

**Effect on the growth parameters of Napier hybrid (CO3) with application of different kind of
organic fertilizers**

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Abstract

A field experiment was carried out to investigate the effects of application of cow dung, goat and poultry manure on the growth parameters of Napier hybrid in Chenkalady, Batticaloa. Treatments were laid out in a Randomized Complete Block Design (RCBD) with three replications. The variables measured were plant height, leaf length, leaf width and tillers number obtained. Data collected were subjected to Analysis of Variance (ANOVA). The means were separated using LSD at 5% level of significance. Results obtained indicated that growth performance of CO3 was lowest in control treatments while positive influence showed in the application of organic manure applied in this study especially poultry manure. The results also revealed that plots treated with poultry manure gave the highest number of tillers with longest and width leaves per grass. Comparatively, second highest growth performance was obtained with the application of goat manure and cow dung. While the least performance of CO3 were recorded in the control treatments. Based on the findings of the experiments it could be deduced that organic manure seems to promote higher growth and yield of CO3. Application of organic manure on Napier hybrid give maximum growth performances, and yield with sustainable and free polluted farming.

Keywords: CO3, cow dung, goat manure, growth parameter, poultry manure

INTRODUCTION

Sri Lanka resembles the South and Southeast Asian countries, low productivity of dairy animals could be accredited to the less availability of forage together with poor quality. To maximize the milk production, it is essential to feed animals with quality green fodder [1]. Therefore, high yielding forages including number of varieties of Napier hybrids have been introduced recently. Hybrid Napier variety CO3 was developed by the scientists at Tamil Nadu Agricultural University (TNAU) at Coimbatore and released for commercial cultivation in 1997 [2].

CO3 is one of the highest yielding perennial tropical fodder grasses and considered as cut-and-carry forage for stall feeder systems. It is superior to other Napier varieties. The characteristic features of CO3 fodder grass are profuse tillering, high yield potential, high dry matter and crude protein content, quick regeneration capacity, high leaf to stem ratio, high palatability, free from pest and diseases and low in adverse factors. There are a number of factors which can influence the successful establishment of pastures and fodders such as the cultivar selection, type of planting material, sowing or planting rate, time of planting both from year to year and within one season, method of sowing or planting, weed management, use of appropriate fertilizers and time of first grazing or cutting. Rainfall cannot be controlled, but correct planning goes a long way towards making the best use of rainfall events to successfully establish a pasture and fodders [3].

Regular pattern of fertilizer application should always be followed by the farmers for this high yielding grass. Thairu and Tessema in 1985 reported that managing high yielding forages without fertilizer is extremely impossible even in normal soil and rainfall conditions [4]. Since this grass is a heavy yielder, it requires high doses of nutrients. On the other hand, nutrient management has pronounced effect on yield and quality of the fodder grass. Further, balanced nutrient supply also ensures utilization of all nutrients. As this grass is a heavy user of soil inputs, some farmers are unwilling to handle of this type of high yielding fodder grasses. Although this grass responds very quickly to inorganic fertilizer, livestock manure that could be supplied with in the farmer premises is an important resource for grass cultivation. However, there is renewed interest in proper and effective use of organic manure to maintain soil fertility [5]. Aside from being source of plant nutrients, organic manure, e.g. poultry manure and ruminant dung has improved agricultural productivity in West African countries. Organic manure helps to increase the population of soil microorganisms which have some influence in protecting plant against pathogens like nematodes and soil born insects and also provides plant growth hormones like auxins[6] [7]. The objective of this study was to evaluate the effects of three different organic manures application on the growth performance of Napier hybrid grown in Chenkalady, Batticaloa.

METHODOLOGY

Selection of land

Field experiment was carried out on the land of pasture establishment over decades in Chenkalady area of Batticaloa region, are belongs to Low Country Dry Zone (DL) of Sri Lanka. The mean annual rain fall is 2056 mm and the mean annual temperature is 28.5°C. Soil type was sandy loamy with moderate fertile and well-drained soil.

Selection of planting material

CO3 is an advanced hybrid variety of Napier grass. CO3 cuttings were procured from department of agriculture with good quality and vigorous criteria. The uniform cutting selected for planting with 15 cm of length, 2 cm of diameter and consist 3 nodes.

