The Effect of Different Grazing Systems on Dairy Goat Productivity
FNE01-369

1. Objectives

The two main objectives of this research were to:

i) examine two grazing methods to determine their effects on milk production, body condition, and parasitism

ii) determine the amount of protein and butterfat produced by grazing dairy goats to aid in selecting animals best suited for low-supplement, rotational grazing.

2. Project Methods

We originally planned to milk 20 does this year, but this was reduced to 16 due to an early season injury and on doe not being bred. The 16 milking does were split into 2 groups of 8. We have a mixed breed herd with a purebred line of Nubians. Kidding occurred in February (13 does) or April (3 does) depending on their ages. We split the groups as follows: Once we started milking we measured individual production and ranked animals from highest to lowest. We split every other animal into one group to try to have somewhat equal production to start with. We then switched animals around to split up twins so we could have genetic equivalents for comparison. Each group (grass or browse) was randomly determined.

Starting in May, a biweekly sample of the milk of each doe (combined from the morning and evening milking) was taken and analyzed for total butterfat and total protein. The pounds of milk produced by each animal per 24 hr period was also measured biweekly. Total milk yield for each group was measured at each milking as well, however reliable data was not obtained until the beginning of June due to the removal of 1 injured doe and the culling of 2 low-producing animals.

During May and most of June, all does were on pasture, since the browse was not fully leafed out and we needed to set up fencing infrastructure. This established a baseline for all the animals with equal feed opportunities. On June 22 we divided the groups and placed 8 animals in browse paddocks and 8 in pasture paddocks. We had originally planned that the browse group would be on pasture at night and browse during the day, but when we assessed the amount of browse we had, we decided to keep the browse group in the brush all the time. The browse paddocks had a perimeter of about 400 feet of elecronet fencing and were moved as needed, usually every 4 to 7 days. Browse plant composition varied from "old field" types including goldenrod, raspberry, and spirea to more early pioneer growth with sumac, small maples, apple, poplar, and birch. We sometimes would fell small trees to extend the time in a paddock.

The pasture group was on pasture all day and night, except during milking, and the paddock formed with a 150-foot long electronet fence was moved every 12 hours. We aimed for a pasture sward height of 8-10 inches to start, since goats don't tend to graze below 4-6 inches. We rotated through the pasture 4 to 5 times during the season. All milking does were fed a total of 3 pounds of concentrate in the parlor (18% protein until Aug 1, then 16%) and free-choice access to a mixture of salt, kelp and minerals. Hay was only accessible in the holding pen for milking (about 1 hr/ day accessibility) and we fed 1 to 2 bales per week. Both groups had access to the same feeder, so group hay consumption could not be measured, however it was noticed that the pasture group ate hay much more vigorously than the browse group.

Total pounds of milk produced by each group was measured at each milking. We also measured the production of individual goats 7 times during the season and samples were analyzed for butterfat and protein. Animals were also weighed and body condition scored twice in the season to determine if they were gaining or losing condition in either treatment.

3. Results

Milk Production

Average daily milk, butterfat, and protein production before and after the split appear in Table 1. Figure 1 presents average protein production per goat in each group throughout the season. Figure 2 shows the average butterfat production per goat in each group and Figure 3 shows the average milk yield. The data in Figure 3 are shown as weekly averages of the twice daily measurements, since day-to-day fluctuations would make the graph difficult to determine.

The data in Table 1 was analyzed with a t-test testing for a significant difference between the two groups both before and after the split of feed types. Using a $p<0.05$ as indicating a statistically significant difference between the groups, the table shows that while both groups were grazing grass they produced statistically equivalent amounts of milk, protein, and butterfat. However, after the split, the goats on browse produced significantly greater amounts of milk, protein, and butterfat.

Table 1.

	Before split		After split			
	grass	browse	grass	browse	p value before	p value after
Milk Produced Daily (lbs per goat)	5.7	5.5	4.9	5.2	0.34	0.001
Protein Produced Daily (ounces per goat)	2.7	2.9	2.1	2.6	0.064	0.031
Butterfat Produced Daily (ounces per goat)	3.7	3.9	2.8	4.0	0.204	0.019

