Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 606-614

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-11 pp. 606-614**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Different Potting Media on Sprouting, Survival and Growth Performance of Bush Pepper (*Piper nigrum* L.)

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A B S T R A C T

The present study entitled "Effect of different potting media on sprouting and survival of bush pepper (*Piper nigrum* L.)" was conducted at College of Horticulture, Dr. B. S. K. K. V. Dapoli, (MS) during the year 2018-2019. The experiment was executed in randomized block design with thirteen treatments and two replications. In different potting media, the earliest sprouting of cuttings (20.00), the highest sprouting percentage (40.00 %) and survival percentage (30.00 %) was observed in T_{10} *i.e.* soil + rice husk + compost (1:1:1). Also this treatment was found best with respect to vegetative parameters *viz.* plant height (35.81 cm), and relative growth rate (0.006 cm) which was highest in treatment T_9 (0.006 cm) *i.e.* soil + rice husk + compost (2:1:1) as well. The maximum number of leaves was recorded in T_9 (7.85) and total leaf area (609.66 cm^2) was noted highest in T_{13} (Cocopeat + Soil + Rice husk + Compost (1:1:1:1). The highest root length was recorded in the treatment T_7 (32.65 cm) *i.e.* cocopeat + compost 3:1 and highest net profit (Rs. 522.36/-) was recorded in T_{10}, promoting highest B : C ratio (1.71).

Keywords

Bush pepper, Potting media, Sprouting and survival

Introduction

Black pepper, the 'King of Spices', and 'Black gold', is the most important and most extensively used spice in the world, occupying a position that is utmost and unique. In the ancient times, black pepper ranked with gold-leaf and was used in barter system. It was only allowed to be owned by the kings and others in the higher classes because of its preciousness. Knowing the importance of Indian pepper brought the Britishers followed by Portuguese to the Indian sub-continent (Ravindran, 2006). The leading countries in the production of the Black Pepper are Vietnam, Indonesia, India and Brazil (Anon., 2019a). In India the area and production of Black Pepper is 1, 37, 378 ha and 6, 1000 tonnes (Anon., 2019b) with major black pepper producing regions as Kerala, Karnataka, Konkan, and Tamil Nadu (Anon., 2019a). USA, UK, Germany, Vietnam, Netherlands, Japan and Sweden are the major consumers of black pepper from the India (Abraham, 2018).

Growing bush pepper is one of the good ideas to bridge the gap between demand and supply of black pepper (Madhura *et al.,* 2000). Considerable interest among urban people has been noted to grow bush pepper in the garden and terrace which in turn increased the demand for planting materials (Ramya *et al.,* 2017).

In propagation, it is observed that the moistness of soil is less and hence the rooting of the laterals for making planting material for bush pepper is difficult. As drying of the soil reduces the formation of root system and hence there is need to be replaced by various media mixtures having moisture availability.

Materials and Methods

The experiment was conducted at College of Horticulture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) India. The experiment was conducted in the Randomized Block Design with thirteen treatments and two replications. The planting material i.e. of Panniyur – 1 variety cuttings of average 10-15 cm length of pencil size thickness with 3-4 buds were selected prior to planting.

Thirteen different growing media were used: T_1-Soil + FYM (3:1), T_2- Soil + SSP + rice husk + organic meal (55:15:15:15), T_3- Soil + Compost (3:1), T_4- Soil + Compost (1:1), T_5- Soil + Cocopeat + Compost (2:1:1), T_6- Soil + Cocopeat + Compost (1:1:1), T_7- Cocopeat + Compost (3:1), T_8- Cocopeat + Compost (1:1), T_9- Soil + Rice husk + Compost (2:1:1), T_{10}- Soil + Rice husk + Compost (1:1:1), T_{11}- Cocopeat + Rice husk + Compost (2:1:1), T_{12}- Cocopeat + Rice husk + Compost (1:1:1) and T_{13}- Cocopeat + Soil + Rice husk + Compost (1:1:1:1). Potting mixtures were prepared with different proportions of media on volume basis and trichoderma was added in each media @ 500 g. Then as per the treatments, the mixture was filled in polythene bags of size 4" × 6". Before planting, basal portion of the cuttings (about 2.5-3 cm) was dipped in Keradix powder. Then, the treated cuttings were planted in polybags containing different combinations of rooting media. The number of days required for sprouting was recorded at an interval of fifteen days. The count of sprouted cuttings was recorded fifteen days after planting of cutting.

The sprouting percentage was calculated from the number of cuttings sprouted in each replication. The survival percentage was recorded at an interval of fifteen days up to end of experiment. Similarly the growth parameters of bush pepper were also recorded at an interval of fifteen days up to end of experiment (180 DAP). The data obtained in the present investigation were statistically analysed by the method suggested by Panse and Sukhatme (1995).

