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Grazing Adaptability of Beef Cattle on the Dwarf Napiergrass (*Pennisetum purpureum* Schumach) Pasture

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ABSTRACT

Grazing adaptability of beef cattle on dwarf variety of late-heading type (DL) napiergrass (*Pennisetum purpureum* Schumach) pasture was examined in summer season at Miyazaki, Japan in 2005. Five paddocks of DL napiergrass pasture with an area 2500 m^2, (500 m^2, per paddock) were established since May 2002. Three heads of raising beef cows (*Japanese-Black*) were rotationally grazed in a week with 4-weeks rest period from June to October. Forage dry yield at pre- and post-grazing averaged 238.6 – 582.6 g/m^2 and 152.8 – 309.5 g/m^2, respectively with percentage consumption averaged 42.5% – 71.6%. Forage consumption and dry matter intake averaged 14.5 – 50.9 g DM/m^2/day and 2.42 – 8.48 kg DM/1 IU/day, respectively with average daily gain was 0,56 kg/day. Grazing adaptability of beef cattle on DL napiergrass needed time for about one week. Thus, the DL napiergrass pasture can be utilized under the rotational grazing at stocking rate of 12 head/ha (calculated 3600 kg LW/ha/day) in the summer season of subtropical area.

Key words: grazing adaptability, beef cattle, dwarf napiergrass, forage consumption, daily gain

INTRODUCTION

The adaptability of grazing cattle is determined by availability and dry matter yield of forage mass (Cuomo *et al*., 1996; Mizuno *et al*., 1998), chemical and physical compositions of the forage (Mosquera-Losado *et al*., 2000) and the nutritional requirement of the animal (Ishii *et al.*, 2005a; Ishii *et al.*, 2005b).

Napiergrasses (*Pennisetum purpureum* Schumach) produce greatly high herbage mass among tropical grasses under a cut and carry system (Cuomo *et al*., 1996; Sunusi *et al*., 1997; Ishii *et al*., 1998; Wadi *et al*., 2003a; Mukhtar *et al.*, 2003; Wadi *et al*., 2003b; Ishii *et al.*, 2005a), and they can be utilized under the grazing system (Mukhtar *et al*., 2004; Ishii *et al.*, 2005c; Ishii *et al.*, 2005d). Mukhtar *et al*. (2004) found that dwarf napiergrass, particularly late-heading type (DL), was higher in tiller number, leaf area index and percentage leaf blade than other dwarf and normal napiergrass, which suggested that DL napiergrass was more suitable to the grazing system than other

varieties. Comparing grazing suitability by dairy cows between DL and normal napiergrass varieties, DL was tolerant to the rotational grazing and maintained re-growth ability with one-month rest period during the hottest summer season. DL napiergrass can be fitted to the intensive grazing pressure in the small paddock as in the other tropical grasses.

Dwarf napiergrass produced the higher quality of forage in terms of crude protein concentration of both leaves and stems, and had a higher ratio of leaf to stem than other tropical grasses (Tudsri *et al*., 2002). Therefore, in this study, the grazing adaptability of beef cattle on the DL napiergrass pasture was aimed to determine forage production, forage consumption, stocking rate, the time for grazing adaptability and daily gain of raising beef cattle on DL napiergrass pasture without concentrate feeding in the hot summer season.

MATERIALS AND METHODS

Pastures Management

The research was carried out in Sumiyoshi Field, Faculty of Agriculture, at the University of Miyazaki, Japan in summer season from May to September in 2005. The examined variety of napiergrass (*Pennisetum purpureum* Schumach) was the dwarf variety of late-heading type (DL), from Dairy Promotion Organization, Thailand.

The field area consists of 5 paddocks of 500 m^2 (20 m x 25 m). Each paddock was established for the rotational grazing by transplanting rooted tillers DL napiergrass of re-grown from the over wintered stubble on May 2005. The plant spacing and density were 1 m x 0,5 m and 2 plants/m^2, respectively. This paddock of DL napiergrass pasture was established on May 2002.

Each paddock was fertilized with 20 g N/m^2/year of compound fertilizer (N; P_2O_5; K_2O at the percentage of 13 %) by 4 split applications (5 g N/m^2/application) before the start of grazing on May and June and just after each grazing. Each paddock had watering facility.

Grazing Design and Animal Measurement

Three head of 10 month old beef cattle (*Japanese-Black* under no pregnancy) with initial of live weight (LW) of 290 kg/head were used in the rotational grazing. Grazing was conducted from June to October with 1-week grazing and 4-weeks rest period for each paddock. Before grazing, the beef cattle were raised with *feedlot* system. LW was measured at 11:00 a.m. when the cattle were moved to the other paddock. No concentrates were fed to the cattle and mineral supplement was fed *ad libitum* during the grazing.

