

## Residual effect of organic nutrients on growth and yield of hybrid napier (*Pennisetum perpureum* X *Pennisetum americanum*) VAR. CO-4

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### Abstract

At present-day, wide requirement for environment friendly agriculture for the production of quality fodder to meet the nutrition demand of livestock. Efforts are ongoing for the sustainable way of fodder production with organic fertilizers from natural resources to enhance the production of important fodders. In this regard an experiment was conducted to define the effect of different organic manure on the growth yield and nutritive value of Hybrid napier (*Pennisetum perpureum* X *Pennisetum americanum*) var. CO-4 . This experiment was designed in a Randomized Complete Block Design with three replicates. Treatments were control (Farm Yard Manure(FYM)(25Kg/ha) (T 1), Goat manure (30 t ha<sup>-1</sup>)and Farm Yard Manure(25Kg/ha) (T 2), Poultry manure (30t ha<sup>-1</sup>) and Farm Yard Manure (25Kg/ha )(T 3), Cattle manure (30 t ha<sup>-1</sup>) and Farm Yard Manure(25Kg/ha )(T 4). These were applied as basal and topdressing application of manure in this experiment and their performance was recorded once in three weeks. Analysis of Variance was performed to define significant difference among treatments ( $p < 0.05$ ). Results revealed that plants grown in Poultry manure (30 t ha<sup>-1</sup>) incorporated with Farm Yard Manure(25Kg/ha) (T3 ) showed significantly ( $p < 0.05$ ) better performance in the measured growth parameters viz. plant height(145cm), leaf area(9000cm<sup>2</sup>), number of tillers (38), while the lowest performance was observed in control (T1) at 11 WAP( weeks after planting). Further the results of this study revealed that relatively higher total dry matter(189.61g/plant) and nutrition composition viz crude protein(18.49%), Ash content(16.78%),crude fiber(39.4%),Ether extract (7.75%) was obtained from the plants treated with poultry manure and FYM (T3) followed by T4,T2 whereas the lowest drymatter yield(52.7g/plant) and nutrition composition was observed in control(T1). Therefore, it could be concluded that the poultry manure combined with FYM can be used to enhance the growth and nutritive value of Hybrid napier (*Pennisetum perpureum* X *Pennisetum americanum*) VAR. CO-4

**Keywords:** Hybrid Napier; Leaf area; Number of tillers; Maximum leaf length; Crude protein; Dry matter yield.

### 1. Introduction

Hybrid Napier var .CO-4 is one of the highest yielding perennial tropical fodder grasses and considered as cut-and-carry forage in dry zone of Sri Lanka. It is a superior fodder grass since it has profuse tillering, high yield potential, high dry matter and crude protein content, quick regeneration capacity, high leaf to stem ratio and high palatability. However the increased production of this fodder is confronted with low yield, soil infertility and deficiency in important mineral nutrients. The reason has been the high cost of fertilizers and non-availability that limit the use by the poor resource farmers. Secondly most of the fertilizers are high soluble types that lead to faster leaching of nutrients. Surplus application of chemical fertilizers in modern farming system leads to yield reduction, environmental pollution and leaching to groundwater. Therefore it is necessary to review various methods aiming on the use of available renewable resources of plant nutrients for accompanying and improving the commercial fertilizer. In this scenario, Organic manures are considered as a prospective element which is available in sufficiently and easily reachable in Sri Lanka.

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Organic manure provides macro and micro nutrients to the soil. It improve the soil to maintain good tilt and better aeration for better plant root development. Organic manure application to sandy soil is not only beneficial for crop growth, but it also improve soil properties of coarse soil (Uzoma *et al.*, 2011) and reduce groundwater contamination caused by leaching of soil nitrogen. Organic manure is abundantly available in Sri Lanka. Therefore, this study was conducted to evaluate the effects of application of organic manure on growth and yield of Hybrid napier (*Pennisetum perpureum X Pennisetum americanum*) var. CO-4

## 2. Materials and methods

### 2.1. Location

The experiment was carried out at the Eastern Region of Sri Lanka. The site was located at an elevation of 100 m above mean sea level. It belongs to the agro-ecological region of low country dry zone in Sri Lanka. The Type of soil is sandy regosol which contains 22 N kg/ha, 235 kg/ha P2O5 and 224 kg/ha K2O .

