A STUDY OF THE RELATIONSHIP BETWEEN SEED VIGOUR AND SEED PERFORMANCE IN TRIFOLIUM PRATENSE L. CV. GRASSLANDS PAWERA

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ABSTRACT

Significant differences in seed vigour within lots of red clover cv. Pawera, white clover cv. Huia and lucerne cv. Wairau were recorded in a preliminary experiment. Subsequently, 7 high viability Pawera seed lots were used to explore the relationship between seed vigour, as measured in the laboratory, and seed performance, both in the field and in storage. Four vigour testing techniques i.e. conductivity, accelerated aging (AA), controlled deterioration (CD) and speed of germination were employed. Results for standard germination (SG) and each of the vigour tests were related to seed performance by correlation analysis. Field performance was monitored for 6 seed lots, sown at 8 dates through spring and autumn. Seed storability was determined by measuring the viability of 4 seed lots under 5 storage conditions (including ambient open storage and simulated temperate controlled storage :20 ^{o}C, 45% to 90% RH) over a total of 11 months. The effects of mechanical damage, thousand seed weight, imbibition rate and storage fungi on seed viability and vigour were also investigated and seed quality changes during storage were monitored.

The vigour rankings found in the laboratory were consistent with those for field emergence, emergence rate over the 8 sowings and performance during storage. Low vigour lots also showed a significant reduction in seedling dry weight for the autumn sowings when soil temperatures were very low.

Each of the four vigour techniques were able to provide more accurate parameters for predicting seed performances than the SG test. For predicting seed field emergence over all the sowings, the best result was provided by the CD test at either 16% or 18% seed moisture content ($r = 0.933$ and 0.911 resp.), followed by AA (2-day AA of surface sterilized seed) ($r = 0.840$) and conductivity ($r = -0.602$). For predicting seed storability, the best result was obtained from the CD test (at either 18% or 20% seed moisture content) for ambient storage conditions, and from both CD (either 18% or 20% seed moisture content) and AA (3-day aging) under controlled storage conditions. Correlation coefficients for vigour tests and storage performance tended to vary between storage periods.

Seeds which imbibed water rapidly (within 4h) were low in viability and vigour, but this was generally related to the extent of mechanical damage to the seed coat. Seed weight was not related to seed vigour.

Seed deterioration during storage was associated with increasing conductivity, abnormal seedlings and dead seed content, and decreasing germination rate, normal seedlings, and field emergence. Vigour was lost before viability. The deterioration rate was quicker at high RH (75 and 90% RH), since the seeds were quickly invaded by storage fungi.

The present experimental results strongly suggest that standard germination was a poor predictor of seed performance, both in the field and during storage. Both accelerated aging and controlled deterioration seem promising techniques for determining vigour of red clover seed lots. The further development of these vigour tests is discussed.

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TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

FIGURE

PAGE

LIST OF PLATES

PLATE

LIST OF APPENDICES

APPENDICES