Plant Measurements

Six DL napiergrass plants were sampled by the line transect method after 4-weeks of rest period at pre-grazing and post-grazing for each paddock. Forage dry matter yield (FDMY) at pre- and post-grazing were determined by cutting plant at 10 cm above the ground level.

Calculation of Forage Consumption, Percentage Consumption and Dry Matter Intake. Forage consumption (**FC**) by beef cattle was estimated as follow:

$$\mathbf{FC = (FDMY_{pre} - FDMY_{post}) + FC_{during\ grazing\ period}}$$

Where:

$$FC_{during\ grazing\ period} = \frac{(FDMY_{pre} - FDMY_{post})}{\text{Rest Period}} \times \text{Grazing Period}$$

Percentage consumption (**PC**) by beef cattle was calculated as follow:

$$PC = \frac{FC}{FDMY_{pre}} \times 100\ \%$$

Dry matter intake (**DMI**) of beef cattle was calculated as follow:

$$DMI = \frac{FC}{SD}$$

Where:

$FDMY_{pre}$ = Forage dry matter yield at pre-grazing

$FDMY_{post}$ = Forage dry matter yield at post-grazing

SD = Stocking density

RESULTS AND DISCUSSION

Forage Production

Changes in forage dry matter yield (FDMY) at both pre- and post- grazing in DL napiergrass pasture during rotational grazing are shown in Figure 1.

At pre- and post-grazing, FDMY tended to increase with the grazing period from the first week to the eighth week, except in the first week of post-grazing, and tended to be constant from the eighth week until the fifteenth week. This was mainly due to the extension of plant growth before the start of grazing. The average of FDMY at pre- and post-grazing of napiergrass pasture during rotational grazing period were 238.6 – 582.6 g/m^2 and 152.8 – 309.5 g/m^2, respectively. It suggested that DL napiergrass pasture expanded the capacity to graze and supply enough herbage of beef cattle for a week in every 5 weeks during a hot summer season. The FDMY in the first week at post-grazing was higher than in the second week until the fifth week of first cycle, because the beef cattle in the first week was still process of grazing adaptability.

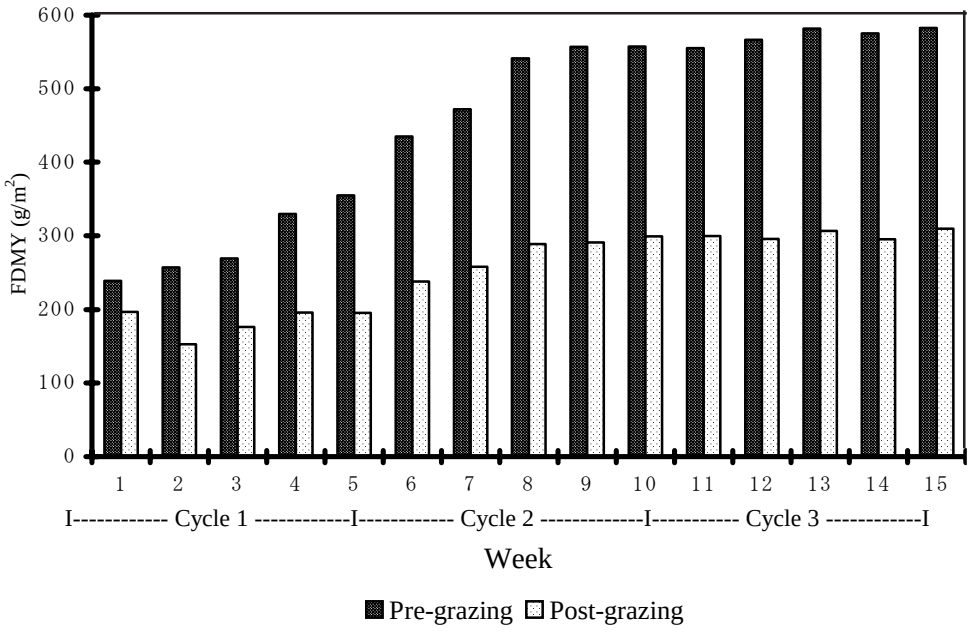

Figure 1. Change in forage dry matter yield (FDMY) at both pre- and post- grazing in DL napiergrass pasture during rotational grazing

