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The Effects of Social Dominance on the Production and Behaviour of Grazing Dairy Cows Offered Forage Supplements

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Abstract: The effect of separating, dominant and subordinate cows on production, behaviour and the relationships between dominance and production parameters, was studied using 80 grazing cows, offered-forage supplements in experiment 1. Dominance was principally related to body weight, but in the pooled data it was also positively correlated with lactation number and negatively correlated with grazing time. In experiment 2, seventy two spring calving cows were classified as dominant or subordinate on the basis of aggressive interactions and further divided by two factors: dominant and subordinate cows grazed together or apart, and with or without a hay supplement. Dominant cows produced more milk. Both dominant and subordinate cows gained more weight and lay down for longer, when kept apart. However, when no hay was offered, dominant cows produced more milk and had a faster pasture biting rate when grazed together with subordinates. Cows high in the dominance order were more likely to enter the parlor first, but not to begin grazing first. The results suggest that production can increase, when dominant and subordinate cows in a competitive situation are separated and there is no benefit to separate them if they are at pasture all the day.

Key words: Dominance, subordinate, hay supplement, grazing, milk production

Introduction

Cattles are gregarious animals and organize themselves into hierarchies according to their wills and ability to fight for scare resources. When they are kept in a small area, such as in intensive housing, the maintenance of personal space is believed to form the basis of the hierarchy, and is therefore, the reason for most aggression between cows (Potter and Broom, 1987). In the grazing situation the maintenance of adequate personal space is assured and priority of access to the best grazing may form the basis of the herd hierarchy, which could explain why dominant cows have sometimes been found to produce more milk then subordinates (Reinhardt, 1973).

In grazing systems conserved forage supplements may be offered at milking times to allow cows the opportunity to maintain a high total intake, by eating the forage when the herbage available for grazing is restricted (Phillips, 1988). The forage is usually of lower feeding value to the cows than the grazing herbage so, the cows eat more of it when insufficient nutrients are available from the herbage. When the cattles are brought into a confined area for forage feeding, there may be a need for dominant cattles to maintain their personal space, which could disrupt the feeding. Two experiments, that investigate the relationships between dominance and production/behaviour in grazing dairy cows, with and without forage supplements are reported here. The first experiment investigates the relationships between dominance and production/behavior variables for both grazing cows and cows offered both grazing and silage. The second experiment investigates whether separating dominant and subordinate cows affects the production and behaviour, both for grazing cows and grazing cows offered a hay supplement.

Materials and Methods

Experiment 1: Eighty spring calving British Friesian cows were grazed on perennial ryegrass pasture (*Lolium perenne* L. cv. S23) from 19 April to 29 October. They were allocated to two treatments, treatment G, where the cows grazed at pasture between milkings and treatment S, where the cows were at pasture between morning and afternoon milking and inside between afternoon and morning milking with silage offered *ad libitum*. Stocking densities were reduced as the season progressed and were on average 4.1 to 7.5 cows/ha for treatments G and S. Representative pasture and silage samples were collected fortnightly for analysis of chemical composition by the procedures of MAFF (1986) and respectively contain 225 and 126 g crude protein, 215 and 340 g modified acid-detergent fibre and 906 and 928 g OM/kg DM. Mean herbage height over the season was 5.1 cm, when measured weekly with a sward-stick by taking 10 measurements/paddock (Hodgson, 1990). Further details of the management of the experiment are given by Phillips (1990).

Each week the cows were weighed and condition scored by the five point method of Mulvancy (1977) and milk yield was recorded. Grazing and silage feeding times were recorded in twenty-four hour observation per month, with recordings every ten minutes during the day and 15 minutes at night. The means and standard errors for these parameters are presented in Table 1. Cows were attributed a dominance value by recording a minimum of ten aggressive interactions/cow and transforming the ratio of wins to losses in each encounter to a normal distribution by the following equation:

$$\text{Dominance Value (DV)} = \text{Sin}^{-1} (\textstyle\sum x/x+y)^{1/2},$$

Where x = number of wins and y = number of losses (Beilharz and Mylrea, 1963).

The relationships between Dominance Value and the measured production/behaviour parameters were examined by Pearson's Correlation Coefficients (Table 2), initially for each treatment separately and then for the two treatments combined. When analysing the combined treatments, the grazing time of cows in treatment S was adjusted by the mean difference between the two treatments to avoid the treatment obscuring any relationship between the two variables.

