Organic fertilizer application on performance and production of king grass in acid soil[1]

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ABSTRACT: A field experiment was conducted at the experimental site of the Forage Crop Science Laboratory of the Faculty of Animal Agriculture, Diponegoro University. Experiments on acid soils met the level of fertilizer consisting of T0, T1, T2 and T3 were 0, 30 and 60 kg N as urea, and organic fertilizer equivalent to 4,5 % C soil organic, respectively. King grass was planted with spacing orders of 50 cm x 50 cm at the experiment plots 3 x 4 m^2. Plants obtained basic fertilizer of 50 kg N/ha, 150 kg K_2O/ha and 150 kg P_2O_5/ha. Appearance of the components of growth and dry matter production of King grass on acid soil added-organic fertilizer higher than urea fertilizer or no fertilizer. Increase soil organic matter content to the level of 4.5% organic C can enhance the appearance of King grass on acid soil. Response of soil organic C increased with application of organic fertilizers on the performance of King grass on acid soils is higher than with urea.

Key word: C soil organic, growth, yield, king grass

INTRODUCTION

Problem of decreasing soil organic matter causes an increasing need for fertilization (Aphani, 2001). This problem can be overcome by improving management practices on agricultural soils. Soil organic matter content in most soils currently decline. Approximately 80% of land soil organic C content of less than 1%, especially in dry lands (Aphani, 2001). Organic C content of less than 1% of the soil can not provide sufficient nutrients, besides nutrients provided by manure can not be held by the soil component so easily leached, cation exchange capacity decreased, weakening the soil aggregation, micro nutrients easily washed and decreased water binding capacity. Soil with low organic C content led to increase demand for nitrogen fertilizer efficiency is declining due to the high level of leaching.

Organic materials play an important role in tropical soils, since nearly all the elements are in it (Agboola, 1974). Cation exchange capacity associated with high soil organic matter content is high. There is relationship between available P with soil organic matter content (Agboola and Corey, 1973). Its relationship will be significant when organic matter content of more than 3%. Soil organic matter play role to prevent the deposition of the element phosphorus by aluminum and iron. Organic fertilizer which is returned through manure other than as a source of soil organic matter as well as a source of nutrients for plant growth (Ende and Taylor, 1969).

Organic fertilizer has been known to have effect of increasing crop production of *Leucaena leucocephala* (Dewi *et al.,* 1998), also in mixed cropping between *Setaria* sphacelata and *Centrosema pubescens* (Sumarsono, 2001). It has been widely known that organic materials such as crop waste, manure and green manure in soil-plant systems can improve soil structure and develop soil microorganisms (Yaacob *et al.,* 1980; Sumarsono, 1983; Kerley *et al.,* 1996; Widjajanto *et al.,* 2001)

Various species of grasses have been selected on aluminum stress on acid soils (Anwar *et al.,* 2003), and King grass tolerant on acid soils. But the success of the growth of forage quality and production is expected to be higher, if the acidity can be reduced, by application of organic fertilizer. Acid soils are generally poor in organic materials, thus improving the organic content to a certain

[1] Thanks to Angga, Febri and Mira, students of Nutrition and Animal Feeds, Faculty Animal Agriculture of Diponegoro University for their help and cooperation throughout the experiment.

level can increase the success of the growth of plants growing on it. Organic matter in soil nutrient sources can play a role, maintaining soil moisture, as a buffer by binding elements that will cause acidity superior to inorganic fertilizers.

This study was aimed to find more information from the role of organic matter through the application of organic fertilizers, and to obtain field evidence to support the success of plant growth of King grass on acid soils.

MATERIALS AND METHODS

Experiment was conducted at the experimental site of Forage Crop Science laboratory, the Faculty of Animal Agriculture, Diponegoro University of Semarang. Soil used contained 0.26% Nitrogen (N), 0.015% phosphorus (P) and 0.022% total potassium (K) and 1.25 % carbon (C). Meanwhile, manure contained 9.72% C and 1.1083% N. The experiment consisted of 4 treatments on the acid soils with 3 replications. A completely randomized design was used throughout the experiment. Four treatment levels of organic fertilizer was as follows: T0, T1, T2 and T3 were 0, 30 and 60 kg N as urea, and organic fertilizer equivalent to 4,5 % C soil organic, respectively.

