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EFFECT OF MAGNESIUM APPLICATION ON DRY MATTER YIELD (DMY), CRUDE PROTEIN (CP) CONTENT AND DIGESTIBILITY (DMD) OF THREE DIFFERENT FORAGES

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ABSTRACT

The objective of this study was to determine the effect of rates and methods of Magnesium (Mg) fertilization on DMY, CP and dry matter digestibility (DMD) of forages of sweet corn (*Zea mays saccarata*), King grass (*Pennisetum hybrid*) and setaria (*Setaria splendida*). Rates and methods of Mg applied were T-0 (control, without Mg), T-1 (2 tons of dolomitic limestone or GLM given via root), T-2 (3 tons of GML given via root), and T-3 (50 kg of epsom given 3 times via stomata). Following factorial experiment, it was found that dry matter yields (DMY) were not affected by rates of Mg applied and the interaction with species of plants. Highest (P<.05) DMY per hectare was observed on setaria (3419.9 kg) comparable to King grass (3140.5 kg), and the lowest (P<.05) was on corn (1186.8 kg). CP content and DMD of leaf and stem were affected (P<.05) by plants species. Rate of Mg applied and the interaction with species of plants were significantly (P<.05) found on the CP content of leaf only. Setaria has the highest (P<.05) CP and DMD content comparable to King grass, while corn has the lowest (P<.05) content. It can be concluded that the best treatment to produce maximum yield (DM, CP and DMD) of forages was T-3.

Key words: Magnesium, Crude protein, Digestibility, Forage, Sweet corn, King grass, Setaria

INTRODUCTION

Fertilizer is one of the important factors that affects pasture productivity, and Mg is one of the major essential elements required by plants that generally are never included in the fertilization program, in Indonesia.

According to Holmes (1989), under favorable temperate zones, a hectare of a good pasture could produce at least 13.000 kg DM of forages that can support 15,000 to 20,000 kg of milk production or 1,000 to 2,000 kg of meat yield for about 180 days of the grazing season. In Indonesia, Soedomo (1993) reported that with introduced species as much as 64 tons to 352 tons of fresh forage yield, equal to about 12.5 tons to 70.4 tons of DM, can be achieved during 6 months of the rainy season. He further mentioned that the soil in transmigration areas was deficient in Mg. Therefore, the forages yielded in that area could be not yet optimal, and probably the fact that Mg content was low would affect the productivity of the animals. Fitter and Hay (1987) reported that the use of Mg together with N, P and K was able to increase pasture yield 4 times over those without Mg fertilizer. Hidayat and Soemarno (1986) showed that napier grass was more responsive to Mg application than 4 other species of grasses used in the study.

MATERIALS AND METHODS

A factorial study (3 X 4 x 3 factors) was performed at Universiti Pertanian Malaysia (UPM) and Malaysian Agricultural Research Development Institute (MARDI) using 3 species of grasses, namely: King grass, setaria and sweet corn, to observe the DMY, CP content and digestibility of forage under 3 rates/methods of Mg fertilization and

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were done in triplicate, namely: T-0 (control, without Mg), T-1 (2 tons of dolomitic limestone containing 3.1% Mg or GML given via root), T-2 (3 tons of GML given via root), and T-3 (50 kg of epsom containing 10.0% Mg given 3 times via stomata at 10 days, 15 days and 25 days after the plant growth). Planting distance was 0.9 m between rows and 0.5 m within rows, and in each hill only 2 plants of corn were allowed to grow. Eighty days after planting, forages were harvested and the yields were weighed. Samples from each plot (about 1.0 kg fresh) were taken and then the stems and the leaves were separated. After determining the fresh weight of the stems and leaves from each plot, they then were analyzed for the DM following the procedure given by AOAC (1975). CP and the digestibility content were determined by near infrared reflectance spectroscopy (NIRS) (Shenk, *et al.*, 1992). All the parameters measured then were analyzed following factorial experiment using SAS microcomputer program.

