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Influence of Organic, Inorganic and Bio-Fertilizers on Seedling Growth in Canes

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ABSTRACT

The experiment was conducted in the nursery of college of forestry, University of agricultural sciences, Sirsi, to study the effect of organic, inorganic and bio-fertilizers on seedling growth parameters in canes. In both the species (Calamus thwaitesii and Calamus nagabettai), significantly higher seedling height, collar diameter and number of leaves at 30, 60, 90,120, 150 and 180 days after planting. was observed in treatment constituting (T_2) vermicompost (20 g/seedling) and vermicompost + 2 g NPK per seedling (T_6) . The extent of increase in seedling height due to treatment (T_2) in Calamus thwaitesii was found to be 26.58, 39.20, 54.17 and 62.61 per cent and treatment (T_6) in Calamus nagabettai was found to be 120.79, 106.33, 99.55 and 102.14 per cent over control at 90, 120, 150 and 180 days after planting respectively. The maximum collar diameter at 180 days after planting in both species (7.20 and 5.15 mm) was observed in treatment T_2 constituting vermicompost (20 g/seedling) followed by T_6 constituting vermicompost + NPK 2 g respectively. There was significant difference in number of leaves per plant due to various nutrient treatments. The increase in number of leaves production was 2.75 and 2.85 in both the species respectively over control at 180 days after planting. The number of leaves per plant varied significantly at 180 days after planting due to effect of nutrients. The treatment T_2 recorded maximum root length (30.08 cm and 15.8 cm) and shoot length (25.45 cm and 18.86 cm) in Calamus thwaitesii and Calamus nagabettai respectively. The root shoot ratio (1.36 and 1.20 in Calamus thwaitesii and Calamus nagabettai) was higher in control over the all treatments both the species. All the biomass parameters were significantly high in application of vermicompost (20 g/seedling) and vermicompost + 20 g NPK per seedling (T_6) treatments in both the species over control.

Key words: *Plant height, biomass , vermicompost, shoot length and root length*

INTRODUCTION

Rattans are climbing palms belonging to the family *Arecaceae* (*Palmae*). Rattans are strong, with medium density, much lighter than other hardwoods and extremely pliable. Because of these desirable characters, it is extensively used in the manufacture of a wide range of furniture and handicrafts items for low, medium and high end markets. It is major non-wood forest product after timber in South East Asia.

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The rattan industry has become a labour intensive and rural (or forest) based with increasing prospects for earning foreign exchange. About half a million people are directly employed in harvesting and processing rattans in South East Asia.

The Indian cane furniture industries produced materials worth Rs 50 million with the value of exports standing at Rs 5 million during early 20th century[4]. In India, Assam, Arunachal Pradesh, Andaman and Nicobar Islands, Karnataka and Kerala are the main suppliers of unprocessed rattans. In recent years, uncontrolled harvesting and deforestation have led to resource exhaustion of the desired species in many rattan-producing countries in Asia. Analysis of distribution of rattans in the three different major areas of India (Peninsular, Northeastern and the Andaman and Nicobar Islands) showed that much change has taken place over the last 20 years.

The severe depletion in the rattan resources resulted in an urgent need for effective conservation and propagation measures to be taken. The available resources in Karnataka are scarce to meet the demands of the cane industry creating a wide gap between demand and supply. But this can be reduced by augmenting the existing resources by large scale cultivation of canes in the state. The increasing global demand for rattans necessitated the research on the seed production and quality seedling production, propagation aspects of rattans species.

The growth of the plant is influenced to a great extent by growing medium. Seedling growing on good media with optimum amount of nutrients is necessary for production of healthy seedlings and for development of sturdy root system. Inexpensive and nutrient rich medium that produce healthy and vigorous seedlings which ensure early establishment are required in raising forest plantations where, after care of seedlings are comparatively less. It also reduces the time the seedling should keep in nursery which intern reduces the cost of production per seedlings. Optimization of plant growth by providing required amount of nutrients is another important factor in raising healthy growing stock. But the optimum type and amount vary with the species due to wide differences in their nutrient requirements and with the prevailing level of soil fertility. Optimization of plant growth by providing required amount of nutrients is another important factor in raising healthy growing stock. But the optimum type and amount vary with the species due to wide differences in their nutrient requirements and with the prevailing level of soil fertility.