Field experiment

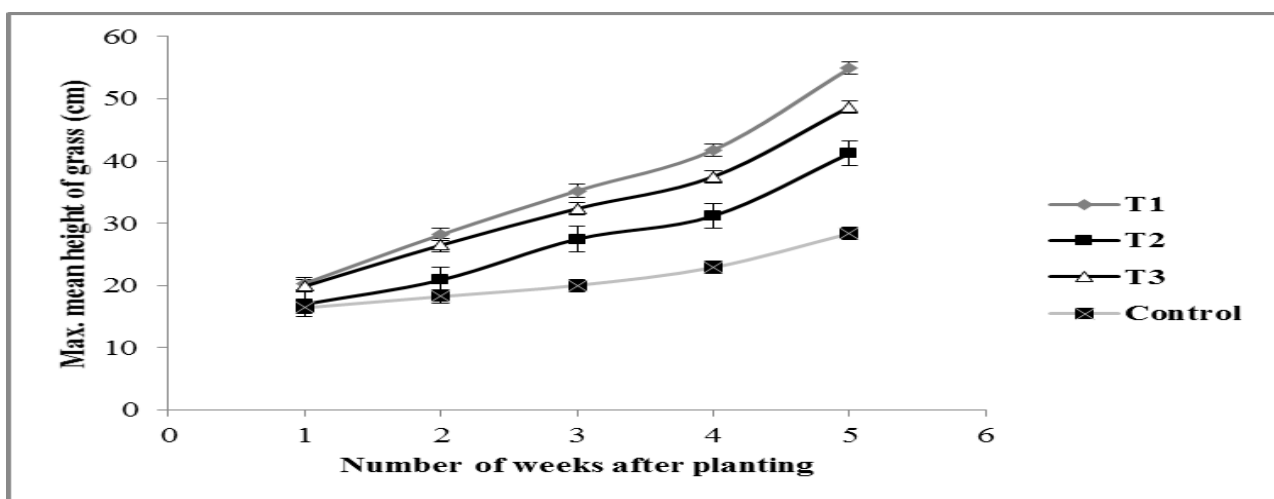
The experimental site was cleared, ploughed, harrowed and divided into different plots. Each plot size was 6×3 m (18 m^2). There were three organic fertilizers treatments and a control treatment (no any organic fertilizer applied), namely poultry manure (T_1), cattle manure (T_2) and goat manure (T_3), applied at the rates of 6 ton/ha. The organic amendments were incorporated with topsoil using hand trowel one week before planting the cuttings. The experimental design used was a randomized complete block design (RCBD) with three replications. Cuttings were planted at a spacing of 60×60 cm. After planting, cultural practices such as irrigation, weeding were carried out according to the recommended interval until harvesting.

Data collection and Statistical analysis

Data on the grass height (cm), leaf length (cm), leaf width (mm) and number of tillers were obtained using 1 m^2 quadrats at one week interval up to day nearest to first harvest (35 days after planting). Data collected were subjected to analysis of variance. The means were separated using the least significant difference test at five percent probability level.

RESULTS AND DISCUSSION

The results of this study revealed that overall performance of grasses were superior with the application of organic manure rather than undertaking no any organic fertilizer endorsements. There were significant grass height, were observed with grass age (Figure1). At two weeks after planting, there were no significant differences in height of CO3 treated with three different organic manures. However, from third week onwards, the response were significant differences in grass heights treated with organic manure than control treatment at 5% significance level. Similar trend were showed in the succeeding weeks. The grasses treated with poultry manure gave the peak height of 54.9 cm (T1) while the control treatment remained at 28.4 cm at harvesting stage.



