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"Effect of Media on Rooting of Black Pepper (*Piper Nigrum)* Cuttings"

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ABSTRACT: *In the present study 80 per cent rooting was obtained by favourable growth regulator treatment when raised in an ideal rooting media under greenhouse conditions. The cuttings raised in the media comprising soil + sand + FYM + vermicompost (1:1:1:1 v/v) significantly increased the different shoot parameters of cuttings such as, days to sprout, number of leaves per cutting, length of shoot, percentage of sprouting, fresh and dry weight (15.93 days, 6.70, 20.26 cm 85.33 %, 17.47 g and 6.65 g respectively). Root parameters such as, minimum days to rooting (33.07 days), higher percentage of rooting (80 %), higher number of primary roots (11.07), maximum fresh and dry weight of roots (5.08 g and 1.96 g, respectively). Whereas, the maximum root length (26.79 cm) was noticed in the media soil + sand + FYM + coir dust (1:1:1:1 v/v). The cuttings raised under control recorded significantly minimum values in respect of all the root parameters.*

Keywords: *Media, Growth regulator, Cuttings, Shoot and Root parameters.*

INTRODUCTION

India is the land of spices. The flavour and fragrance of Indian spices had magic spell in human civilization and culture. India contributes about 40-50 per cent of world's production of spices **(1)**. Black pepper (*Piper nigrum* L., Family: Piperaceae) popularly known as "king of spices", is the oldest and most important spice crop grown in India. It is native to Western Ghats and it is grown in 26 countries including India, Indonesia, Srilanka, Thailand, China, Vietnam, Cambodia, Brazil, Mexico and Guatemala.

Black pepper is widely used spice in the world and it is an indispensable item in the preparation of processed meat, sauces, soups, curry powders and pickles. From medicinal point of view it is used as a carminative, stomachic and febrifuge. The major economic products from pepper are black pepper and white pepper. Other value added products like pepper oil and oleoresin find increasing use in food industries of developed countries. Besides some new forms of pepper like preserve green pepper in brine, vinegar, dehydrated green pepper etc. are becoming more popular. Hence the black pepper is also called as 'Black gold' on account of its economic importance (2).

Black pepper can be propagated through seeds and vegetative methods. Owing to its heterozygous nature, seedlings do not breed true to type and known to have long pre-bearing period. Hence, vegetative propagation through cuttings is commercially adopted. Besides this grafting, budding and layering are also practiced. But propagation through cuttings is easier hence it is preferred for large scale multiplication. Cuttings taken from runners shoots (Creeping shoots on the ground) and orthotropic shoots (erect growing shoots) are used commercially for vegetative propagation.

Availability of adequate quantity of quality planting material for large scale multiplication is one of the major constraints in increasing the productivity of pepper in India. The recent developments like, use of growth regulators, rooting media, greenhouse or mist technology, rapid multiplication techniques are found helpful in solving this problem to a greater

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extent. The conventional methods adopted for establishment of pepper have the disadvantage of false sprouting and poor root development coupled with high disease incidence which eventually leads to poor establishment. In this context plant growth regulators (PGRs) have great potential in increasing the agricultural production and help in removing the barriers imposed by genetic and environmental factors. Plant growth regulators and rooting media, play a vital role in improving the rooting in black pepper cuttings. The maximum rooting percentage found help to increase the establishment of cuttings in nurseries. Growth regulators such as auxins increase more percentage of success and number of roots in black pepper cuttings. This would improve the vigour of freshly transplanted plant material in the field, thus reduces the rate of mortality of plants and helps to maintain adequate crop stand in the plantations. Hence there is an immense need to increase the area under pepper plantation to meet the domestic as well as export market is of greater importance. Therefore, the main objective is to study the effect of media on rooting of black pepper cuttings.

MATERIAL AND METHODS

The present investigations were carried out in naturally ventilated polyhouse with completely randomized design at Regional Horticultural Research and Extention Centre, Mudigere during the period from February 2012 to June 2012. The healthy cuttings of Panniyur-1 variety were procured from the RHREC, Mudigere. The cuttings having two nodes with thickness of 0.8-1.0 cm diameter and 10 cm length were selected. For rooting media a potting mixture consists of jungle soil, sand and FYM in the ratio of 2:1:1 was filled into 20 × 12 cm sized perforated polythene bag of 200 micron thickness. Before planting the cuttings, media was drenched with Copper-oxy chloride (0.3%) as a prophylactic measures against fungal diseases.

