season. **125**

Figure 5-13. Relationship between plant density and above ground dry matter plant^{-1} in Caucasian clover cv. Monaro during reproductive development in the 1995-1996 season. **126**

Figure 5-14. Relationship between plant density and reproductive stem number plant^{-1} in Caucasian clover cv. Monaro in the 1995-1996 season..... **126**

Figure 5-15. Relationship between plant density and plant height in Caucasian clover cv. Monaro in early reproductive development in the 1995-1996 season. **127**

Figure 5-16. Relationship between leaf number and above ground dry matter plant^{-1} in Caucasian clover cv. Monaro in early reproductive development in the 1995-1996 season. **127**

Figure 5-17. Relationship between leaf number plant^{-1} and inflorescence number plant^{-1} in Caucasian clover cv. Monaro in the 1995-1996 season..... **128**

Figure 5-18. Relationship between leaf number m^{-2} and inflorescence number m^{-2} in Caucasian clover cv. Monaro in the 1995-1996 season..... **128**

Figure 5-19. Relationship between leaf number plant^{-1} and seed yield plant^{-1} in Caucasian clover cv. Monaro in the 1995-1996 season..... **129**

Figure 5-20. Relationship between inflorescence number m^{-2} and seed yield m^{-2} in Caucasian clover cv. Monaro in the 1995-1996 season..... **129**

Figure 5-21. Relationship between plant density and inflorescence number plant^{-1} for genotype 1 (G1), genotype 2 (G2) and genotype 4 (G4) of Caucasian clover cv. Monaro. **134**

Figure 5-22. Effects of plant density on inflorescence number m^{-2} for genotype 1 (G1), genotype 2 (G2) and genotype 4 (G4) of Caucasian clover cv. Monaro. **134**

Figure 5-23. Relationship between plant density and seed yield plant^{-1} for genotype 1 (G1), genotype 2 (G2) and genotype 4 (G4) of Caucasian clover cv. Monaro. **136**

Figure 5-24. Effects of plant density on seed yield m^{-2} for genotype 1 (G1), genotype 2 (G2) and genotype 4 (G4) of Caucasian clover cv. Monaro..... **136**

Figure 6-1. Flowering pattern in Caucasian clover cv. Monaro in the 1997-1998 season..... **161**

Figure 6-2. Thrips number per inflorescence in Caucasian clover cv. Monaro during the 1997-1998 season. **161**

Figure 6-3. Patterns of adult onion thrips, adult red clover thrips and adult flower thrips in inflorescences of Caucasian clover cv. Monaro in the 1997-1998 season..... **162**

Figure 6-4. Larval thrips population in inflorescences of Caucasian clover cv. Monaro in the 1997-1998 season. **162**

Figure 6-5. Effect of insecticide application on adult thrips population in Caucasian clover cv. Monaro during the 1997-1998 season..... **169**

Figure 6-6. Effect of insecticide application on larval thrips population in Caucasian clover cv. Monaro in the 1997-1998 season **169**

LIST OF PLATES

Plate 3-1. Layout of the experiment site for root system development of Caucasian clover cv. Monaro (7 plants/row; 8 rows)..... **62**

Plate 3-2. Typical plant structure (primary crown (A) and secondary crowns (B)) and root system development of Caucasian clover cv. Monaro 7 months after transplanting..... **66**

Plate 3-3. Development of primary crown (A), secondary crown (B) and tertiary crown (C) of Caucasian clover cv. Monaro 7 months after transplanting. **67**

Plate 3-4. X-ray photograph (one replicate only) of differences in seed setting percentage of the pods from an inflorescence harvested on 10 February (A) and 10 March (B) 1995..... **80**

Plate 4-1. Leaf size scale from large to small (5 - 1) in Caucasian clover cv. Monaro..... **94**

Plate 4-2. Plants of genotypes 2, 9 and 12 selected from Caucasian clover cv. Monaro..... **96**

Plate 5-1. Layout of seedling transplant (genotype) radial trial (back). **109**

Plate 5-2. Inter-row weed control with Buster herbicide in two radial experiments. **113**

Plate 6-1. Layout of insect pest trial. **153**

Plate 6-2. (A) Adult onion thrips (*Thrips tabaci*) and (B) adult New Zealand flower thrips (*Thrips obscratus*). (Both 40x). **156**

Plate 6-3. Adult red clover thrips (*Haplothrips niger*). (40x). **157**

Plate 6-4. Stages of development of red clover thrips (*Haplothrips niger*) in Caucasian clover florets (A. Larva I, B. Larva II and C. Adult). (All 7x). ... **160**

Plate 6-5. Three types of seeds harvested from cv. Monaro. (A. seeds with brown spots, B. shriveled seeds and C. visually normal seeds.) (All 10x). **165**

LIST OF APPENDICES

Appendix 1. Climate data for Palmerston North, New Zealand from July 1994-March 1995. ..... **215**

Appendix 2. Layout of the experimental plots for genotype 2 (G2), genotype 9 (G9) and genotype 12 (G12) from cv. Monaro in 1994-1995. ..... **216**

Appendix 3. Soil analysis for genotype characteristic trial, campus plot no. 21 of the Pasture Research Unit, Department of Plant Science, Massey University, completed on 24/11/94 by the Fertiliser and Lime Research Centre, Massey University. **217**

Appendix 4. Seed yield harvested from individual plants of Caucasian clover cv. Monaro in the 1993-1994 season (cultivated in buckets since 1992). **218**

Appendix 5. Soil analysis for the seed sown and seedling transplant (genotypes) radial trials, campus plot number 21 of the Pasture Research Unit at Massey University completed on 10/06/94 by the Fertiliser and Lime Research Centre, Massey University. **219**

Appendix 6. Climate data for Palmerston North, New Zealand from July 1995-March 1996. ..... **220**

Appendix 7. A diagrammatic representation of Nelder's radial spacing design (type Ia). **221**

Appendix 8. Comparison of total inflorescence production of 57 plants from density of 44.7 plants m^{-2} to density of 2.6 plants m^{-2} for genotype 1 to genotype 13 in the seedling transplant radial trial in the 1994-1995 season. **222**

Appendix 9. Layout of the experimental plots for the insect pest trial with three treatments (Control (C), treated with Mavrik once (T1) and treated every two weeks (T2)) in 1997-1998 ..... **223**

Appendix 10. Climate data for Palmerston North, New Zealand from July 1997-May 1998. ..... **224**

Appendix 11. Germination of normal seeds harvested after treatment with or without Mavrik in cv. Monaro. **225**

Appendix 12. Germination of brown-spotted seeds harvested after treatment with or without Mavrik in cv. Monaro. **225**

Appendix 13. Germination of shrivelled seeds harvested after treatment with or without Mavrik in cv. Monaro. **226**