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**Evaluation of vegetatively reproductive red
clovers (*Trifolium pratense* L.) for use in
pastoral systems.**

**A thesis presented in partial fulfilment of the requirements for
the degree of Doctor of Philosophy in Plant Science at Massey
University, New Zealand**

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This Thesis is dedicated to my parents, Brenda and Stewart,
for all their love and support over the years.

ABSTRACT

The persistency of red clover (*Trifolium pratense* L.) can be poor when grazed in mixed and pure stands, but it is still regarded as a valuable source of high quality summer feed in some farming systems. Vegetatively reproductive red clover selections offer promise to solve this persistency problem. The objectives of this research were to study the growth, perennation, reproductive ability and productivity of vegetatively reproductive red clover selections. A series of nine spaced plant and mixed and pure sward experiments were conducted at Hastings, Dannevirke, AgResearch Grasslands and Massey University, Palmerston North, New Zealand (latitude 40°23'S) from 1995 to 1998. The vegetatively reproductive red clovers evaluated were cv. Astred, F2419 and cv. Gualdo with Grasslands Pawera and Turoa used as controls.

Preliminary investigations into the incidence of rooted plantlet production by prostrate red clover selections under grazing found 37, 16 and 5 rooted plantlets per parent plant for Astred, F2419 and Turoa, respectively. Astred produced larger rooted plantlets which survived better than F2419 and Turoa.

Astred produced 57% of its plantlets on primary stems, or branches off these stems, that grew from the parent plant crown in September, whereas F2419 plantlets developed on a wider spread of stem ages. The majority of plantlets formed on quaternary branches at a range of distances (4cm - 55cm) from the parent plant crown. Astred produced less rooted plantlets per parent plant, had longer, wider leaves, thicker stems and was taller at 10 months of age than Gualdo.

More rooted plantlets were established per Astred parent plant under wet surface soil conditions than dry conditions (22.2% and 3.7% gravimetric soil surface water content, respectively), but when the dry soil surface was watered, there was a compensatory increase in the number of rooted plantlets. Removal or retention of flowers did not affect rooted plantlet formation.

There was no difference in the total herbage accumulated between Astred and Pawera in the first growing season, under 4, 6 and 8 week grazing frequencies, and lax and hard grazing intensities, but Astred produced more ($P < 0.001$) herbage at the first spring grazing. Astred swards had significantly higher percentages of parent plants than Pawera in all treatments after two seasons grazing. Grazing intensity and frequency affected the number of rooted plantlets produced which ranged from 29 to 66 per m^2 . The recommended grazing management for pure swards of Astred red clover is to graze every 4 to 6 weeks, or when pre grazing height reaches 30cm, whichever is later, with a minimum post grazing residual of 10 cm over the whole grazing season for effective plantlet production.

Pawera and Astred had contrasting total percentages of leaf and stem from 20/9/96 to 6/1/97 ($P < 0.001$) with Pawera having thicker stems compared with Astred in all corresponding grazing treatments ($P < 0.001$). The total percentage of regrowth for Astred or Pawera was not significantly different.

The persistence of tagged parent plants of Astred and Pawera in the 6 weeks hard grazed treatment was similar until after 2.5 years of age when ($P < 0.001$) more Astred parent plants survived. Grazing intensity and frequency affected the number of all plantlets (plantlets with no roots, aerially rooted or rooted) produced, which ranged from 0 to 11 per m^2 for rooted plantlets after each grazing. In mixed swards on three farm trials at Hastings, Dannevirke and Palmerston North, Astred parent plant persistence decreased with increasing grazing pressure, but significantly more parent plants survived than for Pawera. The vegetatively reproductive red clover selections performed at productive levels that could make a significant contribution to New Zealand agriculture as truly perennial, taprooted forage legumes capable of increasing or maintaining their parent plant population over time under grazing.

Key words: Astred, F2419, Gualdo, rooted plantlet, vegetatively reproductive, *Trifolium pratense*

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THESIS STRUCTURE

This thesis is based on a series of papers evaluating vegetatively reproductive red clovers. All chapters, except Chapters One (General Introduction) and Two (Review of Literature), have been structured as scientific papers and modified to thesis format. Chapters Three, Eight and parts of Chapter Nine (see Appendix I) have been published and Chapters Four to Seven are being prepared for submission to journals. Chapters Three to Eight deal with one or more specific experiments with a detailed discussion, conclusion and list of references at the end of each Chapter. References for Chapter One are merged into those at the end of Chapter Two. Chapter Nine contains an integrated general discussion linking the findings of all chapters. A summary of the main findings from the research in this thesis is also presented at the end of Chapter Nine.

Note: All references contained within this thesis referring to two authors have been cited as the first author *et al.*, instead of referring to both authors.

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