Results and Discussion

Number of days to sprout

The earliest sprouting (Table 1) of cuttings was significantly noted in treatment T_{10} (20.00) i.e. soil + rice husk + compost (1:1:1) which was at par with T_9 (18.00). The late sprouting was recorded in treatment T_2 (12.00) which was at par with T_7, T_3 (13.50) followed by T_8 and T_5 (14.00).

Per cent sprouting

The maximum per cent sprouting (Table 1) of cuttings was significantly recorded in treatment T_{10} (40.00 %) which was at par with T_9 (36.00). The minimum per cent sprouting was recorded in treatment T_2 (24.00). T_{10} showed 66.67 per cent more sprouting over T_2.

Per cent survival

Statistically highest per cent survival (Table 1) was recorded in treatment T_{10} (24.00) which was at par with T_9 (19.50). The lowest per cent survival was recorded in treatment T_2 (8.00) which was at par with T_7 and T_3 (10.50).

Plant height

The maximum plant height (Table 2) was recorded in treatment T_{10} (35.81 cm) which was found superior over rest of the treatments. However, the minimum height of plant was recorded in treatment T_7 (24.76 cm) which was at par with T_8 (27.80 cm) followed by T_2 (27.85 cm).

Relative growth rate on height basis

Relative growth rate on height basis (Table 2) was highest in treatment T_1, T_2, T_9, T_{10} and T_{11} (0.007 cm/cm/day) while lowest in treatment T_5 (0.005 cm/cm/day). During the experimental period, the average relative growth rate on height basis was highest in treatment T_9 and T_{10} (0.006 cm/cm/day) while lowest in treatment T_{12} and T_5 (0.003 cm/cm/day).

Number of leaves

The number of leaves (Table 2) was significantly maximum in treatment T_9 (7.85) which was found superior over rest of the treatments. The minimum number of leaves was recorded in treatment T_4 (3.17) which were at par with T_8 (3.69) followed by T_2 (3.76), T_{11} (3.93) and T_3 (4.32).

Total leaf area

There was significant variation in the leaf area among the treatments. The maximum leaf area (Table 2) was noted in treatment T_{13} (609.66 cm^2) which was at par with treatment T_1 (574.43 cm^2). However, the minimum leaf area was recorded in treatment T_4 (284.93 cm^2) which was at par with T_8 (298.72 cm^2) followed by T_{11} (299.68 cm^2), T_2 (304.68 cm^2), T_6 (310.77 cm^2), T_7 (340.96 cm^2), T_3 (344.52 cm^2) and T_5 (357.36 cm^2).

Root length

At the end of the twelve months, the root length was significantly influenced by the different potting media treatments. The root length varied from 15.00 cm to 32.65 cm. The highest root length was recorded in the treatment T_7 (32.65 cm) *i.e.* cocopeat + compost 3:1 which was at par with T_3 (32.20 cm) (*i.e.* soil + compost 3:1) followed by T_{12} (31.72 cm) (*i.e.* cocopeat + rice husk + compost 1:1:1). The lowest root length was recorded in T_1 (15.00 cm) (*i.e.* soil + FYM 3:1).

Benefit cost ratio

The highest net profit (Table 2) (Rs. 522.36/-) was recorded in T_{10} was promoting highest B : C ratio (1.71). Treatment which is used as regular nursery practice T_1 i.e. soil + FYM (3:1) recorded net profit (Rs. 250.47/-) with B : C ratio (1.35). Lowest net profit (Rs. (-) 1095.96/-) and B : C ratio (0.37) was reported in T_7 *i.e.* Cocopeat + Compost (3:1).

Number of days to sprout

Earliness in sprouting might be due to utilizing of stored food material present in cuttings, nitrogen and other factors with the aid of growth hormones (Chandramouli, 2001). Use of soilless media like compost help for increasing porosity, water holding capacity, low shrinkage, low bulk density and slow biodegradation of the medium which resulted in higher sprouting per cent in media mixture containing compost (T_{10}, T_9). Similar

findings were recorded by Shah *et al.,* (2006) in media rice husk for Amstel Queen (*Ficus binnendijkii*), Akshay *et al.,* (2014) in media soil + sand + FYM + vermin-compost (1:1:1:1) for black pepper cuttings.

