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Effect of growing media on the performance of tomato seedling in plastic plug tray

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Abstract
The present experiment was planned to studies on the effect of growing media on the performance of tomato seedling in plastic plug tray. The use of soil or soil less root media viz: coco peat, vermiculite, perlite, biogas slurry, FYM, vermicompost, sand and neem cake alone and its combination used for filling in plug tray with the view of provide better drainage and aeration, therefore promoting better seedling development and also avoid to possibilities of any infestation. It was observed that Bio gas slurry + Vermiculite (2:1) expressed significantly and most effective medium for raising the seedling of tomato among all the treatments. The germination percentage (58.33) height of seedlings (1.69 cm) diameter of seedling (2.33 mm), fresh weight (6.09 g), dry weight (3.04 g), No. of leaves (7.7 g), length of leaves (15.33 cm) width of leaves (7.07 cm), fresh weight (5.13 g) were highest in T_{10} - Vermiculite + Biogas Slurry (1:2), which was at par with T_{13} - Perlite + Farm Yard Manure and significantly different from all other treatments.

Keywords: Plastic plug-trays, tomato, soil and soilless root media, seedling growth

Introduction
In general, vegetable crops are classified into direct sown and transplanted crops based on response to transplanting root crops, cucurbits and okra are sown in situ and do not stand transplanting most of other vegetables are cultivation by transplanting (Gopalakriushnan, 2007) [12]. Crops like tomato, broccoli, brussels sprouts, cabbage, cauliflower, beet root and lettuce are efficient in water absorption and rapidly from new roots after transplanting. Seedlings not only reduces the crop span but also increases the uniformity of the crop and thus, harvesting more as compared to direct sown crops. Transplanting of seedlings also eliminates the need for thinning and provides good opportunities for virus free vigorous and healthy plants. Most of the farmers in India prepare seedlings in soil under open field conditions where biotic and a biotic stresses are major constraints in raising healthy and time bound seedlings. Moreover, popularity of hybrid seed farmers prompted grows to hybrid seed since hybrid seed are sold very high price hence it is crucial to converting every individual hybrid seed into a healthy seedling with cent percent germination. Competition from the weed at early stage and attack diseases and pest do not only affect the plant stand in the field but also reduce the total yield and economic returns to the growers. Hence it is almost essential that nursery of tomato should be raised in proper condition. The resulted in a shift from growing seedling on flat bed and raised nursery beds in open field towards growing value added seedling in specially designed container like plastic plug tray. The plug tray nursery raising technology is aimed to produce disease free, vigorous and season independent seedlings using protected environment. This technique is not only efficient in vigorous root development but also suitable to avoid any damage to the roots and shoots of the seedlings at the time of transplanting (Singh, 2005) [10]. The different soil or soil less root media viz: coco peat, vermiculite, perlite, biogas slurry, FYM, vermicompost, sand and neem cake alone and its combination used for filling in plug tray with the view of provide better drainage and aeration, therefore promoting better seedling development and also avoid to possibilities of any infestation by insect pest and disease. Keeping these facts in view, the present experiment was planned "Studies on the effect of growing media on the performance of tomato seedling in plastic plug tray".

Methods and Materials
The experiment was laid out on October 18, 2006 on tomato variety DVRT-1 in a randomized block design with three replications and consisted 18 different treatments.

