



## Effect of organic manures on the growth of *Plectranthus vettiveroides*

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### Abstract

The experiment on "Effect of organic manures on growth yield and nutrient uptake of *Plectranthus vettiveroides* was carried out in Kollidam during 2020-2022. A field trial was conducted in a Randomized Block Design with nine treatments in three replications. The treatment consisted of organic manures at farmyard manure, vermicompost, neem cake and groundnut cake. Among the different treatments, application of (Vermicompost @ 5 t ha<sup>-1</sup> + Groundnut cake @ 200 kg ha<sup>-1</sup> + Azospirillum @ 2 kg ha<sup>-1</sup>) resulted in enhancing the growth characters like plant height, number of branches per plant, stem girth, number of leaves per plant when compared to control. The number of primary and secondary roots, root length, volume of roots showed an increasing trend at different stages of evaluation and the treatment (Vermicompost @ 5 t ha<sup>-1</sup> + Groundnut cake @ 200 kg ha<sup>-1</sup> + Azospirillum @ 2 kg ha<sup>-1</sup>) recorded the highest root numbers, root length, and girth. Application of (Vermicompost @ 5 t ha<sup>-1</sup> + Groundnut cake @ 200 kg ha<sup>-1</sup> + Azospirillum @ 2 kg ha<sup>-1</sup>) was found to influence the chlorophyll content index of leaves and root oil content.

Based on findings of the present study it can be concluded that present study it can be concluded that combination application of (Vermicompost @ 5 t ha<sup>-1</sup> + Groundnut cake @ 200 kg ha<sup>-1</sup> + Azospirillum @ 2 kg ha<sup>-1</sup>) was found to be beneficial for increasing the growth and Physiological parameters of *Plectranthus vettiveroides*

**Keywords:** *Plectranthus vettiveroides*, vermicompost, groundnut cake, azospirillum, growth

### Introduction

Medicinal plants encompass a huge number of plant species that are used in homeopathy and various Indian systems of medicines such as folk medicine, Ayurveda, Siddha and Unani. About 4500 species are used in different folk medicines, 1700 in Ayurveda, 1000 in Siddha, 700 in Unani and 500 in Homeopathy. The demand for the products obtained from these plants such as phytochemicals, steroids, alkaloids and biologically active compounds etc., is increasing in national and international market. A medicinal plant can be used for therapeutic purposes and used as precursor for the synthesis of useful drugs. Several medicinal plants have been used in traditional medicine for many years (Sofowora *et al.*, 2013) [14]. India is the second largest exporter of medicinal plants next to china. The area under medicinal plants has increased over the years with the annual growth rate of 1.12 % per annum. According to the convention of biological diversity report, there were US \$ 62 billion sales of herbal medicines in the world which is expected to increase to US \$ 3 trillion by 2020. India has been a big producer in medicinal and aromatic plants trade across the globe. Among the different group of medicinal and aromatic plants, the genus Coleus, which is a member of Lamiaceae family contain 300 species, most of which are annual and perennial herbs. *Plectranthus vettiveroides* commonly known as Hrivera, formerly referred as Coleus vettiveroides is a perennial herb belonging to the family Lamiaceae. The plant is a succulent, aromatic herb with quadrangular stem and branches and deep strawcoloured roots leaves glandular hairy, broadly ovate with dentate margins and prominent veins on the back. It has been propagated through vegetative cuttings and conserved at Jawaharlal Nehru Tropical Botanical Garden and Research Institute (JNTBGRI). There are no systematic studies in

*Plectranthus vettiveroides* for its commercial cultivation through organic sources. There is great demand for its roots in Indian system of Medicine (ISM) such as Ayurvedic, Siddha and Unani for traditional medicinal preparations. Limited reports are available on propagation practices in *Plectranthus vettiveroides*. Asexual method of propagation mainly through stem cuttings is practiced. To protect the endangered herbal medicinal plants in their natural habitat, systematic agrotechniques need to be developed for important medicinal species. The cultural practices have not been standardized for *Plectranthus vettiveroides* and are under limited cultivation only in some villages of Nagapattinam in Tamil Nadu. Farmyard manure, Groundnut cake, Neem cake, *Azospirillum* were used in this study. Organic manures play an important role because of the advantage of providing organic source of nutrients for improving biomass and preserving quality of plant products. Hence, organic manures as source is very essential for both boosting the sustainable production of medicinal and aromatic plants. Considering above points, the present study was carried out for increasing the growth and Physiological parameters of *Plectranthus vettiveroides*.

### Materials and Methods

The experiment was conducted in farmer field Kollidam, Sirkazhi Taluk which was located at 11° 19' 50.3508" North latitude, 79° 43' 13.2960" East longitude and at an altitude of 6 meter above mean sea level in the Nagapattinam district of Tamilnadu. Terminal cuttings of 8 to 15 cm length having 3 to 4 pair of leaves were taken from the well grown, healthy, disease free *Plectranthus vettiveroides* plant. Then the cuttings were planted in polythene bags of 15 cm length and 8 cm in diameters, filled with garden soil and sand. These bags are kept in shade and watered regularly.