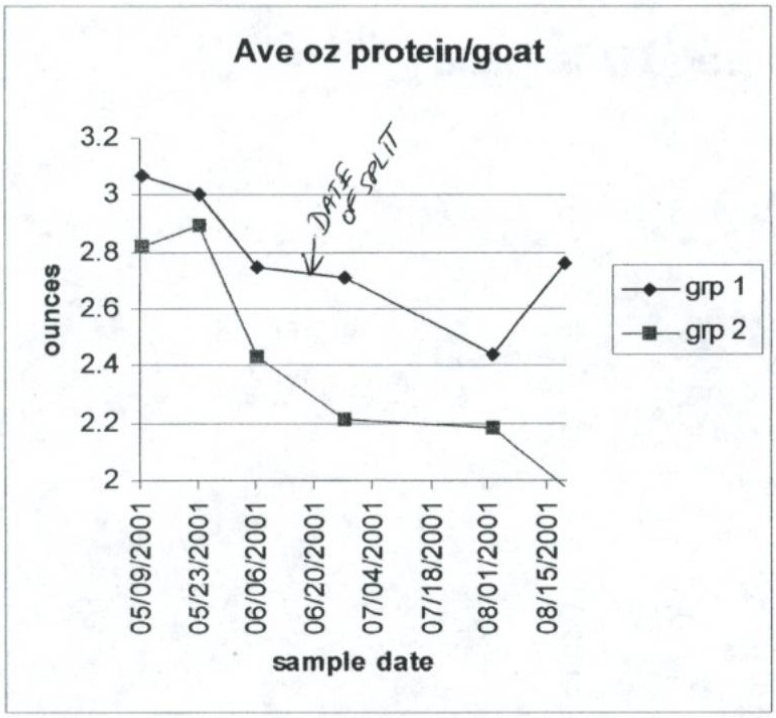

Figure 1. Average amount of protein produced per goat per day in group 1 (browse) or group 2 (pasture). Goats were split into 2 groups from all pasture on 22 June.

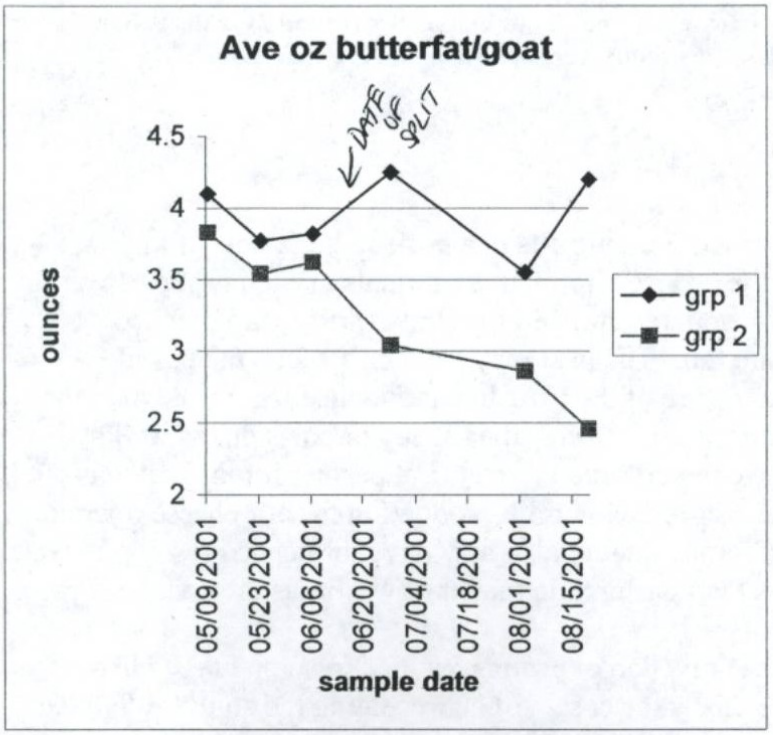

Figure 2. Average amount of fat produced per goat per day in group 1 (browse) or group 2 (pasture). The goats were split into 2 groups from all pasture on 22 June.

