Red clover for silage: management impacts on protein content in the season after sowing

P. O'Kiely and A.D. Black
Teagasc, Grange Beef Res. Centre, Dunsany, Co. Meath

Introduction

A previous report (O'Kiely *et al.*, 2006) indicated that the inclusion of grass with red clover (*Trifolium pretense)* improved crop yield and digestibility. Red clover cultivar (Merviot *vs*. Ruttinova) impacted on annual yield while an earlier harvesting schedule improved herbage digestibility. In contrast, the application of inorganic N to red clover in spring resulted in no benefit. This paper reports the treatment effects on crop crude protein concentration.

Materials and Methods

Within a randomised complete block (n=4) design, field plots (24 per block, each 10m x 2m) were used to evaluate a 2 (cultivars) x 2 (alone or with companion grass) x 2 (harvest schedule) x 2 (application of N fertiliser in spring) combination of factors relating to red clover, and a 2 (harvest schedule) x 4 (application of N fertiliser in spring) combination of factors relating to a monoculture of perennial ryegrass. Two cultivars of red clover (Merviot and Ruttinova) were each autumn sown in monoculture or with perennial ryegrass (*Lolium* perenne, cv. Greengold). They received 0 or 50 kg inorganic N fertiliser/ha in mid-March and had a first-cut harvest date of 2 June or 19 June. Sequential harvests following 2 June were taken after 50, 44 and 97 days, with the corresponding durations after 19 June being 44, 42 and 88 days. Monoculture plots of perennial ryegrass (cv. Greengold) received 0, 50, 100 or 150 kg inorganic N/ha 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 P and K after each harvest. 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. Linear and quadratic equations were fitted to the data from the ryegrass monocultures treated with different rates of N fertiliser.

Results and Discussion

Merviot had a lower crude protein content than Ruttinova in Harvests 1 (159 vs. 172 (sem 2.9) g/kgDM; P<0.01) and 2 (197 vs. 207 (3.0) g/kgDM; P<0.05) (Table 1). Red clover monocultures had a higher (P<0.001) crude protein content compared with binary mixtures with ryegrass in Harvests 1 (184 vs. 147 (2.9) g/kgDM), 2 (216 vs. 188 (3.0) g/kgDM), 3 (246 vs. 210 (4.6) g/kgDM) and 4 (274 vs. 224 (2.4) g/kgDM. Applying N fertiliser in spring had no effect (P>0.05) on crude protein at any harvest. Herbage from the early harvest regime had a lower (P<0.001) crude protein content for Harvests 1 (159 vs. 172 (2.9) g/kgDM), 2 (190 vs. 214 (3.0) g/kgDM) and 3 (216 vs. 240 (4.6) g/kgDM). This result for Harvest 1 was surprising, but was consistent across both red clover cultivars, whether as monocultures or in binary mixtures with ryegrass. The late harvest schedule increased (P<0.05) crude protein content more for Ruttinova than Merviot in Harvest 3. There were no (P>0.05) three- or four-way interactions. The relationships between inorganic N fertiliser inputs and the crude protein content of the ryegrass monocultures were significant (P<0.001) for each harvest (Table 2). Monocultures of red clover had the same crude protein content as monocultures of ryegrass receiving 150, 152, 161 and >200 kg inorganic N fertiliser (estimated by regression) for Harvests 1, 2, 3 and 4, respectively.

Table 1. Herbage crude protein contents for red clover treatments for each harvest in the first year after sowing

Cultivar	Grass[1]	N[2]	Date[3]	H[4] 1	H 2	H 3	H 4
Merviot	No	No	Early	176	195	237	276
	No	No	Late	190	231	250	272
	No	Yes	Early	168	205	242	271
	No	Yes	Late	169	223	243	274
	Yes	No	Early	138	169	200	231
	Yes	No	Late	142	202	220	219
	Yes	Yes	Early	144	166	196	229
	Yes	Yes	Late	149	188	201	214
Ruttinova	No	No	Early	177	206	226	274
	No	No	Late	205	226	273	279
	No	Yes	Early	186	217	241	270
	No	Yes	Late	204	229	258	279
	Yes	No	Early	142	193	196	231
	Yes	No	Late	158	211	241	230
	Yes	Yes	Early	145	169	189	218
	Yes	Yes	Late	160	205	235	220
s.e.m.[5]				8.2	8.4	13.0	6.9

[1]With companion grass; [2]Application of inorganic N in spring; [3]Early or late first-cut harvest schedule; [4]Harvest; [5]For 4-way interaction.

Table 2. Relationships between N fertiliser input (x; kg/ha) and ryegrass crude protein (y; g/kgDM))

H[1]	D[2]	a[#]	s.e.	b[#]	s.e.	c[#]	s.e.	Sig.	R^2
1	E	118	6.2	0.44	0.066			***	0.76
1	L	127	6.1	0.37	0.066			***	0.69
2	E	93	5.8	0.60	0.062			***	0.87
2	L	137	7.6	0.80	0.081			***	0.87
3	E	115	8.5	0.70	0.091			***	0.81
3	L	153	7.5	0.16	0.240	0.004	0.0015	***	0.89
4	E	168	5.1	0.99	0.164	-0.003	0.0010	***	0.93
4	L	185	4.7	0.46	0.051			***	0.86

[1]Harvest; [2]Date: Early (E) or late (L) first-cut harvest schedule; [#]$y=a+bx+cx^2$

Conclusions

Herbage crude protein concentration was generally higher for swards with Ruttinova than Merviot red clover, for monocultures of red clover compared with binary mixtures with ryegrass, and for swards managed in the late rather than the early harvest schedule. In contrast, applying inorganic N fertiliser in mid-March did not impact on herbage crude protein concentration. Quite high rates of inorganic N application were required with monocultures of ryegrass to attain the same crop crude protein content as was obtained from red clover monocultures.

Reference

O'Kiely P., O'Riordan E.G. and Black A.D. (2006). *Grassland Science in Europe*, 11: 243-245.