viz: T_1 - Control (Soil-100%), T_2 – Vermicompost (100%), T_3 - Biogas slurry (100%), T_4 – Sand (100%), T_5 – Farm Yard Manure (100%), T_6 - Farm Yard Manure + Sand (1:1), T_7 - Biogas slurry + Sand (1:1), T_8 - Vermicompost + Sand (1:1), T_9 - Vermiculite + Vermicompost (1:5), T_{10} - Vermiculite + Biogas Slurry (1:2), T_{11} - Perlite + Vermicompost (1:1), T_{12} - Vermiculite + Farm Yard Manure (1:5), T_{13} - Perlite + Farm Yard Manure (1:5), T_{14} - Perlite + Vermicompost + Biogas Slurry + Sand (1:1:1:1) T_{15} - Perlite + Neem cake (1:3), T_{16} - Vermiculite + Neem cake(1:3), T_{17} - Neem cake (100%) and T_{18}– Cocopeat (100%). Collection of various root media by different sources like purchasing by market, NADEP pit, gobar gas plant etc. and after than collection homogenized and prepared for filling in plug tray alone and in suitable treatment combination and filling in cell by manually and sowing of tomato seed was also done by manually. The tray was irrigated immediately after sowing and repeated every day in twice at morning and evening by rose-can till 25 days after sowing (DAS). The water soluble fertilizers @ 0.25% (NPK 19:19:19) was sprayed at 20 days after sowing i.e. three true leaf stage. Seed germination was recorded by visual observation on daily basis at both morning and evening and continued till complete germination of seed and finally germination in per cent was calculated as number of seedling emerged divided by number of seed grown and multiply with 100. Five plants selected randomly from each replication in each treatment to record on various aspects during the experimentation. The number of leaves/plant was completed through counting the whole leaves and divided by the number of plants taken for counting. The length and width of leaves were taken with the help of meter scale. Fresh weight of the leaves was recorded with the help of "Electronic weighing machine". After recording the fresh weight of leaves, they were kept at 60 °C in oven for three days and dry weight of the leaves was weighted by electronic balance. The seedling length was taken with the help of meter scale from the base of plant to the top of the plant. Shoot diameter was taken with the help of Vernier Callipers. The fresh and dry weight of shoot was recorded as same recorded of fresh and dry weight of leaves. Number of roots/seedling was counted and average was worked out. The length of root was taken from 'cap root' to base of the seedling with the help of meter scale. Girth of root was measured with the help of 'Vernier Calipers'. Fresh root were collected in a envelop and weighed with the help of electronic balance. Thereafter, it was kept in oven at 60 °C for three days and weighing was done with the help of electronic balance. The data recorded the investigation was subject to analysis (Fisher, 1970) [2].

Result and Discussion

Presented result of the study indicated that Bio gas slurry + Vermiculite (2:1) expressed significantly and most effective medium for raising the seedling of tomato among all the treatments. The germination percentage was highest in T_{10} (58.33) which were at par with T_3 (56.67), T_4 (46.67 and T_7 (46.67) and significantly different from all other treatments (Table 1). This might be due to that biogas slurry and vermiculite provide better aeration, good moisture and available nutrients, which in turn increase the metabolic activity in germinating seed leading to better germination of seed. Singh *et al* (1995) [11] soaking of wheat seed for 6-12 hours in slurry and water before sowing resulted in significant increase in germination percentage at Palampur, Himanchal Pradesh. Zhicheng (1991) [14] also reported from China that seed soaked with slurry improved germination rate, developed in to better plants that were greener and less susceptible to disease.

It was observed with regards to leaf formation, expansion and weight of leaves significant differences were estimated among different treatments for leaves formation, expansion and weight of leaves (Table 1). The highest number of leaves was counted with T_{10} (7.70) which were at par with T_2 (7.47) and T_7 (7.66). The maximum length of leaves was measure with T_{10} (15.33) followed by T_{14} (11.87) while maximum width of leaves was measured with T_3 (7.66) followed by T_{10} (7.07). The weight of both fresh and dry weight of leaves was weighing maximum in T_{10} (5.13 and 2.89 respectively) which was at par with T_7 (5.10 and 2.09 respectively). These result revealed that vigorous and healthy seedling in the T_{10} showed significant effect due to synergetic combination of both the factor biogas slurry provide a lot of nitrogen, phosphorus and other macro and micro nutrients while vermiculite improved aeration, water holding capacity and maintain P_H such significant response of biogas slurry and vermiculite better for leaf developments. The same finding was reported by Nevratte *et al*. (1997) [7] on the enhancement effect of biogas slurry with vermiculite on growth of the encouraging young tomato seedling. Gurtal *et al*. (1997) [3], Acharya (1953) [1] and Islam 1999 [6] also was agreement of our finding.

