飼料作物の化学的成分と飼料価値に関する研究XV

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Studies on Chemical Composition and Feeding Value of Forage Crops

XV. Effect of clipping on the forage production and feeding value of Pensacola bahiagrass (*Paspalum notatum* FLÜGGE) grown in the warmer Setouchi district in Japan

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Bahiagrass is an excellent grass for grazing in the warmer southern regions of Japan. BEATY et al,[1,2] and STANLEY et al.[6] have reported on the effects of clipping frequency, clipping height and rate of nitrogen application on the forage production of Pensacola bahiagrass, and KAWASEKI et al.[3] and MIAKI[4] have carried out studies on the chemical composition and feeding value of this grass as affected by nitrogen application or stage of maturity. There is, however, no published information on the effect of clipping during the actively growing period (grazing stage) on the feeding value of Pensacola bahiagrass.

This study was conducted to determine the effect of plant height at clipping on the feeding value as well as the yield and persistency of Pensacola bahiagrass grown in the warm plain of Setouchi district.

Materials and Methods

The experiments were carried out in 1967 on a stand of Pensacola bahiagrass established in 1964 in the experimental field of the faculty of Agriculture, Okayama University. Fertilizer at rates of 8.2 kg N, 6.6 kg P_2O_5 and 4.2 kg K_2O per 10 a was topdressed in early April of 1966 and 1967, respectively.

Forage production trial: clippings were repeated during the growing season at two different stages, 1) when the grass reached an average height of 15 cm (abbreviated to 15 cm treatment hereinafter) and 2) when the grass grew to an average height of 30 cm (30 cm treatment), respectively. The above two treatments were replicated three times in a randomized block design, each plot occupying 3 m×3.5 m=10.5 m^2. The plant was harvested with a sickle, leaving a 5 cm stubble. Samples of each plot were analysed according to the method used in the previous report.[5]

Digestion trial: Digestion trial was conducted in 1966 and each clipping treatment

was assigned to two rabbits of about 2500 g body weight. Digestion trials on the 15 cm treatment were conducted ten times during the period from 17 May to 14 September, and those on the 30 cm treatment five times during the period from 29 May to 14 September. The grass harvested was chopped to a length of 1-2 cm and the chopped forage was fed to rabbits daily 9 a.m. and 5 p.m. in equal amounts, at a level to insure complete consumption. Each trial consisted of a 5-day preliminary period followed by a 5-day collection period during which total fecal collection was made. The field area of each clipping treatment for the digestion trial was 100 m². The chemical composition of forages and feces were analysed by the conventional method used in the previous report[5].

Dry matter and digestible nutrient yields in the field for the both trials were represented as the cumulative yield of forage harvested repeatedly during the test period.

Average temperature and precipitation in the growing season of 1966 and 1967 are illustrated in Fig. 1. Average temperature in June to September of 1967 was slightly higher than that of the corresponding period of 1966. Total amount of precipitation during the period from late July September of 1967 was 82% less than the previous year.

Results and Discussion

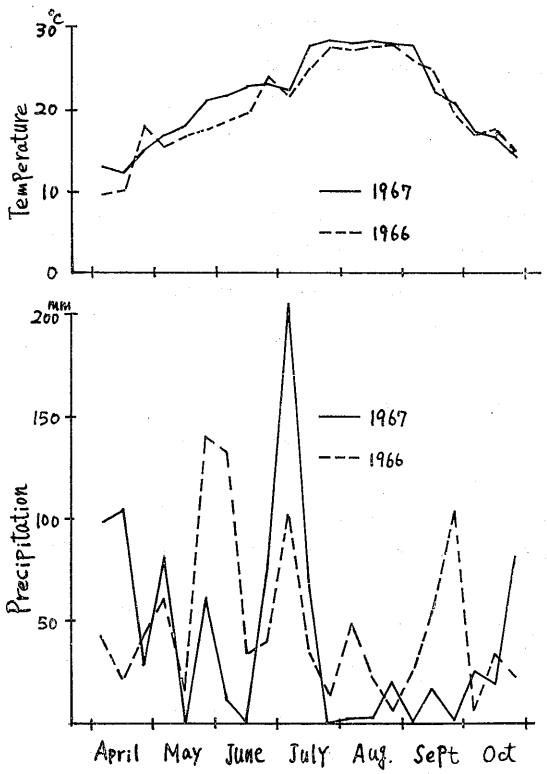

Fig. 1. Seasonal variation in the average temperature and total precipitation during 10 days in 1966 and 1967.