It is well-recognized that microbial inoculants constitute an important component of integrated nutrient management that leads to sustainable production. In addition, microbial inoculants can be used as an economic input to increase productivity; fertilizer doses can be lowered and more nutrients can be harvested from the soil. Bio-fertilizer defined as a substance which contains living micro-organisms and is known to help in expansion of the root system and better seed germination. A healthy plant usually has a healthy rhizosphere which should be dominated by beneficial microbes. Conversely, in unhealthy soil, dominated by pathogenic microbes, optimum plant growth would not be possible[5]. Keeping this in view, the present investigation was carried out with objective of understanding the effect of organic, inorganic and bio-fertilizers on seedling growth and vigours in canes.

MATERIALS AND METHODS

The experiment was conducted in the nursery of college of forestry, University of agricultural sciences, Sirsi. To study the nutrient response on seedling growth and establishment in cane species, uniform sized healthy seedlings were tested in different nutrient media and their combinations. The potting mixture which contains two portion of red earth, one portion of sand and one portion of FYM is treated as control. All other treatment combinations are super imposed on this standard potting mixture. The various treatments given are (T_1) Control (red earth:

sand: FYM in 1:1:1 ratio), (T_2) Vermicompost (20 g/seedling), (T_3) NPK (2 g each/seedling), (T_4) VAM (10 g/seedling), (T_5) GA_3 50 ppm Spray at monthly interval (6 times), (T_6) Vermicompost + 2 g NPK per seedling (T_2 + T_3), (T_7) VAM + 2 g NPK per seedling (T_3 + T_4), (T_8) GA_3 + 2 g NPK per seedling (T_3 + T_5), (T_9) Vermicompost + VAM + 2 g NPK per seedling (T_2 + T_3 + T_4), (T_{10}) Vermicompost + VAM + 2 g NPK + GA_3 perseedling. (T_2 + T_3 + T_4 + T_5). The experiment was laid out in Complete Randomized Design (CRD) with three replications, considering 20 seedlings from each nutrient as a treatment separatetely in both the species. After imposing all the treatments, seedlings were transplanted to polybags. Aftercare like watering and weeding was done regularly as and when required throughout the experimental period. Observations on above ground growth parameters were recorded for three months at monthly interval after imposition of the treatment whereas, below ground parameters and total biomass is estimated at the end of the experiment.

RESULTS AND DISCUSSIONS

The organic manures are not only efficient with their nutrients, but also improve the soil properties and also cost effective. In both the species (*Calamus thwaitesii* and *Calamus nagabettai*), significantly higher seedling height, collar diameter and number of leaves at 30, 60, 90,120, 150 and 180 days after planting was observed in treatment constituting (T_2) vermicompost (20 g/seedling) and vermicompost + 2 g NPK per seedling (T_6) respectively. These results are in conformity with the findings of Swaminathan[8]. The application of NPK in the ratio of 100:60:40:20 kg per ha showed better growth in teak. The extent of increase in seedling height due to treatment (T_2) in *Calamus thwaitesii* was found to be 26.58, 39.20, 54.17 and 62.61 per cent and treatment (T_6) in *Calamus nagabettai* was found to be 120.79, 106.33, 99.55 and 102.14 per cent over control at 90, 120, 150 and 180 days after planting respectively. The increase in seedling height may be due to the presence of all essential nutrients in the vermicompost media which are in readily available form. This leads to increased uptake of essential nutrients which in turn enhances the height of seedling. In same study adding vermicompost and FYM at various proportion in potting mixture of neem seedling. Application of vermicompost alone as the superior media in inducing higher collar diameter, root length, shoot length, leaf area and root-shoot ratio compared to other nutrients studied by Biradar *et al*[3]., (Table-1&2).

