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**THE CARRYING CAPACITY OF PURE AND OVERSOWN GIANT STAR GRASS (*Cynodon nlemfuensis* Vanderyst) UNDER DIFFERENT STOCKING RATE IN SOUTH-WESTERN ISLANDS OF JAPAN**

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**Abstract**

The objective of this study was firstly to know the potential carrying capacity, pasture production, pasture utilization of giant star grass under different stocking rates in intensive rotational grazing system, and to evaluate a carrying capacity of giant star grass (*Cynodon nlemfuensis* Vanderyst) pasture oversown with annual hybrid ryegrass (*Lolium multiflorum* X *Lolium perenne*) on short low productive winter pasture in South-western Islands of Japan. High herbage availability and good quality forage to bring about effective animal productions were produced by using relatively heavy stocking rates of 6 - 8 heads/ha, and achieved optimum pasture utilization of giant star grass. Herbage utilization and daily drymatter intake on pasture oversown with ryegrass were higher than pure giant star grass during winter. Average herbage availability and utilization at heavy stocking rate was higher than at light stocking rate even in winter.

**Keywords:** Carrying capacity, Giant star grass, Japanese Black cattle, Oversowing, Pasture availability, Pasture utilization, Ryegrass, Stocking rate

**Introduction**

We have about 5,000 ha pastures which contains 30 % of grazed sward by Japanese Black cattle, the predominant tropical grass species is giant star grass (*Cynodon nlemfuensis* Vanderyst) in South-western Islands of Japan.

Giant star grass is recognized as one of the high productive species (Skerman and Riveros, 1990) and suitable to grazing by Japanese Black for breeding in this region. It is not enough known, however, an effective year-round grazing system under giant star grass pasture, and also methods of pasture management corresponding to low pasture production in winter.

The objective of this study was firstly to estimate the carrying capacity under different stocking rates, herbage production, herbage utilization of giant star grass in intensive rotational grazing system, and to evaluate the carrying capacity of giant star grass pasture oversown with annual ryegrass in low productive winter pasture under 20 of average temperature.

### **Material and Methods**

The two experiments for establishment and management of year-round grazing were conducted in South-west Islands of Japan( 24-28 S, 123-130 E), where annual rainfall is 1,800-2,400mm, and annual average temperature is 24 with over 18 in coldest month.

Giant star grass (*Cynodon nlemfuensis* Vanderyst) pastures established 20 years ago were evaluated on red-yellow soil (pH 5.5) by year-round grazing. Experiment animals were 25-30 pure Japanese Black cows for breeding (average weight 444 kg) and their calves during nursing after calving until about 3 months of age(average weight 56 kg). Data were collected for one year period from May of 1997 to October (Experiment 1), and November to next April (Experiment 2).

Pastures 4.0 ha in size were divided into four 0.5 ha units by electric fences for rotational grazing with 2, 3, 4 and 5 days of grazing and 30 days rest, and 2.0 ha unit for continuous grazing, which is the traditional method in this area, however, including several days rest in this experiment period (Experiment 1). All pastures were fertilized after each grazing period with 30 kg N-PO5-K2O/ha. All the cattle were gathered in stanchion stall in the center paddock every morning for checking estrus, and fed with about 0.7 kg wheat bran as supplement.

Calves were fed with hay as a creep feeding.

Herbage availability, intake and utilization were estimated by harvesting prior to and after grazing each paddock to a height of 10 cm. These samples were analyzed for in vitro dry matter digestibility ( Goto and Minson, 1978) and crude protein (CP) by micro-kjeldahl nitrogen method.

After Experiment 1, Experiment 2 was followed. Pastures 4.0 ha in size were divided into two 1.0 ha units including pure giant star grass and oversown with annual hybrid ryegrass (*Lolium multiflorum* X *Lolium perenne*), and four 0.5 ha units including two pure and two oversown pasture, respectively. Pastures was rotationally grazed at two stocking rates levels of about 8 and 4 heads/ha by the ' put and take stocking ' such as 5 days grazing and 30 days rest. Annual ryegrass were oversown by pasture sod seeder (Niplo LTD product) after each heavy grazing. Data were collected four months periods from first grazing 50 days after oversown. Another pasture management and evaluation methods were same in Experiment 1.

