

STUDY ON DUAL GRAZING OF CATTLE AND SHEEP

1. The Effect of Sheep Grazing After Beef Cattle Grazing on Product and Composition of Herbage on Perennial Rye Grass-Ladino Clover Mixture Pastures

by

Tomoe SAKUMAT†, Atsushi KAMIDE† & Shinzo MATSUOT

牛とめん羊の組み合わせ放牧法に関する試験

1. ペレニアルライグラス、ラジノクローバ混播草地における肉牛放牧後のめん羊放牧が、牧草の生産量ならびに収量構成内容に及ぼす影響

佐久間 智 工 上 出 純 松 尾 信 三

A dual grazing, shearling grazing after beef cattle grazing, was compared with a grazing of only beef cattle in Perennial rye grass-Ladino clover mixture pastures. Live weight carrying capacity of pastures was higher in the dual grazing of those two animals than in the single use grazing of beef cattle. Nutrient intake by only the beef cattle was smaller in the dual grazing than in the single, but total nutrient intake of those two animals in the dual grazing was larger than one of the beef cattle only in the single use grazing. The sheep of the dual grazing depended much on legume in their nutrient intake and the beef cattle in the dual depended on the legume less than the cattle in the single. Yearly average daily live weight gains of steers in both herds did not differ so much in both managements.

1. Preface

In Japan, sheep have been decreasing year by year and, on the contrary, beef cattle have been increasing. A technique how to manage the cattle well, especially on pastures, is going to become more important. First of all, it needs a maximum forage pro-

duction to have a maximum animal production from pastures.

Over-stocking of animals results in reduction of pasture production and it also decreases their live weight gains. The opposite of overgrazing, extremely low stocking, also reduces forage growth. Commonly an available stocking rate for cattle is thought to be lower than for sheep and there seems to appear a value to dual grazing.

† Hokkaido Prefectural Takikawa Animal Husbandry Experiment Station

This experiment was conducted to explain a practical grazing management method to keep a high and continuous forage production from the pastures for cattle by dual grazing of cattle and sheep.

There are some reports on the dual or companion grazing of sheep and beef cattle. Commonly it was thought that such grazing would give a maximum forage production and also much animal product.

Van KEUREN³⁾ reported that cattle grazing alone tends to leave patches of forage largely untouched and sheep will utilize those areas as well as many weeds not eaten by the cattle. And he thought sheep an important livestock as "follow-up animals." HEINEMANN²⁾ described significantly greater live weight gains with yearling steers grazing followed by sheep, than gains by steers on single use in irrigated pastures in Washington.

It was thought that the effect of such a combination or companion grazing of cattle and sheep was the result of differences between those animal species in respective utilizing forage areas and their proper stocking rates.

In some of the above reports, it was said cattle were grass eaters on sheep pasture, and also described the highest gains from sheep and cattle grazing together at a ratio of 6 to 1. In those reports, the main animal to graze herbage in the pasture was sheep. But, nowadays, because of its national dietary life, the main species for animal production in Japan is not the sheep but the beef cattle. In such a circumstance mentioned above, it must be thought that the first grazing animal in the pastures was the beef cattle, and the sheep must be grass eaters on cattle pasture to maximize the forage production.

2. Experimental procedures

Pastures used for the experiment were Perennial rye grass (*Lolium perenne*)-Ladino clover (*Trifolium repense*) mixture swards which were established 1968. Three ha. of the pastures were divided into two groups with each five paddocks of 0.3 ha.

Japanese black cattle of about nine to ten months age and shearling of Corriedale were used.

One management was a single use grazing by Japanese black cattle only and the another one was the dual grazing of cattle and shearling. The planned grazing rate for prepared herbage for the beef cattle was about 50 to 60 per cent, and for the shearling grazing in the dual the rate was increased to about 75 per cent after the cattle grazing.

The beef cattle were rotated 6 times a year and grazed forage in each of 5 paddocks and did not take any other feeds except some salt. They also drank water freely. But the shearlings used for the experiment were fed in other swards except grazing periods for a treatment of the dual grazing.

Plants in the pasture were manured 3 times a year, early spring and after each second and fourth rotational grazing, with yearly total amount of 3.2 kg of N, 4 kg of P_2O_5 and 7.2 kg of K_2O .

Grazing days of one period in each of the paddocks were decided by an amount of herbage before grazing of animals and also by hypothetical daily fresh herbage intake by those animals, 11 per cent and 14 per cent of their live weight for the cattle shearlings and respectively. To make the rotation and stocking rate intentional, some heads of the cattle were added to the herds of both managements in spring, when the herbage

growth was more rapid than the other season, but 8 head of the cattle, 5 head of steers and 3 head of calves, were grazed rotationally and continuously in identical 5 paddocks through all the period.