The maximum collar diameter at 90, 120, 150 and 180 days in *Calamus thwaitesii* (4.32 mm, 5.22 mm, 6.44 mm and 7.20 mm, respectively) was observed in T_2 constituting vermicompost 20 g/seedling, followed by treatment T_5 constituting GA_3 50 ppm Spray at monthly interval. The extent of increase in collar diameter due to treatment (T_6) in *Calamus nagabettai* was found to be 146.35, 146.26, 139.62 and 123.91 per cent over control at 90, 120,150 and 180 days after planting (Table-3&4).. Results of present investigation are corroborate with the findings of Bharadhwaj *et al*[1]., in *Robinia pseudoacacia* .

There was significant difference in number of leaves per plant due to various nutrient treatments (Table-5&6). The increase in number of leaves production was 2.75 and 2.85 in both the species respectively over control at 180 days after planting. The extent of increase in collar diameter due to treatment (T_2) in *Calamus thwaitesii* was found to be 90.74, 103.12, 94.65 and 78.64 per cent over control at 90, 120,150 and 180 days after planting. The extent of increase in number of leaves due to treatment (T_6) in *Calamus nagabettai* was found to be 184.00, 164.74, 166.66 and 112 per cent over control at 90, 120, 150 and 180 days after planting. These results are in conformity with the findings of Swaminathan[8].

The treatment T_2 recorded maximum root length (30.08 cm and 15.8 cm) and shoot length (25.45 cm and 18.86 cm) in *Calamus*

thwaitesii and *Calamus nagabettai* respectively. The root shoot ratio (1.36 and 1.20 in *Calamus thwaitesii* and *Calamus nagabettai*) was higher in control over the all treatments both the species (Table-7&8). In both the species the shoot length was constant in the initial months, but root length was increasing but within six months it reduced and reached almost equal. The root-shoot ratio varied significantly among various treatments.

All biomass parameters such as fresh and dry weight of shoot root and both differed significantly after 180 days after planting (Table-9 and fig-1&2). All the biomass parameters were high in application of vermicompost (20 g/seedling) and vermicompost + 20 g NPK per seedling (T_6) in both the species over the control (table 15 and 16). The present investigations are confrontation with results of Kannur and Devar[6] (2003) in teak. The increased rate of dry matter production and its partitioning ultimately lead to higher fresh and dry weight of shoot and root reported by Bhuiyan *et al*[2]., and Karthikeyan[7].

Table 1: Influence of organic, inorganic and bio-fertilizers on plant height (cm) at different stages of growth in *Calamus thwaitesii*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	13.00	13.81	14.48	14.87	15.31	15.62
T_2: Vermicompost (20 g / seedling)	14.62	16.73	18.33	20.70	23.60	25.40
T_3: NPK (2 g / seedling)	14.68	16.55	17.33	18.89	20.30	21.60
T_4: VAM (10 g / seedling)	12.52	16.37	17.87	19.56	21.67	23.40
T_5: GA_3 50 ppm spray at monthly interval (6 times)	14.30	17.52	18.17	20.32	21.79	24.20
T_6: Vermicompost + 2 g NPK per seedling ($T_2 + T_3$)	12.56	15.56	17.15	19.01	22.38	23.00
T_7: VAM + 2 g NPK per seedling ($T_3 + T_4$)	13.40	15.18	16.43	18.08	20.83	22.20
T_8: GA3 spray + 2 g NPK per seedling ($T_3 + T_5$)	13.42	16.15	16.87	18.16	19.23	20.60
T_9: Vermicompost + VAM + 2 g NPK per seedling ($T_2+T_3+T_4$)	12.90	16.09	16.73	17.94	19.41	21.10
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. ($T_2+T_3+T_4+T_5$)	13.30	15.77	17.28	19.18	20.64	21.40
SEm±	**0.71**	**1.27**	**1.31**	**1.81**	**2.36**	**2.50**
CD @ 5%	**2.10**	**3.75**	**3.85**	**5.34**	**6.96**	**7.37**

