Grazing behaviour of ruminants

Chapter · January 1997

CITATIONS
12

READS
507

2 authors:

Malcolm John Gibb
Rothamsted Research
122 PUBLICATIONS **2,844** CITATIONS
SEE PROFILE

Robert J Orr
Rothamsted Research, North Wyke, United Kingdom
190 PUBLICATIONS **3,520** CITATIONS
SEE PROFILE

Grazing Behaviour of Ruminants

Malcolm Gibb and Robert Orr

Sward State, Bite Mass and Bite Rate	54
Effects of Physiological State of the Animal	55
Effects of Grass or Clover	56
Handling Time	57
Conclusions	57

GRAZING BEHAVIOUR OF RUMINANTS

Malcolm Gibb and Robert Orr

Grazed herbage is the cheapest feed source available for cattle and sheep. However, grazing animals frequently fail to achieve their production potential because voluntary intake is usually lower than what may be achieved when offering conserved and processed feeds. Under grazing conditions, daily intake is the product of intake rate and grazing time, where intake rate can be considered as the product of intake per bite (bite mass) and bite rate, and grazing time is the product of mean meal duration and number of meals. At IGER we are investigating the factors that limit intake by grazing sheep and cattle, by examining these components of the animals' eating process (Figure 9.1). This is done by measuring the animals' intake rates, and recording and analysing their jaw movements using equipment and software developed at the institute.

Sward state, bite mass and bite rate

Under temperate pasture conditions, bite mass is very highly correlated with leaf area index (LAI, leaf area per unit ground area) or green leaf mass. However, although the precise relationship will be modified where swards differ in their leaf to stem ratios or population densities, sward surface height (SSH) is a useful, practical method of applying the principles of herbage growth and utilisation originally based on LAI. Thus, we find that as SSH

Figure 9.1 *Grazing ewe with twin lambs*

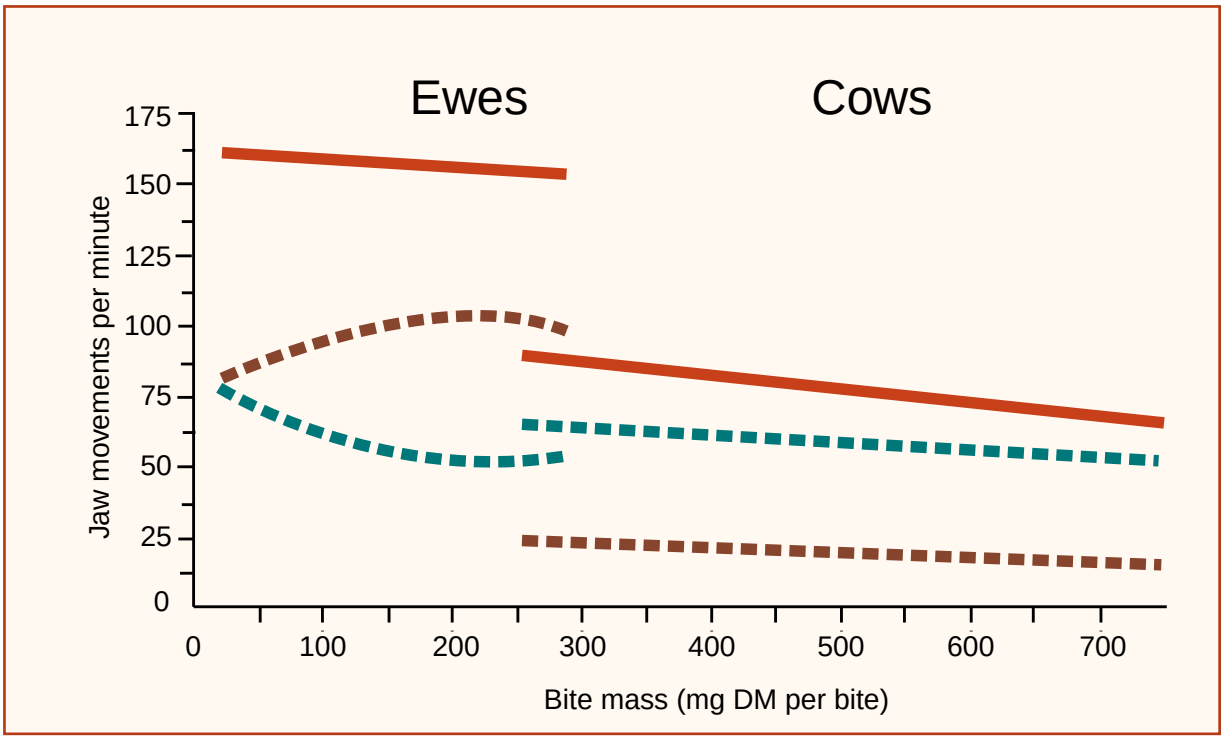

Figure 9.2 *Relationships between total jaw movement (——), bites (- - - -) and mastications (- - -) for lactating ewes and cows grazing ryegrass.*

is increased, bite mass increases, which in turn has a profound influence on bite rate and, as a consequence, intake rate.

Figure 9.2 shows that whilst cattle and sheep both have individual maxima for total grazing jaw movement rate, their apportionment between bites and mastications differs. In sheep, when bite mass increases, the number of bites decreases as the need to masticate increases. In cattle we find a different picture, with many fewer mastications per bite, and as bite mass increases, relatively smaller increases in the proportion of total jaw movements represented by mastications.