The values are means of replicates $\pm$ standard error mean

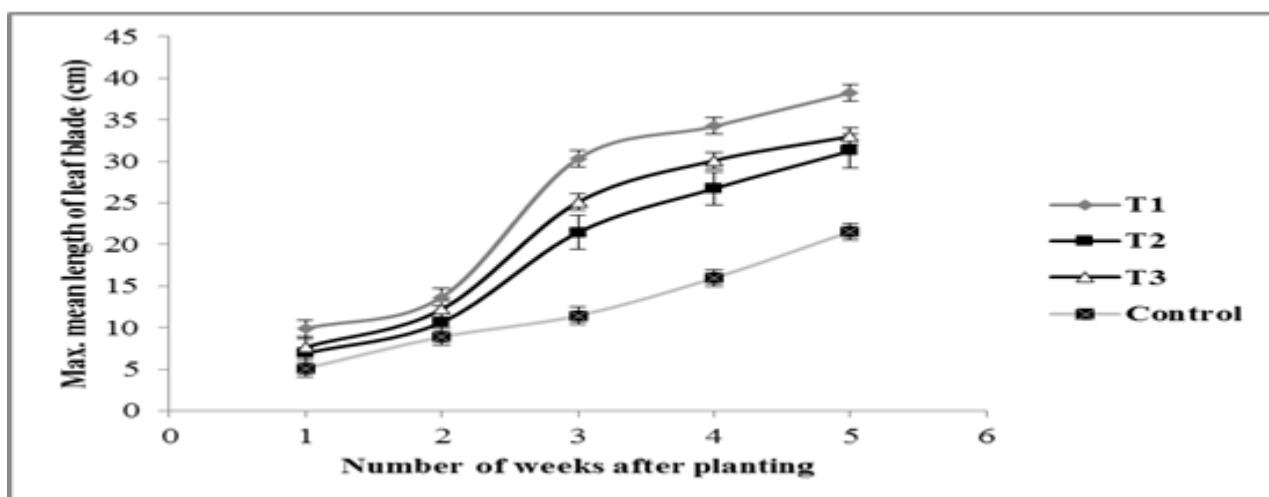
Vertical bars indicate standard errors

Figure 1: Effect on mean grass height (cm) with different kind of organic amendments

The results further exposed that significantly difference exhibited among treatments with the highest recorded in plots fertilized with poultry manure. The composition of each organic manure appear to hold varying amount of plant nutrients as the Napier grass responded differently to treatments. Three weeks after planting, superior growth response were displayed by poultry manure than other treatments indicating that the composition of nitrogen and other essential nutrients could be higher than the counterparts, thus vegetative growth increased in favor of CO3 grass. The result

of the study revealed that plant heights at harvest differ significantly among treatments with the highest recorded in plots fertilized with poultry manure. Similar report had been obtained in vegetable Amaranth [8].

Plants known with increased leaf parameters will result in producing increased leaf area and possess higher photosynthetic capacities. Napier grass follow C4 type photosynthetic pathway, characterizing with increase in water use and nutrient use efficiency than the primitive C3 types. Organic manure naturally contains lower nutrient composition than the expensive inorganic fertilizers. Supplying with the additional plant nutrients by organic amendments seems to be sufficient to promote growth parameters and increased biomass production in Napier grass is possible.



The values are means of replicates $\pm$ standard error mean

Vertical bars indicate standard errors

Figure 2: Effect on maximum mean leaf length (cm) with different kind of organic amendments

Figure 2 shows the mean length of leaves of CO3 in response to application of three different organic manures. There were sharp rise in leaf length were seen treated with organic manures. From third week onwards, the plots treated with poultry manure had dramatic significant differences compare to the control treatment at 5% significant confidence level. They produced the

highest length of leaves (38.3 cm) at fifth week while the control treatment remained at 21.6 cm. Similarly plots treated with goat manure and cow dung produced second and third highest leaf length, 33 cm and 31.3 cm respectively.

The experimental result showed that leaf width were increased with the grass age. (Table 1). At two weeks after planting, there were no significant differences in leaf width treated with three different organic manures. However, from third week onwards, there were significant differences observed in leaf width among the treatments. Poultry manure used showed its superiority over others in leaf width with 305 mm. The result also revealed that CO3 treated with cow dung and goat manure had displayed at fifth weeks after planting (near to harvesting stage) of 257 mm and 283 mm respectively. The least width of leaves (219 mm) was recorded in the control treatment.