DAP: Days after planting

Table 2: Influence of organic, inorganic and bio-fertilizers on plant height (cm) at different stages of growth in *Calamus nagabettai*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	5.26	6.46	7.26	7.89	8.90	9.33
T_2: Vermicompost (20 g / seedling)	12.56	13.73	14.46	14.97	16.03	17.16
T_3: NPK (2 g / seedling)	12.36	13.53	14.43	15.23	16.06	16.73
T_4: VAM (10 g / seedling)	6.86	8.03	8.86	9.73	10.46	11.63
T_5: GA_3 50 ppm spray at monthly interval (6 times)	11.30	12.40	13.26	14.13	15.96	16.26
T_6: Vermicompost + 2 g NPK per seedling ($T_2 + T_3$)	14.40	15.50	16.03	16.88	17.76	18.86
T_7: VAM + 2 g NPK per seedling ($T_3 + T_4$)	11.33	12.53	13.40	14.26	15.23	16.40
T_8: GA3 spray + 2 g NPK per seedling ($T_3 + T_5$)	8.96	10.23	11.06	11.90	12.73	13.72
T_9: Vermicompost + VAM + 2 g NPK per seedling ($T_2+T_3+T_4$)	10.30	11.50	12.36	13.23	14.06	15.16
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. ($T_2+T_3+T_4+T_5$)	6.96	8.16	9.30	10.20	11.00	12.22
SEm±	**1.16**	**1.27**	**1.35**	**1.46**	**1.60**	**1.68**
CD @ 5%	**3.41**	**3.74**	**3.99**	**4.31**	**4.72**	**4.96**

DAP: Days after planting

Table 3: Influence of organic, inorganic and bio-fertilizers on collar diameter (mm) at different stages of growth in *Calamus thwaitesii*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	1.56	1.87	2.24	2.89	3.67	4.45
T_2: Vermicompost (20 g / seedling)	2.36	3.45	4.32	5.66	6.44	7.20
T_3: NPK (2 g / seedling)	2.62	3.40	4.18	4.90	5.52	6.47
T_4: VAM (10 g / seedling)	2.50	3.25	4.06	4.97	5.86	6.63
T_5: GA_3 50 ppm spray at monthly interval (6 times)	2.64	3.48	4.20	5.22	5.83	6.73
T_6: Vermicompost + 2 g NPK per seedling ($T_2 + T_3$)	2.17	3.05	3.70	4.64	5.66	6.33
T_7: VAM + 2 g NPK per seedling ($T_3 + T_4$)	1.92	2.71	3.43	4.15	4.94	5.66
T_8: GA3 spray + 2 g NPK per seedling ($T_3 + T_5$)	2.11	2.85	3.48	4.37	5.24	6.96
T_9: Vermicompost + VAM + 2 g NPK per seedling ($T_2+T_3+T_4$)	2.35	3.06	3.60	4.07	4.72	5.39
T_{10}:Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. ($T_2+T_3+T_4+T_5$)	2.33	2.92	3.44	3.91	4.89	5.54
SEm±	**0.25**	**0.36**	**0.37**	**0.51**	**0.49**	**0.69**
CD @ 5%	**0.75**	**1.06**	**1.10**	**1.49**	**1.46**	**2.05**

