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Chlorophyll, Crop Growth Rate and Forage Yield of Brachiaria (*Brachiaria brizantha* Stapf) as The Result of Goat Manure in Various Nitrogen Dosage

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Abstract. The research was done to find out theeffect of manure and N dosage on chlorophyll content, plant height, crop growth rate (CGR), forage yield, dry matter ((DM) yield and DM content of *Brachiariabrizantha*Stapf. The experiment used manure (0 and 5 ton/ha) and nitrogen dosage (50, 100, 150 kg N ha^{-1}) set in factorial design 2 x 3, repeated three times. The result showed that manure increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content. N dosage increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content. The interaction between manure and N dosage increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content. The result showed that manure usage and nitrogen dosage 150 kg N ha^{-1} increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content in the amount of 27.5; 20.5; 98.4; 68.5; 103.4 and 20.5% compared to without manure and nitrogen dosage in the amount of 150 kg N ha^{-1}.

INTRODUCTION

Brachiaria brizantha Stapf is one of the best grasses for forage that can be planted in thetropic area from 0 – 2400 m above sea level with rainfall 800 mm per year [1]. *B.brizantha*Stapfis known for its high production, high nutrition, resistance to spittlebugs (Homoptera: Cercopidae) and tolerance to acid soil [2].

Nitrogen is one of the most important nutrient elements for a productivity of crops. Nitrogen transformation and availability influenced soil fertility and nitrogen used efficiently so that it can increase high yield [3]. Appropriate manure usage for production keeps microbe biodiversity in an upper layer and enables nutrient to produce forage [4]. Manure provides all kinds of nutrient both macro and micro needed by a plant in available form, thus increases soil's physical and biological characteristic. Fertilizer is usually given in high dosage [5]. Manure is applied to supply N because soil contains too much P and plant production needs an adequate amount of nutrient. Soil with decreasing nitrogen content needs additional N to produce forage [6]. Information about organic fertilizer to cultivate*B. brizantha*Stapf was limited. This research was done to find out an effect of manure and N dosage on chlorophyll content, plant height, crop growth rate (CGR), forage yield, DM yield and DM content of B. brizanthaStapf.

MATERIAL AND METHODS

This research was done in Laboratory of Ecology and Plant Production, Faculty of Animal and Agricultural Sciences, Diponegoro University from August to December 2014. It was pot experiment in 12- liter volume. The pot

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was filled up with soil and manure in the amount 10 kg based on treatment. Goat manure content is 1.7% nitrogen, BO 52.1%, cation exchanged capacity(CEC) 26.3 me 100 g-1 of soil. The research was set in factorial design 2 x 3 repeated three times. The first factor was manure (0 and 5 ton ha-1). The second factor was ammonium sulfate dosage; 50, 100 and 150 kg N/ha. Each pot was planted with one cutting of *B. brizantha*Stapf. The plant was given phosphate of 50 kg SP36/ha and 50 kg KCl ha-1. Micronutrient (Fe, Mn, B, Mo, Cu, Zn, Cl, Co) was addedof 0,5 gram per pot. The plant that didn't grow or died was replaced by the new one. Total chlorophyll contents of a leaf were determined by acetone extraction method, and the absorbance of the extract was read at 645 and 663 nm in UV-VIS Spectrophotometer (ELICO Model SL-1 59) and for blank 80 percent acetone was used [7]. Crop growth rate is plant growth rate parameter measured by the formula[8]: CGR (g2 m-2 day-1) = W2-W1)/(T2-T1); W1 was dried material at time T1, and W2 was dried material at T2. The cropwas done by cutting all parts of the plant using the hand (hand-cutting). Parameter observed was growth, plant height, CGR, chlorophyll content, forage yield, dried material yield and dried material content). Collected data was variance analyzed (ANOVA) and continued with Duncan multiple range test [9].

RESULT AND DISCUSSION

ANOVA result showed that manure had the significant effect on chlorophyll content, plant height, CGR, forage yield, DM yield and DM content. N dosage had a significant effect on chlorophyll content, plant height, CGR, forage yield, DM yield and DM content. The interaction between manure and N dosage had the significant effect on chlorophyll content, plant height, CGR, forage yield, DM yield and DM content (Table 1).

