



LINKING PASTURE AND ANIMAL PROCESSES

Let's graze the cattle at dusk.

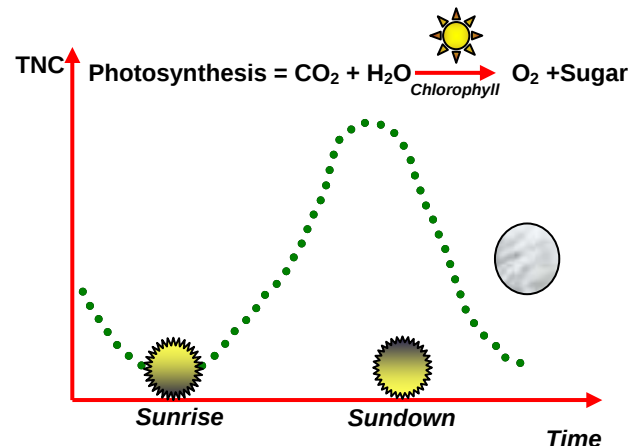
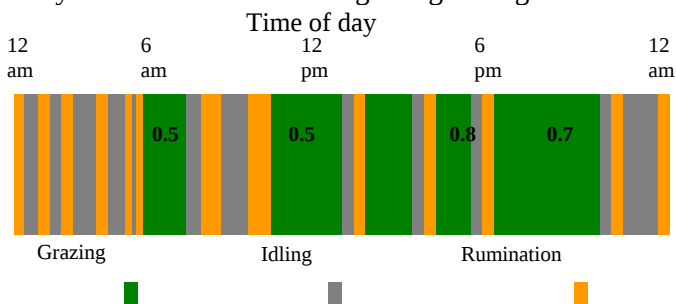
The problem

The profitability of grazing systems can be greatly influenced by the relationship between the grazing animal and the pasture (productivity, quality, quantity, species composition). The "pasture-rumen-animal" interface deals with the internal state of the animal (level of hunger, appetite), the amount and nutritive value of available pasture, as well as the effect of management on the capacity of cattle to harvest the nutrients supplied by pasture. For these reasons, grazing management provides a vital link between primary (plant) and secondary (animal) productivity of pastures. However, optimizing grazing management and herbage intake is still a seemingly simple yet intractable problem. A greater knowledge of grazing behavior, including the effects of management on grazing behavior, is needed to develop best management practices to more efficiently utilize pasture.

Linking pasture and animal processes

Animal decisions on the broader scale (i.e. home range, several day paddock), such as "where" to start grazing, are probably irrelevant in rotational grazing systems with daily allocation of paddocks. Therefore, decisions such as "when" to begin and "how" to distribute their meals (aka. grazing bouts) might be more important. These decisions determine how cattle allocate feeding time to meet nutrient requirements. In general, cattle show a daily frequency of three or four major grazing bouts (Figure 1) with the longer and more intense grazing bouts occurring in the evening.

Figure 1: Typical diurnal grazing pattern and dry matter (DM) pasture intake rate (ounces per minute) of dairy cows under continuous grazing management.