DAP: Days after planting

Table 4: Influence of organic, inorganic and bio-fertilizers on collar diameter (mm) at different stages of growth in *Calamus nagabettai*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	1.52	1.71	1.92	2.01	2.12	2.30
T_2: Vermicompost (20 g / seedling)	3.80	4.30	4.72	4.89	5.00	5.10
T_3: NPK (2 g / seedling)	3.08	4.12	4.51	4.92	4.80	5.00
T_4: VAM (10 g / seedling)	2.20	2.71	2.82	3.00	3.22	3.36
T_5: GA_3 50 ppm spray at monthly interval (6 times)	3.63	3.92	4.18	4.30	4.48	4.66
T_6: Vermicompost + 2 g NPK per seedling ($T_2 + T_3$)	4.16	4.41	4.73	4.95	5.08	5.15
T_7: VAM + 2 g NPK per seedling ($T_3 + T_4$)	3.65	3.92	4.18	4.33	4.51	4.63
T_8: GA3 spray + 2 g NPK per seedling ($T_3 + T_5$)	2.00	3.12	3.31	3.49	3.64	3.83
T_9: Vermicompost + VAM + 2 g NPK per seedling ($T_2+T_3+T_4$)	2.32	3.12	3.41	3.62	3.80	4.16
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. ($T_2+T_3+T_4+T_5$)	2.41	2.82	3.10	3.33	3.52	3.76
SEm±	**0.33**	**0.41**	**0.43**	**0.45**	**0.42**	**0.43**
CD @ 5%	**0.98**	**1.22**	**1.27**	**1.32**	**1.24**	**1.27**

DAP: Days after planting

Table 5: Influence of organic, inorganic and bio-fertilizers on number of leaves at different stages of growth in *Calamus thwaitesii*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	2.00	2.03	2.16	2.56	3.18	3.84
T_2: Vermicompost (20 g / seedling)	2.45	3.36	4.12	5.20	6.19	6.86
T_3: NPK (2 g / seedling)	2.00	2.21	2.83	3.18	3.86	4.52
T_4: VAM (10 g / seedling)	2.25	3.06	3.78	4.16	4.88	5.46
T_5: GA_3 50 ppm spray at monthly interval (6 times)	2.28	3.18	3.81	4.52	5.12	5.96
T_6: Vermicompost + 2 g NPK per seedling ($T_2 + T_3$)	2.00	2.23	2.86	3.46	3.98	4.56
T_7: VAM + 2 g NPK per seedling ($T_3 + T_4$)	2.00	2.21	2.86	3.18	3.82	4.52
T_8: GA3 spray + 2 g NPK per seedling ($T_3 + T_5$)	2.00	2.10	2.21	2.82	3.56	4.48
T_9: Vermicompost + VAM + 2 g NPK per seedling ($T_2+T_3+T_4$)	2.00	2.16	2.56	2.98	3.86	4.42
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. ($T_2+T_3+T_4+T_5$)	2.00	2.16	2.78	3.00	3.96	4.35
SEm±	**0.09**	**0.32**	**0.33**	**0.43**	**0.49**	**0.57**
CD @ 5%	**0.27**	**0.93**	**0.98**	**1.28**	**1.45**	**1.69**

DAP: Days after planting

Table 6: Influence of organic, inorganic and bio-fertilizers on number of leaves at different stages of growth in *Calamus nagabettai*

Treatments	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	180 DAP
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	0.60	1.00	1.00	1.19	1.50	2.00
T_2: Vermicompost (20 g / seedling)	0.80	1.46	2.00	2.27	3.00	4.10
T_3: NPK (2 g / seedling)	0.90	2.00	2.00	2.38	3.50	4.12
T_4: VAM (10 g / seedling)	0.95	1.00	1.00	1.42	2.80	3.00
T_5: GA_3 50 ppm spray at monthly interval (6 times)	0.95	1.00	2.00	2.30	3.00	3.84
T_6: Vermicompost + 2 g NPK per seedling (T_2 + T_3)	0.95	2.00	2.84	3.21	4.00	4.24
T_7: VAM + 2 g NPK per seedling (T_3 + T_4)	0.80	1.00	1.56	1.81	3.00	3.52
T_8: GA3 spray + 2 g NPK per seedling (T_3 + T_5)	0.70	1.00	2.00	2.15	3.00	3.12
T_9: Vermicompost + VAM + 2 g NPK per seedling (T_2+T_3+T_4)	0.80	1.00	2.00	2.00	3.00	3.50
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. (T_2+T_3+T_4+T_5)	0.70	1.00	1.20	1.70	2.50	3.00
SEm±	**0.12**	**0.12**	**0.13**	**0.25**	**0.26**	**0.37**
CD @ 5%	**0.34**	**0.36**	**0.39**	**0.72**	**0.77**	**1.08**

