

INTEGRATED NUTRIENT MANAGEMENT FOR GROWTH AND HIGH YIELD IN *COLEUS FORSKOHLII*.

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ABSTRACT: *Coleus forskohlii* L. is an important medicinal plant species found in tropical regions of India. Roots and tubers are used for treating a variety of purposes, including treating asthma, bronchitis, insomnia, epilepsy and angina. Due to diverse use, the species has been largely exploited from natural habitat leading to its threatened status. A field experiment was conducted to study the influence of organic and inorganic fertilizers on its growth and yield. Six treatments including T₁ Control -No Manures; T₂: 100% NPK recommended dose (N- 40 kg ha⁻¹), T₃: 50% NPK + 10 Tonnes of Farm Yard Manure / ha⁻¹, T₄: 50% NPK + 5 Tonnes of Vermicompost/ ha, T₅: 20 Tonnes of Farm Yard Manure / ha and T₆: Vermicompost 10 Tonnes/ha-1. Results indicated the improvement in the growth and yield. Combination of organic and inorganic fertilizers is very productive than the application of manures or fertilizers alone for achieving higher growth and yield in *C.forskohlii*.

Key words: *Coleus forskohlii*, inorganic fertilizers, organic manures, FYM, asthma, epilepsy, angina and insomnia.

INTRODUCTION

Increased demand for agriculture crop production, urbanization and industrialization resulted in habitat destruction and it has led to the endangered /threatened status to most of the medicinally important plants. Cultivation of such plants is the only remedy for it. The collection of Medicinal plants from wild sources cannot ensure consistent quality due to genetic variability of natural population, ecological and geographical variations and season of collection. Therefore, it is advised to create awareness among the farming community including application of organic farming practices and post harvest technologies. Integrated nutrient management (combined application of chemical fertilizers with organic sources) plays an important role in supplying all the supplements. This increases the degradation of soil health but assures the purity of product.

Coleus forskohlii (Willd.) Briq., belongs to the family. Lamiaceae. In other languages it is called as Pashan Bhedi or Makandi (Sanskrit), *Coleus forskohlii* (English), Makandi, Patharchur (Hindi),

In traditional Ayurveda systems of medicine, *Coleus* has been used for a variety of purposes, including treating asthma, bronchitis, insomnia, epilepsy and angina. *Coleus forskohlii* has also been proposed as a treatment for psoriasis, because that disease appears to be at least partly related to low levels of cAMP in skin cells. The roots are also used in treatment of worms. The root parts is claimed to allay burning in festering boils. When mixed with mustard oil, the root is applied to eczema and skin infections. The plant is also used for veterinary purposes.

Bhandari *et al* (1992) studied the integrated nutrient management in a rice-wheat system. Dudhat *et al* (1997) examined the effect of organic and inorganic sources on growth, yield, quality and nutrient uptake in wheat (*Triticum aestivum*). Joy *et al* (2005) studied the effect of sole and combined application of FYM and fertilizer on growth, yield and quality of black musli (*Curculigo orchoides*). Bhaskar *et al* (2005) has reported the influence of FYM, inorganic fertilizer (NPK) on the yield of *Coleus forskohlii*. Kothari *et al* (2005) studied the growth and yield of *Spilanthus acmella* (Syn. *Spilanthus mauritian*) cultivation influenced by Nitrogen and phosphorous application in semi arid areas. Rajendran and Gnanavel (2008) reported the effect of organic manures and spacing in *Aloe vera* L. Velmurugan *et al* (2008) studied the influence of organic manures and inorganic fertilizers on rhizome yield and quality of turmeric (*Curcuma longa* L.).

Keeping this in view, the present investigation was conducted to study the effect of application of fertilizers and manures on growth and yield of *C.forskohlii*.

MATERIALS AND METHODS

Location of the Experiment

The present study was carried out from July 2007 to December 2007 at Herbal Garden, Department of Botany, Osmania University, Hyderabad. Planting material of *Coleus forskohlii* K-8 variety procured from a nursery near Kurnool, Andhra Pradesh. The experimental area was repeatedly ploughed; finally, it was leveled and divided into plots.

Experimental Details

The variety selected for the present experiment was K-8 a selection from Karnataka, which is under cultivation in Andhra Pradesh because of its higher tuber yield and forskolin content (0.5%).

The experiment was laid out in a randomized block design with 6 treatments and replicated thrice.

A plot size of 3 X 2.5 m (7.5 Sq.m) was given for all the treatments equally.

The details of the treatments are furnished below.

- T₁ : Control – No Manures
- T₂ : 100% NPK recommended dose (N- 40 kg ha⁻¹)
- T₃ : 50% NPK + 10 Tonnes of Farm Yard Manure ha⁻¹
- T₄ : 50% NPK + 5 Tonnes of Vermicompost/ ha
- T₅ : 20 Tonnes of Farm Yard Manure / ha
- T₆ : Vermicompost 10 Tonnes / ha

Note: Recommended P and K were applied commonly to all the treatments.