Table.1 Effect of different potting media on number of days to sprout, per cent sprouting and survival percentage of bush pepper cuttings

Treatments	Number of days to sprouts at 105 DAP	Per cent Sprouting (%) 105 DAP	Per cent Survival (%) 360 DAP
T_1	16.00	32.00 **(34.44)**	15.50 **(23.18)**
T_2	12.00	24.00 **(29.33)**	8.00 **(16.40)**
T_3	13.50	27.00 **(31.30)**	10.50 **(18.86)**
T_4	15.00	30.00 **(33.20)**	14.00 **(21.96)**
T_5	14.00	28.00 **(31.95)**	11.50 **(19.78)**
T_6	15.00	30.00 **(33.20)**	14.00 **(21.96)**
T_7	13.50	27.00 **(31.30)**	10.50 **(18.90)**
T_8	14.00	28.00 **(31.93)**	12.00 **(20.25)**
T_9	18.00	36.00 **(36.87)**	**19.50 (26.20)**
T_{10}	20.00	40.00 **(39.23)**	21.00 **(27.27)**
T_{11}	15.50	31.00 **(33.83)**	14.50 **(22.36)**
T_{12}	14.50	29.00 **(32.58)**	13.00 **(21.12)**
T_{13}	17.00	34.00 **(35.66)**	17.50 **(24.73)**
Mean	**15.23**	**30.46**	**13.96**
SEm (±)	**0.73**	**1.45**	**0.94**
C.D. at 5%	**2.23**	**4.47**	**2.88**

(Value in parenthesis indicates per cent sprouting and survival)

Table.2 Effect of different potting media on different growth parameters and B C ratio of bush pepper cuttings

Treatments	Growth Parameters					
	Plant height (cm) at 360 DAP	No. of leaves (no.) at 360 DAP	Leaf area (cm^2) at 360 DAP	Root length (cm) at 360 DAP	Relative growth rate (cm/cm/day) at 360 DAP	B C ratio
T_1	31.73	7.76	574.43	15.00	0.007	1.35
T_2	27.85	3.76	304.68	19.93	0.007	0.65
T_3	28.23	4.32	344.52	32.20	0.006	0.88
T_4	29.55	3.17	284.93	29.30	0.006	1.20
T_5	29.40	4.55	357.36	23.33	0.005	0.56
T_6	30.86	5.18	310.77	29.90	0.006	0.68
T_7	24.76	4.47	340.96	32.65	0.006	0.37
T_8	27.80	3.69	298.72	23.43	0.006	0.49
T_9	32.77	7.85	431.76	22.85	0.007	1.61
T_{10}	35.81	7.21	469.05	23.75	0.007	1.71
T_{11}	31.56	3.93	299.68	30.08	0.007	0.65
T_{12}	30.85	6.73	470.54	31.72	0.006	0.60
T_{13}	31.94	7.30	609.66	24.33	0.006	0.86
Mean	**30.24**	**5.38**	**392.08**	**26.03**	**0.006**	
SEm (±)	**1.06**	**0.41**	**27.96**	**0.51**		
C.D. at 5%	**3.28**	**1.27**	**86.16**	**1.59**		

Per cent sprouting

Root volume plays an important role in the sprouting of cutting. Use of soilless media like compost and rice husk along with soil resulted in increasing porosity, water holding capacity, low shrinkage, low bulk density and slow biodegradation of the medium along with availability of nutrient resulted in increase in root volume and dry matter content of root. The weather condition during experimental period was also congenial for increasing the cell activity for formation of root, which resulted in higher sprouting per cent in media mixture containing compost and rice husk along with soil (T_{10}). Similar findings were recorded by Akshay *et al.*, (2014) in media soil + sand + FYM + vermicompost (1:1:1:1) for black pepper and Sharath and Bhoomika (2018) in media T_{13} soil + perlite + vermicompost (2:1:2) and T_6 - soil + cocopeat +

vermicompost (2:1:1) of black pepper (*Piper nigrum* L.) cuttings.

Per cent survival

High survival in the media i.e. soil + rice husk + compost (1:1:1 followed by 2:1:1) reflected the fact that these combinations might have provided physical conditions and sufficient nutrients to cuttings particularly for better metabolic and physiological activities along with good development of root system. Similar findings were reported by Sharangi *et al.,* (2010) in sand + soil + FYM + coconut husk (1:1:1:1) for black pepper cuttings, Ella Yusnita *et al.,* (2017) agarwood cuttings (*Aquilaria malacensis* L.) in media soil + rice husk (10:1) + IBA and NAA @ 100 ppm and soil + compost (10:1) + IBA and NAA @ 50 ppm and Sharangi *et al.,* (2010) in media sand + soil + FYM + coconut husk (1:1:1:1) IBA (1000 ppm) for black pepper.

