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Effect of Organic and Bio-Nutrition on the Root Yield of Coleus (*Coleus forskohlii* Briq)

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ABSTRACT

Field experiment was conducted during rabi season of 2005-06 at Agricultural College Farm, Bapatla to study the effect of organic and bio-nutrition on the root yield of coleus (*Coleus forskohlii* Briq). Results of the investigation revealed that maximum growth, development, root yeild and nutrient uptake were increased significantly by the combined use of organic manures and bio fertilizers i.e. FYM 2.6 tonnes ha^{-1} vermicompost 0.4 tonnes ha^{-1} + azospirillum 2.2 kg ha^{-1}.

Key words : Bio-Nutrition, Coleus, Organic.

Coleus forskohlii belonging to family Labiateae, is an ancient root drug claimed to improve appetite, increase vitality and useful for curing the ailments like inflammation, flatulence, deospy etc. Its root juice is given to children for curing constipation (Singh *et al.,* 1980). The novel feature of forskolin is its unique mechanism of generating cyclic AMP in the cells through direct activation of catalytic unit of cyclase adenylate enzyme.

One of the major causes for decline in the productivity of the soils is due to low organic matter content and wherever, the fertilizers have been continuously used without adequate supply of organic manures and decline is faster in addition to certain new problems of insect pest and disease besides leaving residual effects on plants.The plants which are used for medicinal purpose should not have any residue of fertilizer or pesticide other wise they become poisonous than a medicine. Hence there is a need to domesticate organic production of this plant at commercial level.

MATERIAL AND METHODS

A field experiment was conducted on a sandy loam soil with the variety K - 8 during rabi season, 2005-06 at the Agricultural College Farm, Bapatla. The experimental soil was having a pH of 6.8, E.C 0.12 dsm^{-1}, 0.21% organic carbon, 192 kg ha^{-1} available nitrogen, 22 kg ha^{-1} available phosphorus and 458 kg ha^{-1} available potassium. Eleven treatments viz.,T_0 = Control, T_1 = Recommended dose NPK 40:60:50 kg ha^{-1}, T_2 = FYM 8t ha^{-1}, T_3 = Vermicompost 1.3 t ha^{-1}, T_4 = Neem cake 0.8 t ha^{-1} T_5 = Azospirillum 6.6 kg ha^{-1}, T_6 = FYM (4t ha^{-1}) + vermicompost (0.066 t ha^{-1}), T_7 = FYM (4 t ha^{-1}) + neem cake (0.4 t ha^{-1}), T_8 = FYM (4 t ha^{-1}) + azospirillum (3.3 kg ha^{-1}), T_9 = FYM (2.6 t ha^{-1}) + vermicompost (0.4 t ha^{-1}) + azospirillum (2.2 kg ha^{-1}), T_{10} = FYM (2.6 t ha^{-1}) + neem cake (0.26 t ha^{-1}) + azospirillum (2.2 kg ha^{-1}) were tried to study the growth and development of coleus.

All the manures along nitrogenous, Phosphatic and potassic fertilizers were applied as basal dose as per treatments.

RESULTS AND DISCUSSION

Treatment T_9 recorded the highest plant height from 30 to 120 days after transplanting and thereafter the increase was marginal upto final harvest irrespective of the treatments. The number of leaves $plant^{-1}$ increased rapidly from 30 to 150 DAT and decreased thereafter. This might be due senescence of leaves with age of crop. The plants which received higher doses of nutrients in combination with biofertilizers produced the maximum number of leaves which can be mainly attributed to better growing conditions that prevailed in the vicinity of root zone due to the application of bio fertilizers along with manures helping the plants to absorb more nutrients (Naik *et al.,* 1995). Maximum number of leaves were recorded by T_9 at harvest (424.68) which was significant over other treatments. This was followed by T_{10} (401.14), T_1 (379.16) and the least was in control (259.72). The highest leaf area was recorded by T_9 (3359.69 cm^2) at harvest which was on a par with the treatment T_{10} (3149.91 cm^2).

The highest leaf and shoot dry weight (44.56 g, 54.75g) were recorded by T_9. This was followed by T_{10} (41.36g, 48.12g) T_1 (37.36 gm, 42.04 gm), and the lowest was by control (17.31g, 20.67g). This could be due to the availability of nutrients from organic and bio fertilizers in adequate quantities

Table 1. Effect of organic manures and bio fertilizers and growth and root yield of coleus at harvest.