DAP: Days after planting

Table 7: Influence of organic, inorganic and bio-fertilizers on root length, shoot length and Root – shoot ratio at 180 days after transplanting in *C. thwaitesii* and *C. nagabettai*

Treatments	Root length (cm)		Shoot length(cm)		Root – shoot ratio	
	C. thwaitesii	*C. nagabettai*	*C. thwaitesii*	*C. nagabettai*	*C. thwaitesii*	*C. nagabettai*
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	21.82	11.20	15.62	9.33	1.36	1.20
T_2: Vermicompost (20 g / seedling)	30.08	14.60	25.40	17.16	1.12	0.85
T_3: NPK (2 g / seedling)	28.65	14.80	21.60	16.73	1.23	0.88
T_4: VAM (10 g / seedling)	27.8	12.30	23.40	11.63	1.18	1.05
T_5: GA_3 50 ppm spray at monthly interval (6 times)	28.50	13.20	24.20	16.26	1.18	0.81
T_6: Vermicompost + 2 g NPK per seedling (T_2 + T_3)	28.25	15.80	23.00	18.86	1.22	0.84
T_7: VAM + 2 g NPK per seedling (T_3 + T_4)	27.15	14.40	22.20	16.4	1.22	0.87
T_8: GA3 spray + 2 g NPK per seedling (T_3 + T_5)	24.22	12.30	20.60	13.72	1.17	0.89
T_9: Vermicompost + VAM + 2 g NPK per seedling (T_2+T_3+T_4)	25.45	12.60	21.10	15.16	1.20	0.83
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. (T_2+T_3+T_4+T_5)	26.80	11.30	21.40	12.22	1.19	0.91
SEm±	**1.17**	**0.78**	**2.50**	**1.3**	**0.04**	**0.07**
CD @ 5%	**3.46**	**2.29**	**7.37**	**3.83**	**0.11**	**0.22**

Table 8: Influence of organic, inorganic and bio-fertilizers on biomass at 180 days after transplanting in *Calamus thwaitesii*

Treatments	BIOMASS					
	Shoot		Root		Total	
	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	1.68	0.21	1.90	0.29	3.58	0.50
T_2: Vermicompost (20 g / seedling)	3.64	0.87	5.20	1.12	8.84	1.99
T_3: NPK (2 g / seedling)	2.42	0.62	3.52	0.72	5.94	1.34
T_4: VAM (10 g / seedling)	3.20	0.72	4.66	0.89	7.86	1.61
T_5: GA_3 50 ppm spray at monthly interval (6 times)	3.26	0.85	4.72	0.96	7.98	1.81
T_6: Vermicompost + 2 g NPK per seedling (T_2 + T_3)	2.86	0.70	4.10	0.86	6.96	1.56
T_7: VAM + 2 g NPK per seedling (T_3 + T_4)	2.60	0.65	3.78	0.81	6.38	1.46
T_8: GA3 spray + 2 g NPK per seedling (T_3 + T_5)	1.82	0.32	2.12	0.38	3.94	0.70
T_9: Vermicompost + VAM + 2 g NPK per seedling (T_2+T_3+T_4)	2.10	0.52	2.62	0.55	4.72	1.07
T_{10}: Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. (T_2+T_3+T_4+T_5)	2.22	0.61	3.10	0.67	5.32	1.28
SEm±	**0.63**	**0.14**	**0.82**	**0.16**	**1.36**	**0.29**
CD @ 5%	**1.85**	**0.42**	**2.41**	**0.49**	**4.00**	**0.85**