Table 1: Mean (±SE) parameters for cow production and behaviour in treatments G (grazing only) and S (grazing and silage) in Experiment 1.

	Treatment G		Treatment S	
	Mean	SE	Mean	SE
Dominance value	45.0	2.3	45.0	2.4
Milk yield, kg/d	16.1	0.34	13.2	0.23
Lactation number	4.0	0.38	4.4	0.30
Live weight, kg	411.0	9.1	524.0	8.7
Condition score	2.6	0.11	2.3	0.12
Grazing time, min/d	561.0	9.5	476.0	8.8
Silage eating time, min/d	-	-	65.0	1.7

Experiment 2: Seventy-two mid-lactation British Friesian cows were attributed a dominance value as in Experiment 1, and the cows were then classified as dominant (D) or subordinate (S), according to whether they were in the top or bottom half of the hierarchy of dominance values. D and S cows were then allocated at random to two further experimental factors with two levels in each: D and S cows kept together (T) or apart (A) throughout the day and with (H^+) or without (H^-) a hay supplement (Table 3). The experiment was conducted from 7 July to 19 August.

Cows were grazed at a stocking density of 5 cows/ha in six groups in paddocks in a daily rotation. Both the pasture and the hay were of perennial ryegrass (*Lolium perenne* L. cv S23), and the mean pasture height was 6.1 cm, recorded as in Experiment 1. Herbage samples were cut fortnightly to post-grazing level for analysis of chemical composition by the procedures of MAFF (1986) and contained 319 g DM/kg fresh weight and 123 g crude protein, 269 g modified acid-detergent fibre and 932 g OM/kg DM. The hay was offered *ad libitum* to the relevant treatment groups, in the feeding passage of a cubicle house for 75 minutes daily after afternoon milking. Refused hay was collected daily. Unsupplemented cows were returned to the field directly after afternoon milking. Hay was sampled weekly and contained 833 g DM/kg fresh weight and 94 g CP, 332 g modified acid-detergent fibre and 60 g OM/kg DM. All cows were offered 2 kg concentrate/head daily in a feeding passage in their treatment groups after morning milking for 15 min. Cows were milked in these groups twice daily in a parlor containing 18 stalls. Milk yields were recorded on one afternoon and one morning milking weekly and proportional samples were collected at each milking for the determination of fat and protein concentrations by the procedures of MAFF (1986). The body weights of the cows were recorded weekly after afternoon milking, before the hay was fed. Cows were collected into a yard in their treatment groups before entering the crush voluntarily.

Behaviour recording: Four observations of 24 h to determine the time spent in the major behaviours. The time spent by each cow grazing, ruminating lying, ruminating standing, lying (not ruminating) and standing (not ruminating) was recorded at 20 minute intervals by an observer. In addition, because of its short duration the times spend by each cow eating hay and concentrates were recorded at three and one minute intervals, respectively, on four occasions.

The rate of bites, while grazing was recorded for each cow on three occasions on alternate weeks. For the cows supplemented with hay, the eating and chewing rates of each cow were recorded for one minute during hay consumption. The ruminating chewing rate and inter bolus interval were recorded for one minute/cow on three and one occasions, respectively.

The order of cows entering the milking parlor and the weight crush from collecting yards was recorded weekly. The order in which cows stood up from lying to initiate the first grazing bout of the day was recorded for each cow on four separate occasions.

Statistical analysis: The data was found to be normally distributed and parametric analytical methods were therefore used. A three factor (dominance, separation and hay supplementation) analysis of variance was performed by Minitab Statistical Package using GLM model. A Kruskal-Wallis test (Ryan *et al.*, 1980) was used to examine the effects of dominance on mean ranked orders of entry into the parlor and weight crush and of commencing grazing. The relationships between these ranked orders was determined by calculating Kendal correlation coefficients, using the Statistical Package for the Social Sciences (SPSS Release 4.1).

Results

Experiment 1: There was no relationship between the Dominance value and milk yield or condition score (Table 3). However, Dominance Value was positively related to live weight and also lactation number when both treatments were combined and it was negatively related to grazing time when both treatments were combined. It was not related to silage feeding time in treatment S.