Table 1. Chlorophyll content, plant height, CGR, forage yield, DM yield and DM content asas the result of manure treatment and N dosage

Treatments	Chlorophyll (mg g^{-1} leaves)	Plant height (cm)	CGR (g day^{-1})	Forage yield (g.pot^{-1})	DM yield (g.pot^{-1})	DM (%)
Interaction:						
No manure						
N-50	0.81d	90e	0.33e	81.5e	14.1e	17.3e
N-100	1.38c	104e	0.49d	105.5d	21.1d	20.0 d
N-150	3.02b	117cd	0.61c	124.8c	26.2c	21.0 c
Manure						
N-50	1.66 c	127c	0.56cd	116.1cd	24.4cd	21.0 c
N-100	2.71 b	134b	0.85b	170.9b	37.6b	22.0 b
N-150	3.85 a	141a	1.21a	210.3a	53.3a	25.3 a
No Manure	1.74 b	103.6b	0.47b	103.9b	20.4b	19.4 b
Manure	2.74 a	134.0a	0.87a	165.8a	38.4a	22.7 a
N-50	1.23c	108.5c	0.44c	98.8c	19.2c	19.1 c
N-100	2.04 b	116.0b	0.67b	138.2b	29.3b	21.0 b
N-150	3.44 a	129.0a	0.90a	169.5a	39.7a	23.1 a
Manure	*	*	*	*	*	*
Nitrogen dosage	*	*	*	*	*	*
Manure*Nitrogen	*	*	*	*	*	*

*Significant ($p<0.05$)

Variance result showed that manure application had a significant effect on a parameter of chlorophyll content, plant height, CGR, forage yield, DM yield and DM content of *B. brizantha*Stapf grass. Chlorophyll content increased 36.5% compared to without manure. Plant height, CGR, forage yield, DM yield, and DM content increased compared to without manure of 22.7; 45.9, 37.3, 46.9 and 14.5 percent, respectively. Organic fertilizer including manure gave residual effect on growth and crop those were environmental condition improvement and

need of lessening artificial fertilizer cost was the reason to use organic material. Organic fertilizer increased soil fertility by activating microbe biomass.

Nitrogen dosage had a significant effect on chlorophyll content, plant height, CGR, forage yield, DM yield and DM content of *B. brizantha*Stapf grass. Nitrogen giving increase from 50 kg N to 150 kg N ha-1added up chlorophyll content, plant height, CGR, forage yield, DM yield, and DM content both in without manure and with manure. N giving of 100 kg N ha-1increased chlorophyll content, plant height and CGR 179.7; 18.9; 104.5 percent each compared to giving only 50 kg N ha-1. In addition, forage yield, DM yield, and DM content increasedof 71.6, 106.8 and 20.9 percent, respectively.

Nitrogen is an important component of plant organ forming a nucleic acid, amino acid, and protein. Nitrogen absorbed by root and translocated into plant especially in the form of nitrate (NO3-), ammonium (NH4+) and amino acid. In an excessive condition of ion Na and Cl, there is competitive interaction with another nutrition ion (K+, NO3-, H2PO4-) in soil that affects N transport in root cell and after that, it is translocated and disposed of, and it is the partition of a plant [10]. N absorbance level by a plant is very various during plant's growth and between location and time. N supply affects N accumulation on plant and also relates to plant growth level and biomass accumulation[11]. Plant growth level (CGR) increases significantly with each nitrogen level increased[12].

The interaction between manure treatment and nitrogen dosage had an effect on chlorophyll content, plant height, CGR, forage yield, DM yield and DM content of *B. brizantha*Stapf.The result showed that manure usage and nitrogen dosage 150 kg N ha^{-1} increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content in the amount of 27.5; 20.5; 98.4; 68.5; 103.4 and 20.5% compared to without manure and nitrogen dosage in the amount of 150 kg N ha^{-1}.

Manure role as organic source and nutrient needed by plant increased plant relative growth rate. Plant growth and production increased by manure giving. Increasing nutrient available in soil showed plant growth increase. Plant production was affected a lot by plant growth factors including water, sunlight and nutrient that both come from the soil and air (C, H, O). Manure contained high organic material (30%) and humic acid that made soil cations change better. Increasing nitrogen giving will increase production/result in real. The grass is one of the plants which is responsive to nitrogen. The grass which is not given nitrogen has smaller production than the grass which is given nitrogen. Lack of nitrogen causes slow and stunted growth, so its seed production is low. The grass which is given nitrogen will have better production increase than without nitrogen. This agrees the research result of [13] that adequate N is an important need for the plant to grow and develop normally and also former of protein, structure and chloroplast function. Application of chicken manure of 60 ton ha-1 increased leaves number, leaves width, fresh weight and dried weight of plant[14].

CONCLUSION

The interaction between manure and N dosage 150 kg Nha^{-1} in *Brachiariabrizantha*Stapf increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content.The result showed that manure usage and nitrogen dosage 150 kg N ha^{-1}increased chlorophyll content, plant height, CGR, forage yield, DM yield and DM content in the amount of 27.5; 20.5; 98.4; 68.5; 103.4 and 20.5% compared to without manure and nitrogen dosage in the amount of 150 kg N ha^{-1}.

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