Effects of physiological state of the animal

Both intake rate and grazing time can be varied by grazing animals to regulate daily intake, in response to their nutrient requirements. For example, lactating sheep and cows have been shown to increase their intake rates by 10% and 19%, respectively, compared with non-lactating individuals grazing the same swards. Nevertheless, the sheep's or cow's major strategy for meeting the increased nutrient demands of lactation, is to increase total daily grazing time. Thus, lactating cows and sheep have been shown to increase the time spent grazing each day by 22% and 29%, respectively, compared with non-lactating counterparts. As a result of increased intake rate and grazing time, daily intake by sheep and cows can be increased by up to 40% in response to lactation.

Intake rate has also been shown to be under voluntary control as grazing ruminants generally consume herbage at a lower rate than they are capable of. For example, sheep fasted for 24 hours subsequently increased their intake rate and meal length compared with unfasted controls grazing similar swards.

Effects of grass or clover

Ruminants frequently perform better when grazing legume monocultures or grass legume mixtures, compared with monocultures of grass. Non-lactating ewes grazing monocultures of clover, exhibit similar bite rates, but greater bite masses, requiring fewer mastications per unit of feed ingested, when compared with those grazing monocultures of ryegrass. As a result, non-lactating ewes grazing clover can achieve daily intakes similar to those on ryegrass swards, but by grazing for 6 hours compared with 8 hours.

Comparison between the grazing behaviour of lactating ewes and growing dairy heifers grazing grass or clover (Table 9.1) has shown that both animal species consume about 80% more fresh weight of clover than grass per bite. However, these differences were much reduced when bite mass was expressed on a DM basis. On clover, sheep required fewer mastications per bite than grass and this, together with the slightly higher bite masses found for clover, resulted in higher intake rates. For the heifers, only small differences in DM bite mass and a similar number of mastications per bite were found for both grass and clover, giving the same DM intake rate on the two pasture species. Despite the longer time spent grazing by lactating ewes on the grass compared with on the clover, they were unable to compensate for the lower intake rate and consumed less herbage each day. The heifers, like the ewes, grazed for longer on the grass than the clover swards but, in contrast to the ewes, were able to achieve higher daily intake on the grass. These results are reflected by the animal production data, which showed that lambs from the ewes grazing clover

Table 9.1 Ingestive behaviour and performance of sheep and cattle grazing monocultures of ryegrass or white clover.

	Lactating ewes		Growing heifers		Lactating cows
	Grass	Clover	Grass	Clover	Grass
Bite mass (mg FW per bite)	303	547	770	1388	1650
Bite mass (mg DM per bite)	83	93	211	230	432
Mastications per bite	1.7	1.3	0.2	0.2	0.2
Intake rate (g DM per min)	4.5	5.9	12.9	12.9	25.9
Grazing time (h per 24h)	9.7	8.8	8.9	7.3	10.0
Ruminating time (h per 24h)	6.0	4.9	8.8	4.4	7.6
Intake (kg DM per d)	2.7	3.3	6.9	5.6	14.7
Liveweight gain (kg per d)	0.62*	0.74*	0.97	0.99	

* Combined weight gain for twin lambs reared per ewe.
FW = fresh weight, DM = dry matter

Table 9.2 Handling time for sheep and cattle grazing monocultures of ryegrass or white clover.

	Lactating ewes		Growing heifers		Lactating cows
	Grass	Clover	Grass	Clover	Grass
Handling time (s per g DM eaten)					
Eating	4.6	4.1	3.9	3.8	2.7
Ruminating	7.9	5.4	4.6	2.8	1.9
Total	12.5	9.5	8.5	6.6	4.6

grew faster than those from the ewes grazing grass. The similarity in growth rates of heifers on grass and clover indicates that they required to eat more grass to overcome its lower nutritional value (75 v 80 % organic matter digestibility). Such results suggest that, for cattle and sheep, fatigue was not a factor limiting intake when grazing clover, as animals grazing grass grazed for longer than those grazing clover. In addition, for cattle, it can be hypothesised that gut fill was also not a factor limiting intake for animals grazing clover, as cattle eating grass had greater intakes of herbage than those eating clover. This would suggest that control mechanisms other than fatigue or gut fill regulate intake.

Handling time

It has been suggested that the higher intake rate by cattle, compared with sheep, may not be due solely to the greater dental arcade size and hence bite mass, but that the main factor influencing intake rate is 'handling time' (i.e. the time required to take a bite plus the time taken to masticate the herbage in that bite). In addition, rumination may also be considered as a handling cost which, although it will not directly affect intake rate, could affect total intake by reducing the time available for grazing. Table 9.2 shows that lactating cows require less time per unit of herbage ingested than heifers, which in turn, require less time than lactating ewes. Furthermore, whereas sheep take less time per unit of clover ingested than grass, heifers take similar times. Both ewes and heifers have shorter rumination times per unit of clover ingested than of grass. These results explain how cattle can achieve higher intake rates than sheep, why herbage intake rate for sheep grazing clover is higher than that for grass, and why cattle have similar intake rates when grazing grass or clover.

Conclusions

Increased understanding of the relationships between sward state, bite mass and bite rate contribute to our modelling of intake rate. Further information is required concerning the mechanisms controlling initiation and termination of meals and number of meals (and thus grazing time), in order to describe fully the physiological and behavioural factors that limit daily intake by grazing cattle and sheep at pasture.

This work is commissioned by the Ministry of Agriculture, Fisheries and Food

Contact: malcolm.gibb@bbsrc.ac.uk or robert.orr@bbsrc.ac.uk