

# Forage Intake and Grazing Performance by Dairy Cows

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AS early as the late eighteenth century stockmen were concerned with the relationship between pasture forages and the behavior of animals grazing them. James Anderson (1797), who farmed in Scotland, described grazing habits of animals and outlined certain procedures which he felt would give greater production from pastures. One hundred and forty years elapsed before any further large-scale studies were reported in which an effort was made to relate the effects of forage characteristics to the grazing and milk production of dairy cows.

Hancock (1950), working under New Zealand conditions, reported the conclusions drawn from four years' work during which nearly 2,000 cow-days of grazing were recorded. While the data from which the observations were made were not reported, several of the conclusions are of great interest to workers in the field of grassland management. Of particular interest is the observation that the time spent grazing and the subsequent time required for ruminating are interdependent. Either of the periods may be limited or prolonged by the other and, in the case of prolonged ruminating time, total forage intake may be limited by insufficient time for grazing. To enable this relationship to be depicted, the use of the formula

$$\left( \frac{\text{ruminating time}}{\text{grazing time}} = \text{rt/gt ratio} \right)$$

was suggested and used in this paper. The relationship between grazing behavior and the quantity and quality of forage avail-

able per cow is perhaps the newer and more interesting of the reported findings.

Waite, *et al.* (1951) reported on two years' work in Scotland during which an effort was made to relate the forage conditions, grazing behavior, and other factors to the forage intake of the animals under study. He explained the difference in intake between forages characterized as long stemmy material of low moisture content and its opposite on the basis that the rumen is less densely packed when the animal receives the feeling of repletion, thus, giving shorter grazing periods and less dry matter intake. On the short materials of high moisture content, the forage tends to pack in the rumen and the animal grazes longer and takes a greater quantity of forage into the rumen before the state of fullness is reached. The workers found no apparent relationship between the time spent grazing and stage of lactation, individual milk yield, or live weight.

It is the purpose of this paper to describe the techniques being used at the Georgia Experiment Station and some of the preliminary data obtained during the first phases of a long-time study of pasture utilization by dairy cows.

## EXPERIMENTAL TECHNIQUE

Jersey and Guernsey cows in lactation were assigned to various pastures throughout the year to study their reaction to the pastures with or without supplementary barn feeding. (No barn feed in summer—hay and grain in winter). The specific

TABLE 1

*The kind, availability, quality, and intake of forages and cow grazing performance*

DATE	FORAGE	FORAGE (GREEN WT.) CONSUMED		FORAGE (DRY BASIS)			DIG.	TOTAL D.M. INTAKE	GRAZING TIME	RATIO RT/GT
		cow/day	cow/hr. grazing	Avail. cow/acre	Cons. cow/day	Cons. cow/hr. grazing				
				Pounds			Percent	Pounds	Hours	
Aug. 3-17	Starr millet	196	31.3	194	19.6	3.13	73	19.6	6.25	1.09
	Temporary (Av.) <sup>1</sup>	142	22.6	220	16.2	2.58	66	16.2	6.27	1.17
Aug. 17-30	Temporary <sup>2</sup>	120	17.7	261	13.2	1.95	61	13.2	6.75	1.39
	Permanent <sup>3</sup>	49	6.1	96	13.5	1.67	59	13.5	8.09	1.07
Nov. 19-Dec. 3	Fescue	51	6.5	459	14.5	1.86	63	26.1	7.81	1.42
Dec. 3-17	Fescue	58	7.2	237	14.6	1.81	63	24.7	8.05	1.24
Jan. 14-Feb. 7	Temporary <sup>4</sup>	111	14.6	60	22.1	2.90	70	30.6	7.62	.60