Cuttings were transplanted to main field with sufficient number of roots after 20 days. The experimental area was ploughed thoroughly. The field was laid out in randomized block design with individual raised beds of 1.0 X 1.0 m dimension. The treatment were randomly arranged in each replication. Twenty days old healthy uniform rooted cuttings were planted in the main field. Each bed was individually supplied with organic manure as per treatment schedule. Organic manure like vermicompost, farm yard manure, was given fully as a basal. After the application of ground nut cake, neem cake, *Azospirillum* was applied in two split doses 15 and 30 DAP. The data obtained from field observation and laboratory experiment were analysis using 'F' test significance following the method described by Panse and Sukhatme (1978). The value prior to analysis wherever necessary. The critical difference (CD) was calculated at 5 per cent probability level and non- significant levels were indicated NS.

### Results and Discussion

The plant height was maximum in T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) which recorded the values of 48.80 cm and 105.45 cm at 45 and 90 DAS respectively. This was followed by T<sub>1</sub> (100 percent RDF) which recorded the values of 47.00 cm and 102.20 cm at 45 and 90 DAS respectively. The least plant height was recorded with the values of 33.64 cm and 79.10 cm at 45 and 90 DAS respectively in T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>). Among the various treatments T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) recorded the maximum number of branches plant<sup>-1</sup> 12.63 and 18.70 followed by T<sub>1</sub> (100 percent RDF) which recorded the values of 12.03 and 18.06 at 45 and 90 DAS respectively. T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>) recorded the least number of branches plant<sup>-1</sup> respectively (8.66 and 13.60) at 45 and 90 DAS respectively. The stem girth was maximum 7.76 cm and 8.59 cm T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>), followed by T<sub>1</sub> (100 percent RDF) which recorded the values of 7.46 cm and 8.29 cm at 45 DAP and 90 DAP, respectively. The least plant stem girth was recorded with the values of 5.51 cm and 6.20 cm at 45 and 90 DAP T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>). There was a gradual increase in the leaf production from stages I (45 DAP) to stage II (90 DAP). T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) proved to be significantly superior recording 86.60 and 123.05 leaves per plant at 45 and 90 DAP, respectively. The best treatment was followed by T<sub>1</sub> (100 percent RDF) which recorded 83.80 and 119.05 leaves per plant at 45 and 90 DAP respectively. T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>) recorded the lowest number of leaves 63.99 and 91.35 at 45 and 90 DAP respectively. The leaf area was maximum 48.75 cm<sup>2</sup> and 58.64 cm<sup>2</sup> in T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) followed by T<sub>1</sub> (100 percent RDF) which recorded the values of 47.15 cm<sup>2</sup> and 56.74 cm<sup>2</sup> at 45 and 90 DAP respectively. T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>) registered the least values of 35.41 cm<sup>2</sup> and 43.08 cm<sup>2</sup> at 45 and 90 DAP respectively. The chlorophyll content was the highest 2.32 mg g<sup>-1</sup> in T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) followed by T<sub>1</sub> (100 percent RDF) which registered a value of 2.21 mg g<sup>-1</sup>. The chlorophyll content was the least 1.45 mg g<sup>-1</sup> in T<sub>4</sub> (FYM @ 12.5 t ha<sup>-1</sup> + NC @ 200 kg ha<sup>-1</sup>).

The increase in plant height might be due to the increased content of nitrogen, the chief constituent of protein, essential for the formation of protoplasm, which leads to cell division and cell enlargement (Prabhu *et al.*, 2010) [10]. The present results are in conformation with the findings of Sundariya *et al.* (2003) in sweet basil, Anwar *et al.* (2005) [2] in french basil, Rahman *et al.* (2014) [11] in sweet basil, Ponni and Arumugamshakila (2007) in *Phyllanthus niruri* and Patke *et al.* (2018) in aloe. Available soil nutrients were found to be higher due to application of groundnut cake when compared to other oil cakes such as neem cake and sesame oil cake and cotton cake and the nutrients in groundnut cake are readily available to the crop thereby resulting in increased plant height. In addition, the beneficial effect of *Azospirillum* in fixing the atmosphere nitrogen and also its involvement in the release of phytohormones could have increased the plant growth, resulting in higher dry matter production. Similar findings were also reported by Harisha *et al.* (2010) in garden cress. The highest number of branches, stem girth and number of leaves was observed in the treatment vermicompost @ 5 t ha<sup>-1</sup> + ground cake @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup> might be due to more availability and uptake of nutrients particularly N, P, K, micronutrients, water and production of growth promoting substances through the integration of vermicompost and the ready availability of nutrients from the groundnut oil cake. These findings are in consonance with Pandian (2005) [7] in cashew. Similar results were obtained by Mohit Lal *et al.* (2018) [5] in sacred basil cv. Krishna, Sujai Kumar (2001) [15] in glory lily, Selvaraj *et al.* (2003) [13] in rosemary, Sadashiv Nadukeri (2012) in coleus and Chandana *et al.* (2018) [4] in kalmegh. The basal application of vermicompost stimulating the bacterial activity in soil and nitrogen accumulation, nutrient availability in plant resulted in number of branches enhancement. The positive effect of nitrogen doses which increase the production of leaves. The increase in growth parameters due to application of vermicompost might be due to the presence of growth substances, nitrogen fixers and other essential nutrients. The results are in accordance with the findings of Padmapriya *et al.* (2010) [6] in gymnema, Tiwari and Roy (2014) [18] in gloriosa, Ali Khanzadeh and Davood Naderi (2015) [1] in periwinkle, and Suresh *et al.* (2018) [17] in japanese mint. A high photosynthetic activity is a good indication of physiological efficiency in plants. This is primarily dependant on the leaf chlorophyll content and the presence of high level of chlorophyll content in leaves indicates the efficiency of photosynthesis wherein the solar energy is converted into chemical energy.

