Managing to Get More Milk and Profit from Pasture

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Grazing management is the foundation of a successful and profitable pasture based system. For dairy producers who adopt a grazing system, proper management of low cost pasture is critical. In order to maintain or improve profitability, emphasis needs to be on reducing costs and/or improving efficiency at the farm level. Increased reliance on grazed forages offers considerable opportunity to reduce costs. In the USA, the estimated cost of pasture is about one-half the cost of ensiled legume or grass forages on a dry matter basis. The intake by the dairy cow and the efficiency with which low cost pasture is utilized is the single most important factor determining profitability. In grazing, it is about intake.

Potential Pasture Intake and Milk Output

Research from several counties has demonstrated that with well-managed grazing systems, pasture intakes of 35 to 40 lb. of dry matter (DM)/cow/day can be achieved by Holsteins with pasture as the only feedstuff. This is about 3% of the bodyweight for Holstein cows. In a study at Penn State University, we obtained a daily pasture intake of 45 lb/DM/cow with high genetic Holstein cows fed grass pasture as the only feedstuff. This intake can provide adequate energy to theoretically support up to 50-60 lb. of milk/day with Holsteins. However, most cows may still lose substantial body condition to achieve this production since energy outgo exceeds energy intake. Pasture intake and milk yields of this magnitude may only be achieved in the spring or early summer when pasture growth and quality are high. With the generally favorable price of milk in relation to grain supplement in the USA, it is most economical for most graziers to feed supplemental concentrates and feedstuffs rather than feed only pasture.

Factors Influencing Pasture Intake and Milk Output

In confinement operations, DMI is determined by feeding management, the amount fed, frequency of feeding, and other factors. Pasture intake by the grazing dairy cow is largely determined by how effective the cow harvests the pasture in the field. How full is the pasture feedbunk? This depends primarily on the grazing time and the rate of intake during that grazing period. The amount of pasture consumed is characterized by the amount of time spent grazing [(grazing time (GT)]; the rate at which pasture is taken into the mouth [(biting rate (BR)], and the amount of pasture DM eaten with each bite (intake per bite mass or bite size). This can be written more simply as pasture intake = grazing time x biting rate x bite size. Grazing time and biting rate are primarily animal factors, which means that dairy producers have little control of these factors.

Grazing Time (minutes/day)[a]

✖

Biting Rate (bites/minute)[a]

✖

Bite Mass (g intake/bite)[b]

⇓

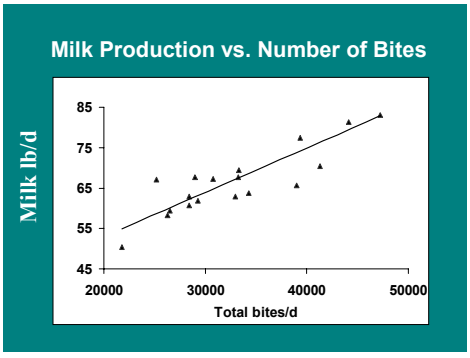
Pasture Intake

[a]Primarily animal factors
[b]Primarily influenced by sward factors

High yielding cows have a stronger hunger drive than low yielding cows, and consequently graze for longer times (500 to 700 minutes/day) and have high biting rates (up to 65 bites/minute). However, the major factor influencing pasture intake is the amount of herbage intake per bite, or bite mass. Bite mass can be controlled by management. Small increases in the intake/bite can have a major effect on daily pasture intake and animal performance. Bite size is primarily influenced by sward factors such as grass height and density of pasture, and the proportion of green leaf in the sward. If intake per bite declines, as it inevitably does on short swards, the behavioral constraints on biting rate and grazing time mean a reduction in daily forage intake. The amount of time spent grazing increases as the amount of pasture decreases which is why high producing cows need to be provided a dense sward with at least 6 to 8 inches pasture height, depending on the type of grass.

We conducted a study at Penn State where we compared concentrate supplementation when high yielding Holstein cows grazed at two pasture allowances (55 vs. 90 lb. of pasture DM/cow/day). Cows were equipped with electronic recorders to monitor eating and chewing behavior (see Table 1). Cows fed only pasture grazed about 617 minutes/day (10 hr), and averaged 56 bites/minute. This resulted in about 35,000 bites/day. This suggests that grazing cows may need stronger jaws and mouths than cows fed in confinement!

Figure 1.



In our study, the cows that produced more milk had more total bites (Figure 1). In fact, some cows producing over 80 lb. of milk had over 40,000 bites per day. Obviously, adequate pasture availability is essential for cows to have this large number of bites. The most noted difference was the intake/bite. The unsupplemented cows in our study that were provided with a larger pasture allowance had a slightly higher DMI/bite (0.60 vs. 0.55g) (Table 1). Couple this with the slightly longer grazing time, and these cows consumed 7 lb. (45 vs. 38 lb.) more pasture DM/day, and produced 6.8 lb. (48.8 vs. 42.0 lb.) more milk than cows with less available pasture.