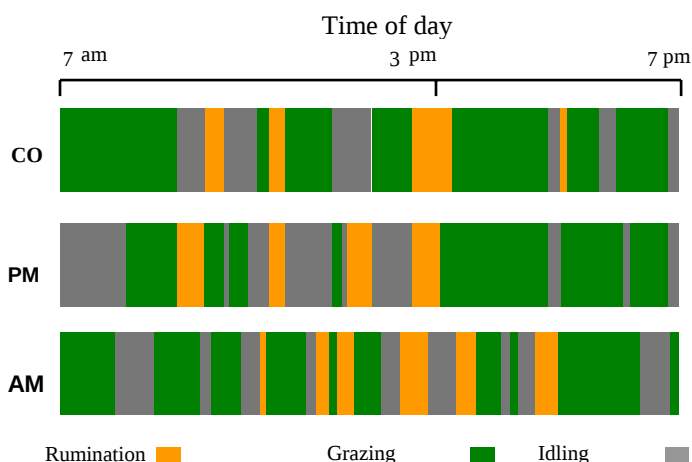


Research conducted in Argentina, US, Australia and Europe has shown significant variations in chemical composition of pasture throughout the day. The dry matter and nonstructural carbohydrate concentrations (sugars) of pasture increase over the course of a day (from morning to evening) due to moisture losses and accumulation of photosynthates (products of photosynthesis, mostly sugars, an excellent energy source), which results in an increase in pasture digestibility and energy concentration as the day progresses. Pasture plants use this energy overnight for maintenance. As a result, pastures have lower energy reserves in the morning than the previous evening. Cattle have adapted their grazing patterns during the day (aka daily grazing pattern Figure 1; Figure 2) around this variation in energy stores of the pasture plants to focus their most intensive grazing when energy stores are highest in pasture plants. Therefore, if our objective is to improve animal performance and efficiently use the nutrient supplied by pasture, it may be advantageous to stimulate cattle to graze longer and more intensively during dusk by providing a fresh allocation of forage in the evening.

Studies conducted in Argentina and US demonstrated that modifications of the grazing pattern (frequency and distribution of grazing bouts) (Figure 2) alter the pattern of pasture and nutrient intakes. These studies linked the natural grazing patterns (shown in Figure 1, and Figure 2 continuous grazing; CO) with the fluctuations in pasture chemical composition and timing of pasture allocation

(opening of the new strip). At equal pasture allowance (6% of live weight per day), they found that afternoon pasture allocation (3:00 pm vs. 7:00 am) caused beef heifers to graze longer (Figure 2) and more intensively (higher amount of pasture per unit of time) late in the afternoon and early in the evening, when pasture had the highest quality. Allocating fresh pasture in the afternoon also led to better daily weight gains and changes in body condition score during the spring and winter. The heifers that were turned in to the new daily strip during the afternoon gained an average of 1.2 lb and 0.0145 points of body condition score more daily than the ones turned into the new strip during the morning.

Figure 2. Grazing pattern of beef heifers grazed under Continuous Grazing (CO) or strip grazing either with Afternoon Herbage Allocation (PM, 3:00 pm) or Morning Herbage Allocation (AM, 7:00 am),



These results are supported by the changes in diurnal chemical composition of pasture and an increased pasture intake during the evening. Neutral detergent fiber (fiber) concentration decreased by 10.8% while non-structural carbohydrates (energy) increased by 34.9% and pasture digestibility increased by 5% from morning to evening, which makes the pasture consumed during the evening more energy/ protein balanced. Moreover, during the evening, pasture had an additional 0.32 Mcal of metabolizable energy per lb. of pasture dry matter. Since higher energy intakes typically result in greater milk yields, providing a fresh strip of pasture in the evening (if cows are moved only once a day to fresh pasture) should result in greater milk production as shown in a similar work conducted with dairy cows in UK. Cows allocated to the new pasture strip after afternoon milking tended to show a higher milk yield (5% higher for cows, morning = 48 vs. afternoon = 51 lb. milk/day/cow) after they have were adapted to this afternoon strip grazing. On the other hand, heifers in the “afternoon strip-grazing” would face a depleted strip during morning (assuming a fresh strip is given only

once daily). This leads to a reduction in pasture intake during the morning, which may generate a stronger feeling of “hunger” at the time they enter to the new strip; and consequently stimulating higher pasture and nutrient intake rate in the evening. These premises were re-tested at the University of Arkansas, finding that “afternoon strip-grazings” increased nutrient precursors for milk yield (glucogenic volatile fatty acids and microbial protein coming from the rumen) .

Implications

Allocating fresh forage in the afternoon when herbage contains the highest energy and digestibility levels and also coincides with the time of day when animals naturally tend to graze the most is a win-win situation. Experimental results showed that this simple pasture management change resulted in an average of 0.73 lb extra gain per day per animal (beef heifers) for no additional monetary input. While pasture quality and availability can be quite variable, this relatively low-input management tool is applicable across nearly all grazing systems to help producers gain greater control and allocate nutrients supplied by pasture with greater efficiency.

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