### Conclusion

Based on the findings of the present study, it can be concluded that combined application T<sub>7</sub> (VC @ 5 t ha<sup>-1</sup> + GC @ 200 kg ha<sup>-1</sup> + *Azospirillum* @ 2 kg ha<sup>-1</sup>) has beneficial effect on the growth and Physiological parameters of *Plectranthus vittiveroids*. However, application of organic manures increased the growth of plant, maintain the quality of plant, soil fertility and also better improvement in the nutrient availability which gives the sustainable yield. Organic manures are eco-friendly and at the same time safe to the nature.

**Table 1:** Effect of organic manures on the growth of *Plectranthus vittiveroides*

T.No	Treatment Details	Plant height (cm)		Number of branches plant <sup>-1</sup>		Stem girth (cm)		Number of leavesplant <sup>-1</sup>		Leaf area (cm <sup>2</sup> )		Chlorophyll content (mg g <sup>-1</sup> )
		45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP	45 DAP	90 DAP	
T <sub>1</sub>	100 percent RDF	47.00	102.20	12.03	18.06	7.46	8.29	83.80	119.05	47.15	56.74	2.21
T <sub>2</sub>	FYM @12.5 t ha <sup>-1</sup> + GC @200kg ha <sup>-1</sup>	37.57	85.73	9.60	14.84	6.08	6.78	69.59	99.25	38.71	46.89	1.67
T <sub>3</sub>	VC @5 t ha <sup>-1</sup> + GC@ 200 kg ha <sup>-1</sup>	39.52	89.06	10.05	15.48	6.36	7.08	72.49	103.25	40.51	48.94	1.78
T <sub>4</sub>	FYM@12.5 t ha <sup>-1</sup> + NC@ 200 kg ha <sup>-1</sup>	33.64	79.10	8.66	13.60	5.51	6.20	63.99	91.35	35.41	43.08	1.45
T <sub>5</sub>	VC @5 t ha <sup>-1</sup> + NC @200 kg ha <sup>-1</sup>	35.62	82.35	9.15	14.22	5.79	6.49	66.79	95.30	37.06	44.98	1.56
T <sub>6</sub>	FYM@ 12.5 t ha <sup>-1</sup> + GC @200 kg ha <sup>-1</sup> + Azospirillum @2 kg ha <sup>-1</sup>	45.15	98.95	11.43	17.42	7.18	7.99	81.00	115.10	45.55	54.84	2.10
T <sub>7</sub>	VC @5 t ha <sup>-1</sup> + GC@200 kg ha <sup>-1</sup> + Azospirillum @2 kg ha <sup>-1</sup>	48.80	105.45	12.63	18.70	7.76	8.59	86.60	123.05	48.75	58.64	2.32
T <sub>8</sub>	FYM @12.5 t ha <sup>-1</sup> + NC @200 kg ha <sup>-1</sup> + Azospirillum @2 kg ha <sup>-1</sup>	41.42	92.36	10.53	16.10	6.63	7.39	75.39	107.20	42.31	50.99	1.90
T <sub>9</sub>	VC @5 t ha <sup>-1</sup> + NC @200 kg ha <sup>-1</sup> + Azospirillum @2 kg ha <sup>-1</sup>	43.32	95.70	10.98	16.73	6.90	7.69	78.19	111.15	43.93	52.90	2.00
	S.Ed	0.77	1.56	0.18	0.26	0.10	0.12	1.32	1.88	0.71	0.88	0.35
	CD (P=0.05)	1.54	3.12	0.36	0.52	0.20	0.24	2.64	3.76	1.42	1.76	0.70

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