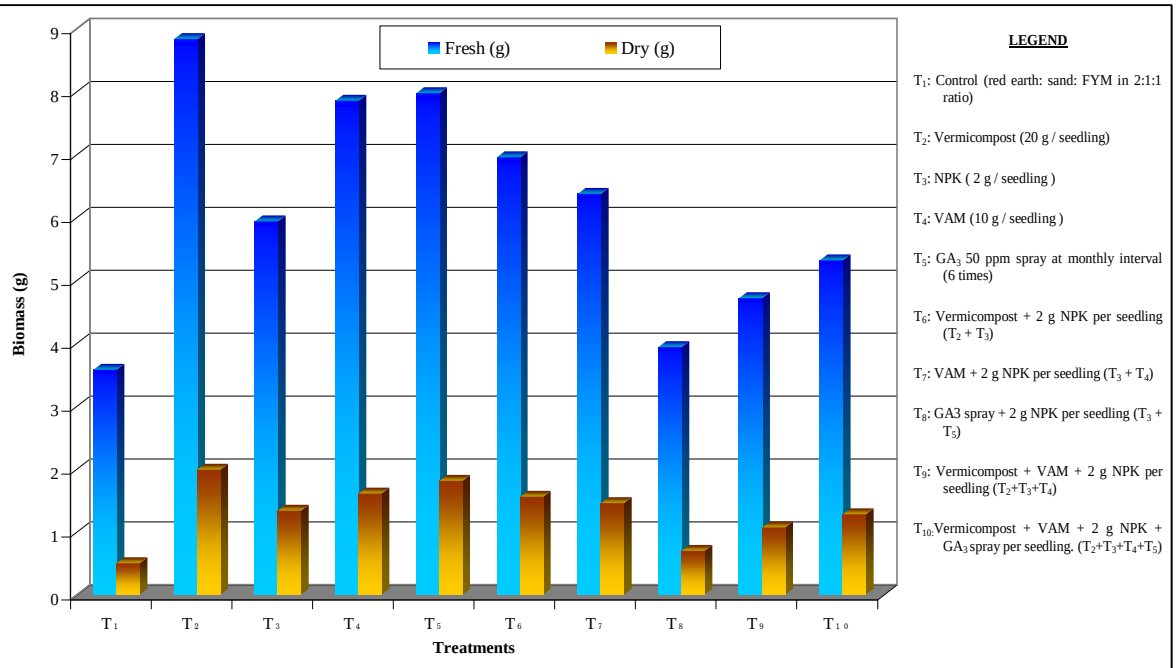

Fig. 1: Influence of organic, inorganic and bio-fertilizers on biomass (g) after 180 days of growth in *Calamus nagabettai*

Table 9: Influence of organic, inorganic and bio-fertilizers on biomass at 180 days after transplanting in *Calamus nagabettai*

Treatments	BIOMASS					
	Shoot		Root		Total	
	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)
T_1: Control (red earth: sand: FYM in 2:1:1 ratio)	1.96	0.21	1.42	0.19	3.38	0.40
T_2: Vermicompost (20 g / seedling)	3.00	0.58	2.10	0.45	5.10	1.03
T_3: NPK (2 g / seedling)	2.83	0.55	2.08	0.43	4.91	0.98
T_4: VAM (10 g / seedling)	2.20	0.38	1.63	0.25	3.83	0.63
T_5: GA_3 50 ppm spray at monthly interval (6 times)	2.81	0.54	2.07	0.42	4.88	0.96
T_6: Vermicompost + 2 g NPK per seedling (T_2 + T_3)	3.10	0.62	2.12	0.47	5.22	1.09
T_7: VAM + 2 g NPK per seedling (T_3 + T_4)	2.76	0.55	2.00	0.38	4.76	0.93
T_8: GA3 spray + 2 g NPK per seedling (T_3 + T_5)	2.70	0.47	1.89	0.38	4.57	0.85
T_9: Vermicompost + VAM + 2 g NPK per seedling (T_2+T_3+T_4)	2.75	0.51	2.00	0.32	4.75	0.83
T_{10}:Vermicompost + VAM + 2 g NPK + GA_3 spray per seedling. (T_2+T_3+T_4+T_5)	2.60	0.42	1.85	0.27	4.45	0.69
SEm±	**0.24**	**0.08**	**0.17**	**0.04**	**0.36**	**0.08**
CD @ 5%	**0.69**	**0.24**	**0.51**	**0.12**	**1.05**	**0.25**