Experiment 2

Intake and production: Hay DM intake was similar for the three groups in which it was offered – dominant and subordinate cows kept apart and the two groups fed together, with mean DM intakes of 2.6, 2.6 and 2.7 kg DM/cow/d, respectively. The dominant cows produced more milk than subordinate cows (Table 4). When offered a hay supplement, the dominant cows produced most milk when they were kept apart from the subordinate cows, but when no hay was fed, the dominant cows produced more when they were kept with the subordinate cows. The hay supplement increased the milk yield and reduced milk protein and fat contents. Keeping dominant and subordinate cows apart increased the weight gain of the dominant cows, whereas keeping them together increased that of the subordinate cows.

Ingestive behaviour: Concentrate feeding time was reduced for dominant cows fed hay (Table 5). Hay feeding time was longer for subordinate cows when they were kept together with the dominant cows, rather than apart. Keeping dominant and subordinate cows together increased their hay eating rate. Although the hay eating rate was not different for dominant and subordinate cows, the chewing rate was faster for the dominant cows.

Grazing time was reduced by hay feeding, especially in the subordinate cows. There was a tendency for dominant and subordinate cows grazed together, to have longer grazing times than those grazed separately. Although there was no difference between dominant and subordinate cows in grazing time, the pasture biting rate was faster for the dominant cows. There was an interaction between the three factors for pasture biting rate and number of bites (Table 6): in the groups not offered hay, when the dominant cows were grazed together with the subordinate cows, the dominant cows increased their pasture biting rate and the subordinate cows decreased theirs. These dominant cows also tended to have the greatest number of grazing bites/day.

Ruminating behaviour: The time spent ruminating, while lying was not affected by treatment, but ruminating while standing was increased by feeding hay to the subordinate cows (Table 7). The total ruminating time was reduced and the chewing

Table 2: The Pearson's Correlation Coefficients between the Dominance Value and cow production/behaviour parameters for treatments G and S and the two treatments combined in Experiment 1.

Production/behaviour parameter	Treatment G	Treatment S	Combined treatments
Milk yield	0.14	0.08	0.06
Lactation number	0.23	0.18	0.21†
Live weight	0.35*	0.47**	0.40**
Condition score	-0.06	-0.11	-0.08
Grazing time	-0.24	-0.21	-0.23*
Silage feeding time	-	-0.16	-

* Significant at 5% level. ** Significant at 1% level.

Table 3: The design of experiment 2, showing the group of 72 cows divided into 36 dominant (D) and 36 subordinate (S) cows, with one half of each group grazed together (T) and other half grazed apart (A), and one half of each group offered a hay supplement (H^+), the other half receiving no hay supplement (H^-).

	72 cows							
	36 Dominant cows				36 Subordinate cows			
	18 grazed Apart		18 grazed	Together	18 grazed Together		18 grazed	apart
Group treatment	9 H^+	9 H^-	9 H^+	9 H^-	9 H^+	9 H^-	9 H^+	9 H^-
	1	2	3	4	7	8	5	6
	DAH^+	DAH^-	DTH^+	DTH^-	STH^+	STH^-	SAH^+	SAH^-

Table 4: The effect of dominance, keeping dominant and subordinate cows together or apart and hay supplementation on milk yield and composition, and live weight gain in Experiment 2 (D=Dominant cows, S=Subordinate cows, T= D and S cows together, A=D and S cows apart, H^+=Supplementation with hay, H^-=No hay supplement). There were no significant interactions between DS and H^+H^-.

	Treatments								SED				P value			
	DT H^+	DA H^+	DT H^-	DA H^-	ST H^+	SA H^+	ST H^-	SA H^-	DS/TA/ H^+H^-	DS x TA	DS x TA x H^+H^-	DS	TA	H^+ H^-	Dsx TA	DS x TA x H^+H^-
Milk yield kg/d	15.1	17.7	16.6	14.0	14.8	14.5	12.6	13.9	0.52	0.74	1.04	<0.001	0.62	0.02	0.63	0.001
Protein, %	3.04	2.96	3.09	3.08	3.04	2.98	3.13	3.18	0.029	0.042	0.059	0.19	0.47	<0.001	0.46	0.79
Fat, %	3.45	3.38	3.79	3.56	3.63	3.40	3.61	3.88	0.067	0.094	0.133	0.20	0.30	<0.001	0.22	0.01
Live weight/ gain g/d.	658	964	862	1063	919	8.36	1162	924	82	117	165	0.38	0.57	0.06	0.01	0.88

Table 5: The effect of dominance, keeping dominant and subordinate cows together or apart, and hay supplementation on feeding behaviour in Experiment 2 (D=Dominant cows, S=Subordinate cows, T=D and S cows together, A=D and S cows apart H^+=Supplementation with hay, H^- = No hay supplement). There were no significant interactions between hay supplementation and keeping dominant and subordinate cows together or apart or interactions between the three factors, other than for pasture biting rate, which is detailed in Table 6.