There were thirteen treatments of different rooting media used singly or in combination. Each of the treatment consisted of 100 cuttings replicated thrice. The experiment was conducted in naturally ventilated poly house. The growth regulator formulations viz., IBA, 1000 ppm was used as a standard pre-treatment to all cuttings. The media formulations are $\mathbf{T_1}$- Soil:Sand:FYM (2:1:1), $\mathbf{T_2}$ -Soil:Sand:FYM:SD (1:1:1:1), $\mathbf{T_3}$ - Soil:Sand:FYM:SD (2:1:1:1), $\mathbf{T_4}$ - Soil:Sand:FYM:SD (3:1:1:1), $\mathbf{T_5}$ - Soil:Sand: FYM:CD (1:1:1:1), $\mathbf{T_6}$ - Soil:Sand:FYM:CD (2:1:1:1), $\mathbf{T_7}$ - Soil:Sand:FYM:CD (3:1:1:1), $\mathbf{T_8}$ - Soil:Sand: FYM:CPC (1:1:1:1), $\mathbf{T_9}$ - Soil:Sand:FYM:CPC (2:1:1:1), $\mathbf{T_{10}}$ - Soil:Sand:FYM:CPC (3:1:1:1), $\mathbf{T_{11}}$ -Soil:Sand:FYM:VC (1:1:1:1), $\mathbf{T_{12}}$ - Soil:Sand:FYM:VC (2:1:1:1), $\mathbf{T_{13}}$ - Soil:Sand:FYM:VC (3:1:1:1). Where, FYM = Farm yard manure, SD = Saw dust, CD = Coir dust, CPC = Coffee pulp compost and VC = Vermicompost.

Several Observations were recorded in this study like Root parameters (Days taken for root initiation, Percentage of cuttings rooted, Number of roots per rooted cutting, Length of the longest root, Fresh weight of roots per rooted cutting, Dry weight of roots per rooted cutting) and Shoot parameters (Number of days taken for sprouting, Per cent sprouting, Length of new shoot per cutting, Number of leaves on sprout per cutting at 30, 60 & 75 days after planting, Fresh weight of shoot per rooted cutting, Dry weight of shoot per rooted cutting).

RESULT AND DISCUSSION

Shoot Parameters

Among the various rooting media studied in the present investigation, there were significant differences in shoot characters (Table 1 & 2). The earliest sprouting (15.93 days) and the maximum per cent sprouting (85.33%) was observed in the media (Table 1 & fig. 1) comprised of soil + sand + FYM + Vermicompost (1:1:1:1 v/v). This might be due to the presence of growth promoting substances in vermicompost which helped in better utilization of stored carbohydrates, nitrogen and other factors. These results are in confirmity with (3 & 11) who reported that vermicompost could be a definitive source of plant growth regulators produced by interactions between microorganisms and earthworms, which could contribute significantly to enhancement of plant growth.

The treatment, soil + sand + FYM + Vermicompost (1:1:1:1 v/v) had a profound influence on length of new shoot and number of leaves (Table 1) per cutting (20.26 cm and 6.70 respectively). The above mentioned shoot parameters combined, led to higher fresh and dry weight of shoot (17.47 g and 6.65 g, respectively). This may be attributed due to the excellent structure, porosity and nutrients in available form such as nitrate nitrogen and soluble phosphorus might have been the main reasons for excellent growth in media comprising of vermicompost (4, 10 &13). Further, (5) reported that, the amounts of nitrate nitrogen in the planting media increased with the increasing vermicompost concentrations. Also, (6) reported that vermicompost might have greatly increased surface

Table 1
Effect of Rooting Media on Shoot Parameters at Different Time Intervals (30,60,75 Days after Planting) of Black Pepper Cuttings

