

THE EFFECT OF STOCKING RATE ON HERBAGE UTILIZATION AND MILK PRODUCTION UNDER TIME-RESTRICTED GRAZING BY LACTATING DAIRY COWS

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ABSTRACT

The effect of two stocking rates of 5 (L) and 7 (H) heads of lactating dairy cows per hectare on herbage utilization and milk production were determined under a time-restricted grazing during 2 years from 1993 to 1994. The annual herbage utilization and milk production from pasture in 1993 were lower in H than L (herbage, 7.9 vs. 9.1tDM/ha; milk, 8.1 vs. 9.6t/ha) since the days of grazing cycle was considerably shorter in H than L (7.8 vs. 17.1days). As a result of changing the expected daily herbage intake per head of H seasonally in 1994, the annual herbage utilization and milk production from pasture were higher in H than L (herbage, 9.9 vs. 9.6tDM/ha; milk, 12.1 vs. 10.5t/ha) even if the stocking rate of H was higher than L.

KEYWORDS

Stocking rate, herbage utilization, milk production, time-restricted grazing, lactating dairy cows

INTRODUCTION

Full production from pastures is achieved only when requirements of animals and productive capacity of the pasture are in balance. Stocking rate which affects intake and animal performance has, therefore, a major influence on pasture utilization (Holmes, 1989). While individual animal performance declines progressively with increasing stocking rate, animal performance per unit area increases as stocking rate increases (Hodgson, 1990; Vallentine, 1990). There is, however, little information under time-restricted grazing on the effect of the stocking rate on per-head and per-hectare response by lactating dairy cows.

In this paper, the effect of the different stocking rate on herbage utilization and milk production were determined under a time-restricted grazing during 2 years.

MATERIALS AND METHODS

The experiment was carried out at a grass and legume mixed pasture (1.87ha, established in spring 1992) in Experimental Farm, Hokkaido University during 2 years from 1993-1994. The pasture was divided equally (0.935ha each), and each sward was grazed by 5 (L) and 7 (H) heads of Holstein lactating cows, respectively.

Cows of both L and H were strip-grazed under time-restricted stocking system (5hr/d: 2.5hr X 2). The area of daily strip was calculated from herbage mass before grazing, expected herbage intake and grazing efficiency. Expected herbage intake and grazing efficiency of both L and H in 1993 was 10kgDM/d/cow and 60% (up to June 20), and 8.0kgDM/d/cow and 40% (after June 21). In 1994, though expected herbage intake and grazing efficiency of L was the same as 1993, those of H was changed to reduce the expected herbage intake in spring and gain it in autumn without changing the total expected herbage intake during grazing period: 10kgDM/d/cow and 60% (up to May 31), 8kgDM/d/cow and 60% (June 1-July 31), and 8.5kgDM/d/cow and 60% (after August 1). In addition, cows were fed grass silage, hay and concentrate in the barn. The daily roughage allowance was equivalent to total digestible nutrients (TDN) for maintenance+13kg of milk based on Japanese Feeding Standard for Dairy Cattle (National Research Council of MAFF of

Japan, 1987). Concentrates were supplemented roughages at rate of 0-28% of milk yield.

Herbage intake was estimated from the difference of herbage mass before and after grazing. Accumulated herbage intakes were regarded as annual herbage utilization. Stocking rate was expressed as cow-hr/ha since grazing time per day was restricted. Milk production from pasture was calculated as follows: total milk production X (herbage TDN intake / total TDN intake).

RESULTS AND DISCUSSION

The results of pasture utilization are shown in Table 1. Beginning dates of grazing were the same in both years. Though grazing days were nearly equal between L and H in 1994, those of H were about 2 weeks shorter than L in 1993 because of lower herbage mass in autumn. Stocking rate of H in 1993 was about 500cow-hr/ha lower than that in 1994. The annual herbage utilization in 1993 was lower in H than L (7.9 vs. 9.1tDM/ha) in spite of higher stocking rate in H. This may be due to considerably shorter days of grazing cycle in H than L (7.8 vs. 17.1days). As a result of changing the expected daily herbage intake per head of H seasonally in 1994, the annual herbage utilization was higher in H than L (9.9 vs. 9.6tDM/ha).

As shown in Table 2, DM and TDN intake of herbage during grazing period in H were lower than L in 1993 because of shorter grazing days (Table 1) though those in 1994 were nearly equal between L and H. Total DM and TDN intake of H were higher than L in both 1993 and 1994. Milk production from pasture in 1993 was lower in H than L (8.1 vs. 9.6t/ha) in spite of a higher stocking rate in H. This is caused by much lower proportion of herbage to total TDN intake. As a result of changing the expected daily herbage intake per head of H seasonally in 1994, milk production from pasture was higher in H than L (12.1 vs. 10.5t/ha).

It was concluded that, in addition to the stocking rate, changing the expected herbage intake seasonally as balancing with herbage production during grazing period was effective in increasing the annual herbage utilization and milk production from pasture.

REFERENCES

- Hodgson, J.** 1990. Grazing management: science into practice. Pages 83-98, Longman Scientific & Technical, Harlow, Essex.
- Holmes, W.** 1989. Grazing management. Pages 130-172 in W. Holmes, ed. Grass (2nd ed.), Blackwell Scientific Publication, Oxford.
- National Research Council of MAFF of Japan.** 1987. Japanese Feeding Standard for Dairy Cattle. Pages 6-11, Central Association of Livestock Industry. Tokyo.
- Vallentine, J.F.** 1990. Grazing management. Pages 335-351, Academic Press, San Diego, California.

Table 1

Results of pasture utilization

	1993		1994	
	L	H	L	H
Beginning of grazing	11 May	11 May	11 May	11 May
Grazing days	171	156	172	169
Stocking rate (cow-hr/ha)	4412	5679	4428	6116
Days of grazing cycle	17.1	7.8	15.6	14.1
No. of grazing cycles	10	20	11	12
Annual herbage utilization (tDM/ha)	9.1	7.9	9.6	9.9

Table 2

Intake and milk production

	1993		1994	
	L	H	L	H
Feed intake (tDM)				
Herbage	8.7	7.4	9.3	9.5
Total	18.7	22.5	18.7	21.6
TDN intake (t)				
Herbage	5.3	4.5	6.0	6.1
Total	11.6	14.1	12.2	14.5
Milk production (t)	19.9	23.5	19.9	26.9
Milk production from pasture (t/ha)	9.6	8.1	10.5	12.1