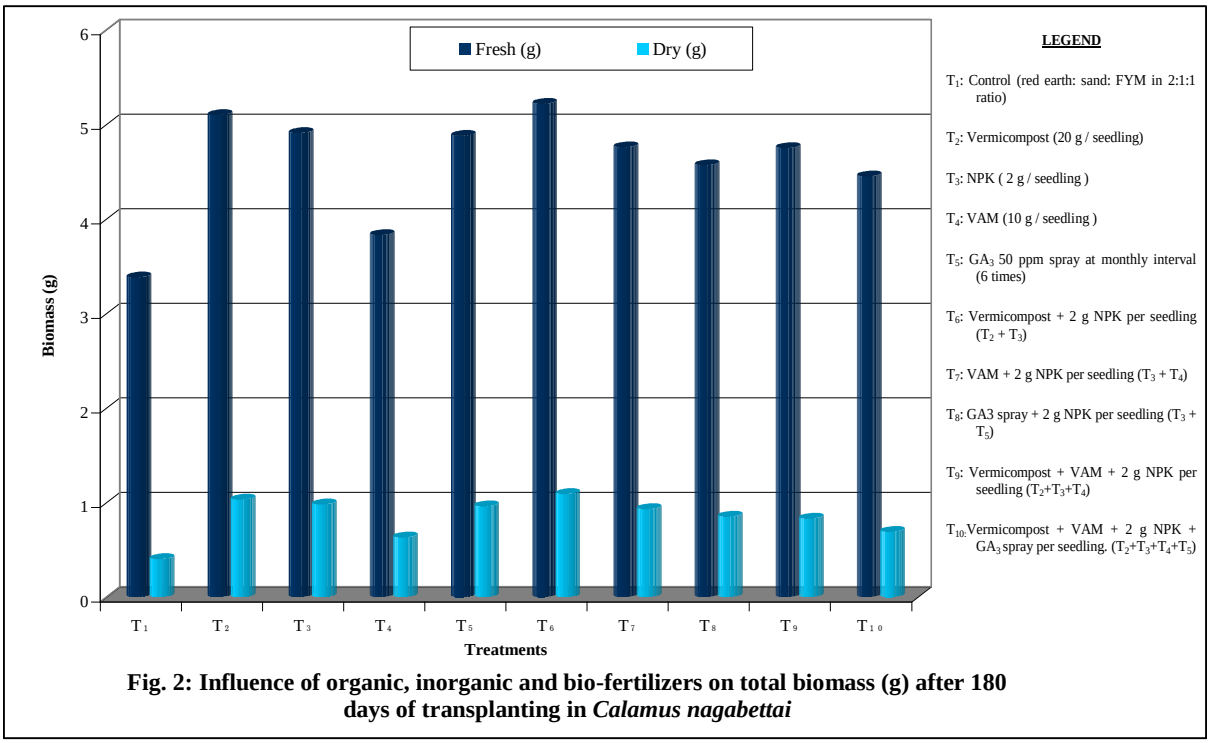

Fig. 2: Influence of organic, inorganic and bio-fertilizers on total biomass (g) after 180 days of transplanting in *Calamus nagabettai*

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