Plant height

Physiological activity in successful cuttings produces new shoot and leaves. More number of shoot and leaves triggered the process of photosynthesis which resulted in accumulation of energy. Simultaneously availability of moisture, nutrient through media (Ikram *et al.,* 2012) hence more increase in height was obtained in media containing soil + rice husk + compost 1:1:1) (T_{10}, T_9 and T_6). Similar findings were reported by Chauhan *et al.,* (2014) in media normal soil + rice husk + coco peat + castor cake + vermicompost (1:1:1:1) for Gerbera and Thankamani *et al.,* (1996) media soil + vermicompost (1:1) and soil + rice husk + compost 1:1:1) (T_{10}, T_9 and T_6).

Relative growth rate on height basis

The maximum relative growth rate on height basis was observed in media T_9 and T_{10} containing soil + rice husk + compost because of stimulatory effect of rice husk and compost. Rice husk along with soil helped to improve the textural and structural properties of soil and added organic matter and humus in the form of compost helped to avail nutrients and moisture easily for plant growth. This might have attributed to the significant increase in plant height and growth and ultimately increased average RGR. Similar findings were recorded by Ragaji (2017) found that highest relative growth was found (0.00605 cm/cm/day) in soil + leaf manure + cocopeat (50:25:25) in Alphonso mango grafts at 180 DAG.

Number of leaves

The media with high organic matter content increases the water and nutrient holding capacity of the medium also high N content resulting in the vegetative growth of the plant. It also has high K content, which improve the water utilization capacity of plant. Joiner and Nell (1982). Physical and chemical activity in the media might be resulted in increase in rate of photosynthesis of the cuttings which triggered the maximum number of leaves. Similar findings were reported by Ella Yusnita *et al.,* (2017) in media soil + rice husk (10:1) + IBA and NAA @ 100 ppm and soil + compost (10:1) + IBA and NAA @ 50 ppm for agar wood (*Aquilaria malacensis* L.) cuttings and Akshay *et al.,* (2014) in media soil + sand + FYM + vermicompost (1:1:1:1) and soil + sand + FYM (2:1:1) in black pepper cuttings.

Total Leaf Area

Among the various treatment growing media T_{13} i.e. cocopeat + soil + rice husk + compost (1:1:1:1) produce the maximum leaf area. Media containing compost are rich in organic matter and humus triggered the production of photo-synthetically function

leaves (Borah *et. al.,* 2008 and Ragaji 2017). Leaves produced more quantity of enzymes which accelerate cell division and expansion of leaf. Chavada *et al.,* (2017) in media soil + cocopeat + Leaf mould (1:1:1) and T_7 - soil + cocopeat + perlite (1:1:1) in rose crop and Shah *et al.,* (2006) in media rice husk (100 %) for Amstel Queen (*Ficus binnendijkii*)

Root length

Among the various media containing cocopeat with or without soil showed increase in the root growth. Easy availability of nutrient, aeration leads to proper gas exchange by maintaining sufficient oxygen supply to the root. Simultaneously removal of respiratory CO_2 helped in root elongation (Heiskanen, 1993). The maximum increase in root length was obtained in media containing cocopeat + compost (3:1) as the medium is a balance of air, moisture and nutrition. Increase in physiological activity might have resulted in accumulation of carbohydrates which cause more root growth. Similar findings were reported by Renuka *et al.,* (2017) in media cocopeat + vermicompost (2:1) in Gerbera, Mohammed *et al.,* (2013) in *Myrtus communes* cuttings in media compost + sand (4:2), Mamba *et al.,* (2010) in media compost (100 %) for geranium and Mohammed *et al.,* (2013) in media compost + sand (4:2) for *Myrtus communes*.

Hence concluded in present study on effect of media, rooting, survival and sprouting of bush pepper cuttings were maximum in the media containing soil along with rice husk and compost (1:1:1) followed by T_9 soil + rice husk + compost (2:1:1) and T_{13} cocopeat + soil + rice husk + compost (1:1:1:1) . Bush pepper cuttings raised in soil + rice husk + compost (1:1:1) (T_{10}), (2:1:1) (T_9) and cuttings raised in cocopeat + soil + rice husk + compost (1:1:1:1) (T_{13}) gave significantly maximum growth with respect to all morpho-physiological parameters and gave highest net profit with highest B : C ratio. Balance of moisture, air and nutrition in media containing soil along with rice husk, compost and cocopeat might have increased the rate of physiological activities which resulted in formation of roots and accumulation of food and energy in stem due to which maximum growth of cuttings was recorded.

This is a pioneer research on propagation of bush pepper cutting in various media in combination with soil for rooting, survival and growth. Though growth of cuttings was satisfactory, survival obtained was very less in the experiment. Hence repetition of same research on propagation of bush pepper is required with temperature and humidity control condition by using similar media for confirmation of these results.

Acknowledgments

The authors duly acknowledge the assistance, support, guidance and encouragement received from Professor and Head, Department of Horticulture, College of Horticulture, Dapoli. The author grateful thank to the research guide for providing the necessary guidance and facilities

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