Treatment	*Days to sprout*	*30 DAP*			*60 DAP*			*75 DAP*		
		No. of leaves	*Length of new shoots(cm)*	*Percent of sprouting (%)*	*No. of leaves*	*Length of new shoots(cm)*	*Percent of sprouting (%)*	*No. of leaves*	*Length of new shoots(cm)*	*Percent of sprouting (%)*
T_1- SOIL:SAND: FYM (2:1:1)	18.07	1.45	3.72	37.67	2.43	7.83	66.67	4.20	10.42	76.00
T_2- SOIL: SAND: FYM: SD (1:1:1:1)	17.07	1.75	4.45	43.00	3.17	9.93	72.00	5.60	15.21	79.33
T_3 - SOIL: SAND: FYM: SD (2:1:1:1)	17.43	1.68	4.27	41.67	3.10	9.39	70.33	5.37	14.52	78.67
T_4 - SOIL: SAND: FYM: SD (3:1:1:1)	17.80	1.65	4.09	39.67	2.97	8.63	68.67	5.10	12.64	76.67
T_5- SOIL: SAND: FYM: CD (1:1:1:1)	16.53	1.92	4.83	44.00	3.30	10.25	74.00	5.90	17.71	81.67
T_6 - SOIL: SAND: FYM: CD (2:1:1:1)	16.87	1.85	4.69	42.33	3.17	9.93	72.67	5.70	16.99	81.00
T_7 - SOIL: SAND: FYM: CD (3:1:1:1)	17.33	1.78	4.25	40.00	3.03	9.40	71.00	5.43	15.77	79.67
T_8 - SOIL: SAND: FYM: CC (1:1:1:1)	17.53	1.72	4.39	41.67	2.93	9.13	70.67	5.23	13.32	78.00
T_9 - SOIL: SAND: FYM: CC (2:1:1:1)	17.67	1.68	4.10	40.00	2.80	8.68	69.00	5.07	12.97	77.33
T_{10}- SOIL: SAND: FYM: CC (3:1:1:1)	17.87	1.62	3.79	38.33	2.67	8.19	67.33	4.68	12.12	76.33
T_{11}- SOIL: SAND: FYM: VC (1:1:1:1)	15.93	1.98	5.78	50.33	3.63	11.80	78.67	6.70	20.26	85.33
T_{12}- SOIL: SAND: FYM: VC (2:1:1:1)	16.20	1.95	5.20	48.00	3.37	10.93	75.67	6.23	18.00	82.33
T_{13}- SOIL: SAND: FYM: VC (3:1:1:1)	16.93	1.85	4.61	45.00	3.13	10.03	71.67	5.70	16.03	80.67
F- test	**	**	**	**	**	**	**	**	**	**
S Em ±	0.38	0.05	0.17	0.77	0.07	0.23	0.70	0.12	0.45	0.99
C D 5%	1.12	0.13	0.50	2.25	0.21	0.66	2.03	0.35	1.31	2.88

FYM – Farm Yard Manure SD- Saw Dust CD- Coir Dust CC- Coffee pupl Compost VC – Vermicompost DAP - Days After Planting ** Highly Significant

Table 2
Effect of Rooting Media on Root and Shoot Parameters of Black Pepper cuttings

