

## Condensed tannin concentration and herbage accumulation of a white clover bred for increased floral condensed tannin

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**Introduction** White clover is a high quality feed for ruminants, however, its high protein content results in excessive urea excretion in urine and can cause bloat, reducing its potential value for animal production. The condensed tannins (CT) in some forages can reduce these problems, but plants may have poor agronomic performance. White clover produces CT in its flower heads, but herbage CT concentrations are normally too low to benefit animals. This paper reports CT concentrations and herbage accumulation over 2 years of an experimental line of white clover (HT) selected for increased flowering and floral CT concentrations.

**Materials and methods** Three 1 hectare (ha) replicates of each treatment (HT white clover and Grasslands Huia white clover) were sown in monoculture in April 2001, in the Waikato region, New Zealand, and grazed by cows. Clover herbage dry matter accumulation was measured monthly in 12 enclosure cages per treatment. Total CT concentrations in clover flower heads were measured every 1-2 months (when flowers were present) using the butanol-HCl method (Terrill *et al.*, 1992). The CT concentration in the clover herbage (leaf plus flower) was calculated from the CT concentration in the flower heads multiplied by the proportion of herbage as flower head. Data were analysed by analysis of variance.

**Results** Huia swards grew approximately 500 kg/ha more dry matter (DM) than HT swards in each spring and summer ( $p < 0.05$ ), with annual herbage accumulations of 10.3 and 9.5 t DM/ha in year 1 ( $p < 0.05$ ,  $sed = 0.16$ ), and 11.7 and 10.6 t DM/ha in year 2 ( $p = 0.07$ ,  $sed = 0.31$ ) for Huia and HT, respectively. Floral CT concentrations varied markedly over time, but were similar between treatments (Table 1). The higher flower head content of HT led to higher clover herbage CT concentrations than for Huia (Table 1).

**Table 1** Flower head content, and total CT concentration in flower heads and clover herbage (leaves plus flowers) for Grasslands Huia and HT white clover, from November 2001 to October 2003

Month/year:	11/01	1/02	3/02	5/02	10/02	11/02	12/02	1/03	2/03	3/03	4/03	5/03	9/03	10/03
Flower head (% of DM)														
Huia	3.6*	4.9**	13.2*	1.2	0.0**	3.2*	4.7*	12.8*	12.6	11.5	5.2*	0.7**	0.1	0.5
HT	9.9	15.3	21.2	2.9	0.7	10.0	14.1	22.0	14.2	14.4	7.7	1.4	0.3	2.6
sed	0.69	0.59	1.35	0.42	0.01	0.27	2.01	0.96	0.45	0.95	0.45	0.04	0.11	0.68
Flower head CT (g/kg DM)														
Huia	65	70	39	45	-	75	71	33	47	28	17	53*	68 <sup>1</sup>	75 <sup>1</sup>
HT	70	79	40	53	46 <sup>1</sup>	79	75	30	47	30	13	54	80 <sup>1</sup>	60 <sup>1</sup>
sed	2.3	2.6	6.8	5.7		2.1	2.8	2.2	1.5	2.1	1.2	0.2		
Clover herbage CT (g/kg DM)														
Huia	2.3*	3.4**	5.0	0.6**	-	2.4**	3.3*	4.3*	5.7	3.2	0.9	0.4**	0.1 <sup>1</sup>	0.4 <sup>1</sup>
HT	7.0	12.1	8.7	1.5	0.3	7.9	10.7	6.5	6.5	4.2	1.0	0.8	0.3 <sup>1</sup>	1.6 <sup>1</sup>
sed	0.98	0.72	1.39	0.07		0.35	1.53	0.48	0.31	0.27	0.08	0.07		

\* =  $p < 0.05$ , \*\* =  $p < 0.01$ , - = no data, <sup>1</sup> = one sample per treatment bulked across replicates

**Conclusions** The HT white clover often had herbage CT concentrations above that thought to prevent bloat (5 g/kg DM; Li *et al.*, 1996), but herbage accumulation was slightly lower than for Huia. In order to attain herbage CT concentrations that may improve ruminant production (20-40 g/kg DM; Aerts *et al.*, 1999) an understanding of the mechanisms influencing white clover floral CT concentrations is required.

### References

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