# Rooted Plantlet Production in a Vegetatively Reproductive Red Clover (*Trifolium pratense* L.) cv. Astred

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# ROOTED PLANTLET PRODUCTION IN A VEGETATIVELY REPRODUCTIVE RED CLOVER (*Trifolium pratense* L.) CV. ASTRED.

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## Abstract

Vegetatively reproductive cultivars of red clover (*Trifolium pratense* L.) can produce clonal daughter plantlets under certain management and environmental conditions, which may improve sward persistency. Six trials involving spaced plants, pure swards or grazed mixed swards were conducted near Massey University, Palmerston North, New Zealand, from 1995 to 1998. Rooted plantlets counted in autumn of each year ranged from 5.8±1.6 to 43±5.1 rooted plantlets/parent plant for ungrazed spaced plants, and 0 to 1.8 rooted plantlets/parent plant for pure and mixed swards under grazing management. It is concluded that clonal, rooted plantlet production is highly variable in Astred depending on grazing management, environmental conditions and companion species, but offers a feasible replacement mechanism for maintaining red clover persistence in mixed and pure swards.

**Keywords:** Astred, persistence, rooted plantlets, *Trifolium pratense* L., vegetative reproduction

## Introduction

Cv. Astred was released in 1992 as the first commercially available cultivar of vegetatively reproductive red clover (*Trifolium pratense* L.) (Smith 1992). This plant type has the ability to

reproduce vegetatively by the production of clonal daughter plants (Smith et al., 1993), here termed plantlets, which mainly form in autumn when soil moisture is not limiting, on stems grown in the previous spring (Hyslop et al., 1999). Smith et al., (1993) reported greater persistence in Astred compared to Grasslands Turoa, Grasslands Hamua and Redwest, possibly due to this trait. Astred was the most prevalent and persistent of five introduced legumes under sheep grazing on easy hill country (Orr et al., 1996). It was also the most prolific producer of rooted plantlets that were large in size, and had the highest survival rate out of three selections of vegetatively reproductive red clovers (Hyslop et al., 1996). Rooted plantlets are likely to enable Astred and cv. Gualdo (Hyslop et al., 1999) to be more persistent than the widely used crown type red clovers.

This paper compares the numbers of rooted plantlets produced by Astred parent plants under a range of grazing managements and sites.

## Materials and Methods

Six experiments were conducted from 1995 to 1998 at Massey University (MU), Palmerston North, New Zealand (40$^{o}$23'S 175$^{o}$37'E). The soil type was a silt loam, with pH 5.7 and Olsen P 17 ug/g soil. The area has an annual rainfall of 995 mm. Two other sites at Dannevirke (D) 50km (1350mm rainfall), and Hawkes Bay (HB) 170km (710mm rainfall) north east of MU, respectively, were included in one of the experiments.

Experiments were (see Table 1):

- completely randomised spaced plant designs under cutting or no defoliation to examine the morphology of plantlet formation, and rooted plantlet formation under different levels of moisture and flower expression.
- pure swards of Astred and Grasslands Pawera sown in a randomised complete block design to compare herbage production, parent plant persistence and plantlet production under 12

treatments (two cultivars, Astred, Pawera; two grazing intensities, hard (5cm), lax (10cm); three grazing frequencies, 4, 6 and 8 weeks), grazed by sheep over 3 years.

- mixed swards of Astred (sown at 5.4kg of bare seed/ha) and perennial ryegrass/white clover to investigate the persistence of individual parent plants, plantlet production and annual and seasonal herbage production under practical farming conditions.

Rooted plantlets were counted pre grazing (or cutting) using a 0.25 $m^2$ quadrat randomly placed in the swards in May (late autumn) when the stem connection to the parent plant had started to decay and the plantlets were firmly rooted. All experiments are fully described in Hyslop (1999).

## Results

High numbers of rooted plantlets were produced by Astred when it was sown as spaced plants (up to 43 plantlets/parent plant) with no cutting, minimal cutting to 20cm post grazing height, or light grazing (see Table 1, MU – MU 5). The number of plantlets produced per parent plant from spaced parent plants was relatively consistent, averaging 21-plantlets/parent plants, except for site MU 3, which did not establish properly due to poor drainage.

The number of rooted plantlets averaged only 0.9-plantlets/parent plants in pure and mixed swards (see Table 1) when parent plant populations ranged from 3 – 87 parent plants/$m^2$. An average of 45 rooted plantlets were produced per square metre in the sward environment and 32 plantlets/$m^2$ across all 10 sites except Hawkes Bay (HB). This site produced no plantlets because of drought, with all parent plants dying within one month after measurement. The minimum post grazing height of 2cm at Dannevirke occurred only once each year when the sward was block grazed by cattle, otherwise the post grazing height was 10cm.

## Discussion

Astred can produce sufficient numbers of rooted plantlets in a wide range of sward and environmental conditions for it to be truly perennial, if successful vegetative reproduction takes place annually. Some of the rooted plantlets would need to survive to parent plant maturity, as found by Hyslop et al., (1996), but only a small percentage out of the average (30 – 40 plantlets/$m^2$) produced each autumn would be needed to maintain sward persistency. A combination of factors dictate the numbers of rooted plantlets produced (Hyslop et al., 1999), as reflected in this data set (see Table 1). High numbers of rooted plantlets at MU 5 possibly indicated that infrequent, lax grazing to 10cm could be beneficial to rooted plantlet formation compared to plants under cutting or no defoliation. Densities of 25 – 35 parent plants/$m^2$ are adequate for a productive red clover crop (Hyslop, 1999), and Astred could readily maintain this density. The number of vegetatively produced Astred plantlets per parent plant was highly variable, however, and depended on companion species, grazing management and environmental conditions. It is concluded that Astred plant types offer an effective vegetative replacement mechanism to maintain red clover persistence in mixed and pure swards.

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**Table 1 -** Number of rooted plantlets per parent plant in spaced plantings (SP) and pure and mixed swards (SW) of Astred red clover at Massey University (MU), Dannevirke (D) and Hawkes Bay (HB).

| Site | Sward type | Management | Minimum grazing rotation (days) | Minimum cutting/ post grazing height (cm) | Parent plants/$m^2$ | SE M | Plantlets /parent plant | SEM |
|---|---|---|---|---|---|---|---|---|
| MU 1 | Pure (SP) | Cutting | - | 20 | 1 | - | 23 | 2.8 |
| MU 2 | Pure (SP) | None | - | - | 1 | - | 20 | 4.3 |
| MU 3 | Pure (SP) | None | - | - | 1 | - | 6 | 1.6 |
| MU 4 | Pure (SP) | Cutting | - | 25 | 1 | - | 16 | 2.6 |
| MU 5 | Pure (SP) | Grazing | 35 | 10 | 1 | - | 43 | 5.1 |
| MU 6 | Pure (SW) | Grazing | 56 | 5 | 69 | 4.5 | 0.52 (36/$m^2$) | (5.1) |
| MU 7 | Pure (SW) | Grazing | 56 | 10 | 87 | 4.5 | 0.75 (66/$m^2$) | (5.1) |
| MU 8 | Mixed (SW) | Grazing | 18 | 7 | 17 | 1.4 | 0.82 (14/$m^2$) | (2.4) |
| D | Mixed (SW) | Grazing | 27 | 2 | 36 | 0.8 | 1.8 (64/$m^2$) | (1.7) |
| HB | Mixed (SW) | Grazing | 15 | 2.5 | 3 | 0.7 | 0 | - |

( ) apply to plantlets/$m^2$ and their corresponding SEM