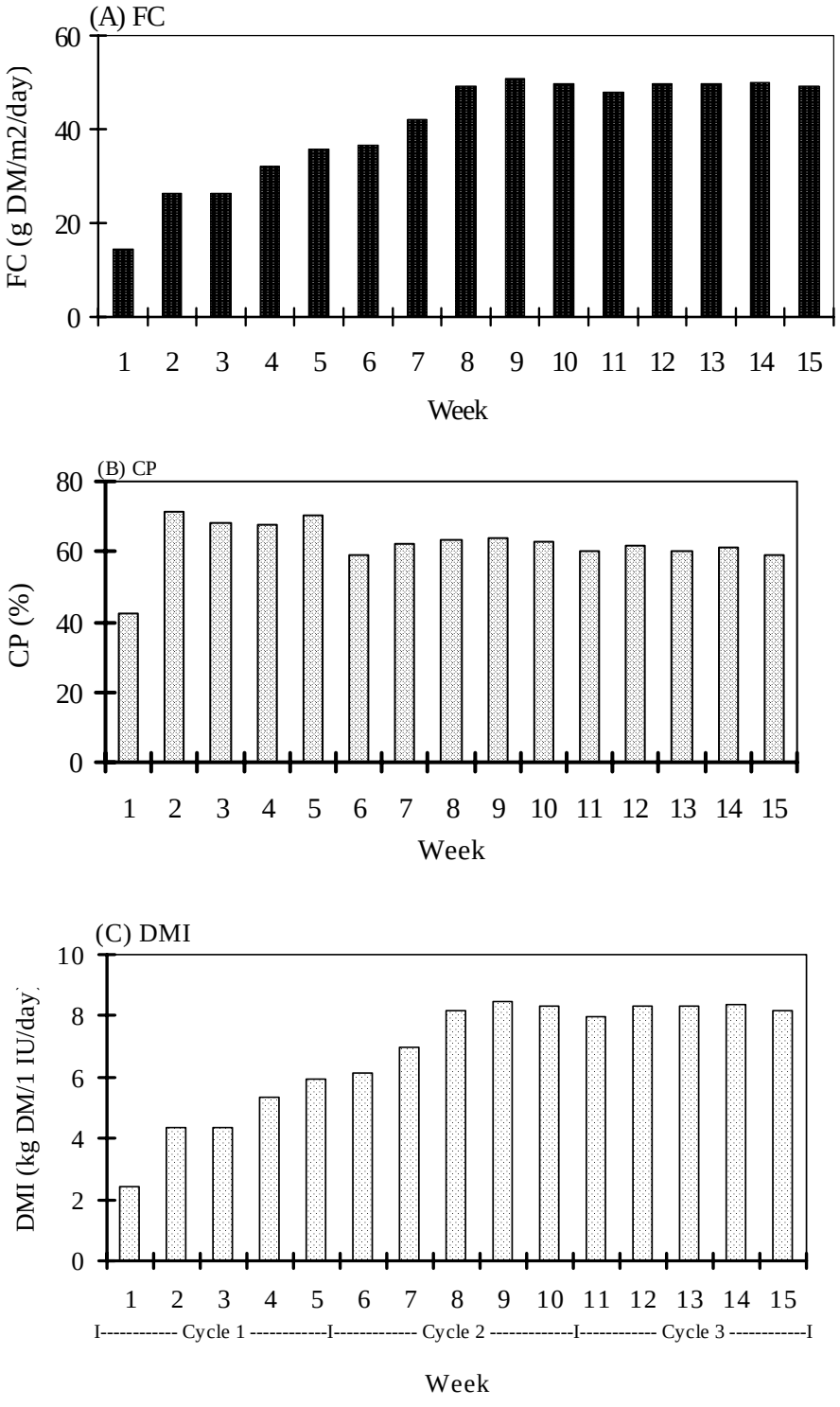

Figure 2. Changes in forage consumption (FC, A), consumption of percentage (CP, B) and dry matter intake (DMI, C) in DL napiergrass pasture during rotational grazing

Forage Consumption

Changes in forage consumption (FC), consumption of percentage (CP) and dry matter intake (DMI) in DL napiergrass pasture during rotational grazing are shown in Figure 2.

The FC and DMI tended to increase with the grazing period from the first week to the eighth week and tended to be constant from the eighth week until the fifteenth week. The increase in FC and DMI at the corresponding period was correlated with the increase in FDMY. The averages of FC and DMI of napiergrass pasture during rotational grazing period were 14.5 – 50.9 g DM/m^2/day and 2.42 – 8.48 kg DM/1 IU/day, respectively. In the other tropical grasses, in Miyazaki, Japan the rate of FC and DMI on bahiagrass (*Paspalum notatum* Flugge) pasture by beef cattle ranged from 19.9 – 59.2 g DM/m^2/day and 14.8 – 42.9 g DM/kg LW/day, respectively (Hirata *et al.*, 2003). The average of CP of napiergrass pasture during rotational grazing period was 42.5% – 71.6%. CP increased from the first week to the second week and tended to be constant from the second week until the fifteenth week. FC, CP and DMI were lowest in the first week during the grazing period. The lowest of FC, CP and DMI in the first week was correlated with the highest of FDMY in the first week at post-grazing in the first cycle, mainly due to the beef cattle in the first week was still process of grazing adaptability.