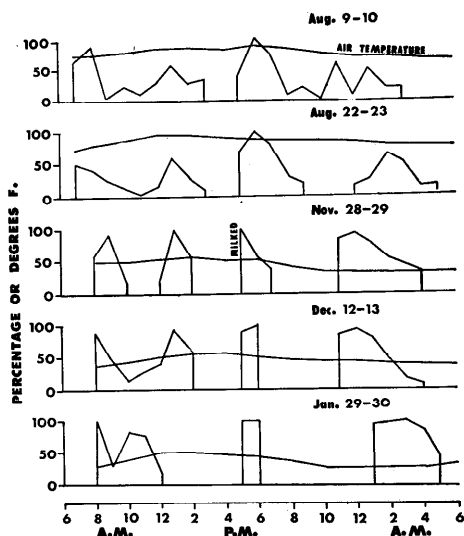
<sup>1</sup> Starr millet, Tift sudan, and brown top millet.<sup>2</sup> Starr millet.<sup>3</sup> Bermuda grass and Dallis grass.<sup>4</sup> Oats, rye grass, and crimson clover.

FIGURE 1. Air temperature and grazing performance (shown as percentage of herd grazing at each interval) on forages during five grazing periods.

factors measured were intake of forage, digestibility of the forage, milk production, and grazing behavior. Forage intake was determined by feeding chromic oxide ( $\text{Cr}_2\text{O}_3$ ) in capsule form and making a three-day composite of fecal samples ("grab method") for each cow. The con-

centration of chromic oxide was determined by the technique of Schurch (1950). Digestibility of the forage dry matter and other nutrients was determined by the chromogen technique of Reid *et al.* (1950). Milk production was determined from daily milk weights and periodic butterfat tests and was expressed in terms of 4 percent fat corrected milk (FCM). During the experimental period, each cow was observed at 15 minute intervals for a continuous 48 hour interval. Observations were made of the time spent grazing, ruminating and loafing.

## RESULTS AND DISCUSSION

The data are presented in Table 1 and Figure 1. The figure shows the grazing performance on the forages under study during each period in terms of the percentage of the cows on the pasture that were observed grazing throughout the 24 hour period. Each time interval represents an average of two consecutive 24 hour periods beginning after the morning milking and ending when the cows were removed from the pasture for milking the

following morning. The average air temperature is recorded for each period. Data shown in the table represent a summary of the grazing performance and intake of forage in relation to the quantity and quality of forage available per cow per acre.

Since it is too early for over-all trends or conclusions to be made, the factors that are apparently in operation during each period will be discussed separately.

*August 3-17.* Three temporary summer forages, Starr millet (*Pennisetum glaucum*), Tift sudan grass (*Sorghum vulgare*), and brown top millet (*Panicum ramosum* L.), were under observation. Apparently nearly ideal conditions for good utilization of the forage were provided by the forages under study. High digestibility of forage dry matter (66 percent) was coupled with good forage intake per hour of grazing time (2.58 lb. d. m.). The favorable rt/gt ratio of 1.17 was further indication of the forage being high in moisture and of relatively high quality. The grazing habit studies would seem to suggest general discomfort of the cows during the daylight hours when the air temperature remained in the high eighties and is indicated by the small number of cows grazing at any one time. Observations indicated that the cows were restless. They ate for a short period and then returned to the shade only to remain for a short period and then returned to grazing. The most positive trend is the long grazing periods during the cooler hours of the night. Over half of the total grazing time occurred between the evening and morning milkings. This is of immediate practical importance because many farmers practice keeping their cows in dry lot during the night-time.

*August 17-30.* This period represents a comparison between two permanent pastures, Bermuda grass (*Cynodon dac-*

*tylon*), and Dallis grass (*Paspalum dilatatum*) and one summer temporary (Starr millet). The permanent pastures were characterized by a small quantity (96 lb. d. m.) and poor quality (59 percent dry matter digestibility) forage available per cow per acre. The long grazing time of 8.09 hrs. per day and the low rt/gt ratio (1.07) would seem to indicate that the point of mutual restriction of ruminating and grazing time had been reached. The relatively good intake of dry matter by the cows was due to the low moisture content of the forage. The tendency of the animals to have distinct grazing periods is also apparently due to the stemmy characteristic of the forage and smaller total forage intake per hour of grazing. Although the temporary forage was of lower quality than during the previous two weeks, the animal intake was lower due to the longer ruminating time as indicated by the high rt/gt ratio of 1.39. The grazing performance of the animals is quite similar to the first period with daytime grazing indicating general uncomfortableness of the cows due to the high air temperature. Again the major portion of the grazing was done during the later evening and hours of darkness. Although not shown in the data, the cows adjusted their grazing habits to the new forage on the first day that they were given access to a different forage. This observation is in line with the findings of New Zealand workers and is an indication of the effect of forage on the grazing performance of animals.