Table 1 shows the total yield of dry matter and clipping frequency for the test periods of 1966 and 1967 in the forage production trial. The yields of dry matter in both years were larger in the 30 cm treatment than in the 15 cm

Table 1. Clipping frequency and dry matter yield of Pensacola bahiagrass used in forage production trial

Clipping treatment	Plant height when harvested	Clipping frequency	Total yield of dry matter[f]
	—1966—		
15 cm	16.2 cm ±4.2[e]	10[a]	4892 g
30 cm	31.3 ±2.3	6[b]	6647*
	—1967—		
15 cm	15.4 ±4.1	7[c]	4346
30 cm	30.1 ±2.2	5[d]	5060

a) During the test period from 25 May to 19 Oct., b) 11 June to 9 Nov., c) 20 May to 18 Oct., d) 2 June to 18 Oct.
e) Standard deviation.
f) Per 5 m².
* Significant at the 5% level as compared with the 15 cm treatment.

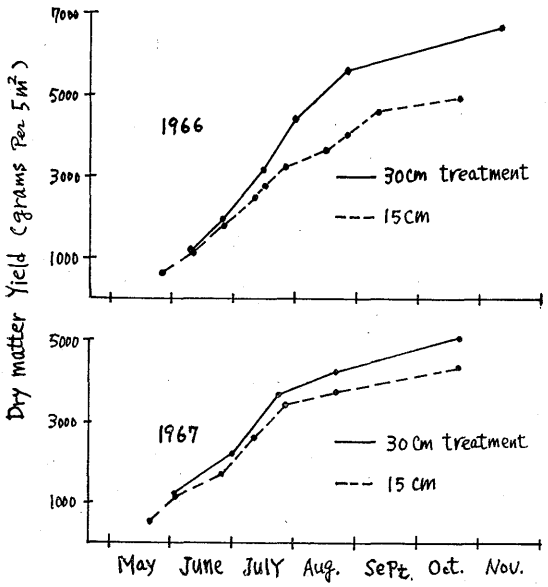

Fig. 2. Cumulative yield of dry matter for each clipping of Pensacola babiagrass in the two clipping treatments.

treatment, and especially there was a significant difference in 1966.

The cumulative yields of dry matter in grams per 5 m² in each clipping treatment are given in Fig. 2. It is shown in Fig. 2 that the large difference in the cumulative yield between the two clipping treatments occurred from late July in both years and the rate of growth of the 30 cm treatment was high when compared with that of the 15 cm treatment. The graph representing the cumulative yield should have been probably linear throughout late spring to summer for all clipping treatments if growth of grass in 1967 was not retarded due to the drought condition in late July to September of that year as shown in Fig. 1.

When the growth curve of grass in 1967 is compared with that in 1966, it is found that in the 15 cm treatment the growth of grass began to be depressed in late August but in the 30 cm treatment in late July. Although the beginning of growth depression was about 30 days earlier in the 30 cm treatment than in the 15 cm treatment, cumulative yields when the growth depression began were similar between the two clipping treatments.

Accordingly, it is suggested that the depletion of soil fertility by the plant nutrients removal from the foil occurred earlier in the 30 cm treatment than in the 15 cm treatment because the amount of fertilizer was the same between both clipping treatments and this early depletion of soil fertility accelerated the growth depression of grass of the 30 cm treatment during the summer of 1967.

It is considered that the results as stated above contributed to no significant difference in the yield of dry matter between both clipping treatments in 1967.