Soil was given with different level of organic fertilizer, which the conditioned soil solution of acid soils with $Al_2 (SO_4)_3$ of 4 mM or 1.368 g /L and was given at the beginning of planting. Firstly, organic fertilizer of manure was composted, then mixed with soil on experimental plots 3 x 4 m^2, together with basic fertilizer 50 kg N/ha, 150 kg/ha of P_2O_5 and 150 kg/ha of K_2O. King grass was planted with cuttings and allowed to grow until the age of 4 weeks when trimming was done. Observation was conducted on growth and production of components at the age of 6 weeks after trimming. The data obtained were processed according to the procedure of analysis of variance and Duncan multiple range test.

RESULTS AND DICUSSION

The value of average behavior of the components of growth, physiological characteristics, production of dry matter and crude protein content of King grass can be seen in Table 1. The analysis shows that various treatments affect significantly ($p < 0.05$) on components of growth and production of dry matter and protein content of King grass on acid soil, but no significant effect on the rate of photosynthesis and content of chlorophyll. King grass gave a positive response to the environmental improvement of land with the addition of organic fertilizers on acid soils. The overall appearance of King grass obtained on the acid soils of added-organic fertilizer (T3) was better compared with added-urea fertilizer (T1 and T2) or without fertilizer (T0). Application of organic manure to improve the appearance of King grass, both based on the components of plant height, nitrogen uptake, dry matter production and crude protein content of forage. In general, the components of growth and herbage dry matter of King grass on treatments T1, T2 and T3, respectively, was significantly ($P < 0.05$) higher than control, T0. Application of organic manure T3 was significantly ($P < 0.05$) higher than T1 and T2, in plant height, nitrogen uptake and dry matter production. In general, the application

Table 1. Observation Results of Component Growth, Physiological Characteristics and Production of King Grass due to Organic Fertilizer

Treatments	Height of crop, cm	Chlorophyll content, mg/g	Rate of photosynthesis, $mgCO_2/dm^2/jam$	Absorbed-Nitrogen, $g/2m^2$	Dry matter production, $kg/2m^2$)	Crude protein, %
T0	148.55^{c}	11.51^{a}	004073^{a}	28.3^{c}	2.27^{b}	7.80^{a}
T1	158.78^{bc}	9.73^{a}	011393^{a}	30.0^{c}	2.53^{b}	7.43^{a}
T2	179.00^{b}	10.18^{a}	010550^{a}	41.0^{b}	2.99^{b}	8.57^{a}
T3	209.67^{a}	1074^{a}	001697^{a}	82.0^{a}	5.90^{a}	8.68^{a}

Figures followed by same letters in the same column are not significantly different at 5% level

of urea fertilizer dose of 30 kg N / ha (T1) was no different than the application of urea fertilizer dose of 60 kg N / ha (T2).

Results Table 1 shows that the increase in components of growth and dry matter production of herbage of King grass was due to the application of organic fertilizers on acid soils. These results indicated that the application of organic fertilizer positively affect on components of growth and dry matter production of King grass.

Organic materials in addition to providing nitrogen elements also provide other elements. Organic matter in soil is also beneficial to neutralize the poor influence caused by acidity, namely pressing the aluminum toxicity, the increased availability of major nutrients especially phosphorus, and also improve the structure of good soil for root growth. The highest indicators of response to increasing soil organic matter in acid soils were dry matter herbage production followed by absorption of nitrogen and plant height.

Crude protein content of herbage and chlorophyll content also indicate the highest average value compared with other treatments. Results of previous research on King grass (Sumarsono, 2005), shows that the rate of increase in herbage production was very high due to increased of soil organic matter content, which reached 212.98% for every additional 1% C organic soil.

CONCLUSIONS

Performance of growth components and dry matter production of herbage King grass on the acid soils with the application of organic fertilizer was better than the application of urea fertilizer or no fertilizer. Increasing soil organic matter content up to 4.5% organic C levels shown to enhance the performance of growth components and dry matter production of herbage of King grass on the field conditions. The responsibility of soil organic C with the application of organic fertilizers on the performance of King grass on acid soils was higher than urea.

Observation is still needed on the effects of residual organic fertilizer for further defoliation, the natural acid soils, and with content of more than 4.5% organic C soil.

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