

BITE BREAKING PROPERTIES OF SOME PASTURE SPECIES

J. THARMARAJ, D.F. CHAPMAN and A.R. EGAN

Institute of Land and Food Resources, University of Melbourne, Parkville, Vic 3052

The average defoliation depth of a sward by cattle appears to fall between 30 and 40% of the initial sward height irrespective of the stage of grazing (Wade *et al.* 1989). The purpose of this study was to understand the mechanical efficiency of harvesting herbage measured as bite breaking force and to test the hypothesis that harvesting bites at 30 to 40% of the sward height is energetically cost effective in gathering nutrients from swards.

A portable apparatus was developed to simulate the bite of a mature dairy cow and used to estimate the peak bite breaking force as Newtons (N) required to remove 100 cm² bite area in the field. Six pasture swards with an average height of 15 cm, were compared during August/September 1997: annual ryegrass, cocksfoot, phalaris (cv. Australian and cv. Holdfast), subterranean clover, and a perennial ryegrass-white clover mixture. Ten bite samples were taken from each pasture type at each of four heights, set at 2 cm intervals down the sward profile. Bite samples from each height from each species were pooled and analyzed for fibre fraction (Goering and Van Soest) and *in vitro* dry matter digestibility (pepsin-cellulase method). Differences in bite weight (BW) and bite breaking force (BF) between species were not significant and the data were pooled. Differences in BF, bite weight / force ratio (BW/N), and digestible bite weight / force ratio (DBW/N) between defoliation depths (DD) were compared by ANOVA, using the within-depth difference as error term.

Bite breaking force was positively correlated with DD ($r^2 = 0.835$, $P < 0.001$), as were BW ($r^2 = 0.740$, $P < 0.001$), total cellulose content of bite ($r^2 = 0.615$, $P < 0.004$) and DBW ($r^2 = 0.817$, $P < 0.001$). Both, BF and BW increased with DD ($P < 0.001$), Table 1. Defoliation depth of 30 to 40% would equate to a layer between 4.5 and 6 cm from the top of the canopy. The difference in BF and BW between the 2 to 4 cm, and 4 to 6 cm depths strata were not significant. However, BF and BW differed significantly between strata above and below 6 cm DD. The mechanical efficiency (BW/N) did not differ significantly between sward strata tested but the data suggest a non linear change in BW/N with DD. The mean difference in BW/N and DBW/N between depths 4 and 6 cm (0.75 mg and 0.66 mg) were greater than the differences between 2 and 4 cm (0.06mg and 0.11 mg). This suggests that at defoliation depths up to 40%, a progressive increase in bite breaking force is experienced. Setting the depth of defoliation within 30 to 40% may help to maintaining the 'grazing momentum' for a longer time per grazing period and would appear to optimize the energetic efficiency of nutrient intake by mature dairy cows.

Table 1. Mean bite force and bite mass characteristics (mean values $\pm$ s.e.) of 100 cm² bites at four defoliation depths with species data pooled

Bite depth (cm) and (% sward height)	No. of bites	Bite weight (mg DM)	Bite force (N/100 cm ² bite area)	Bite weight/Force (mg DM/N)	Digestible DM/Force (mg/N)
2 (13%)	60	572 $\pm$ 83 ^a	71 $\pm$ 9 ^a	8.05 $\pm$ 0.61	6.62 $\pm$ 0.44
4 (27%)	60	768 $\pm$ 70 ^{ab}	98 $\pm$ 8 ^{ab}	7.99 $\pm$ 0.72	6.51 $\pm$ 0.53
6 (40%)	50	835 $\pm$ 65 ^b	121 $\pm$ 12 ^b	7.24 $\pm$ 0.93	5.85 $\pm$ 0.61
8 (53%)	40	1187 $\pm$ 104 ^c	157 $\pm$ 10 ^c	7.69 $\pm$ 0.91	6.28 $\pm$ 0.56
Average	52	808 $\pm$ 60	107 $\pm$ 8	7.77 $\pm$ 0.37	6.34 $\pm$ 0.25
P†		< 0.001	<0.001	NS	NS

† Variance between depths compared to within-depth variance as error term

Values with different superscripts denote significant differences within that column at $P < 0.05$

WADE, M.H., PEYRAUD, J.L., LEMAIRE, G. and CAMERON, E.A. (1989). *Proc. 16th Int. Grassld. Congr.*, Nice, France, pp. 1111-1112.