Table 2 shows the weight of cured stolon in grams per 0.3 m² for each test plot in March before the initial clipping and in November after the last clipping of 1967. The stolon weight of the 30 cm treatment was more than that of 15 cm treatment, but not significantly different. And also there was no significant difference in the rate of decrease in stolen weight with succesive clipping between the two clipping treatments. It can be considered from these results that the plant height at clipping had no apparent deteriorating effect on the persistency of grass stand. This

Table 2. Weight of cured stolon of Pensacola bahiagrass used in forage production trial (1967)

Clipping treatment	Weight[a] of cured stolon, g per 0.3 m²	
	March	November
15 cm	84.0	75.7
30 cm	94.3	81.0

a) Means of three replications in each treatment.

Table 3. Mean digestible nutrient content and cumulative nutrient yield of each clipping of Pensacola bahiagrass harvested for digestion trial (1966)

Clipping treatment	Content[a], %					Yield per 100 m² kg	
	DCP	TDN	Ca	P	Mg	DCP	TDN
15 cm	11.5 ± 3.2	52.3 ±10.5	0.51 ±0.34	0.33 ±0.16	0.25 ±0.14	9.4	42.9
30 cm	10.6 ± 2.5	53.9 ± 6.0	0.51 ±0.39	0.28 ±0.14	0.27 ±0.04	11.5	60.9

a) On a dry matter basis.
Minerals are contents of the grass used in the forage production trial in 1966.
b) Standard deviation.

resembles the results reported by BEATY et al.[1)]

The mean contents of DCP and TDN and their cumulative yields of each clipping of the grass used for the digestion trial in 1966 are indicated in Table 3. The mean contents of some minerals of each clipping of the grass used for the forage production trial in 1966 also are given in this table. The mean DCP content was slightly higher in the 15 cm treatment and inversely the mean TDN content was slightly lower than in the 30 cm treatment. There was no difference in the mean content of calcium between the two treatments but that of phosphorus was higher in the 15 cm treatment than the other. The mean content of magnesium was slightly higher in the 30 cm treatment. The cumulative yields of DCP and TDN in the 30 cm treatment were very high when compared with those in the other.

Summary

The effect of clipping on the yield, stand persistency and feeding value of Pensacola bahiagrass was studied in 1966 and 1967.

The grass was harvested repeatedly when they grew to an average plant height of 15 cm and 30 cm, respectively.

The results obtained were summarized as follows:

1. No significant differences in the mean contents of DCP and TDN of eacn clipping were found between the 15 cm and 30 cm treatments, while the cumulative yields of DCP and TDN were much higher in the 30 cm treatment than in the 15 cm treatment.

2. There was almost no difference in apparent deteriorating effects of frequent clipping on the persistency of grass stand between the two clipping treatment.

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XV. 瀬戸内地帯で栽培したペンサコラバヒアグラス (*Paspalum natatum* FLÜGGE) の生産と飼料価値に及ぼす刈取時の草高の影響について

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放牧時の適当な草丈を明らかにする目的で，収穫時の草高と草地生産，持続性および飼料価値の関係を検討した。すなわち，刈取時の草高を 15 cm と 30 cm とし，それぞれの草高に達した時に繰返えし収穫し，それら収穫物の乾物収量，飼料成分とその収量ならびに匍匐茎の重量等を調査した。なおこの実験は，1964 年に造成した草地で 1966 年と 1967 年の 2 カ年にわたって実施し次の結果を成た。

1. 草高 15 cm 刈区と 30 cm 刈区の平均 DCP 含量は 11.5% と 10.6%，平均 TDN 含量は 52.3% と 53.9%，平均 Ca 含量は 0.51% と 0.51%，平均 P 含量は 0.33% と 0.28%，平均 Mg 含量は 0.25% と 0.27% で大差なかった（乾物中 %）。

2. 乾物，DCP および TDN 収量は草高 30 cm 刈区の方が多かった。

3. 草高 15 cm 刈区も 30 cm 刈区も，その頻繁な刈取りにもかかわらず草生の永続性にほとんど影響を与えなかった。