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Effect of Bio-Fertilizers on Growth and Biomass of Coleus Vettiveroides

Nagappa Desai[1] and S. Thirumala[2]

[1]Department of Horticulture, Krishi Vigyana Kendra, Konehalli, Tiptur Taluk, Tumkur, Karnataka, India
[2]Department of Environmental Science, Govt. First Grade College & P.G. Centre, Davangere, Karnataka, India

Correspondence should be addressed to S. Thirumala, profthirumala@gmail.com

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Abstract Coleus vettiveroides commonly known as Hrivera is a perennial herb belonging to family lamiaceae grown on sandy loams along river banks in plains. A pot experiment was conducted to optimize nutrient requirement through organic sources for optimum plant and root growth. The experiments were conducted at Hullikatte village of Tumkur district. Results found that the higher plant growth and biomass accumulation were found to be significant with the application of FYM along with bio fertilizer as compared with sole application of FYM or inorganic fertilizer.
Keywords *Bio-Fertilizers; Coleus Vettiveroides*

1. Introduction

Coleus vettiveroides best grown in sandy loam soil along river banks in plains. The pattern of root system differs when grown on light and heavy-textured soils. If grown on sandy soils, the tertiary roots are profuse with thin and long; and with less prominent primary and secondary roots. But if is grown on loamy soils, the primary and secondary roots will become prominent than tertiary roots [9].

Among various cultural practices conducive for enhancing root yield, nutrient management plays an important role in enhancing the yield per unit area. In the recent years, chemical fertilizers played significant role in providing nutrients for intensive crop production, but increased use of chemical fertilizer in an imbalanced manner has created problems of multiple nutrient deficiencies, diminishing soil fertility and unsustainable crop yields. Therefore, to minimize residue toxicity, etc. there is a need to practice organic farming. Therefore emphasis is now focused on growing the coleus using organic manures, such as Farm Yard Manure (FYM) and biofertilizers like Azatobacter, Azospirillum, Phosphorus Solubilizing Bacteria (PSB) and Arbuscular Mycorrhiza (AM fungi) are measures to produce roots of higher quality and safety.

Among agro techniques, integrated nutrient management plays an important role because of advantage of providing both organic sources of nutrients for improving biomass and preserving quality of plants products. Hence, integration of organic and inorganic sources of fertilizers is very essential in boosting the sustainable production of medicinal plants.

2. Materials and Methods

A pot experiment was conducted to optimize nutrient requirement through organic sources for optimum plant and root growth. The experiments were conducted at Farmers field of Hullikatte village of Tumkur district.

2.1. Details of the Experiments

The rooted stem cuttings of coleus vettiveroides were planted in pots with a capacity of 5 kg on March 12, 2008 in a growth media of 1:1:1 soil: Sand: FYM. The experiments were laid out in field with various levels of well decomposed FYM as indicated below:
Number of Treatments: 9
Number of Replications: 3

Biofertilizers: - Azotobacter chrococcum (5g) + Bacillus megaterium (5g) (phosphorus solubilizing bacteria) + Glomus mosseae (5g) (Arbuscular mycorrhiza fungi) in 1:1:1 to each pot.
Recommended N: 100 Kgha.

3. Results and Discussion

3.1. Growth Parameters

The data collected on growth parameters such as plant height, number of branches per plant, number of leaves per plant as influenced by micro flora and the treatment details are presented in Table 1.

The data revealed significant differences in plant height among the treatments. The maximum plant height (68.67 cm) was recorded in 25% of recommended N through FYM + biofertilizers and the minimum plant height (55 cm) were recorded in control. Significantly maximum numbers of branches (8.34) were recorded in 75% of recommended N through FYM and the minimum numbers of branches (5.67) were recorded in control. Significantly minimum numbers of leaves (41) were recorded in 100% of recommended N through FYM + Biofertilizers, as revealed in Table 1.

Growth parameters like plant height, number of branches were found to be more in plants applied with FYM along with Bio fertilizers. Further enhances the soil fertility status as biofertilizers like Azatobacter, Phosphorus solubilizing bacteria and Arbuscular Mychorriza fungi independently or in combination enhances the N and P status respectively, which assisted the host plant to promote growth [1] in Mentha spp, [7] in ginger, Earanna [3] in coleus barbatus, [4] in solanum nigrum, [8] in coleus parviflorus, [10] in viola pilosa.