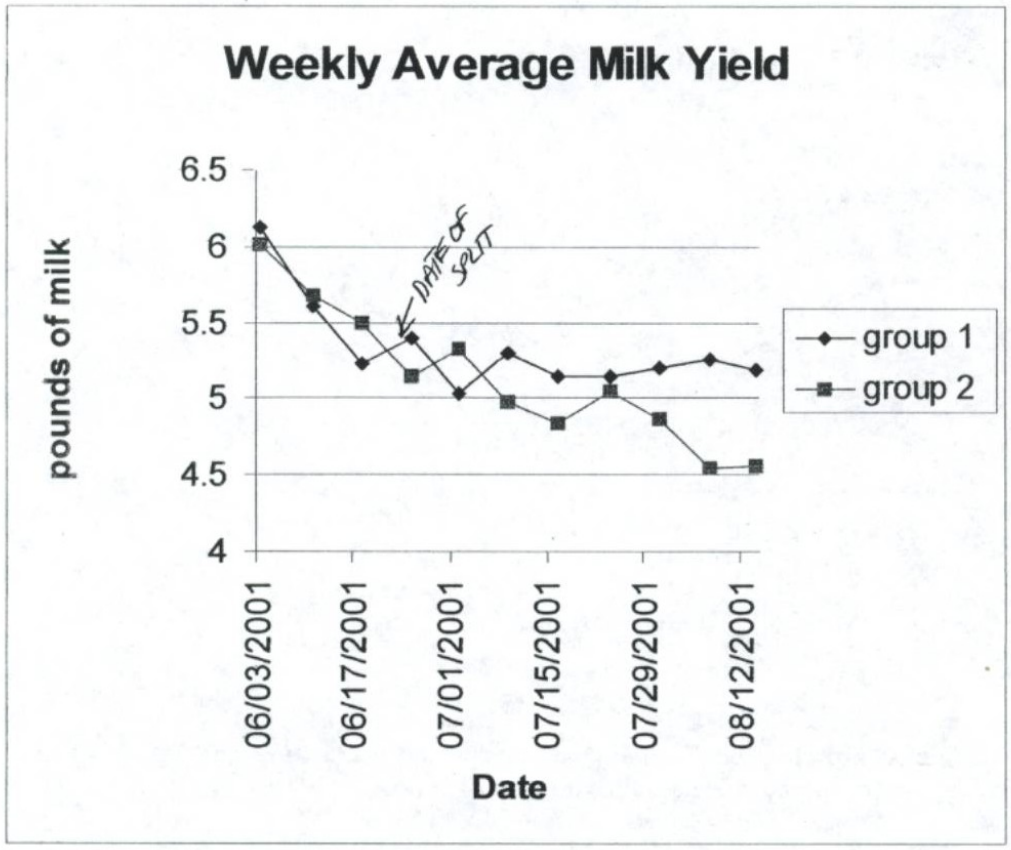

Figure 3. Milk production by goats on browse (group 1) or on pasture (group 2); values shown are averages of every milking for a week. The groups were split into two groups on June 22.

This was only a one-season study, and these results may reflect the effects of this season's growing conditions, or the chance allotment of animals in each group. It was an unusually hot, dry summer and we actually stopped the study earlier than planned because we had no suitable pasture left. The heat may have influenced the pasture group's productivity, since by the nature of their treatment they had less shade than the goats on browse. Goats prefer more fibrous forage than sheep or cows do, as well as pasture that is much longer, and we never forced them to eat pasture forage that was not suitable, since we did not want to risk reducing milk production for our cheese operation. Despite our care in management, forage quality also may have influenced results; browse probably is a better feed for goats than pasture, no matter how fibrous the pasture forage.

There is also the possibility that the division of groups resulted in some bias. There is no way of knowing for sure whether this is the case without repeating the study. We did, however, split 3 sets of twins between groups to have some genetic equivalents, and in each case, the twin on browse produced more than the twin on pasture.

Body Condition and Health

Due to problems of obtaining the scale, weight of each doe was only taken twice, on 12 June and on 17 July. Body condition was determined at these dates as well. There were no large changes in the animals during that time. Goats on browse gained on average of 1 lb and goats on pasture lost on average of 2 lb. The average body condition score changed from 3.2 to 3.3 of goats that went on browse and from 2.5 to 2.8 for goats that remained on pasture.

As mentioned in our proposal, when previously grazing goats on pasture, we felt we were losing production due to goats getting diarrhea and going off feed. This summer we noted 6 incidents of a goat going off her feed in the pasture group and 1 incident in the browse group. We had 2 incidents of diarrhea in browse group, compared to 3 incidents in the pasture group.

Our collaborator, Bill Murphy from UVM, used the grazing treatments as part of his study on managing parasites of grazing livestock on organic farms. He had fecal samples of 3 adults and 3 kids from each group analyzed for parasite egg content every 2 weeks throughout the summer to determine level of parasitism of the animals. There were no significant differences in fecal egg numbers (68-81 eggs/gram) in adult does during the first part of the season (May 7-June 18), nor after groups were split into the treatments (31-34 eggs/gram). This was likely due to the fact that we did not push the goats eating grass, and they did not eat below 4-6 inches. We did however notice, when bringing the goats back and forth to their paddocks, that three different goats on browse lost very long sections of tapeworm with their stools (greater than 1 foot). We had never seen this before and did not notice it happening with any goats on pasture. This happened in the middle of July. This expulsion of tapeworms may have resulted in the browse goats producing more milk, however the fecal egg counts did not reflect any difference in parasite numbers.

