# Growth, Production and Nutritive Value of *Brachiaria mulato* as Affected by Levels of Urea Fertilization

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## ABSTRACT

This experiment was aimed at investigating growth, production, and nutritive value of Mulato grass (*Brachiaria mulato*) as affected by levels of urea fertilization. The experiment was designed with a 3 x 6 completely randomized design to test three application levels of urea fertilizer (0, 150, or 300 kg/ha); each of which was replicated six times. The grass was planted, with a planting size of 60 x 75 cm, on 18 plots having an individual size of 3 x 3 m. All the plants were cut at week three after planting and urea was applied on week four. Parameters measured were plant height, tillage number, leaf width, biomass production and nutrient contents (crude protein [N x 6.25], neutral detergent fibers, and crude fat) of plant dry matter, and measurements of (or sample collection for) these parameters were done on week seven after cutting. Between treatment differences were statistically analyzed with an analysis of variance. Results indicated that the levels of urea fertilizer significantly (P<0.05) affected the plant tillage number, dry matter production and crude protein and neutral detergent fiber contents. Applying 150 kg/ha urea increased tillage number, dry matter production and crude protein content of the plant while reducing the neutral detergent fiber content of the plant compared to unfertilized plants. Increasing the urea application level to 300 kg/ha resulted in further increase in tillage number, dry matter production and crude protein content of the plant and further reduced the neutral detergent fiber content. The level of urea application up to 300 kg/ha did not affect the height, leaf width, dry matter, organic matter or crude fat contents of the Mulato grass.

*Key words: mulato, urea, growth, production and nutritive value*

## INTRODUCTION

Indonesian beef cattle production system is to a large extent managed traditionally by small scale farmers who maintain a limited number of cattle and apply a low level of production technologies. Under the system, the cattle herd is primarily dependent upon feeds available from road sides and communal grasslands, which is provided to the animals through the cut and carry practice or by allowing the animals to graze themselves. Cattle productivity is generally low. Under such systems, Wiryosuhanto (1999) reported the following cattle performances: calving rates 22%, calves mortality rate 18%, calving intervals 15-17 months, and cow mortality rate 2.7%. Some studies (Doho, 1989; Marsetyo *et al*., 2006; ACIAR, 2008) have indicated that native grasses are not able to meet the nutrient requirements of growing calves and the animals will exhibit low growth rates when the native grass is used as the only source of nutrients. This is not surprising because native grasses contain low levels of nutrient; ACIAR (2008) reported a typical nitrogen content of native grasses between 5 and 8%. Availability and nutritional qualities of native grasses are also reduced during dry seasons with a direct impact on animal performances. Wirdahayati *et al*. (1998) and Damry *et al*. (2008) reported that the growth rates of Bali cattle grazing in native pastures during rainy seasons were 0.25-0.50 kg/day, but the animals lost 20% of their body weight during dry seasons.

Introduction of new grass species is one approach that may overcome the low nutritional contents and seasonal availability of grasses for beef cattle production system. The introduced grass has to be tropical in origin or highly adaptable to tropical environments and has appreciably high production rates and nutrient contents. This effort will ensure a continuous supply of feed to beef cattle throughout the year.

One of the tropical grasses seems to be promising is *Brachiaria mulato*. Currently there are two Mulato cultivars available: Mulato I

(*Brachiaria* hybrid CIAT 36061) and Mulato II (*Brachiaria* hybrid CIAT 36087). Mulato I (resulted from crossing *Brachiaria ruziziensis* clone 44-6 and *Brachiaria brizantha* CIAT 6297) is the first product of hybridization program conducted by the International Center for Tropical Agriculture (CIAT) in Columbia (CIAT, 2001). Although Mulato I requires soil condition of medium to high fertility, but it has a high tolerance to drought, fast recovery after grazing, high plant vigor and very good forage quality (Argel *et al*., 2007). Mulato II is the second hybrid, released in 2005 and resulted from three cycles of hybridization and screening by the Center involving *Brachiaria ruziziensis*, *B. decumbens*, and *B. bizantha*. In addition to having the outstanding characteristics of the first cultivar, Mulato II has an ability to adapt well to a broad range of local condition including those with acid soils of low fertility, moderate moisture saturation, and is resistant to spittlebug (Argel *et al*., 2007).

Although the Mulato grass has been introduced into some Indonesian areas, there have been no published works reporting the production parameters of the grass under Indonesian climatic conditions. Therefore, this study reported the effects of nitrogen fertilizer on the growth, production and nutrient contents of the Mulato grass.

## MATERIALS AND METHODS

### Experimental Site, Design and Treatment

This study was carried out in the village of Taipa, the Municipality of Palu, Central Sulawesi. The experiment was done on a land with a total area of 15 x 25 m which was divided into 18 small plots having an individual plot size of 3 x 3 m. Ditches (50 cm in wide) were made between experimental plots for drainage to avoid water logging. The experiment employed a 3 x 6 completely randomized design, and each of the tested urea fertilization levels (0, 150, or 300 kg/ha) was replicated six times. These levels of urea application corresponded to 0, 72, and 144 kg N/ha, respectively.

### Experimental Procedures

Prior to the experiment, the planting area was prepared, clear from unwanted materials and fenced. The area was thoroughly ploughed using hoes. The experiment was commenced by planting *Brachiaria mulato* grass using pols on the experimental plots with a planting size of 75 x 60 cm. The planting was commenced in the morning and completed in one day. Watering was done every two days by draining water to the plantation area. After three weeks of plantation, all the plants were cut at about five cm from the ground to eliminate growth variation of the plant. Urea then was applied on each plot according to the treatment. The urea fertilizer was placed in small holes at distance of about five cm from the plant. Measurements of plant height, number of tillage, leaf width and production were facilitated using 1 x 1 m sized quadrant at week seven after cutting. The plant was cut at about 5 cm from the ground and brought to laboratory for analysis.

