

COMBINED APPLICATION OF NPK AND FARM YARD MANURE TO IMPROVE THE GROWTH, YIELD AND OTHER TRAITS IN *COLEUS FORSKOHLII*

Nageswara Rao, S

Department of Botany, University College of Science, Saifabad, Osmania University,
Hyderabad-500 004, Andhra Pradesh, India

E-mail: nagusingisala@gmail.com

ABSTRACT

The statistical analysis (univariate analysis of variance for different morphological parameters) provides information on the nature and extent of relationship for bringing out improvement in the growth, yield and other traits. The data on correlation studies with reference to growth, yield other attributes of *Coleus forskohlii*, an important medicinal plant are presented in this communication. It is evident from the data that there is a significant positive correlation between growth parameters viz., plant height, number of leaves per plant, leaf area, fresh and dry weights of shoot and roots, root length, root number and root yield besides forskolin content after combined application of NPK and FYM.

Key words : Statistical analysis, Farm Yard Manure, NPK, *Coleus forskohlii*.

INTRODUCTION

Application of farm yard manure (FYM) at the rate of 30 tons ha⁻¹ and 180 Kg N ha⁻¹ produced higher number of shoots (170.2), and highest leaf-stem ratio (2.03) in *Pelargonium graveolens* (Bhaskar *et al.*, 2001). The application of FYM at the rate of 20 tons ha⁻¹, resulted in an increase in plant height (90.18 cm), number of leaves per sucker, number of suckers per clump and number of clumps per plant in *Alpinia galangal* (Joy *et al.*, 2002). In *Cephaelis ipecacuanha* on application of 50 kg N ha⁻¹ highest shoot weight (10.75 g plant⁻¹), root: shoot ratio (1.59), root weight (8.13 g plant⁻¹) and highest root alkaloid content (3.94%) were obtained (Mallick *et al.*, 1989). Application of NPK at 75, 25 and 30 kg ha⁻¹ respectively resulted in highest number of spikes (32.5) and Plant height in *Plantago* (Ramesh *et al.*, 1989).

Pareek *et al.*, (1989) reported that the application of FYM at 10 tons ha⁻¹ increased the total leaf and pod yield by 38.7 and 45.5 % respectively over control. In *coleus parviflorus*, N application at 60 kg ha⁻¹ had significant influence on most of the morphological characters like increased Plant height (17.4 cm), number of branches (15.6), number of leaves (115.3) and leaf area index (3.6) (Geetha and Madhavan Nair, 1993).

Application of FYM at the rate of 30 tons ha⁻¹ along with 180 Kg N ha⁻¹ to *Pelargonium graveolens* produced the highest fresh herbage yields (96.4 tons ha⁻¹) and oil content (224.2 litters ha⁻¹) (Bhaskar *et al.*, 2001). In *Plumbago zeylancia* the fresh and dry root yields were highest (20.33 and 11.07 quintals ha⁻¹) with the application of FYM at 10 t ha⁻¹ + NPK (60:40:30 kg ha⁻¹) (Harinkhede *et al.*, 2001). In sweet basil (*Ocimum basilicum*) Application of N at 150 kg

ha⁻¹ or Vermicopmpost at 2.5 tonnes ha⁻¹ + NPK (75:25:25 kg ha⁻¹ respectively) recorded similar plant height, herbage and oil yields, which were significantly higher than application of 5.0 t ha⁻¹ Vermicopmpost (Singh and Ramesh, 2002).

In *Alpinia galangal*; application of 20 tons ha⁻¹ of FYM alone resulted in the highest fresh rhizome (45.14 t ha⁻¹) and 98.40 liters ha⁻¹ oil yields (Joy *et al.*, 2002). In Safed musli (*Chlorophytum borivillianum*), the yield of fresh tubers increased by 22% with the application of 40 tons ha⁻¹ FYM, besides the increase in number, length and thickness of tubers (Kothari *et al.*, 2003). In *Withania somnifera*, application of a mixture of organic manures (cow dung, bone meal, neem and seed cake) + NPK at 28:28:28 g per 1.3 sq.m) resulted in an increase in vegetative growth, flowering and fruiting

(Maitra *et al* 1998 and Ajay Singh *et al*, 2013). Application of 125 Kg N, 25 Kg P₂O₅ recorded the highest dry root yield along with 2.5 tons of FYM in Aswagandha (Maheshwari *et al.*, 2000). Earlier studies were confined to the experiment of tuber yields in *Coleus forskohlii*, and there are no reports on the influence of nutrients (inorganic and bio fertilizers) of *Coleus forskohlii* plant growth. Keeping this in view, the present investigation was taken up undertaken to enhance the plant growth levels under different fertilizer amendments.

MATERIALS AND METHODS

Application of Fertilizers and Manures and sampling procedures:

All the the manures and nitrogenous fertilizers were applied as basal dose as per treatments.

