

## Forage quality of white clover (*Trifolium repens* L.) X Ball clover (*T.nigrescens* Viv.) hybrids over three harvest years

T.P.T. Michaelson-Yeates, M.T. Abberton, A.H. Marshall, T.A. Williams, H.G. Powell and P. Olyott  
*Institute of Grassland and Environmental Research, Plas Gogerddan, Aberystwyth, Ceredigion, SY23 3EB, UK,*  
*Email: terry.michaelson-yeates@bbsrc.ac.uk*

**Keywords:** backcrosses, reproductive characters, chemical composition

**Introduction** Introgression of reproductive traits from the annual, profusely flowering species ball clover into white clover is one route to improve seed yields in *T.repens*. The interspecific cross produced F<sub>1</sub>, backcross 1 (BC<sub>1</sub>), backcross 2 (BC<sub>2</sub>) and backcross 3 (BC<sub>3</sub>) plants with white clover as recurrent parent (Marshall *et al.*, 2002). These hybrids were found to be comparable with white clover for yield and persistency but produced 30% more flowers and their forage quality, relative to white clover was investigated.

**Material and methods** In August 1997 24 plots of 3.0m x 1.5m were established, with 40 plants of *T.repens*, *T.nigrescens*, F<sub>1</sub>, BC<sub>1</sub>, BC<sub>2</sub> or BC<sub>3</sub> in each plot. After transplanting each plot was oversown with the intermediate perennial ryegrass, Fennema, at a seed rate of 25 kg ha<sup>-1</sup>. Plots were cut seven times in 1998, six times in 1999 and four times in 2000, from May with the final cut in October. Clover and grass fractions were milled separately and *in vitro* dry matter digestibility (DMD), nitrogen (N) and water soluble carbohydrates (WSC) concentrations were predicted by near infrared reflectance spectrophotometer. The CP concentration was then calculated as N concentration x 6.25.

**Results** After the establishment year the legume component of the *T.nigrescens* and F<sub>1</sub> plot was absent and there were no significant differences between white clover and the hybrids for DMD in any of the harvest years. The WSC concentration of the backcross hybrids was less than that of white clover, significantly so in 1998 and 1999, and the CP concentration greater but only significantly so in 1999 and 2000 (Table 1). There was some evidence that the differences between white clover and the hybrids were less in the later backcross generations.

**Table 1** WSC and CP concentration (g kg<sup>-1</sup>DM) of the legume component of plots of *Trifolium repens*, BC<sub>1</sub>, BC<sub>2</sub> and BC<sub>3</sub> hybrids in three harvest years

	WSC			CP		
	1998	1999	2000	1998	1999	2000
<i>T.repens</i>	47.0	56.1	76.4	247.6	254.6	242.8
BC <sub>1</sub>	37.7	43.9	60.5	258.6	271.6	261.4
BC <sub>2</sub>	38.2	45.3	67.9	270.3	266.3	255.3
BC <sub>3</sub>	37.5	47.5	64.1	266.4	263.9	253.4
s.e.d.	1.91	2.49	4.87	10.39	3.12	6.22
Significance	**	***	n.s.	n.s.	***	*

s.e.d., standard error of difference of means; NS, not significant; \*P< 0.05; \*\*P< 0.01; \*\*\*P< 0.001.

**Conclusions** The difference in CP concentration between white clover and hybrids generally reduced with each backcross generation. This suggests that introgression of reproductive traits from *T.nigrescens* can be achieved without sacrificing forage quality and may improve some aspects of forage quality, although these improvements may be removed by further backcrossing. Currently a range of BC<sub>3</sub> hybrids, placed into three leaf size groups is being evaluated for agronomic traits and this material will be the basis for the first hybrid varieties.

**Acknowledgements** We gratefully acknowledge the financial support of Defra and BBSRC.

### References

Marshall A.H., T.P.T. Michaelson-Yeates, M.T. Abberton, A. Williams & H.G. Powell (2002). Variation for reproductive and agronomic traits among *T.repens* x *T. nigrescens* third generation backcross hybrids in the field. *Euphytica*, 126, 195-201.