### Chemical Analysis

Samples of Mulato grass were ground using a refrigerated blender before passing them through a 1mm screen. The samples were analyzed for dry matter and ash (AOAC, 1984) and ash-free neutral detergent fiber (NDF) (Goering and Van Soest, 1970). Feed samples were analyzed for nitrogen with the Kjeldahl method (AOAC, 1984), and ether extracts with the soxhlet method (Woodman, 1941).

### Statistical Analysis

Data obtained were analyzed using one way analysis of variance on the Minitab statistical program. Differences in parameter measured among the treatments were analyzed with Least Significant Differences (Steel and Torrie, 1989).

## RESULTS AND DISCUSSION

Agronomic parameters and nutritional contents of *Brachiaria mulato* as affected by the three levels of urea fertilizer application are presented in Table 1. Level of urea fertilization increased ($P<0.05$) the Mulato tillage number and dry matter production, crude protein and neutral detergent fiber contents. Applying a urea level of 300 kg/ha consistently exhibited the highest values for all of the affected parameters. Urea Results of this study confirm those of the previous one (CIAT, 2007) that *Brachiaria mulato* is highly responsive to nitrogen fertilizer. In the current study, providing 300 kg urea/ha corresponding to a nitrogen quantity of about 144 kg/ha to the soil increased the grass dry matter production by about 150 times, its crude protein contents by about 47 times and thus its crude protein production by approximately 115 times compared to unfertilized soil. The Mulato dry matter productions obtained in the present study were significantly higher than those obtained by studies reported in CIAT (2007) with a nitrogen application rate of 30 kg/ha producing 2.4 kg dry matter/ha.

Mulato grass appears to efficiently absorb the increased nitrogen provided in the soil and use it to form new plants as indicated by increased tillage number associated with urea fertilizer and at the same time increased synthesis rate of nitrogenous substances of the plant tissues, either as protein or non protein nitrogen. This occurs in the expense of fiber synthesis as shown by reduced neutral detergent fiber contents. Growing the Mulato grass will therefore require a regular application of nitrogen fertilizer at rates depending on the existing soil fertility to maintain optimum forage productivity.

Mulato grass is a high quality forage source which is indicated by its high crude protein contents. The crude protein contents of Mulato grass in this study were found to be higher than those of native or elephant grass (*Pennisetum purpureum*) with crude protein contents between 5-9% on dry matter basis (ACIAR, 2008). The grass as animals nutrient source is therefore expected to result in better animal performances than native or other previously introduced grasses such as *Pennisetum purpureum*, *Pennisetum purpureophoides*, *Panicum maximum*, etc. Marsetyo *et al*. (2009) reported that the daily weight gain of young Bali cattle given native grass as the sole feed was 193 g/day which was improved to 366 g/day when the native grass was replaced by the Mulato grass. The low animal performances associated with native or introduced grasses are also found in other reports (e.g. Marsetyo *et al*., 2006; Damry *et al*., 2008; ACIAR, 2008).

The increased animal performances resulted by the Mulato grass over native grass reported by Marsetyo *et al*. (2009) was in line with increased digestible dry matter due to better forage digestibility for Mulato grass than for native grass, without affecting intakes of the forages by the animals. This improved digestibility may due to increased nitrogen contents of Mulato grass had meet the nitrogen requirements of rumen microbes for breaking down the plant biomass. Further studies are needed to study the mechanism of the Mulato grass that exhibits better animal performances compared to other feeds.

## CONCLUSIONS

Fertilization of Mulato grass with urea increased the plant tillage number, dry matter production, protein content and reduced the neutral detergent fiber content.

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Table 1. Effect of urea fertilization on growth, production and nutritive value of *Brachiaria mulato*

| Parameters | Levels of urea fertilization (kg/ha) | | |
|---|---|---|---|
| | 0 | 150 | 300 |
| ***Agronomic parameters*** | | | |
| Plant height (cm) | 61.6± 2.3[a] | 64.08±4.2[a] | 62.34±4.7[a] |
| Tillage number ($m^2$) | 22.2±2.9 [a] | 36.52±3.9[b] | 39.47±3.7[c] |
| Leaf width (cm) | 2.42±0.13[a] | 2.59±0.15[a] | 2.56±0.16[a] |
| Dry matter production (ton/ha) | 4.3±0.13[a] | 7.92±0.15[b] | 10.76±0.10[c] |
| ***Nutritive value*** | | | |
| Dry matter, DM (g/100 air dry) | 29.02± 2.2[a] | 28.58±2.1[a] | 26.96±2.3[a] |
| Organic matter (g/100g DM) | 87.12± 3.6[a] | 88.75±3.5[a] | 89.42±3.3[a] |
| Crude protein (g/100g DM) | 9.37±0.12[a] | 11.63±0.08[b] | 13.78±0.09[c] |
| Neutral detergent fiber (g/100g DM) | 65.31±3.2[a] | 63.28±2.7[b] | 60.74±2.8[c] |
| Fat (g/100g DM) | 1.64±0.03[a] | 1.73±0.02[a] | 1.80±0.02[a] |

Note: means with different superscripts in same column are significantly different (P<0.05).

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