It was suggested that the process of grazing adaptability for beef cattle on DL napiergrass pasture was needed time about one week.

Changes in Live Weight of Beef Cattle and Daily Gain

Live weight (LW) change in raising beef cattle (*Japanese-Black*) grazed on the DL napiergrass pasture is shown in Figure 3. The LW of raising beef cattle in DL napiergrass pasture decreased in the first week and tended to increase with the grazing period after the first week and average daily gain (ADG) was 0.56

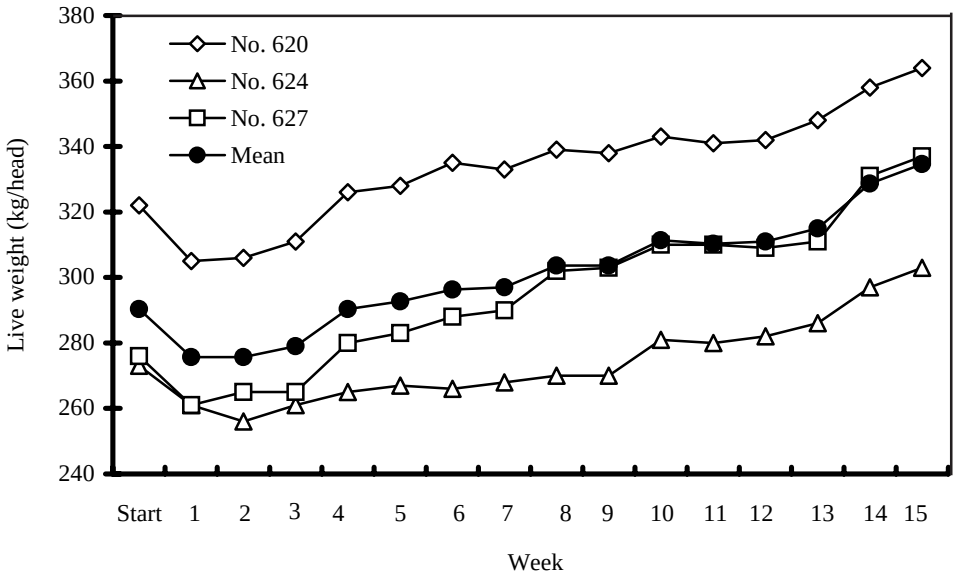

Figure 3. Change in live weight (LW) of raising beef cattle (*Japanese-Black*) grazed on DL napiergrass pasture without any concentrate feeding

kg/day without any concentrate nor supplied roughage feeding under the average of stocking rate of 12 head/ha (calculated 3600 kg LW/ha/day).

In the other tropical grasses, Under the similar stocking rate (3684 kg LW/ha/day) of rotational grazing by raising beef cattle on guineagrass (*Panicum maximum* cv. Natsukomaki) pasture in Kumamoto, Japan, ADG over the season from mid-June to the end of October was 0.56 kg/day (Hirano *et al.*, 2004). On *Paspalum atratum* cv. Suerte pasture in Florida, USA under stocking rate of 3.3, 6.6 and 10 head/ha, the ADG averaged 0.71, 0.55 and 0.49 kg/day, respectively (Kalmbacher *et al.*, 1997). On Pangola grass (*Digitaria eriantha* cv. Stendel) pasture by steer (LW 312 kg) grazing in Queensland, Australia under the stocking rate 4.3 head/ha, the ADG was 0.62 kg/day (Holzknecht *et al.*, 2000). As several tropical grasses pasture mentioned above which was comparable with stocking rate and ADG of beef cattle in this study.

Based on FC. PC, DMI, and ADG under the rotational grazing of DL napiergrass pasture were compared with those under the other tropical grasses pasture, the beef cattle can be grazed on DL napiergrass pasture and 2500 m^2 of DL napiergrass pasture can supply enough herbage without concentrate feeding to keep ADG at 0.56 kg/day for 3 heads of raising beef cattle.

CONCLUSIONS

The DL napiergrass pasture can be utilized under the rotational grazing use at about 12 head/ha (calculated 3600 kg LW/ha/day) in the summer season of subtropical area.

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