Treatment	*Shoots*		*Roots*					
	Fresh weight(g)	*Dry weight(g)*	*Fresh weight(g)*	*Dry weight(g)*	*Days taken to rooting initiation*	*Percent of rooting*	*No. of primary roots*	*Root length (cm)*
T_1- SOIL:SAND: FYM (2:1:1)	10.66	4.02	2.64	0.99	39.13	63.33	7.60	17.78
T_2- SOIL: SAND: FYM: SD (1:1:1:1)	13.03	5.08	3.44	1.34	34.80	73.33	8.73	22.77
T_3 - SOIL: SAND: FYM: SD (2:1:1:1)	12.66	4.85	3.20	1.21	35.27	70.00	8.37	22.05
T_4 - SOIL: SAND: FYM: SD (3:1:1:1)	11.87	4.50	3.01	1.14	35.80	66.67	7.97	19.37
T_5- SOIL: SAND: FYM: CD (1:1:1:1)	15.00	5.77	4.33	1.65	35.87	76.67	9.73	26.79
T_6 - SOIL: SAND: FYM: CD (2:1:1:1)	14.07	5.31	4.07	1.50	36.13	73.33	9.53	24.17
T_7 - SOIL: SAND: FYM: CD (3:1:1:1)	12.83	4.99	3.83	1.37	37.87	70.00	9.10	21.47
T_8 - SOIL: SAND: FYM: CC (1:1:1:1)	11.96	4.53	3.38	1.28	37.00	70.00	8.33	20.16
T_9 - SOIL: SAND: FYM: CC (2:1:1:1)	11.67	4.44	3.16	1.14	37.60	66.67	8.20	19.49
T_{10}- SOIL: SAND: FYM: CC (3:1:1:1)	11.18	4.26	2.76	1.02	38.13	66.67	8.00	18.57
T_{11}- SOIL: SAND: FYM: VC (1:1:1:1)	17.47	6.65	5.08	1.96	33.07	80.00	11.07	24.27
T_{12}- SOIL: SAND: FYM: VC (2:1:1:1)	15.03	6.02	4.52	1.77	33.47	76.67	10.13	23.23
T_{13}- SOIL: SAND: FYM: VC (3:1:1:1)	13.80	5.25	4.17	1.62	34.13	73.33	9.33	22.17
F- test	**	**	**	**	**	**	**	**
S Em ±	0.37	0.14	0.12	0.05	0.40	3.20	0.25	0.47
C D 5%	1.08	0.40	0.36	0.14	1.17	9.31	0.73	1.36

FYM – Farm Yard Manure SD- Saw Dust CD- Coir Dust CC- Coffee pupl Compost VC – Vermi compost DAP - Days After Planting ** Highly Significant