Table 1: Maximum mean width of leaf blade (mm) affected by different kind of organic amendments

Treatments	Weeks after planting				
	1	2	3	4	5
T1 (Poultry manure)	78±1.2	130±2.9	254±4.6	287±8.1	305±8.1
T2 (Cattle manure)	73±2.9	98±4.6	119±11.0	145±1.7	257±5.2
T3 (Goat manure)	75±5.2	119±0.6	231±14.4	262±3.5	283±3.5
T4 (Control)	49±3.5	83±1.2	122±13.3	158±7.5	219±9.8

Mean leaf width + standard error of mean

As a result, the rate of growth parameters were superior and subsequently produced long and wider leaves. Considering the response of other treatments, goat manure and cow dung showed significantly higher growth response than the control treatment. This further indicates the organic manures appear to have the capacity to release nutrients steadily throughout the growth season as required by the plants.

Further, the nitrate ions are known to promote plant metabolisms enable to hasten vegetative growth. This was evident as the present study found the CO3 grass produced larger plants possessing longer leaf length and increased width with the support of organic fertilizers. Similar finding were previously reported as poultry manures are known to supply adequate nutrient to the soil, contributed rapid vegetative growth in other crops [9] [10] [11].

Table 2 shows the significant effects of organic manures on tillers production in CO3 grass. Poultry and goat manures gave the highest number of tillers per bush. Interestingly, there were more or less same trend was also observed between the cow dung and control. Furthermore, poultry manure gave the highest number of tillers 27 per bush at nearest to first harvesting stage and produce about two fold numbers of tillers per bush compared to control treated plot. Compare to poultry manure treated plot, 24 tillers per bush was obtained with the application of goat manure. Cow dung produced 19 tillers per CO3 while the least number of tillers (15) were recorded in the control treatment.

Table 2: Number of tillers produced by different kind of organic amendments

Treatments	Weeks after planting				
	1	2	3	4	5
T1 (Poultry manure)	7	13	20	24	27
T2 (Cattle manure)	5	8	11	16	19
T3 (Goat manure)	6	10	15	20	24
T4 (Control)	3	5	10	13	15

This phenomenon further give rise to excess production of glucose and subsequent conversion of sucrose during the photosynthetic process while trans locating into the remainder plant tissues promote carbohydrate metabolism within the CO3 grasses. Excess amount of carbohydrates and other synthesized products known to increase the rate of production of new plant tissues and organs.

As a result, the tiller count were superior in CO3 plants treated with organic amendments than the control counterparts. Similar trends have been reported for tomato crops as the application of poultry manure has increased the branching number per plant [12].

Application of organic manures provides soil nutrients required by plants, improve soil physical condition, enhances soil cation exchange capacity and acts as a buffering agent against undesirable soil pH fluctuations [13] [14] [15] [16]. Once the manure is incorporated into soil, it undergoes series of physical and chemical changes and eventually releases the withhold nutrients into the soil system. This process is predominantly controlled by soil microorganisms and rate of decomposition and mineralization depend upon on the nature of prevailing environmental conditions particularly on water availability, temperature and soil aeration. It seems the time taken for this process and subsequent release of nutrients required were around four weeks (organic manures were applied one week prior to planting) in the study location as the growth parameters indicated by the Napier hybrid showed no differences among treatments up to three weeks of field planting.

CONCLUSION

Application of organic manures had a significant effect on grass heights, size of leaves and tillers per CO3. This study revealed that best performance of CO3 gained with the application of organic manure instead of undertaking free application of fertilizers. The results conveyed that Napier hybrids responded well to the application of poultry droppings compared to other organic fertilizers and control treatment in the study. Based on the findings of this study, organic fertilizers are valuable to acquire maximum growth and yield of CO3 in the study location. Goat manure which is advisable in the area may be applied in the absence of poultry manure for greater growth parameters. The recommendation is important because the inorganic fertilizers are becoming very expensive to be purchased by small-scale and commercial for dairy farmers for the fodder establishment. In addition, these organic fertilizers appear to have beneficial secondary effects on soil properties and ensuring environmental sustainability. This study can be undertaken further to emerging an elite variety of Napier, quality enhancement of CO3 and silage made with such grass.

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