

The nutritional status of Japanese Black breeding cows grazed in a larger abandoned paddy field

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Introduction

Because rice consumption has decreased in Japan, the number of abandoned paddy fields has increased. Some of the abandoned paddy fields are being used for livestock grazing, effectively using the abandoned fields and reducing the production costs on livestock farms. Such grazing may use an integrated grazing system of scattered small pastures where each of the small abandoned paddy fields scattered in a given agriculture area is defined as one grazing yard, and a herd consisting of two or three head of cattle is moved from one grazing yard to another. However, because the number of abandoned paddy fields has increased, it may be possible to have cattle grazing in larger fields made by combining multiple abandoned paddy fields (Shindo and Tejima 2006). Here we examined the nutritional status of Japanese Black breeding cows that stayed in larger-sized abandoned paddy fields to graze from spring to autumn.

Methods

Experimental site and period of the trials

Grazing trials were conducted in the abandoned paddy fields in Ishikawa, Japan (36°40'N; 136°41'E). The fields were abandoned for approximately 40 years and comprised mainly by silver grass (*Miscanthus sinensis* Anders.) at the beginning of the trials. From July 20 to October 13 in 2010, 0.6 ha of an abandoned paddy field which was made up of 18 small (about 0.04 ha) abandoned paddy fields was grazed; 1 ha of a different field made by combining 32 abandoned paddy fields was grazed from June 15 to November 9 in 2011, and the same field as in 2011 was grazed from June 13 to November 13 in 2012.

Cows and their management

Japanese Black breeding cows were used for 3 years. Two non-pregnant cows (average live body weight [LBW] 342.0 ± 33.9 kg; average age, 32.0 ± 14.1 mo), three pregnant cows (average LBW 342.5 ± 26.3 kg; average age 120.0 ± 45.1 mo) and two pregnant cows (average LBW, 377.3 ± 52.0 kg; average age 96.0 ± 57.3 mo) were used in 2010, 2011 and 2012, respectively. The pregnant cows in 2011 and 2012 were scheduled to calve in February of the following year. The cows were fed 0.9 kg/head/day of

Table 1. Daily body weight gain (DG) and total digestible nutrients (TDN) intake in Japanese Black breeding cows grazed in an abandoned paddy field. Means ± std. dev

Items	Year		
	2010	2011	2012
Number of breeding cows	2	3	2
Grazing density (head/ha)	3.3	3.0	2.0
DG (kg/d)	0.24 ± 0.36	0.62 ± 0.28	0.94 ± 0.13
TDN required for maintenance (kg/d)	2.95 ± 0.22	2.95 ± 0.17	3.17 ± 0.33
TDN required for gain (kg/d)	0.77 ± 1.18	1.89 ± 0.87	2.87 ± 0.05
Total TDN intake (kg/d)	3.72 ± 1.40	4.84 ± 1.03	6.04 ± 0.28
TDN intake from feed (kg/d)	0.55	0.55	0.55
TDN intake from grass (kg/d)	3.17 ± 1.40	4.29 ± 1.03	5.49 ± 0.28

formula feed (crude protein content 16%; total digestible nutrients [TDN] content: 69%).

Parameters

LBW was determined every 2 weeks in 2010, every month in 2011 and at an interval of 1 to 2 months in 2012. We calculated the linear regression equations of LBW on grazing period (days), and the daily body weight gains (DG) of the cows were obtained from the slope of the regression equations. TDN consumption was estimated by calculating the TDN required for maintenance and the gain from the data of the initial LBW and DG by using equations for determining the requirements of maintenance for mature beef cows and the requirements of body weight gain for fattening beef cows (National Agriculture and Food Research Organization 2009). Blood samples were collected from the jugular vein of each cow at the beginning and end of the trials in 2010 and 2011 to determine the concentration of blood components related to the nutritional state. The differences between the concentrations of blood components before and after grazing were tested by the paired samples t-test (IBM SPSS Statistics, v.21).

Table 2. Changes in blood components of Japanese Black breeding cows before and after grazing

	TP	Albumin	BUN	Total cholesterol	Glucose	GOT	γ-GTP	Ca	IP	Mg
	(g/dL)	(g/dL)	(mg/dL)	(mg/dL)	(mg/dL)	(U/L)	(U/L)	(mg/dL)	(mg/dL)	(mg/dL)
Before	7.1	3.3	13.1	92.0	63.6*	62.4	14.6	8.7	6.8*	2.2
After grazing	7.6	3.5	11.4	118*	53.4	63.8	18.4	9.4*	4.7	2.2

TP: Total protein, BUN: Blood urea nitrogen, IP: Inorganic phosphorous. * $P < 0.05$

Results and Discussion

The DG and the TDN intake values of the cows are shown in Table 1. All cows except for a cow grazed in 2010 gained weight linearly as the grazing proceeded. The grazing density was higher in the order of 2010, 2011 and 2012, which is the reason why the DG and TDN intake were lower in the order of 2010, 2011 and 2012. The cows in the present experiment were in the over-nutrition state because breeding cows should not gain weight 2 months before parturition. The difference was not large between the TDN intake from grass and the TDN required for maintenance in 2010, but the TDN intake from grass was much higher than the TDN required for maintenance in 2011 and 2012.

These results suggest that the grazing density should be at least 3.3 head/ha to avoid the over-nutrition state in Japanese Black breeding cows grazed in abandoned paddy fields. Energy supplementation from formula feed was not necessary, as the TDN intake from grass was higher than the TDN required for maintenance. The concentration in blood components were in the normal range except for inorganic phosphorous (P) after grazing (Table 2). The result was in accord with previous reports (Matsui *et al.* 1987, Tanimoto *et al.* 2003, and Nakano *et al.* 2009). The lower content of P in the grass was reported to be the cause of the lower P state in cattle grazed in native grassland (Matsui 1987). The present results showed the need of P supplementation to breeding cows grazed in abandoned paddy fields.

Conclusion

The results of the present experiment suggest that the Japanese Black breeding cows were able to ingest enough energy to keep their maintenance state. However, the grazing density should be at least 3.3 head/ha to avoid the over-nutrition state in cows. P supplementation was necessary when the breeding cows were grazed in abandoned paddy fields.

References

- Matsui T, Morita T, Harumoto T, Yoden Y, Igarashi R (1987). Phosphorus Nutrition of Grazing Cows on Native Grassland. *Animal Science Journal* **58**, 432-434. (in Japanese with English title)
- Nakano M, Kuzuma Y, Yayota M, Ohtani S (2009) Evaluation of blood components and nutritional status in Japanese Black cows grazed on native, sown and native-sown mixed pastures. *Japanese Journal of Grassland Science* **55**, 21-28. (in Japanese with English synopsis)
- National Agriculture and Food Research Organization (2009) "Japanese Feeding Standard for Beef Cattle (2008)." pp. 145-153. (Chuochikusankai: Tokyo) (in Japanese)
- Shindo K, Tejima S (2006) Livestock production by integrated grazing system for scattered small pastures in eastern Japan. *Japanese Journal of Grassland Science* **52**, 111-113. (in Japanese with English title)
- Tanimoto Y, Senda M, Oshima K, Koyama N (2003) Effects of grazing in abandoned fields on the nutrition and health condition of breeding beef cows in southwest Japan. *Japanese Journal of Grassland Science* **49**, 465-470. (in Japanese with English synopsis)