

## LINKING PASTURE AND ANIMAL PROCESSES

### The reason “Why” graze cattle at dusk.

#### The query

The outcome of a grazing strategy results from an interaction among herbage, ingestion, digestion, and nutrient absorption. Herbage is characterized by an increase in nutritive value during the day, which is attributed to moisture loss, non-structural carbohydrate accumulation, neutral detergent fiber and crude protein dilution, and an increase in *in vitro* organic matter digestibility. This diurnal variation in herbage quality coincides with the daily grazing pattern of cattle, which maximizes herbage intake at dusk. Afternoon herbage allocation has demonstrated increased intake at dusk, but it may not be maximized. Several studies found that fasting increased the herbage. Hence, delaying herbage allocation time and fasting might maximize nutrient intake.

Intake pattern dictates the dynamics of fermentation and particulate passage rate through the rumen; hence, a change in grazing pattern might alter patterns of ruminal metabolism. *This latter idea lead us to ask if the timing of herbage allocation is modified to capitalize on afternoon grazing and can intake and ruminal metabolism be augmented by daytime fasting?*



#### The experiment

This experiment was conducted at the Southwest Research & Extension Center in Hope, Arkansas. Four ruminally and duodenally cannulated Angus heifers individually (279 kg BW) strip-grazed a wheat pasture. Treatments were daily herbage allocation in the afternoon (1500, AHA), morning (0800, MHA), AHA plus 20 h of previous fasting (AHAF), and MHA plus 20 h of previous fasting (MHAF). Ruminal liquor was collected at 8 am, 12, 3, 7 and 11 pm to determine

fermentation pattern. Twelve duodenal samples were collected over a 48-h period so that diurnal variation in nutrient flow from the rumen to the intestines was estimated. Duodenal samples were analyzed for dry matter, organic matter, and ruminal microbial protein yield. Eating behavior was recorded every 2 minutes and bite rate every hour, while heifers were in the strips. Ruminal dry matter pools were measured four times daily (8 am, 12, 3, and 7 pm) to determine herbage dry matter intake per day and time of day. Eating time, bite rate and herbage intake rates were then summarized into three times of the day: morning (8 am to 12 pm), afternoon (12 pm to 3 pm), and evening (3 pm to 7 pm) to determine their diurnal patterns.

#### Results and discussion

The eating pattern was modified by treatment, resulting in longer and more intense (higher herbage intake rate, bite rate and bite mass) evening grazing bouts for AHA and AHAF than MHA and MHAF (data not shown); however, daily herbage DM intake did not differ (avg = 15.7 g/kg of bovine weight) among treatments. Ruminal fermentation patterns followed the pattern of herbage intake and ingestive behavior. Non-glucogenic/glucogenic volatile fatty acids ratio and ruminal pH were lower for AHA and AHAF during the evening (Figure). Interestingly, the flow of organic matter, nitrogen, and microbial crude protein to the duodenum was greater in AHA than MHA, MHAF, and AHAF. Total tract digestibility of organic matter did not differ for MHA, AHA, and AHAF, but digestibility was lower for MHAF. True ruminal digestibility of organica matter did not differ among NHA, MHAF, and AHAF, but digestibility was higher for AHA and resulted in increased microbial crude protein yield from the rumen (Table).



Figure. Diurnal pattern volatile fatty acids non-glucogenic/glucogenic ratio [(acetate + 2 butyrate)/propionate] of strip grazed beef heifers, facing morning herbage allocation (MHA; 0800), afternoon herbage allocation (AHA; 1500), MHA plus 20 h of fasting (grazing session 0800 to 1200, MHAF) and AHA plus 20 h of fasting (grazing session 1500 to 1900, AHAF).

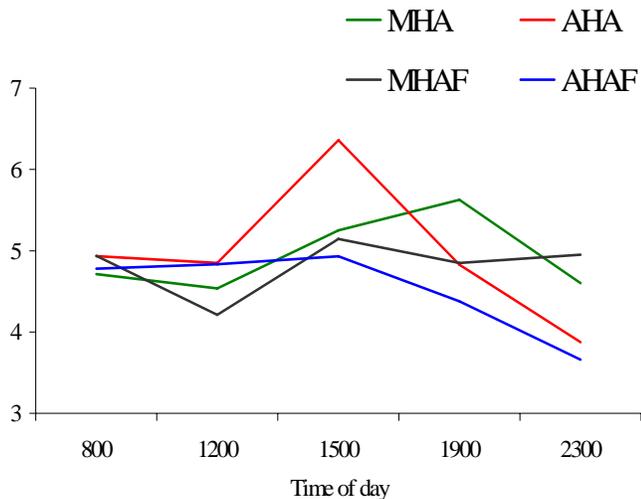


Table. Nutrient flow at the duodenum and organic matter digestibility in heifers strip grazing wheat pasture.

Items	Treatments			
	MHA	MHAF	AFA	AHAF
<i>Duodenum, kg/d</i>				
Total OM flow	3.78	3.33	4.46	3.36
Total nitrogen	0.14	0.14	0.18	0.13
Microbial N	0.17	0.16	0.21	0.17
Non-microbial OM	2.09	1.89	2.55	2.04
Microbial OM	1.64	1.30	2.04	1.61
<i>True ruminal OM digestibility, %</i>				
	47.8	52.3	67.3	44.0
<i>Total tract OM digestibility, %</i>				
	48.7	37.7	46.4	48.3

### The answer

Temporal fluctuations of herbage quality imply that grazing behavior may not be constant in time. A simple change in the time of herbage allocation of strip grazed cattle late in the afternoon instead of early in the morning, modifies the connection among grazing bouts into the temporal distribution that makes cattle graze longer and more intensely during dusk, when herbage has the highest nutritive value. This work not only supports those behavioral changes, but also demonstrates that, at the same resource allocation, grazing management changes the diurnal pattern of herbage dry matter intake, modifies ruminal function, nutrient flow to the duodenum, and site and extent of digestion.

Definitely, afternoon herbage allocations in strip grazing management increases the nutrient supply at the same level of herbage dry matter intake. Although matching of afternoon allocation and fasting did not enhance nutrient supply, it equalized the amount of nutrient supplied by morning herbage allocations. This may allow managers to graze cattle in short grazing sessions, reducing pasture damage through a reduction in pasture residence time. Because the outcome of any grazing strategy results from the complex interaction among herbage dynamics, ingestion, digestion, nutrient absorption, and their feedback, it was believed that producers have partial control over herbage quality and nutrient availability. However, a simple match in plant and animal processes may help graziers “to start managing” nutrients supplied by a dynamic food, pasture.



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