Recommended dose of fertilizers: NPK at 40: 60:50 kg ha⁻¹

Observations

Plant height from base of the plant to the tip of the longest leaf was measured from 10 randomly tagged plants in each treatment at 30, 90,150 days after planting (DAP).

Number of leaves plant⁻¹ was recorded at 30, 90,150 DAP and at final harvest from 10 randomly tagged plants and their mean values were computed and presented. Leaf area was determined at monthly intervals 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.

RESULTS AND DISCUSSION

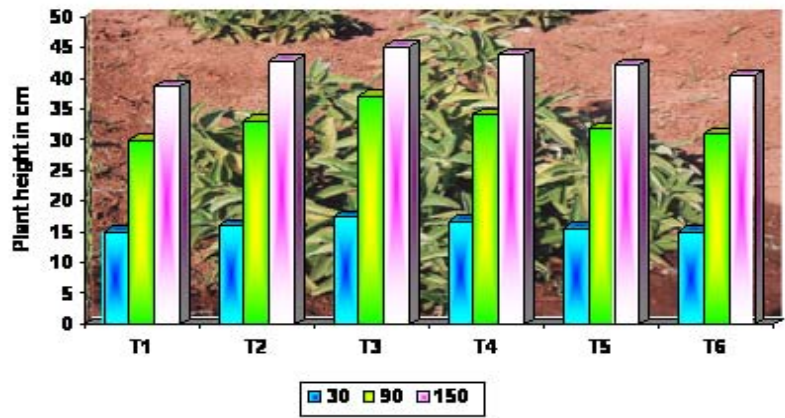
The morphological analysis of plant samples was done on 30 DAP (days after planting), 90 DAP and 150 DAP. The effect of different fertilizer amendments on the plant height has shown in Table 1. The plant height was taken on 30 DAP, 90 DAP and 150 DAP. The plant height significantly increased up to 17.39 cm, 37.06 cm and 45.12 cm in treatment no: 3 for 30, 90 and 150 DAP respectively where 50% NPK and 10 t of FYM ha⁻¹ was added.

Next best increase in height was observed up to 16.75 cm, 34.04 cm and 43.95 cm in treatment No: 4 for 30, 90 and 150 DAP respectively in which 20 t FYM only was given. These results indicate that there is a gradual increase in height in all the treatments from 30-day old plants to 150-day old plants. Least increase height was observed in treatment No.1 (Control) in which no manures was added.

Table 1 showing the effect of various fertilizer amendments on plant height (cm) at different stages of crop growth in *Coleus forskohlii*

Treatments	Days after planting		
	30	90	150
T ₁ : Control – No Manures	14.98	29.89	38.74
T ₂ : 100% NPK recommended dose (N- 40 kg ha ⁻¹)	16.02	33.06	42.87
T ₃ : 50% NPK + 10 Tonnes of Farm Yard Manure / ha	17.39	37.06	45.12
T ₄ : 50% NPK + 5 Tonnes of Vermicompost/ha	16.75	34.05	43.95
T ₅ : 20 Tonnes of Farm Yard Manure/ha	15.54	31.85	42.14
T ₆ : Vermicompost 10 Tonnes/ha	15.03	30.91	40.39

Note: Recommended dose of fertilizers N-40 kg/ha, P-60 kg/ha, K-50 kg/ ha⁻¹



Graph-1 Histogram showing the effect of FYM on height

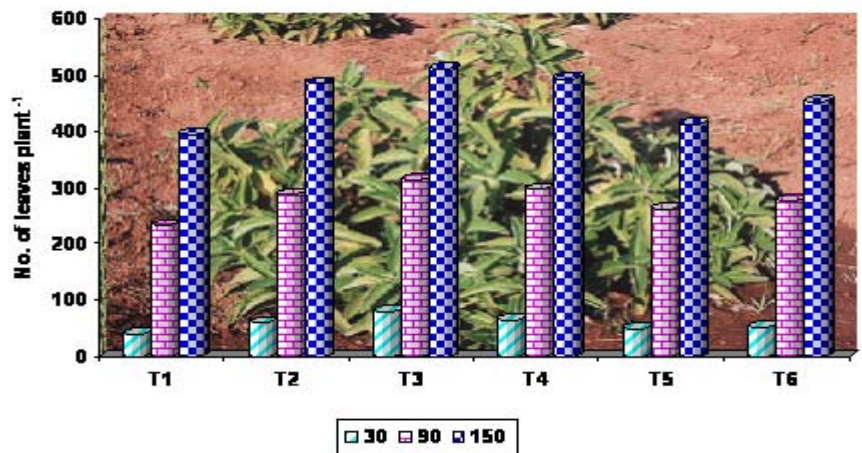
Number of leaves:

Effect of various fertilizer amendments on number of leaves (plant⁻¹) at three different stages of growth in *Coleus forskohlii* is shown in Table no.2 and Graph no.2. There is a gradual increase in the number of leaves in 30, 90 and 150 DAP. At 30 DAP maximum number of leaves (78 plant⁻¹) was recorded in treatment no: 3 where 50% NPK and 10 t of FYM was applied. Followed by next best increase in the number of leaves was recorded in treatment No: 4 with 64 number leaves plant⁻¹. Minimum number of leaves (39) was observed in the control. Similar results was observed at 90 DAP with maximum number of leaves 316 was recorded when compared of to minimum of 234 leaves was recorded in the Control. At 150 DAP highest number of leaves (512) was recorded in which 50% NPK + 10 t of FYM was added. This is followed by T₄ in which 494 leaves plant⁻¹ was recorded in the treatment 5 in which 20 t FYM was applied. When compared to only 396 leaves were recorded in the control.

Table 2 showing the effect of various fertilizer amendments on number of leaves plant⁻¹ at different stages of crop growth in *Coleus forskohlii*

Treatments	Days after planting		
	30	90	150
T ₁ : Control – No Manures	39	234	396
T ₂ :100% NPK recommended dose (N- 40 kg ha ⁻¹)	59	289	486
T ₃ :50% NPK + 10 Tonnes of Farm Yard Manure/ha	78	316	512
T ₄ : 50% NPK + 5 Tonnes of Vermicompost/ha	64	299	494
T ₅ : 20 Tonnes of Farm Yard Manure/ha	48	263	413
T ₆ : Vermicompost 10 Tonnes/ha	51	278	453

Note: Recommended dose of fertilizers N-40 kg/ha, P-60 kg/ha, K-50 kg/ ha⁻¹



Graph-2: Effect of various fertilizer amendments on number of leaves plant⁻¹ at different stages of crop growth in *Coleus forskohlii*

Leaf area (Sq.cm):

The influence of various fertilizer amendments on the leaf area plant⁻¹ (Sq.cm) at different stages in the growth of *Coleus forskohlii* is shown in table no.3 and Graph no.3.

There was maximum [6349 Sq.cm plant⁻¹] increase in leaf area in treatment number 3, as compared to control were the leaf area was only 5094 Sq.cm plant⁻¹. Minimum of 5329 Sq.cm plant⁻¹ was recorded in treatment No.5. There was a gradual increase in leaf area between 30, 90 and 150 DAP.(Days After Plating).

Table-3 Showing the effect of various fertilizer amendments on leaf area plant⁻¹ (sq.com) at different stages of crop growth in *Coleus forskohlii*

Treatments	Days after planting		
	30	90	150
T ₁ : Control – No Manures	604.51	2087.85	5094.63
T ₂ : 100% NPK recommended dose (N-40 kg ha ⁻¹)	732.72	2634.76	6097.58
T ₃ : 50% NPK + 10 Tonnes of Farm Yard Manure/ha	821.73	2874.16	6349.31
T ₄ : 50% NPK + 5 Tonnes of Vermicompost/ha	784.69	2596.01	6185.08
T ₅ : 20 Tonnes of Farm Yard Manure/ha	687.35	2263.65	5328.57
T ₆ : Vermicompost 10 Tonnes/ha	719.27	2475.86	5961.34

Note: Recommended dose of fertilizers N-40 kg/ha, P-60 kg/ha, K-50 kg/ ha⁻¹



Graph-3 Showing the effect of various fertilizer amendments on leaf area plant⁻¹ (sq.com) at different stages of crop growth in *Coleus forskohlii*

Results indicated the improvement in the growth and yield. Though chemical fertilizers shown some impact, improvement with FYM and organic matter is significant.

Increase in the growth and yield parameters with combined use of organic and inorganic rather than their sole application reported in the present investigation is in agreement with the earlier reports of Bhaskar and Sreenivas murthy (2005) in *Coleus forskohlii*, Joy *et al.* (2005) in black musli (*Curculigo orchoides*), Kothari *et al.* (2005) in *Spilanthes acmella*, Rajendran and Gnanavel (2008) in *Aloe vera* and Velmurugan *et al.* (2008) in *Curcuma longa*.

CONCLUSION

Combination of organic and inorganic fertilizers is very productive than the application of manures or fertilizers alone for achieving higher growth and yield in *C.forskohli*. Application of vermicompost at 4 t ha⁻¹ along with 40 kg N, 16.67 kg P and 25 kg K ha⁻¹ is beneficial not only to increase the seed yield (4.47 g per plant) but in augmenting the fertility status of soil.

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