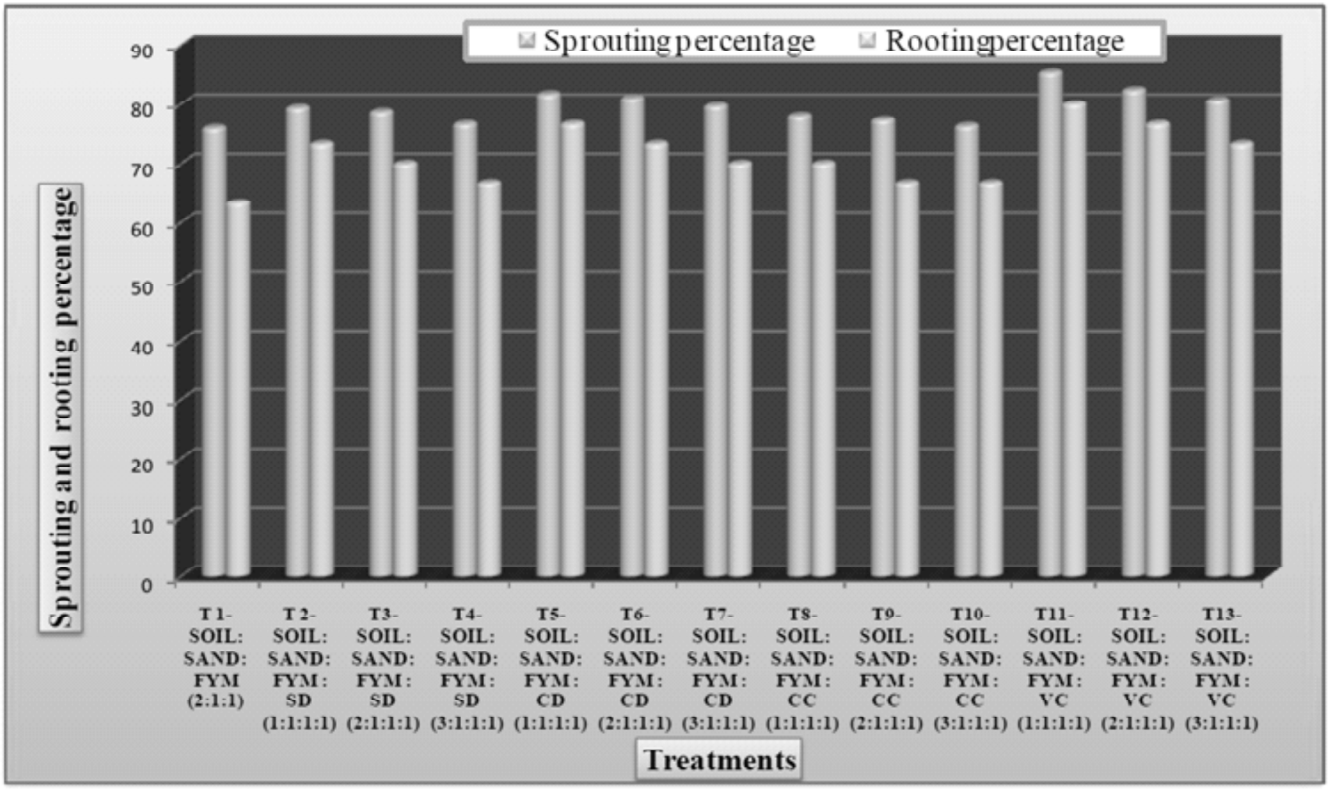

Figure 1: Effect of media on sprouting and rooting percentage of black pepper cuttings.

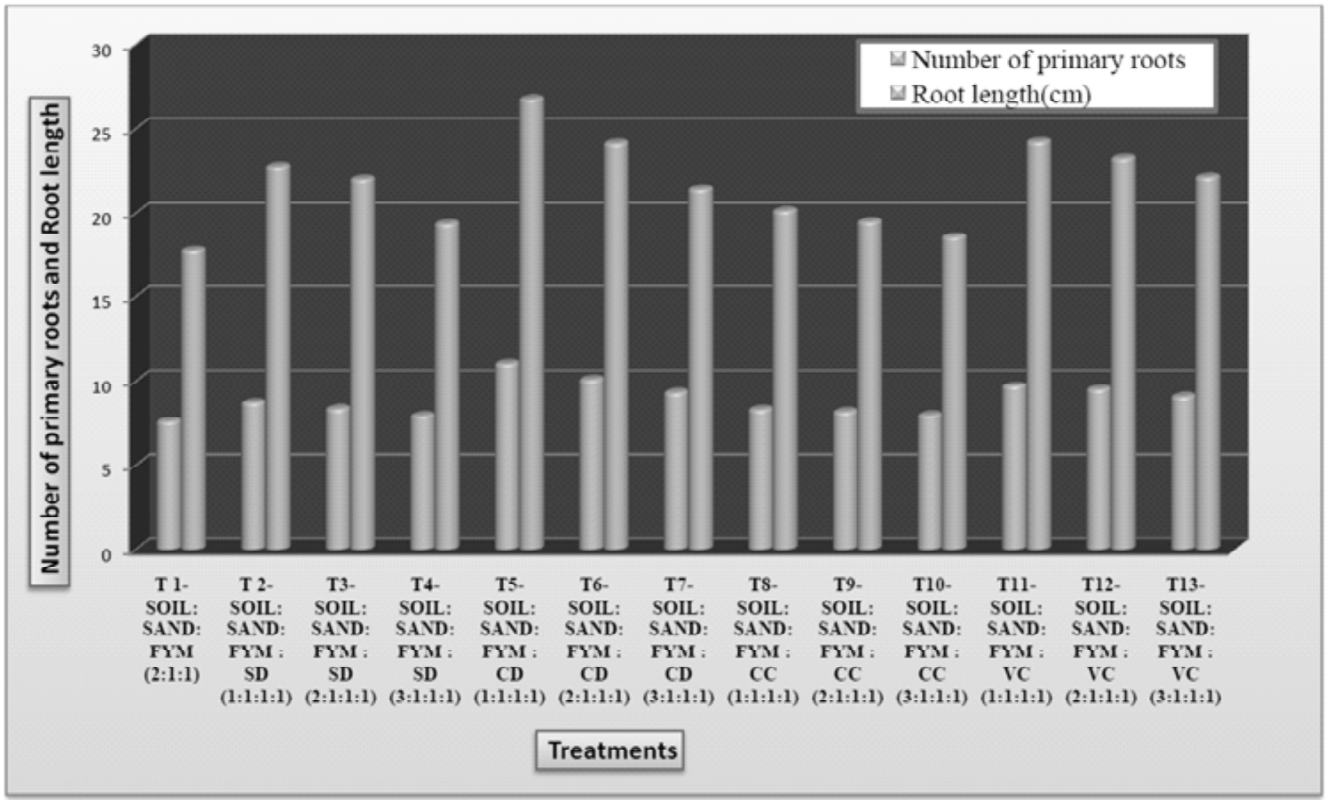

Figure 2: Effect of media on number of primary roots and root length of black pepper cuttings.