Table 1: *Growth Parameters and Biomass (Per Plant) of Coleus Vettiveroides at Harvest as Influenced by Organic Sources and Bio Fertilizers*

Treatments	Plant Height (cm)	Number of Leaves	Number of Branches
T1: Control	55.00	29.34	5.67
T2: 25% of rec. N through FYM	60.67	37.67	7.34
T3: 25% of rec. N through FYM +Biofertilizers	68.67	39.00	7.67
T4: 50% of rec. N through FYM	59.00	33.67	6.34
T5: 50% of rec. N through FYM +Biofertilizers	59.34	34.34	7.34
T6: 75% of rec. N through FYM	59.67	36.34	8.34
T7: 75% of rec. N through FYM +Biofertilizers	63.34	34.67	6.67
T8: 100% of rec. N through FYM	56.00	37.00	7.67
T9: 100%of rec. N through FYM +Biofertilizers	56.67	41.00	8.00
S.Em +	0.98	1.12	0.41
CD @ 5%	2.91	3.33	1.23

3.2. Bio-Mass

Leaf Weight (g/ plant)

Comparing the leaf weight as influenced by organic sources and biofertilizers in unsterilized soil showed significant variations in influencing leaf weight. Significantly maximum leaf weight (130.34g) was noticed in 75% of recommended N through FYM + Biofertilizers, while the minimum leaf weight (81.18g) were noticed in control (Table 2).

Stem Weight (g/ plant)

Stem weight varied significantly among the treatments. The maximum stem weight per plant (139.69g) were recorded in 50% of recommended N through FYM + Bio fertilizer, however it was on par with 100% of recommended N through FYM + Bio fertilizer and the lowest root weight (12.83g) were recorded in control as given in Table 2.

Total Biomass (g/ plant)

Total biomass were found to be significantly higher (293.66g) in 75% of recommended N through FYM+ Bio fertilizer and the lowest total biomass (174.95g) were recorded in control, as given in Table 2.

Leaf weight, stem weight, root weight and total biomass of plant were found to increase in combination with organic with biofertilizers are compared to without biofertilizers. The positive influence on increased dry matter may be attributed to the higher level of organic manures, which are the rich sources of humus besides promoting higher N-fixation, P-solubilization and mobilization by the microbes, which consequently have increased the weight. Higher dry matter accumulation obtained in these treatments might be due to accelerated mobility of photosynthates from the source to the sink as influenced by the growth hormone release or synthesized due to the application of organic manures.

Table 2: *Biomass (Per Plant) of Coleus Vettiveroides at Harvest as Influenced by Organic Sources and Bio Fertilizers*

Treatments	Leaf weight(g)	Steam weight(g)	Root weight(g)	Total Biomass(g)
T1: Control	81.18	80.94	12.83	174.95
T2: 25% of rec. N through FYM	87.93	113.60	15.23	216.76
T3: 25% of rec. N through FYM + Biofertilizers	108.10	125.27	26.53	259.90
T4: 50% of rec N through FYM	83.88	110.23	16.28	210.40
T5: 50% of rec. N through FYM + Biofertilizers	115.06	139.69	28.05	282.80
T6: 75% of rec. N through FYM	85.43	116.60	18.19	220.22
T7: 75% of rec. N through FYM + Biofertilizers	130.34	136.52	26.65	293.66
T8: 100% of rec. N through FYM	90.65	121.68	23.18	235.52
T9: 100%of rec. N through FYM + Biofertilizers	121.16	138.35	31.34	290.85
S.Em +	1.61	1.98	0.80	2.83
CD @ 5%	4.80	5.88	2.39	8.42

The reason for the higher biomass with application of organic manures and Biofertilizers might have helped the plant metabolic activity through the supply of important micronutrient such as zinc, iron, copper, manganese, etc. These are involved in biochemical synthesis of many phytohormones. Besides, organic manures Azotobactor have a role in nitrogen fixation and are also involved in the production of phytohormones like IAA, GA and cytokinin like substances, phosphorous-solubilizing bacteria and Arbuscular mychorriza fungi help in solubilization and mobilization of phosphorous in soil. From the facts mentioned above, it is clear that higher dose of organic manures combined with bio fertilizers like Azatobacter chrococcum, Phosphorous- Solubilizing Bacteria (Bacillus megaterium) and Arbuscular Mycorriha fungi would have led to the higher yield of plants in these treatments. These results are in line with (Mukesh et al., 2006) in marigold, (Vikas et al., 2008) in viola pilosa and (Mohanchandra, 2003) in solanum nigrum.

4. Conclusion

The higher plant growth and biomass accumulation were found to be significant with the application of FYM along with biofertilizers as compared with sole application of FYM or inorganic fertilizer.

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