RESULTS AND DISCUSSION

A significant (P<.05) effect of species and the interaction with block were found in DM and leaf dry matter (LDM) yield while stem dry matter (SDM) yield depended on the species and the Mg applied. DMY of setaria was equal to King grass, and both were statistically (P<.05) higher than the yield of corn (Table 1). The increase in DMY due to Mg in this study was not the same as the report given by Fitter and Hay (1987), and Hidayat and Soemarno (1986). The DMY varied from 2,394.3 kg up to 2,713.8 kg/ha/harvest (Table 2). Since the grasses used in this study were harvested for the first time during the growth, therefore the yield can be considered low. Sarjana (1996) reported his finding that King grass after being harvested 7 times regularly at 6 weeks of age and fertilized with Mg foliarly at the rate of 0.9 kg/ha was able to produce DMY of about 7,405 kg/ha/harvest. The DMY of corn in this study (1,186.8 kg) was also very low compared to the earlier report of study (4,385.6kg) given by Soetrisno (1995). The difference in DMY can be attributed to the different variety of corn used in this study (var. Mas Madu vs. Chia Tai), and the different population density (44,444 vs. 111,111 plants/ha).

Although no effect of Mg on total DMY was found, T-2 and T-3 were able to increase (P<.05) leaf production (Table 2). Analysis of statistics showed that there were significant (P<.05) effects of species on CP and dry matter digestibility (DMD) of leaf and stem of the forages yielded, but the effect

Table 1. Dry matter yield (DMY) and nutritive value of species of grasses

	Setaria	King grass	Sweet corn	MSE
DMY, kg	3419.9 A	3140.5 A	1186.8 B	
LDM, %	47.0 B	53.3 A	47.3 B	3.0
SDM, %	53.0 A	46.7 B	52.7 A	3.0
LCP, %	9.2 B	9.7 AB	11.6 A	1.3
SCP, %	9.8 A	10.6 A	7.3 B	2.5
LDMD, %	65.9 A	63.4 A	56.5 B	2.4
SDMD, %	52.8 B	54.7 A	28.5 C	2.4

MSE with n = 36.
LDM = Leaf dry matter
SDM = Stem dry matter
LCP = Leaf crude protein
SCP = Stem crude protein
LDMD = Leaf dry matter digestibility
SDMD = Stem dry matter digestibility

Table 2. Dry matter yield (DMY) and the nutritive value of forages due to Mg fertilizer application

	T-0	T-1	T-2	T-3	MSE
DMY, kg	2394.3 A	2713.8 A	2588.0 A	2633.4 A	
LDM, %	46.8 B	48.9 AB	50.6 A	50.6 A	9.0
SDM, %	53.2 A	51.1 AB	49.4 B	49.4 B	9.0
LCP, %	10.3 B	8.9 C	9.5 BC	11.9 A	1.7
SCP, %	8.3 A	9.4 A	9.1 A	10.2 A	6.5
LDMD, %	62.3 A	63.0 A	61.2 A	61.2 A	15.2
SDMD, %	45.7 A	45.4 A	44.2 A	46.0 A	5.9

MSE with n = 36.
LDM = Leaf dry matter
SDM = Stem dry matter
LCP = Leaf crude protein
SCP = Stem crude protein
LDMD = Leaf dry matter digestibility
SDMD = Stem dry matter digestibility