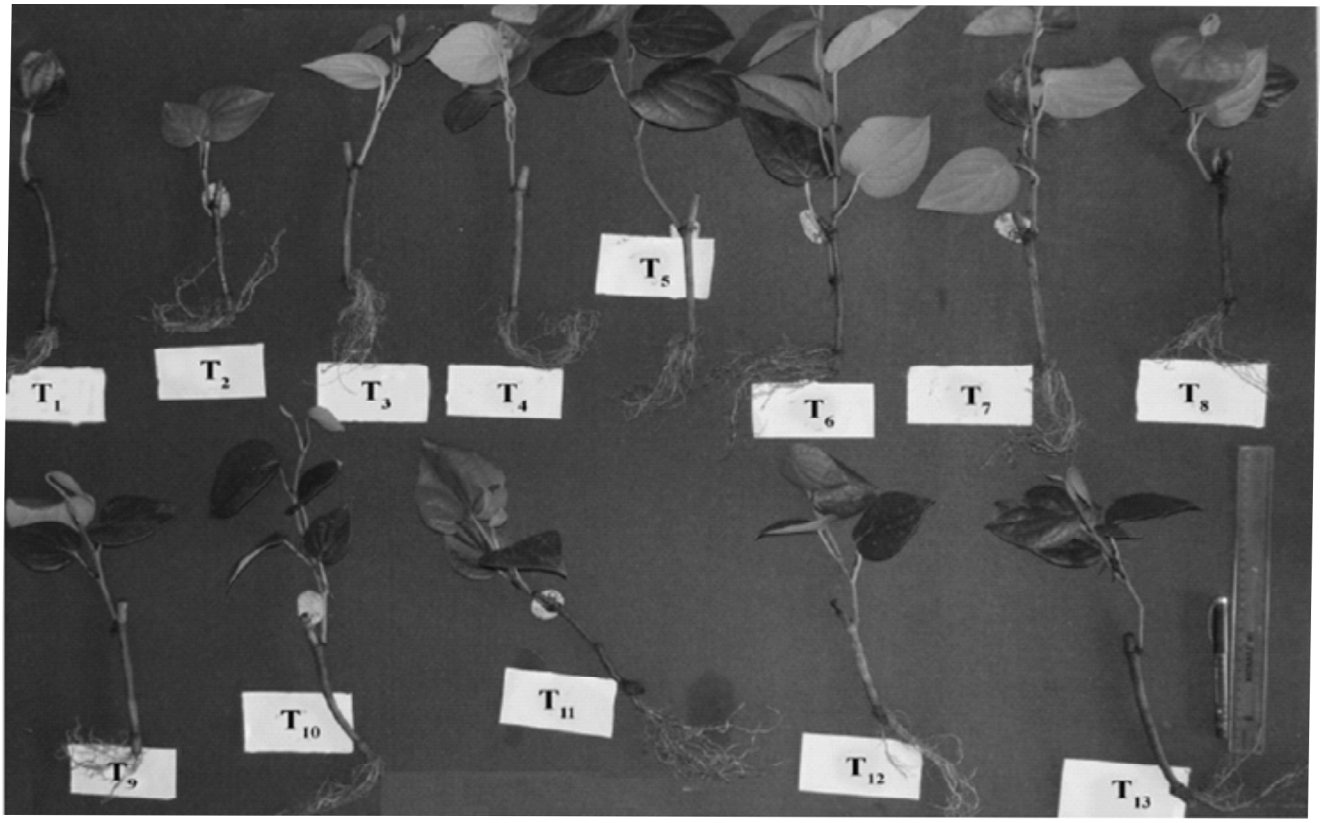

Plate 1: Effect of media on rooting of black pepper cuttings.

areas, providing more micro sites for microbial decomposing organisms and strong adsorption and retention of nutrients which might have resulted in better growth of cuttings. (7) also observed that the length and weight of the shoots of *Catharanthus rosus* and *Oriza sativa* showed significant increase when they were applied with the casts of *Perionyx*. These results are in conformity with (8 & 17) in black pepper.