Table 1. Grazing Behavior, Intake, and Milk Yield of Unsupplemented and Supplemented Cows Grazing Two Pasture Allowances[a].

	Low pasture Allowance (55 lb/cow/day)		**High Pasture Allowance (90 lb/cow/day)**	
	0 Suppl.	**+ Suppl.[b]**	**0 Suppl.**	**+ Suppl.[b]**
Grazing Behavior				
Grazing time, min/day	609	534	626	522
Bites/minute	56	54	56	55
Intake/bite, g DM/bite	.55	.55	.60	.59
Total bites/day	34,400	28,500	35,200	28,600
Intake (lb/day)				
Pasture	38.5	34.1	45.1	35.4
Supplement	-	19.1	-	19.1
Total	38.5	53.2	45.1	54.6
Milk yield, lb/day	42.1	65.3	48.8	65.8

[a] Bargo, et al, J. Dairy Sci. 85:1777-1792 (2002).

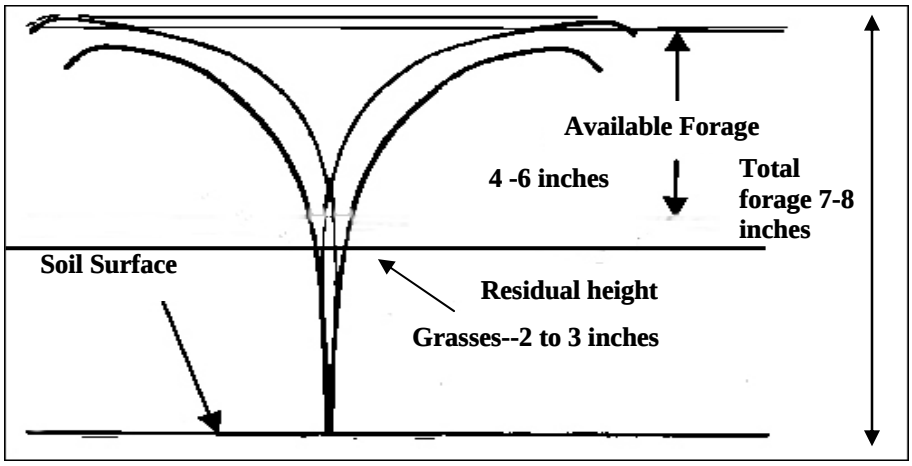
[b]Cows were fed 19 lb. concentrate per day, or about 1 lb/3.5 lb of milk.

In this study, the cows fed 19 lb. of concentrate consumed less pasture, since concentrate replaced pasture. Total feed intake was greater as expected. Daily milk production was 17 lb. (65.8 vs 48.5 lb.) to 23.3 lb.. (65.3 vs 42.0 lb.) greater with supplementation. There was one lb. of milk response for each one lb. of concentrate fed (Table 1). Cows provided a lower pasture allowance had a larger increase in total feed intake and milk production than cows offered the higher pasture allowance. Cows fed the lower pasture allowance were obviously underfed, and had inadequate available pasture. This is common among graziers, particularly in the summer when pasture growth decreases.

Managing Pasture to Maximize Intake and Performance

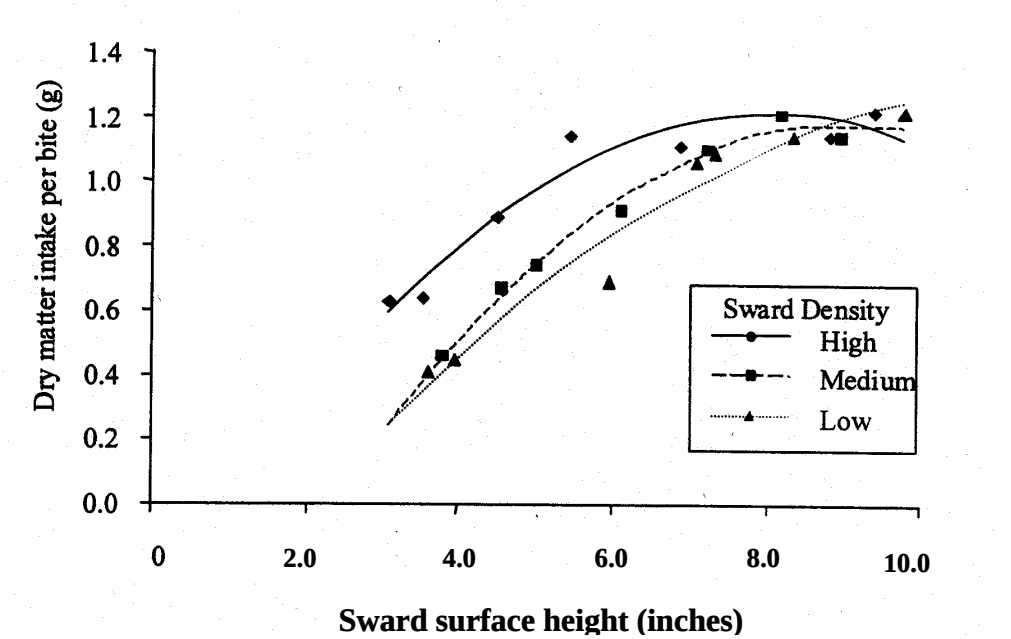
What is available forage (Figure 2)? The inches of available pasture is determined by measuring the height of the pasture and subtracting the desired stubble (residual) height. Pasture should be measured in several representative spots to get an average height. In Figure 2, the total forage from the soil surface is 7-8 inches. With a residual stubble height of 2-3 inches, the cow has 4-6 inches of available forage. It is important that the stubble height be maintained to assure the survival of the desired plant species. This is especially so under drought conditions where over-grazing will severely damage stands and delay regrowth. Under severe drought conditions animals should be removed from pasture and fed stored forages.