The grazing period in an identical paddock was about 5 to 7 days for the beef cattle' and about 2 days grazing by the shearlings followed in the spring to the early summer; but those grazing periods became fewer in the fall by reduction of herbage recovery from grazing.

Herbage samples of each paddock were hand-clipped with 10 quadrates of 1 m² each before and after all of animal grazing, then they were dried and weighed, and the dry matter (DM) product per paddock was estimated in each time of rotation. Content of crude protein and crude fiber was also

analysed from those samples. Then the digestible crude protein(DCP) and total digestible nutrient (TDN) were estimated with ADAMS's regression¹⁾. With the resultant nutrient production, the nutrient intake by those animals were also estimated.

Live weight of beef cattle was weighed 5 times in this period. Withers height and heart girth were also measured in the beginning and end of the grazing period respectively.

3. Results and Discussion

Grazing procedures for both two managements progressed like Table 1 which shows the dates they started to graze and the grazing periods for each time of rotational grazing. Yearly total grazing days of the experiment were 143 days.

Table 1 Grazing procedures

Rotation	Number of grazed paddocks	Beginning dates of grazing in each rotation	Rotational days for a cycle	Average grazing days a paddock	
				Cattle	Sheep
1	4	May 18 th	28	7.0	1.7
2	4	Jun. 15 th	36	6.5	2.5
3	5	Jul. 11 th	28	7.0	2.1
4	5	Aug. 8 th	26	6.5	2.5
5	5	Sep. 3 rd	20	5.0	1.8
6	5	Sep. 23 rd	15	3.0	1.7
Total or average			143	5.1	1.7

Table 2 shows real and calculated animal heads, in conversion with 500 kg live weight

Table 2 Yearly carrying capacity per 10 a

Managements		Real grazed heads	Calculated heads in terms of 500 kg of live weight	%
Dual	Cattle	87.9	37.0	84
	Shearling	171.6	15.5	35
	Total		52.5	119
Single	Cattle	100.2	44.2	100

per 10 a., grazed in both managements.

Yearly average carrying capacity of animal live weight was 37.0 heads per 10 a. for the dual grazing, and it was 84 per cent of 44 heads for the single use grazing of beef cattle only. But total carrying capacity of live weight of beef cattle and shearling in the dual was 53 heads per 10 a., 19 per cent higher than the grazing of beef cattle only.

Table 3 gives herbage product and

Table 3 Herbage product and nutrients intake by animals

Items	Managements	DM	Nutrients DCP	TDN
Nutrients intake by animals (kg/10 a.)	Beef cattle	404 (93)	62 (89)	284 (91)
	Dual <u>Shearling</u>	<u>185</u>	<u>31</u>	<u>134</u>
	<u>Total</u>	<u>589 (136)</u>	<u>93 (133)</u>	<u>419 (134)</u>
	Single Beef cattle	433 (100)	70 (100)	312 (100)
Herbage product (kg/10 a.)	<u>Dual</u>	<u>647 (125)</u>	<u>102 (119)</u>	<u>458 (121)</u>
	Single	516 (100)	86 (100)	378 (100)
% of intake by animals to total product (%)	Beef cattle	62.5(69)	61.3 (67)	62.0 (68)
	Dual <u>Shearling</u>	<u>28.6(31)</u>	<u>30.1 (33)</u>	<u>29.2 (32)</u>
	<u>Total</u>	<u>91.1(100)</u>	<u>91.4 (100)</u>	<u>91.3 (100)</u>
	Single Beef cattle	83.9	80.7	82.7
Daily intake by animals per 500 kg live weight (kg)	Beef cattle	10.9(111)	1.67(106)	7.67(109)
	Dual <u>Shearling</u>	<u>11.9</u>	<u>2.00</u>	<u>8.63</u>
	<u>Total</u>	<u>11.2</u>	<u>1.77</u>	<u>7.93</u>
	Single Beef cattle	9.8(100)	1.58(100)	7.06(100)

nutrient intake by animals. DM, DCP and TDN production was about 20 per cent more in the dual than in the single respectively. The increase of nutrients product in the dual was fitted to the result of increase of the carrying capacity of live weight. This increase of nutrient intake by those animals seemed to be brought about by an ability to increase the stocking rate for the pasture by dual grazing.

Table 3 gives also nutrient intake by those animals per unit pasture area. Each intake by the grazing cattle was larger in the single than in the dual, but the total intake of the nutrients by the cattle and shearlings was larger than the intake by beef cattle only in the single. The ratio of nutrient intake of DM, DCP and TDN by animal per 500 kg live weight was also larger in the dual than in the single.

As a result, the production of herbage from a pasture was larger in the dual than in the single and the tendency did not differ among DM, DCP and TDN, but the total

nutrient intake of the beef cattle only was smaller in the dual than the single. It must be that the increase of herbage regrowth after the shearling grazing could not completely recover the intake by shearling before the next beef cattle grazing, and the nutrient intake capacity of beef cattle itself was decreased.