### **Results and Discussion**

Stocking rates in respective paddock were almost the same as established ones. Herbage availability after 30 days rest had a little decrease from 3.0 to 2.5 DM t/ha with increases the stocking rate of from 3.6 to 8.3 heads/ha in rotational grazing, while pasture utilization increased from 20 to 60% (Figure 1). Herbage availability and utilization was lower in continuous grazing than in rotational grazing under the same stocking rate. Plant height prior to grazing was 70 - 80 cm throughout different stocking rate in rotational grazing. Estimated daily dry matter intake (DMI) decreased from 7.1 to 5.4 kg/head/day in proportion to increases of stocking rate from 3.6 to 8.3 heads/ha in rotational grazing, while protein content (CP) of herbage ingested was higher at stocking rate of 8.3 heads/ha.

As daily nutrient requirements of lactating 450 kg Japanese black are 6.5 kg/head/day for DMI, 12% for CP, 3.2 kg/head/day for total digestive nutrients (TDN) intake (Japanese Feeding Standard for Beef

Cattle, 1995), DMI and nutrients per day required for heads were almost satisfied except for CP at respective stocking rate in the rotational grazing. Though DMI ingested in continuous grazing was so low (3.7 kg/head/day), high CP and digestibility resulted in a high TDN ingested relatively.

From above all, high herbage availability and good quality forage to bring out effective animal productions were produced by using relatively heavy stocking rates of 6 - 8 heads/ha, and achieved optimum pasture utilization of giant star grass. As giant star grass is adapted for more high pasture utilization, such as, over 85% (Adjei, et al., 1980), this results suggests the possibility of being performed higher carrying capacity by using more heavy stoking rate.

Annual crop growth rate (CGR) of giant star grass is shown in Fig. 2. As CGR of giant star grass decrease in winter because of low temperature, temperate grass as ryegrass were oversown in giant star grass pasture for establishment of year-round grazing. After experimental pasture of giant star grass were divided into two level of stocking rates (heavy and light), 1.0 ha and 0.5 ha paddocks were respectively oversown with annual ryegrass (Os-Ir) among them.

Average herbage availability in Os-Ir paddock prior to rotational grazing was a little higher than in pure giant star grass (P-Gs) paddock, which values in heavy stocking rate was higher than that in light stocking rate.

Herbage utilization in Os-Ir paddock was higher than that in P-Gs paddock, averaging was 88% and 74%, respectively. Daily DMI in Os-Ir paddock was 2.7 kg unit higher in light stocking rate, 0.3 kg unit lower in heavy stocking rate, respectively, than that in P-Gs. Herbage grazed in Os-Ir paddock contained higher dry matter digestibility, estimated TDN, crude protein as comparison to that in P-Gs. Herbage availability and utilization at heavy stocking rate was higher than at light stocking rate. In January and February, which average temperature was under 20 °C, pasture utilization was almost over 90% within 2 or 3 days after grazing started. Lighter stocking rate should be carried out and sometimes the rest period should be extended longer in that period of

winter even in pasture oversown with annual ryegrass.

It is suggested that giant star grass is firstly adapted to intensive rotational grazing as compared to continuous grazing, and secondly high carrying capacity (about 2,300 cow-days) is achieved by using stocking rates of 6 - 8 heads/ha or more during about 10 months and 4 heads/ha with supplement of hay or silage during about 2 months for year-round grazing system of Japanese Black cattle for breeding.