Table-1: Correlations matrix of *Coleus forskohlii* at 30 DAP

Variable	Height (cm)	Leaves plant ⁻¹	Leaf area plant ⁻¹	Fresh weight of shoot (kg plant ⁻¹)	Dry weight of shoot	Fresh weight of root	Dry weight of root	Root characters
Height (cm)	1.000	0.860**	0.816**	0.838**	0.839**	0.863**	0.722*	0.845**
Leaves plant ⁻¹		1.000	0.965**	0.975**	0.993**	0.961**	0.942**	0.981**
Leaf area plant ⁻¹			1.000	0.981**	0.960**	0.880**	0.866**	0.979**
Fresh weight of shoot (kg plant ⁻¹)				1.000	0.982**	0.919**	0.870**	0.974**
Dry weight of shoot					1.000	0.956**	0.940**	0.979**
Fresh weight of root						1.000	0.902**	0.905**
Dry weight of root							1.000	0.919**
Root characters								1.000

**Correlation is significant at the 0.01 level (2 tailed).

Table-2: Correlations matrix of *Coleus forskohlii* at 90 DAP

Variable	Height (cm)	Leaves plant ⁻¹	Leaf area plant ⁻¹	Fresh weight of shoot (kg plant ⁻¹)	Dry weight of shoot	Fresh weight of root	Dry weight of root	Root characters
Height (cm)	1.000	0.910**	0.898**	0.952**	0.932**	0.946**	0.859*	0.932**
Leaves plant ⁻¹		1.000	0.978**	0.971**	0.979**	0.939**	0.982**	0.956**
Leaf area plant ⁻¹			1.000	0.954**	0.974**	0.943**	0.975**	0.961**
Fresh weight of shoot (kg plant ⁻¹)				1.000	0.995**	0.964**	0.922**	0.978**
Dry weight of shoot					1.000	0.959**	0.945**	0.983**
Fresh weight of root						1.000	0.908**	0.978**
Dry weight of root							1.000	0.928**
Root characters								1.000

*Correlation is significant at the 0.01 level (2 tailed).

Phosphatic and potash fertilizers, nitrogen, phosphorus and potassium were applied in the form of urea and, single superphosphate and muriate of potash respectively as top dressing at 10 cm away from the plants along the row, followed by irrigation. By opening a small furrow to a depth of 5 cm in bands and covered immediately. Irrigation was followed by top dressing. Nitrogen, phosphorus and potash were applied in the form of urea, single super phosphate and muriate of potash respectively. Ten plants were randomly selected from the net plot of each treatment and tagged for recording biometric observations such as plant height and number of leaves per plant. For the estimation of leaf area, fresh and dry weights of shoots and leaves, sampling was done at 30, 90,150 days

Morphological Data:

Plant height was measured from base of the plant to the tip of the longest leaf from 10 randomly tagged plants in each treatment at 30, 90,150 days after planting (DAP). Number of leaves per plant was recorded at 30, 90,150 DAP and at final harvest. Leaf area was determined at 30, 90,150 DAP and at final harvest. It was measured by using leaf area meter with the transparent belt conveyor utilizing an electronic digital display. Ten randomly selected plants from each plot were pulled out at 30, 90, 150 DAP and at final harvest. After separation of leaves, roots and shoots, they were dried in hot air oven at 60⁰C temperature till the constant dry weights were obtained. Fresh weight of roots was recorded at final harvest by pulling the

plants, separating the roots and their weights were recorded and values in tons ha⁻¹ were computed and presented. After recording the fresh weight, the roots were made into small pieces of 2-3 inches thick and shade-dried for 10-15 days until the moisture content was decreased to minimum extent. After complete and uniform drying, dry weights of roots were taken and values in tons ha⁻¹ were computed and presented. Root length (cm) from base to tip of the root was measured from ten roots at random in each treatment at final harvest and their average was worked out. The number of roots plant⁻¹ was taken from ten randomly selected plants and their mean was computed.

RESULTS & DISCUSSION

Fertilizers in the form of NPK and farm yard manure applied to the field grown plants of

Coleus forskohlii, The results shown that the plant height, number of leaves per plant, leaf area, fresh and dry weights of shoots and root characters (Tables 1, 2 and 3) were better (measured at different intervals like 30, 90 and 150 days after sowing) compared to the corresponding controls that were grown under similar conditions, but without any fertilizer amendments. The results were statistically analyzed using univariate analysis software to ascertain the significance.

The statistical analysis (univariate analysis of variance for different morphological parameters) provides information on the nature and extent of relationship for bringing out improvement in the yield and other traits. The data on correlation studies with reference to growth, yield attributes are presented in Tables 1, 2 and 3. It is evident from the data that all parameters such as plant

Table-3: Table 3 : Correlations matrix of *Coleus forskohlii* at 150 DAP

Variable	Height (cm)	Leaves plant ⁻¹	Leaf area plant ⁻¹	Fresh weight of shoot (kg plant ⁻¹)	Dry weight of shoot	Fresh weight of root	Dry weight of root
Height (cm)	1.000	0.825**	0.763**	0.894**	0.894**	0.860**	0.793*
Leaves plant ⁻¹		1.000	0.981**	0.939**	0.969**	0.988**	0.986**
Leaf area plant ⁻¹			1.000	0.895**	0.948**	0.951**	0.979**
Fresh weight of shoot (kg plant ⁻¹)				1.000	0.972**	0.959**	0.955**
Dry weight of shoot					1.000	0.984**	0.970**
Fresh weight of root						1.000	0.975**
Dry weight of root							1.000

**Correlation is significant at the 0.01 level (2 tailed).

height, number of leaves plant⁻¹, leaf area, fresh and dry weights of shoot and roots, root length, root number and root yield were significantly and positively correlated with each other.

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