### 2.2. Experimental Design

#### 2.2.1. The experiment consisted of four treatments

Treatments were control (Farm Yard Manure, 25Kg/ha) (T 1), Goat manure (30 t ha<sup>-1</sup>) and Farm Yard Manure (25Kg/ha) (T 2), Poultry manure (30t ha<sup>-1</sup>) and Farm Yard Manure (25Kg/ha) (T 3), Cattle manure (30 t ha<sup>-1</sup>) and Farm Yard Manure (25Kg/ha)(T 4).

#### 2.2.2. Agronomy practices

Land was ploughed and leveled. Subsequently experimental plots were prepared and each plot size was 1m×1m (1m<sup>2</sup>). Rooted tillers of Hybrid napier (*Pennisetum perpureum X Pennisetum americanum*) var. CO-4 were collected and tillers were cut into equal size of 5cm each. Tillers were planted at a spacing of 60cm ×90cm to maintain 25 plants/plot (250,000plants/ha). Basal application of organic manures according to the treatments were done one week before planting. As well as Top dressing was done 30 days after planting.

#### 2.2.3. Measurements

Field data was collected in the experiment at two weeks interval from five weeks after transplanting to eleven weeks after transplanting including growth parameters, yield and nutritional compositions

### 2.3. Statistical Analysis

Data were statistically analyzed by analysis of variance using the Statistic Analysis System (SAS) 9.1 and Treatment means were compared according to Tukey's honestly significant difference test at  $\alpha = 0.05$  probability level.

## 3. Results and Discussion

**Table 1** Effect of different organic manure application on plant height Leaf Area (cm<sup>2</sup>) Number of tillers and Dry Weight (Kg) at 11 weeks after transplanting of Hybrid napier (*Pennisetum perpureum X Pennisetum americanum*) var. CO-4

Treatments	Plant Height (cm)	Leaf Area (cm <sup>2</sup> )	Number of tillers	Dry Weight /Plant(g)
T1(Control)(FarmYard Manure)	64 <sup>d</sup>	6400 <sup>d</sup>	11 <sup>d</sup>	120.5 <sup>d</sup>
T 2 (Goat manureand Farm Yard Manure)	130 <sup>b</sup>	7300 <sup>c</sup>	24 <sup>c</sup>	170.5 <sup>b</sup>
T 3 (Poultry manure and Farm Yard Manure)	147 <sup>a</sup>	9000 <sup>a</sup>	38 <sup>a</sup>	189.6 <sup>a</sup>
T 4 (Cattle manure and Farm Yard Manure)	122 <sup>c</sup>	8500 <sup>b</sup>	27 <sup>b</sup>	166.5 <sup>c</sup>

Means followed by the same letter are not significantly different from each other according to Tukey's honestly significant difference test at 5% significant level.

All the way through the experiment, the maximum average plant height was recorded in T 3(147cm), while the minimum number of plant height was recorded in T1 (64cm) (Table.1). It clearly indicate that application of Poultry manure (T3) significantly increase the plant height by 47.54% of Hybrid napier (*Pennisetum purpureum X Pennisetum americanum*) var. CO-4in comparison to control plants ( $p<0.05$ ) followed by T2,T4. An increase in plant height could be influenced by the presence of macro-and micronutrients, as well as large proportion of Nitrogen from poutry manure which increases number of nodes, internode length and accordingly plant height(Feisal *et al.*, 2012). Poultry manure is one of the fertilizers used for soil fertility enrichment to get high yields of agricultural crops and the samples of poultry manure include 0.8 per cent potassium, 0.4 per cent to 0.5 per cent phosphorus and 0.9 per cent to 1.5 per cent nitrogen (Deksissa *et al.*, 2008)

The present investigation showed that application of poultry manure incorporated with FYM on Hybrid napier var. CO-4 increased the average leaf area per plant by 28.88% incomparison to control plants ( $P< 0.05$ ) followed by T4,T2.The highest leaf area was recorded in plots treated with poultry manure and FYM could be due to the concentration of exchangeable K and Mg also resourceful nitrogen availability which enhance the uptake of more nitrogen and in turn large leaves were observed(Akinrinde and Obigbesan, 2000).These results are also confirmed by Shah *et al.*(2016) who found greater leaf area with the application of poultry manure.