	Treatments				SED		P. value			Treatments				P value	
	DH^+	DH^-	SH^+	SH^-	DS/ H^+H^-TA	DS x H^+H^- /DS x TA	DS	H^+H^-	DS x H^+H^-	DT	DA	ST	SA	TA	DS x TA
Concentrate															
Feeding time, min/d	8.5	9.0	9.0	8.8	0.10	0.14	0.21	0.32	<0.001	8.9	8.5	9.1	8.7	<0.001	0.95
Hay Suppt.															
Feeding time, min/d	59	-	56	-	1.6	2.2	0.08	-	-	59	59	60	52	0.004	0.02
Eating rate, bites/min	15.1	-	14.6	-	0.86	1.22	0.55	-	-	15.8	14.4	16.3	12.8	0.01	0.22
Chewing rate, chews/min	64	-	58	-	1.28	1.81	<0.001	-	-	63.6	63.5	58.3	57.7	0.78	0.83
Pasture graz.															
Grazing time, min/d	559	591	535.0	617	11.7	16.6	0.93	<0.001	0.03	593	558	579	574	0.09	0.20
Biting rate, bites/min	66	68	65	64	1.0	1.4	0.03	0.46	0.19	67	67	65	64	0.67	0.91

Table 6: The interaction between dominance, keeping dominant and subordinate cows together or apart and hay supplementation on pasture biting rate and the total number or grazing and rumination bites/d in Experiment 2 (D=dominant cows, S=subordinate cows, T=D and S cows together, A=D and S cows apart, H^+= supplementation with hay, H^-=no hay supplement)

	Treatments								SED	P value
	DTH^+	DTH^+	DTH^-	DAH^-	STH^+	SAH^+	STH^-	SAH^-		
Pasture biting rate, Bites/min	65.2	66.3	68.9	66.7	66.7	62.9	62.7	65.8	2.03	0.01
Total grazing bite bites/d	36957	36434	42625	37695	35787	33551	38930	40294	2181	0.07
Total rumination bites Bites/d	30918	33000	33118	33284	33543	30069	30341	30904	2002	0.09

Table 7: The effect of dominance, keeping dominant and subordinate cows together or apart, and hay supplementation on ruminating behaviour in Experiment 2 (D= Dominant cows, S= Subordinate cows, H^+= Supplementation with hay, H^-= No hay supplement,). There were no significant effects of keeping dominant and subordinate cows together or apart, or interactions between this factor and the other two, or between the three factors.

	Treatments				SED		P value		
	DH^+	DH^-	SH^+	SH^-	DS/H^+H^-	DS X H^+H^-	DS	H^+H^-	DS X H^+H^-
Ruminating lying, min/d	422.0	453.0	435.0	437.0	12.8	18.1	0.89	0.21	0.27
Ruminating standing, min/d	78.0	97.0	89.0	55.0	8.5	12.0	0.07	0.36	0.002
Total ruminating mind/d	500.0	550.0	524.0	491.0	10.9	15.5	0.11	0.44	<0.001
Chewing rate, chews/min	64.8	61.1	61.1	62.5	0.76	1.08	0.44	0.83	<0.001
Interbolus intervals, second	52.6	52.9	49.6	50.9	1.16	1.64	0.04	0.49	0.70

Table 8: The effect of dominance, keeping dominant and subordinate cows together or apart, and hay supplementation on lying and standing behaviour in Experiment 2 (D = Dominant cows, S= Subordinate cows, T=D and S cows together, A= D and S cows apart H^{+-} Supplementation with hay, H^{-} = No hay supplement). There were no significant interactions between TA and H =H^{-}, DS and TA or between the three factors.