Treatments	Plant height	No. of leaves	Dry weight of leaves (g plant^{-1})	Dry weight of shoots (g plant^{-1})	Leaf area (cm^2)	No. of roots	Length of roots (cm)	Fresh weight of roots (g plant^{-1})	Dry weight of roots (g plant^{-1})
T_0	33.53	259.72	17.31	20.67	1975.12	7.98	11.94	236.16	21.56
T_1	49.12	379.16	37.36	42.04	3149.91	17.06	26.85	302.87	41.58
T_2	40.16	291.13	20.15	25.64	2529.31	10.54	16.19	244.31	26.54
T_3	41.39	272.82	24.91	27.56	2659.87	11.56	18.76	250.74	27.61
T_4	38.74	281.39	22.24	24.19	2383.73	9.98	15.34	240.19	24.31
T_5	36.51	274.61	25.16	22.16	2233.48	8.91	13.26	238.64	23.12
T_6	47.34	357.19	38.57	35.13	3028.35	16.49	24.11	281.28	36.51
T_7	45.12	333.16	30.14	33.41	2906.77	15.01	22.57	260.60	31.64
T_8	43.06	311.76	29.54	30.54	2785.23	13.14	21.15	256.56	29.51
T_9	57.54	424.68	44.56	54.75	3359.70	19.12	29.56	350.56	56.54
T_{10}	53.12	401.15	41.36	48.12	3271.47	18.01	27.34	325.13	48.26
SEm±	1.23	6.96	1.01	1.04	38.72	0.43	0.69	7.00	1.06
CD (0.05)	3.62	20.57	2.99	3.09	114.43	1.01	1.24	20.68	3.12

Table 2. Effect of organic manures and bio fertilizers on LAI, RGR, NAR and Nutrient uptake on coleus at 120 - 150 DAT.

Treatments	LAI	RGR (g g^{-1} d^{-1})	NAR (g dm^2 d^{-1})	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_0	2.753	0.00205	0.000009	57.51	19.89	50.74
T_1	3.314	0.00339	0.000080	122.65	39.04	97.79
T_2	3.031	0.00259	0.000049	85.30	27.04	65.09
T_3	3.089	0.00279	0.000056	104.81	32.84	84.55
T_4	2.949	0.00252	0.000011	72.82	23.87	60.27
T_5	2.810	0.00239	0.000010	61.54	21.51	50.15
T_6	3.258	0.00321	0.000075	121.22	38.42	94.05
T_7	3.201	0.00316	0.000069	114.11	35.24	91.16
T_8	3.145	0.00310	0.000067	109.26	33.89	86.45
T_9	3.427	0.00501	0.000097	141.82	47.73	110.39
T_{10}	3.361	0.00435	0.0000090	130.91	42.85	104.35
SEm±	0.0202	0.000142	0.00001848	1.65	0.96	1.89
CD (0.05)	0.0596	0.0000054	0.0000054	4.86	2.85	5.58

which are essential for growth and development.Nitrogen, being constituent of protoplasm and its favourable effect on chlorophyll content of leaves might have resulted in increased synthesis of carbohydrates (Tisdale *et al.,* 1985).

Maximum number of roots were recorded by T_9 (19.12) which was followed by T_{10} (18.01) while, the highest root length was recorded with T_9 (29.56 cm) which was followed by T_{10} (27.24 cm) Table 1.

Maximum fresh weight and dry weight of roots were recorded by T_9 (350.56, 56.54g) which was followed by T_{10} (325.13, 48.26 g). Application of organic manures and bio fertilizers combination resulted in the availability of sufficient quantities of nutrients in the soil in available from for plant uptake. This might have resulted in increase in vegetative parameters which might be due to the increased turgidity of plant cells that resulted in expansion of cell wall and manifested in the increased lateral and linear dimensions of leaves. This in turn resulted in the higher photosyntheitc rate, high dry matter accumulation in plant parts and translocation of more and more phot synthates from source to sink and ultimately led to higher root yield by Khalaf and Taha (1998).

The highest LAI at 150 DAT was recorded by the treatment T_9 (2.427) at harvest stage followed by T_{10} (3.36) and T_1 (3.314) which were on par with each other. The lowest LAI was recorded by the control.

The highest relative growth at 120-150 DAT was recoreded by T_9 (0.00501) followed by FYM + neemake + azospirillum (0.004267), followed by T_{10} (0.003893). It is evident from the results that relative growth rate (RGR) and net assimilation rate (NAR) were high and rapid from the very beginning of plant establishment and favoured sustained growth of roots.

Maximum nutrient uptake was recorded with the treatment T_9 of N (114.82 kg ha^{-1}), P (47.73 kg ha^{-1}), K (110.38 kg ha^{-1}), which was followed by treatment T_{10} (130.90, 42.85, 104.34 kg ha^{-1}). The lowest was recorded by the control (T_0). The increased nutrient uptake could be due to increased and prolonged availability of nutrients to the plants in these treatments (Table 2).

From the above discussion, it is concluded that the combination of FYM (2.6 t ha^{-1}) + vermicompost (0.4 t ha^{-1}) + azospirillum 2.2 kg ha^{-1}) increased the growth, development and root yield in Coleus along with maximum nutrient uptake of N P K over the other treatments.

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