of Mg and the interaction with species was found only on leaf protein (LCP). The highest (P<.05) LCP content (Table 1) was recorded in corn (11.6%) but was statistically the same as King grass (9.7%), and setaria was the lowest (9.2%). Due to Mg application it was observed that the highest (P<.05) LCP content was found in T-3 (11.9%), followed by T-0 (10.3%), T-2 (9.5%) and the lowest were T-1 (8.9%). Statistically T-1 equals T-2, and T-0 comparable to T-2 (Table 2). The CP content of stem (SCP) (Table 1) was high in King grass (10.0%) comparable to setaria (9.8%), and the lowest (P<.05) was in corn (7.3%). The SCP was not dependent on Mg applied, and the stem contained 8.3% to 10.2% CP (Table 2). Table 1 shows that leaf dry matter digestibility (LDMD) of setaria (65.9%) was equal to King grass (63.4%) and the lowest (P<.05) was found in corn (56.5%). Meanwhile, stem dry matter digestibility (SDMD) was recorded highest (P<.05) in King grass (52.8%), followed by setaria (52.8%), and the least was in corn (28.5%). Table 2 indicates that LDMD and SDMD were not affected by Mg fertilization; the LDMD value varied from 61.2% to 63.0%, and SDMD varied from 44.2% to 46.0%. When the data of CP and DMD of leaf and stem in Table 1 and 2 were used to recalculate the total CP and DMD contained in the whole forage, it was found that CP content of King grass (10.1%) was the highest, followed by setaria (9.5%), and corn (9.3%) was the lowest. T-3 (11.1%) gave the best effect on CP content, followed by T-2 (9.3%), T-0 (9.2%), and T-1 (9.1%). The same figure was observed in DMD for the species of grasses (59.3% for King grass, 58.9% for setaria and 41.7% for corn), but the effect of Mg was slightly different: T-1 (54.0%) was superior, followed by T-3 (53.7%), T-0 (53.5%) and T-2 (52.8%) was the inferior. Compared to the data given by Soetrisno (1995) and Sumiyanto (1995) it can be summarized that the CP and DMD content of the forages found in this study were lower than their report. Sumiyanto (1995) found higher (12.9%) CP contained in King grass and Soetrisno (1995) recorded higher DMD (64.0%) for sweet corn. However, this finding is better compared to the report of the study using ordinary corn cv. Arjuna harvested either at 60 or 80 days of age given by Soelistiyadi (1995). The low CP and DMD in the present study may be due to the environment/climate effect, as this study was conducted in Malaysia in the area near the equator. Camoens (1993) stated that the closer to the equator, the ambient temperatures at the same altitude would be

increased, resulting in low digestibility of the forage yielded.

Based on this study, it can be concluded that the best treatment to produce maximum yield (DM, CP and DMD) of forages was T-3.

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REFERENCES

AOAC, 1975. *Official Methods of Analysis*. 11th. Ed., AOAC, Washington, D.C.

Camoens, J.K., 1993. *Impact of Changing Trade Opportunities on Livestock Production in Developing Countries. Grassland for Our World* (Ed.: M.J. Baker). SIR Pub. Wellington, New Zealand. Pp.:310-5.

Fitter, H. and R.K.M. Hay, 1987. *Environmental Physiology of Plants*. 2nd. Ed. Academic Press. New York.

Hidayat, S. and D.S. Soemarno, 1986. *Budidaya tanaman tropik*. Usaha Nasional, Surabaya.

Holmes, W., 1989. *The Utilization of Pasture in Ruminant Nutrition* (Ed.: R. Jarrige). INRA, Paris. Pp.:181-8.

Sarjana, 1996. Pengaruh frekuensi pemberian pupuk magnesium terhadap produksi hijauan segar dan bahan kering rumput Raja (*Pennisetum hybrid*). *Skripsi S-1*. Fak. Peternakan UGM, Yogyakarta,

Shenk, J., J.J. Workman, Jr., and M.O. Westerhaus, 1992. Application of NIR spectroscopy to agricultural products. In: *Handbook of Near-Infrared Analysis* (Ed.: D.A. Burns and E.W. Ciurczak). Marcel Dekker, Inc., New York. Pp.:383-426.

Soedomo, R., 1993. *Potensi dan Konservasi Hijuan Makanan Ternak*. Fak. Peternakan UGM, Yogyakarta.

Soelistyadi, H.K., 1995. Pengaruh umur pemotongan terhadap produksi dan kecernaan bahan kering tanaman jagung dan kualitas silasenya. *Skripsi S-1*. Fak. Peternakan UGM, Yogyakarta.

Soetrisno, D., 1995. The influence of magnesium fertilizer on productivity of sweet corn and the stover. UGM, *Project* No.: 40. Abstract.

Sumiyanto, 1995. Pengaruh aras pupuk magnesium terhadap komposisi kimia rumput Raja. *Skripsi S-1*. Fak. Peternakan UGM, Yogyakarta.