Fig. 2. What is Available Forage?



The quantity of available pasture, which includes pasture height and density, is key to maximizing intake. Just as an empty feed bunk limits the intake and milk yield in a confinement dairy operation, an "empty pasture feed bunk" will limit intake and productivity. The effects of changes in sward height and bulk density on bite mass (intake/bite) with high producing Holsteins are illustrated in Figure 3. These data indicate a relationship between sward height and bite mass, with large increases in bite mass with increasing height over the range from 4 to 10 inches. Bite mass or intake per bite declines more rapidly with decreasing sward height in low density, or "open" swards. The implications suggest that in order to maximize herbage intake, you need to have a "dense" sward to maximize intake/bite and total intake and profitability.

Figure 3. Effect of sward height and sward density on bite mass at different sward densities.



To optimize milk production and profitability, we need to provide cows with pastures that allow them to consume high pasture intake. We need a pasture sward that provides a mouthful of high digestible forage in every bite. If the pasture sward is too short, cows will not have as much intake per bite, and they will spend energy and grazing time. If animals are forced to graze pasture below 2-3 inches, to a short stubble or residual height, this will likely reduce the pasture regrowth.

In the recent Penn State study with Holstein cows (Table 1), the allocation of 90 lb. of pasture DM/cow/day clearly resulted in more pasture intake (45 lb. DM) than the allocation of 55 lb/cow/day (38.5 lb/day). In reviewing research from several countries, it appears that about 80 to 90 lb. of pasture DM should be available daily to each cow if maximum pasture intake is to be achieved when pasture is the only feedstuff. Supplementation with concentrates will reduce the pasture intake because of substitution rate and reduce the needed pasture allowance needed. We suggest the following (Table 3) as a guideline for pasture allowance.

Table 3. Pasture Allowance and Availability Guidelines

Expected dry matter intake (DMI)			Pasture Allowance (DM)
Pasture	Concentrate	Total	Recommended/cow/day
----------	----------	lb DM/cow/day	----------
40	0	40	70-80
37	6	43	60-70
34	12	46	50-60
31	18	49	40-50

For an example calculation, let's assume that we have 100 cows and that 2500 lb. DM/acre of pasture is available based on pasture measurements. Note, this is pasture DM cut to ground level. If our goal is 30 lb. of DMI/cow/day, then we need about 40 to 50 lb. of available pasture DM/cow/day (Table 3). This assumes about 60-70% efficiency of utilization. With 100 cows x 50 lb. of available pasture DM/cow, we need about 5000 lb. of available pasture DM/day. With this information, about 2 acres of pastureland is needed per day to achieve 30 lb. DMI/cow/day for a 100 cow herd.

$$\left[\frac{\text{5000 lb. DM/day needed}}{\text{2500 lb. DM available/acre}} = 2.0 \text{ acre}\right]$$

Assessment of available pasture is needed on a regular basis, just like the assessment of feed refusals and daily intake is needed for confinement feeding. If less pasture is provided, cows will reduce this pasture DMI, and more concentrate and forage supplementation is needed to maintain milk production.

We must emphasize that this example and discussion focuses on optimizing intake on a daily basis, similar to the daily feeding of a TMR in confinement. In both systems, we must plan and budget the acreage of land for each year's forage. With pasture systems in the northeast and upper Midwest, providing one acre/cow for 6 to 7 month grazing season is a reasonable target. This does not include pasture land needed for heifers and dry cows.

SUMMARY

Grazed pasture represents the cheapest source of nutrients for dairy cows. Management of dairy cows and pasture is a major challenge, given the variation in grass growth and grazing conditions during the grazing season. Providing adequate available pasture that has dense sward will maximize the intake/bite and maximize pasture intake and low cost milk production. Allocation of the correct amount of area and pasture to achieve maximum intake is an important decision that the manager must make each day to achieve this.