*Nov. 19-Dec. 17.* The grazing periods will be treated together because of their similarity. The forage under study was nearly pure fescue grass (*Festuca arundinacea* Schreb.). The small intake of green forage per hour of grazing (6.54 and 7.2 lb.) probably lends support to the idea of bulk in the rumen limiting total dry matter intake. The grazing performance

divided itself into four distinct grazing peaks and the relatively high rt/gt ratios of 1.42 and 1.24 would further support the idea that the cow was filling up on volume but not on weight. The long ruminating time may have further limited intake by decreasing the time available for grazing. The shorter ruminating time during the second period was reflected in the longer time spent grazing which would again indicate that the two are near the point of mutual restriction. The short grazing time after the evening milking may have been due to the barn ration of hay and grain that was fed while the cows were in the barn. The small change in the dry matter intake during the second period despite the greater wet forage intake indicated a higher moisture content of the forage and may explain the lowered rt/gt ratio.

*Jan. 14–Feb. 7.* During this period the forage being studied consisted of a mixture of Nortex oats (*Avena sativa*), rye grass (*Lolium multiflorum*) and crimson clover (*Trifolium incarnatum*). The mixture is one of the more widely recommended winter forages in the Piedmont area of Georgia and gives excellent results with dairy cows. Both the total intake of dry matter (30.55 lb.) and forage dry matter (22.14 lb.) were the highest recorded during the period included in the study. There was apparently an interplay of high forage quality (70 percent dry matter digestibility), low ruminating time (rt/gt of 0.60), and good forage intake per hour of grazing (14.56 lb.) during the experiment. The interplay of these and possibly other factors constituted what is commonly considered to be palatability. It was obvious from the data that the term palatability had no meaning unless used in conjunction with the forage quality and intake data as well as the specific characteristics of the forages under con-

sideration. The three grazing peaks shown in the figure and the tendency for relatively long periods during which all cows grazed, lends further support to the idea that compactness of the forages in the rumen is a factor influencing total forage intake. Such conditions as represented in this forage—high quality as indicated by high dry matter digestibility, compact forages as represented by short leafy material, low ruminating time, and a tendency for the cows to have a distinct grazing period—would appear to be the more ideal for maximum intake of forage by dairy cows in this section of Georgia.

### CONCLUSIONS

The data presented are a preliminary report of long time experiments to determine if general principles relating the forage quantity and quality to forage intake and utilization among the common forages in the Southeast used in dairy cattle feeding exist. Within the range of the data the following conclusions appear to be justified.

1. High air temperatures during the late summer months tend to make the cows uncomfortable since they exhibit highly irregular grazing habits.

2. Pastures for night grazing during the summer months are of primary importance since the cows spend about 60 percent of their total grazing time between the evening and morning milkings.

3. The use of the term palatability as generally used is not justified and has little or no meaning unless accompanied by intake and utilization measurements and such specific forage characteristics as digestibility, moisture content, quantity available, and grazing performance of the cows.

4. Apparently, the volume taken into the rumen is as effective in causing the cow to develop the feeling of repletion as is the amount of dry matter.

5. Greatest intake of forage was secured when the forage was of high digestibility, ruminating time was low, and total grazing time was not limited by the necessity to ruminate.

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#### DEMOCRACY

Democracy is based upon the conviction that there are extraordinary possibilities in ordinary people.—*Harry Emerson Fosdick.*



Democracy—that form of government which leaves every citizen free to do his best for the public welfare.—*Louis Pasteur.*



It is to self-government, the great principle of popular representation and administration, the system that lets in all to participate in its counsels, that we owe what we are, and what we hope to be.—*Daniel Webster.*



While democracy must have its organization and controls, its vital breath is individual liberty.—*Charles Evans Hughes.*