Data portrayed in Table 2 indicated that significant response of different root media. The result revealed that the shoot growth characters were significantly influenced by root media. The maximum height of seedling, diameter and fresh weight of seedling (21.30 cm, 3.09 mm and 6.10 g respectively) were recorded with combine used of vermiculite + biogas slurry. Moreover maximum dry weight of seedling (3.08 g) was weighing with T_7 (biogas slurry + sand) which was at par with T_{10} (vermiculite + biogas slurry) and significantly different from all other treatments. The increase in shoot growth characters in response to slurry nitrogen, phosphorus and micro and macro nutrient might have been due to cell elongation, cell division, formation of nucleotide and coenzyme in meristamatic activity and increasing photosynthetic surface resulting in increase the shoot growth attributes. Where as vermiculite possesses high water holding capacity and improved aeration. Similar effect was observed in the experiment with peach seed, where the combination of FYM with saw dust might be attributed to its richer nutritional status which enhanced photosynthetic activities resulted in more plants stored materials there by increasing seedling girth (Rahman *et al*. 2008) [8]. The results of present study are similar to those reported by Reiad *et al*. (1997) [9] reported that nitrogen effect vegetative growth and increase stem circumference.

Significant differences were observed among the different treatment with regards to root growth parameters and maximum number of roots, length of root diameter of root fresh and dry weight of roots (Table 3) (41.50, 11.07 cm, 1.83 mm, 4.09 g and 2.33 g respectively). This superiority can be attributed to the fact that combines effect of vermiculite and biogas slurry, which provide proper aeration, sufficient water and nutrients availability for excellent root growth development. Lakshmanan, *et al*. (1993) [5] reported that slurry provides energy to soil microflora including the N fixing and P solublizing organisms it is well known phosphorus plays an important role in root health and the ability of plants to better tolerate soil born diseases.

The overall fresh and dry weights of seedling were recorded in T_{10} (15.26 g and 7.83 g respectively) followed by T_{18}, T_{14} and T_3 (11.66 g and 5.93 g, 11.33 g and 5.67 g and 6.71 and 3.88 respectively) and significantly different from all other treatments (Table 4). The overall weight of seedling significantly increase may be due to increased in leaf growth, shoot growth and root growth because these parameters directly contribute to the total weight of seedling. Gupta (1991) [4] reported that application of biogas slurry manure gave best result in vegetables crops such as tomato and brinjal followed by maize and urd. Vargas, 1986 also reported that the use of biosol (solid sludge) on alfalfa and maize increase yield more than 25%.

Table 1: Effects of growing medias on germination and leaf growth of germinated seed

Treatment	Germination %	Number	Length (cm)	Width (cm)	Fresh weight five plants (g)	Dry weight five plants (g)
T_1 Control (Soil)	50	5.10	5.30	3.40	1.00	0.40
T_2 Vermicompost	38.33	7.47	10.19	6.83	2.93	1.14
T_3 Bio gas slurry	56.67	7.07	10.32	7.66	3.15	1.23
T_4 Sand	46.67	5.43	5.52	5.07	1.08	0.48
T_5 FYM	28.33	5.27	6.72	5.50	2.04	0.89
T_6 FYM + Sand	35.00	6.07	5.57	4.37	3.11	1.12
T_7 BGS + Sand	46.67	7.66	11.20	6.73	5.10	2.09
T_8 Vermicompost + Sand	20.00	7.17	8.77	6.30	3.09	1.28
T_9 Vermiculite + Vermicompost	43.33	7.18	7.87	5.07	2.71	1.12
T_{10} Vermiculite + BGS	58.33	7.70	15.33	7.07	5.13	2.89
T_{11} Perlite + Vermicompost	43.33	6.17	7.30	5.39	2.11	0.91
T_{12} Vermiculite + FYM	30.00	6.23	5.03	2.94	0.84	0.35
T_{13} Perlite + FYM	20.00	6.30	6.17	4.33	0.88	0.32
T_{14} Perlite + Vermiculite + BGS + Sand	36.67	6.70	11.87	6.33	4.14	1.61
T_{15} Perlite + Neemcake	0	0	0	0	0	0
T_{16} Vermiculite + Neemcake	0	0	0	0	0	0
T_{17} Neem cake	0	0	0	0	0	0
T_{18} Cocopeat	37.67	6.83	6.83	7.13	4.34	1.62
SEm±	6.61	0.14	0.17	0.16	0.06	0.04
CD at 5%	13.44	0.29	0.34	0.32	0.12	0.07