Table 4 shows the proportion of nutrient intake by animals from grass or legume. There was evidently a different tendency in the ratios of the herbage component. Commonly the beef cattle in the dual grazing depended more highly on grass than ones in the single use grazing. Nutrient intake by shearlings was dependent upon the legume more highly than any beef cattle of both managements.

Hand-clipped forage samples were separated into grass and legume by the hand separating method, and the data are given in Table 5. On these Perennial rye grass-Ladino clover mixture pastures, an average

Table 4 Proportion of each grass and legume in the nutrient intake by grazing

Managements	Yearly intake, kg per 0.1 ha.						% of nutrient intake taken from legume in total			
	DM		DCP		TDN		DM	DCP	TDN	
	G	L	G	L	G	L				
Dual Cattle		296	108	37.3	24.9	195	89	27	40	31
	Shearling	100	86	10.8	19.8	63	71	46	65	53
	Total	396	194	48.1	44.7	258	160	33	48	38
Single		273	160	32.0	37.6	179	133	37	54	43

note ; G : Grass, L : Legume

legume content in the samples clearly decreased after animal grazing, especially after the shearling grazing. The periodical progression of legume proportion was also shown with Figure 1.

The legume content in the pastures used for the single progressed more highly than in the dual. From this figure, there seemed to be a low legume proportion in the dual and especially it would be reduced by shearling grazing, which was coincident with their big ratio of nutrient intake from legume. It was inferred that the progression of legume content influenced both the total amount of regrowth of forage plants and the differences of the animals nutrient intake between the two managements.

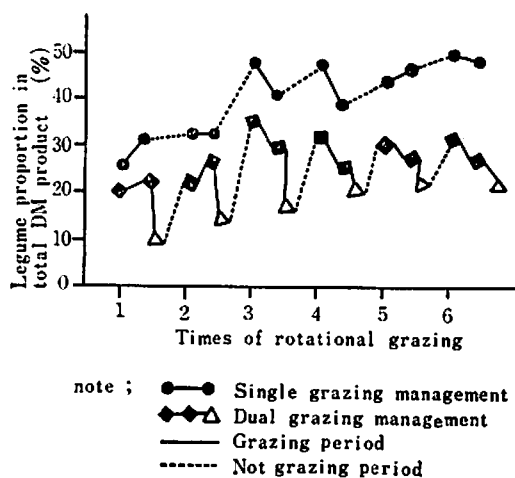


Fig. 1 Transition of legume proportion in total DM product

Table 5 Legume proportion in the clipped samples

Management	Before beef cattle grazing	After beef cattle grazing and before shearling grazing	After shearling grazing
Dual	24.4	22.3	15.2
Single	35.8	34.4	—

note ; Yearly av. of 5 paddocks and 6 rotational grazing, dry matter weight, %

Coefficients of variance of a weight of dry matter samples, which were hand-clipped each time of rotation and in each paddock through the period were calculated. Average of their 28 data was given in Table 6.

Contrary to expectations, the dung deposits, of the beef cattle would be grazed more or less by shearlings and the variance of such weight of the samples would be decreased, yet there was no decreasing tendency of the coefficient of variance in the dual grazing.

From the data the authors inferred that the shearlings also like to graze the dung

Table 6 Coefficient of variance about the DM weight of clipped samples

Managements	Before beef cattle grazing	After beef cattle grazing and before shearling grazing	After shearling grazing
Dual	24.6	32.8	35.0
Single	20.4	36.1	—

note ; Yearly av. of 5 paddocks and 6 rotational grazings, %

deposits made by beef cattle grazing as little as the cattle. And if there was some decreasing tendency of dung deposits, it would be brought by the characteristics of sheep to graze forage with high stocking rate, because the proper stocking rate for sheep grazing was higher than the beef cattle.

With the 5 heads of steers in the 8 beef cattle used continuously for the experiment, their live weight was measured 5 times.

Table 7 Live weight and daily gains of steers used for the experiment

Managements	Live weight (kg/head)	Live weight gains (kg/head)	Daily gains (kg/head · day)	Withers height (cm)	Heart girth (cm)
May 18 th					
Dual	166.4	—	—	96.0	132.8
Single	165.6	—	—	95.6	134.6
Oct. 9 th					
Dual	252.6	86.2	0.603	113.8	149.0
Single	251.0	85.4	0.600	114.4	153.6

Withers height and heart girth of the steers was also given in Table 7, but there was no extreme difference between the two managements.

As a conclusion, it was thought that an effect of the dual grazing of beef cattle and sheep was to maximize the total live weight carrying capacity of animals, brought about by the increase of herbage product per unit area.