	Treatments				SED		P value			Treatments		P value
	DH^{+}	DH^{-}	SH^{+}	SH^{-}	DS/ H^{+} |H^{-}/ TA	DS x H^{+} H^{-}/DS x TA	DS $H^{+}H^{-}$	$H^{+}H^{-}$	DS x	T	A	TA
Lying (not ruminating) min/d	172	163	186	191	10.4	14.7	0.05	0.88	0.48	166	190	0.03
Total lying, min/d	594	616	620	628	14.9	21.1	0.21	0.33	0.64	593	636	0.004
Standing (not ruminating),min/d	129	118	119	124	6.1	8.6	0.82	0.65	0.21	122	123	0.82
Total standing, min/d 207	215	209	179	9.9	13.9	0.09	0.29	0.05	206	199	0.45	

Table 9: The effect of dominance, keeping dominate and subordinate cows together or apart, and hay supplementation on the median rank (1 = first) for grazing, parlor entry and weighing crush entry in experiment 2 (D = Dominant cows, S = Subordinate cows, H^{+} = Supplementation with hay, H^{-} = No hay supplement, T = D and S cows together, A = D and S cows apart).

	Treatments		P value
	D	S	
Grazing rank	9.0	10.3	0.51
Parlor rank	14.6	13.4	0.62
Weighing crate rank	9.3	9.8	0.74
	H^{+}	H-	
Grazing rank	10.8	8.8	0.17
Parlor rank	13.7	14.7	0.48
Weighing crate rank	6.9	12.0	0.00
	T	A	
Grazing rank	9.6	8.9	0.51
Parlor rank 14.2		13.5	0.94
Weighing crate rank	9.2	9.8	0.98

rate increased by offering hay to the dominant cows. When the dominant and subordinate cows were kept together, there was a tendency for the number of ruminating bites/d to be reduced for dominant cows and increased for subordinate cows provided with hay, compared to the dominant and subordinate cows in other treatments (Table 6). The interval between boluses was larger for D than S cows.

Lying and standing behaviour: The time spent lying down, not ruminating was greater for subordinate than dominant cows and also for dominant and subordinate cows kept apart rather than together (Table 8). Keeping dominant and subordinate cows apart also increased the total lying times. There were no treatment effects on time spent standing not ruminating, but total standing time was reduced in subordinate cows not offered hay.

Leadership at grazing and enterance to the milking parlor and weighing crate: There was no significant difference between treatments in the ranks for starting grazing, entry to the parlor or the weighing crate, except that hay supplemented cows entered the weighing crate before those not fed hay (Table 9). The Kendal correlation coefficients for leadership ranks and DV demonstrated that only entry to the parlor was correlated with DV (Table 10), thus more dominant cows entered the parlor early. The entry orders for morning and evening milking were positively correlated.

Discussion

The low positive correlation between milk yield and dominance in the first experiment is in agreement with some authors (Beilharz *et al.*, 1966; Dickson *et al.*, 1970; Soffie *et al.*, 1976), but others have found a significant positive relationship (Schein and Fohrman, 1955; Reinhardt, 1973; Sambraus *et al.*, 1979a). In contrast all research reports on this subject have found dominance to be strongly correlated with the weight of dairy cows (Schein and Fohrman, 1955; Brantas, 1968; Stricklin *et al.*, 1980 and Sambraus, 1979), which was confirmed in this experiment. The absence of any relation with the cows' body condition score demonstrates that dominance is primarily related to the size of the cows, not their fatness. Brantas (1968) specially identified chest girth and body length as key characteristics contributing to the relationship between live weight and dominance. Age and lactation number have also been found to be related to dominance (Schein and Fohrman, 1955; Beilharz *et al.*, 1966; Brantas, 1968; Sambraus, 1979 and Beilharz and Zeeb, 1982), which demonstrates the advantages of experience, but not familiarity (Schein and Fohrman, 1955). The negative correlation between grazing time and dominance may indicate the necessity for dominant cattles to expend time and effort, maintaining their position in the dominance order in a competitive grazing situation, especially since the pasture was short and insufficient for the cows' needs (Le Du *et al.*, 1981). The absence of any correlation with silage feeding time in treatment S may reflect the small proportion of allocated time that was spent feeding on silage and less synchronised nature of the feeding, compared with at pasture, leading to less competition between cows.

