

Red clover for silage: management impacts on yield during the third year after sowing

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Introduction

Red clover is a perennial legume considered productive for a limited number of years. This experiment quantified the impacts of cultivar, companion grass, harvest schedule and nitrogen fertiliser on crop yield in the third year after reseeding, and compared these to grass receiving inorganic N fertiliser.

Materials and Methods

Within a randomised complete block (n=4) design, field plots (24 per block, each 10m x 2m) were used over a number of years to evaluate two cultivars of red clover (Merviot and Ruttinova) each sown in monoculture or with perennial ryegrass (*cv.* Greengold) in August, 2001. They received 0 or 50 kg inorganic N fertiliser ha⁻¹ in mid-March 2004 and had a first-cut harvest date of 26 May or 10 June. Sequential harvests following 26 May were taken after 47, 49 and 93 days, with the corresponding durations after 10 June being 54, 45 and 75 days. Monoculture plots of perennial ryegrass (*cv.* Greengold) received 0, 50, 100 or 150 kg inorganic N ha⁻¹ in mid-March and immediately after the first three harvests, and had similar harvest dates to the red clover. All plots were harvested to a 5 cm stubble height and received 22 kg P and 95 kg K ha⁻¹

after the first, second and third harvests, and double those rates after the fourth harvest. Immediately before the first and final harvests, a visual assessment was made of the proportion of ground cover contributed by red clover. Dry matter (DM) content was determined by drying in a forced-air oven at 98°C for 16h. Clover data were analysed using a General Linear Model that accounted for each of the four factors and all two-, three- and four-way interactions, and for blocking. Linear and quadratic equations were fitted to the data from the ryegrass treated with N fertiliser.

Results and Discussion

Comparing main effects, annual yield did not differ between Merviot and Ruttinova (15347 and 15642 kg DM ha⁻¹; P>0.05), while the inclusion of ryegrass with red clover increased annual yield (15141 and 15849 kg DM ha⁻¹; P<0.01) (Table 1). Application of inorganic N fertiliser to red clover-based swards in spring reduced annual yield (15813 and 15177 kg DM ha⁻¹; P<0.01), while earlier first-cut harvesting of swards containing red clover produced a higher yield than the later first-cut schedule (16033 and 14957 kg DM ha⁻¹; P<0.001). Neither two- nor three-way interactions were significant (P>0.05), while four-way interactions although significant (P<0.05) were of minor importance. The proportion of herbage accounted for by red clover in May or November was higher (P<0.05) for the mono-culture, zero N fertiliser and early-harvest schedule compared to the binary mixture, 50 kg N ha⁻¹ and the late harvest schedule, respectively.

Table 1. Herbage yield (kgDM ha⁻¹) for red clover treatments per harvest

Cult. ¹	Grass ²	N ³	Date ⁴	Cut 1	Cut 2	Cut 3	Cut 4	Total
Merv. ⁵	No	No	Early	6420	5431	4089	389	16329
Merv.	No	No	Late	6327	5153	3026	143	14649
Merv.	No	Yes	Early	5939	5091	3655	390	15075
Merv.	No	Yes	Late	5998	4653	2924	198	13774
Merv.	Yes	No	Early	6394	5341	3829	428	15992
Merv.	Yes	No	Late	6825	5470	3466	357	16119
Merv.	Yes	Yes	Early	6375	5162	3695	584	15816
Merv.	Yes	Yes	Late	7312	4395	2767	552	15026
Rutt. ⁶	No	No	Early	6102	5216	4015	513	15846
Rutt.	No	No	Late	6611	5398	2871	113	14994
Rutt.	No	Yes	Early	6690	4977	3944	523	16134
Rutt.	No	Yes	Late	6351	5026	2715	234	14326
Rutt.	Yes	No	Early	7219	5425	4107	619	17369
Rutt.	Yes	No	Late	7191	4986	2808	219	15203
Rutt.	Yes	Yes	Early	6719	4314	3719	953	15706
Rutt.	Yes	Yes	Late	7185	4848	3038	490	15561
s.e.m. ⁷				330.7	277.2	150.3	105.6	438.6

¹Clover cultivar; ²Presence of companion grass; ³Application of inorganic N in spring; ⁴Early or late first-cut harvest schedule; ⁵Merviot; ⁶Ruttinova; ⁷four factor interaction

Conclusions

Herbage yield was increased in swards with red clover by including ryegrass in the seed mix, by not applying inorganic N fertiliser in mid-March and by adopting the early harvest schedule. Red clover cultivar did not affect annual yield. The optimum red clover treatment combinations gave herbage yields equivalent to ryegrass mono-culture plus fertiliser N (Table 2) as follows: Cut 1 - grass plus 47 kg N, Cuts 2 and 3 - > grass plus any rate of N fertiliser, and Cut 4 - < grass plus 0 kg N.

Table 2. Relationships between inorganic N fertiliser input (x; kg ha⁻¹) and ryegrass dry matter yield (y; kg ha⁻¹)

Cut	Date*	a [#]	s.e.	b [#]	s.e.	Sig.	c [#]	s.e.	Sig.	R ²
1	Early	4369	348.6	68.1	11.19	<0.001	-0.34	0.072	<0.001	0.80
1	Late	5930	439.1	55.0	14.10	0.002	-0.32	0.090	0.003	0.54
2	Early	2357	269.1	45.0	8.64	<0.001	-0.26	0.055	<0.001	0.68
2	Late	2045	154.2	36.7	4.95	<0.001	-0.18	0.032	<0.001	0.86
3	Early	2072	170.7	26.7	5.48	<0.001	-0.12	0.035	0.005	0.77
3	Late	1942	333.5	26.8	10.71	0.026	-0.11	0.068	0.136	0.52
4	Early	1023	132.8	24.5	4.27	<0.001	-0.15	0.027	<0.001	0.72
4	Late	595	144.3	15.6	4.64	0.005	-0.07	0.030	0.026	0.58

*Early or late first-cut harvest schedule; [#]y=a+bx+cx²