Table 2: Effect of medias on shoot growth

Treatment	Height (cm)	Diameter (mm)	Fresh weight five plants (g)	Dry weight five plants (g)
T_1 Control (Soil)	11.10	1.25	1.10	0.49
T_2 Vermicompost	12.63	2.33	4.08	2.12
T_3 Bio gas slurry	12.60	2.84	3.08	1.51
T_4 Sand	17.57	2.23	1.08	0.52
T_5 FYM	14.37	2.03	1.14	0.54
T_6 FYM + Sand	15.51	2.26	2.08	1.01
T_7 BGS + Sand	14.17	2.84	6.08	3.08
T_8 Vermicompost + Sand	17.70	2.23	4.10	2.48
T_9 Vermiculite + Vermicompost	17.57	2.33	4.90	2.56
T_{10} Vermiculite + BGS	21.30	3.09	6.10	3.04
T_{11} Perlite + Vermicompost	14.93	1.67	1.12	0.55
T_{12} Vermiculite + FYM	12.43	1.60	1.18	0.53
T_{13} Perlite + FYM	14.30	1.67	2.70	1.31
T_{14} Perlite + Vermiculite + BGS + Sand	17.57	2.70	5.12	2.71
T_{15} Perlite + Neemcake	0	0	0	0
T_{16} Vermiculite + Neemcake	0	0	0	0
T_{17} Neem cake	0	0	0	0
T_{18} Coco peat	19.87	2.70	5.37	2.65
SEm±	0.12	0.06	0.04	0.17
CD at 5%	0.24	0.12	0.08	0.35

Table 3: Effect of medias on root growth

Treatment	Number of roots	Length (cm)	Diameter (mm)	Fresh weight five plants (g)	Dry weight five plants (g)
T_1 Control (Soil)	10	3.40	0.25	0.80	0.40
T_2 Vermicompost	32.23	7.41	1.11	0.82	0.47
T_3 Bio gas slurry	34.63	10.60	0.37	1.15	0.61
T_4 Sand	28.07	4.40	0.62	0.80	0.38
T_5 FYM	17.47	3.57	0.41	1.08	0.51
T_6 FYM + Sand	15.07	2.94	1.06	1.08	0.52
T_7 BGS + Sand	30.07	4.83	0.87	1.08	0.57
T_8 Vermicompost + Sand	28.20	5.59	0.74	2.08	1.11
T_9 Vermiculite + Vermicompost	30.70	7.90	1.45	1.02	0.55
T_{10} Vermiculite + BGS	41.50	11.07	1.83	4.09	2.33
T_{11} Perlite + Vermicompost	23.17	5.37	0.91	1.08	0.67
T_{12} Vermiculite + FYM	18.13	4.33	1.10	1.15	0.60
T_{13} Perlite + FYM	22.77	3.07	1.47	0.81	0.42
T_{14} Perlite + Vermiculite + BGS + Sand	29.57	5.63	1.67	2.12	1.31
T_{15} Perlite + Neemcake	0	0	0	0	0
T_{16} Vermiculite + Neemcake	0	0	0	0	0
T_{17} Neem cake	0	0	0	0	0
T_{18} Coco peat	32.00	6.20	1.64	2.33	1.44
SEm±	3.08	0.12	0.03	0.04	0.06
CD at 5%	0.27	0.24	0.07	0.08	0.12

Table 4: Effect of medias on fresh weight (g) and dry weight (g) of seedlings

Treatment	Fresh weight five plants (g)	Dry weight five plants (g)
T_1 Control (Soil)	2.83	1.21
T_2 Vermicompost	7.69	3.70
T_3 Bio gas slurry	6.71	3.38
T_4 Sand	3.36	1.36
T_5 FYM	4.23	1.94
T_6 FYM + Sand	6.27	2.65
T_7 BGS + Sand	12.26	6.08
T_8 Vermicompost + Sand	9.27	4.87
T_9 Vermiculite + Vermicompost	8.63	5.03
T_{10} Vermiculite + BGS	15.26	7.83
T_{11} Perlite + Vermicompost	4.31	2.12
T_{12} Vermiculite + FYM	3.17	1.44
T_{13} Perlite + FYM	4.40	2.05
T_{14} Perlite + Vermiculite + BGS + Sand	11.33	5.67
T_{15} Perlite + Neemcake	0	0
T_{16} Vermiculite + Neemcake	0	0
T_{17} Neem cake	0	0
T_{18} Coco peat	11.66	5.93
SEm±	0.28	0.39
CD at 5%	0.58	0.80

