

# CHARACTERISTICS OF GRASS SPECIES IN PASTURE FOR HIGH PRODUCING COWS IN NORTHERN JAPAN

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## ABSTRACT

The purpose of this research was to investigate characteristics of grass species under different conditions appropriate to the intensive grazing system for high producing cows (8000 kg for a 305-day lactation) in northern Japan. Meadow fescue (*Festuca elatior* L.), timothy (*Phleum pratense* L.) and perennial ryegrass (*Lolium perenne* L.) white clover (*Trifolium repens* L.) pastures were established and divided into two plots by difference of regulated plant height (meadow fescue and timothy) or of stocking intensity (perennial ryegrass). Each plot was 60m<sup>2</sup> and was grazed when plant height reached 20cm or 30cm. Meadow fescue and perennial ryegrass were superior in herbage production to timothy under 20cm plant height plots. The 30cm plant height plots and the low stocking intensity plot had an advantage of quantitative production but had disadvantages of utilization efficiency and nutritive value of pasture.

## KEYWORDS

Meadow fescue, timothy, perennial ryegrass, cattle, herbage production, nutritive value, intensive grazing, Japan

## INTRODUCTION

In northern Japan, grazing of milking cows has been revalued recently. Timothy (*Phleum pratense* L.) is a main grass species there because of its cold hardiness, but its regrowth and persistency under intensive grazing of high producing cows are not satisfied. On the other hand, perennial ryegrass (*Lolium perenne* L.) is suitable for intensive grazing, but cannot survive winter in some severe cold areas of northern Japan. Introducing meadow fescue (*Festuca elatior* L.) pasture has a possibility to solve these problems, but there is little knowledge about the characteristics under intensive grazing. This study was conducted to investigate basic characteristics of these species under different conditions.

## METHODS

In 1994 summer, small plots (60m<sup>2</sup>) of meadow fescue-, timothy-, and perennial ryegrass-white clover (*Trifolium repens* L.) pasture were established in Hokkaido National Agricultural Experiment Station, and four Holstein heifers grazed these plots between period of vegetation (from May to October) in 1995 when plant height reached regulated height. Regulated heights of meadow fescue plots were 20cm (M2) and 30cm (M3) and ones of timothy were also 20cm (T2) and 30cm (T3). Perennial ryegrass plots were grazed at 20cm height and stocking intensity of the plots were set normal (PN) and low (PL). Heifers were grazed on plots until they stopped their eating behavior except PL. PL were grazed as percentage of utilization of plant height reached not more than 50%. Nitrogen, phosphorus, potassium and magnesium were fertilized on each plot and their amounts were 6.0, 6.0, 3.4 and 1.6 kg/10a/year respectively. Plant height and herbage mass by rising plate meter were measured before and after grazing, and samples were collected before grazing for analyses of dry matter digestibility (DMD) by Tilley and Terry method (Tilley and Terry, 1963), crude protein (CP) by Kjeldahl method and neutral detergent fiber (NDF).

## RESULTS AND DISCUSSION

Table 1 summarizes the results of each plot. Average percentages of utilized plant height and herbage mass were more than 50%, 40% respectively except PL.

Dry matter (DM) herbage productions of each plot were between 523 and 1034 g/m<sup>2</sup>, and there were tendencies that herbage production of M3, T3 and PL were higher than that of M2, T2 and PN respectively. Concerning quantitative productivity and frequency of grazing, perennial ryegrass and meadow fescue were greater than timothy.

DMD of each plot were high in May and June. Average DMD through grazing period were more than 69%, and those of M3, T3 and PL tended to be lower than those of M2, T2 and PN respectively. This tendency was strong especially after July. Increasing of dead material might be one of the reasons. Average CP of each plot through grazing season were 16-18% and seasonal change were not found. NDF of M2, PN and PL were low in early May and NDF of all the plots exceeded 46% after June. The differences of NDF within a species were small except meadow fescue.

The tendencies of dry matter intake (DMI) and digestible DMI (DDMI) among species and treatment were similar to that of herbage production. The ratios of M3/M2, T3/T2 and PL/PN were relatively high with herbage production and low with DDMI, and the difference of T3/T2 between herbage production and DDMI was less than other species (Table 2). These results proved that M3 and PL had an advantage of quantitative production but had disadvantages of utilization efficiency and of herbage quality compared with M2 and PN. Any disadvantages of productivity, palatability and nutritive value with meadow fescue were not found under intensive grazing compared with timothy and perennial ryegrass. But further study concerning persistency would be needed.

## REFERENCES

Tilley, J.M.A. and R.A. Terry. 1963. A two-stage technique for the in-vitro digestibility of forage crops. *J. Grassland Sci.* **18**: 104-111.

**Table 1**

Results of each plot between period of vegetation

	Meadow fescue		Timothy		Perennial ryegrass	
	M2	M3	T2	T3	PN	PL
Average plant height before grazing, cm	20.6	27.6	19.4	25.5	19.5	21.2
	2.3 <sup>x</sup>	3.0 <sup>x</sup>	3.5 <sup>x</sup>	3.5 <sup>x</sup>	1.8 <sup>x</sup>	3.5 <sup>x</sup>
Average percentage of utilized plant height, %	63.4	63.2	56.9	52.4	59.4	43.0
	6.3 <sup>x</sup>	7.9 <sup>x</sup>	2.5 <sup>x</sup>	4.1 <sup>x</sup>	2.4 <sup>x</sup>	7.8 <sup>x</sup>
Herbage production, DMG/m <sup>2</sup>	523	836	472	642	529	1034
Average percentage of utilized herbage mass, %	60.3	58.1	56.7	57.4	45.1	39.1
	12.4 <sup>x</sup>	10.0 <sup>x</sup>	7.4 <sup>x</sup>	7.4 <sup>x</sup>	6.6 <sup>x</sup>	11.8 <sup>x</sup>
Frequency of grazing, time	9	8	7	6	11	14
min	74.8	69.1	71.0	71.7	76.1	69.5
DMD, % average	77.5	72.8	75.5	73.8	79.1	75.7
max	81.4	76.6	78.8	77.0	83.4	81.4
min	14.0	13.3	10.8	11.4	14.2	14.5
CP, % average	17.5	16.8	17.2	16.2	17.4	16.4
max	21.9	20.1	23.1	18.6	24.3	17.9
min	40.1	48.9	45.7	48.0	36.8	36.9
NDF, % average	45.5	51.3	50.0	50.2	45.3	45.9
max	48.2	53.4	53.6	54.2	48.6	48.4
Percentage of dead material 5cm above ground in October, DM%	7.4	16.3	12.4	15.8	14.5	23.5
Sum of DMI, g/m <sup>2</sup>	499	691	424	578	481	833
Sum of DDMI, g/m <sup>2</sup>	387	519	322	425	384	625

<sup>x</sup> Standard error**Table 2**

Comparison between treatment within a species

	M3/M2	T3/T2	PL/PN
herbage production	1.60	1.36	1.95
DMI	1.38	1.36	1.73
DDMI	1.34	1.32	1.63