Summary

Dual grazing of Japanese black cattle and shearling of Corriedale was compared with beef cattle grazing only in Perennial rye grass-Ladino clover mixture pastures by rotational grazing in 1970.

Total DM, DCP and TDN production from the pastures, total live weight carrying capacity and total intake of nutrients by those animals were more in the dual than in the single. The facts were inferred to depend on the high forage utilization of the dual

From those results, live weight gains and daily gains from the beginning of grazing to the end were shown in Table 7.

There were no evident differences of average seasonal live weight gains between the dual and the single in the last of the grazing. Though there was a slight tendency of little live weight gains at the early period and of large gains in the late period, in the single, it was not significant.

grazing. But with only the beef cattle they were rather reduced in the dual.

In forage samples, clipped before and after the animal grazing, legume content after the animal grazing was extremely reduced, especially after the shearling grazing, and the proportion of legume was low in the dual. As resulted, the nutrient intake of beef cattle in the single was more highly dependant upon the legume than the nutrient intake in the dual.

There was no significant difference of the beef cattle's live weight gains for the experiment period between the two managements.

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Literature cited

- 1) ADAMS, R. S., J. E., BAYLOR, 1961 ; Role of forage testing in improving forage quality and animal production. *Journal of Dairy Science*, 44, 2105.
- 2) HEINEMANN, W. W., 1970 ; Dual grazing of irrigated pastures by cattle and sheep. *Proceeding of 11th International Grassland Congress, Australia.*, 810-814
- 3) Van KEURN, R. W., 1970 ; Symposium on pasture methods for maximum production in beef cattle : Pasture methods for maximizing beef cattle production in Ohio., *Journal of Animal science* 30, 1, 138-142.

摘 要

畜産振興、とくに肉畜生産の必要性が指摘されるなかで、肉用牛飼養は増大の一途にあるが、一方同じ草食動物でありながら、年々激減を続けてきためん羊も、近時肉畜として再度その地歩を固めつつあるかにうかがえる。しかし、現状からは、肉用素畜育成のための草地利用も、いぜんとして肉用牛を中心に考えざるを得ない。そこで、比較的高度な草地の利用は期待できないと考えられる肉用牛に、めん羊を組み合わせ放牧し、放牧地の有する生産性の機能的な活用を図ろうとした。

ここでは、あらかじめ慣行的な肉用牛の放牧を行なった後にめん羊を放牧する、いわゆる後追い放牧を行ない、主として草地の生産性を中心に、肉牛のみの放牧と比較し、検討した。

1. 造成3年目のベレニアルライグラス、ラジノクローバ混播草地に、入牧時月齢約9.5か月の黒毛和種30頭を、5月中旬から10月上旬まで輪換放牧した。季節的な草量の増減に対しては、利用牧区数の調整と頭数の増加によって対処し、適当な準備草量が得られるよう努めた。しかし、去勢牛5頭、雌牛3頭の計8頭は、全期間を通じて設定された管理の下に置き、そのうちとくに去勢牛については増体量についても検討を加えた。

肉牛放牧後のめん羊後追い放牧には、ごく短期間ずつ、コリデール種の明2歳羊を導入して採食させた。

2. その結果、この期間の牧養力としては、10アール当たり、肉牛単独区では入牧時体重166kgの肉牛100頭、めん羊後追い区では同体重の肉牛88頭に体重約50kgのめん羊172頭の放牧が可能であった。したがって、肉牛のみの牧養力ではむしろ低下したことになるが、両畜種合計の牧養力を示すため500kg体重の換算頭数で示すと、それぞれ44頭および53頭となり、めん羊後追い区で約19%増加した。

DM および ADAMS の回帰式により推定した DCP, TDN の総生産量でも、これらの傾向は、牧養力における関係とほぼ一致した。

3. 摂取栄養量のうち、めん羊ではマメ科草に依存する度合いが高く、めん羊による後追い放牧区の肉牛では逆に低かった。これは、マメ科率が放牧圧の増加にともなって低下し、とくにめん羊の放牧後はいちじるしく低下したためであると判断された。

4. 供試草地にあっては、いちじるしい不食草地の形成は認められなかったが、各採取試料重の牧区内分散を示す変異係数を算出した結果は、家畜の放牧により増大する傾向を示し、これは、めん羊の放牧によっても低下しなかった。このことから、肉牛放牧後のめん羊放牧が、不食草地の形成を抑圧するに十分な効果があったとは認められなかった。

5. 全期間を通じて、一定の放牧管理を行なった8頭中の去勢牛5頭の期間平均の日増体量は、肉牛単独放牧区で0.600kg、肉牛放牧後のめん羊放牧区で0.603kgであって、管理法の差による影響は認められなかった。

6. 以上から、肉牛放牧後にめん羊を放牧する放牧方法は、放牧家畜全体をこみにした牧養力の増大をもたらすということが、その主たる特徴であるものと考察した。