Root Parameters

The present study indicated that, significant influence of rooting media on increasing the rooting percentage of black pepper cuttings propagated under naturally ventilated polyhouse. The effect was marked in rooting media *viz.*, soil + sand + FYM + vermicompost (1:1:1:1 v/v) with 80%, soil + sand + FYM + vermicompost (2:1:1:1 v/v) with 76.67 % and soil + sand + FYM + coir dust (1:1:1:1 v/v) with 76.67 per cent (Table 2). Similar views were reported by (9 & 16) in vanilla . This can be attributed due to the better physicochemical properties of vermicompost consisting media like optimum water retention capacity (57.35%) and near neutral pH (7.60). As it is also a source of plant growth regulators, it had resulted in highest rooting percentage. These results are in confirmity with views of (10) who reported that vermicompost is finely divided peat-like materials with high porosity, aeration, drainage, waterholding capacity. Also, (11) reported that vermicompost could be a definitive source of plant growth regulators. The earliest rooting (33.07 days) was observed in the cuttings pretreated with IBA 1000 ppm and raised in the media, soil + sand + FYM + vermicompost (1:1:1:1 v/v) which differed significantly from rest of the treatments. An early sprouting and higher shoot parameters in initial stages might have brought earliness and better rooting (Table 2). Further, stored food materials with the aid of growth regulators and better physicochemical properties of the media had hastened the rooting (12).

The different rooting media also influenced the number of primary roots (Fig. 2 & Table 2). The maximum primary roots (11.07) were observed in the treatment soil + sand + FYM + vermicompost (1:1:1:1 v/v). This may be attributed to the excellent structure, porosity and nutrients in available form such as nitrate nitrogen and soluble phosphorus for excellent rooting in vermicompost comprising media. (13). (14) also reported more number of primary roots in vermicompost (18.2) when compared to sand (9.8),

while studying the effect of different media on cardamom seedlings. Regarding the length of the longest primary root (Fig. 2), the media comprising soil + sand + FYM + coir dust (1:1:1:1 v/v) registered significantly the longest primary root length (26.79 cm) followed by soil + sand + FYM + coir dust (2:1:1:1 v/v) with 24.27cm, showed better performance as compared to other media. Coir dust has a low particle density indicating it's high specific surface, which contributes to the high adsorption of water and ions. Coir dust has a high water holding capacity (15). Increased root length might be attributed to the better texture and porosity of coir dust which probably facilitated easy penetration of roots (16) and also being a well drained media it promoted better root characters.

The fresh and dry weight of roots was significantly higher (5.08 and 1.96 g, respectively) in cuttings raised on soil + sand + FYM + vermicompost (1:1:1:1 v/v). The fresh and dry weight of roots reflects the root parameters recorded. The treatments with better root parameters have higher fresh and dry weights, while treatments with lower root parameters had shown lower fresh and dry weights.

CONCLUSION

It was evident in the present study that the percentage of rooting of cuttings would be better if they are pre-treated with growth regulators and kept in better rooting media for favourable rooting. This indicates that cuttings need some physiological stimulation and better environment for favourable rooting. In the present study 80 per cent rooting was obtained by favourable growth regulator treatment when raised in an ideal rooting medium under greenhouse conditions. These technologies would go a long way in improving the ''turnover efficiency'' of availability of rooted cuttings per unit time to meet the increasing demands of growers. It may be summarized that the black pepper planting material can be raised with high success (80 %) by pre-treatment of cuttings with IBA at 1000 ppm and growing in the medium of soil + sand + FYM + vermicompost (1:1:1:1 v/v) in polyhouse conditions. As an alternative, the medium comprising of coir dust can also be used in the places where, vermicompost is scarce and costly. By this way, higher turnover of planting material can be accompanied quite easily.

In general, the cuttings raised in the media comprising of vermicompost as one of the components excelled in all the growth parameters except in root length among the different rooting media. This was followed by coir dust comprising media. Among the different proportions of rooting media, the cuttings raised in 1:1:1:1 proportions of all the substrates, recorded excellent growth in all the parameters studied as compared to other proportions under investigation.

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