In experiment 2, there was no evidence of shorter grazing times in dominant cows, which may reflect less competition at pasture than in experiment 1, due to the taller pasture and lower mean stocking density. The greater milk yields of dominant cows than subordinates has been observed previously (Reinhardt, 1973) and may be related to their faster feeding rates, particularly in their pasture biting rate and rate of chewing hay. Overall their chewing rate while ruminating, did not differ from the subordinate cows, but they had a longer period between regurgitations, suggesting that each bolus remained for a longer period in the rumen. Rumination is under voluntary control in cattles (Hancock, 1950) and may indicate a relaxed state (Ewbank, 1978). The more frequent regurgitations of subordinate cows could be due to a greater state of nervousness, leading to less effective rumen digestion. The increased milk yield of dominant cows was greatest for the hay-fed treatments, when they were kept apart from subordinate cows. Keeping the dominant and subordinate cows apart appears to have reduced the tension, as both dominant and subordinate cows lay down for nearly 45 min longer when they were apart, compared with when they were together. It also reduced the hay eating rates of both dominant and subordinate cows, which is an evidence of competition between them when they were kept together for hay feeding. Such competition was also evident in the number of ruminating bites/d, which was reduced for dominant cows and increased for subordinate cows when they were kept together.

When no hay supplement was fed, the milk yield of the dominant cows was greater when they were grazed together with the subordinate cows than apart. This reflects their faster biting rate at pasture and greater number of grazing bites/d (Table 4) and may be the result of competition between the cows.

The subordinate cows appear to have competed more for hay when they were together with dominant cows, since feeding times were longer than when the two groups were grazed separately. When they spent longer eating hay in the presence of the dominant cows, they also spent less time grazing. The competition during hay feeding in this

Table 10: Kendall correlation coefficients between grazing, entry to parlor and weighing crate ranks and dominance value in experiment 2 (parlor = milking parlor rank, mean of a.m. and p.m.)

Ranks	Dominance Value	Ranks			
		Grazing	Parlor	Parlor a.m.	Parlor p.m.
Grazing	-0.09				
Parlor	0.21*	0.03			
Parlor a.m.	0.04	0.03	0.56**		
Parlor p.m.	0.07	-0.02	0.50**	0.50**	
Weighing crate	-0.07	-0.07	0.17	0.16	0.13

* significant at 5% level. ** Significant at 1% level

experiment is likely to have been greater than during silage feeding in Experiment 1, as the proportion of total time allowed that was spent feeding was greater (77% for experiment 2, compared with 7% in experiment 1). Greater competition from the subordinate cows in hay feeding may have disturbed the dominant cows when the two groups were together, leading to increased milk yields when the dominant cows were separated from the subordinates. In the treatments not offered hay, the dominant cows may have been less disturbed, or not disturbed at all, by the subordinate cows, as at pasture the inter-individual distances would have been sufficient for interactions to have been rare. Dominant cows were not any more likely to begin grazing early in the first grazing bout than subordinate cows, which suggests that they did not compete the access to the best pasture in this experiment.

The earlier entry of hay-supplemented cows to the weighing crate than those without hay suggests that the cows were eager to reach the hay. The hay increased the milk yield, demonstrating that the pasture availability in this experiment was inadequate. McPhee *et al.*, (1964) found no relationship between order of entry to a crush and dominance value, but no reward was offered. The earlier entry of more dominant cows to the milking parlor may have been due to their desire to reach the hay (after p.m. milking) or be returned early to pasture (after a.m. milking). Even though each group was returned to pasture together, those leaving the parlor first would lead the group out to pasture and be the first to enter the field. The positive correlation between dominance and milking orders has also been observed by Reinhardt (1973) and Soffie *et al.* (1976). Others have observed a correlation between milk yield and milking order (Rathore, 1982; Gadbury, 1975), which is believed to derived from the greater reward to a high-yielding cow with high udder pressure from being milked, compared with a low-yielding cow. The increased milk yields in dominant cows in this experiment may have produced a greater reward to early entry to the milking parlor.

Conclusions

The milk production of dominant cows may be improved by separating them from subordinate cows, when they are offered pasture and a forage supplement. Both dominant and subordinate cows will lie down for longer when they were separated and the weight gain of the dominant cows will increase. When cows are only offered pasture, the dominant cows produce more when grazed together with subordinate cows, because they then have a faster pasture biting rate.

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