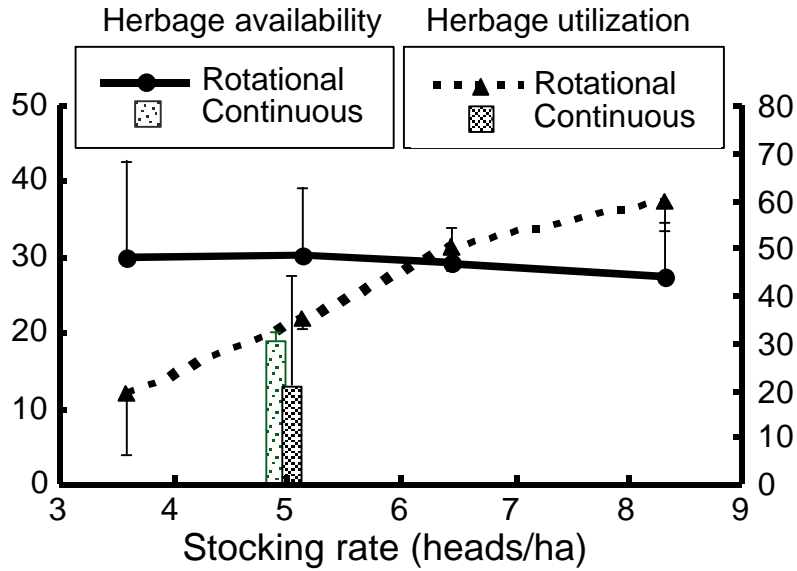
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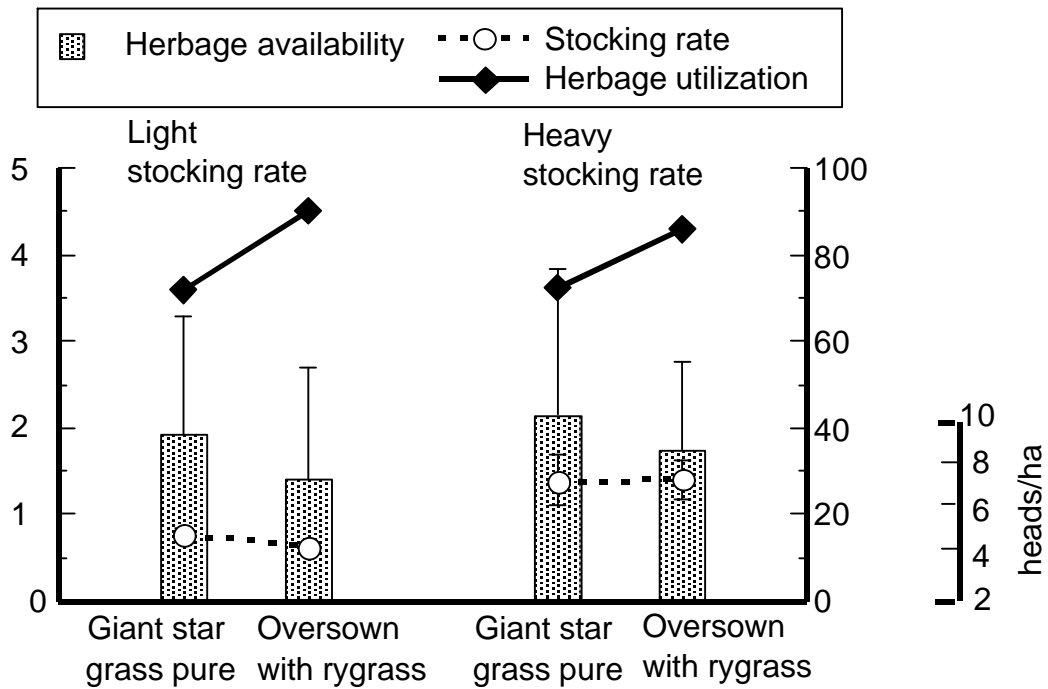
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**Figure 1** - Herbage availability and utilization of giant star grass as affected by stocking rate.



**Figure 2** - Herbage availability and utilization of oversown giant star grass with ryegrass as affected by two levels of stocking rate.