Throughout the experiment the maximum mean number of tillers per plant recorded in T3 ( poultry manure 25 tonnes  $ha^{-1}$  ) and FYM while the minimum number of tillers were recorded in T1 (control)(Table: 1).The analysis of data on mean number of tillers per plant showed that application of poultry manure on Hybrid napier significantly ( $P< 0.05$ ) increased the mean number of tillers/plant by 71.05% in treated plants comparison to control plants. better than other organic manures and gives considerable increase in organic C,N ,available P and exchangeable cations. It was found that poultry manure increased the nutrient status of the soil and boost crop productivity (Ndubuaku *et al.*,2014)

The maximum average total dry weight was recorded in T3 followed by T2,T4 while the minimum average of total dry weight was observed in T1(Fig 4). The observed increase in total dry matter in response to the poultry manure application could be attributed to the increase leaf area /plant which increased photosynthetic area and improved solar radiation capture that enhanced accretion of photosynthates. Akande and Adediran (2004) found that poultry manure improve tomato dry matter yield since it has high proportion of N, P, K, Ca and Mg

**Table 2** Effect of different organic manure application on % of Crude protein,Crude fiber,Ether extract and % of Ash content of Hybrid napier (*Pennisetum purpureum X Pennisetum americanum*) var. CO-4.

Treatments	Crude Protein %	Crude Fiber%	Ether extract %	Ash%
T1	8.26 <sup>d</sup>	31.17 <sup>ab</sup>	1.4 <sup>d</sup>	6.8 <sup>c</sup>
T2	11.52 <sup>c</sup>	35.92 <sup>a</sup>	3.4 <sup>c</sup>	9.96 <sup>b</sup>
T3	18.49 <sup>a</sup>	39.4 <sup>a</sup>	7.75 <sup>a</sup>	16.78 <sup>a</sup>
T4	12.84 <sup>b</sup>	36.97 <sup>a</sup>	4.95 <sup>b</sup>	11.25 <sup>b</sup>

According to the results (Table-2),there was significant ( $P<0.05$ ) differences among the treatments on the crude protein of Hybrid napier var. CO-4. Hybrid napier var. CO-4fertilized with poultry manure and FYM had higher crude protein(18.49%) and was followed by T4 .Incorporating poultry manure into the soil results in increasing micronutrients content (exchangeable Fe, Cu, Zn, Mn).

The present study clearly showed that there was no significant ( $p<0.05$ ) differences among the treatments on % of crude fiber. However maximum crude fiber % (39.4) was recorded in poultry manure and FYM application ( T3) while the minimum crude fiber % was recorded in control (T1).It clearly indicate that application of different manures had no significant influence on crude fiber % of Hybrid napier (*Pennisetum purpureum X Pennisetum americanum*) var. CO-4.

Results obtained revealed that there was significant ( $P<0.05$ ) differences among the treatments on the % ash content of Hybrid napier var. CO-4(Table 1). Hybrid napier var. CO-4fertilized with poultry manureand FYM had higher ash content (16.78%)and was followed by cattle manure and FYM while the lowest value was observed on control.

Data recorded on % Ether Extract represented in Table 1 .The response of % ether extract to different treatments were significant ( $p<0.05$ ). The maximum % Ether Extract was recorded in T3(7.75%) while the minimum % Ether Extract wa

recorded in T1 ( control). The results of present study were in agreement with the results of Munir *et al.*, (2007) who found that poultry manure gave higher oil contents in sunflower.

#### 4. Conclusion

The results reveal that the highest plant height, leaf area, number of tillers and dry matter yield were achieved in T3 Poultry manure (30 t ha<sup>-1</sup>) and FYM (25Kg/ha). The plant treated with poultry manure and FYM significantly ( $P < 0.05$ ) increased the crude protein(18.49%), Ash content(16.78%), crude fiber(39.4%) ,Ether extract (7.75%) contents in Hybrid napier over the control. Based on these results, it could be concluded that highest yield with optimal nutritive compositions could be gained by the application of the Poultry manure (30 t ha<sup>-1</sup>) incorporated with FYM (25 t ha<sup>-1</sup>) as basal and as top dressing in Hybrid napier var. CO-4 fodder cultivation. This study also defined that the use of organic manure is an ecofriendly technique to lift fodder production in Sri Lanka.

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