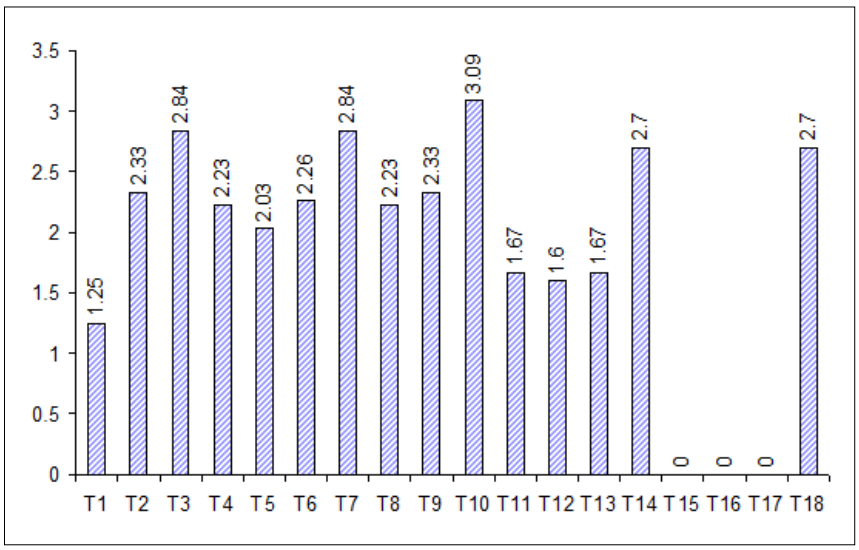

Fig 1: Effect of different growing medium of diameter of shoots of tomato.

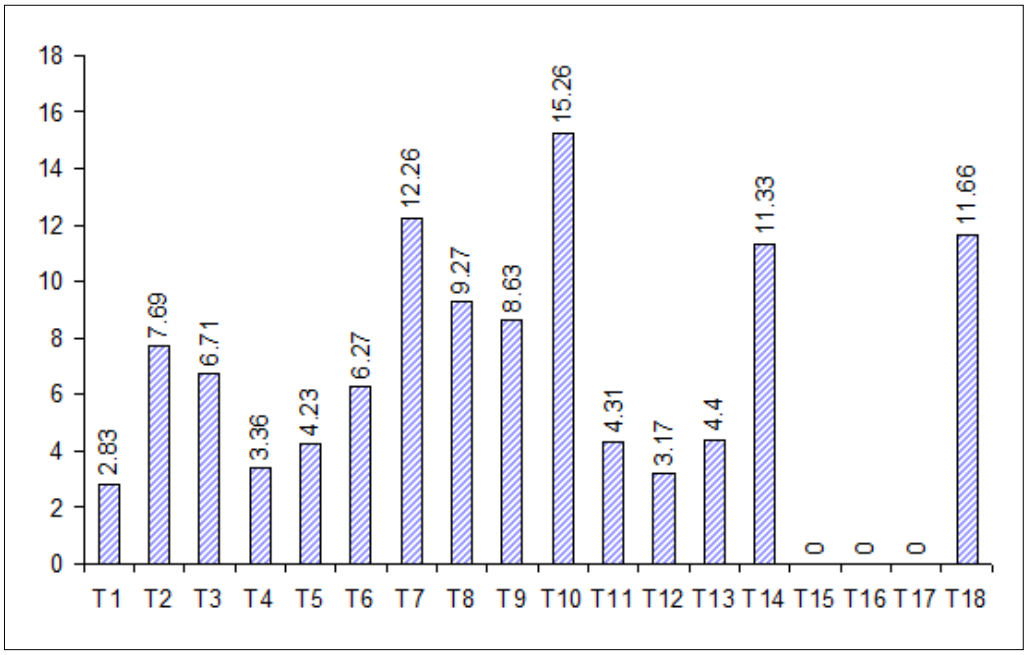

Fig 2: Effect of different growing medium on fresh weight of tomato seedlings.

Conclusion

The present experiment was conducted that Bio gas slurry + Vermiculite (2:1) expressed significantly and most effective medium for raising the seedling of tomato among all the treatments and produced the every individual costly hybrid seed into a healthy seedling with highest germination percentage.

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