Although it was not directly related to the study, the results of parasite levels of kids is worthwhile to note. Our replacement doelings spent the summer on browse and the kids for the pasture group consisted of: one doeling grazed with the milkers, and 2 male kids raised with the males in a separate paddock. We made a fatal error grazing our males this year, in that we often followed the does with the males to save time setting up fence and because the males seemed willing to graze closer to the ground, often to 2-3". Because of this we saw severe parasitism and anemia in our male kids, and this showed up in the fecal samples in mid-July, about 1 month after they began the second rotation on pasture. Between May 7 and July 2, parasite fecal egg levels in young animals averaged 2 eggs/gram. Between July 14 and August 27, they averaged 107 eggs/gram in pastured animals, and 20 eggs/gram in animals on browse.

4. Plans for the Future

Our long-term goals include having a larger proportion of browse for our goats. It is very clear that that is what they prefer. When we would let our goats on pasture out to move

the fence they always ran to the woods to eat browse species. This study indicates that feeding browse increases productivity, compared to pasture alone. However, pasture will also be an important component to our system. Goats are quite enthusiastic about eating grass in the early spring before browse has leafed out and in the fall when the browse is starting to senesce. Our ideal plan would be to utilize browse from early June to mid September, with pasture access on either end of the grazing season.

Our obstacles to grazing more browse include inadequate browse land area, so we need to clear more young growth forest; inadequate fencing infrastructure, and the fact that the browse is very hard on electronet. If we had a better infrastructure set up, feeding browse may not be much more labor intensive, because the animals stay in the same browse paddock for 4-7 days, instead of being moved every 12 hours on pasture.

Further study should be done on the most appropriate way to rotate through browse paddocks. Questions we currently have include: How frequently can an area have animals grazing without turning the browse forage to pasture grasses and legumes? What is an adequate stocking density? What level of defoliation should occur before moving animals? We currently move through an area only once a year and notice good regrowth of brush by the end of the year. It will take several years of this treatment to determine if this is sustainable for the brush species.

5. Economic Impact

The objective of this study was not to study the economics of grazing goats but to study the two grazing methods. However, it seems worthwhile to make note of the information we have. During winter months, our does and yearlings consumed 22 to 25 bales of hay per week. When milking in February, March, and half of April, we fed 4 pounds of concentrate per day. Once we started grazing, the hay consumption dropped to about 2 bales per week and concentrate down to 3 pounds. The savings in hay alone (at $2/bale) is $40-$45 per week over at least 25 weeks. This would be a feed savings of $1000 - $1125 on hay for our 16 milking does. Next year we may consider increasing our savings on grain by dropping the level of concentrate further, due to the fleshy condition of many of our goats.

The costs of grazing include setting up the fencing and watering infrastructure. Costs to a farm would be very individual depending on the layout of the land. There are also maintenance costs to the fencing, since the electronet does not last forever. We will plan to replace 1-2 fence lengths per year ($150-$300).

Grazing goats may be more labor intensive. For our farm, it is probably a break-even venture. We are not set up to mechanically clean our barn, so removing manure, turning compost, and spreading compost is all done by hand. If this is not more work than moving goats it is certainly more unpleasant work. We also have the assistance of two very capable Border Collies, which are absolutely critical to the function of our farm.

And of course, that which is not easily economically quantifiable is the health and happiness of our animals. They enjoy being outside, even at night, and they survive all kinds of summer weather with minimal complaints. I would also say that our goats eating browse, climbing trees, and leaping from ledges, have an added vitality over those merely chewing grass or clover in a flat pasture paddock with nothing more exciting to jump over than the fence.

5. Outreach Plan

Enclosed is an article that appeared in the St.Albans Messenger. Additionally we hosted a pasture walk in the middle of July and explained our study with preliminary results. The final project report was printed in the Small Ruminant Dairy Newsletter produced by Carol Delaney. Bill Murphy brought his pasture management class from UVM out for a pasture walk in October where we explained the study and results. We are also scheduled to give a presentation on the findings at the annual Grassfarmers conference in Randolf VT in February.

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FNE01-369